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FOREWORD

Since 2016, the College of Sports and Health – Vocational Studies has successfully organized an international scientific and professional conference titled "Sports, Recreation, Health" every other year. The fifth conference was held on May 19 in Belgrade.

The goal of the conference was to exchange and improve scientific and professional knowledge, experiences, ideas, as well as to spread good practice among the scientists and professionals engaged in the complex and multidisciplinary fields of physical culture, sports management and medicine. Particular attention was given to all relevant factors of physical activity, from contemporary tendencies in physical education, sport and recreation, as well as health-related aspects of physical activity and the promotion of sport for the purpose of a healthy lifestyle, prevention and treatment of different conditions, to the significance and impact of the function of management in sports organizations.

Within three separate modules and scientific and professional fields: sport, recreation and health, the conference participants presented and discussed the results of their scientific research and professional reflections.

Of the total number of submitted papers, 30 received a positive review; of these, 5 papers were selected for publication in the scientific journal "Sport - Science and Practice" published by the College of Sports and Health.

Conference Organizing Committee

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SPORT, RECREATION, HEALTH

GASTRONOMY IN RURAL HOUSEHOLDS OF SERBIA AND HEALTH RURAL FOOD (HRF)

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Abstract: In recent decades, more and more importance has been given to researching the frequency of healthy and organic food in rural gastronomy. On the other hand, quality food is of utmost importance for better human functioning in the social and physical sense, prolonged maintenance of health, but also a factor in attracting visitors to rural households. The goal of the research was to determine the extent to which the quality of rural gastronomy is evaluated, and whether any of the existing types of gastronomy can influence the better placement of healthy food in rural areas of Serbia. The results indicate that most of the services of the gastronomic rural offer are positively evaluated, and that organic and ecological gastronomy can greatly influence the greater use of healthy rural nutrition. It has only been shown that modern gastronomy has a negative effect. The innovativeness of the research is reflected in the addition of literature on the issue of healthy food and the larger dilemma of preparation in rural households. Also, the results can be used to improve rural tourism.

Keywords: *rural gastronomy, health food, Serbia*

INTRODUCTION

It is known that over 80% of Serbia is a rural country, and that there are huge natural resources for growing ecological and organic food, which can certainly be found in the gastronomic offer in rural households that provide services to tourists (Cvijanović et al., 2020). The development of gastronomy through rural tourism is aimed at sustainable development, the production of healthy food and its placement on the market. Agricultural activities in this context are not only related to land cultivation and food production (Gajić et al., 2020), but also to environmental management, as well as the provision of services to the local community and the entire society, which all contribute to a more rational use of natural resources, suppression of excessive concentration of the economy in cities, stopping negative migration movement and the revival and development of villages, and of course the potential better development of rural tourism (Petrick, 2004). Rural areas with their specific history, tradition and eno-gastronomic heritage are suitable for the development of successful food niches of ecological and organic healthy food. An increasing number of farmers show a positive attitude towards the articulation and development of healthy food, especially related to the enrichment of rural tourism activities (Bhat & Mishra, 2020).

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The goal of the research was to determine the extent to which local, ecological, traditional and organic food can be found in the gastronomic offer in rural households in Serbia, and to what extent their development can influence the better marketing of healthy food in rural households. Also, one of the goals was to determine the assessment of the current offer of gastronomy in rural households of rural Serbia. The fact is that the pandemic has caused great damage in the business sphere of all catering facilities, but it has had the opposite effect in rural households. Namely, over 90% of all trips took place within the state, and in rural areas. The trend towards natural, mountainous and rural areas continued after the pandemic. The results reached by the authors undoubtedly show that the quality of the gastronomic rural offer is well on its way to a higher market position, but also that the existing supply factors influence the development of healthy rural food. The significance of the research can certainly contribute in a theoretical and applied sense, as a complement to the existing literature, which is rather poor in terms of information about healthy food in rural agriculture, and as an informative basis for strategic measures of entrepreneurs to influence a better gastronomic offer.

LITERATURE REVIEW

For the last two and a half years, the COVID-19 pandemic has influenced a change in trends when it comes to the principles of nutrition, but also the directions of tourist movements (Arwajfah et al., 2020). The largest percentage of tourists moved within state borders, more precisely they moved towards mountainous, rural and ecological areas (Gajić et al., 2020). Such a trend was encouraged by the state, by distributing vouchers with which certain groups received appropriate discounts (Cvijanović et al., 2020). However, the main reason for such a trend was the security measures that were determined by each state for health protection (Cvijanović et al., 2020. Movements and working hours are restricted, facilities are completely closed or have reduced working hours, distance between people is maintained (Long et al., 1999). All this influenced people to seek escape and salvation in nature (Rytkonen & Tunon, 2020). Creating such a trend, people increasingly began to demand the use of healthy food, ecological or organic, which is the most common in rural households (Canoves et al., 2004). However, there is a wide range of benefits from the production of healthy food and the development of rural tourism, among which, with greater production and marketing of agricultural products (Vukolić et al., 2021), the conditions are created for higher earnings, new jobs, the number of visitors increases, rural households are maintained, but which is also the primary goal, stops population migration due to lack of work (Chang et al., 2018). With this, experts say, the village is rejuvenated, natural population growth is encouraged, and cultural and historical values are protected and valorized (Lie et al., 2007). Rural gastronomy, as a tourist resource, is valued not only for its own sake, but also for its ability to generate rural development (Sharplez &Sharpley, 1997; Bustillos et al., 2015). Gastronomic tourism helps to increase rural sources of income and improve income levels and employment of the local workforce (especially women)(Cvijanović et al., 2020). The essence of the offer in rural areas is a stay in renovated country houses in a traditional style with the possibility of preparing food independently, getting to know traditional cultural values and customs, and all this in an ecologically healthy environment (Georghe et al., 2014). Accommodation and food for tourists in this way are much more attractive, economically cheaper and at the same time healthier than usual hotel accommodation and food (Jacob & Luloff, 1995; Gajić et al., 2020), and he sees the special importance of rural and gastronomic tourism and its advantage precisely in the fact that it is functional all 365 days a year (Williams et al., 2014).

In recent decades, the food environment has been shown to have a strong influence on individuals' eating patterns, food choices and diet quality (Jennings et al., 2015). The number of food establishments in the villages in Serbia was constantly increasing, but it also had

negative consequences, as the availability of processed and ready-made food in the villages increased, and less home-made food (Richards, 2015). In city centers, the trend of fast food, which is primarily unhealthy, is growing, and the number of meals eaten outside the home has also increased, which has led to individuals choosing energy-dense foods (Rojas de Garcia et al., 2019). Food environment studies have examined individuals' access to food using the proximity of their homes to the nearest food store or the density of types of food stores in their communities (Wiggins & Proctor, 2001). These studies have characterized aspects of the food environment that exist in communities (Cvijanović et al., 2020). However, the main limitation of these studies is that their findings assumed that all restaurants or food stores of the same type offer the same quality of unhealthy food, while marketing healthy food information and promoting low prices (Vukolić et al., 2021). Sustainable and healthy gastronomy is emerging as a strong driver of the food system in rural areas of Serbia (Vukolić et al., 2021). Gastronomy refers to the art of cooking and enjoying food, but also to the growing promotion of healthy eating (Parso & Hu, 2004). Also, the gastronomy of the modern age touches on the less rational, more creative, emotional and inspirational dimensions of food, in order to bring about changes in the pattern of production and consumption (Bacon & Krpan, 2018). Gastronomic initiatives around the world are multiplying in many forms, and the strongest initiative is the creation of a greater representation of healthy nutrition on offer, especially in rural areas (Kelly et al., 1994). The modern age, education, and the fast pace of life are the creators of the principles of healthy rural nutrition (Maagnini & Kim, 2016). The urban environment is the driver of change, they are more "open" to adapt their consumption behavior and create a lifestyle (Cvijanović et al., 2020). Sustainable rural and healthy gastronomy can increase opportunities for market diversification and differentiation for food suppliers, chefs, retailers and the food service sector, driving innovation and new economic dynamics and developing the tourism sector of rural areas in Serbia (Gajić et al., 202). Sustainably produced local ingredients, especially nutritious fruits and vegetables are key (Vukolić et al., 2021). In addition to working on improving food security, attracting tourists, it will also bring benefits to the rural population (Georghe et al., 2014). Sustainable and healthy gastronomy can become a means of preventing food loss and waste (Richards, 2015). Gaining access to healthy and affordable food can be a challenge for rural residents (Kelly et al., 1994). Many rural areas lack food vendors and are considered deserts: areas with limited supplies of fresh, affordable food (Jennings et al., 2015). Ironically, some of these food deserts are located in areas where agriculture is important to the local economy (Williams et aal., 2014). In rural areas, access to food may be limited by financial or other factors, such as transportation challenges (Vukolić et al., 2021). Shoppers in rural areas may rely on more expensive and less nutritious foods, such as the kind available at convenience stores at gas stations, or face a long drive to a city with a supermarket or grocery store that has fresh produce, milk, eggs and other staple foods (Liese et al., 2007). Some rural residents and households are food insecure, meaning they cannot rely on sufficient affordable and nutritious food at all times, increasing the risk of poor health outcomes (Bustillos et al., 2009). Insecurities and anxieties, chronic diseases and poor health among working-age adults are strongly associated with poor nutrition (Bacon & Krpan, 2018). A healthy diet produced in rural areas can affect learning, development, productivity, physical and mental health and family life (Liese et al., 2007).

Based on the research problem, the goal and the available literature, initial hypotheses were set:

H1a: The quality of the entire gastronomic offer in rural households in Serbia is positively assessed.

H1b: There are positive influences of the obtained factors on creating a perception about the need for healthy rural nutrition.

METHODOLOGY

On the basis of the set goal, the authors found a suitable solution to the problem through survey research in rural households. The research is voluntary in nature. On the basis of similar research and the set goal and hypotheses, the authors started field research in rural households in Serbia. A total of 500 questionnaires were distributed, of which 350 were taken into analysis. Questionnaires were distributed to 30 rural households, in the period from July to December 2022. The questionnaire contained three groups of questions. The first group of questions was related to the sociodemographic characteristics of the respondents, while the second group of questions contained all questions related to the quality of the gastronomic offer in rural households. The third question related to healthy food was taken as a criterion variable, where the examination of factors for better development of HRF (healthy rural food) will be carried out. Respondents answered this question separately. A total of 87.4% of them declared that they were absolutely in favor of the development of healthy rural gastronomy. All obtained data were analyzed in IBM SPSS version 23.00 software. and SPSS AMOS. In order to determine the reliability of the questionnaire, the authors performed a Cronbach alpha analysis for each of the questions. The values are given in table 1. Descriptive statistical analysis determined the average scores and standard deviation for all items from the questionnaire. All 20 questions were extracted by exploratory factor analysis. Factor analysis is often used to rationalize the number of questions found in surveys. In order to determine the possible effect of socio-demographic factors and the type of food in rural households on the development of healthy rural gastronomy, structural modeling and path analysis were used. Path analysis is a form of multiple regression statistical analysis used to estimate causal models by examining the relationship between a dependent variable and two or more independent variables. By using this method, the height and significance of causal relationships between variables can be assessed.

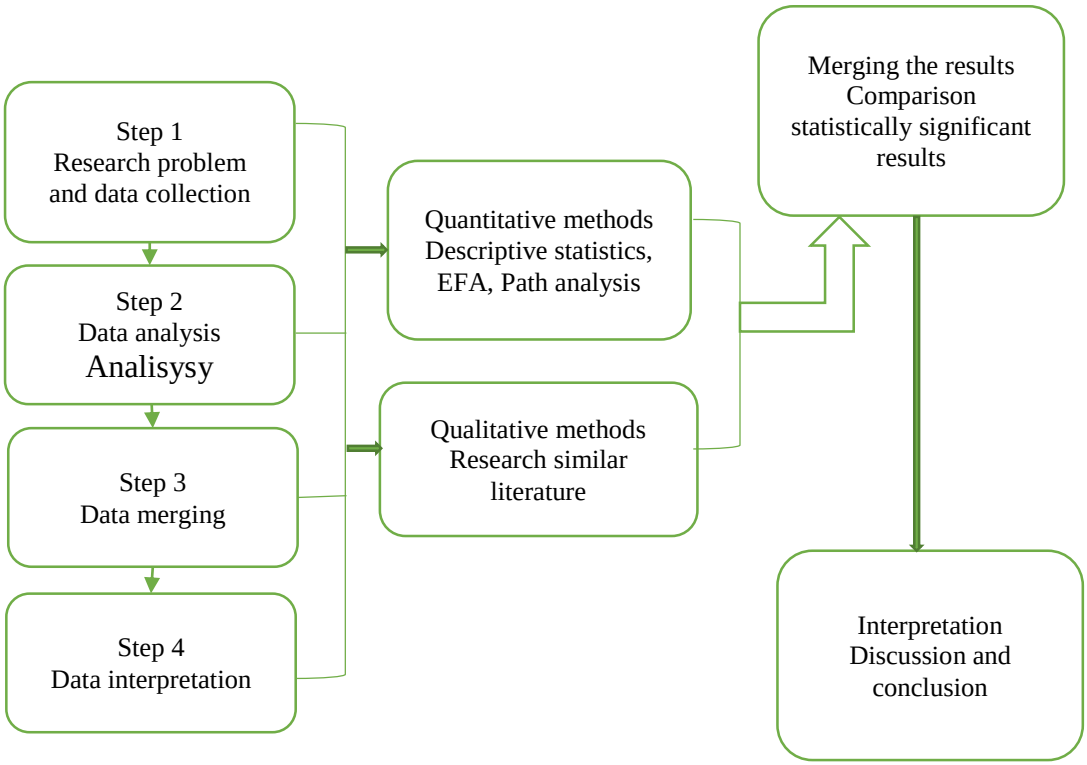

Figure 1. Recearch flowchart
Source: author`s research

RESULTS AND DISCUSSION

Survey research was conducted on a total sample of 350 respondents, visitors to rural households in Serbia: Vojvodina (120 respondents), Šumadija (150 respondents) and Eastern Serbia (80 respondents). Socio-demographic data are given in table 1. The highest percentage of respondents were men, as well as over 51 years of age, those with a university degree and respondents with an average monthly salary of 600-800 euros.

Table 1. Sociodemographic characteristics of respondents

Gender	Education	Earn	Age
Male 62.1 %	High school 32.1%	400-600 euro	18-30
Female 37.9%	Faculty 48.9%	600-800 euro	31-50
	MSc, PhD 19%	>800 euro	>51

Source: author`s research

Descriptive statistical analysis revealed that the respondents gave fairly good values for all items. The highest score was given to the item related to the fact that the locals know all the food, as well as the presence of local food. The item having organic food and trying food on the spot received a low average score. The values of arithmetic means and standard deviations can be seen in table 2.

Table 2. Descriptive values and extraction of all items, as well as reliability values of the questionnaire

Items	m	sd	α	KMO and Bartlett's Test			
				X^2	df	p	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.
Q1. Rich gastronomic offer	3.58	.759	.788	3522.215	10	.000	.640
Q2. Satisfaction with the overall gastronomy	3.86	.859	.878	**Extraction Sums of Squared Loadings**			
Q3. Organic food	1.97	.898	.816	**Total**	**% of Variance**	**Cumulative %**	**Rotation Sums of Squared Loadings**
Q4. Food without chemical treatment	2.75	.803	.866	5.233	26.163	26.163	5.144
				3.188	15.942	42.105	3.450
Q5. Organic food	2.69	.871	.770	**F1- Type of food** Q3, Q4, Q5, Q6, Q8, Q9, Q10, Q11			
Q6. Fresh groceries	2.91	.757	.764	**F2- Rural gastronomy** Q1, Q2, Q7, Q12, Q13, Q14, Q15, Q16, Q17, Q18, Q19, Q20			
Q7. The hosts know all the foods	4.57	.794	.757				
Q8. Quality food	3.47	.694	.843				
Q9. Implementation of the HACCP Food Safety System	3.56	.823	.866	**Confirmation hypothesis**			
Q10. Homemade food	4.84	.879	.849	**The quality of the entire gastronomic offer in rural households in Serbia is positively assessed**			
Q11. Homemade drinks	3.25	.695	.865				
Q12. Food texture	2.17	.480	.880				
Q13. Marking of origin of food	2.44	.724	.854				
Q14. Contemporary gastronomy	2.20	.873	.866				
Q15. Food storage on site	2.52	.598	.800				
Q16. The price reflects the quality	1.79	.731	.865				
Q17. Food color	2.04	.913	.712				
Q18. Tasting of local food	1.58	.884	.817				
Q19. Appearance of food	2.05	.689	.711				
Q20. The taste of food	2.43	.794	.873	**H1a**			

Source: author`s research. *m-arithmetic means, sd-standard deviation, X^2 – Chi Square, $p<0.05$

All conditions for performing an exploratory factor analysis were met, as shown by the values of KMO and Bartlett's Test (X^2= 3522.215, df= 10, p=0.00) =0.640. Using exploratory factor analysis, he extracted a total of two factors. The first factor Type of Food gathers 8 items and explains 26.1% of the variance of the questionnaire. The second factor Rural gastronomy gathers a total of 12 items and explains a total of 16% of the variance of the questionnaire. The total percentage of questionnaire explanations is 42%. In order to determine the influence of factors on the criterion variable healthy rural diet, the authors used structural modeling, path analysis, which is a type of extended regression analysis. Also, all criteria for path analysis were met: Chi-square (X^2) = 194.395, Degrees of freedom (df) = 16, Probability level (p)=0.00. The model fitting parameters are as follows: CLI=0.936, TLI=0.955, CMIN=2.390, RMSEA=0.06.

The table 3 shows the results of the effects of the factors on the variable healthy rural food (HRF). It can be observed that the effect of gender and education is statistically significant, in the direction that the older and more educated the HRF will be rated better. It is a positive correlation. For other factors, statistical significance is shown for all types of gastronomic offer except for modern food, where the correlation is negative and the influence is not statistically significant. In all other examples, it is about a positive impact on the assessment of greater application of healthy rural food.

Table 3. Results of path analysis - direct influences and confirmation of hypotheses

Direct influences		Estimate	S.E.	C.R.	P	Confirmation hypothesis
HRF <----------	Gender	.306	.118	2.595	.009	✔ ☺
HRF <----------	Age	.010	.076	.126	.899	✘ ☹
HRF <----------	Education	.181	.076	2.390	.017	✔ ☺
HRF <----------	Earn	.138	.080	1.732	.083	✘ ☹
HRF <----------	Modern food	-.091	.065	-1.395	.163	✘ ☹
HRF <----------	Organic food	.244	.074	3.284	.001	✔ ☺
HRF <----------	Ecological food	.487	.077	6.361	***	✔ ☺
HRF <----------	Tradition food	.219	.069	3.153	.002	✔ ☺

Source: authors research. *HRF- health rural food

The results from the table indicate that hypothesis H1b is partially confirmed, because not all factors influence the better development of HRF. Figure 2 gives an insight into the standardized and non-standardized values of the influence of all factors. The values of direct and indirect effects between the factors are observed. The biggest direct effect on HRF is Ecological food r=.0.49, and gender r=0. 31. Other direct effects also have a significant and positive correlation.

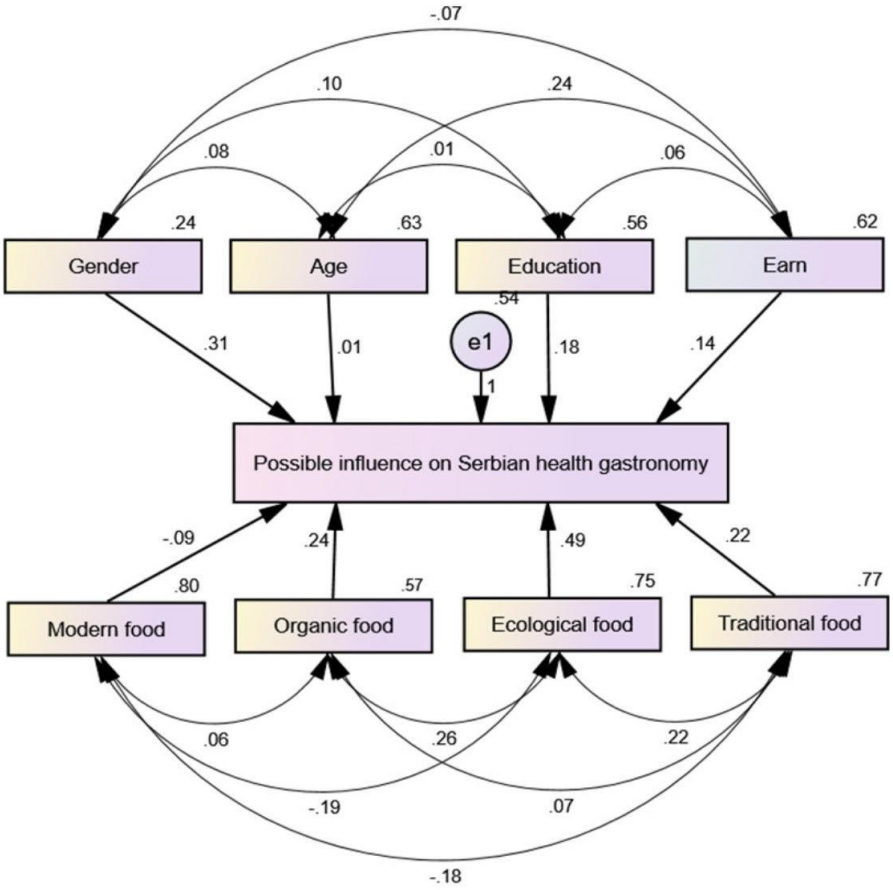

Figure 2. Standardized and unstandardized effects of path analysis
Source: author`s research

CONCLUSION WITH LIMITATIONS AND FUTURE IMPLICATIONS

Years ago, the evolution and history of gastronomy was clearly influenced by the social and economic background (Gajić et al., 2020). Also, the evolution of gastronomy has led to the use of new ingredients and technologies that could interact with nutrients and change the contribution of food to overall nutrition (Magnini & Kim, 2016). However, in recent years, gastronomy has received a completely new beginning, which is a return to tradition, ecology, nature, rural ways and principles of nutrition and food preparation (Cvijanović et al., 2020). As gastronomy and modern cuisine are intensively connected with social interactions, it is extremely interesting to analyze their implications on one of the main current concerns of society health (Parso & Hu, 2004. Household nutrition is influenced by interactions between food security and local knowledge (Canove et al., 2004). Health beliefs and food taboos are two manifestations that emerge within these processes that can contribute to beneficial, benign, or harmful health outcomes (Gajić et al., 2020). During the 20th century, industrialization began to threaten artisans and many abandoned their traditional techniques (Vukolić et aal., 2021). But in the past two decades, there has been a resurgence in demand for quality products made using time-honored methods (Jennings et aal., 2015). Gastronomy is one of the elements incorporated into the new concept of cultural heritage and cultural tourism, driven by the

growing trends of a good lifestyle, authenticity, environmental protection and the need for a quality experience. Tourists increasingly want food that emphasizes the heritage and culture of the place, which helps preserve traditional forms of agriculture and cultural heritage (Williams et al., 2015).

The authors tried to investigate the extent to which the quality of the rural gastronomic offer was assessed in the villages of Serbia. The research included a total of 350 respondents who visited rural households in that period. The questionnaire contained 20 questions related to the quality of the offer, and a descriptive statistical analysis revealed that all factors of the gastronomic offer were rated quite high. Also, a total of two factors were extracted by exploratory factor analysis. Furthermore, with the help of structural modeling or path analysis, the authors established the direct influence of factors on the HRF criterion (healthy rural food). The research results showed that most factors have a strong and positive influence on HRF, except for the modern food factor, which has no statistical significance. As far as sociodemographic factors are concerned, older and more educated people certainly gave better ratings to HRF marketing.

Research has theoretical and applied importance. In the first place, there is a very scarce alliteration for the promotion of healthy food that is marketed in the villages of Serbia. It is about the existence of highly ecological food, and to a large extent modern food that is processed in cities, but very little research on organic food in rural households in Serbia, which deal with offering accommodation and food to tourists. This research will certainly complement the existing literature on the same issue. Also, with regard to the applied significance of the results, it is about the fact that they can serve as an informative basis for further research and their use by the hosts and managers, in order to use them in activating the shortcomings in the current employment, and finding strategic measures to increase profit, increase in supply, but in the direction of sustainable development.

There were limiting circumstances during the investigation. Primarily, it was about the weak cooperation of the respondents with the researchers. Some were completely uninterested, but also out of fear of the pandemic to be in contact with people. Some of the respondents had a poor understanding of the questions due to their age, and some gave half-hearted answers.

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PR VALUE OF GREAT SPORTS EVENT ON THE EXAMPLE OF 36TH BELGRADE MARATHON

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Abstract: Great sports events occupy a special place in the modern event industry, with increasingly significant effects in the field of public relations in national, regional and planetary frameworks. Sports events that gather a large number of participants and spectators, enjoy great reputation, have tradition, include accompanying events, require greater human, financial and material-technical resources for organizing and that attract a lot of media attention are considered to be those events. Media-propaganda activities present the event to the general public in order to promote the value of sport and recreation, provide financial resources for its realization (through donors, sponsors and potential business partners) and satisfy the needs of users of sports information through printed and electronic media. That is why the PR value of great sports events is being taken into account more and more. The Belgrade Marathon is one of the largest sports events in Serbia and the Western Balkans region, with a long tradition and sporting, recreational, cultural, economic and media benefits, which is why it is categorized as an event of special national importance. This paper analyzes the PR value of the 36th Belgrade Marathon, as a kind of economic benefit from the implementation of appropriate communication strategies in public relations.

Keywords: *great sports events, Belgrade marathon, PR-public relations, PR value*

INTRODUCTION

The last decades of the previous century and the beginning of this one have brought about revolutionary changes in how organisation and management of sporting events are perceived. Mega-events have not only sporting, but also economic, commercial, political, sociological and other connotations and consequences. The aim of this paper is to uncover the interdependence between sports mega-events and Public Relations, as well as the potential of different communication instruments in organization of big sporting events.

One not so irrelevant thing is that in this paper is a review of the biggest sporting event in Serbia. Not accidentally, but with the idea that awareness in those who need to see the interest and value that such a mega event brings to everyone, we will present the facts that happened on the 36th Belgrade Marathon held on April 23rd 2023.

History of Belgrade Marathon

The Belgrade Marathon Race is the largest and the most mass attended sporting event in Serbia. It has come out of an idea of a group of enthusiasts to resume the race run as far back as **1910.** from Obrenovac to Belgrade. The **First Marathon Race** was held on **May 8, 1988**, the racetrack length was **23 km**, with several passing finish lines. The racetrack of the **Second Marathon Race** was **46.7 km** long, the starting-finish line being in front of the National Assembly Building.

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Having believed that the marathon race event is one among the identifiabilities of large world metropolises, "Partizan", the Yugoslav Sporting Club, undertook the responsibility to arrange for the marathon race, supported by ardent understanding of the City of Belgrade and assistance of all city services, municipal services and governance bodies. In September 2003, the Assembly of the City of Belgrade brought a decision to proclaim the Belgrade Marathon as the event of special importance for the City of Belgrade. In September 2022, The Goverment of Rebublic of Serbia proclaim the Belgrade marathon as the event of the biggest national interest as well.

The Belgrade Marathon is organized to suit all ages:

• the **Children's Marathon**, the race for the youngest
• the **Fun Run**, the most mass-attended race
• the **Half-marathon**, arranged under all applicable world standards, intended for highly eager runners
• the **Marathon,** the main race of the event, intended for the most ready runners.

All events on the streets are monitored by the entire local and majority of foreign media. The in-site reports are broadcasted by Eurosport, Sky Sport, ISPN through history while in 2023, after so many years TV Arena sport broadcasted live, while the presence of large mass-media centers and the publicity given to the event extends an opportunity to the whole world to take an indirect part in the marathon race and cheer the winners and friends of the event.

The organization of the event is managed in compliance with the highest world standards, and the team of the managers has won numerous world and local recognitions for the work done. Belgrade has proven to the world its competence and readiness to enter the large family of the countries having the potentials and recourses to organize the most complex running races of the highest quality and to take its position side by side with the largest world marathon races such as the ones of New York, London, Paris, Rotterdam…

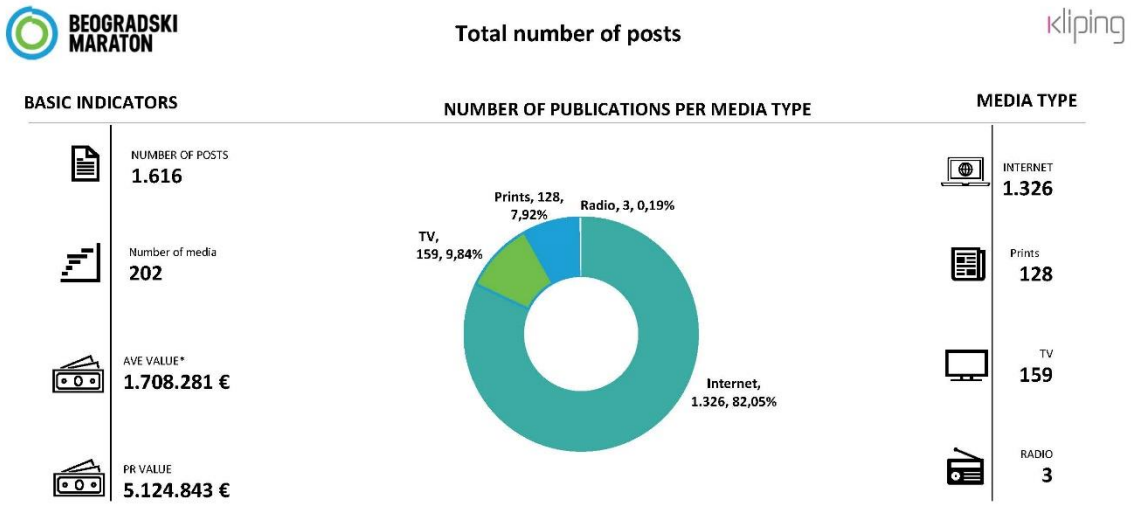
Management of 36th Belgrade marathon

The running spectacle, which according to many people was the best organized so far, brought with it revolutionary numbers: The event was followed by 75,000 people along the way; There were 15,000 runners in all disciplines; More than half a million people watched the tv broadcast; More than 3000 people worked on the course that day for runners; 25 different music stations was positioned along the course for the good atmosphere.

This kind of event is prepared for a year according to all management standards. A good plan and coordination between sectors in the organization itself are half of the entire event.
The main sectors in the technical organization of the event are the start, finish and course. In addition to the technical organization of the race, there are sectors for communication with sponsors, vip zone, medical team, judges, TV broadcast team, security of the route and participants, volunteers, pr team, digital team…
Mini-events that take place at the same time are a running expo, a children's marathon, a sports forum and special teams are hired for this as well. Running expo has been visited by over 20 thousand people in 3 days.
All this speaks for itself and the significance of these figures is multifaceted for all those who are directly or indirectly involved in the organization of such a large sporting event.

PR Value of 36th Belgrade marathon

*(**Advertising Value Equivalence - AVE)** publication is based on the price of an advertisement of the appropriate size in the given medium and represents the commercial value of the publication. AVE values are calculated by measuring the size of the publication in square centimeters (in the case of print media) or seconds (in the case of electronic media), which are multiplied by the price of 1 cm² or 1 second of advertising space in the given medium. The value obtained indicates how much an ad of that size would cost, that is, an advertisement of that duration in a given medium. By adding up the values of all posts recorded on the analyzed topic in a certain period, the total AVE value of the posts is obtained. **The PR value is obtained when the AVE value is multiplied by 3.**



Picture 1. Belgrade Marathon

The diagram clearly shows the value of such a large sporting event through just one month of media coverage.
1.616 posts in 202 diferrent media. 159 performances on all television stations in Serbia in live. It is clear that this is the perfect platform for all sponsors of the Belgrade Marathon who can gain great visibility through just one event organized by this company.

CONCLUSION

Like any special event, sporting events, and especially sports mega-events, can be the reason behind a serious communication activity, prepared and analysed through public relations. This paper analyses only the relationship and effects communication and public relations have with/on sporting events, as well as the basic possibilities of applying them to sports mega-events. Furthermore, actively spending leisure time is one of the highly important segments when it comes to promoting sports and sport communication practitioners must bear that in

mind. Finally, this area deserves attention and, considering the given trend and rate the sport world is being developed at, it shall only expand more in the future.

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6. Belgrade Marathon Race| City of Belgrade (beograd.rs)

PHYSICAL ACTIVITY ASSESMENT OF PEOPLE EMPLOYED IN THE IT SECTOR

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Abstract: The IT industry is known for its sedentary nature, as many IT jobs involve sitting in front of a computer for long periods of time, which can have negative effects on health. The move to working from home as a result of the pandemic eliminated many workday opportunities for physical activity. Even after the end of Covid-19 pandemic, remote type of work remained the most common choice among people employed in the IT sector. The aim of this paper was to assess the level of physical activity among male and female workers employed in informational technologies industry. The study lasted from March 29, 2023 to March 31, 2023. For the assessment, a questionnaire was conducted based on the „International Physical Activity Questionnaire - Short Form", and a questionnaire of basic information about individual morphological characteristics and working conditions. Sample of respondents included 35 male and 24 female employees from 3 different private firms in Belgrade, Serbia. The average age of female respondents was 34,3, whereas average age of male respondents was 34,9. Average BMI for amounted to 25,4 among males, and 21,9 among females, which indicates that both groups met the conditions for inclusion in the study. Results of IPAQ-SF are expressed as MET levels, and the analysis shows that 20% of the surveyed men belong to the „HEPA active" category, 77% to the „Minimally active" category, and 3% to the „Inactive" category. When it comes to women, they had slightly different results, where 33% of the respondents belonged to the „HEPA active" category, 63% belonged to the „Minimally active" category and 4% to the „Inactive" category. Based on the results of the descriptive statistical analysis, it has been revealed that the average duration of sitting on workdays is approximately nine hours for both genders, male and female. Regular physical activity is essential for maintaining good health and preventing chronic diseases. As per the findings, a significant proportion of the group has satisfied the minimum physical activity criteria set forth by the World Health Organization (WHO).

Keywords: *hypokinesis, sedentary lifestyle, physical activity, health, IT industry*

INTRODUCTION

The IT profession is a rapidly growing field, with a high demand for skilled workers. According to the US Bureau of Labor Statistics, employment in computer and information technology occupations is projected to grow 11% from 2019 to 2029, much faster than the average for all occupations. As for the number of people in the IT profession, it's difficult to provide an exact

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figure as the field is quite diverse and includes a wide range of roles and specializations. However, according to the CompTIA Cyberstates report, which provides an analysis of the US tech industry, there were approximately 11.8 million tech workers in the US in 2020. In terms of young people choosing IT as a profession, the field is quite popular among college students. According to the 2021 NACE Job Outlook report, which surveyed US employers about their hiring plans, computer science was the second most popular major among bachelor's degree candidates, behind business.

On the other side of the world, IT industry in Serbia has been rapidly growing over the past decade, with many global companies setting up operations in the country. Serbia has a highly educated workforce, with a large number of engineers and computer science graduates, which makes it an attractive location for tech companies. The IT industry in Serbia is primarily focused on software development, with a growing emphasis on emerging technologies such as artificial intelligence, blockchain, and the Internet of Things (IoT). The country has a thriving startup scene, with many young companies focused on developing innovative products and services. Some of the largest IT companies operating in Serbia include Microsoft, IBM, Oracle, Cisco, and Ericsson, among others. Many of these companies have established development centers in Serbia, which employ local talent to work on global projects. The Serbian government has also been supportive of the IT industry, offering tax incentives and other benefits to attract foreign investment. This has helped to fuel the growth of the industry, making Serbia a key player in the global tech landscape.

Informational Technologies industry is known for its sedentary behavior. This is a concern because workers spend a significant amount of time sitting at their desks, which can lead to a lack of physical activity and potential health risks (Information Technology Industry Association, 2019). In addition, many IT workers may work long hours, leading to even more time spent sitting in front of a computer screen.

Hypokinesis is a medical term used to describe a lack of physical activity or movement (MedlinePlus, n.d.). It is often used interchangeably with the term "sedentary lifestyle," which refers to a way of living characterized by low levels of physical activity. A sedentary lifestyle can have negative impacts on a person's health. Studies have shown that prolonged sitting or inactivity is associated with an increased risk of various health problems, such as obesity, type 2 diabetes, heart disease, and even some types of cancer. This is because a lack of physical activity can lead to a decrease in muscle mass and a reduction in the body's ability to use insulin effectively. In addition to physical health risks, a sedentary lifestyle can also have negative effects on mental health. Research has linked sedentary behavior to an increased risk of depression, anxiety, and cognitive decline in older adults (Smith, 2019).

Based on all of the above, we can conclude that as the IT industry grows, so will the number of less active people. To combat the negative effects of hypokinesis and a sedentary lifestyle, it's recommended to incorporate regular physical activity into daily routine. For 18–64-year-olds, the WHO recommends 150–300 minutes of moderate- or 75–150 minutes of high-intensity activity per week.

This study aims to assess physical activity in IT workers and investigate if, among these individuals, there was a link between undertaking physical activity (of different types and intensities) and gender//BMI.

Previous research on the similar subject, assessing physical activity of people employed in the IT sector during the COVID-19 pandemic, that was done in Poland reveals that IT employees are mostly characterized by sufficient levels of physical activity. 363 employees of the IT sector (63 women, 300 men; average age: 29; average BMI 26.17) met the conditions for inclusion in the study. In total, 26.17% were in the insufficient group, 54% in the sufficient group and 19.83% in the high physical activity group. Neither the work shift nor gender, nor form of work were related to undertaking physical activity of different types and intensities. It was assumed that there are other factors that determine this (Pazio, 2022).

MATERIALS AND METHODS

Cross-sectional survey of 59 IT workers was conducted to assess their current levels of physical activity and sedentary behavior using the International Physical Activity Questionnaire (IPAQ) short form. The study sample was recruited from a variety of IT companies in Belgrade.

To collect data on physical activity levels, participants were asked to complete the IPAQ short form questionnaire via Google Forms. The IPAQ is a widely used self-reported physical activity questionnaire that measures the frequency, duration, and intensity of physical activity performed in a typical week. The short form version of the IPAQ consists of seven questions that assess various types of physical activity, including walking, moderate-intensity activities, and vigorous-intensity activities.

By administering the IPAQ short form questionnaire via Google Forms, we were able to efficiently collect data from our study participants in a convenient and accessible manner.

Sociodemographic data such as age, gender and self-reported biometric data on height and weight were collected. Respondents, given their employment in the IT sector, were asked about their form of work.

This data was collected from 35 male workers and 24 female workers. The average age of male workers was 34.8 years, with a minimum age of 26 and a maximum age of 54. The average deviation was 5.34 years. The average age of female workers was 34.3 years, with a minimum age of 26 and a maximum age of 46. The average deviation was also 5.34 years. To better describe the age data, additional measures of central tendency, variability, and distribution were calculated. The median age of male workers was 35 years, while the median age of female workers was 33.5 years. The standard deviation of age for both male and female workers was 8.98 years, with a variance of 80.68 for male workers and 80.33 for female workers. The range of age for male workers was 28 years, while for female workers it was 20 years. The data showed that male workers were generally older than female workers, with a wider range of ages.

The height of the male participants averaged 182cm, while body weight averged 84,76kg. The average body mass index (BMI) was 25,35 kg/m^2. The height of the female participants averaged 168cm, while body weight averged 61,71kg. The average body mass index (BMI) was 21,9 kg/m^2.

Table 1. presents the demographic characteristics of the study participants, including their type of work and BMI classification.

Table 1. Demographic data and weight of respondents

	MALE IT WORKERS		FEMALE IT WORKERS	
	Number	%	Number	%
Participants	35	59%	24	41%
Type of work				
Hybrid	23	66%	15	63%
Remote	8	23%	6	25%
Office	3	9%	3	13%
BMI				
Underweight	0	0%	1	4%
Normal weight	16	46%	20	83%
Overweight	18	51%	3	13%
Obesity	1	3%	0	0%

The classification of body mass index (BMI) is widely used to assess adiposity and obesity-related health risks. The standard BMI classification includes six categories: underweight (BMI <18.5 kg/m2), normal weight (BMI 18.5-24.9 kg/m2), overweight (BMI 25.0-29.9 kg/m2), obesity class 1 (BMI 30.0-34.9 kg/m2), obesity class 2 (BMI 35.0-39.9 kg/m2), and obesity class 3 (BMI ≥40.0 kg/m2) (Centers for Disease Control and Prevention, 2021). These categories have been established based on epidemiological and clinical evidence that links BMI with various chronic diseases, such as cardiovascular disease, diabetes, and cancer. Therefore, BMI classification is a useful tool for clinicians, researchers, and public health professionals to evaluate individual and population-level health risks associated with excess body weight.

In the IPAQ Short Form, participants were asked to report the number of minutes they spent engaging in moderate-intensity physical activity, vigorous-intensity physical activity, and walking in the past week. The reported minutes of activity are then multiplied by the MET values assigned to each activity level to calculate the total MET-minutes per week.

Metabolic Equivalent of Task (MET) is used to express physical activity levels in the IPAQ Short Form. MET is a unit that measures the energy cost of physical activities.

After calculating the total MET-minutes per week for each participant based on their reported physical activity levels, the IPAQ Short Form classifies physical activity levels into three categories:

- Inactive: Participants who report less than 600 MET-minutes per week are classified as having a low physical activity level.
- Minimally active: Participants who report between 600 and 3000 MET-minutes per week are classified as having a moderate physical activity level.
- HEPA active: Participants who report more than 3000 MET-minutes per week are classified as having a high physical activity level. HEPA Active stands for "health-enhancing physical activity," which is a term used to describe physical activities that provide health benefits beyond the level achieved by activities of daily living.

All statistical data analyses were performed using Microsoft Office Excel. Descriptive statistics were initially performed for all variables (mean value, standard deviation, minimum and maximum value), in relation to gender.
Relationships between variables BMI and Total MET score were studied by Pearson's

correlation coefficient (r), where correlation values of 0.10, 0.30 and over 0.50 were considered small, medium and large, while values less than 0.10 were considered no correlation (Cohen, 1988).
Based on the met level achieved in the questionnaire, the results are reported also as percentages, indicating the number of respondents belonging to each group as per the IPAQ short form standards used to assess physical activity levels.

RESULTS AND DISCUSSION

Table 2 shows the average amount of time that male and female IT workers sit on weekdays.

Table 2. Descriptive indicators of the dependent variable - "Average daily time spent sitting"

	MALE					FEMALE				
Time (hours)	N	Min	Max	Mean	St. Dev.	N	Min.	Max.	Mean	St. Dev.
Sitting (Weekdays)	35	4	15	8,9	2,22	24	6	12	9,2	1,9

According to the table, male office workers sit for an average of 8.9 hours on weekdays, with a standard deviation of 2.22 hours. Female office workers sit for an average of 9.2 hours on weekdays, with a standard deviation of 1.9 hours. The minimum sitting time reported for male office workers was 4 hours, while the maximum was 15 hours. The minimum sitting time reported for female office workers was 6 hours, while the maximum was 12 hours. The results suggest that both male and female office workers may be at risk of a sedentary lifestyle, which is associated with negative health outcomes.

The results of descriptive statistics for MET score of different intensity are shown in the Table 3.

Table 3. Descriptive indicators of the dependent variables - "MET scores" for physical activities of different intensity

	MALE					FEMALE				
MET LEVEL	N	Min	Max	Mean	St. Dev.	N	Min.	Max.	Mean	St. Dev.
Vigorous physical activity	24	160	4800	1261,67	1007,6	12	240	3600	1336,7	870
Moderate physical activity	18	120	1920	683,33	542,6	14	100	3360	810	856,9
Walking, min. 10'	34	148,5	3465	990,9	808,5	23	115,5	4158	1459,2	1216,03

Out of 35 male IT workers, 24 respondents reported that they have weekly vigorous physical activity, where MET result ranged between 160 and a maximum value of 4800. The mean MET level for vigorous physical activity is 1261.67, indicating that the average intensity of the activities reported by the participants is relatively high. However, the large standard deviation of 1007.65 suggests that there is considerable variation in the reported MET score for vigorous physical activity, with some participants reporting much higher levels than others.
The data shows smaller number of participants that conducted weekly moderate physical activity, with a minimum MET value of 120 and a maximum MET value of 1920. The mean

MET score for moderate physical activity is 683.33, indicating that the average intensity of the activities reported by the participants is lower than for vigorous physical activity. The standard deviation of 542.59 is still quite large, however, suggesting that there is still considerable variation in the reported MET levels for moderate physical activity.

The data shows that the range of MET score for walking is quite large, with a minimum value of 148.5 and a maximum value of 3465. The mean MET score for walking is 990.9, indicating that the average intensity of the activities reported by the participants is moderate. The standard deviation of 808.5 is also quite large, however, suggesting that there is considerable variation in the reported MET score for walking.

When comparing the results for male and female respondents, we can observe that both groups engaged in a range of physical activities of varying intensities. For vigorous physical activity, the mean MET score was slightly higher for female respondents (1336.7) than for male respondents (1261.67), although the difference was not statistically significant. The standard deviation for both groups was also relatively large, suggesting that there was considerable variation in the intensity of the reported activities.

For moderate physical activity, the mean MET score was lower for male respondents (683.33) than for female respondents (810), although again, the difference was not statistically significant. The standard deviation for both groups was relatively large, indicating that there was considerable variation in the intensity of the reported activities.

For walking, the mean MET score was also higher for female respondents (1459.2) than for male respondents (1162.5), although the difference was not statistically significant. The standard deviation for both groups was also relatively large, suggesting that there was considerable variation in the intensity of the reported activities.

Overall, these findings suggest that both male and female respondents engaged in a wide range of physical activities, with some engaging in highly intense activities and others engaging in less intense activities. While there were some differences in the mean MET score between male and female respondents, these differences were not statistically significant and there was considerable variation within each group.

Table 4 shows the results of Pearson correlation analysis between BMI and Total MET score for different groups based on gender and physical activity levels. The sample sizes (N) are also provided for each group.

Table 4. Correlations between physical activity category and body mass index (BMI)

	r	p	N
Correlation between BMI and Total MET score/ Men	-0,151	0,387	35
Correlation between BMI and Total MET score/ Women	-0,035	0,873	24
Correlation between BMI and Total MET score/ HEPA active men	-0,650	0,113	7
Correlation between BMI and Total MET score/ HEPA active women	0,080	0,851	8
Correlation between BMI and Total MET score/ Minimally active men	-0,099	0,624	27
Correlation between BMI and Total MET score/ Minimally active women	0,109	0,710	15

For men, there was a small negative correlation between BMI and Total MET score, but the correlation coefficient (-0.151) was not statistically significant (p = 0.387). This suggests that there is no strong linear relationship between BMI and Total MET score among men.

Similarly, for women, there was no correlation between BMI and Total MET score, as the correlation coefficient (-0.035) was very weak and not statistically significant (p = 0.873).

Among HEPA active men, there was a large negative correlation between BMI and Total MET score, but the correlation coefficient (-0.650) was not statistically significant (p = 0.113). This suggests that there is no strong linear relationship between BMI and Total MET score among physically active men.

Among HEPA active women, there was no correlation between BMI and Total MET score, as the correlation coefficient (0.080) was very weak and not statistically significant (p = 0.851).

Among minimally active men and women, there was no correlation between BMI and Total MET score, as the correlation coefficients were very weak and not statistically significant.

Overall, the results suggest that there is no strong linear relationship between BMI and Total MET score for the different groups analyzed, and the lack of statistical significance in most cases suggests that any observed correlations are likely due to chance. However, it's important to note that correlation does not necessarily imply causation, and other factors not included in the analysis may also influence the relationship between BMI and Total MET score.

In addition to the previous interpretation, it is important to note that correlation analysis could not be performed for the Inactive group in each gender, as there was only one respondent in each group. Therefore, no conclusion can be made regarding the relationship between BMI and Total MET score for this group.

After the calculation of all the respondents' physical activity values and time spent sitting, and taking into account the IPAQ-SF scoring protocol, the participants were divided into three physical activity categories: HEPA active, Minimaly active, Inactive, as shown in Table 5.

Table 5. Number and percentage of respondents according to MET score classification: Hepa active, Minimaly active, Inactive

MALE			FEMALE		
HEPA active	Minimally active	Inactive	HEPA Active	Minimally active	Inactive
7	27	1	8	15	1
20%	77%	3%	33%	63%	4%

The majority of male respondents were categorized as "Minimaly active" (77%), followed by "HEPA active" (20%) and "Inactive" (3%). The majority of female respondents were also categorized as "Minimaly active" (63%), followed by "HEPA active" (33%) and "Inactive" (4%).

These findings suggest that there is a difference in physical activity levels between male and female IT workers, with a higher percentage of male respondents being classified as "Minimaly

active" and a higher percentage of female respondents being classified as "HEPA active". These results are consistent with previous research indicating that women tend to engage in more moderate physical activity, while men tend to engage in more vigorous physical activity.

Higher levels of weekly physical activity among female respondents may have contributed to their lower BMI values. It is important again to emphasize that the mean BMI for women in our study was 21.9, while the mean BMI for men was 25.35.

This could be due to a number of factors, including a higher level of engagement in physical activity outside of work hours, or a greater willingness to take breaks from sitting during the workday. It is also possible that there may be other factors contributing to the observed differences in BMI between male and female IT workers, such as differences in dietary habits or metabolic rate. Further research would be needed to explore these possibilities in greater detail.

Small number of respondents in each group may limit the generalizability of these findings to other populations of IT workers or to the general population. Future studies with larger sample sizes are needed to confirm these results and to investigate other factors that may contribute to physical activity levels among IT workers, such as job demands, work environment, and individual preferences.

Overall, these findings highlight the need for workplace interventions that promote physical activity and reduce sedentary behaviors among IT workers, particularly among those who are classified as "Minimaly active" or "Inactive". Such interventions may include workplace walking programs, standing desks, and breaks for physical activity during the workday.

CONCLUSION

In this study, we investigated the physical activity levels of IT workers and their relationship with BMI. Our findings suggest that IT workers have relatively high levels of weekly physical activity, which could be a compensatory response to long hours of sitting during weekdays. However, we did not find any significant correlation between BMI and the level of physical activity among the study participants. The relatively small sample size (59 respondents) may have limited our ability to draw strong conclusions about this relationship. Future studies may consider including body fat and muscle mass information to better understand whether BMI is influenced by muscle or fat content. Overall, our results suggest that IT workers' physical activity levels should be considered when designing interventions to promote healthy lifestyles and prevent sedentary behaviors in this population.

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DIFFERENCES IN THE MOTOR ABILITIES OF FEMALE VOLLEYBALL PLAYERS AT DIFFERENT PLAYING POSITIONS

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Abstract: Given the existence of different positions in volleyball, it is likely that there are also differences in motor abilities among players due to the specific physical demands of each position. Most of the research so far has studied the differences in body composition and motor abilities of male and female volleyball players in different playing positions in the elite level of competition. In this regard, the aim of this research was to determine the differences in motor abilities of female volleyball players in different playing positions of the lower level of the competition. The sample of respondents consisted of volleyball players of the women's volleyball club "Student" from Niš who play in the second league "Istok" with an average chronological age of 21.4 ± 2.95 years, who have been training for an average of 10 ± 2.73 years. Explosive power (*CMJ, CMJwas, SJ*), agility (*T-test, Illinois test, CODAT*) and speed (*5m, 10m, 20m*) were measured. Based on the obtained results, we saw that there is no statistically significant difference between the parameters of motor abilities in volleyball players in different playing positions in the lower level of competition. Therefore, based on previous studies and this study, it can be concluded that there is a significant difference between volleyball playing positions between higher and lower levels of competition, but not within them.

Keywords*:* *volleyball, playing positions, explosive power, agility, speed*

INTRODUCTION

Volleyball is a sport played over a net without direct contact between players and opponents; demonstrates superior technique, strategy and tactics; requires a certain speed of play; and thereby attracts all groups of players and spectators (Janković, & Marelić, 1995). Volleyball is a complex sport that abounds in many motor forms. It is referred to as a "poly-structural complex sport" in which athletes must use technique, tactics and motor abilities, in order to achieve certain results (Janković, & Marelić, 1995). One of the elements that undoubtedly has a large coefficient of influence on the quality performance of volleyball players is their motor abilities (coordination, explosive power, agility, speed) (Magill, 2007).

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No technical component in any sport (even volleyball) can be performed correctly without adequate motor abilities, which require rational technique for performing movements (Bokan, 2009). The motor abilities that define volleyball players are explosive muscle power during jumps and speed in performing fast, multidirectional movements, and agility (Ciccarone, Croisier, Fontani, et al, 2008).

Differences in physical ability and anthropometric variables between athletes regardless of position, both in volleyball (Barnes, Schilling, Falvo, et al, 2007; Gabbett, & Georgieff, 2007) and other team sports (Mohamed, Vaeyens, Matthys, et al, 2009; Boone, Vaeyens, Steyaert, et al, 2012), have been investigated in previous studies. Players in different positions are required to develop different motor abilities and engage in different tactical tasks during a match (Granatelli, Gabbett, Briotti, et al, 2014).

The volleyball team consists of 12 players of different positions. The positions are defined as receivers, correctors, technicians, middle blockers, and liberos (players specialized in defensive abilities). Each position plays a specific and different role during a volleyball game (Gabbett, Georgieff, Anderson, et al. 2006). Given the existence of different positions in volleyball, it is likely that there are also differences in motor abilities among players due to the specific physical demands of each position (Mielgo-Ayuso, Calleja-González, Clemente-Suárez, & Zourdos, 2014).

Determing the existence of differences in body composition and motor abilities in volleyball players in different playing positions in the elite rank was the goal of many studies (Milić, Grgantov, Chamari, et al. 2017; Pocek, Milosevic, Lakicevic, et al 2021; Mielgo-Ayuso, Calleja-González, Clemente-Suárez, & Zourdos, 2014; Sattler, Hadžić, Dervišević, & Markovic, 2015; Palao, Manzanares, & Valadés, 2014).

Most of the research so far has studied the differences in body composition and motor abilities of male and female volleyball players in different playing positions in the elite level of competition. In this regard, the aim of this research was to determine the differences in motor abilities of female volleyball players in different playing positions of the lower level of the competition.

METHODS

The sample of respondents

Volleyball players of the women's volleyball club "Student" from Niš, who play in the second league "Istok", participated in this work. The average chronological age of the players was 21.4 ± 2.95 years and they had been training volleyball for an average of 10 ± 2.73 years. Before testing, all respondents were familiarized with the protocol and gave voluntary consent to participate in the study.

Testing procedure

The testing was done in the volleyball-specific hall in the late evening. The respondents were given a 15-minute warm-up to get their bodies ready for the test, which included a variety of mobility drills and drills exclusive to one volleyball practice session.

Explosive power was measured using Optojump photoelectric cells. Three static tests, the Squat Jump (SJ), the Counter Movement Jump (CMJ), and the Counter Movement Jump With Arm Swing (CMJwas), were carried out by the participants to gauge their explosive power. The maximal vertical jump is made during the SJ test from a half-squat, which is executed while holding hands fastened to the hips. The CMJ test also involves the responder doing a maximal vertical leap while lowering herself to a semi-squat position, while holding her arms fixed to her hips. The CMJwas test begins from the same position as the CMJ, but the respondent also employs an arm swing (Madić, Nikolić, & Stojiljković, 2015).

At an accuracy of 0.01s, Witty photocell gates from Microgate in Italy were used to measure the responders' running pace (Madić, Nikolić, & Stojiljković, 2015). The test respondents had to complete a given section in the least amount of time feasible starting from a high start and at the meter's signal. Meter signals were placed at 5, 10, and 20 meters, where photocell gates with informational displays were positioned.

Witty photocell gates (Microgate, Italy) were also employed to measure agility; they were positioned at the start and/or finish of each of the three tests (*CODAT, Illinois Agility Test, T-test*). In the agility *T-test*, the cones are arranged in the shape of a letter T, with the start cone being 9.14 meters from the start and the side cones being 4.57 meters apart. The test required the subjects to run straight to the first cone and touch it, then move laterally in a step-by-step motion to the left cone, touch it as well, move laterally in a step-by-step motion to the right side cone, touch it as well, return with the same movement to the central cone, touch it, and complete the test by moving backwards to the starting position (Madić, Nikolić, & Stojiljković, 2015). The *Illinois agility test* involves an area 10m long and 5m wide, where cones were placed in the middle at a distance of 3.33m. Test respondents start at the lower left cone. At the meter's signal, they run to the upper left cone, go around it, then return to the lower center cone and begin a slalom movement between the center cones in both directions. After exiting the figure eight, the subjects run to the upper right cone, go around it and finish the test at the lower right cone (Madić, Nikolić, & Stojiljković, 2015). In the CODAT test, participants do a sprint for 5m, followed by two zigzag sprints of 3m each at 45° and 90°, before completing the test with a sprint for the last 10m (Lockie, Schultz, Callaghan, Jeffriess, & Berry, 2013).

Statistical data processing

The IBM SPSS Statistics 20 program was used for statistical data processing. Given that the normality of the data was confirmed by the Kolmogorov-Smirnov test, One-way ANOVA was used to determine the differences in the motor abilities of volleyball players according to position.

RESULTS

Descriptive parameters of the performed tests, as well as the normality of data distribution are shown in Table 1.

Table 1. Descriptive statistics and normality of data distribution

	Mean ±Std. Dev.	***K-S (Sig.)***
CMJ	27.50 ± 3.53	.661
CMJwas	31.67 ± 3.90	.989
SJ	26.94 ± 3.83	.643
5m	1.29 ±0.109	.986
10m	2.16 ±0.13	.986
20m	3.76 ±0.18	.945
Ilinois	18.07 ±0.67	.916
T test	11.62 ±0.89	.958
CODAT	6.34 ±0.48	.960

Legend: **K-S (Sig.)** – *Kolmogorov-Smirnov test*; **CMJ** – country movement jump; **CMJwas** – country movement jump with arm swing preparation; **SJ** – squat jump; **5m** – sprint for 5 meters; **10m** – sprint for 10 meters; **20m** – sprint for 20 meters; **Illinois** - agility test; **T-test** – test for assessing agility; **CODAT** - change of direction and acceleration test

The detailed difference in motor abilities of female volleyball players in different positions is presented in Table 2.

Table 2. Results of One-way ANOVA.

	One-way ANOVA	***Sig.***
CMJ	Between Groups	.967
CMJwas	Between Groups	.257
SJ	Between Groups	.613
5m	Between Groups	.555
10m	Between Groups	.581
20m	Between Groups	.455
Ilinois	Between Groups	.674
T test	Between Groups	.356

Legend: **K-S (Sig.)** – *Kolmogorov-Smirnov test*; **CMJ** – country movement jump; **CMJwas** – country movement jump with arm swing preparation; **SJ** – squat jump; **5m** – sprint for 5 meters; **10m** – sprint for 10 meters; **20m** – sprint for 20 meters; **Illinois** - agility test; **T-test** – test for assessing agility; **CODAT** - change of direction and acceleration test

Based on the One-way ANOVA shown in Table 2, it can be concluded that there are no statistically significant differences between the parameters of motor abilities in volleyball players in different playing positions.

DISCUSSION

Volleyball is a challenging sport with a wide variety of motor patterns. Athletes must use technique, strategy, and motor abilities in this "polystructural complex sport" in order to attain certain results (Janković, & Marelić, 1995). The volleyball team consists of 12 players of different positions. The positions are defined as receivers, technicians, middle blockers, setters, and liberos (players specialized in defensive abilities), and each position plays a specific and different role during a volleyball game (Gabbett et al., 2006). In this regard, the aim of this research was to evaluate the differences in the motor abilities of female volleyball players in different playing positions at lower range of competition.

Based on the results shown in Table 2, it can be seen that there are no statistically significant differences in the motor abilities of female volleyball players of different playing positions in the lower level of competition, which is in accordance with the previous literature (Sattler et al., 2015; Milić et al., 2017) which dealt with the same topic. The study by Gabbett, & Georgieff (2007), which had the same research objective, was conducted on a sample of young volleyball players of different levels of competition. Namely, the researchers concluded that there were statistically significant differences in the motor abilities of volleyball players of different ranks, in favor of elite competitive volleyball players compared to semi-professional and amateur volleyball players, in the area of agility and explosive power of the lower extremities. Furthermore, a study by Ciccarone, Croisier, Fontani et al. (2008), who determined differences in lower extremity explosive power, came to the observation that there were differences in lower extremity explosive power in favor of middle blockers and receivers. A study (Mielgo-Ayuso, Calleja-González, Clemente-Suárez, & Zourdos, 2014) found that there were differences in explosive power and speed between different playing positions in volleyball in favor of middle blockers.

Milić, Grgantov, Chamari et al. (2017) indicated that there were no statistically significant differences between volleyball players of the same competitive level, which is in line with this study. However, they indicated that there were differences in motor abilities between different playing positions when comparing female volleyball players of different levels of competition (Milić et al., 2017), which aligns with the results of the study (Pocek et al., 2021). Palao et al. (2014) determined that there are differences in explosive power and agility between different player positions in the team, in favor of middle blockers and receivers, while players in the position of technician and libero showed greater speed.

CONCLUSION

The results of this study showed that there is no statistical significance in female volleyball players in different playing positions in the lower level of the competition. Other studies that compared the differences between female volleyball players in different playing positions in the elite, semi-professional and amateur ranks came to similar results. Therefore, based on previous studies and this study, it can be concluded that there is a significant difference between

volleyball playing positions between higher and lower levels of competition, but not within them. The differences found in the studied variables with regard to the playing position are related to players' needs regarding the actions they perform.

Limitation of the study

This study has potential limitations. The first limitation is the small sample size. Therefore, it is desirable to conduct such research with a larger sample of respondents. Another limitation is the number of measuring instruments (tests) that were used in the assessment of the domain of motor abilities. Namely, it is recommended to use a larger number of tests of motor abilities or test modifications for conditions specific to the game of volleyball.

Future research

For future research, it is recommended to use a larger number of motor ability tests. Also, it is desirable to have a larger sample of respondents.

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THE STRUCTURE OF THE RELATIONS BETWEEN THE DIMENSIONS OF PERSONALITY, PARENTING ATTITUDES AND PEER VIOLENCE IN CADET VOLLEYBALL PLAYERS

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Abstract: The aim of this cross-sectional study was twofold: (1) to define the latent structure of the dimensions of personality, and (2) to examine the effect of personality traits and parenting attitudes on peer violence among adolescents. The research was conducted on a pertinent sample (N = 122) of volleyball players from two volleyball clubs in Serbia. The average age of participants was M = 17.32 years of age (SD = 5.26). Following measuring instruments were applied: Peer Violence Assessment Questionnaire (PRONA), The Junior Eysenck Personality Questionnaire (JEPQ), and Parenting Attitudes Questionnaire (UVS). Analyzing the main components (PCA) within the construct of peer violence, three main components which account for 28.09% of the variance were extracted, where risky behavior (F_1), victimization (F_2), and psychological violence (F_3) were interpreted as latent dimensions. The findings of the multiple regression analysis indicate that the statistically significant partial influence in predicting the results on the dimension risky behavior is determined by three predictors: a) Psychoticism, b) Neuroticism, and c) L scale. The results have shown that the significant partial correlation between the independent variables Neuroticism, L scale, and Parenting attitudes of a mother is a significant generator of the 33% of the variability of the dimension Victimization, while Psychological violence, with 29% of the variability, is significantly explained by the basic personality trait Psychoticism (β = .40, $p \leq$ .01). This study also deals with the probable implications of the obtained findings, as well as with the guidelines for improving the methodology of future research. The results of this transversal research contribute to rare and inconsistent findings on the relations between the dimensions of personality, parenting attitudes, and peer violence in adolescent volleyball players.

Keywords: *volleyball players, cadets, Eysenck, UVS, PRONA*

INTRODUCTION

Keeping in mind the fact that the beginning of the XXI century is characterized by the increase of violence and aggressive behavior among adolescents, the form and correlation between peer violence in schools has become the more frequent subject of psychological research (Boyer et al., 2023; Coley et al.,2021; M. Ivanović, U. Ivanović, 2022; Jelsma & Varner, 2020). The construct *peer violence* includes a situation of unequal strength where a student is, as a victim, subjected to systematic and constant negative behavior of one or more bullies (Pregrad et al., 2007). The most common type of peer violence is *physical violence*, which includes bodily harm or making person feel unease, striking with hands and feet, pinching or physically blocking their path (Bjereld et al., 2019; Ivanović et al., 2015). Another most common type of physical violence in schools is psychological violence which is committed by verbal (mocking,

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teasing, insulting, threatening) and non-verbal acts (lewd movements, grimacing, deliberate exclusion from the group or refusal to indulge a person), and deliberate tendency to abandon. In accordance with the aforementioned definitions, direct and indirect type of violent behavior manifest themselves and generate two types of victimization – direct and.

Keeping in mind the fact that the beginning of the XXI century is characterized by the increase of violence and aggressive behavior among adolescents, the form and correlation between peer violence in schools has become the more frequent subject of psychological.

Even though there aren't many empirical studies on the correlation between the main personality traits and peer violence, it has been found that insufficient control of unrestrained behavior, along with the violence, is in relevant interaction with violent behavior (M. Ivanović, U. Ivanović, 2021; Husky et al., 2020). Additionally, some results show that certain types of risky and self-destructive behavior, such as alcohol abuse and smoking cigarettes, correlate to violent behavior (M. Ivanović & U. Ivanović, 2017; Okumu et al., 2020). With that finding in mind, *victimization* usually correlates to lack of self-esteem and passiveness, even though that, along with the passive victims, the so-called victim-provocateurs are identified in this context (Olweys, 1998, Sinobad, 2005). There are more victims who do not fight back (Crouch et al., 2019; Ivanović et al., 2015), and they are generally careful and sensitive. They perceive themselves as unattractive and more powerless than others, which means that they are more susceptible to peer violence. Physical indifference in correlation to fear means that a person is insecure and will not fight back if attacked, but will react with fear and aggression (Sidhu et al., 2019). The research results (Arató et al., 2021) show that, depending on the adolescent's attitude towards violence, there are the following categories of students: bullies, victims, bully-and-victim, and uninvolved. These categories are in accordance with the findings of earlier research (Ivanović et al., 2014; Jones et al. 2019) and indicate that peer violence and victim behavior are not necessarily in collision. The results (Olweys, 1999, prema Frisen et. al.,2007) where bullies come from inadequate family environment and who see aggression as an instrument for achieving power and influence among peers indicate that family atmosphere is a relevant predictor of occurrence and development of violent behavior. The aforementioned authors believe that minimal parental care for children is a relevant factor in the occurrence of violence. The authors (Thomas et al., 2019; Ivanović et al., 2013) believe that: overly indulgent parents, lack of parental warmth and attention, as well as physical punishment are factors which generate violent behavior, where boys have higher tendency towards physical violence, while girls are more often victims of psychological violence. It is assumed that different types of violence have significant consequences to mental and physical health of a victim who, due to daily abuse, can commit suicide. In addition, physical, mental, and social behavior also have negative influence on a bully's well-being (Salem & Al-Diyar, 2021; Ivanović et al., 2012).

Seeing how the complex construct of the latent structure of personality dimensions and the relations to peer violence and its various manifestations have not been fully explained, as well as the fact that identical studies have not been conducted on the Serbian athletes, *The aim* of this transversal *research* was twofold: (1) to define the latent structure of the group of indicators of violent behavior, and (2) to identify the correlation between the dimensions of peer violence and significant personality traits and parenting attitudes. Based on the findings mentioned in this study, the following *hypothesis* was tested (H): it is expected that the characteristic tendency towards violent behavior will match the prominent aggression, impulsivity, and tendency towards risky behavior, and that these tendencies correlate to family environment – parenting attitudes of parents.

METHOD

Participants and procedure

The pertinent sample included participants (N = 122) from four volleyball clubs from interregional Kolubara-Macva league: "VA 014" (Valjevo), "Loznica" (Loznica), "Karađorđe" (Topola), and "Valjevo" (Valjevo). The average age of participants was 17.32 ± 5.26 years. All the participants had minimum years of systematic and organized volleyball training, at least three times a week.

Prior to conducting the research, the permission for students to take part in the research was asked of their parents, coaches, and club management. The participants were told that they could quit at any time and that they do not have to answer certain questions. The testing lasted approximately 30 minutes. The research was conducted in accordance with the Declaration of Helsinki, and was approved by the ethics committee of the Serbian Academy of Innovation Sciences from Belgrade. The research was conducted during the month of February, 2023.

Instruments

Peer Violence Assessment Questionnaire (PRONA; Maksimović et al., 2008) assesses peer violence among preadolescents. The questionnaire includes the following aggressive tendencies: a) direct involvement in physical attacks on other children and inciting physical violence, b) psychological violence, such as threatening, gossiping, mocking, ignoring, extorting service, etc., and c) suffering from various types of aggression. Apart from behavioral actions of peer violence, PRONA contains markers of certain behaviors which include interaction between types of violence, for example taking psychoactive substances and taking part in petty theft. The questionnaire contains 42 items with Likert-type answers, 7 of them being excluded. The coefficient of internal consistency was presented through Cronbach's alpha, and for the entire scale is (α = .79), which indicates satisfactory reliability, and the reliability of Cronbach's alpha type partially are: for dimension risky behavior (α = 78), victimization (α = 80), and psychological violence (α = 76).

The Junior Eysenck Personality Questionnaire (JEPQ: Eysenck & Eysenck, 1994) assesses main dimensions of personality. It includes 98 items and four scales: a) Psychoticism – 34 claims, b) Neuroticism – emotional stability (20 claims), c) Extraversion-introversion (24 claims), and d) the scale of social desirability, which is a proclivity for socially desirable responding (20 claims). The participants give yes-or-no answers ("yes" – it refers to them, "no" – it doesn't refer to them). The coefficient of internal consistency (Cronbach's alpha) for this psychological construct was: α = 77 (for the scale *Extraversion*), α = 79 (for the scale *Neuroticism*), α = 75 (for the scale *Psychoticism*), and α =.85 (for the scale *Social desirability*).

Parenting Attitudes Questionnaire (UVS; Genc i Kodžopeljić, 1995) assesses the parenting attitudes of parents. The psychological construct used here consists of two bipolar dimensions of parenting attitudes. The extremes of the affective dimensions are presented as warm vs. cold parenting, while the dimensions of control are the indicators of lenient vs. limiting parenting. This scale includes 22 items, and the parenting styles of a mother and of a father are assessed on a four-point Likert-type scale (1 = *never*; 2 = *yes, but rarely*; 3 = *yes, often*; 4 = *yes, almost always*). The participants would answer how often their mother or father act is a certain manner. In this research, five items which include different types of abuse or neglect of a child were added to the scale that assesses affective dimensions. The reliability of this questionnaire was satisfactory because the value of Cronbach's alpha was (α = .81).

RESULTS

The latent structure of the system of indicators of peer violence, contained in the PRONA questionnaire, was examined in Table 1 by principal components analysis – PCA based on the participants' response to 34 items (Tabachnick Fidell, 2013). Based on the Scree test used for interpreting factorial structure, three main components (trifactor solution) with their vectors or characteristic root above or equal to one ($\lambda i \pm 1$) n were kept in the analysis, which explained 28.09% of the total variance of the base variables (Table 1). The *Promax rotation with Kaiser-Guttman* rule was used on the extracted orthogonal components, which is the covariance between the manifested variables (Subotić, 2013). Kaiser-Meyer-Olkin test and Bartlett's test were used to check the suitability of the matrix for the factorial analysis (KMO = .71, $\chi 2$ = 3519.1, $p \leq .01$), which indicates that they are statistically significant, meaning that all items in the trifactor structure represent the analyzed participants adequately, and are adequate for factorization (Pallant, 2009).

Table 1. *Main components, characteristic roots and the percentage of the explained variance*

	Pre rotation		Post rotation	
Main components	Characteristic lambda root	% of the explained variance	Cumulative % of the explained variance	Characteristic root after rotation
1.	5.05	13.90	13.90	4.95
2.	4. 12	9.86	22.76	4.03
3.	3.26	6.33	28.09	3.14

The extracted communalities (h^2) of all items in the trifactor solution in Table 2 represent segments of the variance of the manifest variable which significantly explain main components. Looking at the values of the communality, one can see that all values are within the satisfactory range (.15 do .62). Additionally, the factorial saturations of the trifactor model are in accordance with the criteria (Tabachnick & Fidell, 2013), lower or equal to .32, so it is safe to conclude that they are good representatives of the examined questionnaire.

Table 2. *The factorial structure of the first isolated "Promax" component and communality*

Items	Constitution	Structure		h^2
I tried cigarettes	.79	.77		.62
I sometimes consume alcohol with friends	.73	.68		.50
I often argue with my peers	.61	.57		.35
It happened that I stole something	.48	.50		.33
I had a fight with friends from school	.50	.56		.32
I am a good student	-.47	-.35		.30
I know how to instigate a fight	.39	.60		.49
I tease friends about some of their shortcomings or flaws	.38	.50		.31
I like to embarrass in front of everyone	.36	.42		.32

someone who annoys me				
I would engage in a fight to defend a friend	.32	.37		.30
I regularly watch American wrestling	.32	.35		.33
I would never hurt other children	-.35	-.39		.32
I like to read	-.32	-.37		.31

Legend: h^2 = Communality

Within the constitution matrix there are the saturations of the extracted "*Promax*" factor for the assessment of 14 items. The first significant latent dimension is affected by factorial load with linear combinations of the original variables, with 13.90% of the variance, which means that they are predominantly defined by the items which include various forms of socially unacceptable manifestations such as use of alcohol, cigarettes and marihuana, and theft. In addition, the constitution and the structure of this mutual latent variable are also significantly saturated by the indicators of the low school grades. Finally, this extracted maximum variance from the group of data is affected by the factorial load of the items which define the tendency to fight and argue, as well as the intention to hurt and embarrass other preadolescents. Therefore, the profile of this construct represents various types of unacceptable behavior, which means aggression oriented towards others, and direct physical violence. The linear combinations of the manifested variables mentioned in this component model can be interpreted as the extracted factor (F_1) *Risky behavior*.

The second "Promax", with 11 claims in total, explains 9.86% of the remaining variability. Its constitution and structure ($\lambda = 4.12$) is represented by the items which structure includes situations in which a participant is subjected to direct physical or verbal aggression, such as teasing or shushing (Table 3).

Table 3. *The factorial structure of the second isolated "Promax" component and communality*

Items	Constitution	Structure	h^2
I was beaten up by a friend from school	.68	.62	.49
My peers often tease me	.63	.59	.39
Children often mock me	.59	.58	.38
Stronger peers often mock me	. 67	.64.	.42
Other children often shush me when i try to say something	.63	.61	.40
Many of my peers avoid me	.64	.50	.37
Other peers force me to do them small favors	.52	.48	.30
Some children often embarrass me in front of friends	.50	.43	.28
I avoid peers who I don't like because if some shortcoming or flaw	.38	.40	.25
Some of my peers threatened me	.40	-.41	.22

I defend my friends when others tease them	-.40	-.39	.19

Legend: h^2 = Communality

This latent variable also includes items that indicate that preadolescent is a victim of psychological violence – avoidance, embarrassment, mocking, and being threatened by peers. The structure of this latent dimension, which is the summary of the projections of linear combinations of manifested variables, can be identified as a separate factor (F_2) *Victimization*. The third "Promax" dimension mostly correlates to 11 items which include more subtle and latent forms of violent behavior (Table 4).

Table 4. *The factorial structure of the third isolated "Promax" component and communality*

Items	Constitution	Structure	h^2
Other children have to do me small favors	.80	.75	.59
I often smack or swat other children or pull their hair in passing	.79	.73	.60
I manage to convince my friends not to spend time with those who we do not like	.48	.46	.30
It happened to bring a small knife or some other self-defense weapon to a sports club	.39	.38	.23
I gossip with friends about people who deserve that	.38	.37	.20
I like movies that feature a lot of violence	.37	.36	.40
I threatened those who annoy me	.43	.50	.42
I often mock children weaker than myself	.34	.37	.18
I sometimes first hit a friend on purpose	.29	.38	.50
I know how to instigate a fight	.37	.61	.49

Legend: h^2 = Communality

Taking an insight into the factorial structure, one can see that the items of the latent variables about forcing other children to do favors, threatening, excluding from social group, and gossiping explain minimal percentage of the variance, 6.33%. They represent certain types of minor physical violence, where the aim is not to physically hurt the victim, but to mock and humiliate. With the obtained factorial saturation, that reduced dimension with minimal percentage of the residual variance can be interpreted as an isolated factor (F3) *Psychological violence*.

Mathematical-statists method of multiple regression analysis (Tabachnick & Fidell, 2013) was conducted in Table 4 with the aim of predicting total and partial influences of predictor variables the dimensions of personality and parenting attitudes on the criterion variable peer violence.

Table 5. *The results of the multiple regression analysis for predicting the criterion variable peer violence*

Predictors	Risky behavior *β (SE)*	Victimization *β (SE)*	Psychological violence *β (SE)*
Psychoticism	.29 (.06) **	.34 (.02) **	.40 (.03) **
Neuroticism	-.12 (.01)	.30 (.14) **	-.15 (.13) *
L scale of socially desirable responding	-.33 (.15) **	.29 (6.21) **	-.22 (5.96)
Extraversion	.30 (.02) **	-.20 (.04) **	.08 (.01)
Parenting dimension of control - father	.03 (.07)	-.17* (.12)	-.31 (5.43) **
Affective dimension of parenting - father	-.05 (6.07)	.19* (6.17) **	-.01 (.010)
Parenting dimension of control - mother	-.03 (5.11)	.38 (.07) **	.11 (.04)
Affective dimension of parenting - mother	.10 (.09)	.32 (6.105) **	-.06 (5.05)
R	.69	.62	.49
ΔR^2	.49; $p \leq .01$	.33; $p \leq .01$	.29; $p \leq .01$

Legend: β = standardized regression coefficient; *R* = coefficient of multiple correlation; R^2 = coefficient of determination; *SE* = standard error of the *β* coefficient estimate. $^{**}p \leq .01$. $^{*}p \leq .05$.

The obtained values of the coefficient of determination, even with the remaining residual variability which occurred under the influence of the uncontrolled factors, show that the tested regression model is statistically significant (p ≤. 01). Additionally, the calculated coefficients of multiple correlation are statistically significant, which means that the independent variables measured using JEPQ and UVS criterion variable peer violence are in linear correlation.

Taking an insight into the regression function, or equation, one can notice that, with the risk level of 1%, the dependent variable *Risky behavior* and the group JEPQ and UVS predictors, explains the maximum percentage, 49%, of the total variance. Within the regression model, three independent variables Psychoticism, Extraversion (positive indicators), and Socially desirable responding (negative indicators) have a relevant contribution to the partial prediction of the construct Risky behavior. The obtained inverse – negative direction of the correlation indicates that the increase of peer violence conditions the decrease of socially desirable responding. Variables Neuroticism, the scale of socially desirable responding, and parenting attitudes of mother have shown significant positive linear correlations to the dimension Victimizations, with 33% of the explained variability, which means that the more intense restrictive parenting attitudes coincide with the higher score on the criterion *Victimization*. In addition, with 29% of the explained variations, the predictor variable *Psychoticism* with positive indicator has a partial influence on and statistically significant direct correlation, with 95% of the probability of correct assessment (α error), in explaining the results on the dependent variable *Psychological violence*. The obtained positive beta coefficient ($\beta = .40$, $p \leq .01$) indicates that an increase in peer violence in the examined adolescent population coincides with the increase of the value of psychoticism.

DISCUSSION

The findings obtained in this research indicate that the latent environment of the questionnaire for assessing peer violence is structured by three dimensions: a) risky behavior, b) victimization, and c) psychological violence.

The first latent dimension *Risky behavior* includes different types of unacceptable behavior which include aggression oriented towards self and others. The structure of this dimension that includes risky and delinquent behaviors and tendency towards violence is in accordance with the results of the research (M. Ivanović i U. Ivanović, 2022; Kim, & Craig, 2020; Nery wet al., 2019; Marracho et al., 2021). The structure of the correlations between these variables has not yet been fully identified; even though the findings indicate that they create a compact latent variable, one can assume that the correlation is not direct. Some research authors actually believe that risky behavior contribute the increase of self-esteem and popularity, which enables the manifestation of aggression (Flores et al., 2020; Ivanović et al., 2015; Ríos & Ventura, 2022). Based on the findings of this research, that explanation cannot be unconditionally accepted, but we also cannot fully reject it.

The second extracted latent dimension, defined as *Victimization*, consists predominantly of indicators of inactive behavior of a victim, and it includes indicators of physical and mental violence. Within this "Promax" component, there is a clear presence of behavior aimed to avoid confrontation, shifting within a social environment where victim avoids those who he/she doesn't like, and does not stand up for others.

Finally, the "Promax" component isolated as *Psychological violence* essentially includes types of violent behavior of adolescent volleyball players which do not include intense physical aggression, but are primarily oriented towards intimidating and humiliating a victim, and isolating a victim from social activities. Certain types of risky behavior, such as using marihuana, are in negative interaction with this latent dimension. However, certain correspondence with it still exists, and is manifested mostly as proclivity to incite violence.

The results on the constitution of the latent violent behavior among peers are in most cases in accordance with the accepted views regarding the constitution of the construct peer violence. Additionally, the indicators of physical aggression did not form the same latent dimension, the items which include more serious physical aggression, such as fighting or protecting, are isolated on the first, while the items of minor physical violence are predominantly extracted on the third "Promax" component. The latent dimension Victimization does not correlate to any of the remaining factors, which leads to conclusion that there is probable match of the functions of bully and victim. The general view is that peer violence is a complex phenomenon dominated by both physical and psychological types, as well as the indicators of antisocial behavior. It also leads to the opinion that further research should be conducted on the correlation between these variables and main dimensions of aggression. The obtained findings regarding the interaction between peer violence, personality traits, and parenting attitudes indicate that all dimensions of PRONA are in significant correlation to the independent group of the examined items.

The correlation between physical violence and the group of independent variables is the most intense. Codependence of this dimension with Psychoticism and Extraversion indicates that impulsivity, aggression, and tendency towards sensation play significant role in creating and developing risky and violent behavior. The negative correlation that L scale of the personality questionnaire realizes with the dimension risky behavior puts an emphasis on the antisocial structure of this latent dimension, because the combination of high values of the standardized regression coefficients on Psychoticism and Extraversion, and low values on the L scale reveal insufficient impulse control which, along with the aggression and tendency to incite violence in social environment, can indicate violence towards others.

The only statistically significant determinant on the criterion variable Victimization is the result on the parenting dimension of control-mother. Seeing how the results on Neuroticism and L scale are in significant and positive correlation on the criterion Victimization, one can conclude that preventing and avoiding conflict and excessive socialization that are caused by strict parental control, with the manifested anxiety and tendency to social retreat, are the expected latent dimensions for taking the role of inactive victim of violence.

The isolated latent dimension *Psychological violence* shows relevant partial correlation to the result on the variable Psychoticism. The obtained result is in accordance with the earlier findings, and indicates that there's a tendency towards isolating peers from social activities, gossiping, lack of respect for rules, and lack of empathy towards victims. According to the research (M. Ivanović & U. Ivanović, 2013; Parent & Vaillancourt-Morel, 2021) the existence of the element of self-interest through forcing others to do favors is an expected consequence. The results of the study (M. Ivanović. & Ivanović, 2021; Smederevac i Mitrović, 2006) reveal correlation between the dimensions of personality and the dimensions of peer violence – as relevant determinants of delinquent behavior. However, even though the delinquency cannot be equated to peer violence, there is similarity within the structure of the dimension *Risky behavior*. In that case, variable *Extraversion* represents significant determinant of the criterion risky behavior, which can also refer to inciting socially unacceptable activity. The independent variable *Neuroticism* is in accordance with the criterion victimization since the high score on this dimension does not exclude the possibility of violent behavior for the role of passive victim, while its' other forms such as hypersensitivity can have a role of potential violent provocateur towards victim. Finally, the dimension Psychoticism is, as suspected, in significant interaction with the dimensions that include aggression and violent behavior.

CONCLUSION

The findings of this empirical study reveal the complexity of the construct peer violence and its significant codependence with the dimensions of personality of cadet volleyball players and parenting attitudes of parents. The structure of the isolated "Promax" components is in accordance with the results of the earlier studies (Jankauskiene et al., 2008) in which the predictor Risky behavior gives relevant contribution to the dimension of the criterion Peer violence, and based on that the potential programs to stop violence in sports should be oriented towards preventing risky behaviors in adolescence. In addition, indicate that there should be more detailed analysis of the predictor victimization because of the observation of victim as an inactive target of violence. At the same time, the correlation between peer violence and independent variables parenting attitudes of parents also require further analysis. Even though the correlation between Victimization and rigid parenting attitudes of mother is significant, it was assumed that the indicators of bad family atmosphere will correlate to the variables which include violent behavior. Therefore, items that evaluate other views on family relations should be added to the questionnaire, and include parents as participants. Finally, seeing how this research included relatively small number of adolescents very close in age, the findings can serve as guidelines for creating programs aimed at preventing peer violence in sports. That would include modifications of questionnaires (with added items about victim-provocateur behavior) that assess tendency towards peer violence, thus finding potential bullies or victims.

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PRESCHOOL RECREATIONAL EXERCISE

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Abstract: Preschool recreational exercise is a systematic and continuous process that monitors and encourages children's growth and development, and at the same time represents the prevention of postural and other changes brought about by the modern way of life in an urban environment. The prevalence of overweight and obesity among children today is increasing in many countries of the world, including ours. Regular implementation of recreational activities from an early age contributes to the prevention of mass non-communicable diseases, which are the leading cause of death and illness in developed countries and countries in transition.
The subject of work is the recreational influence on children's physical ability and health. Recreation in preschool is the first step towards physical education that leads to the overall development of the child's personality. The goal of this work is the implementation of ideas and standards that will show the importance of recreation for children of preschool age. The methods used in this work are the methods of showing, demonstrations. Another method that was used is the method of explanation, living words. The third method is the method of children's expression (imitation). The parents were questioned on Fruška Gora in the children's recreational resort "Testera". Data on children's recreational activities before recreational classes were collected at departure, with the help of questionnaires filled out by parents. The conclusion is reached that the importance of recreational activities in preschool age is extremely important. Based on observation, examination, observations and the return of the questionnaire that the parents filled out a couple of weeks after the ten-day recreational classes, the work showed that recreation really has a role in the child's growth.

Keyword: *recreational activities, preschool children*

INTRODUCTION

Preschool recreational exercise is a systematic and continuous process that monitors and encourages children's growth and development, and at the same time represents the prevention of postural and other changes brought about by the modern way of life in an urban environment. The prevalence of overweight and obesity among children today is increasing in many countries of the world, including ours.

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It is believed that one of the two most important reasons for this increase is the insufficient physical activity of children. Activities such as video games, use of the Internet, cell phones, and television viewing increase the time spent in sedentary activities and decrease the time children spend moving and playing. Regular implementation of recreational activities from an early age contributes to the prevention of mass non-communicable diseases, which are the leading cause of death and illness in developed countries and countries in transition.

In 2004, a global strategy on nutrition, physical activity and health was adopted with the main goal of improving health through proper nutrition and physical activity. It is considered that all quality national programs for raising the level of physical activity should include children and youth, and preschool institutions play a very important role in creating habits that contribute to preserving and improving health. The level of physical activity among children depends on individual influences, as well as on the influence of parents and the environment, economic conditions, proximity to places for recreation, as well as the support of parents, their education, socioeconomic status and other factors that influence the implementation of recreational activities in childhood and youth .

Recreation of children of preschool age should be an inseparable part of education because of its significant physical activities in the education of children. Recreation is a healthy way of life and attitude towards oneself and the environment, that is, a contribution to building one's own personality (Mitić, 2001).

It is extremely important in the earliest period of children's development to properly organize recreational activities because they allow the body to gain strength and ensure not only physical but also all-round development of the child's personality. Proper and normal development of the child's organism results in good health of the child.

Nowadays, children's movements during the day are below the age norms due to the fact that children spend a lot of time sitting in front of the TV, playing games and watching movies. Their position is static, and it is known that a static position increases the static load of certain muscle groups, causing their fatigue, thereby reducing the strength and working capacity of the muscles, which leads to a series of negative consequences (disruption of proper posture, bending of the spine, flat feet, stagnation of development physical abilities). Such children are often sick, lag behind in physical development and tire quickly. With them, there is an imbalance of the abilities of all organs and systems, which leads to weaker attention, memory and the absence of will and joy in life, which to a large extent depends on their spiritual, mental and aesthetic development.

The subject of work is the recreational influence on children's physical ability and health. Recreation in preschool is the first step towards physical education that leads to the overall development of the child's personality.

The goal of this work is the implementation of ideas that will show the importance of recreation for children of preschool age.

The methods used in this work are the methods of showing, demonstrations.

Another method that was used is the method of explanation, living words.
The third method is the method of children's expression (imitation).
The parents were questioned on Fruška Gora in the children's recreational resort.

Data on children's recreational activities before recreational classes were collected at departure, with the help of questionnaires filled out by parents.
The sample of respondents is 30 children, of both sexes, of preschool age of 6 years, of which 13 boys and 17 girls. A pilot questionnaire contains 9 different questions. The obtained frequencies from the questionnaire were calculated using a percentage calculation statistical program.

THE RESULTS WITH DISCUSSION

Physical development of the preschool child

The growth and physical development of a child are complex physical processes, they continuously and dynamically take place in a regular sequence, approximately the same for each person. Growth is an increase in the number of cells, individual tissues, organs, parts of the body and the organism as a whole. Development means morphological, anatomical, physiological, functional and mental changes in the human organism. Both of these complex processes are interconnected, so the harmonious development of the organism is possible only with the proper growth and development of all tissues and systems in a person. Body height is a basic indicator of physical development that maintains complex internal processes in the human body. It is not only an indicator of the growth process, but also of a certain level of maturity of a preschool child, the intensity of growth is the highest during the period of inter uterine development. Postnatal intensity is weaker and different growth parameters have their swings at different ages and are of different intensity.

Body mass increases due to cell proliferation, fat accumulation and water retention in the body. The most important of these three ways to increase body mass is cell reproduction. Body weight increases over 20 times from birth to adulthood. Environmental factors, socioeconomic conditions, food, etc., can significantly affect body mass, which is why it is a less reliable indicator of growth and development than body weight.

The coefficient of variation of body weight is 3-4 times higher than the coefficient of variation of body height. The greatest increase in body mass occurs during the first year of life. At the end of the first year, it triples in relation to the body weight with which the child was born. After the first year, the progress in body weight is slower so that by the end of the second year of life, the child quadruples in weight. From the third year, the increase in body weight amounts from 1.5 to 2.6 kg per year. In the period between the sixth and seventh years of life, the increase is 2.2 - 2.5 kg. At the age of six, a child should be approximately 6-7 times heavier than when he was born. The average weight of a seven-year-old girl weighs from 21.5 to 27.5 kg, and for boys, the weight ranges from 21.6 to 27.9 kg.

Recreational activity and child development

Physical activity is of great importance in the development of a child's personality. In the game, the child develops his functions, different abilities and gains experiences. However, the influence of children's activity in the game on the development of abilities and on the acquisition of experience cannot be strictly separated because these processes are interconnected and influence each other.

A child gains his first experiences with objects by holding them with his hand, observing, moving and stacking them. In this way, he gradually discovers how objects differ from each other, how he can use them, and so on. Based on the movements of his own body, which come

to the fore in playing with various objects, and the function of other senses and abilities, the child gains experience of space.

Thus, with the help of game activities, one learns to distinguish larger from smaller, longer from shorter, and so on. The experiences that the child acquires concretely through game activity are a necessary condition for successful comparison and conclusion. In addition, the child develops the ability to perceive, understand spatial relationships and reason. In addition to the basic experience in science, all these abilities are a necessary condition for the child's later progress in mathematics, geometry, physics and other sciences.

It is known that some children of school age have difficulties in navigating spatial relationships and understanding quantities and their proportions. That is why they do not succeed in those subjects that require mainly such abilities. The causes of these difficulties in averagely intelligent children most often come from this preschool period.Namely, children did not have enough opportunities to acquire knowledge about spatial relationships through physical activity.

In its content and form, recreational activity is attractive and encourages children's activity, which, in addition to the dispositions and real opportunities for development provided by the environment, is a significant factor that allows the child to develop to the end of his potential possibilities of psychological development.

Only in this way can the irreplaceable role of children's physical activity in preschool age be understood for the overall development of the child's personality. The child fully engages in physical activity, works intensively and persistently, rejoices in his creations in creative play, is satisfied with them, and others also give him credit for his success.This increases the child's self-confidence and strengthens the motives for further participation in the game. Through the activity in the game, the child develops his abilities, gains experience, strengthens his motives for work, and thus without any particular difficulties and with joy, he moves on to work tasks. In the game as well as in work tasks, the child confronts various difficulties and obstacles, although he overcomes them in his own way. It is often a matter of coping in new situations where the mechanical application of experience is not enough, but the child is forced to look for new ways. In such cases, the child's intelligence comes to the fore.

Morning exercise

This form of activity was performed every day, almost always at the same time, before breakfast, with the aim of forming the habit of daily exercise in children, to eliminate drowsiness and stimulate the work of all organs and systems after sleep, to create a good and cheerful mood, as children would be ready and in a good mood for the next activities. It is certain that daily morning exercise will have a stimulating effect on the work of the most important processes in the body. This type of recreational activity strengthens muscles, affects the respiratory system, enables the child to breathe properly, deeply, rhythmically, and therefore strengthens his health and develops the organism as a whole.

Before starting the activity, children should be in comfortable and appropriate clothes and shoes. Exercises must be interesting and attractive for children, they should not require learning and many explanations.

The introductory part begins with the application of different forms of movement, walking, running, jumping. Movements are realized by giving special tasks, for example, children walk

in a column, circle, between obstacles, then walk or march in place. If it is quite cold, the children are first given a gentle run in order to reach a certain body temperature, and then they move on to walking and jumping.

The main part of the activities are exercises aimed at strengthening large muscle groups. These are stretching, stretching, and loosening exercises aimed at the muscles of the arms and shoulder girdle, back, abdominal muscles, and muscles of the legs and feet.

When applying morning exercises, the peculiarities of the nervous system should be taken into account, because children's nervous processes are unbalanced, their attention is unstable, and they tire quickly. The first exercises are given to strengthen the muscles of the arms and shoulder girdle. Attention is paid to the position of the body, head, breathing, gaze. Then there are exercises for the trunk and muscles of the spine and pelvis, the physiological load increases, and all organs and systems are involved in the work. Then the muscles of the legs and feet are included in the activity, and the exercises are aimed at preventing and strengthening the arch of the foot.

Mobile games

We call the games with which we perform physical exercise tasks mobile games. Movement games are the oldest form of exercise.

Since games are based on running, jumping, throwing, they have a preventive effect on the growth and development of the child. Military games are a means of developing moral qualities, they strengthen will and perseverance, they influence the bonding of children and reduce their egocentricity.

Engaging in mobile games is of great importance for the proper physical development and health care of a preschool child. They stimulate the work of all muscle groups, speed up blood flow, breathing and metabolism, thanks to which the interconnected functions of all organs and systems are activated, increasing the functional ability of the child's overall psycho-motor skills. Coordination of movements, orientation in space, and all physical abilities, such as strength, speed, agility, dexterity, readiness to react quickly in response to changing situations are improved. In mobile games, the child gets rid of the tension and harmful consequences of the modern way of life. Correct movement games develop cooperation to achieve common goals, mutual aid and fair play. Mobile games are considered games with ready-made rules and are based on the performance of certain movements and actions with one's own body, with the help of various props, devices, balls, hoops, sticks, suitable toys, which provide the motivation of the game.

The games of older preschool children contain more complex movements that require self-control, speed and agility. Children need to be able to apply the same form of movement for a long time and several different forms together.

Mobile games are applied in the sense of prevention. We apply them preventive as a stimulating tool in maintaining the general functional ability of the organism, but also as exercises to prepare the loco-motor apparatus for more complex physical activities with a higher workload.

Each exercise, that is, the game, is performed from a predetermined starting position, which may be different in relation to the effect we want to achieve (standing, squatting, kneeling,

lying down). We can perform games with props or without props such as (balls, bats, screws, hoops, cones, bags) individually, in pairs or in groups.

The variety of application of mobile games is unlimited because they can be performed in all conditions and occasions. It is recommended that the games be performed in the fresh air in nature, but if the weather conditions do not allow it, then they should be performed in a closed space that should be ventilated beforehand.

Children should be comfortably dressed in sports equipment that will allow them to breathe and move freely. Exercises should never be performed immediately after taking a large amount of food into the body, but two to three hours later in order to avoid the unwanted occurrence of nausea.

In recreational exercises, dynamic exercises should prevail, because they are less tiring, provide easier blood flow, promote lung ventilation and remove harmful substances faster.

During exercise, children of preschool age should not hold their breath, breathing should be free and natural, coordinated with the rhythm of movement. Any exercise should encourage and facilitate pulmonary ventilation.

Movement exercises

Walking, as a form of movement, has a great positive effect on the child's organism. This form of movement does not require a lot of effort, because the shortening and loosening of the active muscles alternate evenly.

Children under the age of six do not have proper coordination of movement when walking and running and are often unable to maintain a certain direction and rhythmic. In this case, we have exercises on the toes, with the knees raised high, which develop the muscles of the legs and feet.

These exercises should not be applied for a long time but in combination with ordinary walking. When practicing walking, children are involved in various cart-type games in which at first a small number of children participate, but when the children master walking, their number increases, and eventually all children participate, and the game is enriched with new and more difficult tasks: crossing the roller, walking between two lines, stop at the given signal.

Running, as a form of movement, requires a large amount of muscles to be involved in the work, thus a greater physiological effort including the work of all organs and systems. The main difference between running and fast walking is the flight phase, which appears in children at the end of the third year, so we cannot even talk about running in children up to three years of age as a form of movement. An indicator of the development of running is the development of speed. That is why children are initially given simple and easy exercises (individual running with a toy in their hands with a pace and direction specific to each child).

Then the children are given to run in a certain direction, most effectively through games when they need to bring a ball, a cube, a toy. When exercising with children, attention should not be paid so much to accuracy and coordination, but to the correct posture of the body when walking and running. Six-year-old children, in most cases, walk and run properly. So they apply exercises and games in which these movements are rhythmic and free. Special attention is paid to correct body posture. The duration of these exercises must be well dosed so that the children

do not tire quickly. The goal of these exercises is to enable children to walk and run individually, in small groups, in the whole group in a certain direction, column, line, group, ellipse and freely in an unlimited space. And develop children's balance, precision, speed, dexterity, coordination of movement.

The preventive tasks of these recreational exercises are to create conditions for a balanced, harmonious development of the musculoskeletal system, strengthening the loco-motor apparatus, sensitive parts of the spinal column, neck and lumbar region, preventing deformities, eliminating deficiencies and influencing proper body posture.

Expression through movement

One of the really important factors in children's recreation is expression through movement. These are contents that cause pleasant emotions in children and the desire to express themselves through movement. The choice of musical accompaniment is extremely important. Care should be taken to ensure that the selected songs are suitable for children in terms of character, content and rhythm. In their work, they used classic numbers that have been promoted in recreation for many years, starting from children's songs to the famous Colita, Bomba and Macarena. Music itself should be an inspiration for children's dance, because through movement, the child becomes familiar with music, and the stiffness and hardness of movements are removed. While the movement itself is more beautiful, more elastic, more precise and more graceful.

Using the guidance method, the recreator directs the children to adopt a new movement. The opposite of the leading method is the improvisation method. The child is directed towards finding his own expression through movement. It invents movements, and tries to make them different from the movements of recreator and other children. In order to bring the movements to an appropriate level, the children must first work on simple movements and then move on to more complex movements, choreographies, jumps and jumps.

Movement can also be expressed through dramatic activities. One child performs a small improvised story in front of the others and in his own life, in which the accent is on the pantomime game without words, only with movement while the recreator and other children determine a sign or hand clap for the beginning and end of the game.

Based on the obtained results, the conclusion is reached that the importance of recreational activities in preschool age is extremely important. Based on observation, examination, observations and the return of the second questionnaire that the parents filled out a couple of weeks after the ten-day recreational classes, the results showed that recreation really has a role in the child's growth. Implementation of recreational activities among the examined children goes 6.67% never, 13.33% sometimes,36.67 % often and 43.33%.The obtained results showed that the effect on the transformation of motor dimensions in children, their mood, sensitivity, timidity, activity, aggressiveness and appetite. Subjective assessment of parents about the child's movement in relation to other children goes 56.67% said the same as the other kids, 20.00% said litle bit more, 13.33% said much more. Recreation as such activity is recommended both in preschool institutions and outside them, especially in such a sensitive period of children's growth and development.

Recreational exercise influenced the development of both basic and advanced physical abilities in children, increasing the working capacity of the child's organism. During and after the recreational activities, the children were cheerful, happy, refreshed and in a good mood. Recreators, educators and parents are the ones who should provide and provide recreational

activities for the child. An important item that recreators should pay attention to is that when practicing recreational activities, they should take into account the characteristics of the exercises themselves. Its impact on the child's body also depends on the type of exercise chosen.

In order for recreational activities to have a positive impact on functional systems, on proper growth and development, there must be optimal conditions for exercise, as well as a positive attitude of the child towards exercise. Properly selected and well-dosed exercises, carried out in the appropriate volume, with equipment that corresponds to the exercise, in conditions that are pleasant for work, are inevitable components of the methodological procedure in working with children of preschool age. A positive self-concept is acquired during childhood and once formed, it is difficult to change. Through participation in recreational activities, games, dancing, the child develops and acquires competence that significantly affects the development of the self-concept. It is necessary that the recreational activity is appropriate, and the movement tasks are measured in order to enable a high degree of success. Children highly value dexterity in ugra, which is related to acceptance by the group, because children who are not motor skilled are often excluded from group activities and games.

Recreational activity is very important in childhood because it improves the health of the child, which later benefits the health of the adult, an active lifestyle in childhood has direct health benefits in later years. An active child becomes an active person, who is therefore exposed to a lower risk of illness. Therefore, it is very important that we start directing children towards recreation and sports from an early age.

CONCLUSION

A series of scientific research in our country and in the world has shown that the increased intensity of exercise has a positive effect on physical development, without having a negative effect on other aspects of development.

There is a direct connection between health and exercise, exercise affects health and health affects exercise. The question is often asked what is the single dose of recreational physical activities that can have a positive effect on a child's growth and development and on his health in general.

In the preschool period, the minimum amount of self-movement is at the highest level compared to all other periods of life, because the organism is in a state when it is being built morphologically and completed functionally. The amount of movement is obtained through play, and it is a child's vital need.

Recreational exercise has a beneficial and beneficial effect on the growth, development, strengthening of the immune system and overall health of the child. The essence of recreational activities is primarily reflected in the general biological laws of the child's development and functioning. They form the child's body, affecting the development of all functional systems.

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THE EFFECTS OF A WELLNESS PROGRAM IN NATURE ON THE REDUCTION OF PSYCHOSOMATIC STATE (STRESS) IN WOMEN AGED 40-50

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Abstract: This paper aims to determine the effects of an experimental wellness program package in natural conditions (applied for 14 days) on the transformation of biochemical, functional and morphological indicators, and in connection with the psychosomatic state of inactive women aged *40-50*. The research problem is the effect of the wellness program package (yoga, hiking, exercises in water, cascade baths, programmed diet) on the transformation of the psychosomatic state of inactive women. The subject of the research is changes in the psychosomatic status of inactive women under the influence of the wellness program package in natural conditions. The sample of this research consisted of N=30 women, aged between 40 and 50 (distributed into control-K and experimental group-E, 2X15 respondents). We tested variables that primarily show the psychosomatic state of the subjects (biochemical indicators – cortisol, sugar; essential minerals – magnesium, zinc; functional indicators – blood pressure, pulse; morphological indicators – body mass, body height, abdominal circumference). The applied experimental treatment had a positive effect on the psychosomatic status of women. The tested differences of arithmetic means (t-test) between the initial and final measurement of the examined variables of the wellness treatment show a significant statistical difference in favour of the experimental group (E) at the level of significance $p<0.05$ for all examined variables. By comparing the obtained indicators of psychosomatic status with the reference values, we see that after the treatment the examined indicators move within the limits of the prescribed values. Indicators of psychosomatic status in the subject of the experimental group show positive changes, and the applied wellness program package is an effective tool for reducing stress in inactive women.

Keywords: *wellness program packages, stress reduction, cortisol, psychosomatic state*

INTRODUCTION

Wellness programs held in nature are increasingly applied as complex health-preventive programs. Recently, effective and rational wellness programs have been applied with the aim of relaxation, effective rest and recovery of the body from everyday stressful situations. These programs are quite successfully implemented as packages of wellness programs consisting of various contents that are carried out outdoors in nature. Numerous scientific studies, as well as examples of good practice, repeatedly confirm the effectiveness of practising wellness programs in nature (Cvikl, Pajk, 2015).

Stress is evident in the modern way of life and it on the psychosomatic status of a person, and it is necessary to take measures aimed at reducing, eliminating and mitigating stressful situations, i.e. undertaking appropriate activities in order to manage stress. One of the ways to prevent and reduce stress is the application of appropriate wellness programs in natural conditions in order to optimize the spiritual, emotional and intellectual capacities of the modern man. Contemporary concepts view stress as a dynamic relationship between a person and his

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environment, emphasizing the dynamics of the psychological mechanism of cognitive manifests itself in various aspects of the modern lifestyle (Gajić, Ralić, 2010). Every day we are faced with various forms of stressful situations, both in random places and in the family environment. Stress certainly has negative effects evaluation of stressful events by a person. Such an approach is called transactional, and some call it "transactionistic"; (Lazarus, 1996). What will be stressful for a person depends on the importance they attach to the situation they are in, as well as their assessment of available coping resources. We can define stress as a person's adaptive response to situations and events that pose physical and/or psychological demands, mediated by individual differences in the assessment of those events (Popov, 2018). The medical approach to the study of stress focuses on physical stressors, such as high temperature or noise, and bodily changes, such as hormonal changes or high blood pressure, which are of appropriate importance as indicators of stress. Researchers within the medical model conclude that the stress process activates the so-called "fight-or-flight" (eng. a term first described by Walter Canon), which includes hormonal changes and mobilizes the organism to cope with perceived threats from the environment (Popov, 2018). Selye is considered the father of modern stress. According to him, regardless of what causes stress, the body reacts in the same way, only individual differences determine which organ "breaks" first (Selye, 1956). The main role of the body's response to stress is to help a person face the stressor more easily. When a person is faced with an internal or external stressogenic agent, there is the activation of A1/A2 noradrenergic neurons in the medulla oblongata (Pezzone et all, 1993). These neurons produce noradrenaline (NA) and PRL-releasing peptides that stimulate ACTH secretion from the anterior lobes of the pituitary gland. ACTH controls the secretion of corticosteroids, primarily cortisol from the adrenal medulla. In conditions of chronic stress, i.e. when the above system is constantly activated, the homeostatic state of the organism is disturbed and the cumulative consequences lead to various psychosomatic disorders such as accelerated metabolism, increased heart rate, increased blood pressure and breathing frequency. This means that the body's response to active stress has a protective role, but in the case of chronic stress, this response leads to numerous disorders (Grajić, Ralić, 2010). The approach to solving stressful situations should be in the direction of reducing and managing stress, that is, avoiding, eliminating, modulating and controlling various stressors. This requires a change in behaviour patterns, a positive orientation towards the problem and a lifestyle change. It is inevitable to include and control the following elements: psychological balance, elimination of risk factors of a mental and physical nature, sleep, detoxification, controlled physical activity, adapted healthy food, psychophysical balance, socialization, social activity, elimination of risk factors - tobacco, alcohol, opiates, lifestyle management (Grajić, Ralić, 2010).
Recently, to reduce stress, various wellness programs have been applied in natural conditions, among other things, the so-called “forest selfness” in Slovenia as a forerunner of a new type of relaxation (Zvikl, Pike, 2015). With a view to their sustainability and durability, forest wellness products-services include: forest paths, natural moss, marked forest paths with different forest organic and inorganic substances, meditation near selected trees, use of resin and oil for massages, baths and cosmetics, touching, smelling forest land, picking forest fruits, watching and listening to forest animals, physical activity in the forest. Staying in the forest should have a beneficial effect on people, and the forest should remain untouched as long as possible, with the possibility of new ones. We must always think about nature, forests and trees because it is an important part of our heritage, a symbol of strength, wisdom, fertility and life.

The reasons that led us to engage in this research are the creation of a model package of a wellness program that is carried out in natural conditions outdoors, as well as the effects of the implemented package of wellness programs on the psychosomatic status of the respondents

aged 40-50 years. The applied package of the wellness program consisted of elements of yoga, hiking in the forest, cascade baths and programmed nutrition.

Yoga practice can help reduce excess weight, boost metabolism and reduce stress. Yoga positions and breathing exercises can be used to balance hormones, emotions and metabolism (http://www.yoga-beograd.com). A walk in the forest has an extremely beneficial effect on the psychosomatic status of a person. The forest offers visitors, first of all, the opportunity to engage in physical activities, mental relaxation and well-being, healthy nutrition, and sometimes body care. The tree is a therapeutic mirror for man. (Bouchardon, 2000). Hydroprocedures in natural conditions, and above all cascade baths, have an extremely favourable effect on the psychosomatic state of a woman's body. The advantage of this treatment is that the falling water currents saturate the air with positive and negative ions and cause the water to move. Ionized air improves the function of the nervous system, improves sleep and primarily affects the diseases of modern civilization. In practice, it has been proven that the effect of natural baths improves (in natural outdoor conditions at a temperature of 14-20 degrees) in combination with exercises in the conditions of ionized air and the vibration effect of water currents (Jotov, 2018).

The subject of the research is the scope of changes in the psychosomatic status of inactive women under the influence of the wellness program package in natural conditions.
The research problem is the effect of a package of wellness programs (yoga, a walk in the forest, water exercises, cascade baths, programmed nutrition) on the transformation of the psychosomatic state of inactive women aged 40-50.
The research aims to determine the effects of the wellness program package in natural conditions on the psychosomatic status of inactive women aged 40-50.
To realize the set goal of the research, it is necessary to carry out the following tasks:
T1 To determine the mean level and variability of the psychosomatic status of the test subjects in the applied wellness program package.
T2 Determine the homogeneity of the groups (E, K) and the values of the indicators of the psychosomatic status of the test subjects at the initial and final testing.
T3 Determine the level of quantitative changes in the psychosomatic status of the test subjects and compare the obtained values of the investigated variables with the reference values.

METHODS

Methodological framework of the work is the research of an experimental nature with an experimental group (E-package program consisting of yoga, forest walks, water exercises, cascade baths, and programmed diet) and a control group (K) that did not participate in the experimental treatment. Using the method of theoretical analysis, appropriate written sources were studied, based on which information was obtained about the impact of the applied wellness program package on the psychosomatic status of the respondents. The research sample consisted of 30 women assigned to the experimental (E) N=15; control group (K), N=15. It should be noted that the control group K did not participate in experimental wellness program. All test subjects were tested before the start of the experiment and after 14 day of application of the experimental treatment. The respondents had to fulfil certain conditions, i.e. they should be 40-50 years old, inactive, i.e. leading a sedentary lifestyle, as well as voluntarily accepting participation in the experiment. Both groups are equal in age. The results of the t-test and the level of significance show that there is no significant statistical difference between the groups when it comes to age ($t=0.0567$; $p=0.9552$). The experimental factor took place within the wellness program package in natural conditions. Namely, the program was implemented for 14

days according to the principle of an active programmed. The holiday package. The applied experimental tretmant consisted of the following wellness content yoga, a walk in the forest, exercises in the void, cascade baths, programmed nutrition. During the experimental treatment, it was applied every day a 30 minute yoga program, a 45 inute walk in the forest, 1-hour voidexercise and cascade baths, as well as a programmed diet. We tested individual characteristics of psychosomatic status; that is, we tested variables from the following areas: biochemical indicators of blood - (KO) cortisol, (SU) sugar; essential minerals (via blood) - (Mg) magnesium, (Zn) zinc; functional indicators-(SABP mmHg) systolic arterial blood pressure, (DABP mmHg), diastolic arterial blood pressure (blood pressure measuring device, (HRAR) heart rate at rest (SPORT key TE 3000); morphological indicators- (BM) body mass, (BH) body height, (WS) abdominal circumference (TANITA BC-418 device, Martin anthropometer, elastic metal band). Biochemical samples (KO, SU, Mg, Zn) were tested on an empty stomach in the early morning hours. Namely, before taking the simple (blood), the test subjects rested for 20-30 minutes. Psychosomatic condition testing was performed in the office for functional, i.e. biochemical diagnostics in the morning hours by a specialist doctor. In addition among the mentioned methods, we also used the method of statistical data processing, i.e. the method of descriptive statistics (M-aritmetic mean, Min, Max, R-range, SD-standard deviation, V%-coefficient of variation). To determine differences between groups, we used the t-test.

RESULTS

Table 1. Deskriptive and comparative statistical indicators of the psychosomatic status of the subjects in groups E and K at the initial and final measurement

Variables		N	M	M	Min	Max	R	SD	V%	T	P
KO	E	15	I	595.07	481	716	235	67.295	11.30	11.343	0.000
			F	543.93	421	628	207	60.056	11.04		
	K	15	I	593.27	476	712	236	67.73	12.56	-1.030	0.320
			F	600,33	475	713	238	73,30	12,21		
SU	E	15	I	7.923	5.7	9.5	3.8	1.320	10.44	11.864	0.000
			F	5.940	4.3	7.9	3.6	0.971	16.35		
	K	15	I	7.853	5.6	9.3	3.7	1.377	17.54	-1.435	0.173
			F	125.71	117	149	31	8.44	6.48		
VIT C	E	15	I	0.1290	0.028	0.400	0.372	0.1229	95.22	-5.586	0.000
			F	0.2273	0.090	0.420	0.33	0.0977	42.98		
	K	15	I	0.1686	0.031	0.490	0.459	0.1444	85.68	-0.642	0.531
			F	0.1855	0.030	0.491	0.461	0.1493	80.65		

Zn	E	15	I	10.413	8.2	13.9	5.7	1.1822	17.40	-22.544	0.000
			F	13.960	11.9	17.3	5.4	1.839	13.17		
	K	15	I	10.347	8.4	14.2	5.8	1.73611	16.77	-0.235	0.810
			F	10.353	8.5	14.3	5.8	1.7574	16.97		
Mg	E	15	I	0.5133	0.28	0.79	0.51	0.1825	35.37	-11.928	0.000
			F	0.7553	0.49	1.20	0.71	0.2228	29.50		
	K	15	I	0.4900	0.28	0.78	0.50	0.1710	34.63	-1.388	0.188
			F	0.4987	0.28	0.79	0.51	0.1721	34.52		
SABP	E	15	I	141.53	124	157	33	9.665	6.829	10.019	0.000
			F	133.13	119	144	25	8.305	6.238		
	K	15	I	145.00	121	158	38	10.617	7.332	0.676	0.510
			F	144.80	120	159	39	10.811	7.466		
DABP	E	15	I	85.47	70	91	21	6.416	7.656	4.699	0.000
			F	79.33	70	89	19	4.894	6.169		
	K	15	I	83.80	70	91	19	5.139	6.829	2.359	0.033
			F	84.40	70	89	19	5.138	6.88		
HRAR	E	15	I	78.60	67	84	17	4.793	6.098	13.163	0.000
			F	75.33	66	80	14	4.353	5.779		
	K	15	I	75.87	66	84	18	4.809	6.338	-0.878	0.395
			F	76.27	68	83	15	4.773	6.258		
BM	E	15	I	73.900	64.2	83.6	19.6	6.3908	8.648	11.881	0.000
			F	72.100	62.1	81.1	19	6.5972	9.150		
	K	15	I	74.113	65.4	82.8	17.4	5.9753	8.062	-1.645	0.122
			F	74.227	65.5	82.9	17.4	6.0186	8.108		
WS	E	15	I	85.73	74	98	24	8.388	1.542	8.404	0.000

			F	84.00	72	97	25	8.211	9.775		
	K	15	I	85.20	75	99	24	8.037	9.443	-1.522	0.150
			F	85.67	74	100	26	8.042	9.387		
WH	E	15	I	164.09	157.30	168.30	11	7.58	1.66	-	-
			F	-	-	-	-	-	-	-	-
	K	15	I	163.18	169.30	156.20	13.1	3.08	1.88	-	-
		15	F	-	-	-	-	-	-	-	-

Legend: N- number of respondents; m- measurements(I-initial, F- final); M- mean arithmetic value; Min- minimum value; Max- maximum value; R- range; SD- Standard deviation; V%- coefficient of variation; t- t test; p- degree of significance.

Table 2. Statistical significance of differences between groups (E and K) at the final measurement

Independent Samples Test		Levene's Test		t-test		
		F	Sig.	T	Df	Sig.
KO	= Var assumed	1.321	.260	-2.305	28	.029
E fin - K fin	= Var not assumed			-2.305	26.957	.029
SU	= Var assumed	7.329	.011	-4.398	28	.000
E fin - K fin	= Var not assumed			-4.398	24.828	.000
VIT C	= Var assumed	7.150	.012	.960	28	.368
Efin - K fin	= Var not assumed			.916	24.133	.369
Zn	= Var assumed	.293	.593	5.491	28	.000
E fin - K fin	= Var not assumed			5.491	27.942	.000
Mg	= Var assumed	.924	.345	3.530	28	.001
E fin - K fin	= Var not assumed			3.530	26.323	.002
SABP	= Var assumed	1.023	.320	-3.314	28	.003
E fin - K fin	= Var not assumed			3,314	26,256	.003
DABP	= Var assumed	.014	.908	-2.765	28	.010
E fin - K fin	= Var not assumed			-2.765	27.934	.010
HRAR	= Var assumed	.325	.573	-.560	28	.580
E fin - K fin	= Var not assumed			-.560	27.766	.580
BM	=Var assumed	.111	.741	-,922	28	.364
E fin - K fin	=Var not assumed			-.922	27.767	.364
WS	=Var assumed	.055	.816	-.562	28	.579
E fin - K fin	=Var not assumed			-.562	27.988	.579
WH	=Var assumed	-	-	-	-	-
	=Var not assumed	-	-	-	-	-

The obtained differences in the results between the initial and final testing indicate that the applied program of the wellness package of the experimental group E had a statistically

significant effect on the optimization of the psychosomatic status of the test subjects in all tested variables. In the control group K, the only one was yellow A significant statistical difference was observed in (DAPB) diastolic blood pressure (Table 1). The results of the coefficient of variation (V) in both groups at the initial and final testing describe the sample as a homogenous group except for the vitamin C and magnesium (Mg) variables. The t-test values (Table 2) of the differences between the groups at the final testing indicate a significant statistical difference. difference in cortisol (KO), p=0.029; sugar (SU), p=0.00; Zn, p=0.00; Mg, p=0.02; SAPB, p=0.01. With vitamin C, HRAR, BM, and WS, there are no significant statistical differences. The dynamics of results of mean arithmetic values of the variable (KO) cortisol show a decrease in group E (MINI=595.07; MFIN=543.93), which is statistically significant p= 0.000. In control group K, the cortisol level at the final test remained at the same level as at the initial test. The observed results of the sugar variable (SU) at the final measurement in group E indicate a decrease in values (Mini=7.923; MFIN=5.940), which is statistically significant (p=0.00). In the control group K, the results of this variable remained unchanged at the final test. The values of the vitamin C variable in the experimental group E registered a greater increase (0.0983mg/dl) at the final measurement, which is statistically significantly different (p=0.00). The interpretation of the value of the zinc variable (Zn) indicates a greater increase in the results (3.547nmol/L) recorded in the experimental group E, which is statistically significant p=0.00. In the control group K, the values of this variable remained unchanged compared to the initial measurement. When it comes to the variable (Mg) magnesium, a greater increase in results (0.242 nmol/L) was registered in the experimental group E, which is statistically significant p= 0.00. In the control group K, there was no increase in the results at the final measurement. Indicators (SABP) of systolic arterial blood pressure show a greater reduction (8.4 mmHg) in group E, which is statistically significantly different (p=0.00). In the control group K, the results of this variable remained at the same level as at the initial measurement. The registered values (DABP) of diastolic arterial blood pressure of group E at the final measurement show a decrease in values (4.47mmHg), which is statistically significantly different (p=0.00). In the control group K, there was also a decrease (DAPB) in diastolic blood pressure (1.07 mm/Hg), which is statistically significantly different (p=0.33). The dynamics of the resting heart rate (HRAR) results indicate a decrease in the experimental group E, which is statistically significantly different (p=0.00). In the control group K, the results of the pulse at rest in the final measurement have almost the same values as in the initial testing. When it comes to morphological indicators (BM) of body mass, experimental group E experienced a reduction in body mass (1.8 kg), which is statistically significantly different (p=0.00). In the control group K, the body mass at the final test remained at approximately the same level as at the initial measurement. The values of waist circumference (WS) in experimental group E recorded a decrease (1.73 cm), which is statistically significantly different (p=0.00). The values of the same variable in group K remained approximately at the same level at the final measurement. As for the value of body height (BH) in both groups, it remained at the same level considering that the growth of the subjects was completed.

DISCUSSION

After the applied treatment of the wellness program package, quantitative changes were recorded in group E in all investigated variables except body height (BH). The observed results of the psychosomatic status of the test subjects of the control group K only indicate the existence of quantitative changes in the DAPB variable, i.e. we register a significant statistical difference with this variable. The decrease in cortisol level (CO) in the blood in the morning hours at the final measurement in the experimental group E is significantly higher compared to the control group K, which is statistically significant. If we compare the obtained values of the

mean arithmetic means of KO in group E with the reference values of this variable (171-536 nmol/L), we register lower cortisol values at the final measurement, i.e. the results of this variable are at the level of the upper limit of the reference values, i.e. there has been a reduction WHO. This indicates the fact that the applied wellness package of the experimental treatment had a positive effect in group E. In the control group K, which did not participate in the experimental treatment, the level of KO at the final measurement remained at the same level. The implemented wellness package program obviously had a positive effect on the reduction of KO in group E, i.e. exercise in natural conditions with the use of adequate nutrition (legumes, fresh salads, cooked vegetables, bread made from wholemeal flour, fish, supplementation based on calcium, magnesium and zinc). Taking into account the level of KO at the initial measurement in both groups, we can say that the test subjects had psychosomatic complaints, i.e. they were under the influence of stress. The results of our research are in line with the research and recommendations of Weinstein (2004). Namely, according to this author, an elevated level of cortisol in the blood can cause itblems (heart disease, chronic fatigue, depression, obesity, anxiety, mood swings, and other psychosomatic conditions). When it comes to the variable blood sugar (SU), a decrease in the level of sugar was registered in group E after the applied treatment, which is statistically significant. If we compare the mean arithmetic values (SU) at the final measurement with the reference values of this variable (4.0-5.6 mmol/L), we register results that are on the border of the upper reference values. According to scientific studies (Shlomo, 2020) reduced utilization of glucose in the cell occurs as a consequence of the influence of cortisol. It slows down the use of glucose somewhere between the place where glucose enters the cell and the place where it is completely broken down. There is an increase in blood sugar concentration. Increased values of the vitamin C variable at the final measurement were registered in group E, which is statistically significantly different. In group K, this variable remained at approximately the same level as at the initial measurement. If we compare the values of the arithM causes numerous health prometic means of vitamin C at the final test, we notice that they are within the reference values (0.2-0.6mg/dl). The results of our research regarding the vitamin C variable are in line with the research of the American Chemical Society. Namely, a study conducted in 1999 showed that vitamin C helps normalize the level of hormones that are released during stress and that cause many health problems. According to them, these hormones are reduced by the daily use of food containing vitamin C, especially oranges, greens, currants, and mangoes (Swords, 1999). By looking at the results of the mean values of zinc (Zn) in group E, we notice that at the initial testing, the Zn values are at the limit of the lower reference values (10.7-17.5nmol/L), and after the applied treatment in group E there was an increase in the value Zn in the serum of the test subjects, which is statistically significant. Our research is in accordance with the research (Winstein, 2004), and according to his recommendations, Zn has a significant role in the optimization of the nervous system and antidepressant effect. The registered values of magnesium (Mg) at the final measurement indicate the normalization of the value of this microelement in group E within the recommended reference values (0.75-1.25mmol/l). In group K, the level of Mg at the final measurement remained unchanged. The results of our research are in accordance with research (Cuciureanu, Vink, 2011) which shows that stress is closely related to the status of magnesium in our body. Namely, muscle pains and cramps occur during stress, which indicates a lack of Mg. Mg is an effective mineral in the fight against stress, and some call it the "anti-stress mineral". The observed results of systolic arterial blood pressure (SABP) at the final measurement in group E are slightly higher than the recommended values for that age (126mmHg), and they register a significant statistical difference between the initial and final testing, which speaks of the effect of the applied wellness program package. At the initial measurement, it is obvious that the test subjects were exposed to stress, during which the body releases, that is, secretes stress hormones more. According to (Gajić, Rajić, 2010), stress

hormones affect increased heart rate and narrowing of blood vessels, and as a consequence, an increase in blood pressure occurs, that is, psychosomatic disorders occur. The values of diastolic blood pressure (DABP) in both groups at the final test are within the recommended values for that age (84 mmHg). Namely, blood pressure values vary during the course of a day, and depend on the strength of the heart function, the elasticity of the arteries, the total amount of blood circulation, and emotions (Nikolić, 2002). The results of the mean values of resting heart rate (HRAR) in group E indicate reduced mean values after the application of the wellness program package, which is statistically significantly different. A decrease in resting heart rate caused a decrease in sympathetic tone and/or an increase in parasympathetic activity. This effect can be of intracardiac or extracardiac origin (Nikolić, 2002). The results of BM indicate reduced values, while those of group K remained approximately at the same level. Namely, according to (Shlemo, 2020), due to long-term exposure to stress, there is an increased secretion of cortisol, and stress stimulates the desire for sweet, calorie-dense food, and salty food, which leads to fat storage in the body and an increase in body weight. The results of waist circumference (WS) indicate that after the applied treatment there was a decrease in WS in group E. The accumulation of fat deposits in the abdominal area before the treatment was due to an increase in cortisol, which is the cause of burning fewer calories and reducing the body's ability to release fat (Schlemo, 2020). As for the morphological indicators of body height (BH), there were no changes in the subjects, so the values were not calculated, i.e. the growth of the examined persons was completed. The obtained results of the psychosomatic condition were examined in group E, where the experimental package of the wellness program was applied, indicating positive quantitative changes in the examined variables.

CONCLUSION

After the implementation of the experimental package of the wellness program, we obtained significant data on the changes in the psychosomatic status of the test subjects. Previous research speaks about the importance of applying wellness procedures, which is a prerequisite for the optimal functioning of the organs that affect the psychosomatic status of women. This study can be a good basis for conducting similar research. The mean level and variability of the psychosomatic status at the initial test were approximately the same in both groups. In experimental group E, there is a significant statistical difference between the initial and final measurements in all investigated variables, and in group K, a significant statistical difference was registered in the diastolic arterial blood pressure variable. After the applied treatment, experimental group E achieved better results in all tested psychosomatic state variables, so we can say that the applied wellness program package is a good instrument for optimizing the psychosomatic state of women aged 40-50.

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THE ROLE OF PHYSICAL ACTIVITY IN REDUCING STRESS AND MAINTAINING THE HOMEOSTASIS OF THE ORGANISM

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Abstract: The importance of physical movement and engaging in physical activity in everyday life is an unavoidable topic in the study of healthy lifestyles, psychological well-being and improving the health status of the individual and society as a whole. The acceleration of the pace of life from year to year becomes an increasingly dominant excuse for postponing the start of recreation or sports, so that the chronic human problem of lack of time additionally increases the action of stressogenic drugs, obesity and general inactivity, adversely affecting the psychophysical health and homeostasis of the organism. Psychological instability disrupts the physiological, as a result of which a psychosomatic illness may arise. In order to prevent or reduce the effects of stressful stimuli on the body, it is necessary to strengthen the personal potential and motivation of a person to improve the quality of his life and improve the health status of the body. Physical activity is one of the ways to achieve health and emotional well-being, scientifically confirmed in relevant medical and psychological studies. The aim of the work is the review and analysis of scientific results on the impact of stress on the body and the synthesis of results that confirm the importance of physical activity in the reduction of stressful conditions, especially in post-stressful circumstances, that is, adaptation to stress. The effects of physical exercise, as a preventive measure, affect the optimal health status of the individual, which indirectly improves the general functioning and efficiency of the individual who exercises. The progress of neuroscience has set the experts the task of using the previous knowledge and discoveries about the positive impact of exercise in order to better understand all aspects of adaptation to stress and re-establishing the body's homeostasis.

Keywords: *physical activity, health, stress, homeostasis, prevention.*

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INTRODUCTION

Stress is often defined as the body's response to a challenge, which may be of a physical, psychological or emotional nature. When the organism faces a stressor, certain neurohormonal mechanisms are activated, which lead to physiological changes in the body. These changes include an increase in heart rate, an increase in blood pressure, an increase in cortisol and adrenaline levels in blood, and a decrease in the immune response. Considering that, year after year, we are witnessing an increased interest in the contribution of physical activity to the preservation of mental health, but also to the mitigation of problems caused by mental illnesses. In this paper we are addressing the confirmed positive impact of physical activity in stress reduction, i.e. prevention and reduction of occurrence of physical diseases, and thus maintaining the homeostasis of the organism. Physical activity, as a form of physical movement, is related to important metabolic processes of the organism, and can be considered a planned or organized activity with the aim of increasing or maintaining physical condition (Šošić, Varjačić, 2015). Several decades ago, numerous scientific studies observed the relationship between physical activity and health, as well as the effects of physical exercise on various organ systems (Kohl et al., 2013). It has been shown that the impact of physical exercise

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on health is significant enough, so that researchers have consistently documented a strong association of physical exercise with health benefits (Siscovick et al., 1985; Sylvia et al., 2014., according to: Lazarevic et al., 2021). The increasingly complex demands and pace of life of modern civilization often exceed the personal capacities and potentials of the individual to fulfill them, and this, in most cases, results in an internal conflict, a discrepancy between the real and the possible, on the one hand, and what is the concept of ideal in the individual's perception, on the other hand (Kostić, 2022). The introduction of physical activity into this topic is a particularly significant moment, because of the role that activity plays in the complex process of dealing with stress and choosing a strategy to overcome it. Although in everyday life the most frequent consideration is the influence of physical activity on our mood, the effects on the health status of the individual are far more serious, and some research also indicates a correlation between exercise and psychological well-being (Hassmen, Koivula, & Uutela, (2000); Scully, Kremer, Meade, Graham, & Dudgeon, (1998), according to: Popov and Jakovljev, 2017). The subject of this paper is the study of the influence and effects of exercise on the field of psychological functioning of the organism through a review of scientific studies that have confirmed the positive effects of physical activity on mental health.

DISCUSSION

The triangle: stress, physical exercise, and homeostasis of the organism

The term "stress", in today's everyday life, is one of the terms that people most often and arbitrarily use to interpret the most harmless symptoms of impaired health status, but also to interpret serious organic symptoms or diseases. This fact initially hints at the complexity of the phenomenon of stress in the psychological and scientific sense, which requires a very serious approach in the study of a wide range of factors that cause it, as well as the consequences it can lead to. Violation of the optimal health status of the organism is a consequence of the action of a wide range of factors, external and internal, so that, in a scientific context, one should not focus only on one determination and definition of this construct or a group of related ones. Stress and its components, mechanisms of action on the mental and physical plane, and ways of dealing with these unfavorable life circumstances are determined by the style in which we recognize and experience them on an individual level, which further determines the path, and manner in which it is manifested at the moment of their existence, but also in longitudinal time dimension. From Hans Selye, who was the first to define the construct of stress - until today, hundreds of scientists, doctors and experts have tried to break down stress into: physiological, biological, chemical, psychological, and physical plan. It can be said that there are as many definitions of stress as there are authors who study it, and everyone has his own view, experience, and personal definition of this psycho-physical status of the organism. Modern medicine, among others, advocates the point of view that regular physical activity is very important in the treatment of diabetes. That is why it is important to define the differences between acute and continuous physical activity, and their effects on the psycho-physical status of the organism and the general state of health. It has been shown, for example, that acute exhausting exercise increases oxidative stress, but that regular physical activity regulates antioxidant defense (Stanković, Radovanović, 2012). Authentic findings in a study conducted on 8,000 subjects show that regular physical activity significantly reduces the risk of depression and anxiety disorders (De Moor et al., 2006), but also that even one-time physical activity leads to a reduction in symptoms of depression, anxiety and stress immediately after the end of physical activity (Stonerock et al., 2015; Strickland & Smith, 2014. according to: Lazarevic et al., 2021). Numerous studies have demonstrated the positive effects of physical activity on stress reduction. For example, a study by Salmon et al. (2019) found that a 12-week exercise

program significantly reduced stress and anxiety levels in college students. Similarly, a study by Ng et al. (2017) found that a single bout of moderate-intensity exercise reduced cortisol levels in healthy adults.

The terms sport and recreation are not synonyms, although they are often used interchangeably, especially among physically inactive individuals. Sport and recreation are closely interconnected with cause-and-effect influences, but the domain of sport is wider and larger, while recreation plays an important role in the social expansion and affirmation of sport. Although recreation plays an important role in the social expansion of sport, sport provides a significant range of activities to meet people's recreational needs (Aydm et al.,2019), and it can be defined as a planned and continuous activity that becomes someone's lifestyle with a higher intensity of physical activity than exercise (Blažević,2017). Understanding the importance of continuous engagement in physical activity, its definition, and its relationship to activity are largely determined by available media content, and they affect the psychological parameters of human personality, shaping attitudes towards healthy lifestyles and respecting them. Physical and mental health are inseparable entities of the complex apparatus called the human body, and their inseparable connection supports the thesis that strengthening physical and mental capacities should be simultaneous actions that will result in a positive health status.

Homeostasis refers to the body's ability to maintain a stable internal environment despite changes in the external environment. This is achieved through a complex network of feedback mechanisms that regulate various physiological processes, including heart rate, blood pressure, and body temperature. Physical activity can play a crucial role in maintaining homeostasis by stimulating these feedback mechanisms and promoting overall health and well-being. Physical activity has also been shown to have a positive impact on homeostasis maintenance and plays a crucial role in maintaining homeostasis by stimulating various physiological feedback mechanisms. For example, exercise can increase heart rate and blood flow, which can help to regulate blood pressure and oxygen levels in the body. Regular exercise has also been shown to improve insulin sensitivity, which can help to regulate blood sugar levels. For instance, a study by O'Donovan et al. (2017) found that regular physical activity was associated with lower levels of inflammation and oxidative stress in older adults. Similarly, a study by Phillips et al. (2018) found that resistance training improved insulin sensitivity and glucose homeostasis in overweight and obese adults.

Results of recent psychological studies on the effects of physical activity on stress reduction and homeostasis maintenance are also significant. Recent psychological studies have provided further support for the beneficial effects of physical activity on stress reduction and homeostasis maintenance. For example, a meta-analysis by Gerber et al. (2018) found that exercise had a moderate to large effect on reducing stress and anxiety. Similarly, a study by Ekkekakis et al. (2018) found that exercise intensity had a significant impact on mood and stress reduction, with high-intensity exercise leading to greater improvements. The study of exercise and cognition with older adults shows that there are many lifestyle factors (for example: intellectual engagement, social interaction, diet, and physical activity) that are associated with the maintenance of cognitive function and a reduction in risk for age-associated neurodegenerative disorders, such as Alzheimer’s disease and vascular dementia (Hillman et al., 2008). It has been shown that physical activity has a significant impact on reducing the level of stress, and this is further reflected on the level of homeostasis of the organism. Stress is a natural response to challenging situations, but chronic stress can lead to dysregulation of the body's feedback mechanisms, resulting in various health problems. Physical activity can help reduce stress levels by promoting the release of endorphins, which

are the body's natural feel-good chemicals. Regular exercise has been shown to reduce symptoms of anxiety and depression, improve mood, and increase resilience to stress (Mikkelsen et al., 2017).

Numerous studies have examined the effects of exercise on stress and have consistently found that exercise can help to reduce stress levels. Physical activity has been shown to increase the production of endorphins, which are natural chemicals that can help to reduce pain and promote feelings of pleasure and relaxation. Additionally, exercise can also increase the production of neurotransmitters such as serotonin and norepinephrine, which can help to improve mood and reduce anxiety. One study by Salmon (2001) found that regular exercise was associated with lower levels of stress and anxiety in adults. Similarly, a study by Lindheimer et al. (2015) found that a single bout of moderate-intensity exercise was effective at reducing stress levels in college students. The researchers found that the exercise session led to a significant decrease in cortisol, a hormone that is released in response to stress. Other studies have also shown that exercise can be effective in reducing symptoms of depression and anxiety. For example, a study by Blumenthal et al. (1999) found that exercise was just as effective as medication in reducing symptoms of depression in older adults. Another study by Petruzzello et al. (1991) found that exercise was effective in reducing symptoms of anxiety in individuals with panic disorder. Overall, the evidence suggests that exercise can be a powerful tool in reducing stress and promoting overall mental health and well-being. While the exact mechanisms underlying these effects are not fully understood, the evidence highlights the importance of physical activity as a means of managing stress and promoting psychological resilience. Stress can have negative effects on the body's health if not regulated properly. However, the body possesses a complex network of mechanisms, known as homeostasis, which allows it to maintain a stable internal environment despite changes in the external environment. Scientific research has shown that physical activity can play a key role in maintaining homeostasis by stimulating feedback mechanisms and promoting overall health and well-being. Exercise can also have a positive impact on maintaining the body's homeostasis by stimulating various physiological feedback mechanisms. Research shows that regular exercise promotes health throughout the body; routine physical activity can improve cardiovascular health, strengthen bones and muscles, and reduce the risk of certain cancers. Physical fitness can have a positive effect on brain health, as regular exercise can reduce the effects of stress on the body, improve mental health and mood, and even improve memory and cognitive abilities (American Psychological Association, 2019).

CONCLUSION

Stress is a complex phenomenon that affects many aspects of our lives, including our physical and mental health. Chronic stress has been linked to a range of health problems, including cardiovascular disease, diabetes, and depression. Homeostasis, on the other hand, is the process by which the body maintains a stable internal environment, despite external changes. Physical activity has been shown to have a significant impact on both stress reduction and homeostasis maintenance. The purpose of this paper was to review recent psychological studies on the effects of physical activity on stress reduction and homeostasis maintenance. That is why it is very important for all of us, no matter how old we are, to recognize our place in this complex cause-and-effect system of stress, to better distinguish the triggers that provoke our defense system, and to recognize for ourselves whether we are under stress or not. In this sense, each chapter is specific and contributes to the importance of facing oneself, in order to recognize stress and then overcome it as successfully as possible. In conclusion, physical activity plays a crucial role in maintaining homeostasis by stimulating various physiological feedback

mechanisms. Regular exercise can promote overall health and well-being, reduce the risk of chronic diseases, and help to manage stress levels. As such, it is essential to promote physical activity as a fundamental component of a healthy lifestyle. The perception of the importance of physical activity and promoting healthy lifestyles is individual and partly determined by subjective assessment of one's own health status; it is determined by socio-economic conditions, habits, and human needs, as well as developmental, educational, cultural, and other factors. The pursuit of ideal health is a human constant, regardless of the outcome; the ideal of beauty changes through epochs, often conditioned by socio-economic factors, while the basic premises of health are also constant.

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SIGNIFICANCE OF KEEPING IN UCHI KOMI EXECUTION THE *Push-Pull* JUDO PRINCIPLE AS STATED BY JIGORO KANO

Importanţa respectării în execuţia Uchi Komi a principiului Judo *trage-împinge* în concepția lui Jigoro Kano

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Abstract: In the worldwide framework of current Judo competitional training of *tachi waza* it could observe an emphasis lack in applying the two most valuable moments of *kuzushi* (braking the balance) and *tsukuri* (fit-in). It should be highlighted that Judo was created by Jigoro Kano not at all randomly, but as a result of the long series of observations and research during many years. In his research, Jigoro Kano found out that *kuzushi* is a very important moment, but *tsukuri* is most important, too. Concerning the indissoluble bond of these, Kano wrote down this great conclusion: if the opponent pushes – you should pull him, and if the opponent pulls – you should push him, or shortly, the *push-pull* principle. At Kodokan University, Kano organised *uchi komi* according to this conclusion. For understanding the deep significance of keeping *uchi komi* for *tachi waza* execution as stated by Jigoro Kano, we emphasize the increased efficiency of these technics as a direct consequence of the right execution by applying the *push-pull* principle. In the present paper, we used the scientific method of comparative analysis by practical demonstration on tatami with and without exact execution of the starting *push-pull* principle. Our detailed analysis emphasized the guaranteed success of *tachi waza* technics in the presence of a well executed first two moments, meaning the combination of the *kuzushi* followed as soon as possible by *tsukuri*. Considering a series of meaningful technics, we studied *ashi guruma*, *tai otoshi*, *o soto gari*, *harai goshi*, *tsuri komi goshi*, *ippon seoi nage* and *ohten gatame*. We demonstrated that *tachi waza* technics in the absence of this combination in *uchi komi* is quite difficult to be successful. Therefore, we considered that in *uchi komi* for *tachi waza* and *ne waza* execution the *push-pull* principle is basic.

Keywords: *tsukuri, seiryoku zenyo, uchi komi*

REZUMAT

Context. Actualmente, pe plan mondial, în antrenamentele *tachi waza* pentru competiție se observă absența majoră în accentuarea importanței celor două momente extrem de valoroase *kuzushi* (dezechilibrare) și *tsukuri* (acţiune pregătitoare). Judo nu a fost creat la modul întâmplător de prof. dr. Jigoro Kano, ci reprezintă rezultatul unui șir lung de observaţii şi cercetări efectuate de-a lungul mai multor ani. În cercetările sale, Kano a constatat că momentul *kuzushi* este important, dar la fel de important este și momentul *tsukuri*. Dată fiind legătura indisolubilă dintre acestea, Kano conchide: când oponentul te împinge – tu îl tragi, dacă el te trage – tu

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trebuie să îl împingi, ori *push-pull*. La Universitatea Kodokan, Kano a organizat *uchi komi* (antrenamentul prin repetiție) conform acestei concluzii.
Obiectiv. Pentru înțelegerea semnificației profunde a principiului *push-pull* stipulat de Kano în *uchi komi* de execuție a procedeelor din *tachi waza* şi *ne waza*, se evidențiază beneficiul unei eficiențe sporite a acestor procedee tehnice ca o consecință directă a execuției corecte cu aplicarea acestui principiu.
Metoda. În prezentul studiu, am folosit metoda științifică a analizei comparative aplicată în demonstrațiile practice pe tatami, între execuția inițială corectă a principiului *push-pull*, precum și în absența acestuia.
Rezultate. Analiza noastră detaliată a evidențiat succesul garantat al procedeelor tehnice din *tachi waza* şi *ne waza* în prezența unei execuții corecte a celor două momente inițiale, respectiv a combinației *kuzushi* urmată cât mai repede de *tsukuri*. Considerând o serie de procedee importante, am studiat *ashi guruma, tai otoshi, o soto gari, harai goshi, tsuri komi goshi, ippon seoi nage* şi *ohten gatame*.
Concluzie. Am demonstrat că finalizarea cu succes a procedeelor tehnice din *tachi waza* este extrem de dificilă în absența execuției corecte a combinației celor două momente în *uchi komi*. Ca urmare, considerăm că evidențierea principiului *push-pull* în *uchi komi* pentru execuția procedeelor tehnice din *tachi waza* şi *ne waza* este de maximă importanță.

Cuvinte cheie: *tsukuri, kuzushi, seiryoku zenyo, uchi komi*.

INTRODUCTION

Motto: *Judo must be understood to be appreciated* (FIJ, 2021)

Being invited to the National Championship of Judo on March 19th, 2022 in the "*Lucian Grigorescu*" Hall, we observed that often in the *shiai* a series of judoka competitors did not succeed to end the tried technique to apply. This way, they proved to lack important knowledge related to the Principles of Judo stated by Pofessor Jigoro Kano. Other words, they proved to be lacking in basic knowledge of *kuzushi* (unbalancing) and of *tsukuri* (set-up to execute technique) – many of them going directly in *jigo tai* (defensive posture) or even avoiding the *shiai*. In conclusion, it could be stated that a series of competitors didn't practice *uchi komi* (repetition training) – the well thought-out by Kano (1986) which during the time showed its *maximal efficiency*. As a matter of fact, Kano clearly laid down the *push-pull* principle, mandatory to apply by any judoka wanting to win a *shiai*: apply the minimal effort to obtain the maximal effect. There are several types of *uchi komi*, as follows:

- *Speed uchi komi* – the techniques are executed by maximal speed in subsequent series of 7-10 times repetitions;
- *Force uchi komi – Tori* has a much havier *uke* partner or even two of them;
- *resilience uchi komi* – the selected technique is executed as possible in identical manner, a significant number of repetitions (for example 10) in a large number of series interrupted by a very short relax time (of 1-2 minutes) aiming to generate a reflex movement;
- *Adroitness uchi komi* – this type of training is most important as it helps to develop abilities and skills in the execution of any technique;
- *Opportunity uchi komi* – this type of training is essential to prepare judoka for national and international competitions. This special training is of high complexity assessing the high expertise a coach gathered in time as an active observer in many competitions, using high quality professional devices (photo/video cameras) to register *shiai* of his own and others important competitors. Selected registrations from his organized data base are analyzed by the coach in front of his team during special training sessions. During the time, a good coach gathers a precious library offering necessary suggestions to every judoka of his team for a successful participation in future competition (Watanabe and Avakian, 1960).

The original *Training Algorithm* (Laşcu, 1986, p.89) dedicated *to acquire judo techniques* is very useful as it highlights the key-moments of all the *tachi waza* techniques (Inokuma and Sato, 1979) and *ne waza* techniques (Laşcu and Gotelet, 1981). Not entering into details, the authors (Vial et al., 1978) emphasize the meaning of the *uchi komi* training.

RESEARCH

The present study was realised by the interdisciplinary group for judo and martial arts, under the leadership of the author LVG – pionier of judo and martial arts in Romania. The experiments run on two groups of students, an experimental group in comparison with a witness group, containing the same number of judoka-students. The participants in this experiment were carefully selected by testing their physical abilities, and after passing the tests they were randomly distributed in the two earlier mentioned groups. The judoka-students from the witness group followed the usually practiced training in Romania, but the experimental group was trained in the Kano's conception of *uchi komi*.
Following the command of the coach, every judoka from the experimental group was active, semi-active or passive, and he was alternatively *Tori* and *Uke*. The goal of this special training in the *uchi komi* system is to help the judoka to acquire the ability to change fast the *Uke* character into a *Tori* character, by the smart takeover of his opponent's action: if *Uke* is pushing him, *Tori* should pull, and likewise, if *Uke* is pulling him, *Tori* should continue this action by pushing. Therefore, the key for success is to apply the *push-pull* principle (Ishikawa and Draeger, 1974). In other words, this special training system is meant to teach a judoka competitor to use as much as he can the *push-pull* principle to undertake the control in order to apply and successfully end his own well mastered *tokui waza* technique (Kawaishi, 1960).
Selected by the frequency of applying them in the national and international competitions the two techniques used in our experimental study belong to two different categories of judo techniques, meaning *tachi waza* (standing techniques) and *ne waza* (ground techniques). From the first category we selected the technique *ashi guruma*, and from the second one the technique *ohten gatame*.

Both groups were trained by the same schedule, but the experimental group was focused on applying the *push-pull* principle of Kano.
On the coach's command, all the couples of the experimental group executed *kumi kata* and started to perform the initial forward / backward steps. On second command of the coach, *Uke* pushed forward stronger by applying the force $\mathbf{F}_U$ on *Tori*. Next, as soon as possible, *Tori* overtake this impulse with his left hand by pulling with the force $\mathbf{F}_T$ and, as a result, he amplifies *Uke*'s displacement preparing to enter *migi ashi guruma* technique – according to the figure 1a position. In the same time with this *pull* movement, *Tori* advances his left leg to the right side of *Uke* and twists his body to his left, as shown in the before mentioned figure. Now, *Tori* start acting with both his hands. Aiming to amplify *Uke*'s unbalancing as necessary for entering *ashi guruma*, *Tori*'s right hand in the collar grip pushes with the force $\mathbf{F}_1$ and his left hand with the sleeve grip continues to pull with the force $\mathbf{F}_2$, as shown on the figure 1b. Finally, *Tori* succeeds to thrown down his opponent over his right leg with the resulting force **R**, closing the *migi ashi guruma* technique with *Uke* falling on *tatami*.

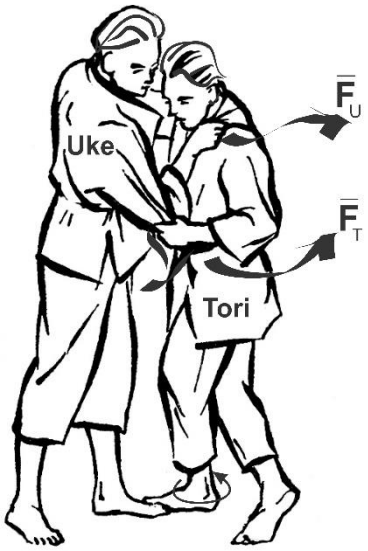

Fig. 1a – Entering *ashi guruma*.

Fig. 1b - Ending *ashi guruma*.

The second judo technique used in our experimental study was *ohten gatame* belonging to *ne waza* category. The *uchi komi* training system is applied in *ne waza*, too, although the ground techniques are often neglected. We observed that many times *shiai* is ended by the referee who declared *mate* when one of the competitors was thrown down. Nevertheless, one of commonly used technique applied to go on with the *shiai* is *ohten gatame*, which we decided to include in the present study.

In the situation when *Tori* doesn't succeed to end one of the *tachi waza* techniques (for example *harai goshi* or *ippon seoi nage*), but he succeed to unbalance *Uke*, the later may end on the ground on both his hands and knees. This is a most sensitive moment, as *Tori* should act without losing time, in order to avoid the Referee declaring *mate*. Therefore, *uchi komi* training is focused now on *Tori*'s action starting with this position.

In the experimental group training, on coach's command, all the judoka acting as *Uke* fall on the *tatami* and remain on both their hands and knees. This movement downwards represents the *push* which *Tori* should quickly overtake. Very smart, *Tory* slides his right hand under *Uke*'s right armpit firmly gripping his right arm meanwhile managing to conduct his right leg overriding *Uke*'s body as shown in the figure 2a. Afterwards, as shown on the figure 2b, *Tori* continues the overriding and executes a pure rolling down applying the force **R** and meantime moves his left leg under *Uke*'s chin and pushes hard upward with the force $\mathbf{F}_T$ as shown in the figure 2b.

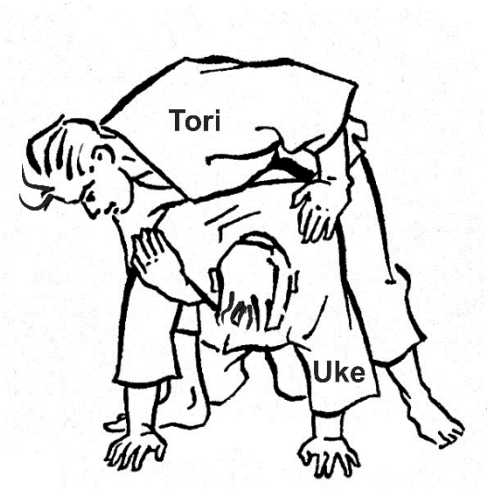

Fig. 2a – Entering *ohten gatame.*

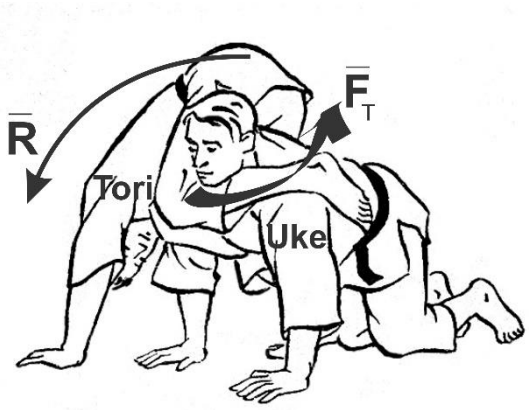

Fig. 1b – Applying *ohten gatame.*

Fig. 2c – Closing *ohten gatame*.

This roll over is the important moment *pull*. Using this pure roll and quickly pushing upward his left leg acting as a hook, but keeping tight the right hand grip, *Tori* succeeds to twist his opponent on his back as shown on the figure 2c. Most important, during the rolling over, *Tori* conducts *Uke*'s right arm between his own knees to fasten it and slips fast his hand toward *Uke*'s right wrist which *Tori* grips firmly with both his hands. In this final position *Uke* has no more movements to do and this moment represents the successful end of the *ohten gatame* technique (Aida, 1964 and Harrison, 1960).
The heart and soul of this technique is the high speed of *Tori*'s execution in order to incapacitate *Uke* to escape (Gilbert and Flamand, 1970). Essentially, our experiment demonstrated the outstanding advantage of the *uchi komi* system helping the correct learning of every single step until forming of a reflex movement as a result of the significant number of repetitions of the right action and finally achieving the needed fluidity of the execution.

RESULTS

The two techniques analysed in the present study were selected to emphasize the efficiency of using the *push-pull* principle, which in the *ashi guruma* technique is used in the direct version: *uke* pushes and *tori* pulls, while in *ohten gatame* execution it is used the reverse version: *uke* pulls and *tori* pushes.
After judoka-students belonging to the experimental group succeeded to learn the correct execution of the *push-pull* principle applied to the two selected techniques, in a first stage of six months training in the *uchi komi* system they executed three series of 20 repetitions for each of these techniques in every single day of judo training. At the end of a second stage lasting for three months continuing the training in the *uchi komi* system, the judoka-students belonging to the experimental group registered a consistent progress. Acting as *Tori*, their successful ending of the two selected techniques statistically increased by 30%.

CONCLUSIONS

The comparison between the two technical performance statistics concerning the successful ending of the two selected techniques registered by the experimental group and by the witness group revealed that entirely due to the *uchi komi* training system the judoka-students belonging to the first group acquired a performance higher by 30%, referring to the statistics of the successful execution of the two selected techniques. Meanwhile, these judoka-students registered better reaction in the execution of several other techniques applied in *shiai*, too.
Our results confirm an older recommendation (Watanabe and Avakian, 1960) that in order to acquire higher results in competition it is better to apply the *uchi komi* system of training for an extended period of months, even years as to finally achieve a successful execution of one or few *tokui waza* techniques.
Our incipient research (Palaga, 2016) was further continued by studying the unbalancing technique applied in aikido, and the results will be published.

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ROBOTS IN FUNCTION OF IMPROVING TEAMWORK OF MEDICAL TEAMS IN DIGITAL AGE

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Abstract: In the digital age, medical professionals increasingly collaborate with various robots and automated machines, which are rightly seen as equal members of innovative medical teams that contribute to greater automation of routine medical procedures, increased productivity and work efficiency, and the provision of high-quality medical services. The aim of this paper is to point out the importance of applying modern medical technology and robotics in medical teams because it has the effect of creating high-performance teams that are primarily focused on providing high-quality medical services. Collaboration between humans and robots dates back to the last century, and over time it has only become a more sophisticated and integrative part of work and business operations in almost all economic sectors, as well as scientific research and development. The role of medical robotic systems, automated and collaborative robots (co-robots) is invaluable and they are used in surgery (robots that assist during operations, e.g. in neurosurgery, or in vivo spinal kinematic instruments), laboratories (preparation and testing of blood samples), physical medicine and (neuro)rehabilitation (application of tactile sensors and Lokomat intended for exercise, learning and correction of gait impaired due to neurological, muscular and bone disorders) (Mann, et al., 2015; Preising, Hsia & Mittelstadt, 1991). Focus on the application of highly sophisticated technology in clinical diagnostics (magnetic resonance imaging, PET-SCAN) is increasing. Also, the application of humanoid robots in health care teams implies that they help deliver medicines and measure blood pressure to patients in hospitals, provide physical assistance in daily activities to disabled or elderly people. Using robotics and digital technology, these teams improve the outcomes of diagnostic and therapeutic treatment, and the healthcare process for the patient. However, the paper also pointed out certain limitations of the application of medical robots as members of medical teams. Above all, the implication of the lack of social and ethical aspects of the application of robotics, as well as the impossibility of achieving quality, humane interaction and affective interconnection between people as team members and patients with robotic systems (Olaronke, Oluwaseun, & Rhod, 2017).

Keywords*: medical robots, robotic systems, medical team, teamwork*

INTRODUCTION

The development of modern information and communication technology (ICT) and automation of processes aim at the application of "responsible innovation" whose focus is increasing cost efficiency and prosperity for all stakeholders (employees, consumers, employers, society, and the environment) (Cotta et al., 2021) and creating a smart society that uses renewable energy sources and available resources (Xu et al., 2021). The industrial revolution arose as a need to convert previously conventional machines into machines that could learn independently, improve management and maintenance processes, and organizational performance. The

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Industrial Revolution 4.0 integrated production systems with ICT in order to achieve process automation and improve decision-making strategies based on a greater ability to analyse data in real time (Dalenogare et al., 2018). This industrial revolution introduced new forms of technology such as artificial intelligence (AI) which enabled the interconnection of computers, intelligent machines and smart materials connecting them to the environment with minimal human involvement (Gilchrist, 2016; Ghobakhloo, 2020). The development and implementation of Industrial Revolution 5.0 is related to three basic goals: human-centeredness, ensuring environmental sustainability, and resilience (Breque et al., 2021; Doyle-Kent & Kopacek, 2021). It connects human intelligence and efficient machines based on AI in industrial production but also in other economic areas with great accuracy and precision (Khan et al., 2023).

The development of robotics and robotic systems in the last decade has evolved so much that it is impossible to imagine any industry and economic sector in which special purpose robots are not used. They have significant applications in agriculture, transportation, military, tourism and hospitality, in the storage, packaging, shipping and retail industries (Manyika et al., 2017), in the automotive, electrical and electronic industries (Hudson, 2019), as well as numerous other industrial sectors. However, the revolutionary role and effect of the application of robotics and AI on humanity has taken place in the health care sector. Intelligent robotic systems, the development of health information technology and digital transformation have contributed to the fact that every individual can be provided with a high-quality health service today, all in function of their longer, healthier and better life (Kurniasih et al., 2022).

Health care systems today cannot function without a team-oriented organizational structure, the focus of which are high-performance teams (multidisciplinary and interdisciplinary ones). The requirement of teamwork in health care, and especially the work of medical teams, is based on the continuous improvement of the provision of health care services with increased accuracy and precision. This means that each patient must be approached in a systemic and holistic way, that an adequate diagnostic procedure and treatment and care protocol must be set up and implemented, which in return results in a higher probability of success in treatment and recovery, greater patient satisfaction with the health services provided, but also the satisfaction of all stakeholders with the overall health care system (Lazarević & Lukić, 2017). In the digital age, these results in medicine can be achieved by applying highly sophisticated technology, robotics and AI that will take a significant place in collaboration with members of medical teams.

The goal of this paper is to point out the importance of the application of various robots in certain areas of medicine, which have become indispensable members of modern medical teams. The degree of collaboration between medical experts and medical robots is becoming increasingly complex and demanding, with the tendency for robots to independently take over and perform certain activities of the treatment process and patient care at a high level, allowing the medical team of experts to focus and dedicate themselves to a more efficient professional approach and humane work with patients.

KEY CHARACTERISTICS AND TYPES OF ROBOTS

Robots are visible machines that contain sensors, actuators and a certain level of artificial intelligence (Smids et al., 2020). The International Organization for Standardization defines an industrial robot as an automatically controlled, programmed, multipurpose machine that can be either fixed in a certain place, or mobile (International Organization for Standardization, 2012).

The International Organization for Standardization distinguishes four types of robots (International Organization for Standardization, 2012):

1) An industrial robot is an automatically controlled, programmed, multipurpose machine that can be mobile or fixed in a certain place.

2) A professional or personal service robot which functions by being controlled by operators, outside of an industrial environment in an unstructured and unpredictable environment, with or without the presence of humans.

3) Collaborative robots are designed to interact directly with humans. They combine human flexibility and problem-solving skills with the strength, precision and durability of mechanical robots.

4) Managerial collaborative robots are designed so that instead of monotonous, repetitive and simple tasks, they perform more complex tasks and activities using their connection to the Internet, memory and the expressed power of analysing collected data.

According to other authors, there are the following types of robots (Smids et al., 2020):

1) Pre-programmed robots that perform detailed tasks in a well-defined and controlled environment of a company engaged in the process of mass, serial production.
2) Robots that are continuously controlled by humans (submarine robots, drones).
3) Autonomous robots that are able to interpret the environment and take appropriate actions (robots in hospitals that deliver medicines to patients).
4) Robots that are connected or integrated with the human body (robot legs or arms that are used to carry some heavy equipment).

In the age of Industry 5.0, collaborative robots - cobots, which work together with people, are increasingly being used. For example, robots that know how to interpret emotions have eyes that look in the direction of their interlocutor and can set appropriate facial expressions according to the feelings of the interlocutor (recognition of danger, stress, fear) (Murashov et al., 2016).

Robots are increasingly becoming an integral part of teams and teamwork. More and more is heard about "human-robot" and "multi-robot" teams. A human-robot team consists of humans and robots working as a team to achieve a common goal. In a multi-robot team, several robots work as a team to achieve a common goal. This team can be divided into sub-teams consisting of small groups of robots that perform a certain set of tasks (McKee & Varghese, 2011). If robots are homogeneous by nature, they will be equally burdened with work tasks and activities. If the robots are of a heterogeneous nature, work tasks and activities will be distributed according to their capacities and abilities. Just like in human teams, robot teamwork must also be aligned and coordinated to achieve set goals.

Unlike industrial robots that mostly performed routine and manual tasks, in the digital age robots are increasingly cooperating with people and performing more complex tasks. Advances in the field of artificial intelligence have contributed to robots starting to perform intellectual and non-routine tasks and activities (Parschau & Hauge, 2020). It can be said that robots in the future will be more and more complex and will have better and better features and capabilities.

ROBOTS AS MEMBERS OF MEDICAL TEAMS

The first robots in the medical industry began to be applied in the early 1980s. Today, in medical clinical practice, the use of robotic systems and different types of robots has become a critical factor for the effective and efficient work of modern medical teams. There are

significant differences in the types of robots used in different branches of the medical field, according to their technical and functional characteristics. This is why there are different classifications of medical robots. Thus, according to the function and role they perform, medical robots can be classified into active, passive, synergistic, semi-active and intracorporeal systems (Smith-Guerin et al., 2008). Because of their performance, and above all their high adaptability, flexibility and precision, active robots have the greatest practical application in medicine (Kasina et al., 2017). According to the same criterion (function), other authors have categorized medical robots into surgical robots, rehabilitation robots, assistance robots and robots for hospital services (Guo et al., 2021; Wang et al, 2008). In accordance with the second classification of medical robots, the paper will detail the importance of the application and characteristics of specific robots in diagnostic, surgical and rehabilitation teams, as well as patient care teams.

Robots and artificial intelligence (AI) in diagnostic teams. In medicine, special artificial intelligence systems have been developed that can recognize and classify benign and malignant tumors much more precisely and accurately compared to humans. Many radiologists, at first, felt threatened and less valuable when robots started making accurate and precise diagnoses. However, when the bigger picture of the application of robotic systems is taken into account, radiologists and their teams have more time to treat patients and collaborate with other members of the medical team. Robots can free radiologists from monotonous, routine and time-consuming tasks, leaving them more time for systemic approach and work with patients (Smids et al., 2020). Also, the sensitivity and specificity of AI in medicine has proven to be effective due to the early and very accurate diagnosis of many diseases, e.g. cataracts in patients with diabetes, in dermatology when diagnosing and classifying skin cancer or early detection of cardiovascular diseases (Esteva et al., 2017; Weng, 2017).

Modern digital technology and artificial intelligence algorithms in medicine use sophisticated clinical diagnostics that enable early, precise, painless and faster diagnosis of conditions and various diseases, which allows medical experts to respond quickly with adequate therapy, especially when it comes to oncology patients. The most modern and precise tumor diagnosis methods include: magnetic resonance imaging (MRI), positron emission tomography (PET scanner), computed tomography (CT scanner), and 3D ultrasound. Preoperative computed tomography or magnetic resonance imaging are extremely useful for generating information about the patient's condition, and creating unique treatment plans that are tailored to the individual needs of the patient.

Surgical robots. The first medical robots were applied in the field of orthopedic surgery and neurosurgery. Laparoscopic robotics is considered to be the most widely used and commercially successful area of medical robotics (Dupont et al., 2020). Robots in laparoscopic surgery today represent a minimally invasive technique compared to other challenging surgical procedures. Compared to the standard open procedure, the effect of using laparoscopic robots is less blood loss, less likelihood of wound infection, smaller operative incisions and pain, and a shorter postoperative period. There is no doubt that, by applying this sophisticated technique, surgical teams improved the surgical outcome, that is, their manipulation and perception of surgical plans increased, thus significantly increasing the accuracy and precision of performing surgical interventions (Simaan et al., 2018). On the other hand, the efficiency of laparoscopic robotics is greater compared to the standard (manual) method, bearing in mind that it is also applied with considerable success in complex surgical procedures for radical interventions, especially in the fields of cardiology, neurology, urology, nephrology, gynecology and gastroenterology.

Robotics, regardless of the surgical branch of medicine, provides specialized medical (surgical) teams with a high degree of consistency and intraoperative support because robots are able to maintain a fixed position and hold medical instruments with high precision and accuracy,

maintaining stationary position for long periods of time. In this way, the characteristics of robots enable difficult team (surgical) tasks to be highly automated, which leads to higher work productivity, increased performance of members of medical teams and more successful achievement of team goals (probability of successfully performed surgical procedures and postoperative recovery of patients). Research has shown that in 2018 in the United States, about 15% of surgical procedures were assisted by surgical robots (Sheetz et al., 2020).

A new trend in surgery that will attract a lot of attention in the future is robotic systems in telesurgery that will help dislocated medical teams to control robots remotely during surgical processes. The application of these types of robots already helps to access surgical procedures in conditions and areas where there are interfering factors (natural disasters, wars) for the treatment of traumas (Xia & Lu, 2021).

Robots in physical therapy and rehabilitation (exoskeletal robots). Non-specific robots are used in physical therapy and rehabilitation, so-called exoskeletons that are used to train the body or parts of the body to restore mobility. These robots have the role of replacing a set of external muscles and bones that have suffered injury in patients with neurological, muscular and skeletal disorders. In the late 1990s, robotic systems were developed that train patients to walk and help them improve their level of locomotor ability. Lokomat is one such robotic system composed of a pair of robotic arms that attach to the patient's lower extremities, and a walking belt system that is individually programmed according to the patient's needs (Alashram et al., 2021). The function of Lokomat is to provide complete support during exercise, learning and correction of functional walking. This and similar robots very successfully replace the role of physiotherapists in the medical team of experts during the rehabilitation process of patients. Also, the application of, for example, the REX robotic exoskeleton helps people in wheelchairs to stand up and walk independently, using a pair of robotic legs and a belt attached to the hips (Kasina et al., 2017).

Robots for patient and elderly care. The job description and responsibilities of nurses in hospitals and nursing homes require them to perform a large number of different care, treatment and support tasks in a single working day, which are of vital importance to the users of these services. However, the lack of medical professionals in the field of health care on the labour market has imposed the need to develop and design such robots that will be strategically deployed to deficient workplaces and thereby improve the quality of services provided, and facilitate and improve the work and performance of already existing health professionals. On the other hand, developed software systems (robots, sensors, watches) and artificial intelligence are already widely used in health care for personalized administration of daily therapy, blood pressure and pulse measurement, monitoring of the electrical activity of the heart, rapid detection of veins during blood sampling or independent lifting and moving bedridden patients. The use of these robots provides a higher quality health care service to nursing teams while ensuring a better health outcome.

Humanized robots for socializing. One of the very important factors in the process of treatment and recovery of patients is the emotional support of medical professionals. The social interaction that is established in the relation between a medical professional and a patient, and the feelings of pleasantness, conscientiousness, openness, understanding and empathy that are important for patients positively correlate with the improvement of their quality of life and well-being. Due to the large volume of work, medical professionals are often unable to devote themselves socially and emotionally to patients. The development of humanized robots (cobots) is an attempt to provide some form of "emotional support" and mentally stimulate users. One such robot is Pepper, which is used in a penitentiary in Japan and has a "healing effect" - it keeps the inmates company, talks to them about various topics, plays music, congratulates them on their birthdays, invites them to exercise, communicates interesting information about weather forecast, astrology, etc. (Musulin, 2019). Humanized robots

designed in this way could find application in hospitals and homes for the elderly. In moments of loneliness, lethargy or emotional emptiness, patients could "emotionally" connect with the robots. However, the fact that a robot is humanoid and has the appearance of a human does not mean that it has a "soul" and that it can provide that human emotion that only a human can provide to another human in delicate and difficult moments.

DISADVANTAGES OF ROBOT APPLICATION IN MEDICAL TEAMS

In addition to the positive aspects of the application of modern medical robotics, which is aimed at improving medical services and the health status of patients, it should be noted that the development and application of medical robots can also produce negative attitudes. Increased introduction of medical robotics creates stress and a sense of fear among team members that they may be replaced and lose their jobs. Likewise, it should be borne in mind that in medical teams, jobs consist of more complex tasks and activities that are not so suitable for automation and the use of robots. Therefore, team members should not be exposed to the fear and stress of being replaced by robots. Moreover, robots will represent help and support in work. However, team members need to be focused on acquiring competencies that are not easy to automate - creativity, critical thinking and problem solving, communication, adaptability, initiative, persistence, perseverance and curiosity.

It is certain that attitudes about the acceptance of human-robot collaboration can be influenced by the interpersonal factors of the employee as a team member - origin, work experience and abilities (Hancock et al., 2011). On the other hand, it should not be ignored the fact that trust between team members is a key factor in the success of any teamwork, so here too the factor of people's trust towards robots (Kim et al., 2020), the degree of their acceptance and the transparency of cooperation with them is very significant (Kim, 2022). The extent to which people will accept the information and suggestions provided by robots will depend on the degree of cooperation and trust between team members and the robot (Hancock et al., 2011).

CONCLUSION

This paper underlines the importance of the application of various robots in certain fields of medicine, which have become indispensable members of modern medical teams. Using robotics and digital technology, these human-robot teams are improving the outcomes of diagnostic and therapeutic treatment, and the patient health care process. The attitude of team members towards robots depends on the level of development of their team skills and their attitude towards modern technologies and trends. Just as in teams made up of people, interpersonal relationships depend on their communication, trust and behaviour, a team made up of robots and people depends on the same principle.

It's important to note that the same rules that apply to human teams also apply to human-robot teams. At the individual level, one should take into account their attitude towards robots: previous experience, attitudes towards robots, feeling in the presence of robots, confidence in the adequate functioning of robots, confidence in the safety of working with robots, the way of communication with robots, tendency to accept new technological trends, as well as the level of technological competences and skills. At the organizational level, a set of measures and activities should also be undertaken to create an environment suitable for the introduction and implementation of human-robot teams. Above all, in terms of safety measures - physical contact with robots, distance from robots, safety in working with robots, and the occupational safety system.

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POLYPRAGMASIA IN MEDICAL PROCEDURES IN A SPORTS CLUB – IS IT REALLY NECESSARY?

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Abstract: Polypragmasia (polytherapy, polypharmacy) is often defined as the simultaneous use of 5 or more drugs or medical therapy modalities. This study aimed to evaluate the number of therapeutic procedures executed per injured athlete per day and see if an appropriate amount of therapeutical modalities were applied. Medical procedures in a sports club are somewhat different than usual because there is an imperative to getting the injured athlete back in training in the shortest period possible. This urgency is sometimes producing the need of using more therapy modalities than what would be good medical practice. The medical team in a sports club is trying to rationalize medical procedures and minimize polypragmasia, but, due to non-medical, external pressure, often unsuccessfully. We have listed the number of injuries, injured athletes, and therapeutic modalities executed in a team of 26 professional football players during the period of six months. We have registered 45 injuries of various grades and a total of 277 daily therapy sets. We have found that an average treatment lasted for 6.11±4.55 days per injury, and an average of 3.52±1.65 physical treatments were applied per day of therapy. Polypragmasia was present in 19.49% of the total number of therapy sets. When the use of drugs is added, we have found polypragmasia in 33.57% of all injury therapies, in some cases using a total of 11 physical procedures and drugs in a single day. We conclude that polypragmasia is significantly present in daily medical activities in a sports club, regardless of efforts to exclude it.

Keywords: *polypragmasia; sports injuries; physical therapy*

INTRODUCTION

Polytherapy (polypragmasia, polypharmacy) is most often defined as the simultaneous use of 5 or more medical therapy modalities (Masnoon et al., 2017). Therapeutic procedures within a sports club consist mainly of physical procedures and the use of medications (drugs). To distinguish these modalities, in this text, the term polypragmasia will be used for the use of 5 or more physical procedures, and the term polypharmacy for the use of 5 or more drugs. Therm polytherapy will be used when both modalities are combined.

Polytherapy (polypharmacy) is common in elderly patients with multimorbidity where the number of medicines is set by each of the medical problems, sometimes resulting in the use of much more than 5 medicines per day in total. Since that can cause unwanted and sometimes harmful side effects (Veehof et al., 2000) the medical community is aiming to solve this issue with collaboration between doctors of different specialties and pharmacists involved in the treatment of a patient, reducing the number of medicines from “too many” to “many”, in the same time trying not to affect treatment results (Bushardt et al., 2008; Rollason & Vogt, 2003; Scott et al., 2015). This phenomenon in the young population is much rarer and can be present only in cases of multiple diagnoses, similar to the older population (Menditto et al., 2019).

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On the other hand, polypragmasia and polypharmacy in sports are considered normal, because when an injury or illness of an athlete occurs, it should be treated with utmost urgency set not only by the athlete, but also by the coach and his training schedule, management of the club, media, and supporters. That urgency is a major factor dictating certain amendments in medical protocols that are not by good medical practice and are often ethically wrong, and polypharmacy and polypragmasia are examples of such malpractice.

METHODS

During 6 months (one half-season of a national football championship in Serbia), we counted and listed all injuries, illnesses, and medical procedures (which we were aware of) in a total of 26 players of a professional football club.

Results:

We have found a total of 45 injuries of various severity in different structures and tissues (Table 1.).

Tissue	Number of injuries	Percent of total
Muscles	21	46.7
Ligaments	8	17.8
Tendons	6	13.3
Skin	4	8.9
Other	6	13.3
Total	45	100.0

We have found that physical therapy averages 6.11±4.55 days (ranging from 2 to 28 days) and that an average of 3.52±1.65 physical procedures were conducted per day (ranging from 1 to 8). In terms of the duration of therapy sessions, we have found an average of 74 minutes of therapy per day (from 12 to 144), in most cases divided into two therapy sessions (one in the morning and one in the afternoon). Most important, we have found the simultaneous use of 5 or more physical agents (i.e polypragmasia) in 19.49% of all daily therapy sets. It is important to stress that in most cases drugs were used in addition to physical procedures (from 1 to 3 different medicaments per day), adding an average of 1.49±0.66 medicaments per day, summing 33.57% of cases of polytherapy. Furthermore, the sum of the number of medicaments and the number of physical therapy procedures, in therapy days right after injury topped 11 different treatments.

Discussion:

To our knowledge, this is the first study of polypragmasia in therapy in athletes in the world. Because of that, we are unable to compare our results with others and discuss our findings. Nevertheless, we shall emphasize all the hazards and potential problems, as well as the benefits that can result from polypragmasia.

If there is a common cold, for example, an ill athlete often doesn't have time to rest and heal, but immediately starts with harsh medical treatments, which can comprise the simultaneous use of several medications and/or supplements. The use of a combination of two or more antibiotics, decongestants, and mucolytic agents is common practice. Some of the medications used can produce side effects in the digestive (nausea, vomiting, pain, bleeding, diarrhea), or nervous system (insomnia, hypersomnia, anxiety, decline in motor functions), either due to drug-drug or drug-disease interaction (Craig Brater, 1986; Magro et al., 2012; Petric, 2021). The doses and frequency of use of those medications are in most cases bigger than recommended. What may be most important, sometimes it happens that an ill athlete conducts separate therapy, in addition to the treatment set by his team physician, who is not even aware

of that parallel program. Sometimes, athletes are unknowingly taking medications that are banned for use as doping, but that is another problem altogether.
When comes to physical procedures in therapy and rehabilitation after injury, the situation is even worse. During recovery, therapy will comprise almost every available procedure. The use of therapeutic agents is perplexing, they are combined and used simultaneously, and the period between two procedures is only a couple of minutes. This is not only polypragmasia but some sort of „rapid polypragmasia“, which may cause adverse response from the injured and surrounding tissue. Sometimes the injured athlete chooses what procedure is to be conducted because some of them are more useful in their opinion! And then, there is a problem with additional procedures (physiotherapeutic, kinesiotherapeutic, etc.) conducted out of the knowledge of the team physician, in a facility outside of the club.
Polypragmasia and polypharmacy are considered medically and ethically wrong for several reasons:
First, during physical treatments, a big amount of various forms of energy is delivered to the body, either in one focal point or in a larger area, affecting not only the point of injury but also the uninjured surrounding tissue. When more physical agents are combined, there is a risk of adding too much energy to some of the structures, which can give an adverse reaction and even worsen the status. Generally, this can help heal the injury, but can simultaneously affect surrounding tissue, making it inflamed and sometimes prone to developing another problem.
Second, there is a problem of potential interaction between applied treatments, interactions with foods/beverages, and interactions with dietary supplements.
Third, a series of physical treatments can seriously affect the skin in the area of the treatments. There are methods of prevention and protection, but sometimes it does not help and skin ends up damaged.
Fourth, there is always a risk of damage to gastrointestinal mucosae, when oral administration of drugs is used. Besides that, some of the most used drugs, or their combinations (NSAIDs, myorelaxants, painkillers, etc.) can negatively interreact with the liver, spleen, kidneys, blood pressure, sleep, mood, etc (Aithal & Day, 2007; Johnson et al., 1994; Laine et al., 2006; Sabatino et al., 2020; Woo & Ratnayake, 2020).
Then, there is the time issue. Every treatment takes some time to execute and when adding them, the duration can be several hours, affecting professional, sociological, and personal duties and obligations.
Of course, there is also a financial issue. Every drug or therapy procedure cost some amount of money, either directly or indirectly.
Last, but not least, it is important to stress that athlete is in most cases not properly informed about the procedure, neither about benefits nor the risks, which is a violation of medical ethics.

CONCLUSION

We conclude that polypragmasia is intensely present in the medical procedures in a sports club. In an effort to reduce polypragmasia, the medical team should minimize the number of treatments, both pharmacological and physical, as much as possible, and split physical therapy into two daily sessions at least 6 hours apart, giving the tissue the chance to respond appropriately to the treatment and to safely receive the big amount of various energy inputs during procedures.

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SUSTAINABLE DEVELOPMENT ON THE EXAMPLE OF SPORTS IN THE ARMY OF SERBIA

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Abstract: The main goal of the research was to show that applying the principles and factors of sustainable development on the example of sports in the Serbian Army through modern methods and management models contributes to the sustainable development of the Republic of Serbia and increasing the efficiency of civil-military cooperation. After numerous military sports events organized in the previous twenty years of active membership in the International Council for Military Sports (CISM), the Republic of Serbia hosted and participated in the organization of numerous sports events. The CISM motto - "FRIENDSHIP THROUGH SPORT" was primarily promoted at the competitions, but these large sports events were a test where the organizers and other organizations that took an active part showed that the joint implementation of sports events in circumstances of limited resources has meaning through the function of civil-military cooperation and the principle of sustainability. The basic factors of sustainable development were an integral part of the management of this event. Through the presented results, we conclude that by applying the basic principles of sustainable development and civil-military cooperation, we can significantly contribute to the sustainable development of the Republic of Serbia through improving health, reducing the consequences of poverty, reducing social exclusion, preventing social isolation and conflicts within groups, developing human capital (especially among youth), developing collective identity, which facilitates collective action, fostering social networks and voluntary associations.

Keywords: *Sustainable development, sport management, Serbian Army, civil-military cooperation, sports events*

INTRODUCTION

The concept of sustainable development and sport is characterized by the constant expansion and complication of relevant theoretical and practical-organizational issues. The increasingly pronounced multidimensionality and interdisciplinarity of sustainable development and sport require significantly larger funds of scientific and professional facts and information than before, which imposes the need for continuous scientific monitoring and study of various fields and phenomena (Baena-Morales et al., 2021). This especially refers to the economic, social, social, health and ecological aspects, but also their other most concrete expressions, through which the very essence of sustainability is reflected. Such importance of sustainable development and sports requires a complex process of planning, preparation and "production" in the conditions of increasingly developed civil-military relations. Due to the globalization of business, economic crises, the creation of various alliances and fierce competition on the world market of events, the need for successful management of sustainable development and sports through civil-military cooperation is growing, which is achieved through the creative application of all functions of modern management and principles of sustainability. The army,

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as an element of security and peacekeeping, affects sustainable development in many ways, and that is because there is no sustainable development without peace, and peace without sustainable development (Jenne, 2022).
In the field of sustainable development and sports, the border between military and civilian, national and international action and organization is less and less recognized (Bošković, 2012). In such conditions, the military organization is also required to incorporate changes in its structure and programs that are in line with the principles of sustainable development and create new values that will be successfully managed in a complex and uncertain environment.
One of the important areas of sustainability of civil-military cooperation is sport, which is experiencing significant expansion in the area of joint organization, use of joint resources, joint management, which follows the development and general characteristics of other areas, but also contains certain specificities (Jeftić, 2009). This, of course, also applies to sports and military events, especially those that, due to their military, political, social, economic, cultural and other characteristics, belong to the category of large sports events. Large sports military manifestations represent a serious challenge for the military organization, because their preparation and execution test the readiness and ability of all available human, material, technical, financial and informational resources in a changing environment (Todorov, 2014). At the same time, civil structures take part and give support to these tasks, which have recently become more and more demanding and uncertain (Marić et al., 2016). We should also take into account the demands of reducing or limiting resources for the needs of defense affairs in many countries due to the global economic and financial crisis, which most often has an unfavorable effect on sports in the Serbian Armed Forces (hereinafter referred to as the AF).
The motivations for the research are:
- insufficient research into the connection between sustainable development and sports in the Army from a scientific and theoretical point of view;
- lack of conceptual and operational definition of sustainable development through sport;
- insufficient recognition of the importance and specificity of sustainable development in the realization of large sports military manifestations in relation to other large sports manifestations;
- an effort to contribute to the finding of effective solutions for the realization of large sports military events by applying the principles of sustainable development;
- the desire to systematize and present the knowledge and experience from the civil-military organization and implementation of sports to the wider scientific and professional public and thus contribute to the improvement of the theory and practice of sustainable development on the example of sports in the Serbian Armed Forces (Marić, 2016).

MATERIALS AND METHODS

The research resolved issues related to defining, classifying and characteristics of sustainable development, civil-military cooperation, sustainability of sports in the Serbian Army (military sports and military sports events), management of sports events, specifics of large military sports events in relation to other large sports events and, as a key, the problem of finding an efficient model of sustainable development on the example of sports in the Serbian Army. A practical explication study was carried out on the example of the 25th Summer Universiade, the 55th World Military Cross Country Championship and the 13th CISM Futsal Cup for Peace. Considering the complexity and specificity of sustainable development, on the one hand, and the insufficient research of that area on the example of sports in the Army in the conditions of dynamic changes in the environment and limitations in the military organization itself, on the other hand, work on this research involves combining theoretical and empirical research methods, that is, a combination of qualitative and quantitative approaches.

The qualitative approach refers to descriptive studies (conversations, interviews and case studies) and historical studies (external and internal records and systematized use of historical facts). The quantitative approach refers to the application and processing of questionnaires, the analysis of the content of documents (international and national in the field of sports, legal regulations, organization and management) and the comparison of statistical indicators. At the same time, the choice of methods is determined by the defined subject and research problem. General and special scientific methods were used in the parts of the work related to the definition of the basic concepts for the discussion on sustainable development and the characteristics of sports in the Army and sports military events.

Of the general scientific methods, mostly the so-called qualitative methods: analysis-synthesis, induction-deduction, abstraction-concretization, generalization-specialization and classification.

From the group of special scientific methods, the following were used: the method of analyzing the content of documentation, the historical-comparative method, the descriptive method, the examination method, the method of expert evaluation (the so-called Delphi method) and the statistical method.

Strategic management methods were used to establish a model of sustainable development on the example of sports in the Army, namely: SWOT analysis, SMART approach, Case study, Project management and Model methods.

In order to collect empirical data for testing the hypotheses of the research, a special research instrument was prepared: Questionnaire called "Sustainable development management on the example of sports in the Army".

The questionnaire consists of 31 closed-ended questions or statements in which respondents were offered the opportunity to choose answers according to the strength of their attitude, opinion and knowledge on a scale from 1 (do not agree at all) to 5 (agree completely). Each question - statement had the status of one item, that is, elementary information about one of the four key fields of the researched phenomenon: defining and classifying the management of sustainable development; identifying the specifics of sport through civil-military cooperation, contributing to CISM membership and proposing a sustainable development management model based on the example of sport in the Army. Such an approach enabled the numerical display of scores, facilitated statistical processing and made the data more interpretable.

The survey based on the Questionnaire was conducted on a representative sample of 217 members of civil structures and armed forces, of which 165 are from Serbia, and 52 respondents are from 13 other countries. There were 15 incorrectly filled questionnaires, so 202 correctly filled questionnaires were taken into the research. The respondents were military and civilian persons, active and former athletes, sports workers who organized and implemented sports events together with military structures, as well as persons without sports competition experience, who perform various duties in the field of military sports in the home armed forces, from reference to top management. In order to achieve the greatest representativeness of the sample, a simple random sample was applied, which provided an equal probability to each unit of the basic set to be selected in the sample (Marić, 2016).

The data obtained from the research were processed using the applied statistical program SPSS Statistics 20.0. Factor analysis as one of the most popular multivariate techniques presents two goals:

1. identification and understanding of the basic idea, i.e. common characteristics for several variables.
2. reducing the number of variables in the analysis when there are too many, where some of them "overlap" because they have similar meaning and behavior.

As an interdependence technique, we looked for a group of variables that are similar in the sense that they "move together" and therefore have selective interdependence. Factor analysis rationalized the number of questions in the Questionnaire.

RESULTS

Since there is no division into dependent and independent variables, because they are all independent, we searched for a model of the relationship between the variables that makes sense from the aspect of the research problem as reasonable, meaningful and optimal in terms of solutions by reducing the entire space of variables to a smaller number of factors.
The resulting eight factors with 64% variability define the entire system of variables. The highest percentage of variability refers to BENEFITS VS MEMBERSHIP PRI CISM with about 28%. With 17% variability, the synergistic expression through the fourth, sixth, seventh and eighth factors determined SUSTAINABLE DEVELOPMENT MANAGEMENT.
In order to confirm the general hypothesis which assumes that the application of modern methods and techniques of management of sustainable development on the example of military sports contributes to the sustainable development of the Republic of Serbia and increasing the efficiency of civil-military cooperation, and according to the results obtained, we can state that it is fully accepted.
After, in order to obtain a simpler solution, the rotation of the main components into the varimax position (shown in Table 1) was performed, the set and structure of predictor variables were obtained, which confirm sustainable development on the example of sports in VS, and which can be very reliably interpreted in accordance with past practice and experiences.

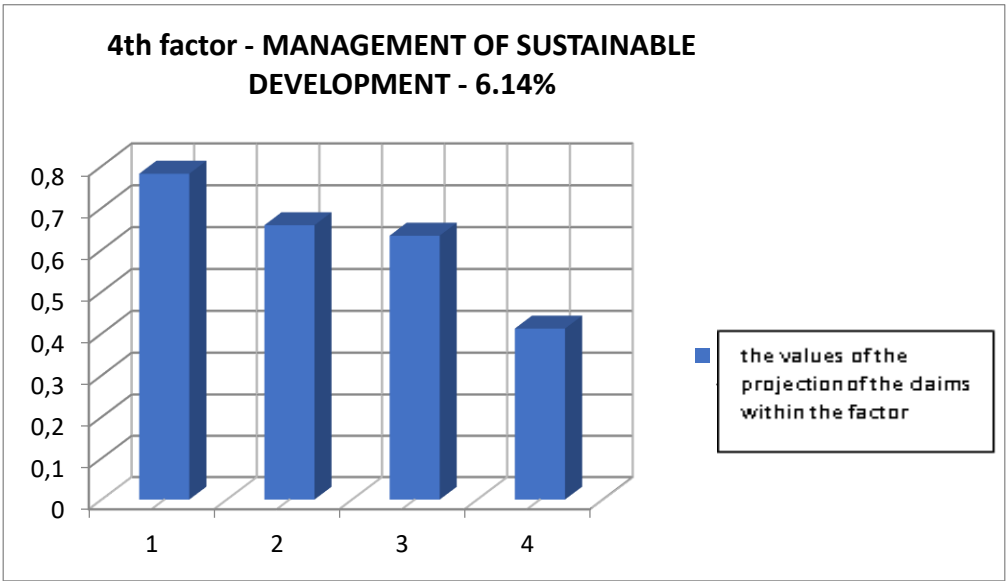
Table 1 – Intercorrelation of predictor factors

	1	2	3	4	5	6	7	8
1	1,000							
2	,318	1,000						
3	,325	,484	1,000					
4	,248	,360	,259	1,000				
5	,357	,355	,260	,092	1,000			
6	,178	,345	,254	,248	,162	1,000		
7	,245	,307	,128	,187	,267	,203	1,000	
8	,236	,263	,349	,111	,270	,252	,275	1,000

The FOURTH FACTOR determines the variables with 6.14% of the variability of the entire system, which represent the management of sustainable development. The general characteristic of all variables is that they act synergistically on sustainable development through the development of sports and tourism potential of the local community and region, through military tourism institutions, environmental protection, through the optimal use of natural resources for the realization of sports events, lessons learned about efficiency and more rational use of resources in the future of sports events, control of the organization and implementation of the sports event by the civil-military management, which more successfully eliminates shortcomings and perceived problems in the function of sustainable development of

the environment in which the sports event is held. The highest projection with 0.782 on this factor is the claim that the optimal use of natural resources for the realization of sports events is a function of environmental protection. We name this factor as SUSTAINABLE DEVELOPMENT MANAGEMENT.

Graphic 1 - Variability within the fourth factor



The SIXTH FACTOR defines variables with 4.05% of the variability of the entire system that have an impact on peace and security in sports. Primarily, these variances relate to the necessary development of sustainable construction projects and sports grounds, greater security of sports events in a civil-military organization, maintaining peace in the region through the development of the Army and thus sustainable development of sports and the entire social community. The highest projection on this factor of 0.796 has the claim that the development of the Army contributes to the maintenance of peace in the region. Therefore, the structure of this dimension allows this factor to be interpreted as PEACE AND SECURITY THROUGH SPORTS.

The SEVENTH FACTOR largely determines the elements of sustainable development, where the observed variables contribute to the development of regional cooperation and reconciliation through the development of gender equality, the development of health and healthy habits, the promotion of informal education about sports and the participation of the athletes of the Croatian Armed Forces in domestic and international civil sports events, complementing the contribution of sustainable development of sports in the Army. The dimension is determined by 3.65% of the variability of the entire system through four manifest forms that complete the sustainable development factor and we define them as GENDER EQUALITY, HEALTH, EDUCATION.

EIGHTH FACTOR defined by 3.45% of the variability of the entire system with three variables that are intended to evaluate certain social and cultural components through sports events, which confirms the first special hypothesis that the management of sustainable development on the example of sports events as a segment of the Sustainable Development Strategy of the Republic of Serbia through social- cultural features contribute to the sustainability of sports in the Army. The characteristics of the variables are determined through the contribution of sports events to the prevention of social isolation, the development of collective identity and the development of multiculturalism. A distinct projection of 0.859 has the claim that during the

development of sports manifestations, the development of collective identity occurs. Since sustainable development is of great importance for this factor, it largely complements the fourth factor and we name it SOCIAL AND CULTURAL COMPONENTS.
Based on the defined factors, a global picture of sustainable development was created using the example of sports in the Serbian Army. By reducing the 31 statements to eight main factors that cover most of the variation, we obtained data that can be used for additional analysis of the respondents in relation to which country the participants are from, what education they have, and what status they have in the organization of the sports event.

DISCUSSION

Sport is otherwise one of the most democratic and suitable mechanisms for establishing favorable relations between different social structures and as such is an extremely rewarding field for civil-military cooperation (Pucher, 2005). Often, military sports precede the establishment of various types and forms of civil-military cooperation. In this regard, we should not look for a better example than a kind of model of civil-military cooperation through sports, which was established in Serbia about 20 years ago. Larger non-competitive sports events should not be neglected when it comes to contributing to the development of military sports and sustainable development in general. CISM symposia, congresses and annual assemblies, continental conferences and regional meetings fill the gap between periodic competitions and ensure the continuous development of military sports, thereby contributing to sustainable development (Svensson ed al. 2017).
There is no easier and cheaper way to promote civil-military cooperation than through sports. The costs are very low and the impact can be huge. Good examples are Serbia, South Korea, Suriname, China, Austria, Finland. The key word in the organization is communication with journalists and the public, but the situation in the armies is such that communication with the media and the public is very weak. You need to do what you are best at, which is military sports. In all other areas of sports, civilian organizations are much better than military ones. Soldiers achieve the best results in military sports competitions. With the application of marketing and more active communication with civil structures, competitions can be more interesting.

CONSLUSION

In strengthening social awareness, promoting informal education about sports, organizing conferences, seminars and professional training on the topic of sports, campaigns on sports activities of an educational character, the Army can play a very active role by forming a stronger institutional structure to enable the full integration of sports, health and life environment at all levels of decision-making. The army has already intensified cooperation with relevant state structures and international actors with a special emphasis on the region. Sports, exercise and physical education can professionally empower people in the Serbian Armed Forces and thus contribute to the development of the community. Through policies, programs and practices, sport contributes to sustainable economic and social development (improving health, reducing the consequences of poverty, social exclusion, preventing social isolation and conflict within groups, developing human capital, especially among youth, developing a collective identity that facilitates collective action, fostering social networks and voluntary associations).
Professional management will have to develop new capacities and build new institutions through social work so that sports activities lead us to a better world. Sustainability implies the concept of social equality and economic justification with the addition of environmental integrity with practices around the world, which aims to be done better not only as a concept

but also as a daily practice. A sports event is sustainable when it meets the needs of today's sports community and goes in the direction of future sports opportunities, and all this through improving the integrity of the natural and social environment on which it depends.
Sport has the power to unite people around common ideas and projects (institutional projects, projects of reconciliation and tolerance, sustainability projects of civil-military cooperation, environmental protection projects, sustainable construction projects of sports fields and facilities for the use of the military and the civil sector), and furthermore of all other buildings that are built on the globe, in the function of holistic sustainable development.
The popularity of sports is an ideal medium for promoting the Army, interstate and intermilitary cooperation, healthy habits and lifestyles, environmental awareness and environmental protection, especially among young people. Famous athletes, as symbols of victory, courage, leadership and goodwill ambassadors, are promoters of a sustainable way of life and sustainability on a global level.
The objective function is satisfied and results in success only if all principles of sustainability are respected, starting from the individual level, through national, international, to comprehensive and global.

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DEPRIVATION OF RURAL CHILDREN AND SPORTS

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Abstract: The article was created as an aspiration towards a more active and responsible engagement of all relevant factors that can ensure adequate treatment of sports and physical activities in villages. The goal was to obtain principal data on the situation and problems faced by children of preschool age. The survey was conducted among teachers in preschool institutions, using a quantitative method through an online questionnaire. The case study included 20 villages in the region of Banat: Veliko Središte, Malo Središte, Mali Žam, Uljma, Gudurica, Pavliš, Izbište, Zagajica, Parta, Orešac, Vlajkovac, Ritiševo, Vatin, Markovac, Vojvodinci, Straža, Sočica, Potporanj, Šušara, and Ritiševo. A decrease in social and cultural participation is a result of various factors, due to either long distance to sports and recreational clubs or a lack of them in rural areas, a low level of awareness of parents about the importance of sports and recreation, a lack of financial means of parents, or a lack of information among parents about the existence of such activities. Limited freedom of choice at an early age can affect the beginning of the process of social exclusion of rural children, which in later stages of life can narrow their social space and reduce their cultural capital. The development of sports in rural areas should be based on the social responsibility of all individuals and organizations engaged in agriculture who must become active factors in determining the needs of their children in the field of sports and physical culture, namely: physical activity and exercise, socialization with other children, building team spirit, learning the fair play code, and spending quality free time. The aim of the research was to determine whether there is deprivation of children in the countryside when it comes to sports. We started from the hypothesis that children have worse conditions. The idea is to publish the results of the research to encourage local governments and sports associations to improve the quality and quantity of sports in the villages of Banat.

Keywords: *sport, preschoolers, rural environment, deprivation*

INTRODUCTION

One of the main characteristics of children's age is permanent development and growth, which requires taking care of conditions that will positively affect the child's health. All relevant factors of socialization – from the family to educational and health institutions, point to the importance of the kinesis factor. The goal is to create a positive climate for the growth and development of the child. There are numerous sports schools and sports clubs nowadays, in addition to the already mentioned relevant factors for a child's physical fitness. Children of preschool age can walk up to 98 km over one week, and when they start school, this movement decreases to 54 km per week (Nikolić, 2019). Such indicators are expected considering that when children start school, they spend half a day sitting at their school desks. In today's modern society of the Internet and social networks, children spend more and more of their free time after finishing school in a sedentary lifestyle. Of course, this also applies to preschoolers.

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Research and studies that dealt with the negative consequences of using computers at preschool age indicate that in addition to insufficient exercise, other risk factors can be distinguished: besides the physical and mental health of children, there are risks for social and emotional development and risks for intellectual development and creativity (Lazić, 2014). Preschool age includes a very sensitive period in the child's development when the child's curiosity is awakened and the desire to acquire new knowledge grows. The preschool program for older groups in kindergartens involves activities that introduce children to letters and numbers and generally plays an important role in preparing them for school duties. Children encounter the form of assignments and homework. They learn the basic rules that should be observed in a class. They learn to wait for their turn, listen and follow what others are saying, speak up and express their opinions. Preschool age is divided into three periods: up to the age of three, from three to five years and from six to seven years. It is known that the development of preschool children is fast and dynamic, and as a result their bones are still soft and their muscles are weak. The child's nervous system and body are not fully developed yet. Above all, the emphasis should be placed on the development of coordination, and that in all three preschool groups of children." (Martinić, 2018) The importance of physical activity for children through play and sports in preschool age cannot be overemphasized. It is also guaranteed by the International Charter on Physical Education and Sports, where the first article states that "engaging in physical education and sports is a fundamental human right for everyone" (Nikolić, 2019:58). Being aware of the importance of this right, parents and society invest a lot of effort in creating the best conditions for their children for exercising this right. In urban areas in Serbia, children have at their disposal a large number of sports schools and sports clubs. This is supported by hundreds of territorial sports associations. Their members, such as the Vojvodina sports association, in Banat for example, the city of Pančevo alone has 180 active members, 20 different women's and 60 different men's clubs, the city of Vršac has 22 members covering a wide variety of sports – football, basketball, volleyball, taekwondo, dance, table tennis, athletics, cycling, archery and other. Unfortunately, there is a large discrepancy between the offer of the number of registered sports clubs and schools overall, and the particular offer in the rural areas of Banat, which were the subject of this case study. The complexity of the problem and numerous factors – primarily economic, infrastructural, organizational, demographic, social and all other, have resulted in marginalization of some social groups that have remained out of these trends of expansion of the consumer society, commercialization, and globalization of sports. The internet has reached some of these communities, but gyms and exercise facilities, animators for children and sports coaches will remain unavailable in their territories for another decade or several decades.

Regardless of the fact that the majority of the population in Serbia lives in cities, there is a large number of those who live in rural areas and whose children attend rural kindergartens and schools. They make up 40.5% of the total population. Namely, 2,914,990 inhabitants live outside the urban areas, according to the 2011 census. (Gulan, 2019). At that time, 7,163,034 people lived in Serbia, and according to the latest census, that number is 6,690,887, which reveals the trend of population shrinking in general, and the data can be expected soon that will be reveal to the public as to how it affected rural areas. We can hope that the global pandemic may have slightly stopped the trend of the outflow of people from rural areas, but the trends of the death of villages certainly indicate the need for a radical reorientation of public policies in terms of key issues such as changing development strategies and placing emphasis on a more even regional development of agriculture and villages, whereas creating conditions for children's physical activity in villages is a small but very important segment.

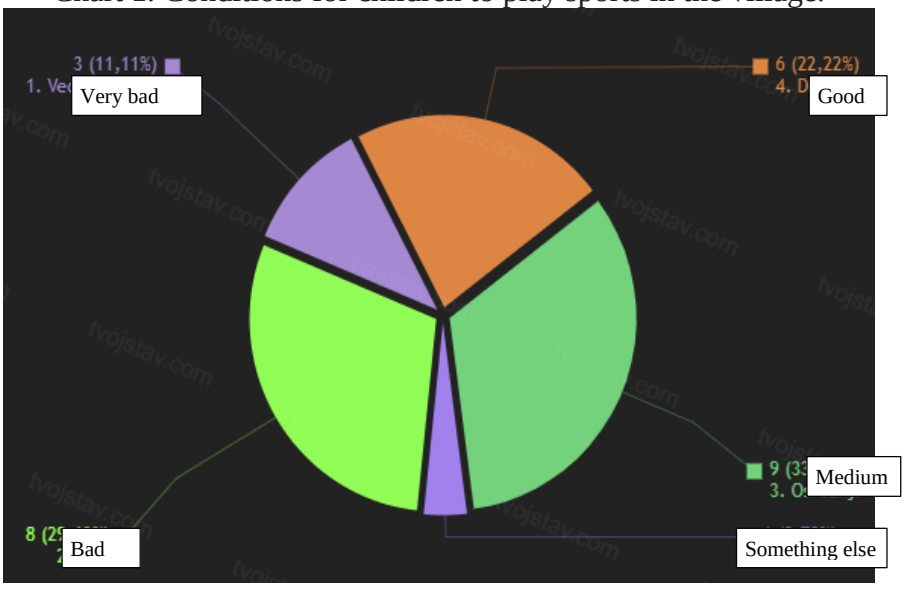
METHOD

For the purposes of preparing the questionnaire, qualitative research was also conducted using the method of focused group discussions in several villages where the research was conducted. The main goal of the focused group discussions was to gain an insight into the needs of rural children and their families for social services in the field of sports, the quality and availability of these services, as well as an insight into the main obstacles that hinder their more successful provision. With the same aim, a broader context of the possibility of economic and social improvement of life in the countryside was observed, which implies the activity of the parents themselves and other actors relevant to the improvement of social services in the field of sports in the countryside. The research survey was conducted using the quantitative method through an online questionnaire among pedagogues in preschool institutions. The case study included 20 Banat villages: Veliko Središte, Malo Središte, Mali Žam, Uljma, Gudurica, Pavliš, Izbište, Zagajica, Parta, Orešac, Vlajkovac, Ritiševo, Vatin, Markovac, Vojvodinci, Straža, Sočica, Potporanj, Šušara. The questionnaire was filled out by the teachers in institutions that have pure preschool groups and the teachers in institutions where there are mixed groups, or where the education of preschoolers is carried out within elementary school classes. The respondents were asked four closed questions and one open question on the "Your attitude" online research deliberation, and mediation platform and were sent a link where they could give their answers.

RESULTS

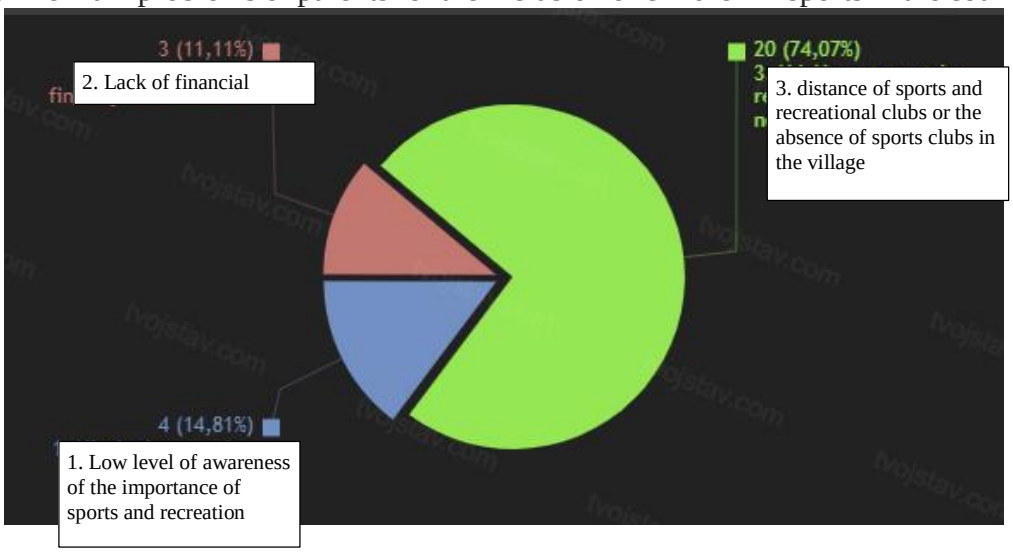
The largest number of respondents – 40%, assessed the conditions for playing sports in the countryside for children as very bad or bad, while only 22% thought they were good. (Chart 1.) A fairly high percentage rated the conditions as mediocre, and the possibility of an open comment, under something else, was used to indicate that regardless of the conditions, there were few children in the villages overall.

Chart 1. Conditions for children to play sports in the village.



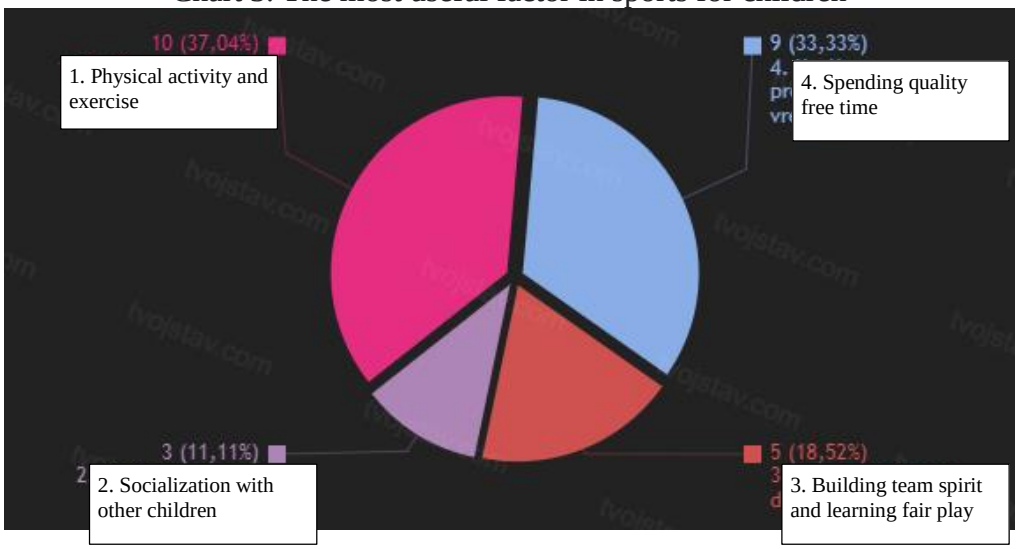
According to the opinion of 74% of the respondents, the biggest problem of parents regarding the involvement of children in sports activities (Chart 2) is the distance of sports and recreational clubs or the absence of sports offer in the village, while the low level of awareness of the importance of sports and the lack of financial resources make 26% of responses.

Chart 2. The main problems of parents for the inclusion of children in sports in the countryside.



When it comes to choosing the most important factor for the development, growth and upbringing of children, the respondents chose different answers. In an approximate percentage (Chart 3.), they think that physical activity and exercise and spending quality free time are the most useful, and immediately after that, building team spirit and learning fair play, and finally socialization with other children are mentioned as the most useful.

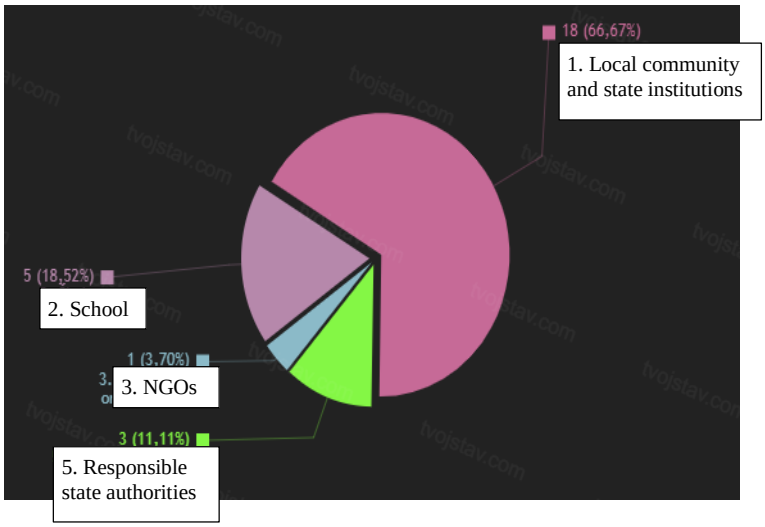
Chart 3. The most useful factor in sports for children



To the open question in the survey: "Are there enough sports and recreational clubs in the village where you work, and specify which ones?", the largest percentage of respondents answered that there was no choice of clubs or that there were none at all, 22% of respondents answered that there was only one club. The following six sports were mentioned in the survey: football, table tennis, archery, aikido, karate, and athletics. Two respondents stated that there is folklore in the village and only one respondent stated that there were three clubs in the same village: football, karate, and boxing.

According to the respondents, the local community (67%) and the school the children attend (19%) can influence better conditions for regular sports activities in the countryside, while much a smaller proportion of the respondents trust in competent state bodies and the least of all in non-governmental organizations (Chart 4).

Chart 4. Entities that can influence the development of sports in the countryside



DISCUSSION

The results of the research confirmed the initial assumption that there is deprivation of children in the countryside when it comes to conditions for sports and physical activity, not only by the direct answers of the respondents who rated the conditions as bad and very bad, but also by further data that were presented and show that in 20 villages in Banat children do not have the opportunity to play: basketball, volleyball, handball, dance, tennis and many other sports. In the villages where there is a sports club, it is mostly one sport, so they don't have a choice. The distance of sports clubs is cited as the biggest reason for not including children in them. Even though the distances are not too great – 15 km or 20 km from the larger sports centers, it is obvious that together with the financial situation of families, the general socio-economic conditions and the way life in the village, it represents a serious problem. The possibility of children going independently to sports activities in their village, in their school, would increase their involvement in different sports. This is probably the reason why local communities and educational institutions themselves are recognized as the factor that can most influence the improvement of the sports offer for children in the countryside. What is positive and can provide benefits for children and the sports offer in the countryside is the existence of awareness of the importance of all factors in sports for children, from physical exercise and regular physical activity, through building team spirit, fair play and socialization to quality spending of free time in sports. If we take into account that rural areas are very suitable for development of outdoor recreational sports, perhaps local communities should be directed towards engaging experts in the field of sports, and not just raising the level of infrastructural solutions in the form of additional outdoor fields or building indoor halls. The initiative of the Association of Physical Education Teachers of Serbia, which was sent to the Ministry of Education and the National Education Council at the beginning of 2023, to increase the fund of physical education classes for primary school students and to hire physical education teachers in addition to teachers, did not meet with the approval of the Association of Teachers of Serbia due to the additional burden of children with an excessive fund of hours. Regardless of the data in the aforementioned Initiative (SSPFVS, 2023), that every fourth child is obese, that every fifth child has poor posture, that 70% of primary school children do not engage in sports activities outside of school, that the vast majority of children (90 %) is occupied with digital virtual reality and that parents are not financially able to pay for their training, this initiative did not take off. Considering the results of our research, the question can be raised as

to why this kind of initiative is not aimed at preschool institutions, especially in rural communities.

There are many different socio-economic factors that play a significant role in improving the situation of children in the countryside, especially when it comes to the possibility of playing different sports. It is clear that parallel work must be done on the improvement of the sports offer, in the educational institutions themselves, in terms of both infrastructure and by hiring experts, but also outside the institutions in order to spend quality free time, which requires a stronger connection with local clubs and sports associations while finding different financing channels.

The process of improving the position of sports for children in the countryside requires action in both directions – from the national action plans of the ministries for sports and youth to regional and local institutions and vice versa – from local institutions to clubs, federations, city councils for sports and non-governmental and international organizations. The strategy for the development of education and upbringing in the Republic of Serbia until 2030 was adopted in 2021. The document was drawn up on 93 pages, which, among other things, stipulate: operationalization of strategic measures and activities." (Government of the RS, 2021:16) Furthermore, the strategy states that the desired state in the field of preschool education and education implies the further development of the preschool education system to meet the needs of children and families as the support for the well-being and overall development of children of preschool age, in line with the principles of preschool upbringing and education: accessibility, democracy, openness, authenticity and development, through: ensuring a wider availability of various programs and forms of educational work with children of early age, according to the established needs of children and families and the possibilities of the local community. Within the chapter on connections with the existing policies and the legal framework, the Law on Sports is also mentioned, which among other regulates school, university and physical education of children of preschool age. A brief insight into the situation of sports offers for preschoolers in the villages of Banat through the results of the research shows that the conditions in this segment are not satisfactory.

The current strategy for the development of education and upbringing in the Republic of Serbia until 2030 provides a good legal and theoretical framework in which better real and practical conditions for practicing sports for children in the countryside could be achieved.

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ASSESSMENT OF PHYSICAL ACTIVITY OF FEMALE STUDENTS FROM NIKŠIĆ USING THE IPAQ QUESTIONNAIRE

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Abstract: Physical activity is one of the most important aspects of a healthy lifestyle at any age (WHO, 2023). The main goal of this research was to determine total physical activity of female students from Niksic using the short version of the IPAQ questionnaire. The short version of the IPAQ questionnaire consisted of 4 questions assessing physical activity in household and garden work, leisure and recreation, walking, and time spent sitting in the last week (Craig et al., 2017). The sample of respondents consisted of 128 undergraduate and master's degree students from Niksic with an average age of 20.9 years, classified according to age criteria. Descriptive statistics (MET values) were used for data processing. Analysis of variance (ANOVA) was used to determine statistically significant differences in the level of physical activities between subsamples. The results showed that the physical activity of female students is at a moderate level. There were no statistically significant differences in the level of physical activity with regard to age. The results show that the physical activity of female students is not at a very satisfactory level, however, the reasons for such results can be found in the fact that numerous obligations and lack of time represent the main problem for engaging in physical activity (Stojmenovic, & Milosavljevic, 2017).

Keywords: *physical activity, female students, IPAQ questionnaire*

INTRODUCTION

Physical activity represents all movements that increase energy expenditure above consumption at rest (Ostojic et al., 2009). The same authors mean by this type of activity everyday activities such as walking, riding a bicycle, climbing stairs, working in the house and going shopping. For decades, the positive effects of controlled physical activity and moderate nutrition on the human body have been demonstrated. The modern way of life, which brings with it a large number of sedentary activities, along with poor-quality nutrition, significantly undermines the health of the nation, and the most vulnerable are children and young people (Vukicevic et al., 2018). On the other hand, regular physical activity is of great importance for the health of adults, but also the proper growth and development of children and adolescents, as well as their psycho-physical health and cognitive abilities (Rodriguez Ayllon et al., 2018; Romero Perez et al., 2020). Regular physical activity is important for the health of bones, joints and muscles, for the optimal functioning of all organic systems and strengthening the adaptive capacity of the organism (Pavlovic, 2016).

Despite the importance of physical activity, the latest data from the World Health Organization show that 28% of the world's adult population and even 81% of adolescents aren't physically active enough (WHO, 2022). According to the same survey, women are less active than men - one in three women and one in four men is physically inactive, and physical inactivity is more pronounced in high-income countries compared to middle- and low-income countries. When it comes to students, some research has shown that most are aware of the importance of physical activity, however, for various reasons, the most dominant of which is lack of time, they do not

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pay enough attention to physical activity (Stojmenovic, & Milosavljevic, 2017). Macanovic et al. (2013) conducted research showing that 77% of students of both sexes are physically active, 55% of them engage in physical activity 2 to 3 times a week, and 24% engage in physical activity for only 30 minutes. The authors state that the percentage of students who spend 4 hours a day sitting is 39%, and 8 hours a day 29%, as well as that men are more physically active than girls. According to some research (Stojanovic et al., 2009; Malcic, & Jurisin, 2018), the physical activity of students generally indicates a lower level of moderate physical activity, as well as that male students are more active than female students. Also, female students are more inclined to a sedentary lifestyle (Obradovic, 2020).

The above data indicate that the physical activity of the student population isn't at a satisfactory level. The human organism is predestined for physical activity, so in situations of prolonged inactivity it shows signs of declining functions (Ostojic et al., 2009). Numerous health problems are associated with insufficient physical activity, and it's considered that it contributes to the occurrence of heart diseases, arterial hypertension, malignant diseases, diabetes, obesity and depression (Ostojic et al., 2009; WHO, 2022). It has also been established that physical inactivity affects the appearance of stress, anxiety and depression in young people (Da Costa Silva et al., 2021; Aijbewa et al., 2021; Wang et al., 2014; Chacon Cuberost et al., 2019; Banerjee et al. al., 2021).

Considering the importance of physical activity for health and overall life, as well as the consequences caused by lack of it, the main goal of this research is to determine the level of physical activity of female students from Niksic.

METHOD

The sample of respondents within the research consisted of 128 female students (20.9±3.28 years) from University of Montenegro. Given that this research is part of a larger study, in this paper a sample of undergraduate and master's students from Niksic, who aren't active athletes and who do not have regular Physical Education classes at the faculties, was taken. The sample was divided into 5 subsamples, according to the criterion of the year of study (Table 1). The research was conducted at the mentioned faculties, with the permission of the dean. The survey and assessment scale were anonymous, and the survey was voluntary, so the respondents could stop at any time, however, no one did. Surveys that were not completely filled in or were illegibly written were not included in the final results.

Table 1. The sample of respodents

Year of study	N
I year U	55
II year U	32
III year U	19
I year M	14
II year M	8
Total	128

Legend: N – number of students; U – undergraduate; M – master

A sample of measuring instruments consisted of a short version of the IPAQ questionnaire for assessing physical activity in the last week (Craig et al., 2017). The modified short version of the IPAQ questionnaire contains 6 variables that assess total physical activity (intense, moderate and easy activity - walking) in the domain of housework and gardening, time spent in recreation, walking/walking and sitting in the last week. For each variable with which

physical activity was assessed, the basic descriptive parameters, arithmetic mean and standard deviation were calculated. These are shown as IPAQ values (MET minutes - metabolic equivalent). Those values were obtained by multiplying vigorous physical activity by 8, moderate by 4, and walking by 3.3. Differences among the subjects with regard to age were calculated by analysis of variance - ANOVA ($p<.01$).

RESULTS

Table 2 shows the basic descriptive parameters (arithmetic mean and standard deviation) when it comes to the intensity of physical activity by days/week and MET minutes/week that the respondents performed in household and garden work, recreation and walking, their total physical activity, as well as daily time spent sitting.

Table 2. Basic descriptive parameters of physical activity of female students in a week

Activity		Mean	StDev
Vigorous PA	d/w	.96	0.81
	MET min/w	179.37	160.47
Moderate PA	d/w	2.89	1.01
	MET min/w	278.90	112.39
Easy PA	d/w	3.81	1.14
	MET min/w	160.39	49.43
Total	MET min/w	618.66	160.47
Sitting	Min/d	458.72	112.65

Legend: PA – Physical activity; d/ – days in week; MET min/w – MET minutes in week

Table 2 shows that the surveyed female students spend an average of less than one day per week (.96) in performing vigorous household and garden activities and spend an average of 179.37±160.47 MET minutes. When it comes to moderate physical activity, they perform it on average almost 3 days (2.89) per week, or 279.90±112.39 MET minutes. They carry out light physical activity, ie walking and walking, almost 4 days a week (3.81) and spend 160.39±49.43 MET minutes in it. The total average physical activity of female students in one week is 618.66±160.47 MET minutes. The time spent sitting is 458.72±112.65 minutes per day.

Table 3 shows the results of the ANOVA analysis ($p<.01$), which determined the difference in total physical activity with regard to the year of study.

Table 3. Differences in total physical activity between subsamples (ANOVA)

Subsamples	F	Sig.
I year U	1.93	.04
II year U	.682	.76
III year U	1.47	.20
I year M	1.05	.40
II year M	.558	.83

Table 3 shows the ANOVA analysis ($p<.01$), which determined the difference in physical activity among the subsamples with regard to the year of study.

DISCUSSION

Physical activity, apart from its positive effect on physical health, has an important role in improving mental health. Physical activity increases self-esteem and self-confidence, improves cognitive functions and socialization, maintenance of normal sleep rhythm and stable mental health (Maric et al., 2020). According to the recommendations of the World Health Organization, it's necessary to carry out moderate physical activity between 150 and 300 minutes per week or intensive physical activity lasting up to 150 minutes for positive health effects (WHO, 2020). The results obtained in this research show that the total level of physical activity of female students is at a moderate level (618.66 MET minutes), which would correspond to engaging in physical activity of moderate intensity for 150 minutes per week. Female students spend the least amount of time per week performing vigorous physical activities (179.37 MET minutes), and the most time performing moderate physical activities (279.90 MET minutes). They spend 160.39 MET minutes walking, and 458.72 minutes a day sitting. There were no statistically significant differences between female students of different years.

Comparing the results with the results of previous studies, we can see that they largely match, that is, the physical activity of female students is at the low-moderate level (Stojanovic et al., 2009; Malcic, & Jurisin, 2018). The results also indicate that they spend more than 7 and a half hours sitting, that is, they tend to lead a sedentary lifestyle, which also confirms the results of research (Obradovic, 2020). Considering the tendency towards a sedentary lifestyle, as well as the suggested lower limit for moderate physical activity of 600 MET minutes per day (WHO, 2020), it can be see that the physical activity of female students from Niksic isn't at a satisfactory level. The reasons for these results can be found in the fact that physical activity decreases during studies (Cocca et al., 2014). The authors believe that the lack of time, as well as more complex material and more obligations have a strong influence on the reduced physical activities of students (Stojmenovic, & Milosavljevic, 2017; Cocca et all., 2014). On the other hand, colleges have a great potential for the possibility of a positive influence on the health of a large number of young people and directing them to an active lifestyle and physical activity (Milroy et al., 2012). The sample of respondents of this research consisted of female students who aren't active athletes and do not have regular Physical Education classes, so it can be concluded that the introduction of mandatory physical education classes at colleges would enable continuity in the practice of physical activities and an active lifestyle.

CONCLUSION

The main goal of this research was to determine the level of physical activity of female students from Niksic. The results showed that the level of physical activity of the examined female students was at a moderate level, and that there were no differences in physical activity with regard to the year of study. Thus, it's necessary to take appropriate measures to improve the physical activity of students through various exercises, organized exercise, physical education classes at faculties, etc. This research contributed to the evaluation of the current situation when it comes to the physical activity of female students from Niksic, and it's necessary to conduct further research on a larger sample of respondents, in order to determine the exact number of inactive female students and prevent the consequences caused by the lack of physical activity.

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NUTRITION IN THE FEMALE ATHLETE TRIADE

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Abstract: Female Athlete Triade refers to three interrelated conditions: disordered eating, amenorrhea and osteoporosis. A significant number of active females' diet and use harmful weight-loss practices to meet their goals. These patterns may lead to under-nutrition, menstrual dysfunction, and subsequent bone loss. The American Psychiatric Association recommends nutritional rehabilitation as first step in the treatment of both Anorexia nervosa and Bulimia nervosa, as well as in the Female Athlete Triade. In the nutritional rehabilitation it is insisted on respecting: the rhythm of meals and portions. The goal changes over time from the original approach, limited to grams and calories, to a well-balanced nutritional program. Specific nutritional rehabilitation includes extensive education of the patient regarding food and nutrition in general, taking "forbidden" foods, the effects of starvation on the body, but also on the occurrence of binges, misconceptions about diets and maintaining body weight with the help of compensatory mechanisms.
The aim was to determine whether diet therapy is useful in the treatment of Female Athlete Triade. 14 girls suffering from Female Athlete Triade, treated at the Clinical Centre Institute of Psychiatry in Belgrade, were monitored. All subjects completed a battery of anonymous tests, including a test on satisfaction with the performance of diet therapy.
Most of the respondents i.e., 62.8% declared that the diet therapy was beneficial, as well as their desire to continue with it.
The conclusion is that educating the young sports and non sporting population is a necessary step towards adopting proper eating habits.

Keywords: *Female Athlete Triade, nutrition, nutritional rehabilitation, diet therapy, eating disorders*

INTRODUCTION

The Female Athlete Triad (FAT) refers to three interrelated conditions: disordered eating (DE), amenorrhea and osteoporosis. Some female athletes do not consider training or exercise as sufficient to accomplish their idealized body shape or level of thinness. Therefore, a significant number of active females' diet and use harmful weight-loss practices to meet their goals. These patterns may lead to under-nutrition, menstrual dysfunction, and subsequent bone loss. Each portion of this triad increases the chance of morbidity and mortality, but the dangers of the three together are synergistic (Otis et al. 1997, Sundgot-Borgen et al. 2003). Disordered eating behavior is characterized by disturbances in eating behavior, body image, emotions and relations. Athletes constitute a unique population and special diagnostic considerations should be made when working with this group (Thompson et al., 1993). Prevalence of ED behavior and eating disorders (ED) among athletes have been estimated to range from 1–62% (Smolak et al. 2000). The prevalence seems to be higher in elite athletes when compared to less active elite athletes and controls (Sundgot-Borgen J. et al. 1998). Furthermore, ED are more frequent

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among female athletes competing in aesthetic and weight-class sports than among athletes competing in sports where leanness is considered less important (Sundgot-Borgen J. et al. 1993).
Factors associated with the development of EDs are psychological, biological and social factors (Garfinkel et al. 1987). Because of additional stress associated with the athletic environment female elite athletes appear to be more vulnerable to ED than the general female population. Risk factors that have been discussed are restrained eating and training, frequent weight-cycling, early start of sport-specific training, personality factors, injury, overtraining and the impact of coaching behavior (Barrow et al., 1988).
Pressure to reduce weight has been the common explanation for the increased prevalence of eating related problems among athletes. The important factor may, however, not be dieting per se, but rather the situation in which the athlete is told to lose weight, the words used and whether the athlete received guidance or not. In addition to the pressure to reduce weight, athletes are often pressed for time, and they must lose weight rapidly to make or stay on the team. As a result, they often experience frequent periods of restrictive dieting or weight cycling. Weight cycling has been suggested as an important risk or trigger factor for the development of ED in athletes (Byrne et al. 2001). Medical consequences of ED may cause serious medical problems and can even be fatal. Whereas most complications of anorexia nervosa (AN) occur as a direct or indirect result of starvation. Irregular menstrual bleeding and amenorrhea result in suppressed estrogen levels and affect bone health and fertility (Jonnavithula et al. 1993). Complications of bulimia nervosa (BN) occur as a result of binge-eating and purging. The loss of fluids and electrolytes during purging can lead to serious medical problems like dehydration, acid-base abnormalities, and cardiac rhythm disturbances. Dehydration and electrolyte abnormalities decrease coordination, balance, and muscle function. Therefore, the behavior is dangerous to their health and counterproductive to improving their athletic performance. AN patients display up to six times increase in standard mortality rate compared to the general population. Death is usually attributable to fluid and electrolyte abnormalities, or suicide (Szmukler et al., 1985). Mortality in BN is less well studied, but deaths do occur, usually secondary to the complications of the binge-purging cycle or suicide. Mortality rates of EDs among athletes are not known. However, several death cases of top-level athletes representing gymnastics, running, alpine-skiing, and cycling have been reported in the media. Five (5.4%) of those diagnosed in the Norwegian study reported suicide attempts.
Although athletic amenorrhea represents the most extreme form of menstrual dysfunction, other forms can also result in suppressed estrogen levels and affect bone health and fertility (Jonnavithula et al. 1993). The loss of bone mineral density (BMD) is a silent process, and the athlete is usually unaware that a problem exists until a related injury, such as a stress fracture, occurs. Furthermore, studies report a higher incidence of injuries and stress fractures among amenorrhoeic and oligomenorrheic as compared to eumenorrheic athletes (Beals et al. 2002). Also, a higher frequency of athletes displaying ED behaviors report menstrual irregularity and sustain more bone injuries during their collegiate career (Lloyd et al. 1986).
A nutrient worthy of consideration for supplementation to the female athlete's diet is calcium. In general, most experts agree that a calcium-rich diet is the most appropriate dietary prescription to promote and support optimal bone density. In addition, vitamin D plays an important role in maintaining calcium homeostasis and vitamin K deficiency is associated with an increased risk of hip fracture in adults. Other minerals important for bone health include sodium, magnesium and zinc.
Reduced bone mass per se does not necessarily give physical nuisance. However, elite athletes can experience bone loss that leads to osteoporosis, increased risk for fractures, pain, a reduction in training volume, frequent training breaks caused by injuries and an ended athletic career. To date, no long-term study has shown that amenorrhoeic individuals can fully regain

lost BMD, despite returning to a normal reproductive status. This risk is especially critical for the adolescent or young adult athlete as peak bone mass is reached by the third decade of life (Manore 2002).

Prevalence of the Triad

The prevalence among athletes ranges from 1-62% according to the American Psychiatric Association. The prevalence seems to be higher in elite athletes, especially in sport where leanness is important, such as ballet, figure skating, figure swimming, gymnastics, triathlon etc. (Brownell et al. 1987, Brownell et al. 1992).

Prevention of the Triad

Since athletes at least at the elite level, are evaluated by their coach every day, changes in behavior and physical symptoms should be easily observed. However, symptoms of the Triad in competitive and elite athletes are too often ignored or not «detected» by coaches. One reason for this is lack of knowledge about symptoms of the Triad. Most individuals with EDs do not realize that they have a problem, and therefore do not seek treatment on their own. Athletes, however, might consider seeking help only if they experience that their performance level is leveling off. In contrast to the athletes with anorectic symptoms most athletes suffering from BN are at or near normal weight and therefore difficult to «detect». It should be noted that the presence of some of these characteristics does not necessarily indicate the presence of EDs or the Triad. However, the likelihood of one or more of the components of the Triad being present increases as the number of presenting characteristics increases. A history of menstrual dysfunction is one of the most common and obvious signs that can point to the Triad. However, it is important to identify the cause of irregular or absent menstruation. It is often found that it is not necessarily lack of energy or high training volumes that cause the hormone imbalance, but that the overall stress on the athlete is too great. In contrast to the finding from the general adolescent population, talking to competitive athletes and coaches about the Triad (definitions, risk factors, consequences and preventive strategies, nutrition education) seems to have a preventive effect (Thompson et al. 1993, Sundgot-Borgen et al. 1998, Sundgot-Borgen et al. 1994).

METHODS

The aim was to determine whether diet therapy is useful in the treatment of FAT. 14 girls suffering from FAT, treated at the Clinical Centre Institute of Psychiatry in Belgrade, were monitored.

The including criteria for the research were: gender (female) as the pathology of eating disorders is much more indicated in females (Bulik et al. 2006), age (16 to 29), aiming at covering the most vulnerable period in which disorders appear most frequently (Garfinkel 1987, Garcia-Alba 2004), and the patients in the experimental group who fulfilled all DSM IV diagnostic criteria for eating disorder (Nielsen et al. 1998), and eating disorder previously diagnosed by a psychiatrist. The excluding criteria were age younger than 16 and older than 29, existence of any other primary illness (diabetes, cardiovascular, renal, liver, etc. diseases) considering that nature and manner of treatment could significantly influence changes of the usual behavior and the way of nutrition; and examinees who did not fill the questionnaires in full.

All subjects completed a battery of anonymous tests, including a test on satisfaction with the performance of diet therapy.

The examination protocol included: illness history data, a "24-hour Recall Questionnaire" and the "Eating Disorder Diagnostic Scale", nutritional status assessment, data analysis and statistical processing. The illness history data were obtained by a standard anamnestic questionnaire, in a direct contact with examinees. The retrospective method ”24-hour Recall

Questionnaire" was used for the assessment of nutritional intake, which was based on the memories of the examined person on the amount, type and manner of preparing food, consumed in the previous 24 hours (Beer-Borst et al. 1995). The second instrument was the "Eating Disorder Diagnostic Scale", a most widely used instrument in the diagnosis of eating disorders, which is applied in the assessment of symptoms, behavior and eating disorder psychopathology (Stice 2000, Copper et al. 1987). The nutritional status was defined by anthropometric examination according to the WHO recommendations. Measures taken from all participants were: body height (BH) in centimeters measured in the morning, only wearing underwear, by using an anthropometry; a body weighing scale (BW) in kilograms that measured using the medical decimal scale with a movable weighing scale (precision ±100 g). Based on these parameters the body mass index (BMI) was calculated (Must et al. 1991). The data analysis was performed by the SPSS program, version 3.0. The chi-square ($\chi 2$) test, Pearson's correlation test and analysis of variance (ANOVA) were used. P values were determined by the Student's t-test, where $p<0.05$ indicated that there was statistically significant difference.

RESULTS

Basic anthropometric characteristics (body weight and BMI) among FAT are far from the usual values for that age, which indicates the existence of suspected diseases (Table 1).
Numerous investigations have shown that patients with the FAT obtain considerably less calories daily compared to the healthy persons in the control group (Kontic 2007, Kontic 2008, Mladenovic 2018). This kind of energetic deficiency is caused by the fear of gaining weight, which is the basic characteristic of this disease. The results of the present study showed that patients with the FAT had an average daily intake of 1092 kcal (Kontic 2008). Beside lower caloric intake, patients with FAT often state the occurrence of many other compensatory behaviors in order to maintain or reduce weight. Our study showed that extreme dieting with or without excessive exercise was the dominant type of compensatory behavior, though 30% of patients stated misuse of laxatives and diuretics and 25% the use of all examined compensatory behaviors. Such a result confirms the claim of other investigators (Mladenovic 2018, Kontic 2012, Rosenvinge et al. 1997).

Table 1. Basic anthropometric and other characteristics of the investigated group

Variable	X±SD	p
Age (years)	22.6±3.0	>0.05
Body height (cm)	162.5±6.6	<0.001
Body weight (kg)	44.0 ± 3.4	<0.001
BMI (kg/m2)	16.8 ± 0.8	<0.001

According to the "24 hour Recall Questionnaire" patients consumed on average 1092 kcal which is lower than the usual and recommended intake in the average year. The analysis of the frequency of compensatory behaviors during a week showed that all compensatory behaviors emerged usually once to three times a week. The majority (75%) of patients engaged in excessive exercise and extreme dieting as two most frequent forms of compensatory behavior, which usually occurred once to four times a week. The Pearson's correlation test showed that in our sample there was a statistically significant linear correlation between BMI and the frequency of compensatory behavior ($r=0.04$; $p <0.001$).
The most frequent form of compensatory behavior was excessive exercising done by 75.0% of patients, usually once to four times a week. The next most common compensatory behavior

was extreme dieting which occurred in 70% of patients, usually once to three times a week (Table 2).

Table 2. Prevalence of different associated compensatory behaviors (number of patients)

Number of established forms of compensatory behaviour	Total N
1	1 (7%)
2	3 (21.4%)
3	4 (28.6%)
4	6 (43%)

Most of the respondents i.e., 62.8% declared that the diet therapy was beneficial, as well as their desire to continue with it (Table 3). This result is consistent with other researches (Manore 2002, Mladenovic 2018).

Table 3. Satisfaction with the diet therapy

Degree of satisfaction with the diet therapy	%
0	37.2%
1	5%
2	21%
3	36.8%

DISCUSSION

Numerous investigations, as well as American Psychiatric Association, have shown that patients with the FAT obtain considerably less calories daily compared to the healthy persons in the control group (Garfinkel 1987, Mladenovic 2018, Manore 2002). This kind of energetic deficiency is caused by the fear of gaining weight, which is the basic characteristic of this disease. The results of the present study showed that AN patients had an average daily intake of 1092 kcal, which corresponded to the results of other investigators (Garcia-Alba 2004). Beside lower caloric intake, AN patients often state the occurrence of many other compensatory behaviors in order to maintain or reduce weight. Our study showed that extreme dieting with or without excessive exercise was the dominant type of compensatory behavior, though 30% of patients stated misuse of laxatives and diuretics and 25% the use of all examined compensatory behaviors. Such a result confirms the claim of other investigators who noticed that 8% to 62% patients primarily diagnosed with AN obtained some of bulimic symptom in the first 5 years of illness (Mladenovic 2018, Otis 1997).

Early intervention is important, since EDs and the Triad are more difficult to treat the longer they progress. Therefore, professionals working with athletes should be informed about the possible risk factors for the development, early signs and symptoms of the Triad, the medical, psychological and social consequences of the Triad, how to approach the problem if it occurs, and what treatment options are available. Therefore, within the sport arena, coaches, trainers, administrators and parents should receive information about energy and nutrition demands, consequences of extreme weight control methods, EDs, the menstrual cycle and related issues such as growth and development and the relationship between body composition, health and performance. In addition, coaches should realize that they can strongly influence their athletes. Coaches or others involved with young athletes should not comment on an individual’s body

size or require weight loss in young and still growing athletes. Without offering further guidance, dieting may result in unhealthy eating behavior or EDs in highly motivated and uninformed athletes (Mladenovic 2018, Cyr 2008). Teammates, coaches and parents who are aware of the signs of the Triad are likely to notice them. Those who provide medical care for athletes should be alert to energy deficiency, use of ED behavior, irregular periods, fractures, fatigue, anemia, and depression as possible signs of the Triad, particularly noting unusual fractures that occur from minimal trauma (Beals et al. 1994, Eisenman et al. 1990).

According to Manore and others (Jorunn Sundgot-Borgen 2003, Thompson 1993, Strober et al. 2000), the most common nutrition issues in athletes with ED and/or menstrual dysfunction are poor energy intake and/or poor food selection, which can lead to poor intakes of protein, carbohydrate and essential fatty acids. The most common micronutrients to be low are the bone-building nutrients, especially calcium, the B vitamins, iron and zinc. If energy drain is the primary contributing factor to athletic menstrual dysfunction, improved energy balance will improve overall nutritional status and may reverse the menstrual dysfunction, thus returning the athlete to normal reproductive function. Because bone health can be compromised in female athletes with menstrual dysfunction, intakes of bone-building nutrients are especially important. Iron and zinc are typically low in the diets of female athletes if meat products are avoided. Adequate intake of the B vitamins is also important to ensure adequate energy production and the building and repair of muscle tissue. In addition, focus on normalizing weight, body composition, menstrual cycle, modifying unhealthy thought processes that maintain the disorder, and dealing with the emotional issues in the individual's life, is important. The younger the athlete, the more the family's involvement is recommended (Thompson 1993, Nielsen 1998).

The conclusion is that educating the young sports and non sporting population is a necessary step towards adopting proper eating habits.

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MOTIVATION OF TEENAGE ATHLETES IN SERBIA

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Abstract: Motivation can be defined as conscious or unconscious experience that serves as a factor that determines a person's behavior or her social action in a given situation (Ilić & Višnjić, 2012). Motivation is very wide field of investigation in psychology in general, but, somehow, it's importance is a bit overemphasized in field of sports. There are plenty of definitions of motivation and there are even couple of original theories in field of sports' psychology, which were developed especially for explanation and prediction of behavior of athletes in sports field. So far, various studies had identified over 100 different factors that explain why people engage in sports. However, the reasons for sports participation may be different depending on different factors. In this research, author tried to investigate some of these factors which might contribute differences in motivation of athletes. The sample consisted of 764 athletes, with 489 males and 275 females, 13 to 19 years old. They participated in 32 different sports' branches. Independent variables were sex, age, length of sports' experience, and type of sports (group or individual). Dependent variables were ten reasons for sports' participation (Bačanac et al., 2007; Ilić & Višnjić, 2012). Data were obtained by χ^2 and percents. The results showed that the most important reason for sports' participation of teenagers in Serbia was love for their sports' branch and the least important was popularity. Also, age was the least important factor for distinction of reasons for sports' participation, and type of sport was the most important. Obtained results were in concordance of the results of some previous results (Bačanac et al., 2007; Ilić & Višnjić, 2012; Longhurst & Spink, 1987), about differences in motivation of young athletes according to the sex and sports' type.

Keywords: *motivation in individual sports, motivation in team sports, sex differences, sports' experience.*

INTRODUCTION

There are plenty of definitions of motivation, questionnaires and research papers dedicated to studiing of different aspects of motivation. Motivation in sports' psychology is seemed to be one of the most investigated fields and perhaps the most important field within the discipline (Tušak, 1997). Finch (2002) suggests that motivation can give insight into sports' iniciation (why did an athlete choose his sports' branch), direction (it is important to know why an athlete chose those specific aims), intensity and persistence in direction behavior.

Motivation can be defined in different ways. For example, as movement force which directions behavior and also explains beginning, direction, intensity and perseverance of behavior. Or, it can be defined as state or process which runs inside of person and which stimulate, maintain and direct behavior towards certain goal, which cannot be directly seen, but it can be deducted from knowledge about someone's needs or urges. It implies that only obvious behavior cannot make collusions for sure about someone's motivation with concrete conclusions (Bratko,

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2001). Bratko (2001) says that important characteristics of motivation are variability and dynamism and that intensity of motivation can grow or fall, also. Petz (2005) defines it as a condition where we are driven from the inside by some needs, impulses, desires, wishes, or motives, and directed towards achieving a goal that from the outside functions as a stimulus for behavior. Motivation is a complex phenomenon that is impossible to simply subsume under a single model (Bosnar & Balent, 2009).

In a context of a motive to engage in physical activities and sports, the authors most often focused on a difference between intrinsic and extrinsic motivation, although motivation in sports can be studied form different perspectives: theory of motivation competence, theory of self-determination, theory of expected value, theory of goal orientation, developmental theory in sport, theory of social motivation. The focus of theory of social motivation is investigation why young athletes persistence in their sports (Horn, 2008, Weiss et al.., 2009). However, identification of reasons for participation is the first step towards understanding motivation of athletes Gill et al. (1983).

Ko et al. (2008) states that in previous researches over 100 different factors which explains sports' participation were identified. These original investigations of motivation wanted to identify simply motives for sports' participation. They found that there are universal motives which are suggested by athletes: fun, enjoyment, competence, friendship, competition, achievement, fit, pressure of others, health, money, glory. Investigation showed that athletes give more than one reason for sports' participation (Weiss & Petlichkoff, 1989). Weiss and Petlickhoff (1989), for example, categorized the major motives for participation into competence (e.g. to learn and improve skills), affiliation (e.g. to make friends be part of a team), fitness (e.g., to be physically active, get in shape), and fun.

Gill et al., (1983) investigated motivation for sports' participation of young athletes. They showed that the main reasons for sports 'participation were at first place fun, second development of sports 'abilities, third success and social status, fourth health, fifth relive of extra energy and tension, sixth friendship, seventh being part of the group, eighth – other situational factors (parents, coach, idol, etc.) Wankel (1993) and Koivula (1999) found that athletes stated that fun and enjoyment were the most important motives for sports participation, and they suggest that those findings have important implications for the rest of sports' career.

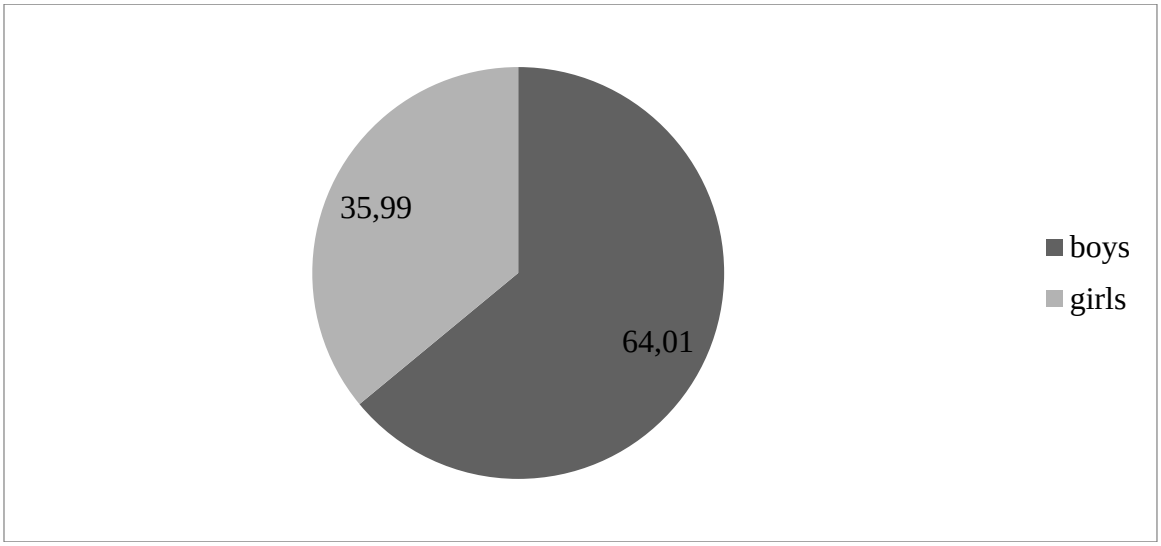
Some researchers found that there are differences in ranking of motives for sports participation according to sex (Gill et all., 1983; Koivula, 1999), sports branch (Ilić & Višnjić, 2012; Nekić & Barić, 2021), previous sports experience and competition level and frequency and duration of a sports activity (Nekić & Barić, 2021, Kocić et al. 2016).

Motivation is one of the key moments in sports participation in adolescence. Adloescence is a period form 11 – 13. to 18 – 20. Years. It is emotionaly very intensive and stressfull period with intensive physical psychological, emotional and personal changes (Kuzman, 2009). Peroid of adolescence is very important for personal development since behavior patterns acquired during this phase of peronaliy development remains during adulthood. And that is the reason why the adolescent period is important for development and maintaining lifelong healthy life style (Wang et al., 2017).

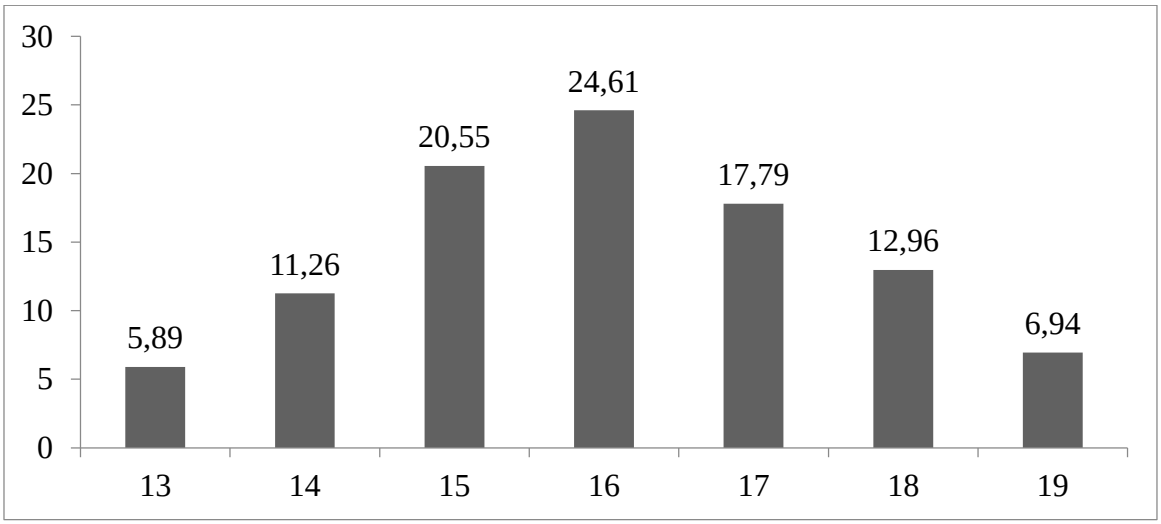
That is the reason why the subject of this research is investigation of specific motives for sports participation of Serbian teenage athletes, according to the different factors which might caused differences in some motives.

METHOD

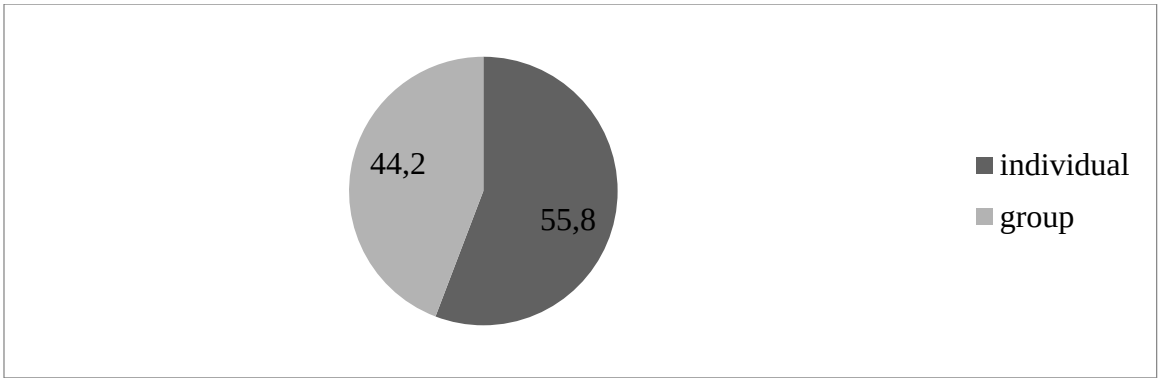
Sample: The sample consisted of 764 athletes, with 489 males and 275 females, 13 to 19 years old. They participated in 32 different sports' branches: skiing, swimming, judo, soccer, tennis, snowboard, water polo, handball, volleyball, basketball, athletics, gymnastics, karate, kick boxing, weight lifting, rowing, fencing, shooting, taekwondo, rugby, bowling, triathlon, jiu jitsu, kayak, rhythmic gymnastics, bocca, savate, Nordic skiing, kjokushinkai, canoe, diving, badminton.
Independent variables: Independent variables were sex, age, length of sports' experience, and type of sports (group or individual).



Picture 1. Sample by sex (%)



Picture 2. Sample by age (%)



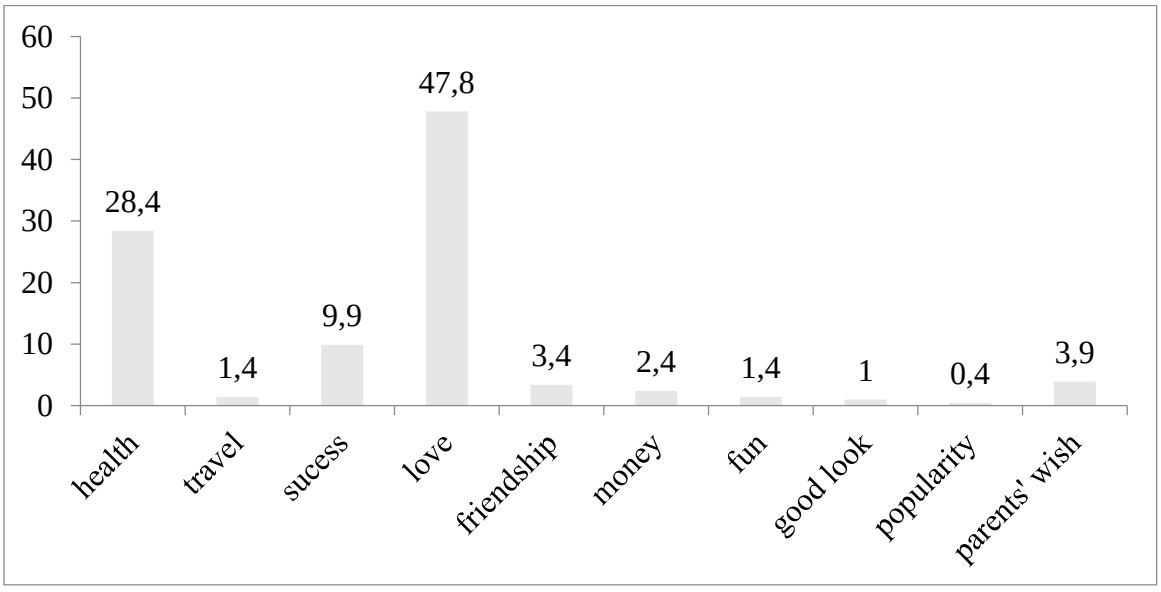
Picture 3. Sample by type of sports (%)

Dependent variables: Dependent variables were ten reasons for sports' participation (Bačanac et al., 2007; Ilić & Višnjić, 2012).

Techniques: Data were obtained by χ^2 and percents.

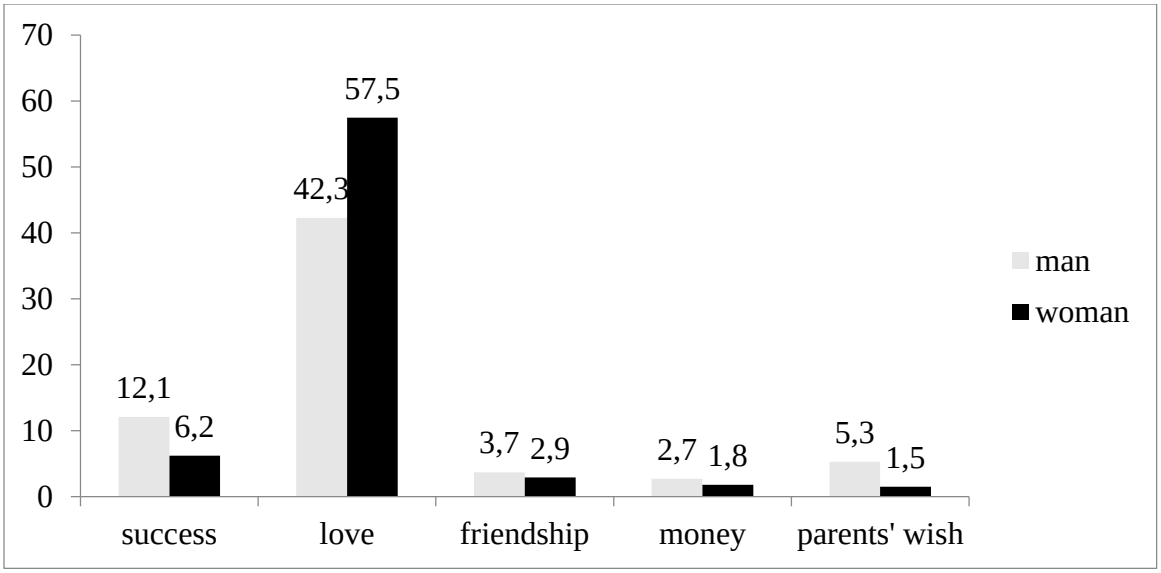
RESULTS

The obtained results show that the most important reason for sports' participation is love towards sports, maintaining health, success, parents' wish and friendship.



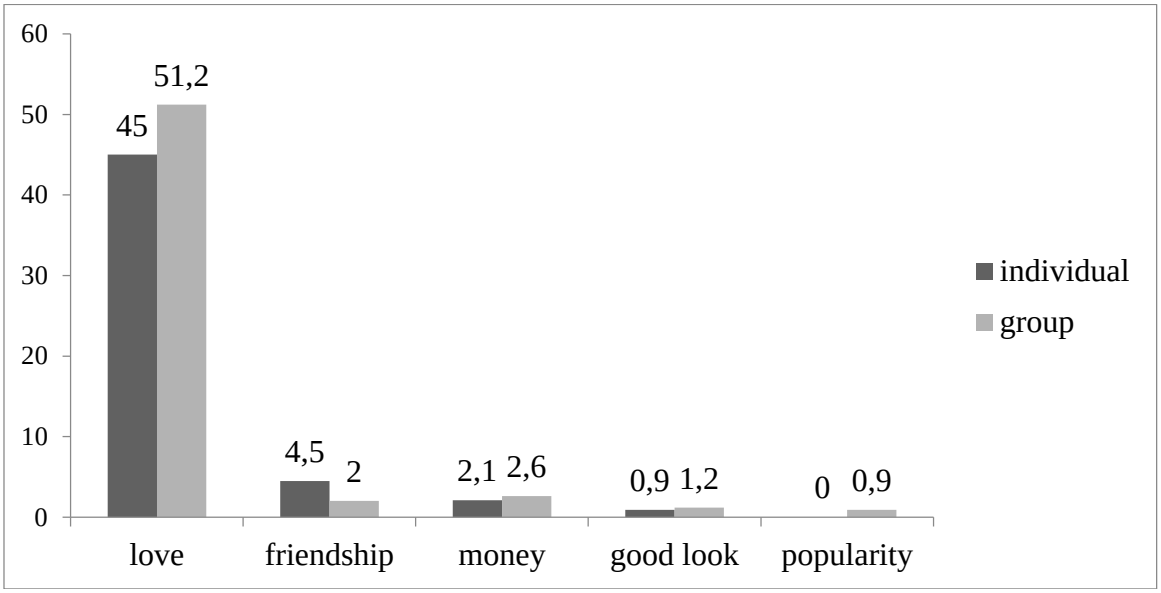
Picture 4. Importance of reasons for sports' participation of teenagers in Serbia (%)

However, there are some statistically significant differences according to the sex of athletes in evaluation of importance of reasons for sports' participation: success (χ^2=16.684, df=9, p<.05), love (χ^2=22.345, df=9, p<.008), friendship (χ^2=20.831, df=9, p<.013), money (χ^2=28.843, df=9, p<.001), parents' wish (χ^2=21.129, df=9, p<.012). Only in case of love towards sports female athletes had higher scores.



Picture 5. Differences in importance of reasons for sports' participation according to sex (only statistically significant % were shown)

Also, there are some statistically significant differences according to the sports' type in evaluation of importance of reasons for sports' participation: love (χ^2=21.767, df=9, p<.010), friendship (χ^2=26.274, df=9, p<.002), money (χ^2=33.514, df=9, p<.000), good look (χ^2=19.655, df=9, p<.020), popularity (χ^2=27.600, df=9, p<.001). Friendship was the most important reason for participation in sports for athletes in individual sports.



Picture 6. Differences in importance of reasons for sports' participation according to sports' type (only statistically significant % were shown)

Statistically significant differences according to the length of sports' experience in evaluation of importance of reasons for sports' participation were obtained: sucess (χ^2=155.107, df=126, p<.040), friendship (χ^2=177.117, df=126, p<.002), money (χ^2=153.771, df=126, p<.047), parents' wish (χ^2=167.623, df=126, p<.008). Parents' wish was the most important reason for sports' participation at first year of sports' experience, money was the most important reason

for sports' participation at sixth year of sports' experience, success was the most important reason for sports' participation at tenth year of sports 'experience, friendship was the most important reason for sports' participation at 13th year of experience. Also, fun was statistically the most important reason for sports' participation at year of nineteen (χ^2=74.869, df=54, p<.032).

DISCUSSION

The most important reason for sports' participation in our sample is love towards sports. After that, other important reasons were maintaining health, success, parents' wish and friendship. On the sample of young athletes in combat sports, Ilić andVišnjić (2012) found that love for sports', health reasons and sucess were the most important reason for sports' participation. On previous research of Bačanac et al. (2007), health and love toward sports were the most important reasons of young athletes in Serbia.

The data about statistically significant sex differences in evaluation of importance of reasons for sports' participation showed that love towards sports was the most important motive for girls. For boys, success, friendship, money, parents' wish was more important. Our results are not completely in accordance with previous results of Gill et al. (1983) and Longhurst and Spink (1987) that the for boys were more important success and social status and for girls more important were fun and friendship. Sirard et al. (2006) found that for boys were more important competition, social benefits and health, while for girls were more important friendship and health, but the main reason for both sex was fun, so as the result of Gould et al. (1985). Kondrič et al. (2013), on the sample of students found that sport potentially means more to men as a tool for achieving popularity in society and among friends, while women experience sport more as a means of relaxation, which is in principle congruent with traditional male and female stereotypes and roles.

Friendship was the most important reason for participation in sports for athletes in individual sports. For athletes ih equipe sports' more important reasons were love, money, good look, popularity. Nekić & Barić (2021) found that for athletes in equip sports friendship and social status were the most important reasons for sports' participation.

Statistically significant differences according to the length of sports' experience in evaluation of importance of reasons for sports' participation were obtained. Parents' wish was the most important reason for sports' participation at first year of sports' experience, money was the most important reason for sports' participation at sixth year of sports' experience, success was the most important reason for sports' participation at tenth year of sports'experience, friendship was the most important reason for sports' participation at 13th year of experience. Social environment (parents, coach, peers) also have big impact on young athletes perception of sports participation and social climate about it (Brustad, 1992; Weiss, 2013; Weiss & Williams, 2004; Ullrich French & Smith, 2009). Mladenović and Marjanović (2011) on the sample of young soccer players of different age also find differences in motivation. On the sample of Croatian athletes, Nurkić and Barić (2021) also found that biggest motivation level is present in those athletes who had the biggest number of trainings during the week, the biggest sports' experience and theri most dominant motive is friendship.

Also, fun was statistically the most important reason for sports' participation at year of nineteen. On the contrary, on the sample of students athletes, Kondrič et al. (2013) did not found age differences. Horn and Hasbrook (1986) and Chan et al. (2012) results showed that the age has relative impact on motivation of young athletes.

In conclusion, we might say that the most important reason for sports participation of teenage athletes in Serbia is love towards sport. Also, sex, age, length of sports' experience, and type of sports (group or individual) have an impact on differences in maintaining reasons for sports participation. Some other factors, like nationality (Mladenović & Marjanović, 2011; Pelletier et al., 2007; Sindik, 2013) or social status of the family (Bačanac et al., 2007), family support (Ilić, 2012), might also have an impact. Understanding of dynamic of motivation in sport is very important since, it might improve our knowledge about fluctuation of motivation at certain stages (like adolescence) since some authors (Salguero et al.., 2003; Sallis, 2000; Weiss & Amorose, 2008) believes that the main reason for droping out od sports at teenage period is lack of motivation.

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ETIOLOGICAL THEORIES OF SPINAL DISC DEGENERATION - SHORT REVIEW STUDY

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Abstract: Low back pain is a very common problem, affecting 30 to 80% of the adult population worldwide. Studies also report that a majority of the population older than 80 years of age have degenerated disks. Published literature, as well as experts, have divided opinions regarding the etiology of spinal disc degeneration.
This is a short review study, which outlines the topic of etiological theories of spinal disc degeneration.
Studies show a difference in scientific views on the possible etiology of degenerative changes in the spinal discs. The most frequently presented theories in literature are: Involution theory, Hormonal theory, Blood circulation theory, Infection theory, Mechanical theory, Functional theory and Hereditary theory.
In conclusion, it can be said that regardless of possible strong insistence, none of the etiological theories provide a complete explanation. This indicates that the etiology of disc degeneration might be multifactorial, as well as the possibility that certain aspects of different etiological theories lead to disc degeneration.

Keywords: *disk degeneration, cervical disk, etiology, etiological theory, low back pain, spinal disc, lumbar disc*

INTRODUCTION

Low back pain is a very common problem, affecting 30 to 80% of the adult population worldwide (1-3). Studies also report that the majority of the population older than 80 years of age have degenerated disks. It is not uncommon to see divided opinions amongst experts in practice, as well as scientific literature, regarding the etiology of spinal disc degeneration. Regardless, disk degeneration has been extensively studied, with the selection of a number of factors that influence the appearance of this problem or accelerate its process (4). The factors most often shown in the literature as causes are: aging, mechanical factors, genetic and systematic and toxic factors (4). On the other hand, there are literature and experts supporting different etiological theories as a potentially exclusive root for this health condition (5). Although the disc degeneration is a very common occurrence, the significance of this problem may vary due to the strength of eventual symptoms and influence on the quality of the lifestyle, working abilities or on the sports performance in athletes. When it comes to the athletes, disk degeneration, disk bulging and herniated disk, even when asymptomatic, affects the muscle motor patterns and biomechanics.

For the aforementioned reasons, the aim of this paper is to present a brief review of the literature on the most popular etiological theories of degenerative changes in the spinal discs.

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METHODS

This is a short review study, which examines the topic of etiological theories of spinal disc degeneration. The literature searched was based on the key words. Papers with titles that match the topic were included in the further processing, after which the abstracts were reviewed. Papers whose abstracts did not match the topic were also excluded from further processing. The remaining papers, after reading them in their entirety, were further selected following this criteria: papers that did not match the topic were excluded, papers included were further studied based on the author's expert knowledge and according to the limitation and brevity of the text.

RESULTS

Studies show a division of scientific views on the possible etiology of degenerative changes in the spinal discs. The most frequently presented theories in the literature are: Involution theory, Hormonal theory, Blood circulation/Vascularization theory, Mechanical theory and Hereditary theory of spinal disc degeneration.

In addition to the ones mentioned above, there are other theories that can be encountered in practice and literature. However, these are less often compared to the previously mentioned, namely: Infection theory, Infectious-allergen theory, Bioelectrical theory, Functional theory Anomalous theory and others.

Involution theory

Involution thory is based on the trophic changes that occur as the disc ages (4). The matrix of the disk is changing, concentration of the cells is decreasing, especially in the annulus fibrosis (6, 7). In the first place, trophic changes occur in tissues that are not blood-supplied, and then in those that are poorly blood-supplied. In addition, there will be changes in vascularized tissues, especially with age-related changes in the blood vessels. This is why in practice you can often hear the saying: ”We are only as old as our blood vessels".

After the age of 20-25, the blood vessels that existed in the spinal discs until then obliterate, which then causes bradytrophic changes to occur (5). The spinal disc changes caused by changes in the blood vessels and vascular network will be highlighted later in the text. Metabolic processes then primarily occur at the expense of diffusion. In further steps, disruption of the diffusion process directly leads to qualitative changes in the nuclei of the spinal discs themselves. As Hadhipavlou et al. are referencing in their paper (4): proteoglycans synthesis rate is decreasing, as well as its concentration in the nucleus. The collagen content is increasing and changing its type, leading to a more fibrous nucleus. There is also a significant decrease in glycosaminoglycan content, which plays a key role in the rapid binding and release of water, which is important in maintaining intradiscal pressure. Intradiscal pressure plays a crucial role in the biomechanics of the spinal column. Although these changes increase with age and are widely researched and described in the literature, their causes are still a scientific unknown.

The practical basis of the Involution theory is often found in the fact that with each decade of age there is a progressive increase in dystrophic changes in the spinal discs. Research shows that after the eighth decade, more than 90% of respondents have significant changes in the above-mentioned structures. On the other hand, the non-comprehensiveness of the Involution theory, for example, the appearance of dystrophic changes in the spinal discs and facet joints in young people, as well as in people where such changes do not exist in other parts of the

locomotor apparatus, leads to the necessity of looking at other theories and to a multi-aspect approach to this problem.

Hormonal theory

The hormonal theory is based on the belief that the cause of dystrophic changes are actually hormonal changes, which then lead to changes in the facet joints, vertebrae and spinal discs. Hormonal theory, like the previously mentioned involutionary theory, is not comprehensive, although it can explain certain changes.

Blood circulation/Vascularization theory

In the section of this paper of the Involution theory, it was briefly mentioned that changes in vascularization lead to dystrophic changes in the anatomical structures of the spinal column. Impairment of local circulation leads to impairment of water-salt metabolism, which affects the migration of Na+, which results in osteochondrotic changes. In his book Clinical Neurology of Spinal Vertebrae, the author Khabirov talks about 4 stages of development of dystrophic changes of spinal discs (5). As already mentioned, after 20-25 years, obliteration of blood vessels occurs, which makes metabolism dependent on exclusively diffusion processes, which later leads to trophic changes.

Mechanical theory

Excessive mechanical impact of external forces on the spinal column leads to damage to the fibrous annular tissue that surrounds the nucleus of the disc, resulting in dystrophic changes.

The mechanical theory of the etiology of spinal disc degeneration is perhaps the most common both in clinical practice and in the literature, especially when it comes to athletes. Disk degeneration is one of the most leading causes of poor functionality (8). In sports and in sports recreation practice, great attention is paid to exercises that have been shown to be risky for spinal disc injuries, such as: squats with a heavy load, deadlifts, jumps with a heavy load on the shoulders and jumping from great heights during plyometric training. In recent years, sports and recreational activities that carry a high risk of spinal injuries especially because of overloading and overtraining, such as cross-fit, have become extremely popular.

Even though certain exercises, which are necessary for sports success, have been shown to be risky and can lead to injuries to the spinal discs, sports practice still doesn’t include enough injury preventive exercises for the spinal segments.

Disk injuries due to mechanical action in sports activities can occur due to the:

- Short term or Single time impact of large external forces:

a) Exercises with loads: squats, deadlifts, weighted exercises with rotations and torsions, especially exercises with rotations with maximal or submaximal loads
b) Explosiveness exercises: jumps with a heavy load, jumps from an inadequate height during plyometric training...
c) Falls: collision with the ground during a fall in various sports activities such as football, handball, figure skating, martial arts etc.
d) Collisions and contacts of great powers with sports opponents: martial arts, american football, etc.

- Long-time, chronic overloading of the spine:

a) Overloading with the training process itself
b) Nature of sports activity: martial arts, skiing…

Combination of aforementioned factors. Often, after a long time of overload exposure, a one-time effect of large external forces will more easily lead to an injury.

In physically inactive individuals, a single exposure to mechanical forces is the most common trigger of injury that causes them to see a doctor. Patients complain that they felt pain after awkward bending, lifting heavy objects, etc. However, it is known that lifting an object from an awkward position was only a trigger on fertile soil that was asymptomatic until that moment but under a very questionable condition.

In addition to being the most prevalent theory in practice, the mechanical theory is also not in the background of all subjects with spinal disc degeneration.

Hereditary theory

The literature is also reporting the hereditary etiological theory of degeneration of the spinal discs, with the genetic factors playing an important role (9, 10, 11). The author's personal opinion is that when interpreting works related to potential heredity, the question should be asked whether it is a hereditary factor, or a similar lifestyle and similar habits that increase their risk of degenerative diseases of the locomotor apparatus and, therefore, of the spinal discs. There are studies showing a small influence of external factors in identical twins (10). On the other hand, due to the mechanical theory explained above, or because of mechanical factors whose influence has been unequivocally demonstrated, claims about the weak influence of the external environment on the degenerative processes of the spinal discs should be taken with caution.

If rural areas are considered, children often inherit similar jobs from their parents, which are in the scope of physical work, often hard physical work: such as working on farms, working in a mine in often well-known mining towns and etc. Often entire families have a large number of members who are engaged in the same or similar heavy physical work. In addition, even when it is not a matter of heavy physical efforts, several other factors can sneak in unnoticed. A good example of this is smoking, the consumption of nicotine has been proven to have a negative effect on the vascularization of the spinal discs, and in addition to active smoking, family members can also be passive smokers (12). In their paper Hadjipavlou et al. are reporting that there are patients with predispositions for certain types of IX collagen, which have an increased risk for lumbar disk disease and chronic sciatica (4). At the same time they are citing the work of Solovieva et al. (13) which states that those who carry the Trp3 allele are at a higher risk for developing disk degeneration in the case of obesity, directly showing the hereditary factor, but also the strong influence of the environment. Obesity has multiple mechanical effects on the spinal column exerting a constant, high pressure on the intervertebral discs, as well as affecting the center of gravity, changing the centers and axes of rotation and influencing the muscle work patterns. All of these effects are occuring with significantly higher forces on the spinal anatomical structures then in non-obese people.

DISCUSSION

Etiological theories independently can partially explain the degenerative process. Authors of a previously cited paper (4) on the topic of pathophysiology of disc degeneration are reporting that degeneration is not a diagnosis but an expression of the disk state, and it is a result of several factors. Those factors can have independent or joined influence. The main lack of etiological theories may be the eventual tendency of the authors, and more often experts in the field to fully explain the occurrence of disc degeneration with one of the theories. Modern literature is increasingly moving towards and talking about etiological factors, rather than exclusive etiological theories, that can contribute to the development of degenerative disc conditions, very often highlighting the multifactorial influence on the development of degenerative diseases of the spinal discs.

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HOME CARE - CONCEPTS, MODERN TRENDS AND MODELS

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Abstract: Home care is a vital part of the health care system. It is an essential part of daily life, and important part of everyday life. In this paper, we will discuss the current state of home care in world, focusing on nursing home care. The aim of this paper is to provide a brief overview of the current status of the home care system in Europe and beyond, and to provide some suggestions for future research in this field.
We researched databases Serbian Citation Index (SCIndex), based on various combinations of keywords: nursing home care, care services, models home care, trends home care work, we found one paper in Serbian. A search of the Medline index database, in English, selected 355 papers. The keywords used to search the Medline database were similar to Serbian, adapted to the English-speaking words. We found 7 papers based on the given criteria for inclusion and exclusion from the study. In the largest number of works included in this research, the researchers focused on quality of care and cost reduction. The basic concept in home care usually refers to a professional service provided to patients or clients who need extra care and attention but want to stay in their own home. Today, one of the main trends is the provision of personalized care and use of technological innovations.. Modern models in home care involve the nurse playing major roles, such as establishing contact with the patient and his family, conducting health care, and health education. The Buurtzorg model is a model of innovative organization of home care provision. Understanding the concept of home care is important for understanding current trends and models. Home care services offer a wide range of benefits: increasing independence, promoting safety and comfort, improving quality of life.The use of technology is the present and the future in home care. Investing in this sector is an excellent opportunity for business growth and improving people's lives.

Keywords: *Buurtzorg model, home care, nursing*

INTRODUCTION

Home care can be defined as a combination of measures provided to health care users in their homes to maintain or improve physical, mental health and social well-being. It includes activities of daily living such as bathing, dressing, and complex health services such as wound dressing, taking care of medication therapy and physical therapy (Berman et al., 2021). Home health care is an important concept that is increasing for the last 20 years because it plays a key role for the elderly, disabled and chronically ill who prefer to be in their own homes rather than being hospitalized. The trend in the popularity of home care can be attributed to several factors such as the aging of the population, the favoring of home care by insurance companies who want to bring the rising costs of hospitalization under control, the ability of agencies and institutions to provide quality health care with modern technological capabilities, as well as the desire of health care users to receive quality care in their homes. Besides that, the active principle and support of the independence of the patient and the family members involved in

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care, as well as the great reduction of hospitalization costs - great savings in the health system - are essential (Berman et al., 2021; Genet et al., 2011).
Home health care encompasses a wide range of health professionals who provide services in the home environment to patients recovering from acute illness, injury, chronic illness, or people with disabilities. The provision of professional health care in the home setting has increased in frequency, scope and complexity over the past decades. Users of home health care belong to a diverse population that includes all ages, different health problems and families of different structures and cultural backgrounds (Ivetić & Jovanović-Milenković, 2017; Pajić-Nikolić et al., 2022).
The aim of this paper is to provide a brief overview of the current status of the home care system in Europe and beyond, and to provide some suggestions for future research in this field. Regulatory framework for home care will also be in our scope, the role of formal and informal caregivers and innovations in the field of home care.

METHODS

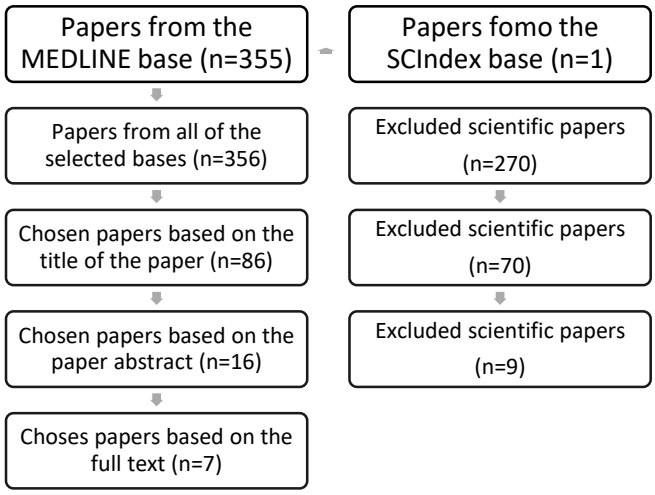
We researched databases Serbian Citation Index (SCIndex), based on various combinations of keywords: nursing home care, care services, models home care, trends home care work, we found one paper in Serbian. A search of the Medline index database, in English, selected 355 papers. The keywords used to search the Medline database were similar to Serbian, adapted to the English-speaking words.

TABLE - CRITERIA FOR INCLUSION AND EXCLUSION FROM THE RESEARCH

Inclusion criteria	
Topic	Home care systems and models, trends, concepts
Sample	Europe, North America
Type of study	Review articles, qualitative and quantitative studies
Language	English and Serbian
Time frame	From March 2008. to March 2023.
Exclusion criteria	
	Topics that were not relevant, conclusions that were not relevant, case reports

By reviewing papers based on the title, 86 works were selected. Further reading of the abstracts revealed 16 papers. Papers and studies that did not include models of home care, as well as those that were not relevant to the topic, were not taken into further consideration. Conclusions that are not relevant to the work or research that is not directly related to home care, 17 papers were additionally eliminated. The flow of papers selection is illustrated in diagram 1. In this paper, 7 papers that meet all the mentioned criteria will be analyzed.

DIAGRAM 1 – Works selection



RESULTS

Modern models in home care involve the nurse playing major roles, such as establishing contact with the patient and his family, conducting health care, and health education. Ivetić and Milenković (2017) in their professional work on the home care delivery model - the Buurtzorg model, highlight an innovative approach developed in the Netherlands. This model (Buurtzorg - neighborhood nurse, in the original meaning) is a model of innovative organization of home care provision. Providing home care to patients and the elderly has a long tradition, and nursing itself is highly valued in the Netherlands. Nurses were an integral part of the community, working closely with the family, neighbors and doctors of the patient they cared for. From the beginning until almost the end of the 20th century, they worked as independent entrepreneurs. At the beginning of the nineties of the XX century, a proposal was adopted to form organizations that will employ until then independent "nurses from the neighborhood" (Ivetić & Jovanović-Milenković, 2017).

This proposal led to the creation of a new model of home care provision in the Netherlands, which focuses on teamwork and the integration of medical care with social care. The system introduced change to increase productivity, financial savings for insurance companies, etc. Several organizations merged and there were a lot of nurses, but almost as many administrative staff. A series of events led to the loss of autonomy of the nurses, they had superior regional managers who planned what should be done. The new arrangement didn't increaseed effectiveness and efficiency. The superiors wanted to improve the situation by optimizing work in the field, setting time norms for each intervention. They failed. There was a loss of the personal relationship with the nurse, which was the main feature of the Dutch home care system. At the end of 2006, the Buurtzorg organization was founded with one team and became one of the largest home care organizations in the Netherlands. The Buurtzorg model has become known for its innovative organizational structure, which focuses on small teams of 10-11 nurses who are responsible for providing care to patients in their home. These teams are autonomous and have full control over their work, including scheduling decisions and tailoring care to patient needs. Buurtzorg also uses its information and communication network to support the organizational structure, which allows for more effective communication between teams and better coordination of care. The Buurtzorg model has achieved significant results in the Netherlands, including high ratings from users of home care services and awards for best employer. Patients who were take care of by Buurtzorg nurses had 30% fewer hospitalizations,

employee satisfaction was at a high level, and absenteeism was 60% less compared to other organizations. In 2016, Buurtzorg employed more than 10.000 nurses distributed in almost 900 teams in several countries. Buurtzorg operates in Switzerland, Belgium, England, Scotland, Japan, Canada, China and South Korea. The characteristics of this model are the structure in the organization: self-managing teams, the decision-making process and a web application, similar to well-known social networks, for exchanging information with colleagues (Ivetić & Jovanović-Milenković, 2017).

Bodker et al. (Bødker 2019) presented a model approach on the normative implications of introducing reablement into the home care system in Denmark. Reablement refers to short-term home training programs that aim to re-enable older people to live in their own homes independently of hospital-like care. According to the authors, "good care" in the context of reablement is care that allows older people to regain their independence and daily life skills. This involves a shift away from traditional home care practices that focus on performing tasks for older people, towards training and development through performing tasks with them. At reassembly, "good caregivers" are able to facilitate this process of training and development. The authors of the article suggest that the introduction of reablement into the Danish home care system has several normative implications. For example, it challenges traditional notions of care and shifts the focus towards older people's ability to regain their independence and daily living skills. These implications can be applied to other countries as reablement has been introduced in several countries around the world. However, the authors note that the success of a training program may depend on factors such as cultural norms, funding structures, and the availability of trained professionals, ie. local context (Bødker et al., 2019). An interesting study (2016) was also published in Denmark, which examines the care of the elderly through a sociological framework. They researched how health care workers think based on needs, requirements and possibilities in their daily work. Applying feminist time theory and anthropological social movement theory, the results point to two overarching time dilemmas in different home care situations; one in which process time prevails over clock time and another in which healthcare professionals balance between. The study shows how healthcare workers mediate between different perceptions of time to meet disparities between time and care needs. The article also identifies different tactics used by healthcare professionals, which is that time is available even though it is limited, spending more time with patients. That they think that the working conditions when providing care are bad, but they don't want the patients to notice it, nor that they are nervous or under stress, because the patients are happy to see them (Tufte & Dahl, 2016).

An epidemiological study conducted in Denmark (2019) indicates that exactly this type of research has a key role in improving public health in Denmark. By analyzing health contacts and database records, epidemiologists can identify risk factors for diseases and conditions, assess the effectiveness of treatments and preventive measures, and provide valuable insights to policymakers about the most effective ways to improve public health. These data are available in Denmark due to the extensive network of medical databases that are collected in the population. Preventive visits were organized for all persons over 65 years of age, and persons over 80 years of age were provided with mandatory visits in order to detect the need for care. Home care services in Denmark are aimed at elderly people who live at home but are unable to carry out daily life activities on their own. Home care includes practical assistance (such as cleaning and laundry), personal care (such as bathing and shaving), and nursing services in terms of training for self-care to independence and self-reliance. In 2015, 12% of all persons over the age of 65 received home care services. Municipalities in Denmark are responsible for determining whether an elderly person should be offered the option of moving

to a nursing home, which provides extensive specialized care for those who no longer have full physical or mental capabilities. In 2015, about 4% of people over the age of 65 lived in nursing homes in Denmark. Nursing home service users pay individually for their room, board and personal expenses, while nursing and health care services are provided free of charge. The waiting time for a standard place in the nursing home is no longer than 2 months after referral (Schmidt et al., 2019).

Yakerson (Yakerson, 2018) presents a critical review of the current situation in Ontario, which medical staff, patients and caregivers are going through in terms of health equity, problems with access to care, and caregiver burnout due to lack of support. Seen through the prism of politics, economics and the influence of the neoliberal agenda, there has been a decrease in competition, an increase in the cost of care and a decrease in health services at a time when the need for care is increasing. There were also bad working conditions for women, high turnover of jobs, lower wages, no benefits, no security, with burnout syndrome. The lack of a national home care program has resulted in different definitions of services in the provinces and territories, leading to inadequate quality of care and inaccessibility of home care. Jakeerson concludes that investment in the home care system is needed, more qualified staff with a professional approach to care is needed (Yakerson, 2019).
The National Health Service (NHS) of Great Britain provides free public health care to all residents through the National Health Service. The budget is funded through general taxation and the Government agency NHS England oversees and allocates funding to agencies at local level. In addition, about 10.5% of the population has voluntary additional insurance. Practically, the NHS provides preventive health services, care inside and outside of the hospitals, maternity care, therapy in hospitals but aslo therapy in ambolatory care, essential clinical dental services, ophthalmologists, mental health support, palliative care and some form of long-term care. Long-term care and social support are an important part of the NHS. The National Health Service of England covers the cost of long-term care at home - home care or in facilities for that purpose - residential care, for people whose needs arise from illness, accident, disability or if hospice care is required. In 2018, about 0.2% of the population used this type of healthcare. Other local long-term care and social support is not free except for cases of time-limited rehabilitation due to illness or injury, minor modifications in the home. For comparison in 2019. the allocation to the NHS is 10.15% or $5087 (Tikkanen et al., 2020).
Stone and Bryant (Stone&Bryant, 2019) suggest that one way to better understand and value the work of home caregivers is to increase awareness of the complex nature of their work and the potential contribution they can make to achieving greater quality of care and quality of life for people with chronic diseases. This can be achieved through education and training programs that help clinical team members and society in general to recognize the professional skills and competencies required for this type of work. In addition, policy makers, health systems, and service providers should consider taking action to assess and spread awareness of the value of this workforce and build their capacity to become members of home care teams. They concluded that the inclusion of informal caregivers in home care teams may have several potential advantages; informal caregivers can help improve the quality of care and quality of life for people with chronic or serious illness by providing assistance with activities of daily living, medication management, and other tasks. They can also help reduce hospitalizations, reduce the need for emergency services by providing ongoing support and monitoring in the home environment. In addition, the inclusion of an informal caregiver in care teams can help ease the burden on the health worker and improve job satisfaction for other team members. Finally, including the informal carer as a formal member of the care team can help promote their professional development and also career opportunities (Stone & Bryant, 2019)

DISCUSSION

In the largest number of works included in this research, the researchers focused on quality of care and cost reduction. Understanding the concept of home care is important for understanding current trends and models. There are several models of long-term care provision in the literature. The basic elements of the long-term care system are interconnected and complex to consider, depending on the criteria. The philosophy of the system refers to the overall responsibility for patient care, whether it is the family or the state. The way in which the state organizes care can be through services, cash benefits or a combination of these two approaches. Financing of the long-term care system also plays an important role in ensuring quality patient care, and the level of government support that affects the long-term care system can vary by country and its policies. European social models can be classified into three groups: models where the state assumes responsibility, a model where the family is responsible and a subsidiary model where the family participates with the state (Berman et al., 2021; Ivetić & Jovanović-Milenković, 2017). Recent literature from 2011. on the topic of home care has limited data, especially in the countries of Central and Eastern Europe. One third of the studies focused on one aspect of home care. Funding data are scarcely described, which constitutes a significant gap in the literature, as funding is a critical component of any health system. This conclusion indicates that there is a great need for additional research on home care with more comprehensive and standardized data collection methods to better understand the state of home care across Europe. In addition, this study highlights the importance of understanding the financing of home care in Europe (Genet et al., 2011).
The basic concept in home care usually refers to a professional service provided to patients or clients who need extra care and attention but want to stay in their own home. In projections about the future of home care health workers, the first thing to note is the importance of training and support for home care, support for formal and informal caregivers, and support for other team members. Several factors have been identified in the literature that hinder the inclusion of home care helpers in care teams. One of the obstacles is the lack of awareness and appreciation of the complex nature of the work and the potential contribution that formal and informal caregivers can make to achieving a higher quality of care and quality of life for people with chronic or serious illnesses. Helpers are often referred to as "unqualified," are not recognized as professional care providers, and are undervalued as evidenced by their low wages and lack of adequate benefits. Other barriers include inadequate investment in training and education for this workforce to develop their knowledge and competencies, as well as variations in state delegation laws that limit the scope of practice and therefore the ability of helpers to work effectively in teams and advance their careers (*Pristup Uslugama Dugotrajne Nege u Srbiji*, n.d.).

The current demographic situation in Serbia is characterized by an aging population and a negative natural increase. The current demographic structure of the population of the Republic of Serbia is among the oldest in Europe, our average age is 43.5 years. According to official statistical data for 2021, the share of people over 65 years old in the population of Serbia is 21.28%. According to the same data, the percentage of people over 80 years old is 4.64% (*Zakon o Zdravstvenom Osiguranju*, n.d.). In addition, we also have a low fertility rate, as well as delaying the birth of the first child. A large number of the population of Serbia get sick, die prematurely or are disabled due to preventable diseases. Those diseases refer to the poor population and risk groups, i.e. inequalities in health (*Zakon o Zdravstvenoj Dokumentaciji i Evidencijama u Oblasti Zdravstva*, n.d.). Another component that significantly affected these data is the gross domestic product (GDP), which must increase with the increase in average age. In 2019, the GDP value was 7.417 dollars, and the real GDP growth rate was 4.2%. Out

of that, the total expenditure on health services is 8.64% for 2019, which ranks us together with Western countries and of Northern Europe looking only at percentages, while the real amount is significantly lower at 641 dollars (*Zakon o Zdravstvenom Osiguranju*, n.d.). The provision of health and other services in the home is divided between the social protection system, the pension insurance fund and the health care system, which slows down the decision process and timely provision of services. The health system provides long-term care services in secondary and tertiary health care institutions, while home care and palliative care is carried out within the framework of primary health care, health centers(*Zakon o Zdravstvenoj Zaštiti: 25/2019-40*, n.d.). There is a time gap between patient's need to the authorities' decision, which is impossible for patient to wait for, and all the necessary care, if possible, is provided by the patient himself. The Association of Voluntary Insurers of Serbia says that over two million people in Serbia have some form of voluntary health insurance. Voluntary health insurance means non-life health insurance, the types are: supplementary, additional and private health insurance. In 2019, 5.2% of elderly people used home care and home help services. A quarter of the elderly population stated that they have strong social support in terms of informal care and help at home, and more than half moderate, while the rest rated social support as weak (*Zakon o Zdravstvenom Osiguranju*, n.d.). Ivetić raises the question of the implementation of this model in state and public companies where employees are used to "a system that does not change, that has no tendency to change and that aims to not change anything". However, the authors express faith that there are real people who could lead the changes. They also say that it is important to provide suitable personnel and then deploy them. The model of providing care in the Republic of Serbia relies for the most part on the support of family and relatives (informal caregivers), and the state provides about 5% through financial allowances for help and care. They say that this indicator is a sufficient reason for the development of this model in our country (Ivetić & Jovanović-Milenković, 2017). Legal frameworks related to home care directly determine the quality of the care provided and the satisfaction of the patient and the employees.

Health insurance law: "Mandatory health insurance is insurance that provides the insured persons and other persons with the right to health care and the right to financial benefits in accordance with this law", Art. 3. It includes insurance in case of illness, injury outside of work and at work, as well as insurance for occupational diseases. The Law on Health Insurance defines the concept of home treatment that is justified and medically necessary when parenteral drug administration is indicated by a doctor, rehabilitation treatment that can be provided by a health worker-nurse to an insured person in case of immobility or movement with the help of another person. And it can be carried out as a continuation of inpatient treatment, Art. 55. The concept of palliative care is framed more closely in order to improve the quality of life of the insured person through the elimination of psychological and physical suffering, Art. 59 (*Zakon o Zdravstvenoj Dokumentaciji i Evidencijama u Oblasti Zdravstva*, n.d.)**.**

The Law on Health Care: Lists health care as part of primary health care, where the Health Center provides health care from the service of polyvalent patronage, home treatment and home treatment with palliative care and health care, Art. 65. and 75. The same law states that the Institute for geriatrics and palliative care provides health care for the elderly, works to preserve and improve health and prevent disease, performs home treatment, health care and rehabilitation of persons over 65 years of age, as well as palliative care for all patients, Art. 84 (*Strategija Za Palijativno Zbrinjavanje*, n.d.).

The Law on health documentation and records in the field of health: It regulates health documentation and records in the field of health, the types and content of health documentation

and records, the manner and procedure of keeping them, the persons who are authorized to keep health records and enter data, deadlines, availability of data from medical records of patients, which is used for data processing, quality assurance, data protection and storage, etc. There is no information in the text about nursing documentation or care process documentation (*Program o Zaštiti Mentalnog Zdravlja u Republici Srbiji Za Period 2019–2026. Godine*, n.d.).

The strategy for palliative care: It was adopted as a result of "the growing need for this type of health care as a result of the aging population of the Republic of Serbia and the increasing number of patients with progressive diseases (cardiovascular diseases, malignant diseases, diabetes, neuromuscular, cerebrovascular diseases), HIC/AIDS, traffic trauma, etc." According to the Law on Health Care and the Strategy for Palliative Care, it is carried out within the Health Centers and the Institute for Geriatrics and Palliative Care (*Strategija Za Palijativno Zbrinjavanje*, n.d.; *Uredba o Nacionalnom Programu Za Očuvanje i Unapređenje Zdravlja Starih*, n.d.).

Program on mental health protection in the Republic of Serbia for the period 2019–2026. In 2008, a system of measures was agreed which states that the elderly are a very vulnerable category in the population and are at great risk of a part of that population turning into "psychogeriatrics". There is also a lack of motivated staff, as well as institutions where only elderly people with mental disorders would be cared for (*Program o Zaštiti Mentalnog Zdravlja u Republici Srbiji Za Period 2019–2026. Godine*, n.d.).

Based on the previous data, **the Regulation on the improvement of the health of the elderly (2018-2026) and the Regulation on the national program for the preservation and improvement of the health of the elderly (2017)** were adopted, where the leading active principles on developing personal responsibility for health, promoting healthy lifestyles and preservation of functional ability in old age through several specific goals. In order to monitor the success of the Regulation in the field, the instrument *"Comprehensive geriatric assessment"* is used, as well as the action plan derived from the Regulation for improving the health of the elderly (*Bruto Domaći Proizvod, 2019 | Republički Zavod Za Statistiku Srbije*, n.d.).

A proposal for reforms within the system of social protection and long-term care, in terms of informal caregivers, was adopted this year, where it is proposed to establish an institution of informal care until the development of services in the community for the elderly, investment in rehabilitation, prevention and innovative technologies. All together should lead to reduced costs in the home and increased efficiency in long-term care. This series of proposals was created as part of a three-year project in the Western Balkans region "Strengthening the resilience of the elderly and people with disabilities during COVID 19 and future disasters". The project also proposes greater investment in the education of specialized professionals and the establishment of dedicated insurance funds, which is of key importance due to the aging of the population and the consequent increase in GDP for health costs. Examples from the world and Europe speak in favor of the fact that they are already working according to these recommendations and again with the aim of optimizing functioning, while in our country it is necessary to implement the ruling models and trends, which requires a revision of the current legislation and the establishment of additional funds and the strengthening of additional health insurance (*Pristup Uslugama Dugotrajne Nege u Srbiji*, n.d.).

Perspectives of development

The Republican Secretariat for Public Policies issued a document that talks about the 2030. Agenda and the global goals and how we want our world to look like in 2030. (*Agenda-UN-*

2030.Pdf, n.d.). One of the advanced 17 goals is its third goal: "*Good health*: ensure a healthy life and promote well-being for people of all generations' which relates to this work on home care. A more detailed presentation of the priority sub-goals of the 2030. Agenda is contained in the documents of the "Sustainable Development for All" Platform. According to the aforementioned Platform "Monitoring report on progress in the preparedness of Serbia for the implementation of Agenda 2030 and sustainable development goals" (*Ageing and Health*, n.d.), it was noted in previous years that Agenda 2030 is being neglected due to a lack of capacity for development planning, while "Monitoring report Serbia 2030: Is Serbia managing its (sustainable) development" describes a slight progress in achieving the goals of the 2030. Agenda (*Srbija 2030 - Pripremljenost Za Sprovođenje Agende 2030 - Održivi Razvoj Za Sve*, n.d.; www.yillit.com, n.d.). It is certain that the emergence of artificial intelligence (AI) will help to achieve the third goal of the 2030 Agenda, both through general communication between providers and recipients of health services, as well as in health education work with the user of health services, as well as in other specific areas of home care. Today, one of the main trends is the provision of personalized care and use of technological innovations.

The great role of modern technologies is evident and the world will not be the same in any aspect in five years. This positive development of technology will have more revolutionary inventions than in known history so far - until Tesla, leading to the ease of people's lives and a jump in the development of humanity. It is predicted that virtual reality (VR) will be implemented in working with the user and thus achieve great savings, which represents a new area of research and application of modern communication technologies in the field of health.Home care services offer a wide range of benefits: increasing independence, promoting safety and comfort, improving quality of life. The use of technology is the present and the future in home care. Investing in this sector is an excellent opportunity for business growth and improving people's lives.

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QUALITY OF LIFE AND PHYSICAL ACTIVITY IN PEOPLE WITH RHEUMATOID ARTHRITIS

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Abstract: Rheumatoid arthritis (RA) is the most common form of inflammatory rheumatism. The onset of synovitis in middle aged population, the irreversibility of damage and the progression of the disease reduce the possibilities and capacities of a person with RA to fulfill their needs and thus achieve the overall quality of life. Quality of life (Qol) is a multidimensional concept defined by the World Health Organization as a state of complete physical, mental, and social well-being. Early diagnosis, the therapeutic approach *"treat to target"* and the application of biological therapy are current recommendations that contribute to the Qol of people with RA. Regular physical activity (PA), or any physical movement that leads to energy expenditure, is a key component of a healthy life. Since existing research has shown a significant impact of PA on chronic diseases of the modern era, the question of the benefits of PA in RA arises. The objective of this paper is to review and analyze the available recent research in order to examine the effects and importance of the implementation of PA on the Qol of people with RA. This study is a review of the literature using PubMed/MEDLINE and Science Direct, not older than ten years. People with RA, in addition to designed programs of therapeutic exercises as part of physiotherapy, also practice different forms of PA in their free time or through organized activities. The results indicate that the implementation of regular PA, dosed according to time and intensity as well as according to the current picture of arthritis reduces the symptoms of arthritis, which improves the overall Qol of these people. Implementation of PA is beneficial for people with RA. In order to improve the Qol, it is necessary to design adapted programs of PA, respecting the specifics of each individual.

Keywords: *rheumatoid arthritis, quality of life, physical activity*

INTRODUCTION

Rheumatoid arthritis (hereinafter RA) is the most common form of inflammatory rheumatism. It represents an autoimmune and systemic disease, with a chronic course, followed by progressive damage to the joints and extra-articular manifestations with limitation of activity and impact on the quality of life. In general, women suffer from rheumatoid arthritis (hereinafter referred to as: RA) three times more often than men, most often between the ages of 40 to 60 (Favalli et al., 2019; Vujasinović Stupar, 2000). The prevalence of RA in developed countries is 0.5 - 1.0% (Smolen et al., 2018), while for comparison, the standardized prevalence of RA in Serbia is 0.34% for the entire population, with a higher prevalence in women (0.49 %) compared to men (0.17%) 3:1 (Zlatković-Švenda et al., 2014), which is in agreement with data in modern research. It is considered that the causes of the development of RA are

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unknown, however, genetic risk factors as well as several environmental factors can activate RA and trigger an autoimmune response against modified own proteins, years before the appearance of the inflammatory process in the joint synovium (synovitis) and clinical symptoms of the disease (Smolen et al., 2018).

The clinical picture is described from mild to severe, where the severe clinical picture is dominated by chronic pain and permanent joint damage. In addition to articular manifestations, RA is accompanied by the appearance of extra-articular subcutaneous nodules, systemic changes and associated syndromes, as well as cardiovascular changes, which are the cause of up to half of the observed premature deaths, the risk of death is twice as high as in the general population (Biskup et al., 2018). Therefore, the onset of synovitis in middle age, the irreversibility of damage, the chronicity and progression of the disease reduce the opportunities and capacities of a person with RA to fulfill their needs and thus achieve the overall quality of life.

The therapeutic approach "*treat to target"* or treatment according to the set goal and the application of biological therapy are current recommendations that contribute to the quality of life of people with rheumatoid arthritis. However, the application of physiotherapy procedures, as well as occupational therapy, maintains the mobility of the joints, strengthens the muscles and slows down the onset of deformities. On the other hand, education about the disease as well as designed programs of dynamic exercises and even aerobic fitness exercises influence the health and overall status of a person with RA and enable participation in activities of daily life (American College of Rheumatology Subcommittee on Rheumatoid Arthritis Guidelines. 2002).

Quality of life (hereinafter Qol) is a multidimensional concept defined by the World Health Organization as a state of complete physical, mental, and social well-being. Another definition reads *"individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns"* (WHOQOL Group, 1993: 153). There are different definitions of this concept in relation to the area of interest. Thus, Qol can be viewed in relation to health as a subjective assessment from the patient's point of view. By applying this concept and the instrument of Health-related quality of life (HRQOL), the focus is on the effects of the disease and the impact of treatment on the Qol. On the other hand, Qol is a much broader concept that includes the domains of physical and psychological health, social relationships and environment. RA can affect all of the aforementioned domains and significantly compromise an individual's Qol (Chang et al., 2009). Qol can also be threatened by socioeconomic factors – age, work and economic status as well as lifestyle habits of a person with RA (Malm et al., 2016).
Regular physical activity (hereinafter PA), or any physical movement that leads to energy expenditure, is a key component of a healthy life. Moderate to high intensity PA is thought to improve muscle strength and cardiovascular capacity (Scrutinio et al., 2005). Also, existing research points to the importance of the impact of PA on chronic diseases of the modern age, and we find that regular exercise and PA significantly reduce the occurrence of cardiovascular changes and the process of atherosclerosis, as well as the slowing down of radiographic changes in arthritis (Stavropoulos-Kalinoglou et al., 2013; Verhoeven, et al., 2016). Despite this, people with RA tend to lead a sedentary lifestyle and avoid PA (Metsios et al., 2008). The reason may be the clinical picture of RA dominated by pain, reduced range of motion in the joints, reduced muscle strength and hand grip, stiffness of varying intensity, as well as the appearance of fatigue and reduced general functionality. The question arises as to how exercising PA affects the Qol in people with RA.

METHOD

The objective of this paper is to review and analyze the available recent research in order to examine the effects and importance of the implementation of PA on the Qol of people with RA. This study is a review of the literature using PubMed/MEDLINE and Science Direct, not older than ten years, available in full text and in English. The analyzed works had to be of a research nature, published in their entirety and in accordance with the stated topic, where at least one variable had to be related to quality of life and physical activity in people with rheumatoid arthritis.

In the search of electronic databases, we used the following keywords: Rheumatoid arthritis (lat./engl.), Rheumatic disease, physical activity, exercising, quality of life, well-being. Based on the processing and selection of collected studies, we chose to analyze six studies in order to examine the connection between quality of life and physical activity in people with rheumatoid arthritis.

RESULTS

Malm et al. (Malm et al., 2016) analyzed the influence of lifestyle habits (physical activity, diet, smoking, alcohol consumption) on the Qol of people with RA. The descriptive exploratory study included a total of 22 respondents with RA, 14 female and 8 male (aged 30 to 84). The study participants were asked an open-ended question: "How do your lifestyle habits affect your quality of life?". A qualitative analysis of the content of the received answers was performed, where the influence of lifestyle habits on the Qol of the respondents was observed through three categories in terms of limitations, self-regulation and socializing. Based on the analyzed answers, it was determined that people with RA try to achieve a balance between their lifestyle habits and their disease in order to achieve a normal life and influence the quality of their life. Qol here includes health consequences, pain, fatigue, as well as physical functioning and social participation (Malm et al., 2016). Priorities in everyday life change as well as the choice of lifestyle habits, so it is concluded that people with RA balance between the ideal situation and reality.

Shao et al. (Shao et al., 2021) conducted a randomized controlled trial on the application of a *self-management* program in patients with RA. The aim of this program was to develop behavioral awareness among people with RA in terms of preserving joints from further damage and improving their own PA. During the program (25-40 min per day), participants were trained how to recognize activities that increase pain, sensitivity and cause the appearance of other symptoms or, on the contrary, provide relief. The ultimate goal of the program was improvement in activities of daily living and QoL. According to the appropriate criteria, the research included a total of 224 patients with RA (intervention group and control group). Assessment instruments were administered at the beginning of the trial, at two and three months during the implementation of the intervention and after 6 months from the start of the trial. To assess Qol, Short-form Health Survey-36 (SF-36) was used and within it Physical Component Score and Mental Component Score, Modified Health Assessment Questionnaire (MHAQ) was used to assess functionality, while to assess the level of self-control in preserving joints and physical activities a designed and modified scale was applied. The results showed that in the group in which the *self-management* program was implemented in order to reduce the symptoms of arthritis and through the improvement of PA, there were significant improvements in physical functioning, self-efficacy and behavior, while the impact on disease activity and quality of life was not significant. It seems that for patients with chronic diseases, a longer period of time is needed for program training, but also for monitoring the results. Thus,

the aforementioned interventions would lead to more significant changes in the daily life and lifestyle of a person with RA, as well as improving Qol as the ultimate goal.

Due to the COVID 19 pandemic, many restrictions were introduced, which, among other things, also affected the reduced practice of PA in the general population. In accordance with the health situation, people with chronic diseases such as cancer, diabetes or RA have been advised to reduce their movements in a targeted manner and stay at home. Balchin et al. (Balchin et al., 2022) investigated the current topic, taking into account that sedentary behavior and avoidance of PA due to the onset of pain or worsening of symptoms are very common in people with RA. The aim of the research of the mentioned authors was to determine the consequences of "lockdown" during the pandemic on participation in PA in people with RA (n=27) compared to people without arthritis (n=101). Data on the disease, the subject's body weight, mental well-being and Qol were collected using an online protocol specially created for the mentioned research. To assess Qol in relation to the two groups of subjects, different Rheumatoid Arthritis Quality of Life (RAQoL) and WHOQOL-BREF instruments were used, which were then transformed into a scale of 0-100 using a standardized formula. Analysis of the obtained results revealed a significantly lower participation in PA during isolation for people with RA compared to the control group ($p < 0.001$). This trend was characteristic in the first months of the pandemic, which additionally influenced people with RA to reduce their PA practicing (59%). Closed gyms and unavailability of equipment are some of the reasons for these results. The outdoor environment and going out into nature affect mental well-being (Brady et al., 2021) and may also be the reason for lower Qol in people with RA who were under care. Encouraging PA is important for the mental health and Qol of people with RA during isolation situations such as a pandemic. Another group of authors who followed these patients in a lockdown situation (Lévy-Weil et al., 2021) reported that 50% of subjects reduced PA, by 57% in frequency and 47% in relation to exercise intensity ($p < 0.005$). The result showed that the worsening of arthritis affected the indicators of the quality of life - on the increase of pain and fatigue, restriction of movement, deterioration of the quality of sleep, which is also related to the reduction of PA.

Raczkiewicz et al. (Raczkiewicz et al., 2015) analyzed the relationship between vitamin D deficiency, quality of life, physical activity, and RA disease activity. From the total sample (86 subjects), the research included 74 subjects with RA and 22 patients with osteoarthritis as a control group (all with different concentrations of vitamin D deficiency). The QoL assessment instruments Medical Outcome Study Short Form 36 (SF-36) and Health Assessment Questionnaire (HAQ) were applied, then, a 5-point scale for quantifying PA (no exercise - 0, at least three times a week - 4), DAS28 for assessment of disease activity and laboratory tests. The aforementioned authors also took into account the results of certain previous studies that confirmed the relationship between the physical components of Qol and PA, according to which a lower degree of PA is associated with poorer Qol. Current research (Raczkiewicz et al., 2015) indicates that there is an association between vitamin D deficiency, higher rates of disease activity and poorer quality of life, where regular physical activity is correlated with higher vitamin D concentrations and better quality of life in RA.

The aim of a recent prospective controlled study (Özlü et al., 2022) was to compare kinesiophobia, fatigue, PA and QoL in RA patients in remission versus a healthy population. Kinesiophobia is a behavior caused by fear of movement, physical activity and exercise. Due to the damaged joint structures and the resulting chronic pain in some people with RA, the painful experience is a "harmful sensory stimulus" and the person avoids PA in order not to increase the pain and possibly cause an injury (Knapik et al., 2011). The mentioned study

included 45 female patients with RA in remission and the same number of female persons from the general population who made up the control group. The following assessment instruments were applied: HAQ, DAS28, VAS, Tampa Scale of Kinesiophobia, Fatigue Severity Scale, and International Physical Activity Questionnaire, which examines PA (duration of at least 10 minutes) in the past week, intensity and frequency of activity. PA is divided into activities of high (soccer, aerobics, weights), moderate intensity (cycling at normal speed, dancing, bowling), walking and sitting and is calculated in minutes and displayed with the corresponding score. The results of the study indicate a lower Qol in subjects with RA in remission compared to the control group, as well as a significant correlation between kinesiophobia, moderate-intensity PA and Qol among subjects with RA in remission. It is recommended that appropriate interventions are used to reduce the occurrence of kinesiophobia in order to create conditions for participation in physical activities and improve the Qol of people with RA.

Non-pharmacological procedures such as exercise and diet reduce the possibility of cardiovascular problems, hence a group of authors (García-Morales et al., 2020) reasearched the effect of a dynamic exercise program combined with a Mediterranean diet on Qol in women with RA. García Morales et al conducted a randomized clinical trial (duration of 24 weeks) among 144 female subjects with RA, divided into three groups that carried out a single and combined intervention, as well as a control group. The diet program was carefully balanced and based on the principles of the Mediterranean diet (olive oil, fruits, vegetables, cereals, legumes), exercises were planned twice a week (80-90 min), carried out through five phases (warm-up, aerobic exercises, anaerobic, sports games, stretching) under the supervision of a therapist. SF-36 was used to assess Qol, followed by HAQ, DAS28 (low disease activity), VAS and laboratory analyses. The results of the study indicate that the combination of the aforementioned interventions (exercises and the Mediterranean diet) affects the improvement of Qol and daily activities in people with RA. The main effect comes from the synergistic effect of both interventions and the duration of the program, with the note that the continuity of the nutrition program, the frequency and intensity of the exercises are important.

DISCUSSION

This study demonstrated the positive impact of physical activity on quality of life in people with RA through various programs and interventions. People with RA, in addition to designed programs of therapeutic exercises as part of physiotherapy, also practice different forms of PA in their free time or through organized activities. The results indicate that the implementation of regular PA, dosed according to time and intensity as well as according to the current picture of arthritis reduces the symptoms of arthritis, which improves the overall Qol of these people. As the findings suggest, PA generally contributes to health status and Qol both in the general population (Haskell et al., 2007) and in people with chronic diseases (Hernández-Hernández et al., 2017). Through the presented review of the literature, we found that a significant number of people with RA practice some form of PA to a lesser extent or spend less time in activities of moderate intensity compared to the general population (Balchin et al., 2022; Özlü et al., 2022). According to some researches (Jahanbin et al., 2014; Katz et al., 2020) PA, most often in the form of exercises, can influence the activity of the RA disease, reducing pain, fatigue, and improving functional and mental status, which is in accordance with the results of the presented research (Raczkiewicz et al., 2015). Considering the social aspect of participation in PA, for example by exercising in a group, conditions are created for socializing and making social contacts. It brings satisfaction and a sense of belonging to people with RA, who are often isolated and not very active in everyday life, which improves the Qol of the individual (Malm et al., 2016). PA in people with RA has been shown to be hindered by joint pain, limited

movement, and fatigue, as well as fear of falling, which belongs to the *limitation* category (Malm et al., 2016). In order to overcome limiting situations and remain physically active, people with RA use different strategies, adapted equipment and aids. The current health situation and modern means of communication have enabled the availability of PA video programs online, through applications and social networks (Balchin et al., 2022; Lévy Weil et al., 2021). Since we analyzed the practice of structured physical activity programs from the field of complementary methods in one of the previous papers (Šimpraga et al., 2019), in this paper we did not include the Yoga system of exercises that significantly improves the physical and mental status of people with RA. Yoga represents a suitable therapeutic possibility and an acceptable PA that, with the guidance of a trained yoga instructor or even a physiotherapist, as we have previously established, can affect the improvement of the quality of life of people with RA.

The selected studies are different in design, belonging to the type of descriptive exploratory (Malm et al., 2016), randomized trials (García-Morales et al., 2020; Shao et al., 2021), and prospective controlled studies (Özlü et al., 2022). In the analyzed studies, quality of life was measured with different instruments, the Rheumatoid Arthritis Quality of Life Questionnaire (Balchin et al., 2022) specific for RA was used, then the frequently applied generic Short-form Health Survey-36, which includes several domains (physical function, pain, vitality, general health, social participation, emotional and mental health) and gives the possibility to compare Qol with the population in good health or with other diseases (García-Morales et al., 2020; Raczkiewicz et al., 2015; Shao et al., 2021). We noticed that in some studies (Özlü et al., 2022) the Health Assessment Questionnaire was used to assess Qol, a standard instrument for assessing functional abilities in RA. We found that due to the significant impact of RA on functionality decline, the HAQ is sometimes used as a "surrogate marker" of quality of life also with generic measures to collect more data (Kingsley et al., 2011).

CONCLUSION

Implementation of PA is beneficial for people with RA. In order to improve the Qol, it is necessary to design adapted programs of PA, respecting the specifics of each individual. It is very important for people who have some form of chronic, rheumatic disease to learn about the benefits of PA both in the purpose of preventing further development of the clinical picture of the disease and in the purpose of having a recommended therapy. With a multidisciplinary approach, PA and education on proper lifestyle habits and healthy eating, then availability of modern means and equipment, health workers in daily clinical practice as well as other participants in rehabilitation can significantly influence the improvement of the quality of life of people with RA.

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SUSTAINABILITY OF THE OWNERSHIP TRANSFORMATION MODEL OF PROFESSIONAL FOOTBALL CLUBS IN SERBIA

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Abstract: The main problem facing Serbian football is the ineffective organizational structure of football clubs and the lack of competitiveness in international competitions. The current "post-communist" situation is characterized by a lack of appropriate legislation, undefined ownership relationships, non-transparency, unclear management accountability, poor governance and a lack of environment to stimulate private investment. The goal of the research was to better understand the multidimensionality of club goals, the relationship of interested parties, the principles of sports management, comparative economics and different models of ownership transformation in the European sports ecosystem, the results of privatization in countries in transition and data collection based on a Likert-type structured survey questionnaire, with a particular focus on stakeholder views on this topic. Valuable information is also drawn from the UEFA Intelligence Center (conversion experiences of European legal clubs, analysis of the impact of these changes - before and after comparisons, key considerations and potential risks after privatisation) and other economics and management literature. Based on the collected information and the results of the aforementioned analysis, a sustainable model of ownership transformation through guidelines with appropriate modalities was proposed, which would include an algorithm of activities on ownership transformation, as well as a proposal and recommendation of the necessary legislative activities, which would regulate this issue in order to better manage Serbian football clubs. This means that Serbian football clubs could be more competitive and efficient in the future.

Keywords: *privatization, professional foodball, management efficiency, competitiveness in football, Serbian football clubs*

INTRODUCTION

When the issue of improving sports results is raised, a great number of authors proceed from the assumption that the status change of a sports organization in terms of ownership transformation is a prerequisite for "more efficient" business. The term "more efficient" is used exclusively in economic terms and identifies with increasing profits of the sports organization. That can be interpreted as the interest of a private investor solely to achieve the biggest possible profit and club's efficiency, while all other goals are secondary. Therefore, the primary motivation of a private investor can be in conflict with the expectations of other stakeholders in the sport system. The diversity of interests with a stake at European sport is large (Chatzigianni, 2014). For example, the state, in addition to the interest in the top sporting result, has the interest to increase the coverage of citizens participating in sports activities, to minimize violence and misbehavior at sports events and sports organizations, to prevent improper behavior related to the sports system (doping, money laundering, financial embezzlements etc.), stimulates and participates in securing the material basis for conducting sports activities

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at all levels, affects the quality of professional work in the sports system, creates facilitations for the functioning of the sports system (tax policy, customs policy, security policy, health policy etc.).
Top athletes as stakeholders expect to be adequately rewarded for the sporting results they achieve, to provide them with material, technical and financial conditions for training and competitions. To be provided with appropriate sports professionals and coaches necessary for the realization of the planned training process.
Sports officials (amateurs and volunteers) draw their motivation from philanthropic initiatives, the desire for social/political/professional promotion, affirmation and attainment of appropriate status, socialization and social affirmation at all levels, increasing social/political/professional influence in the environment.
The motives of the various stakeholders vary significantly, and are often in conflict with each other. For this reason, it is necessary to identify stakeholder motives and establish a system in which structural, organizational and functional solutions will establish a balance between different expectations and in the interest of improving the whole sports system.So, we could conclude that the main motive for ownership transformation (privatization) in all areas of economic and social activity is the need to make the existing organizational structures more efficient. In field of sport, it means that the most successfull clubs are organized as profit-oriented companies (American professional clubs) or a mostly win-oriented, but also business companies (European football clubs). The sports business in Europe has been recently altered by a court decision granting greater freedom to players in the labor market. Also, the televising of major sporting events has become more popular, generating big increases in revenues to many clubs (Andreff & Staudohar, 2000). Unlike American clubs which prefer to use profit-maximising strategy, European football clubs mostly use win-maximising strategy.
Some authors pointed out that maximising a club owner's utility function has been interpreted as optimisation of the trade-off between profit-making and wins on the pitch. Thus, economists and mangement scientists are sensible enough to accept the view that club may have multidimensional objective function. So we could agree that European football clubs have multidimensional objectives such as wins, high performance, competitiveness, profit, revenues, fan engagement, attendance, quantity of superstars and talents attracted, high level of media coverage etc. There are many examples in the field of sports that support those statements, although some sports organization are present in the sports reality where the titular of ownership is not personalized and clearly defined.

METHODS

The research has conceived as an observational exploration study based on:
• Comparative law experience in the selected European countries in regarding the organization and functioning of the sports system, as well as in terms of legally allowed models of ownership transformation,
• Recording motivational factors (structured survey questionnaire) in different stakeholders' group (state authorities, businessman, sports experts, experts in sport, sports officials, sports professionals, athletes, fans/supporters), which would be done on an appropriate sample of representatives of particular stakeholder categories.

The research was conducted as an exploration study with parallel groups on a sample of 159 respondents who were clasified into stakeholder groups: Sports experts (n=14), State authorities (n=21), Businessmen (n=17), Sports professionals (n=24), Fans/supporters, (n=19), Experts in sport (n=16), Sports officials (n=22) and Athletes (n=26). All subjects were administered an initial questionnaire with 34 Likert-type items with five response modalities.

After determining the metric characteristics of the proposed items, due to the characteristics of response distribution and the high level of unique variance, items marked in gray are excluded from the instrument. Polychoric correlation coefficients for each pair of items were calculated over the obtained results. The correlation coefficient matrix is condensed by exploratory factor analysis, which is derived by the principal components method. The number of significant factors was determined by the parallel bootstrap analysis on 500 generated matrices of random correlation coefficients by permutation of the raw data.

The initial parsimony factor solution was rotated to the most interpretable form according to the normalized Varimax criterion, which produced an orthogonal structure of the basic dimensions of the explored space.

For the purpose of quantitative analysis of distances between stakeholder groups on each of the isolated basic dimensions, factor scores on the isolated factors were calculated for each subject. Since these dimensions are by definition multivariate normally distributed, a t-test for independent samples was used to test for significance of differences between the analyzed stakeholder groups.

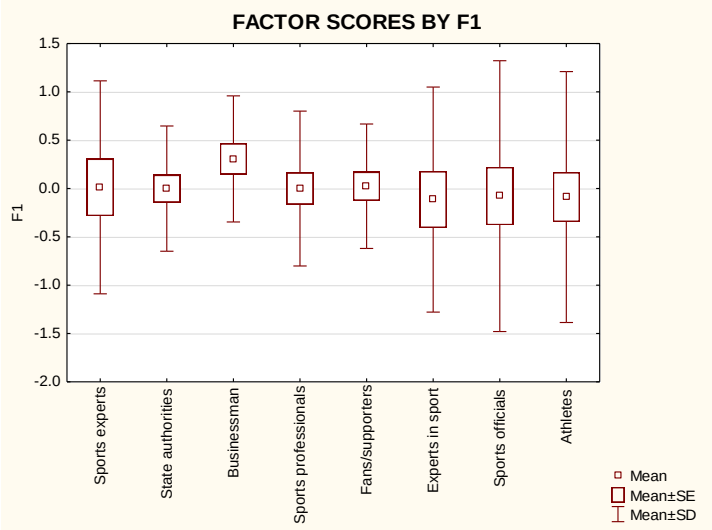
RESEARCH RESULTS

The basic research sample was 159 subjects and has structured into 8 sub-samples (Table 1)

Table 1. Structure of the basic research sample

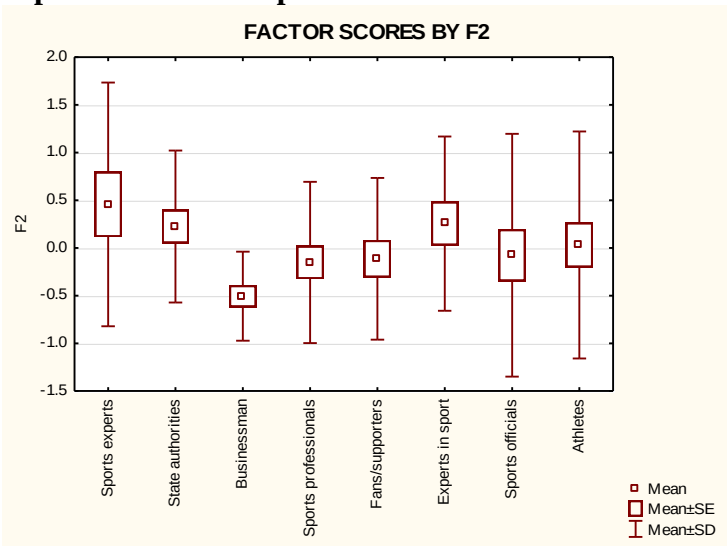
Category	Count	Percent
Sports experts	14	9.86
State authorities	11	7.75
Businessmen	10	7.04
Sports professionals	24	16.90
Fans/supporters	19	13.38
Experts in sport	16	11.27
Sports officials	22	15.49
Athletes	26	18.31

Factor analysis was carried out in a manifest space defined by 23 research variables. Eleven variables had to be excluded from the analysis because their metric characteristics were unsatisfactory. The results indicate the real conception of the latent structure of the space determined by 5 fundamental dimensions. This model has explained 0.6115% of the total registered variance.



Graph 1.

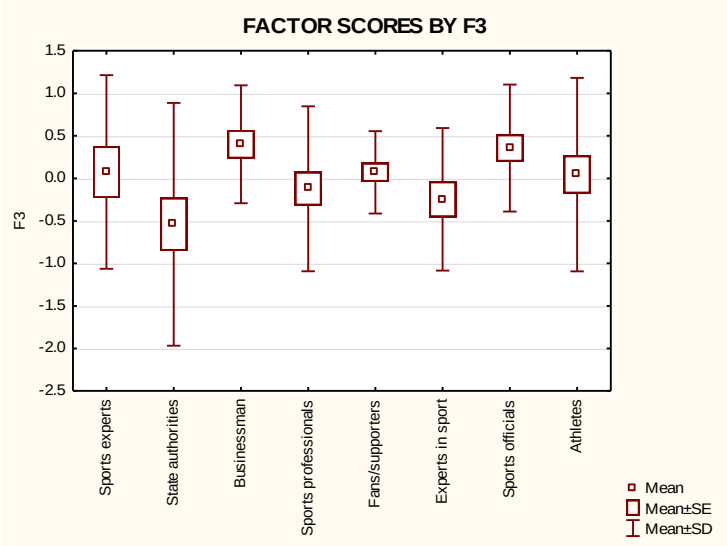
In the latent dimensions model of the analyzed space, 1st extracted Varimax factor described 0.2227% of the total registered variance. This factor statistically significantly saturated 7 analyzed manifest variables. By analyzing the structure of the variables that prominently defined this extracted factor, it can be concluded that respondents favor privatization to a smaller number of shareholders. In addition, it is important to determine the nature of this factor and the fact that stakeholders expect that the involvement of foreigners in the privatization process will result in a more efficient governance structure. These expectations are also reflected in the assumption that clubs with an appropriate management structure will achieve better competitive results. Therefore, the first extracted factor can be defined as a **dimension of the organizational aspect of successful privatization.**



Graph 2.

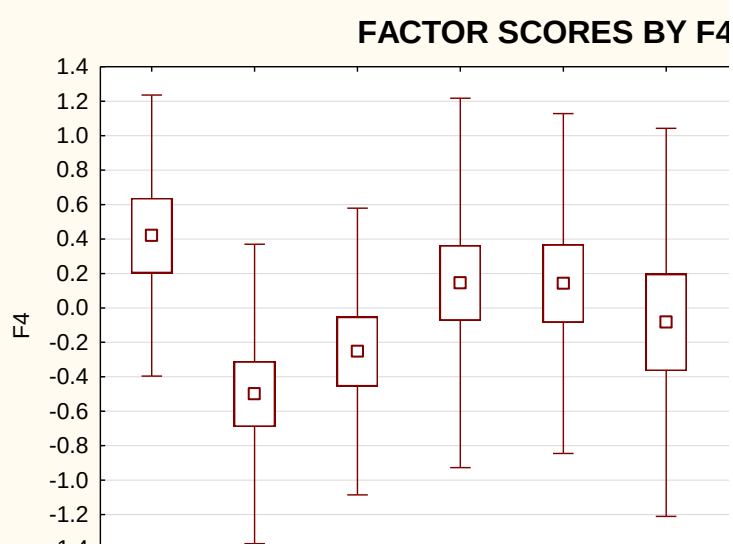
In the latent dimensions model of the analyzed space, 2nd extracted Varimax factor described 0.1251% of the total registered variance. This factor statistically significantly saturated 7 analyzed manifest variables. To determine the nature of this extracted factor, it is important to note that it unifies the respondents' expectations that after the privatization there will be an increase in the popularity of football, but that at the same time there will be a decrease in the negative phenomena that affect the football organization. Also, it is expected that the number

of volunteers engaged in football clubs will decrease. The natural consequence of the privatization of clubs is also a reduction in government investment, as the transformation is expected to increase the efficiency of their businesses and significantly provide the necessary funding from real sources. These facts allow the second extracted factor to be interpreted as a **dimension of the social collateral effects of privatization.**



Graph 3.

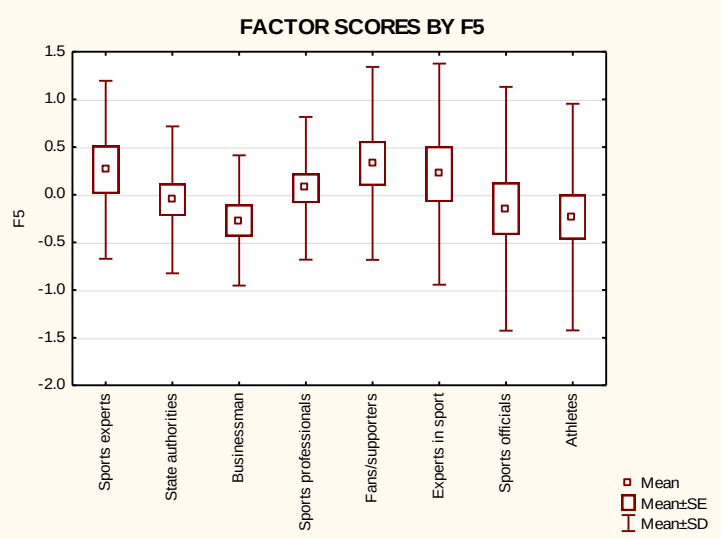
In the latent dimensions model of the analyzed space, 3rd extracted Varimax factor described 0.1027% of the total registered variance. This factor statistically significantly saturated 7 analyzed manifest variables. Variables saturated by the third extracted factor generally show information on material issues related to ownership transformation. This issue is described by the views on the extent of ownership interventions in the transformation process, then on the form of a more efficient use of the existing material basis, as well as on a more conscientious management of the club's assets. This structure of variables, which most significantly define this factor, suggests that this is **the dimension of material aspects of privatization.**



Graph 4.

In the latent dimensions model of the analyzed space, 4th extracted Varimax factor described 0.0897% of the total registered variance. This factor statistically significantly saturated 7

analyzed manifest variables. The structure of variables that projected significantly on this extracted factor primarily indicates the need to centralize management of the club and completely separate it from the influence of state government bodies, even in a situation where post-privatization sports performance would be worse. This tendency in the views expressed by the respondents indicates that this is **a dimension of the management aspects of privatization.**



Graph 4.

In the latent dimensions model of the analyzed space, 5th extracted Varimax factor described 0.0713% of the total registered variance. This factor statistically significantly saturated 10 analyzed manifest variables. The attitudes that saturated the last extracted factor were grouped into indicators that show biggest interest of spectators, which can be described by increased international competitiveness and a decrease in football-related malpractices and negative phenomena. This has the effect of increasing media interest for both fans and wider audiences, suggesting that this is **a dimension of the impact of privatization on the attractiveness of football.**

DISCUSSION

Nowadays professional sport has evolved significantly in two ways, simultaneously developing its sports component and, at the same time, more than that, its business component. In other words, professional sport has become a business that generates significant capital over the last few decades.

Regarding the comparative law analysis, we can conclude that ownership transformation of football clubs in Serbia guideline aims to consider the above tendencies in order to facilitate the development of professional sports in the Republic of Serbia. In this sense, the new law proposal should provide the possibility of transformation of sports association into sports business company and transferring a controlling interest in the capital of such a company to a private investor(s) or strategic partner(s), which enables all major business decisions to be made without interruption, including smooth investment of capital and profit sharing.

Essentially, the proposed ownership transformation model guideline aims at simultaneously stimulating private investment in professional sports in the Republic of Serbia and thus also decreasing state investment in this field (even indirectly), and with full respect for the

Constitution proclaimed the principle of freedom of association and protection of the built identity of every sport organizations.

Recognizing the fact that sports associations have been financed in the past decades in the way that most often entailed borrowing (not least because of financing existing obligations rather than long-term investments), many football clubs are burdened with significant debts and various demands from various creditors, who are not always in the books of the club precisely expressed. The proposal should respect all interests and protect the interests of the identity of the association, sport as an activity, the position of a private investor and also of creditors.

Each of the isolated basic dimensions of the explored space represents a potential motivational mechanism that determines to a significant extent the behavior of different stakeholder groups. In order to identify conflicting motives of different stakeholder groups, the significance of differences in factor scores, which were achieved by the individual baseline dimensions, was examined. All the groups of stakeholders had uniform views on the organizational aspects of successful privatization.

In the dimension of social collateral effects of privatization, a group of businessmen had significantly higher expectations compared to a group of sports experts, state authorities and experts in sport, which represents a possible conflict situation in privatization processes.

The material aspects of privatization represented a dimension in which significant differences were shown, that is, a possible point of conflict between businessman and sports officials in relation to the attitudes of state authorities and experts in sport.

The dimension of governing aspects of privatization polarized the analyzed stakeholder groups. Businessmen show a need for higher levels of managerial independence than experts in sport. Contrary, state authorities were significantly more skeptical than sports experts, sports professionals and experts in sport in regard to a higher degree of independence in club management.

The attractiveness of football is isolated in the research as one of the basic dimensions of the explored space in which significant differences are registered, that is, opposing attitudes between a group of businessmen and a group of fans/supporters. Specifically, businessmen are extremely optimistic about increasing the attractiveness of football through privatization processes, which fans do not share this statement.

The research results allow that both research hypotheses can be considered confirmed. In this way, the assumption was made that the phenomenon of privatization of football clubs was approached in a rational way. This means that all conflicting situations between stakeholders interested in and involved in the privatization process can be resolved through appropriate social and legislative measures, which would allow privatization to be carried out in the most painless, and thus most efficient manner.

The results of the research open the possibility for similar research to be conducted internationally, with larger samples of respondents, which would result in increased validity of the instrument developed in this research, as well as the stability of the results obtained. This would potentially create assumptions to develop a methodology for accessing privatization problems arising from the conflicting interests of stakeholder groups involved directly or indirectly in this phenomenon.

CONCLUSION

Based on the results of this research, which relate to the comparative analysis of privatization experiences of both Western European and Eastern European countries and to considering all existing theoretical models of ownership transformation of sports clubs, as well as the analysis of motivational factors in all stakeholder groups and potential stakeholders' conflicts, the following proposals and recommendations could be:

- Football Association of Serbia as a leading football authority in Serbia, together with all stakeholders in Serbian football, should initiate the process of adopting new legal solutions within the existing legal system and make a concrete proposal of guidelines and framework for drafting the Law on the transformation of sports associations into business companies with clear ownership structure;
- It is necessary to adopt a separate law as “Lex specialis”;
- German model of transformation football clubs into a business companies could be the starting point for defining the future model of ownership transformation of football clubs in Serbia.
- The transformation model should be based on the principle of the voluntary transformation due to fact that the freedom of association is guaranteed by the Constitution of Republic of Serbia;
- The sustainability principle of a sports association shoud be to achieve the following three goals: (1) preserving the tradition and identity of the sports club, (2) the protection of a youth school established by a sports association, which the sports association will continue to develop after the transformation has taken place and (3) involvement of a wider circle of persons in sports activities and decision-making processes;
- According to the regime prescribed by the Companies Law for Limited Liability Companies (LLCs), the most rational solution would be to transform clubs into sports companies in the form of limited liability companies.
- Protective mechanisms for changing the purpose of sports activities and sports facilities, as well as the restriction of the right to acquire capital in a sports company for precisely designated persons has been established with the aim of protecting the integrity of sport, preventing conflicts of interest and regularity of sports competition.
- New club owners should be given the opportunity to buy sports facilities if local governments declare themselves interested in selling them;
- Considering potential stakeholders interest conflicts, The Football Association of Serbia should motivate and invite all stakeholders group to take active part in the public debate and to contribute to the drafting of the law.

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FRACTURES OF THE LOWER JAW: ETIOLOGY, DIAGNOSIS, TREATMENT, POSTOPERATIVE CARE

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Abstract: The most common causes of fractures of the lower jaw occur in sports, at home, traffic accidents, fights and assaults. Each fracture is more or less specific. Signs of the fractures can be divided into: sure signs (abnormal mobility of fragments and crepitation) and uncertain signs (pain, feator ex ore, trismus, functio laesa, swelling, hyperwasalivation, occlusion disorder, deformation of the lower third of the face). The presence of all sure signs indicates the existence of the fracture. The absence of a sign does not necessarily mean that the fracture does not exist.Theses fractures can be classified depending on the anatomy of the lower jaw, the characteristics of the fracture, the number of fracture lines and the location of the fracture. The most common fractures are fractures of the condyle of the mandible, followed by the angulus and the corpus of the mandible.Fracture diagnosis is based on history, clinical and radiographic examination. Clinical examination includes inspection, percussion and palpation. Retroalveolar scan, OPG, CT and MRI are most often used for radiographic diagnosis.The goal of treating these fracture is to establish a good anatomical position of the fragments and normal occlusion. The choice of treatment method depends on the type and location of the fracture, the number and condition of the teeth, and the general health of the patient. Treatment can be divided into conservative and surgical. Treatment is mostly surgical and mostly reduced to intraoperative repositioning of fragments and fixation using mini-plates or screws. The appearance of complications is possible. In cases where complications occur, the operative field is reopened, the wound is cleaned and fragments are repositioned and fixed. When fractures do not require surgical treatment, treatment is carried out with exercises or physical therapy. Postoperative care includes good oral hygiene according to the instructions of the physician.

Keywords: *anatomy of the lower jaw, diagnosis of the fracture, treatment of the fracture, postoperative care*

INTRODUCTION

The lower jaw is the most prominent and the only mobile bone of the facial skeleton and is therefore most often exposed to injury. The most common causes of mandibular fractures occur in sports, at home, in traffic accidents, in fights and assaults. They can be classified according to the type of fracture, the, the direction of the fracture line, the state of the teeth and the location of the fracture. Good knowledge of anatomy, histology, physiology and pathophysiology made it possible to treat fractures of the lower jaw routinely, without severe complications and deformations for the patient. (1, 2)

For the surgeon himself, excellent knowledge of the anatomical structures of the head, good diagnostics, correct determination of therapy, quality selection of surgical technique and types of osteosynthesis and fixators are necessary.

In the past, the diagnosis of mandibular fractures was mainly made by clinical examination and palpation, while in recent years, preference is given to radiological diagnosis of injuries, orthopantomogram (OPG) and modern computerized tomography (CT), which does not reduce the value of clinical examination and knowledge of the clinical manifestations of individual

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fractures. The treatment methods have changed over the years, so today we have at our disposal fixations, modern titanium plates and screws that enable smooth fixation in the postoperative period and thus excellent and fast bone healing. (1, 2)

ANATOMY OF THE LOWER JAW

The lower jaw (*mandibla*) is an odd facial bone. Together with the temporal bone, it forms the temporomandibular joint. Its parts are: the horseshoe-shaped body (*corpus mandibulae*), two branches - right and left (*ramus mandibulae*) and jaw angle (*angulus mandibulae*). This is the only facial bone that is connected to the skull by a movable joint. (3, 4)
The *corpus mandibulae* consists of the lower part, the *basis mandibulae*, and the part above the *pars alveolaris*. At the point where the original separate halves of the lower jaw meet, there is an upright ridge, indicating the fusion of the fetal bone. Going down, the ridge forms a triangular field. *Protuberantia mentalis* forms the base of the triangular field. At the ends of the protuberantie mentalis there is a protrusion of the *tuberculum mentale*. Lateral to the tuberculum mentale, there is one opening *foramen mentale* on each side. An artery and a nerve of the same name (a. et n. mentalis) pass through the foramen mentalis. The body of the mandible can be viewed from the front, back and top. From the back, we can see the mylohyoid line (*linea milohyoidea*). Above the mylohyoid line is the *fovea sublingualis* in which the sublingual gland is located, and below and more laterally is the *fovea submandibularis* in which the submandibularis gland lies. The second part of the corpus mandibulae is the *pars alveolaris*. Its free end has depressions called *alveoli dentales*, in which the dental roots of the lower teeth are located. The forementioned recesses (*alveoli dentales*) are separated by partitions (*septa interalveolaria*). On the outside of this part of the trunk of the mandible, the roots of the teeth create protrusions (*juga alveolaria*). (3,4)
Ramus mandibulae has the shape of a bone plate and together with the body of the mandible forms an angle (*angulus mandible*). The value of this angle depends on age and gender, and ranges from 90° to 140°. On both sides of the angle there is a rough part and it is *tuberositas masseterica*, on the outer side and *tuberositas pterygoidea*, on the inner side. The *foramen mandibulae* is an opening in the middle of the inner side of the ramus of the mandibulae and leads into the *canalis mandibulae*. The canal extends throughout the mandible under the roots of the teeth. Blood and nerve elements are located in the canal, which are responsible for the vascularization and innervation of the lower teeth. (3, 4)
The *lingula mandibulae* is a bony tongue that limits the *foramen mandibulae* from the front. Towards the top, the *ramus mandibulae* ends with two processes: the anterior process (*processus coronoideus*) and the posterior process (*processus condylaris*), and between them is the *incisura mandibulae*. *Crista temporalis* is the front edge of the *processus coronoideus* and the muscle of the same name (*m. temporalis*) attaches to it. The front edge divides behind the back molar into two arms, which, together with the back edge of the last alveolus, limit the triangular surface (*trigonum retromolare*). The *processus condylaris* has an articular body (*caput mandibulae*) at the upper end, and the neck of the mandible (*collum mandibulae*) is located below it. On the front side of the colluma mandibulae there is a depression (*fovea pterygoidea*). (3, 4)

FREQUENCY OF FRACTURES OF THE LOWER JAW

According to etiology, all injuries and fractures of the lower jaw can be divided into those caused by systemic or local diseases, and those caused by external force. The most common causes of fractures caused by local diseases are: tumors, large cysts, osteomyelitis, muscle contractions due to electric shock. When the lower jaw bone is weakened, these fractures are called pathological fractures. The most common fractures caused by external forces are: sports

injuries (4%), traffic accidents (over 45%), fights (30%), falls (7%), work injuries (7%), war injuries, gunshot wounds and others. (5, 6, 7, 8)
These injuries are mostly in men, aged 21 to 30 years. The share of children under 14 years of age varies from 5% to 20%. Children over 6 years of age suffer maxillofacial injuries 4x more often than those under that age. (5, 6, 7, 8)
Associated injuries to other parts of the body are most often found in traffic victims, and are present in 1/3 of patients with maxillofacial fractures. One fifth of these patients have an associated injury that endangers the patient's life, which should be taken into account when triaging the patients. The most dangerous are injuries that endanger breathing, such as injuries of the larynx or pneumomediastinum, which according to most authors occur with fractures of the lower jaw. (5, 6, 7, 8)

SYMPTOMATOLOGY OF FRACTURES OF THE LOWER JAW

The signs of a mandibular fracture depend on the size of the injury itself, that is, on the degree of the injury. Each fracture is more or less specific, so a burst or linear fracture gives fewer symptoms than a double, comminuted or open fracture of the lower jaw. Signs of fracture can be divided into safe and unsafe. The presence of all sure signs of a fracture indicates the existence of a fracture, and the absence of certain signs does not necessarily mean that there is no fracture. (9,10)
Uncertain signs of a fracture are:
PAIN - at the time of injury, intense pain occurs, after which it decreases, it reappears when performing some functions such as speaking, swallowing, chewing. Pain is also present when palpating the injured area. By applying temporary or definitive immobilization, the pain gradually stops.
SWELLING - occurs in the first 6 hours after the injury, it is often associated with subcutaneous hematomas and discoloration. It occurs in the immediate vicinity of the fracture site and is the result of extravasation of blood vessels and lymph. In the case of swelling in a place that is far from the place of action of the traumatic force, the existence of the so-called swelling should be taken into account. indirect fracture.
FUNCTIO LAESA – is the impairment of the function of the lower jaw depends on the type of fracture. Most often, it is a disorder of opening and closing the mouth. When it comes to more severe forms of fractures, there is often a disturbance of functions such as speech, chewing, swallowing, etc.
TRISMUS - is the name for the condition of difficult or impossible or limited opening of the mouth, which is a consequence of the disturbed function of the masticatory muscles. Its presence can also be explained as a reflex defense mechanism, i.e. forced natural immobilization of fragments of the lower jaw. It is a common symptom of mandibular fractures, especially in angulus or ramus fractures.
HYPERSALIVATION - occurs as a result of altered anatomical relationships and a false sense of the presence of a foreign body in the oral cavity and is a common symptom of a mandibular fracture.
FAETOR EX ORE – as a symptom, it can be more or less pronounced with a fracture of the lower jaw. When physiological self-cleaning is absent during the chewing function, faetor ex ore occurs.
DISORDER OF OCCLUSION - the degree of malocclusion depends on the type and severity of the fracture, that is, on the degree of dislocation of the fragments. It manifests itself in the form of partial or total open bite, crossbite, or displacement of the center of the crossbite to the side of the fracture. Disturbance of occlusion is a common and quite striking sign of a fracture of the lower jaw, it rarely occurs in edentulous jaws.

DEFORMATION OF THE LOWER THIRD OF THE FACE - it is a consequence of the dislocation of fragments and traumatic edema and is more pronounced the greater the degree of dislocation of the fragments. This symptom is more or less pronounced when the lower jaw is at rest, it can increase during jaw movement. In single fractures, the chin part is more or less moved towards the injured side, and in double fractures, the chin is moved to the side of the more distal fracture line. (4,9,44)
Certain signs of a fracture are:
ABNORMAL MOBILITY OF FRAGMENTS - is present in the case of a complete interruption of the continuity of the lower jaw, whereby movements occur at the place of the fracture that are not present in that place in a healthy state. It is most often detected by a bimanual examination, where one hand first fixes one side, then the other, and the other hand tries to obtain abnormal mobility.
CREPITATION - exists only in case of complete fractures, and is manifested by a characteristic sound due to the friction of uneven bone surfaces in the place of abnormal mobility. You should not insist on this sign, because during rough manipulations, the continuity of the vein may be interrupted. and n. alveolaris inferior, a closed fracture can also turn into an open one. (4,9,10)

TYPES OF FRACTURES OF THE LOWER JAW

Fractures of the lower jaw can be classified differently, depending on its anatomy or the characteristics of the fracture, the number of fracture lines, the location of the fracture, etc. Each fracture can be unilateral or bilateral, while their combinations are rarer. (9,10)
There are several divisions of a mandibular fracture. Those are:

- ✓ fractures of the lower jaw according to the relationship between the fracture and the soft tissue;
- ✓ fractures of the lower jaw divided by the shape of the fracture;
- ✓ fractures of the lower jaw due to the action of traumatic force;
- ✓ fractures of the lower jaw according to the location of the fracture;
- ✓ fractures of the lower jaw according to the dislocation of the fragments;
- ✓ fractures of the lower jaw according to the number of fragments;
- ✓ special fractures;

CLINICAL PICTURE OF THE PATIENTS WITH A FRACTURE

The patients first report pain as a symptom, the intensity of which is increased by moving the lower jaw and swallowing saliva. Performing functions such as swallowing, chewing are difficult and painful or impossible. One of the most common signs of mandibular fracture is occlusion disorder. There may also be a sensitivity disorder in the innervation region of n. alveolaris inferior, then paralysis of n. facials. Upon inspection, swelling is observed at the fracture site as a result of edema and hematoma. If it is a fracture where there is a tooth in the fracture line, there is often an infection caused by microorganisms from the oral cavity. Deformity is also possible, which can be caused by the dislocation of fragments. Faetor ex ore is present in some patients. (9, 10, 11)

DIAGNOSIS OF FRACTURE OF THE LOWER JAW

The diagnosis of mandibular fracture is based on history, clinical and radiographic examination. In the anamnesis, we ask questions about the manner and type of injury, subjective and objective complaints of the patient. Anamnesis provides information about the patient's general state of health. It is important to exclude CNS injuries or polytrauma from the

diagnosis. During the clinical examination, all safe and unsafe signs accompanying fractures of the lower jaw should be determined. Inspection can reveal soft tissue hematoma or edema and very often impaired occlusion. The presence of edema can cause difficulties during palpation, so precise palpation of the bone is not possible and the degree of traumatic lesion cannot be determined with certainty based on the local findings. From the degree i.e. the severity of the injury depends on the signs of the fracture. Linear fractures without fragment dislocation cause few local symptoms and are often mistaken for soft tissue contusions. In fractures with dislocation, there are occlusion disorders to a lesser or greater extent. The skin and soft tissues in the immediate vicinity of the fracture are most often sensitive to the touch, the gingiva shows signs of bleeding or tearing. The lower third of the face may be deformed due to large dislocations of fragments of the lower jaw and consequent edema. In the case when the malocclusion does not indicate the type of fracture, palpation is used. Palpation is performed with both hands, examining whether there is a break in the continuity of the bone. Palpation should examine all those places that are suspicious of a fracture, in order to find out if there are abnormal movements or crepitations. If there is a fracture, the patient feels pain when pressing on the fracture, there is crepitation or movement. (12,13,14,15)

Fractures without dislocation, as well as incomplete fractures, are difficult to detect on the basis of clinical examination alone, but are confirmed by radiography. Treatment plan, treatment control depends on both clinical examination and radiographic findings. Radiographically, the classic retroalveolar imaging, orthopantomogram (OPG), computed tomography (CT) and magnetic resonance imaging (MRI) are most often used. Classic x-ray imaging involves two images, which are vertical to each other, oblique, lateral and posteroanterior images are also taken. (13, 14, 15)

Orthopantomogram (OPG) is most often used for the radiographic assessment of fractures of the lower jaw today, where, in addition to the fracture, the condition of all teeth in the upper and lower jaw is shown. The disadvantage of OPG is that in some fractures, the size of the dislocation cannot be accurately determined, so images from different directions are needed. (13,14,15)

CT is used to show mandibular fractures and offers the most detailed and comprehensive view of the facial skeleton. Recording is done in all 3 dimensions, and 3D reconstruction is also possible. The disadvantage of CT imaging is the high cost of imaging, the patient is exposed to a higher dose of radiation. This scan is done when we suspect a fracture of the mandible combined with fractures of the zygomatic bone, orbit and maxilla. When making a diagnosis, it is very important to rule out injuries to the spinal cord, neurocranium, large blood vessels, brain and other structures that could threaten the patient's life. (13,14,15)

METHODS OF TREATMENT OF FRACTURES OF THE LOWER JAW

The main goal of mandibular fracture treatment is to establish a good anatomical position of the fragments and normal occlusion. The success of properly repositioned fragments is reflected in the establishment of occlusion. The choice of treatment method depends on the type and location of the fracture, the patient's general state of health, and the number and condition of the teeth. (16, 17)

Methods of treatment of the lower jaw are divided into closed or conservative and open or surgical. Closed treatment methods include closed reposition and indirect immobilization through intermaxillary fixation, while open methods represent open reposition and direct fixation of fragments by osteosynthesis. (16, 17)

There are numerous conservative and surgical methods of treating mandibular fractures.

CONSERVATIVE METHODS OF TREATMENT OF FRACTURES OF THE LOWER JAW

Immobilization of jaw fractures by tying both jaws in the occlusal position is called intermaxillary fixation or mandibulomaxillary fixation, so there are numerous methods of establishing intermaxillary fixation. The results of repositioning and immobilization after establishing normal occlusion are controlled by radiographic examination. When the fragments are in the anatomical position on the X-ray, conservative therapy is continued, and if the fragments have not taken their anatomical positions, the surgical method of treatment is used. (16, 18)

SURGICAL TREATMENT OF FRACTURES OF THE LOWER JAW

Fractures of the lower jaw, such as fractures with an unfavorable line, fractures with multiple fragments, fractures with dislocation of fragments, fractures with a bone defect require surgical treatment (surgical repositioning, immobilization with interosseous fixation). Considering the location of the fracture, surgical treatment methods can be: intraoral, extraoral and combined. The surgical method of treating fractures allows the operator good visibility of the operative field, easy handling of fragments and simple osteosynthesis. When a fracture of the lower jaw is treated surgically, such an approach has 4 principles: immediate fixation, atraumatic performance technique, returning fragments to their original anatomical position and stable functional fixation. (9,10)

THE JAW FRACTURES IN CHILDREN

According to anatomical-histological characteristics and physical characteristics, the jaw bone in children differs from the jaw bone of adults. It is less resistant to trauma, more elastic and less rigid, the periosteum is well developed and resistant to trauma compared to the periosteum of adults, which is thin, easily torn and less resistant. Because of all the above-mentioned characteristics, the bone in children reacts differently to trauma. There is bending, bending of the bone and a special form of fracture known as "green stick". Fractures in children most often occur when they fall or are the result of injuries during play. Due to poor cooperation with the patient, clinical examination and X-ray imaging are difficult. Fractures that were not diagnosed in time, untreated or inadequately treated fractures represent a special problem in children. As a consequence of these fractures, there may be changes in the temporomandibular joint in terms of ankylosis, damage to the growth center of the lower jaw and deformity of the lower third of the face. It is very important when a fracture is suspected to carry out a detailed clinical and radiographic examination. Surgical methods of treatment are rarely applied because the permanent tooth embryo can be damaged by the material used for osteosynthesis. (9, 10, 19)

THE FRACTURES OF TOOTHLESS JAWS

Due to sclerotic changes in old age, fractures in all bones, especially in the mandible, are much more frequent. Loss of all teeth leads to resorption of the alveolar process, as well as atrophy of the body of the lower jaw. X-ray imaging is simple, because there are no teeth that can create difficulties in terms of camouflaging the fracture crack. During the clinical examination, the lack of teeth makes it impossible to observe occlusal disorders. The choice of treatment method depends on several factors. When the patient has his own prostheses, and it is a fracture without fragment dislocations, the prostheses are put on, and fixation is done with a simple or elastic bandage. If the patient does not have prostheses, prostheses can be made and fixed with a bandage as in the previous case. (9, 10)

COMPLICATIONS

Complications can occur immediately after the fracture, during the treatment of the fracture (early complications) and after the completion of the primary treatment phase (late complications). Various general and local factors influence the occurrence of complications and the frequency of occurrence is high. Among the general factors are various general diseases that cause changes in the bone system, such as rickets, osteomalacia, etc., then chronic diseases such as diabetes, diseases of the respiratory system, which lead to a weakening of the immune system. The appearance of complications can be influenced by poor nutrition, inappropriate drug therapy, especially antibiotic therapy. Local factors that contribute to complications are injuries to the soft and bony structures of the face and jaws, associated injuries, as well as inadequate treatment of individual injuries and fractures. As for the treatment of mandibular fractures, the reason for failure can be the error of the surgeon during the surgical procedure, infection, non-observance of postoperative guidelines and the complexity of the injury itself, i.e. the fracture. (9,10,20)

Complications according to the time of occurrence can be temporary or definitive. The most common early complications are: bleeding, infection, damage to the n. alveolaris inferior and n. facialis. The most common late complications are: slow healing, ankylosis of the temporomandibular joint, deformation of the lower third of the face, pseudarthrosis, failure of fixation, consequences of failure of fixation due to non-union of fragments and infections. Regardless of whether they are early or late complications, they require teamwork, that is, specialized surgical treatment according to all standards of today's surgical doctrine. (9, 10, 20)

POSTOPERATIVE CARE

Postoperative care begins at the end of the operation and lasts until the patient's recovery. It is important to explain to the patient, in a comprehensible way, the importance of the period after the operation and to follow the instructions given by the doctor. The importance of maintaining oral hygiene should be emphasized to the patient, in order to avoid the possibility of infection and the consumption of soft and mushy food. (9, 10, 17)

Physiotherapy is an important aspect of postoperative care. Laser therapy, ultrasound, electrotherapy and magnetotherapy can be recommended as physiotherapy methods. (9,10,17)

CONCLUSION

Fractures of the lower jaw are not often seen by a general practitioner, but the task of every doctor, if he is not an expert in a certain area, is to refer the patient to further treatment, that is, to refer the patient to a specialist. Therefore, every doctor of general medicine or dentistry is obliged to know how to recognize a fracture, provide first aid and refer the patient to a specialist (maxillofacial surgereon). Diagnosing fractures on time is of great importance, especially in children. An undiagnosed fracture or an inadequately treated fracture of the lower jaw has a number of consequences, such as ankylosis of the temporomandibular joint, deformation of the lower third of the face, etc. Today, thanks to the progress of medicine, the treatment of fractures is almost routine, and in most cases it does not leave lasting consequences for the patient.

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VITAMIN D AND HEALTH

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Abstract: In recent years, vitamin D has become a current topic in research, which has led to new knowledge about its physiological roles as a vitamin, hormone and immunomodulator. The classic role of vitamin D in the musculoskeletal system is well known, as well as the consequent strong negative impact on bone health in cases of vitamin D deficiency (rickets, osteomalacia, osteopenia, osteoporosis, sarcopenia and musculoskeletal pain). However, in the last two decades new actions of vitamin D have been discovered. Numerous studies indicate that vitamin D has many extraskeletal effects. These include the regulation of cell proliferation, differentiation, reproduction, immune and muscle functions, as well as cardiovascular and metabolic properties. The aim of this work was a theoretical consideration of the current knowledge about the physiology of vitamin D, the classical and new roles were summarized. Data on the causes of the vitamin D deficiency pandemic were reviewed and analyzed, and practical recommendations for the prevention and treatment of vitamin D deficiency were presented. Vitamin D plays an important role in health. Vitamin D deficiency has become a global public health problem. Vitamin D deficiency is closely related to functional disorders and various chronic non-communicable diseases. Therefore, maintaining an adequate level of vitamin D is important for improving health.

Keywords: cholecalciferol, homeostasis of calcium and phosphorus, new roles, deficiency, supplementation.

INTRODUCTION

The first clear descriptions of rickets were published between 1645 and 1668, successively by Whistler, Boot, Glisson and Mayow. The first if this quartet, Daniel Whistler, submitted a thesis for the degree of Doctor of Medicine in Leiden. Little progress was made over the next two centuries though there were reports that cod liver oil could heal rickets. The association between lack of sunshine and rickets was first recognized in the beginning of the 20th century and around 1920 healing of rickets with sunlight was reported. McCollum and colleagues gave the title "Vitamin D" in 1922, suggesting the existence of "a vitamin which promotes calcium deposition". (O'Riordan, & Bijvoet, 2014). Windaus and colleagues provided chemical syntheses of the vitamin D compounds, confirming their structures and making them available for the treatment of disease. For his contributions, Windaus received the 1938 Nobel Prize in chemistry. Further discoveries of great importance were the finding active metabolites of vitamin D, 25-hydroxyvitamin D (25OHD) and 1,25-dihydroxyvitamin D ($1,25(OH)_2D$), and expression of the vitamin D receptor and vitamin D-metabolizing enzymes in almost all human tissues (Deluca, 2014).

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In recent years, vitamin D has become a current topic in research, which has led to new knowledge about its physiological roles as a vitamin, hormone and immunomodulator. The classic role of vitamin D in the musculoskeletal system is well known, as well as the consequent strong negative impact on bone health in cases of vitamin D deficiency (rickets, osteomalacia, osteopenia, osteoporosis, sarcopenia and musculoskeletal pain). However, in the last two decades new actions of vitamin D have been discovered. Numerous studies indicate that vitamin D has many extraskeletal effects. These include the regulation of cell proliferation, differentiation, reproduction, immune and muscle functions, as well as cardiovascular and metabolic properties. The high prevalence of vitamin D deficiency is a particularly important public health issue, an estimated 1 billion people worldwide have a vitamin D deficiency (Nair & Maseeh, 2012). The aim of this work was a theoretical consideration of the current knowledge about the physiology of vitamin D, the classical and new roles were summarized. Data on the causes of the vitamin D deficiency pandemic were reviewed and analyzed, and practical recommendations for the prevention and treatment of vitamin D deficiency were presented.

Vitamin D Sources, Metabolism and Physiology

Vitamin D is a liposoluble vitamin of steroid structure. The two main forms of vitamin D are: vitamin D_3 or cholecalciferol and vitamin D_2 or ergocalciferol (the differences are situated in the side chain). Vitamin D is obtained by cutaneous synthesis and from foods or dietary supplements (Rosic, & Jakovljevic, 2022).

Skin synthesis is the main source of vitamin D for most people. When skin is regularly exposed to sunlight, cutaneous production satisfies 80-90% of needs (Laktasic Zerjavic, et al., 2011). Vitamin D_3 is synthesised in the skin by the action of sunlight containing ultraviolet B (UVB) radiation (wavelength 280-315nm), where previtamin D_3 is formed from provitamin 7-dehydrocholesterol. Previtamin D_3 is thermodynamically unstable and it is converted to the more stable vitamin D_3 in an isomerisation reaction which takes place in the plasma membrane of epidermal cells over a period of 2-3 days (SACN, 2016). One cm^2 of skin under the action of UVB rays, under optimal conditions creates 160 international units (IU) per day of vitamin D (Laktasic Zerjavic, et al., 2011). Cutaneously produced vitamin D_3 enters the extracellular fluid before diffusing into dermal capillaries. After entering the circulation it is transported to the liver bound to vitamin D binding protein (DBP), which is synthesised in the liver (SACN, 2016). Part of the vitamin D_3 that is created in the skin is sequestered and deposited in fat tissue for later use.

Dietary vitamin D supply becomes essential if there is insufficient cutaneous synthesis (generally caused by limited solar exposure during the summer and lack of UVB containing sunlight during the winter). The main dietary sources of vitamin D are foods of animal origin, fortified foods and supplements. There are few naturally rich food sources of vitamin D. Foods that contain significant amounts are mostly of animal origin and contain vitamin D_3. Rich sources include egg yolk (12.6 µg/504 IU per 100g) and oily fish (5-16 µg/200-640 IU per 100g), such as salmon, mackerel, herring and sardines (Finglas, et al., 2015). Vitamin D_3 has also been identified in the leaves of some plant species (which includes vegetables such as potato, tomato and pepper) (Jäpelt, & Jakobsen, 2013). Food sources of vitamin D_2 are limited, wild mushrooms are a rich natural source, (containing 13-30 µg /520-1200 IU per 100g fresh weight) (SACN, 2016). Foods are fortified with either vitamin D_3 or D_2, including milk, breakfast cereals, milk substitutes, yoghurts, cheeses, juices, and spreads with amounts ranging from 1-2.5-3.6 µg (40-100-144 IU) per serving. Dietary vitamin D supplements contain either vitamin D_2 or D_3 (Dominguez, et al., 2021; SACN, 2016). Dietary vitamin D is lipid soluble

and is absorbed with long-chain triglycerides in the small intestine. Dietary vitamin D_2 and D_3 are transported in chylomicrons via the lymph and blood plasma to the liver. Although vitamin D_2 undergoes similar metabolic transformations to vitamin D_3, it is unclear if all details of regulation and biological activity are identical to those of vitamin D_3 (SACN, 2016).

Both forms of vitamin D (endogenous and exogenous) are metabolized in the same way. The first hydroxylation step is in the liver where vitamin D is hydroxylated to 25(OH)D, which is the major circulating metabolite of vitamin D (Lips, 2006). It maintains the status of vitamin D in the body (sufficiency, insufficiency, deficiency), because its half-life in plasma is 2 weeks and its concentration correlates well with the appearance of secondary hyperparathyroidism, rickets and osteomalacia. That is why its concentration is determined when one wants to know the status of vitamin D in the body (Laktasic Zerjavic, et al., 2011). The second hydroxylation step is in the kidney and other tissues where 25(OH)D is converted to $1,25(OH)_2D$ (Lips, 2006). The concentration of $1,25(OH)_2D$ is significantly lower than the concentration of 25(OH)D and is 60-108pmol/L for adults, its biological activity is 500-1000 times higher than that of 25(OH)D, so it is considered active form of vitamin D and its production is strictly controlled through the activity of 1α-hydroxylase (Laktasic Zerjavic, et al., 2011). Synthesis of $1,25(OH)_2D$ is stimulated by parathormone (PTH), and inhibited by calcium ions (Ca^{2+}), as well as by $1,25(OH)_2D$ itself. When plasma calcium levels decrease, PTH levels rise and stimulate renal 1α-hydroxylase to increase production of the active vitamin. Because of the place where the active form of vitamin D is produced, it is called the "kidney hormone" (Rosic, & Jakovljevic, 2022).

24-hydroxylation is the first step in the inactivation of 25(OH)D and $1,25(OH)_2D$, in the kidney it is converted into 24,25-dihydroxyvitamin D ($24,25(OH)_2D$) (SACN, 2016), which is a water-soluble inactive metabolite that is excreted in the urine.

Vitamin D is a steroid hormone regulating the expression of almost 900 genes (Laktasic Zerjavic, et al., 2011). The active metabolite $1,25(OH)_2D$ enters the cell and binds to the vitamin D receptor (VDR). This complex forms a heterodimer with the retinoid receptor and binds to a vitamin D responsive element on a responsive gene, such as that of osteocalcin, calcium binding protein or 24-hydroxylase. This is followed by transcription and translation and proteins are formed such as the calcium binding protein or osteocalcin. Upon binding VDR, genomic and non-genomic actions are carried out by $1,25(OH)_2D$ (Lips, 2006).

Calcium and phosphate homeostasis are closely linked, primarily because of their roles in bone metabolism. PTH, vitamin D and calcitonin regulate the homeostasis of calcium and phosphorus, with the interaction of the endocrine, skeletal, digestive and urinary systems. Vitamin D has a hypercalcemic and hyperphosphatemic effect and acts at the following sites:

- In the gastrointestinal tract, it increases the absorption of calcium and phosphate in the small intestine. It increases the concentration of calcium and phosphate ions in the plasma, thus providing a suitable environment for bone mineralization.
- Increases bone remodeling. It increases the mobilization of calcium and phosphate, acting on osteoclasts and osteoblasts. Vitamin D is necessary for the balance between mineralization and resorption.
- It stimulates the reabsorption of calcium and phosphate in the kidneys.

Active vitamin D levels in the blood are tightly regulated by feedback control. The activation of the vitamin D by PTH is important in long-term calcium homeostasis. Vitamin D reduces the secretion of PTH. PTH stimulates bone resorption, while vitamin D plays a role in bone building and is necessary for the continuous remodeling process (Rosic, & Jakovljevic, 2022).

Classical Action of Vitamin D - Regulation of Calcium and Phosphate Homeostasis

Vitamin D is essential for skeletal health. The effects of vitamin D on mineral homeostasis are realized by the genomic effect (Laktasic Zerjavic, et al., 2011). Bone mineralization triggered by $1,25(OH)_2D$ occurs mainly by increasing intestinal calcium and phosphate absorption to maintain an adequate calcium–phosphate product, which crystallizes in the collagen matrix leading to bone mineralization. $1,25(OH)_2D$ stimulates the expression of osteocalcin, the main non-collagenous protein in the skeleton. PTH and $1,25(OH)_2D$ enhance bone resorption by eliciting the expression of receptor activator of nuclear factor kappa-B (RANK) ligand (RANKL) on osteoblasts cell membrane and releasing it into the circulation (Dominguez, et al., 2021). RANKL interacts with RANK on the monocytic osteoclast precursor cell, leading to maturation and activity of mature osteoclasts, bone resorption and thereby the release of Ca^{2+} and HPO^{2-} from bone (Dominguez, et al., 2021, Laktasic Zerjavic, et al., 2011). Thus, vitamin D, together with PTH, give rise to an endocrine network that plays a crucial role in maintaining calcium and phosphate homeostasis, as well as normal bone growth and mineralization (Dominguez, et al., 2021). A clear inverse relationship was established between serum 25(OH)D and PTH. When serum calcium levels decrease, PTH secretion is stimulated and activates $1,25(OH)_2D$ synthesis. Both PHT and $1,25(OH)_2D$ stimulate calcium renal reabsorption and mobilization from bones (bone resorption). In contrast, if serum calcium levels rise, PTH secretion drops, leading to a decrease of $1,25(OH)_2D$ and calcium mobilization. (Gil, Plaza-Diaz, & Mesa, 2018).

Vitamin D deficiency (VDD) results in abnormalities in calcium, phosphorus, and bone metabolism, and it is associated with diseases affecting bone health (rickets, osteomalacia and osteoporosis). VDD causes a decrease in the absorption of dietary calcium and phosphorus, resulting in an increase in PTH levels. The PTH-mediated increase in osteoclastic activity creates local foci of bone weakness and causes a generalized decrease in bone mineral density (BMD), resulting in osteopenia and osteoporosis. Osteoporosis is characterized by a decrease in bone mass and pathological changes of the microarchitecture due to a low serum level of 25(OH)D, leading to an elevated risk of osteoporotic fractures (Wintermeyer, et al., 2016). An inadequate calcium–phosphorus product causes a mineralization defect in the skeleton. Severe vitamin D deficiency (30 nmol/L) in infants or children, who have little mineral in their skeleton, this defect results in a variety of skeletal deformities classically known as rickets (Bouillon, et al., 2019; Nair & Maseeh, 2012). Osteomalacia, another metabolic bone disease mainly caused by malfunction of the vitamin D or phosphate metabolism, leads to a reduced bone mineralization in adults (Wintermeyer, et al., 2016). Osteomalacia is clinically apparent and found in patients with 25(OH)D serum levels <15-20 nmol/L (SACN, 2016).

In clinical studies, the concentration of 25(OH)D shows a positive correlation with mineral bone density in all age groups, especially in the elderly. In order to ensure bone health (to prevent a decrease in bone mineral density), the concentration of 25(OH)D must be at least 50 nmol/L, that is also the minimum therapeutic goal when supplementing vitamin D. According to the new guidelines, it is desirable that the concentration of 25(OH)D be ≥75 nmol/L, which is the optimal therapeutic goal for vitamin D supplementation (Laktasic Zerjavic, et al., 2011). Despite major progress during the last decades in understanding the role of vitamin D and its metabolites on bone homeostasis, many important questions remain incompletely answered.

Novel Extraskeletal Actions of Vitamin D

The expression of the VDR and of vitamin D-metabolizing enzymes in almost all human tissues and cells suggests a widespread role of vitamin D for overall human health. In line with this, numerous epidemiological studies documented that low 25(OH)D concentrations are

associated with an increased risk of all-cause mortality and major acute and chronic diseases, such as cancer, cardiovascular and autoimmune diseases, as well as infections (Pludowski, et al., 2022).

Other actions with evidence in the literature are those that involve muscle. The non-genomic effect of $1,25(OH)_2$ D is responsible for the rapid intramuscular influx of calcium ions. $1,25(OH)_2$ D accelerates the release of Ca^{2+} from the sarcoplasmic reticulum and increases Ca-ATPase activity. In this way, it accelerates the transport of Ca^{2+} and the amount of Ca^{2+} available for muscle contraction. On the other hand, the genomic effect of $1,25(OH)_2$ D in the muscle is realized through the highly specific VDR in the cell and is responsible for long-term, structural changes in the muscle (Laktasic Zerjavic, et al., 2011). Calcitriol activates multiple metabolic processes in the muscular tissue, resulting in the stimulation of protein synthesis and in an increased number of fast twitch muscle cells (type II fibers), responsible for high power output, fast muscle contraction, and muscle development. Both protein synthesis and increased type II muscle cells lead to the increased muscle contraction velocity and strength. These effects have led to a number of studies testing the association of vitamin D status with muscle strength and exercise performance in athletes. However, even if some studies in older populations seem to point to the positive effects of vitamin D supplementation on muscle performance, the results from studies conducted in athletes are inconsistence (Dominguez, et al., 2021). Many studies have shown an association between low vitamin D concentrations and an increased risk of fractures and falls in older adults. Vitamin D insufficiency (VDI) has been associated with reduced muscle performance and loss of fast-twitch type II muscle fibers. More severe VDD (values less than 30-20 nmol/L) causes clear, clinically manifest myopathy. In addition, VDRs are located on the fast-twitch muscle fibers and VDD causes changes in type II muscle fibers, which are responsible for fast and powerful muscle contraction and are the first to be activated during a fall. Myopathy manifests itself primarily in the proximal muscle groups (pelvic muscles and thigh muscles). This results in lower muscle strength, poorer balance and a higher risk of falling in people with VDD (Laktasic Zerjavic, et al., 2011). Based on an extensive meta-analysis, muscle (especially proximal muscle) strength may modestly improve with vitamin D supplementation of elderly subjects with serum 25OHD levels <30 nmol/L. A meta-analysis showed that daily supplementation of 700 to 1000 IU vitamin D significantly decreased the fall risk. There is at present no consensus regarding the potential beneficial effects of vitamin D supplementation on muscle function, balance, and risks of falls. However, overall the data seem to indicate that modest doses and daily provision of vitamin D supplementation of elderly vitamin D–deficient subjects may modestly improve muscle function, improve balance, and decrease the risks of falling. The optimal dose and dose frequency for maximal fall reduction remain to be established, as the high intermittent dosing or high serum 25OHD concentrations may increase the risk of falling in elderly subjects (Bouillon, et al., 2019).

The role of vitamin D in reducing the risk of cancer incidence and death has been studied for years. In recent decades, many experimental studies in cultured cells and animal models have described a wide range of anticancer effects of vitamin D compounds. Many studies have discussed of vitamin D antitumor mechanisms in particular cancer types (breast, prostate, colon, ovarian, gastric, thyroid, hepatocellular, leukemias, lymphomas, pancreas, lung, Kaposi's sarcoma, liver, renal). The most relevant topics of the anticancer action of vitamin D, underlying mechanisms include the control of tumor cell survival (autophagy, apoptosis) and phenotype (differentiation); and the inhibition of their proliferation, invasiveness, and metastasis; attenuation of the proliferation and phenotypic features of some effects on cancer stem cells; modulation of the physiology of diverse non-tumoral stromal cells (fibroblasts, endothelial cells); the regulation of several types of immune cells and responses; and systemic effects (detoxification and microbiome) (Muñoz, & Grant, 2022). Together, these effects

reflect a multilevel anticancer action of vitamin D. Therefore, an appropriate vitamin D status of the organism should be maintained to minimize the risk and severe consequences of many neoplasias.

Recent evidence links vitamin D with several non-bone ailments such as metabolic syndrome (MetSy), obesity, type-2 diabetes mellitus (T2DM), and cardiovascular diseases (CVD). The exact mechanism through which vitamin D ameliorates pathologies associated with these diseases is not clearly understood. However, it has been proposed that vitamin D functions in upregulating anti-inflammatory responses, stimulating insulin production, and improving insulin sensitivity. Dysbiosis related to low vitamin D has been associated with the risk of developing cardiometabolic diseases such as MetSy, obesity, and T2DM. A blood pressure-lowering function has been attributed to vitamin D since VDRs, 1-α hydroxylase, and 1,25(OH)2D are mapped in endothelial cells. Several mechanisms have been proposed to relate VDD and blood pressure. These include disruption in renin gene expression, and altered vascular tone through direct or indirect dysfunction of the endothelial and vascular smooth muscle cells (Sukik, Alalwani, & Ganji, 2023).

Active vitamin D modulates the immune response by interacting with innate and adaptive immune system cells, regulating the expression of cytokines, since macrophages, dendritic cells, and activated B and T lymphocytes express 1α-hydroxylase and VDR. Vitamin D is a well-known regulator of innate immunity, and the first data on this topic have been generated on the treatment of diseases caused by mycobacteria. Active vitamin D induces the production of antimicrobial peptides, including cathelicidin and defensing, by macrophage and monocyte increasing their antimicrobial activity, which could be essential in the eradication of bacterial or viral infections, as well as multiple cytokines, chemokines, and other signaling molecules. Moreover, $1,25(OH)_2D$ increases chemotaxis, autophagy, and phagolysosomal fusion of innate immune cells. Data in humans on infections other than mycobacterial have been generated on urinary and respiratory infections and on sepsis. Vitamin D is able to modulate innate immune system, also increasing the phagocytic ability on immune cells and by reinforcing the physical barrier function of epithelial cells. Several papers suggest that vitamin D is one of the actors of the complex relationship between microbiota living in the gut and immune system modulation (Sassi, Tamone, & D'Amelio, 2018). The innate immune system is the first line of defense against invading pathogens initiating the inflammatory response and activating the adaptive arm of the immune defense mechanism. The adaptive immune response involves specialized cells such as dendritic cells and macrophages that present antigen to effector cells such as T and B lymphocytes (Bikle, 2022). $1,25(OH)_2D$ is an inhibitor of T cell proliferation and activation thus inhibiting the production of pro-inflammatory cytokines, such as Interferon-γ (IFN-γ), interleukins (IL-6, IL-2), and tumor necrosis factor (TNF-α) (Sassi, Tamone, & D'Amelio, 2018), also inhibits B cell differentiation and antibody production (Gil, Plaza-Diaz, & Mesa, 2018). Numerous clinical studies have revealed associations between VDD and increased risk of infections, particularly of the upper respiratory tract. Connections between VDD and infections can be traced back to the 1800s with the recognition that sunlight was beneficial for patients suffering from tuberculosis. Another indication where vitamin D supplementation may be of therapeutic benefit is in the treatment of patients with inflammatory bowel disease (IBD), in particular Crohn disease (CD) (Bouillon, et al., 2019). The actions of vitamin D in the immune system have also raised the possibility that vitamin D supplementation may combat viral infections, including those caused by SARS-CoV-2. There is evidence from several preclinical and clinical studies that vitamin D supplementation can attenuate viral respiratory tract infections (Ismailova, & White, 2021). Overall, the immunomodulatory action of vitamin D ends in an increase of the innate immune response antimicrobial activity and the decrease of the adaptive immune response proinflammatory action. Taken together these data point to a role of vitamin D in defending the organism against

pathogens suggesting that vitamin D sufficiency has to be granted in patients affected by acute or chronic infection.
Thanks to the evidences of immunomodulatory effect of vitamin D the role of VDD and supplementation in autoimmune diseases has long been studied. Observational data have consistently confirmed an association between poor vitamin D status and all major autoimmune diseases. It has to be underlined that an impact of vitamin D on the immune system is usually cell type, tissue, or organ dependent. For instance, it was recently suggested that vitamin D could be useful in the prevention and treatment of autoimmune diseases such as multiple sclerosis, type 1 diabetes mellitus, autoimmune thyroid disease, IBD, rheumatoid arthritis, or systemic lupus erythematous (Zmijewski, 2019).

Causes of Vitamin D Deficiency

Serum 25(OH)D status varied according to age, gender, skin color and season. So older age, female gender, people with dark skin colour, less skin exposure to the sun and bad eating habits are the main factors associated with deficiency vitamin D. Synthesis of vitamin D is the only established benefit of solar UV exposure. The amount of vitamin D_3 made in the skin depends on exposure of the skin to UVB radiation and efficiency of cutaneous synthesis. Exposure of skin to UVB radiation is affected by a number of factors such as time of day, season, latitude, altitude, cloud cover, air pollution, as well as clothing and sunscreen use. Vitamin D production in the skin when exposed to UVB rays depends primarily on the solar zenith angle. The solar zenith angle depends on season, time of day and latitude. When the solar zenith angle is increased (in the early morning, late afternoon, during winter and at high latitudes), UV radiation has to pass through more ozone which means that less UVB reaches the Earth's surface. UVB radiation is sufficient for year round vitamin D synthesis at latitudes below ~37^{o}N (SACN, 2016). Therefore, in the area of latitudes distant from the equator, i.e. above 35° north and south very little vitamin D is produced in the skin from the October to March of the month in year, regardless of the skin exposure to the sun. In the rest of the year it is enough to expose the skin of the face and hands to the sun for 10-15 minutes/day in order to create a sufficient amount of vitamin D in the skin, provided that they are not exposed to the sun early in the morning or late in the afternoon (Laktasic Zerjavic, et al., 2011). Therefore, the concentration of vitamin D shows seasonal variations. It is lowest in late winter and early spring, a highest in summer and early autumn. Seasonal variations in 25(OH)D concentrations have been widely reported, even in subtropical locations with sunny weather year-round. Bolland and colleagues, who reside in a subtropical location at latitude 37°N, there were seasonal variations in 25(OH)D [peak 25(OH)D - trough 25(OH)D] of 21 nmol/L in women and 39 nmol/L in men. The amount of seasonal variation of 25(OH)D is likely to be determined by the latitude and the climate. Seasonal changes in cloud cover also may contribute to the greater atmospheric absorption of UV radiation. In addition, exposure of the skin to UVB is generally decreased during the colder months, because more clothes are worn (Bolland, et al., 2007). Epidemiological studies consistently show that people with dark skin colour have lower serum 25(OH)D concentrations than those with lighter skin colour. It is not clear if this is due to differences in physiology or differences in lifestyles (e.g., sun avoidance behaviour). However, the pigment melanin, which gives skin its brown or black colour, absorbs UV radiation (SACN, 2016). Therefore, individuals with higher amounts of melanin, conferring a darker skin color, would have reduced vitamin D_3 synthesis. This has been examined in studies that compare vitamin D status between different racial/ethnic groups. These studies have shown that racial/ethnic groups that are generally darker skinned have lower 25(OH)D concentrations than groups with lighter skin color living in the same geographic area (Sawicki, et al., 2016). Sunscreen use is recommended for the prevention of sunburn and skin cancer, which has raised

concerns that its application may inhibit or prevent vitamin D synthesis (SACN, 2016). Older adults are at high risk of developing VDI because of aging. Their skin cannot synthesize vitamin D as efficiently, they are likely to spend more time indoors, and they may have inadequate intakes of the vitamin (Nair, & Maseeh, 2012). The lowest measured concentrations of vitamin D and the highest prevalence of vitamin D deficiency are found in the elderly institutionalized persons (Laktasic Zerjavic, et al., 2011). It is possible that the lower serum 25(OH)D concentrations reported in older people could also be due to the development of conditions that become more common with increasing age (such as reduced liver and/or kidney function) (SACN, 2016).

Various diseases, conditions and medications can lead to vitamin D deficiency. There is an inverse association of serum 25(OH)D and body mass index (BMI) >30 kg/m^2, and thus, obesity is associated with VDD. This relation may occur because vitamin D and its metabolites are fat soluble, which leads to greater sequestration in the adipose tissue of obese persons. Other possible explanations would be that overweight persons have less exposure to sunlight because of their choice of clothing or because of lower exercise levels and less mobility. Also, because vitamin D is fat soluble, therefore it requires some dietary fat in the gut for absorption. Fat malabsorption is associated with a variety of medical conditions including some forms of liver disease, cystic fibrosis, and Crohn's disease. Patients with one of the fat malabsorption syndromes and bariatric patients are often unable to absorb the fat soluble vitamin D, and patients with nephritic syndrome lose 25(OH)D bound to the vitamin D-binding protein in the urine. Patients on a wide variety of medications (antiepileptics, barbiturates, rifampicin, glucocorticoids), are at risk because these drugs enhance the catabolism of 25(OH)D and $1,25(OH)_2D$. Patients with chronic granuloma-forming disorders (sarcoidosis, tuberculosis, and chronic fungal infections), some lymphomas, and primary hyperparathyroidism who have increased metabolism of 25(OH)D to $1,25(OH)_2D$ are also at high risk for VDD (Nair, & Maseeh, 2012).

Screening of Vitamin D Deficiency in Adults

European expert panel stress that it is currently not justified to recommend a general screening for vitamin D deficiency by measuring 25(OH)D concentrations in the whole general population. Nevertheless, considering that certain groups of individuals or patients are particularly prone to VDD and may particularly benefit from vitamin D treatment, they suggest, in line with the Endocrine Society, that 25(OH)D measurements should be considered in these groups (Pludowski, et al., 2022), as listed in Table 1.

Table 1. Vitamin D Deficiency Screening Algorithm

Screening of Vitamin D deficiency should be considered in these conditions or patients:

1. Osteoporosis; Osteomalacia; Chronic kidney disease; Hepatic failure; Malabsorption syndromes; Hyperparathyroidismus; Chronic treatment with medications that influence vitamin D metabolism; Pregnant and lactating women; Institutionalized or hospitalized patients: Older adults (> 65 years) in general; Older adults with history of falls or a history of nontraumatic fractures; Granuloma-forming disorders; Chronic autoimmune diseases; Obesity (BMI ≥ $30kg/m^2$); Dark skin pigmentation; Different types of cancer; Certain cardiovascular disorders; Diabetes mellitus and its comorbidities; Certain neurological diseases; Recurrent acute respiratory tract infections.
2. In symptomatic patients with musculoskeletal pain
3. Before starting osteoporosis treatment with antiresorptive medications

Prevention and Treatment of Vitamin D Deficiency in Adults

In the literature, vitamin D status refers only to the concentration of 25(OH)D in the serum. It does not include vitamin D or its metabolites in fat or elsewhere, which might be quickly mobilised (SACN, 2016). Sufficient - adequate concentrations of 25(OH)D considered are 30-50ng/mL (75-125 nmol/L). Most nutritional vitamin D guidelines conclude that vitamin D requirements are met for the vast majority (i.e., 97.5%) of the population when achieving a target 25(OH)D concentration of at least 20 ng/mL (50 nmol/L). Recommended dietary reference intakes for vitamin D usually range from 600 to 800 IU/ day and should ensure a sufficient vitamin D status under conditions of minimal-to-no sunlight exposure (Pilz, et al., 2018). It is also recommended that older adults over 65 years, regardless of their bone mineral density, be provided with vitamin D supplementation in a daily dose of 800 to 1000 IU throughout the year, not just in the winter months. The stated daily dose of vitamin D is considered to ensure in most people a vitamin D concentration of at least 50 nmol/L, which should ensure bone health, even in conditions of reduced dietary calcium intake (Laktasic Zerjavic, et al., 2011). Pludowski and colleagues recommend a vitamin D supplementation dose of 800 to 2000 IU/day for adults who want to ensure a sufficient vitamin D status, with up to 4000 IU/day for certain groups, particularly for patients with obesity and malabsorption, as well as for individuals with a dark skin pigmentation. If a clinician is asked by a random individual which vitamin D dose is safe and very likely avoids VDD, a dose of 800 to 1000 IU/day should fulfill these criteria for the vast majority, even if individual characteristics, including the 25(OH)D status, is unknown (Pludowski, et al., 2022).

Individuals with a measured 25(OH)D concentration below 20 ng/mL (50 nmol/L) - Deficient, should be treated with vitamin D supplementation, but there is controversy in the scientific literature whether 25(OH)D concentrations between 20 ng/mL (50 nmol/L) and <30 ng/mL (75 nmol/L) - Insufficient justify vitamin D supplementation. The recommended dose range of 800 to 2000 IU per day is a reflection of various considerations underlying such treatment goals. When aiming for a minimum 25(OH)D concentration of at least 20 ng/mL (50 nmol/L), a daily vitamin D supplement dose of about 800 IU/day is sufficient for almost all individuals, even during the winter season, in Europe. Data are less clear on which vitamin D doses are required to achieve a 25(OH)D concentration of ≥30 ng/mL (75 nmol/L) in almost all patients, but doses may be in the range of about 1500 to 2000 IU/day or even higher. The classic rule of thumb that 100 IU of vitamin D/day increases serum 25(OH)D concentrations by about 1 ng/mL (2.5 nmol/L) seems to be a useful approximation. Evaluations of treatment success, by measurements of 25(OH)D, may be considered in certain patients, such as those with e.g., malabsorption, but this should not be done earlier than 6 to 12 weeks after starting vitamin D supplementation, as this is about the time that it takes to reach a steady-state in serum 25(OH)D concentrations. Although there is a seasonal variation in serum 25(OH)D concentrations, usually with higher levels during summertime, as a consequence of endogenous vitamin D synthesis in the skin, consensus statements, in general, recommend continuous and, usually, fixed doses of vitamin D supplementation throughout the year (Pludowski, et al., 2022). If a rapid correction of vitamin D deficiency is clinically indicated, a regimen with a higher initial vitamin D dose, i.e., 6000 IU/day, and in certain cases, even up to 10,000 IU/day, followed by a maintenance dose with 800 to 2000 IU/day is recommended. The clinical indications for a rapid correction of vitamin D are osteomalacia, patients with secondary hyperparathyroidism, osteoporosis patients with a very high fracture risk, extremely low 25(OH)D concentrations and reduced serum calcium concentrations (Pludowski, et al., 2022).
Regarding treatment of vitamin D deficiency and its prevention, promoting a healthy lifestyle by preventing or reducing obesity, regular physical activity with moderate sunlight exposure,

and a healthy balanced diet are also effective measures to improve both vitamin D status and overall health.

As for the prevention of vitamin D deficiency, Pludowski and colleagues recommend vitamin D_3 (cholecalciferol) over vitamin D_2 (ergocalciferol) for its treatment. Calcitriol ($1,25(OH)_2D$) and its analogues are used at much lower doses compared to vitamin D_3, have a relatively high risk of hypercalcemia and a relatively narrow therapeutic window, and are not recommended for the treatment of common vitamin D deficiency. Therefore, active vitamin D treatment is only indicated in certain diseases, such as chronic hypoparathyroidism, chronic kidney disease, or mineral and bone disorders (Ramasamy, 2020).

The risk of overdose, or intoxication, is small. Vitamin D toxicity can lead to hypercalcaemia which results in deposition of calcium in soft tissues, diffuse demineralisation of bones and irreversible renal and cardiovascular toxicity. Hypercalcaemia can also lead to hypercalcuria. Cutaneous synthesis of vitamin D is regulated so that prolonged sunlight exposure does not lead to excess production of cutaneous vitamin D because endogenously produced previtamin D_3 and vitamin D_3 are photolysed to inert compounds. High doses of oral vitamin D supplements have, however, been shown to have toxic effects. Studies suggest that plasma 25(OH)D concentrations associated with toxicity are above 375 nmol/L (SACN, 2016).

There are hardly any contraindications to correct vitamin D deficiency by vitamin D supplementation (e.g., kidney stones are per se no contraindication) except of rare conditions with an increased sensitivity to vitamin D treatment, such as inherited 24-hydroxylase-deficiency. This is a rare genetic disorder in which catabolism of vitamin D metabolites is impaired, leading to hypercalcemia, low PTH concentrations, and relatively high serum 25(OH)D concentrations along with an increased risk of nephrolithiasis (Pludowski, et al., 2022).

CONCLUSIONS

Vitamin D plays an important role in health. Vitamin D deficiency has become a global public health problem. Vitamin D deficiency is closely related to functional disorders and various chronic non-communicable diseases. Therefore, maintaining an adequate level of vitamin D is important for improving health. These findings point to a need for continued ongoing and future studies to better recognize the fundamental problem of vitamin D deficiency, and recognize the crucial role of maintaining adequate vitamin D status to improve bone health and overall health.

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MOTIVATION AND SATISFACTION LEVEL OF WOMEN PARTICIPATING IN RECREATIONAL SPORTS ACTIVITIES

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Abstract: Recreational Sports is the term that describes all sports activities in which people participate in their own free time with the aim of improving their health and quality of life. Many studies have been able to prove that regular recreational sports activities postpones and delays the decline of functional abilities (M. Misigoj-Durakovic et al. 2018, 111). Furthermore, regular recreational activities improves both physical and psychological health. The aim of this article is to determine the participants' level of motivation and satisfaction and the profile of the recreational sports middle-aged and elderly female participants.The sample was consisted of 32 middle-aged and elderly female participants who were regular recreational sports class attendees. For the purpose of this research they were asked to participate in 6 question survey. The questions referred to the participants' social structure, motivation level for attending the recreational activities and the level of their personal self-approval. The percentage calculation was used for the purpose of the survey analysis.There are many different reasons that motivate people to participate in the recreational sports activities, primarily they want to achieve their goals in terms of their physical wellbeing and reach self-fulfillment. This research results have shown that the participants' age is closely related both to the intensity of recreational activities and the desire for maintaining good health. The largest number of participants were between the ages of 56 and 65. A multiple choice question regarding participants' motivation was included in the survey. The participants also referred to other relevant facts which were crucial to determine the motivational aspects as well as the importance of recreational activities. To question 'Do you consider the recreational activity as an enjoyable activity?' 29 out of 32 or 90. 91% participants answered positively, while 3 or 9.09% chose the negative answer. All participants have expressed the wish to keep participating in the recreational sports program as often as possible, which represents an important information for this research. If it is our goal to motivate people to exercise and maintain the level of physical activity, it is important to determine the reasons why a person chooses a specific physical activity, with respect to their goals, values and opinions (Simunic and Baric, 2011, 45). These results will motivate professionals in the field of recreational sports to commit themselves to continue with the programming and organizing recreational sports activities specialized for women, with the aim of their health preservation and improvement.

Keywords: *survey, recreational sports, motivation*[2]

INTRODUCTION

Recreational Sports is the term that, according to Klaudije Galien, describes all sports activities in which people participate in their own free time with the aim of improving their health and quality of life. Taking into account all physiological changes that come with the process of aging, it may be concluded that the recreational sports activities aim to fulfil several goals, such as the maintenance or improvement of a person's function abilities, prevention of diseases, and

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the treatment and recovery processes of acute and chronic diseases. That being said we could conclude that regular recreational sports activities postpone and delay the general decline of functional abilities (M. Mišigoj-Duraković and ass. 2018, 111).
It has been scientifically proven that insufficient and reduced physical activity leads to deterioration of health in elderly people. Therefore, they must be constantly motivated to new challenges (Spencer, Rathus, 2000, 45). Similar issue was also analysed by Bjelajac (2006, 67-75). For his particular research, he used 32-question survey.
The results of the survey were similar and showed that the active participation in sports recreational activities during their free time had a positive impact on socialization of elderly women and their overall health status. Many individuals, as well as recreational sports centres have developed and presented programs that are not only for young and healthy population, it has been specifically adapted so that people regardless of age, gender, anthropologic characteristics can choose the program to meet their own personal needs. In this respect, regular physical exercise contributes to the creation of 'healthier' society, as well as ensures the general improvement of quality of life (Bartoluci, 2007, 57-61).
Motivation for sports recreation activities represents the subject of a large number of researches. There are several definitions that describe motivation, one of which is postulated by Bungić and Barić (2009, 67). They define motivation as internal impulses that directly trigger specific activity, which emerge as a direct result of one's needs, desires and new expectations. There are many different motives that stimulate individuals to start any kind of physical recreation programs, such as person's health status, obesity prevention, socializing, and escape from everyday life, improving cognitive abilities for the purpose of better concentration, academic and professional performance, etc. (Gudelj Šimunović and Vukelja, 2022, 1497-1505). A person’s abilities and characteristics and the time and environment in which the person lives influence all motivations.
The motivation is the ingredient that that gives the energy component to every activity, including sports, that determines the activity's form, duration and intensity. Nowadays, specific living conditions that typically do not correspond to the biological requirements of the human organism have found recreational sports to be a foothold for compensation and satisfaction of their personal needs (Andrijašević, 2010, 42). Both the lack of physical activity and other bad habits might speed up the aging process. Regular physical activity has a positive impact on both physical and mental health, it is the best medicine given to us by Mother Nature!

AIM

The aim of this article is to determine the participants’ level of motivation, satisfaction and the profile of the sports middle-aged and elderly female participating in recreational sports activities. The obtained results bind the experts to continue with the designing and organizing women’s sports recreation programs, within the framework of professional and scientific expertise and with the aim of preserving participants’ health.

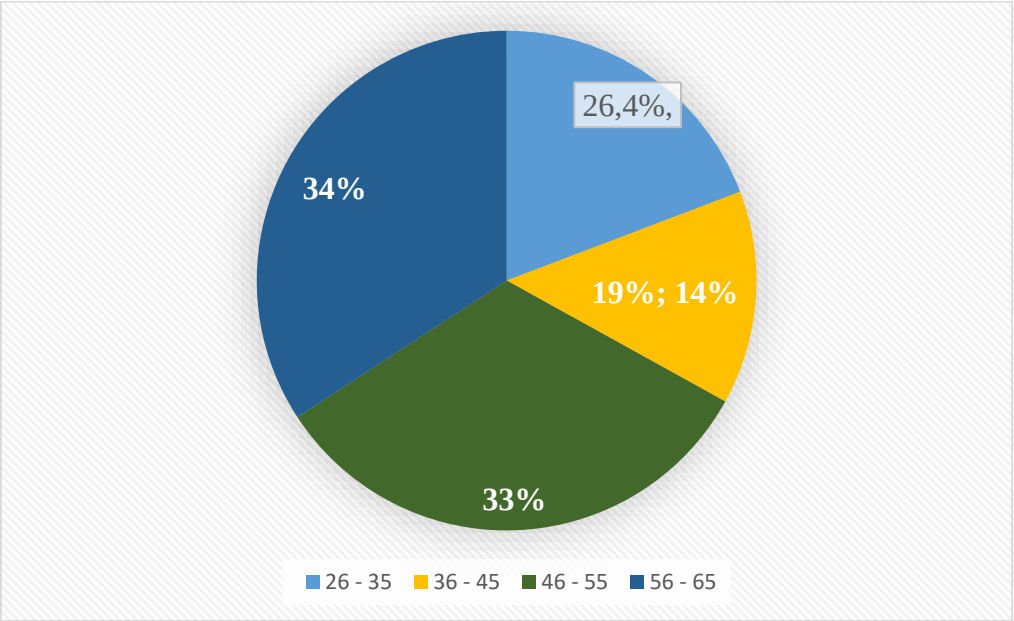
METHODS

The sample included 32 middle-aged and elderly female participants who were regular recreational sports class attendees. For the purpose of this research, they were asked to participate in 6-question survey. The questions referred to the participants’ social structure, motivation level for attending the recreational activities and the level of their personal self-approval. The percentage calculation was used for the purpose of the survey analysis.

RESULTS AND DISCUSSION

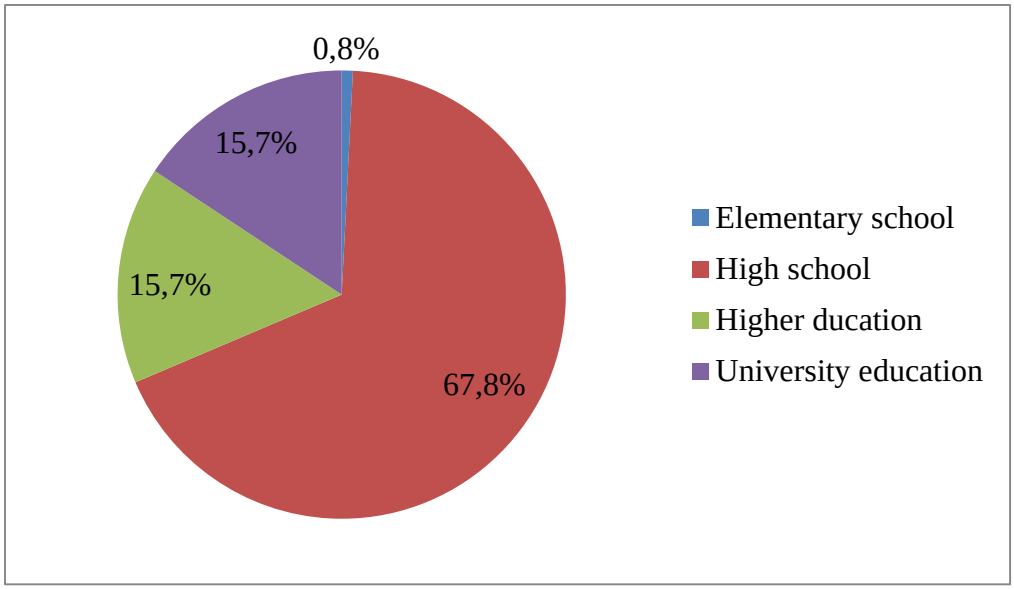
Since the chosen method was the survey, it was not an assessment of abilities and skills, the outcomes were to be expected and could be used to process data. The participants' age structure analysis has shown that the most attendees were between the ages of 56 and 65. The smallest percentage of attendees came from 36-45 group. (**Chart 1**). Out of 36 female attendees 26.4 belonged to the 26-35 group, 19% to 36-45 group, 33% to 46-55, while 34% were between the ages of 56 and 65.

Chart 1 The participants' distribution by their age



The survey has shown that the participants' age is closely connected to attendance consistency. The assumption that the older participants has shown a higher motivation for attending the sports recreation classes, can be interpreted with their awareness and wish to prolong and sustain their work productivity, as well as overall health, vitality and physical appearance.
The age difference within the group of female attendees did not prove to be demotivating factor, since it turned out that the regular physical activity could bring many positive changes and better functional ability, all in order to preserve their health and physical mobility.
Answer analysis based on attendees' education level **(Chart 2**) has shown that the majority of attendees are secondary education graduates (67.8%). The least percentage of participants were primary education graduates (0.8%).

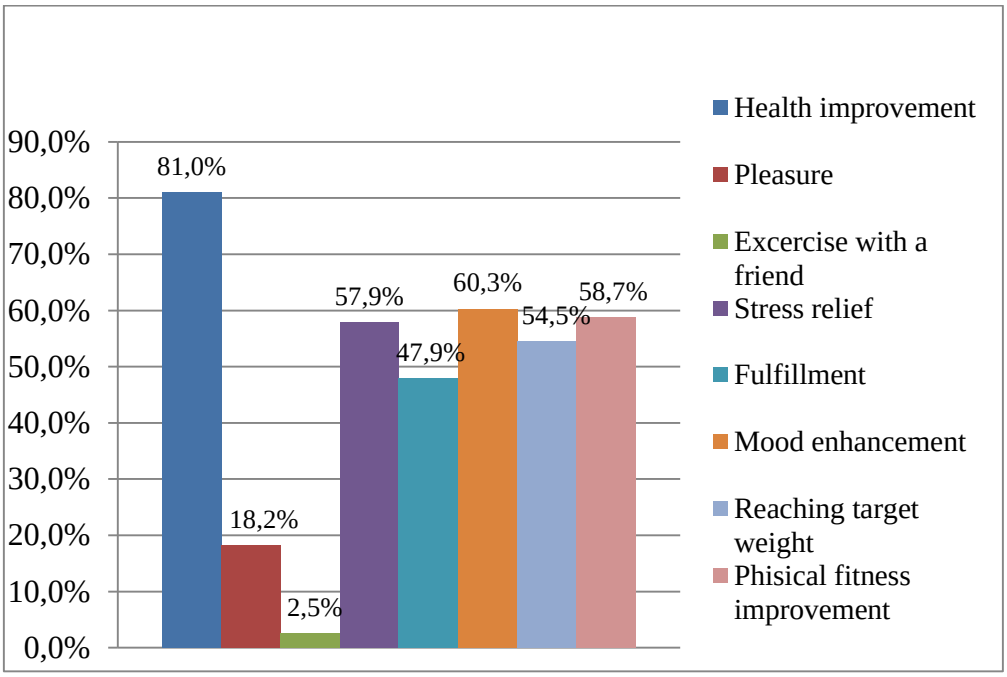
Chart 2 Attendees'' education level



The survey has proved that the educational structure does not represent a crucial criterion for a decision to attend recreational sports activities. With both higher and university vocational degree were 15.7% attendees, which proves the claim that the level of education has no influence on the awareness of the importance of exercise and health preservation.

There are many motives that inspire individuals to start exercise, meet their goals and personal needs. The question connected to attendees'' motivation **(Chart 3)** offered the option of choosing multiple answers, since it is highly probable that several different notions motivated the participants. All suggested answers were chosen by the respondents.

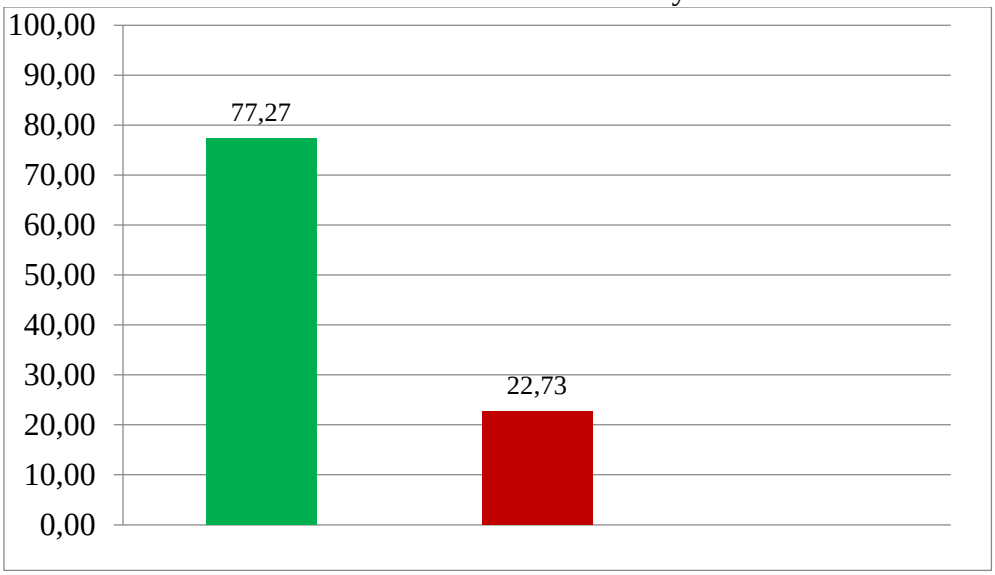
Chart 3 Attendees'' sources of motivation



81% of the respondents chose the health improvement, mood enhancement, stress relief and physical fitness improvement as one of the sources of motivation. Less represented motives were pleasure and fulfilment.
18.2% of participants opted for the Pleasure as a source of motivation, Exercise with a friend only 2.5%, while 57.9% respondents selected Stress relief. Forty-seven point nine percent (47.9) selected fulfilment, 60.3% opted for Mood enhancement, which was the second most common answer.
Fifty-four point five percent (54.5) selected reaching target weight, while 58.7% opted for physical fitness improvement.
In their research about physical exercise motivation of middle-aged and elderly women Rajković Vuletić and ass. (2022) specified the similarities and differences between different sources of motivation.
The results imply that the most common source of motivation in such age diverse group is the respondents' health condition. If we want to motivate individuals to participate in physical exercise activities it is crucial to determine the reasons why a person choses a specific activity with regard to the goals of exercise, one's values and attitude. (Šimunić and Barić, 2011, 19-25).

To the question 'Is working out twice a week enough?' **(Chart 4**), **out** of 32 respondents, 25 (or 77.27 %) answered negatively, while seven (22.73%) thought that it is sufficient.

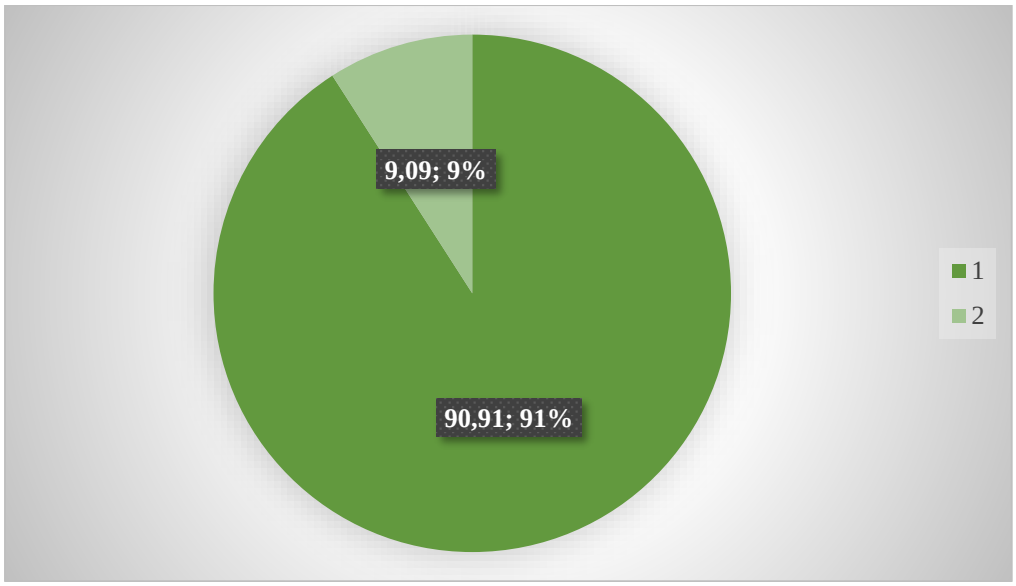
Chart 4 A sufficient number of weekly workouts



The fact that 77.27 % of participants thought that two workouts per week is insufficient, can be in correlation with the correct employment of designed exercise program under kinesiologist's professional guidance. The tendency to increase the number of weekly workouts indicates the attendees'' awareness of the benefits of exercise and its direct positive impact both on their health and preservation of their functional abilities.
Under the personal trainer's professional guidance, the participants feel safe and looked after. Taking into consideration the group's diverseness, the important notion is that the majority of attendees emphasizes health as a primary motive for regular physical exercise and that two classes a weak has proved to be insufficient.

To question 'Do you consider exercise to be an enjoyable activity?' out of 32 participants 29 (90.91%) answered positively, while three (9.09%) answered NO. (**Chart 5**).

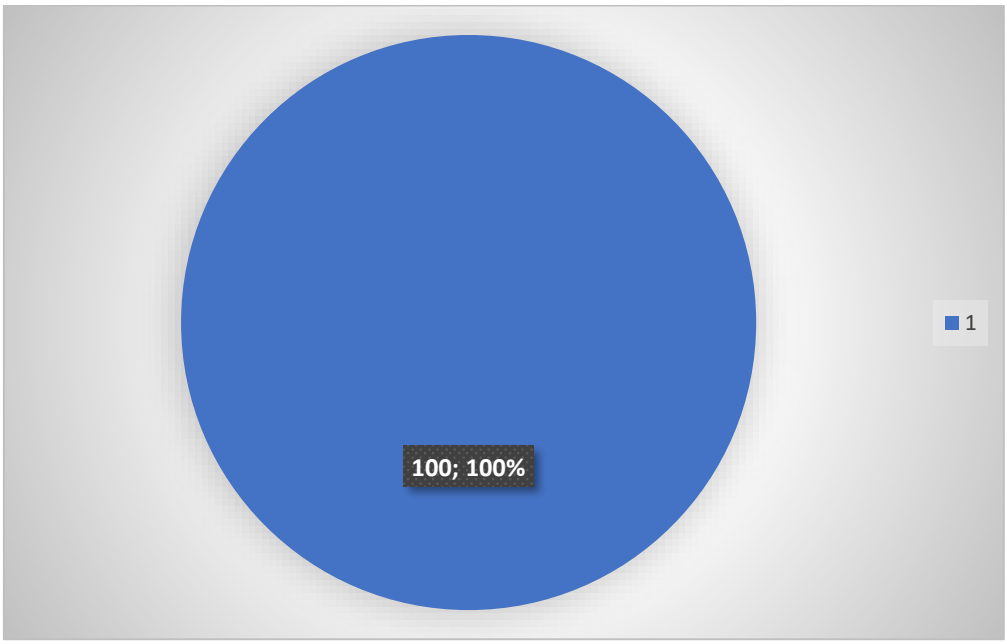
Chart 5 Enjoying physical exercise



Further analysis of the respondents that did not enjoy exercise brought to the conclusion that those participants were attending the classes as an additional program or as a part of their physical therapy program. Regular physical exercise significantly improves the quality of life and boosts the essential motor skills. Physically active life will ensure a better quality of aging process, which represents an important motive for exercise.

To sixth question, 'Do you feel contentment after exercise?' (**Chart 6**) all 32 attendees' (100%) answered positively.

Chart 6 Contentment after exercise



One hundred percent positive answer to the question about the contentment after exercise leads to a conclusion that there is a high level of personal health awareness. The possibility to socialize with other participants provided the sense of belonging while at the same time increased the sense of contentment. It can be assumed that one hundred percent positive answer

to the question about the contentment after exercise is the direct consequence of coming back to recreational sports classes after COVID-19 pandemic.

Analysing the sample of regular attendees of sports recreation programs represents the research that has its justification and certainly can be expanded to a larger sample. Moreover, the results indicate that all attendees wish to attend sports recreation programs more frequently, which represents an important information for creating the prerequisites for increasing the number of exercise programs for women.

It is of an extreme importance to emphasize that there is no age limit when it comes to physical exercise (Andrijašević, 2006, 266-271). It is crucial to inform women of different exercise program and to remain constantly supportive in their attempts to include regular physical exercise in their lifestyle.

The obtained results bind the experts in the field of kinesiology to continue with the designing and organizing sports recreation programs for middle-aged and elderly females, constantly questioning participants' contentment with the program, as well as their particular expectations. Those continuous activities will greatly contribute to preservation of participants' overall health and their physical state after physical exercise. Today's specific lifestyle leads us to be aware of how and where to satisfy our needs and compensate for modern life's inadequacies.

Lastly, we can conclude that physical exercise has a positive impact on elderly persons' health preservation and quality of life, assuming that the exercise program is age-appropriate and with the individual needs in mind. If the above conditions are met, there will be no contraindications and side effects that may impair individual's health. Consequently, it is pivotal to constantly promote exercise by explaining its significance and all its benefits and therefore develop a habit of regular physical exercise.

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PHYSICAL ACTIVITY IN THE PREVENTION OF FALLS OF ELDERLY PEOPLE

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Abstract: Introduction: Physical activity must be such that the individual approaches it voluntarily, that such activity has a positive effect on his physical health, that it includes him or facilitates his inclusion in the social community, and that it gives him a sense of self-confidence and satisfaction. The total volume and type of physical activity required for the elderly is not very well defined. However, it can be concluded that the combination of physical activity (strength training, endurance training, exercises for the development of balance and mobility, ...) and adequate nutrition (sufficient intake of essential amino acids/sources of protein) is of crucial importance for preserving physical condition, motor skills and the health status of people of the third age, and therefore in the prevention of falls. The aim of the work is to collect evidence about the effectiveness of physical activity in the prevention of falls in the elderly by reviewing the available literature. Work method: The search included a review of relevant databases: Google Scholar, Pub Med, EBSCO, Academia Edu. Results: Three randomized controlled studies, one systematic literature review and two therapeutic studies were included in the literature review. Conclusion: Based on the review of available research, it can be concluded that the application of physical exercises in an individual can achieve social interaction, and in this way helps himself. Additional education is needed for the elderly population, as well as raising awareness in certain institutions.

Keywords: *fall prevention, social interaction, physical activity, health, old people, falls*

INTRODUCTION

Regular physical activity can bring significant health benefits to people of all ages, and the need for physical activity does not decrease with age, but it has been proven that it can prolong a healthier and more independent life, prevent disability, and significantly contribute to improving the lives of the elderly. In addition to the fact that every type of physical activity improves motor skills (strength, coordination, balance, agility), mental health (self-esteem, quality of life) and reduces the risk of cardiovascular and all other causes of death, regular participation in exercise improves mobility and functional independence in adults.
A fall is an event in which a person, without intention, ends up in a lying position on the ground or at a lower level. (1). Regardless of the health status of the individual, falls are associated with insufficient movement, reduced opportunities to perform daily activities (dressing, bathing, housework), and the risk of being admitted to institutions where the care of non-independent persons is provided. Arthritis, depression, cognitive impairment, vision, problems

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with balance and unbalanced gait, loss of muscle mass, as well as excessive use of medication increase the risk of falling (2).

ANATOMICAL DATA

The decline in old age not only causes physical injuries, health complications, and premature mortality but is related to the decline in quality of life and independence in conducting activities of daily life. The occurrence of fear of falling is common in older people. Fear causes insecurity, which increases the lack of independence and the avoidance of activities that could lead to a fall. Besides fear, reduced physical activity, or activity in general can be additional factors in the occurrence of falls, but they also have a significant impact on individual mental health disorders. Sometimes it happens that an elderly person who has experienced an unfortunate fall lies motionless and helpless for hours or even days. In such cases, they can suffer hypothermia, pneumonia, and psychological stress, and in some cases, death can follow. The most common injuries because of falls are dislocations or broken bones and joints (hip and spine), head injuries, skin scratches, and bruises.

CLINICAL STAGES

Epidemiology and risk factors

Falls are the second leading cause of injury-related mortality and morbidity in the elderly worldwide, as approximately 35-40% of people over the age of sixty-five experience this unfortunate event once a year. Such events in old age can cause numerous consequences, such as isolation from society, and at the same time require high economic losses both for the individual and for the entire society. At this age, an accidental fall is the first cause of unexpected death, and if the fall does not result in death, it becomes the main reason for disability, as well as for the loss of independence and the need for institutionalization. (3, 4).
Falls are caused by the patient's general health condition. There are numerous factors, i.e., risk factors for the occurrence of falls in a hospital facility. Common risk factors for falls are previous falls, use of a wheelchair, age over sixty-five, lower extremity prosthesis, and use of mobility aids.
Physiological risk factors for falling are reduced patient mobility, getting out of bed independently, and some chronic diseases and conditions. Physiological factors include activities that the patient performs without asking for help, one of which is going to the bathroom.
In addition to the mentioned general and physiological factors, there are also environmental factors, namely: weak lighting in hospital rooms, distance from the bathroom, bed without protective railings, inadequate surfaces for movement, slippery and wet floors, and use of inappropriate clothes and shoes.
With many of the factors previously mentioned, it is believed that there are more factors and that they are specific ones that relate to healthcare workers. The remaining possible factors are a decrease in the number of nurses, a work overload of nurses, and the replacement of skilled nurses with a less educated workforce.
These risk factors must be known in order to prevent falls and their consequences for the elderly.

Anamnesis and physical review

When a more complete assessment of risk factors is required, the focus is on identifying external, internal, and situational factors that can be reduced through targeted interventions.
Patients are questioned about previous falls, followed by more specific questions about the time and place of the fall and what they were doing. Witnesses are asked the same questions. Patients should be evaluated if they have had any previous or related symptoms (palpitations, shortness of breath, chest pain, dizziness) and if they have lost consciousness. Patients should also be examined to see if any obvious external or situational factors are involved. Medical history should include questions about past and present health problems, use of prescription and over-the-counter medications, and alcohol consumption. Since it is impossible to eliminate all risks of future falls, patients should be examined whether they were able to stand up without the help of others after the fall and whether there were any consequential injuries; the goal is to reduce the risk of complications arising from a future fall.
The physical examination should be comprehensive enough to rule out obvious internal causes of falls. If the fall was recent, a body temperature should be measured to determine if the fever was a factor. Heart rate and rhythm should be assessed to detect overt bradycardia, resting tachycardia, or irregular rhythm. Blood pressure should be measured in patients while lying down and after 1 and 3 minutes in a standing position to rule out orthostatic hypotension. Auscultation can detect many types of heart valve disease. Visual acuity should be assessed with the patient wearing their usual corrective lenses if they need them. Abnormalities in visual acuity should prompt a more detailed vision examination by an ophthalmologist. The neck, spine, and limbs (especially the legs and feet) should be assessed for weakness, deformity, pain, and limitations in range of motion.
A neurological examination should include testing muscle strength and tone, sensation (including proprioception), coordination (including cerebellar function), stationary balance, and gait. Basic control of body position and proprioceptive and vestibular systems is assessed using the Romberg test (in which patients stand with legs together with eyes open and eyes closed). Tests to assess high-level balance function include standing on one leg and walking with one leg in front of the other. If the patient can stand on one leg for 10 seconds with eyes open and walk correctly for 3m with the foot in front of the foot, there is minimal likelihood that there is an intrinsic deficit in body position control. The physician should assess positional vestibular function (for example, via the Dix-Hallpike maneuver) and mental status. (5).

TREATMENT

Physical therapy and exercise

Patients who have fallen more than once or who have problems with initial balance and gait testing should be referred for physical therapy or an exercise program. Physical therapy and exercise programs can be held at home if patients have limited mobility.
Physical therapists adjust exercise programs to improve balance and gait and correct certain specific problems that contribute to fall risk.
More general exercise programs in health care settings and the community can also improve balance and gait. For example, tai chi can be effective and can be done individually or in groups. The most effective exercise programs to reduce the risk of falls are those adapted to the patient's deficit provided by professional training of individuals with a sufficient balance challenge component conducted over a longer period (e.g., $\geq$ 4 months)

Many senior centers, YMCAs, or other healthcare facilities offer free, or reduced-cost group exercise classes geared toward seniors, and such instances can help with availability and persistence.

AIDS

Some patients benefit from the use of various aids (cane, walker). Canes may suit patients with minimal unilateral reduced muscle or joint function, but walkers, especially wheeled walkers, are more suitable for patients with an increased risk of falls due to bilateral leg weakness or impaired coordination (wheeled walkers can be dangerous for patients who cannot fully control). Physiotherapists can help adjust the shape or height of aids and teach patients how to use those Therapeutic devices and assistive devices.

MEDICATIONS

Medications that may increase the risk of falls should be discontinued or the dose should be adjusted to the level of the lowest effective dose. Patients should be evaluated for osteoporosis, and if osteoporosis is diagnosed, they should be treated to reduce the risk of fractures in the event of future falls.
If any other specific disorder is recognized as a risk factor, targeted interventions are needed. For example, drugs and physical therapy can reduce the risk for patients with Parkinson's disease. Vitamin D, especially taken with calcium, can reduce the risk of falling, especially in patients with a reduced amount of vitamin D in the blood. Pain management, physical therapy, and sometimes joint replacement surgery can reduce the risk of arthritis patients. A change in the use of appropriate glasses (unifocal glasses, instead of bifocal or trifocal) or surgery can help a patient with visual impairment.

Measures for environmental adaptation

Correcting environmental risk factors at home can reduce the risk of falls. For example, footwear should have a low heel, ankle support, and a firm, non-slip sole. Many patients with chronically limited mobility (caused by severe arthritis or paresis) benefit from combined medical and rehabilitation procedures and environmental adaptations. Wheelchair adaptations (movable foot platform to reduce stumbling during transfer, anti-tip levers to prevent backward tipping), and wedge seats to prevent falls in patients with poor balance in a sitting position or severe weakness when sitting or transferring.
Shoelaces can lead to more falls and other complications and should not be used in general.
Hip pads (pads sewn into special underwear) have been shown to reduce hip fractures in high-risk patients, but many are reluctant to wear them all the time. Softer floors (firm rubber) can help cushion the force of the impact, but a floor that is too soft (soft foam) can destabilize the patient.
Patients should also be educated on what to do if they fall and are unable to get up. Useful techniques include turning from a horizontal position to a vertical position, getting on all fours, crawling toward a firm support surface, and lifting. Frequent contact with family members or friends, a telephone that can be reached from the floor, a remote alarm, or a wearable emergency response device system can reduce the likelihood of lying on the floor for an extended period after a fall.

GOAL OF WORK

The aim of this paper is to show how physical activity can influence the prevention of falls in older people.

METHOD OF WORK

The search included a review of relevant databases: Google Scholar, Pub Med, EBSCO, and Academia Edu. Keywords used: fall prevention, social interaction, physical activity, health, old people, falls.

THE RESULTS

Systematic examinations included medical history and physical examination. In this way, we could see how the fall occurred, whether a person had fallen before, and where he or she suffered the fracture (5).
In a randomized clinical trial, it was examined whether there are different interventions for the prevention of falls, and they are divided into those that include the entire population without exceptions and specific groups in which the risk of falling is increased, namely: women, weak elderly people or people who have experienced at least one fall in the past Such interventions can be planned to affect the reduction of one internal or external risk factor or can be focused to reduce a combination of risk factors. However, physical activity represents a key role in the prevention of falls by limiting the reduction of muscle mass and strength and stimulating postural control and accelerating recovery after injury. It has been proven that a higher level of physical activity (MET $\geq$ 3) reduces the risk of falls by between 30 and 50% in every published study that aimed to examine the risks of falls in the elderly, the conclusion was that physical activity, even general activities, is an effective method for maintaining balance and preventing falls. However, there is still uncertainty as to what type of physical activity can give the best results in order to reduce the risk of falls As mentioned in the introduction, according to the guidelines for physical activity in the elderly it is recommended that physical activity to strengthen muscle groups be performed two or more times per week, for a total duration of 150 minutes per week at a moderate intensity. Some review studies have dealt with the recommendations of different specific exercise programs (strength, flexibility, and balance training) that could affect the regulation of fall risk. conditions in older people and leads to the prevention of undesirable events such as falls and damage to the functionality of certain systems. On the other hand, exercises aimed at improving strength and balance are highly effective in improving independence and preventing falls in the elderly.

CONCLUSION

Falls in the elderly are one of the most common phenomena that occur due to numerous internal and external factors, and they alone or in combination can lead to fatal consequences. The benefits of physical activity for improving musculoskeletal function and metabolic health are well known, while the total amount and type of physical activity required for older adults is not well defined. However, it can be concluded that the combination of physical activity (strength training, endurance training, exercises for the development of balance and mobility) and adequate nutrition (sufficient intake of essential amino acids) is of crucial importance for preserving the physical condition, motor skills, and health status of people in the third age, and therefore also in the prevention of falls. Based on the facts presented, the strategy for choosing an exercise program to improve the neuromuscular and cardiovascular status of the elderly should include the following:

- Weight training performed two or three times a week, through three sets of 8 to 12 repetitions with an intensity that progressively increases from 20 to 30% of one repetition maximum (RM).
- To improve functional abilities, endurance training should be based on performing tasks such as walking with a progressive increase of 5 to 30 minutes per session.
- Balance training should include exercises such as standing on one or both legs, line walking, heel-toe walking, and weight transfer from left to right leg.
- Tai Chi program multi-component exercise programs should include a gradual increase in volume, intensity, and difficulty of exercise performance, along with the simultaneous performance of resistance, endurance, and balance.

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