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THE CHARACTERISTICS OF PHYSICAL ACTIVITY PRACTICE IN THREE ROMANIAN SCHOOLS WITH DIFFERENT ETHNIC GROUPS

SANDOR IOSIF[1*], ISIDORI EMANUELE[2], TADDEI FRANCESCO[2], KALININ RĂZVAN[1]

ABSTRACT. The lifestyles of minor ethnic groups in Romania are significantly different due to several habits inherited from ancient times. Being these differences significant, we presume that they could influence the physical activities the people from different ethnic groups practice in their free time. In particular, our study will focus on physical activities practiced by young people from three high schools with curricula taught in Hungarian, Ukrainian, and Slovakian language. The main aim of our paper is to deepen the influence of parents on physical activities practiced by students from the three Romanian ethnic groups mentioned above. The study aims to understand parents' impact on the motivation for physical activity practice in these people. In this regard, we will show some data regarding this influence. The data was collected by a questionnaire administered to three groups of Hungarian, Ukrainian, and Slovakian students from the northern and western part of Romania. The questionnaire was administered to a sample of 149 adolescents. Our data shows the primary role played by parents as the main educational agent in influencing and determining the involvement of adolescents in physical activities. In conclusion, this study would want to encourage Romanian parents from the tree ethnic groups object of our research to take awareness of their parental and educational role as social agency promoting sport and human values and influencing the motivation for physical activity in their children independently of their cultural, social, economic, and political heritage.

Keywords: *ethnic groups, physical activity, parents, education.*

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Introduction

The nation of Romania is home to many ethnic groups. The members of these ethnic groups are Romanian citizens but have several cultural and linguistic characteristics and are animated by the will of maintaining a collective identity with regard to culture, traditions, and language of the nation from which their original families come. At the international level, Romania is unanimously recognized as a country very committed to protecting its national minorities.

It is known that minority ethnic groups complement Romanian traditions, history, and culture. Nowadays, about 10.5% of Romania's population is represented by minorities (the rest of 89.5% are Romanians).

The Hungarians and Ukrainians are considered principal minorities and, in a smaller number, the Slovaks. Our study aims to study young people practicing physical activities who are from the three ethnic groups. The sample of our research was taken from the three historical regions situated in the north and west of Romania.

The Hungarian minority in Romania consists of 6.1% of the total population (1,227,623 citizens, according to the 2011 census), and it is the most significant ethnic minority of the country. From a historical point of view, Romanian people always had the most numerous and frequent contacts and interactions with Hungarian people living in the territories of their country.

In the last years, Hungarians living in Romania created and developed an influential network of educational, cultural, and information institutions. The results of their efforts can be seen in the extensive network of kindergartens, primary and secondary schools whose curricula are taught exclusively in Hungarian. Most of these Hungarians live in Maramureş County. In 2002, in the town of Sighetu Marmatiei, it was re-opened a former Hungarian school bearing the name of the pedagogue and revolutionary Leövey Klára (1821–1897), a Hungarian pioneer educator and women's' rights activist, who participated in the 1848 revolution.

The Ukrainians are the third largest ethnic minority in Romania. According to the 2011 Romanian census, they are about 51,703 people, making up 0.3% of the total population. Ukrainians mainly live in northern Romania, in areas close to the Ukrainian border. Over 60% of all Romanian Ukrainians live in Maramureş County (31,234), where they make up 6.77% of the population. Ukrainians make up a majority in seven communes of Maramureş County.

Since 1990, education taught in the Ukrainian language is going back to revive. In some schools in Maramureş, there are subjects taught in the Ukrainian language. In 1997, in Sighetu Marmatiei, secondary school "Taras Sevcenk" with education in the Ukrainian language was re-established.

After 1989, the social life of Slovaks all over Romania acquired a new dimension. Despite the natural process of integration after 1989, the region with the Slovakian population is preserving its specific features. Since the beginning of the nineties, the activities of local Slovakian organizations have been intensifying actions aimed at promoting the cultural, social, and political life of the population in rural and forest areas such as Bihor County.

The Slovakian population living in isolated localities is preserving its traditions and ethnic autonomy. In the vast majority of Slovakian mountain localities, the hard-living conditions did not allow the instruction level of the population to develop as it should be.

There exist Slovakian confessional schools in some areas, but most of the Slovakian schools, because of insufficient financial means, cannot develop a curriculum aimed to promote Slovakian language and cultural heritage. The activity of Slovakian Roman Catholic priests from Bihor County was highly relevant in the consolidation of Slovakian national identity in the region. The Slovak population has obtained and implemented the unitary development of the Slovakian network of schools. Budoi, in Bihor County, hosts the second high school in Romania with Slovakian as the primary teaching language: the Jozef Kozacek High School.

All those institutions we have mentioned contributed and are still contributing to the conservation of the cultural heritage of the three ethnic groups object of our research.

Nowadays, very few data are available on the physical behaviors of Hungarian, Ukrainian, and Slovakian adolescents from Romania. Even fewer are the data on physical activity behavior patterns of adolescents from the historical region of Maramures and Bihor County. Although they are all Romanian citizens, in the adolescents of the three ethnic groups there could be different views regarding the motivational valences and perception of physical activity.

Physical activity and sport are relevant for their contribution to the development and building of modern society. We have supposed that in each ethnic group (the Hungarian, Slovakian and Ukrainian one), there could be tendencies towards specific views and perception of physical activity valence and values (Sandor, Biddle, & Soos, 2010).

After joining the European Union, Romanians' lifestyles went through a significant transformation. Data on how physical activity influences the behavior of Hungarian, Ukrainian and Slovakian adolescents is very scarce, and our study aims to collect information to understand that better.

Some theorists argue that personality can be modeled by practicing physical activity in free time. Furnham (1990) has explored the effects of sport and recreational activities. He has shown that by socializing and changing the

way of life through different patterns of interaction with different individuals, the functioning of personality could be substantially changed.

We are convinced that, on the basis of traditional education and how it is imparted in the three small ethnic groups, the family plays a fundamental role in developing the attitude and motivation of youngsters towards physical and sports activities. The different ethnic ways of life, the tradition, and culture through which parents conceive education within their families play a crucial role in helping children acquire traditional ethnic values through physical activities (Marshall, Biddle *et al*., 2004).

In the north and western part of Romania, where these ethnic groups live, the economy is based on agriculture, mining, and logging, that is to say, on manual and physical labor. In the last decades, Romanian families, like those from ethnic minorities, due to relevant economic, social, and demographic changes, have experienced significant changes regarding lifestyles (Soos, Biddle, *et al*., 2014). Therefore, as an adaptation response, the ethnic groups living in Romania have changed their behaviors. The three ethnic groups have adopted a particular and specific way of life, which has affected and influenced the social, economic, political habits of their members. This effect and influence are mirrored in the principal attitudes towards practicing physical activity in free time, mainly active or sedentary behavior.

We present below data on how the Hungarian, Ukrainian, and Slovakian families influence adolescent's involvement in physical activity. Our scope is to provide prospective researchers with useful baseline data to investigate the changes in lifestyle and attitudes towards physical activity by adolescents in areas like northern and western Romania.

The ethnic and traditional lifestyles reflect the sociological status of the families. Therefore, we are interested in understanding what determines or does not the 14-17 years Hungarian, Ukrainian, and Slovakian adolescents' practice of physical activities. Also, we would want to understand whether there are similarities that concern the influence of the family regarding the practice of physical activities.

Methods

1. Participants

A sample of 55 Hungarian, 55 Ukrainian, and 39 Slovakian secondary school students aged between 14-17 years old has taken part in the study. The characteristics of the sample (sample size, gender, age) have been summed up in Table 1.

Table 1. Characteristics of the sample (sample size, age, standard deviation) divided by ethnic group and gender

Participants N (AGE - mean, Std.Dev.)		Ethnic group			
		Hungarian	Slovakian	Ukrainian	Total
Gender	Female	28 (16.11, 0.96)	26 (15.58, 1.17)	43 (15.37, 0.90)	97 (15.64, 1.03)
	Male	27 (16.11, 0.85)	13 (15.38, 1.12)	12 (15.92, 1.00)	52 (15.88, 0.98)
	Total	55 (16.11, 0.90)	39 (15.51, 1.14)	55 (15.49, 0.94)	149 (15.72, 1.02)

2. Questionnaire

The questionnaires were administered in the schools where the teaching language is Hungarian (in "Leövey Klára" High School in Sighetu Marmatiei), Ukrainian (in "Taras Sevcenko" High School in Sighetu Marmatiei) and Slovakian (in "Jozef Kozacek" High School, Budoi, Bihor County).

To carry out the research, a questionnaire validated in a previous study was used (Isidori, *et al*., 2014). The survey was aimed to detect the motivations, attitudes, and behaviors of adolescents concerning physical activity practice. The original Italian version has been translated into Romanian language and validated with a forward-backward translation procedure, verifying its comprehensibility, clarity, and conformity. Each student from the three ethnic groups speaks the Romanian language; therefore, they did not meet any problem in understanding the questions and answering.

In this research, only the data from questions dealing with the influence of parents and various educational agents on the choice and practice of physical activity by the Hungarian, Ukrainian, and Slovakian adolescents were analyzed. Participants responded to the statement, «your parents have influenced you to practice regular physical activity in your free time» and had to indicate their level of agreement on a 5-point Likert scale (1=at all; 2=less; 3=moderate; 4=much; 5=very much).

When asked, «who did influence you most in choosing the type of physical activity in your free time you are engaged in?» participants had to choose among the following options: 1. Parents; 2. Brothers or sisters; 3. My Physical Education teacher; 4. Another teacher; 5. A coach; 6. My friends; 7. Church; 8. Somebody else/who?

Also, the items from the same questionnaire aimed to detect the influence relating to who has influenced more the start of sports practice in the young Hungarian, Ukrainian and Slovakian have shown again how parents have been more influential than other social agents (codification of answers: A=Thanks

to my parents who have motivated me to join clubs, associations or sports circles; B=In the school through the participation in extracurricular activities; C= Through the suggestion of friends who practice various sports activities; D=Through my Physical Education teacher; E=Thanks to the sports offered within the town council; F=Thanks to the sports activities offered at the county or national level; G=Other).

3. Data analysis

A descriptive analysis was carried out by taking into account all variables of interest. The relationships between the answers and the ethnic groups were analyzed. For this reason, Cramer's V was calculated, and standardized residuals were analyzed to identify significant differences.

Results

Parents influence – Ethnic group

The analysis of the evaluations provided by the participants on the impact of parents in the regular practice of sport based on ethnic groups has shown significant differences (Cramer's V=.240, p<005). The analyses of the responses and standardized residues show that Ukrainians give greater importance to the influence of parents than other ethnic groups. The frequencies of the answers are significantly lower, compared to other ethnic groups, for the at All-less responses and higher for the "Much-Very much" reactions (fig. 1).

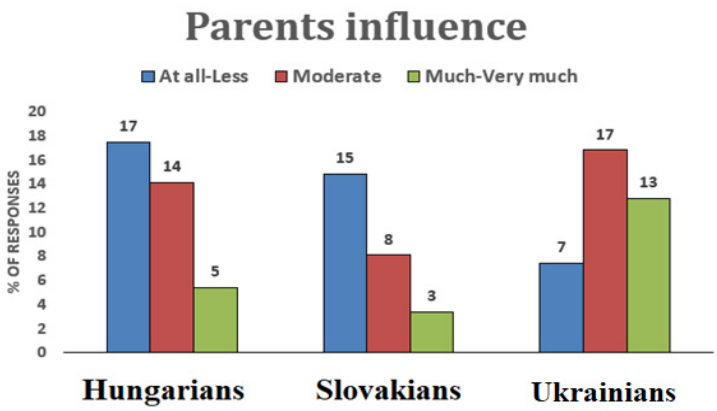

Fig. 1. Ukrainians declare that they give more importance to the influence of parents than other ethnic groups (Cramer's V=.24, P<.005)

Importance of practice - Ethnic group

Concerning the assessment given by adolescents on the importance of sports practice, the data analysis has shown significant differences (Cramer's V=.215, P<.01). Slovaks show higher frequencies in the "At all/Less" response than the other groups (Fig. 2).

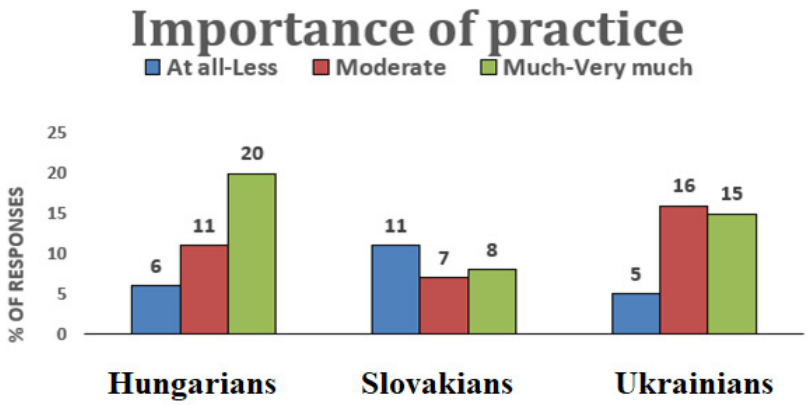

Fig. 2. Slovaks seem to give less importance to the practice of sport than other ethnic groups (Cramer's V=.24, P<.005)

Physical activity practice by Ethnic group

To the question «Do you practice physical activity and sport as free time activities?». The majority of participants answered "yes" (74.5%) (tab. 2). No significant differences have emerged from the answers by the ethnic groups.

Table 2. Answers to the question:
Do you practice physical activity and sport as free-time activities?

Participants N (%)		**Ethnic groups**			
		Hungarian	**Slovakian**	**Ukrainian**	**Total**
Physical activity	YES	41 (74.5%)	28 (71.8%)	42 (76.4%)	111 (74.5%)
	NO	14 (25.5%)	11 (28.2%)	13 (23.6%)	38 (25.5%)
	Total	55 (100.0%)	39 (100.0%)	55 (100.0%)	149 (100.0%)

Reasons for "yes" by Ethnic group

About the purposes for adolescents to practice physical activity, some differences emerged between ethnic groups (Cramer's V=.548, P<.001). For Slovaks, the predominant reason is physical development (20%), while for Hungarians, it is the harmonious development of Personality (18%). For Ukrainians, the main reason is "maintaining an optimal state of health" (10%), which, taken together with the answer "Personality," reaches 22% of the total responses.

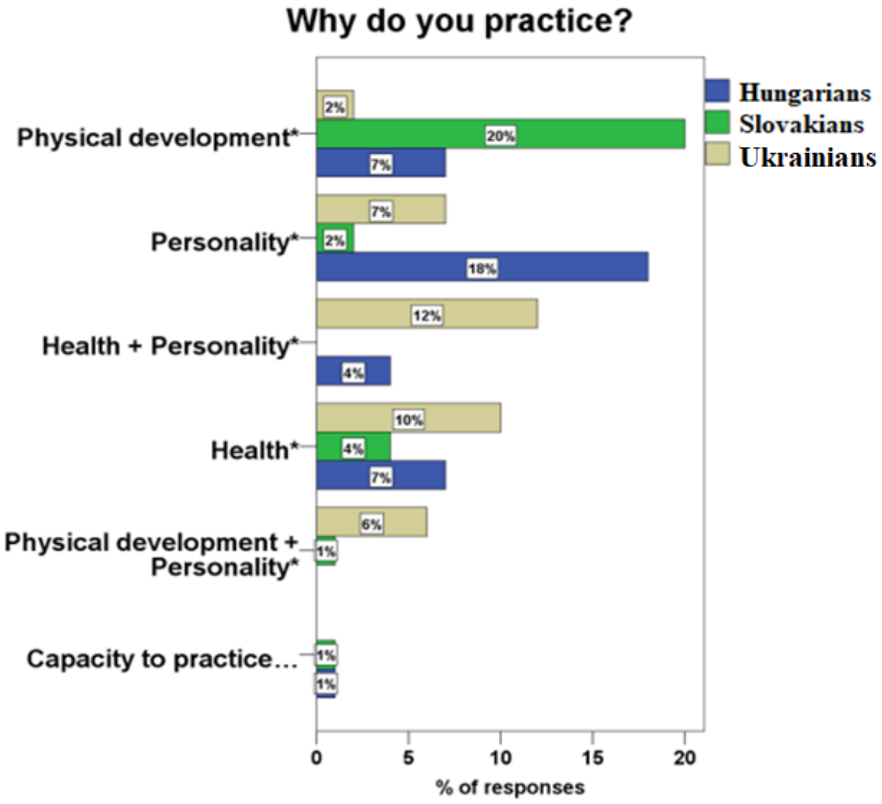

Fig. 3. Answers to the question *Why do you practice physical activity?* Asterisks indicate significant differences between ethnic groups

Reasons for "no" by ethnic group

The reasons for participants not to exercise are generally lack of interest (*I'm not interested*, 65%) and lack of time (*Lack of time*, 23%). Significant differences emerged among the groups (Cramer's V=.495, P<.05): in Ukrainians,

the answer "Lack of time" has obtained higher frequencies than the other groups (17%), while for Slovaks the most frequent reason is «I don't want to leave my family» (9%) (Fig. 4).

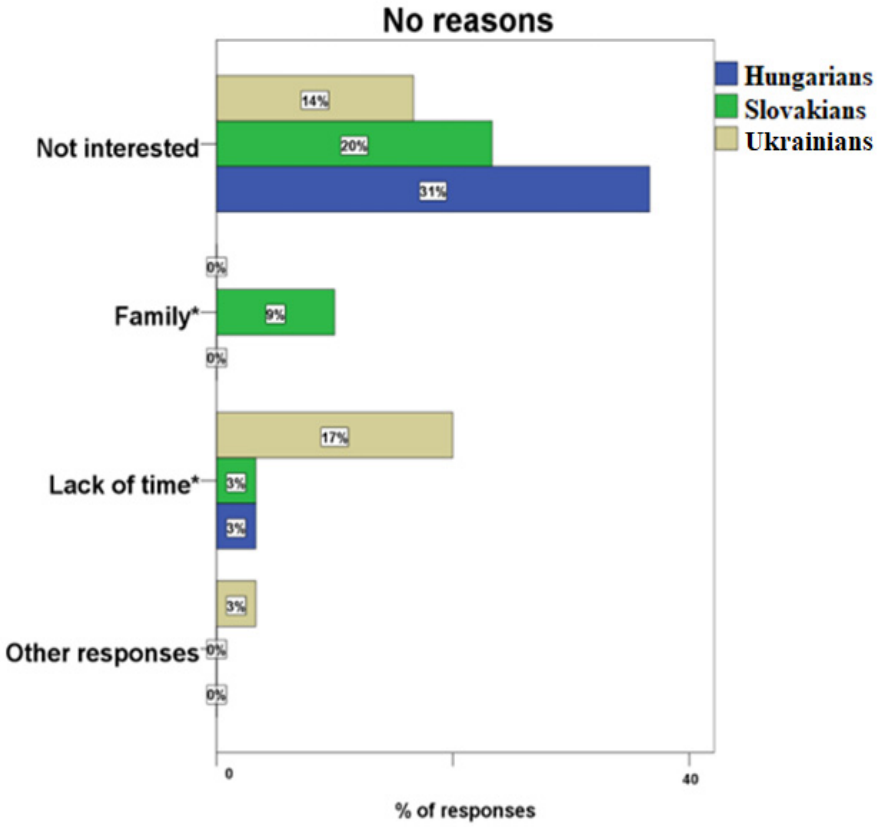

Fig. 4. Reasons for adolescents not to do physical exercise.
Asterisks indicate significant differences between ethnic groups

Analysis of answers concerning the question "How did you start" by ethnic group

The answers to the question *How did you start practicing physical activities*, they showed no significant differences between the groups. For all participants, the most frequent responses were: *at the suggestion of friends who practice various sports activities* (34%), *thanks to my parents, who have joined me in clubs,*

associations or sports circles (22%), *thanks to advise and guide of the physical education teacher* (15%), *in the school through participation in extracurricular activities* (14%).

Analysis of answers concerning the question "Who did influence you most" by ethnic group

The answers to the question *Who did influence you most in choosing the type of practiced physical activity you practice*, they showed no significant differences between the groups. The answers were very fragmented and difficult to interpret. For all participants, the most frequent responses were: My friends (14%), My Physical Education teacher (13%), Parents (10%), A coach (5%).

Discussion and conclusions

The data collected and used in our study should be carefully interpreted because they were obtained on a rather small sample of individuals. In summary, the data analysis conducted has shown that:

1) Ukrainian adolescents seem to give more importance to the influence of their parents than other ethnic groups in the choice of the physical activity they practice;

2) Slovakian adolescents seem to give less importance to the practice of physical activity than other ethnic groups;

3) the reasons for adolescents to practice physical activities seem to differ according to the ethnic group: for Slovaks, the predominant reason is physical development, while for Hungarians, it seems to be the harmonious development of personality; instead, for Ukrainians, the main reason is maintaining an optimal state of health;

4) as regards to the reasons that influence the decision not to practice sport for Ukrainian adolescents it seems to be the lack of time, while for Slovakian adolescents these reasons deal with the family;

5) all individuals have highlighted the primary role played by friends in influencing the choice to start physical activity practice and, secondly, that of parents;

6) Moreover, in the selection of physical activity, the role of friends seems to prevail, followed by the physical education teacher and parents' one.

More scientific relevance to our study might come, in the future, from the enlargement of the sample of subjects studied. Moreover, it might come from possible case studies one could carry out in the geographical areas of Romania, in which the three ethnic groups we have examined live. It is hoped that, in these studies, a mixed quali-quantitative methodology will be used.

This methodology will allow collecting quantitative data and going hand in hand with the understanding and interpretation, through narrative methods, of the values deriving from the cultural and social contexts in which Romanian adolescents with different ethnic origins live and practice physical activity.

REFERENCES

Furnham, A. (1990). *Personality and demographic determinants of leisure and sports preference and performance.* International Journal of Sport Psychology, 21:3, 218-236.

Isidori, E., De Santis, M.G., & Ramos Echazarreta R., (2014). *Sport, famiglia ed educazione: uno studio pilota sulle influenze dei genit ori nella scelta delle pratiche sportive degli studenti universitari di scienze motorie*. La famiglia. Rivista di problemi familiari, 48:1, 261-279.

Marshall S.J, Biddle S.J.H., Gorely T., Cameron N., & Murdey I. (2004). *Relationships between media use, body fatness and physical activity in children and youth: a meta-analysis*. International Journal of Obesity, 28:10, 1238-1246.

Sandor I., Biddle S.J.H, & Soos I. (2010). *The Relation Physical Activity-Rural Space Concerning Romanian 13-18 Age Youth.* Journal of Settlements and Spatial Planning, 1:1, 18-21.

Soos I., Biddle S. J. H, Boros-Balint I., Sandor I, Szabo P., Hamar P., & Simonek J. (2014). *Prevalence of sedentary behavior in young people in Romania and Slovakia*. European Physical Education Review, 18:1, 19-46, DOI: 10.1177/1356336X11430659.

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SPORTS, PHYSICAL ACTIVITY AND PELVIC FLOOR MUSCLE DISORDERS

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ABSTRACT. Introduction: Physical activity is essential to leading a healthy lifestyle; however, in some cases (when not adequate to one's individual needs, both quantitatively and qualitatively), it might lead to unforeseen outcomes. One such consequence is pelvic floor muscle dysfunction, nowadays a major public health problem, mainly because of its impact on the quality of life of the general population and the associated high health costs, respectively. **Material and Methods:** The articles used for the study were available via online databases. Our research is based solely on studies written in English, out of which 65 represent the main frame of this paper. **Results:** Participating in high-intensity physical activities (competitive sports, challenging manual labour) can increase the load on pelvic floor muscles. What is more, overloading the pelvic floor muscles might lead to disorders such as incontinence or pelvic organs prolapse. Some studies showed a 41% prevalence of urinary incontinence in elite athletes. This prompted us to review the circumstances leading to the pelvic floor disorders, more specifically, the relationship between physical activity and pelvic floor muscle dysfunctions. The analysis was based on the available published literature. Physical activity (PA) refers not only to recreational and regular physical training, but also to household tasks and other work-related and transport-related undertakings. Women engaged in hard manual labour can be 9.6 times more likely to have stage 2-4 grade uterine prolapse. **Conclusions:** Women suffering from urinary stress incontinence should be encouraged to participate in regular leisure and fitness activities and women engaged in vigorous physical activity have to be forewarned. Specific perinea muscle reinforcement may be needed in order to maximize the pelvic floor muscle strength.

Keywords: *physical activity, sport, manual labour, pelvic floor muscle dysfunction.*

REZUMAT. *Sportul, activitatea fizică și disfuncțiile musculaturii planșeului pelvian*. Introducere: Activitatea fizică este esențială pentru a avea un stil de viață sănătos; cu toate acestea, atunci când nu este adaptată nevoilor individuale, atât din punct de vedere calitativ, cât și din punct de vedere cantitativ, ea poate

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avea urmări nedorite. Una dintre aceste consecințe nedorite este afectarea musculaturii planșeului pelvian, considerată în prezent o problemă majoră de sănătate publică, datorită atât impactului negativ asupra calității vieții, cât și costurilor mari pe care le generează. **Material și Metode**: Articolele introduse în acest studiu au fost selectate din bazele de date disponibile online. Au fost căutate doar articole în limba engleză, fiind selectate 65 dintre acestea. **Rezultate**: Practicarea activităților fizice de mare intensitate (sport, muncă fizică solicitantă) poate crește solicitarea musculaturii planșeului pelvian. Suprasolicitarea musculaturii planșeului pelvian poate duce la incontinență urinară sau la prolapsul organelor pelviene. Unele studii indică o prevalență de 41% a incontinenței urinare în rândul sportivelor de performanță. Drept urmare, am decis să investigăm condițiile în care apare afectarea musculaturii planșeului pelvian, precum și legătura dintre activitatea fizică și afectarea musculaturii planșeului pelvian, bazându-ne pe literatura de specialitate disponibilă online. Prin activitate fizică se înțelege nu doar activitatea fizică practicată în mod regulat sau recreațional, ci și munca fizică sau căratul. Femeile care prestează muncă fizică grea au un risc de 9.6 ori mai mare de a prezenta prolaps uterin de gradul 2-4. **Concluzii**: Femeile care suferă de incontinență urinară de efort trebuie încurajate să practice în mod regulat activități fizice recreaționale, iar femeile care practică activități fizice de mare intensitate trebuie să fie prevenita asupra riscurilor. Exercițiile specifice pentru planșeul pelvian pot fi utile pentru a crește rezistența musculaturii de la acest nivel.

Cuvinte cheie*: activitate fizică, sport, muncă fizică, disfuncțiile musculaturii planșeului pelvian.*

Introduction

Pelvic floor disorders (PFDs), for instance urinary incontinence and pelvic organ prolapse (POP) disregard age, having damaging effects on the quality of life and self-image of all women experiencing these disorders.

Pelvic organ prolapse refers to the abnormal descent of the pelvic organs (bladder, uterus, vagina, small bowel and rectum), from their normal position into the pelvis. Urinary incontinence (UI) is defined as any involuntary leakage of urine (Sultan et al., 2017) and is the most prevalent type of PFM dysfunction among women (Islam et al., 2017). Pelvic floor muscle dysfunction (PFMD) is present in many other clinical conditions, such as fecal incontinence (Hock et al., 2019), pelvic pain syndrome and sexual dysfunction (Bortolini et al., 2010). Regarded as shameful, sexual dysfunction is oftentimes difficult to approach thus making it a rarely looked upon problem, though it would be easily measured using the Female Sexual Function Index (FSFI). (Rosen et al., 2000; Wiegel et al., 2005; Hock et al.,

2019). Advancing age, childbirth, obesity and race are associated with both pelvic organ prolapse and urinary incontinence. (Good et al., 2019) Other risk factors, such as hysterectomy, hormone therapy and family history, have been less well explored. Up to one in seven women undergoes surgery for pelvic organ prolapse and/or urinary incontinence in her lifetime, procedure that can also be accompanied by incontinence and deterioration in one's sexual life. (Hock et al., 2014; Hock et al., 2015).

Stress urinary incontinence (SUI) is defined by the International Urogynecological Association (IUGA)/International Continence Society (ICS) as 'a complaint of involuntary loss of urine on effort or physical exertion (e. g. such as sporting activities), or on sneezing or coughing'. SUI lowers the quality of life and well-being (Monz et al., 2005; Krause et al., 2003; Papanicolaou et al., 2005) of affected women and reduces their participation in sports and fitness activities (Bo et al., 2004; Nygaard et al.,1990) as well. A higher prevalence of UI has been found in female athletes (Eliasson et al., 2002) as they appear to have a 2.5 times greater risk of having UI than physically inactive women (Da Roza et al., 2015). SUI is a non-negligible problem in nulliparous female athletes, with the prevalence varying from 12.5% to as high as 80% (Almousa et al., 2015). SUI in young athletes often goes unreported for fear of embarrassment (Hägglund et al., 2007). Earlier studies have shown that treating women with incontinence or prolapse can positively influence their quality of life and sexual satisfaction. But women may delay care or not seek help because these conditions may lead to stigmatization. It is very important for the women to be forewarned, because different physiological conditions such as pregnancy, childbirth, or menopause can also alter further on pelvic floor muscle strength. (Hock et al., 2019, Hock et al., 2006)

One little known risk factor leading to pelvic floor muscle dysfunctions is choosing inadequate physical activities. Hence, this study is built as a survey meant to show the impact of physical activities on pelvic floor muscle conditions.

Methods

The articles required for the study were searched by means of the available online databases (www.sciencedirect.com / PubMed http://www.ncbi.nlm.nih.gov/pubmed), using keywords such as 'physical activity', 'leisure time physical activity', 'sports', 'physical work', 'incontinence', 'pelvic organ prolapse' and 'pelvic floor muscle strength'. Language was an equally important criterion in selecting the articles used in this survey; publications in other than English foreign languages were excluded. In this article, we mainly deal with the problems affecting women. Nonetheless, men also encounter pelvic floor muscle conditions and dysfunctions.

Pelvic floor exercises are commonly performed by women in order to strengthen their pelvic muscles, to improve continence and sexual function. Recent studies suggest that pelvic floor exercises can improve mens' sexual function as well. (Palancsa et al., 2018; Randolph et al., 2019). Based on the before mentioned criteria, 65 studies were selected. (We quoted 23 more articles in the explanation of the base definitions in the introduction and method section.)

Results

Recreational sports or leisure time physical activities and competitive sports

In a cross-sectional study of U.S. women, 28% of those who report UI find it to be at least a moderate barrier to exercising. 11.6% of women with UI did not exercise because of UI, 11.3% exercised less, 12.4% changed the type of exercise and 5% stopped exercising in a gym. For women with severe UI, about one-third did not exercise or exercised less because of UI. Women with other type of incontinence (overactive bladder, OAB) are less likely to undergo moderate or vigorous physical activities or to satisfy the recommended PA levels compared to those with no or minimal symptoms of OAB. (Nygaardet al., 2005; Coyne et al.,2013)

Habitual walking can decrease the odds of SUI by roughly one-half in older women from various ethnic backgrounds. Increased physical activity could, by increasing overall strength, regularly engaging pelvic floor musculature and decreasing weight, decrease UI or POP. Several studies have shown that current leisure activity is associated with lower odds of SUI while lack of exercise increases these odds (Hannestad et al., 2003; Zhu et al., 2008; Nygaard et al., 2015).

Knowledge of pelvic floor muscles (PFMs) in young female athletes is limited. There are two opposite hypotheses regarding their PFMs: (1) physical activity may strengthen the PFMs and (2) physical activity may overload and weaken the pelvic floor. The first theory is supported by findings of an increase in the cross-sectional area of PFMs in subjects whose activities included high-impact landing. (Kruger et al., 2005). Current data concerning the latter theory do not indicate that strenuous exercise prompts the development of SUI.

Even young nulliparous women often experience incontinence during exercise. Occurrence is greater during activities that require repetitive jumping (Fernandes et al., 2014), or is significantly more likely to occur in women who underwent basic parachute training than for those who did not (Larsen et al., 2007).

According to the "hammock hypothesis" theory, the levator ani muscle plays a crucial role in maintaining urinary continence (DeLancey et al., 1994). Whilst the intra-abdominal pressure increases, this pelvic floor muscle closes the uro-genital hiatus with a strong postero-anterior contraction in order to maintain continence and to resist the downward descent of the organs.

Assuming that high-intensity sport activity, sustained for a long period of time, can lead to an overload of the female musculoskeletal system, frequent exposure is expected to cause some degree of muscle damage or impairment and consequently alter the biomechanical response of the musculature in the long term (Bo et al., 2004; Dietz et al., 2008). Clinical observations have shown that levator ani injuries can result in reduced urethral support (urethral hypermobility) (DeLancey et al., 2002), which is often associated with stress incontinence.

However, there are significant differences in physiological conditions and environmental factors when comparing young female athletes with the general female population. (The contribution of these factors to the pathophysiology of stress incontinence remains unclear and requires further investigation.)

First, young female athletes are often exposed to significantly greater and sudden onset intra-abdominal pressure, especially during activities such as running and jumping (Goldstick et al., 2014). A pad test was used to test for loss of urine during jumping on a trampoline.80% of the participants reported urine leakage during training or competition and only 51.4% found it embarrassing. (There was no loss of urine during coughing, sneezing or laughing.) The mean urinary loss during the pad test was 28g (9-56g).

The examined athletes were less able to interrupt the flow of urine by voluntary contraction of the pelvic floor muscle than the control group. Incontinent trampoline athletes were significantly older (16 vs. 13 years old), trained longer and more frequently (Eliasson et al., 2002). Based on this, it seems that not only the type of exercise but also the frequency and intensity should be differentiated as a view of urine incontinence. In another study of nulliparous women, the largest negative effect of urine loss was reported during the most intensive part of the preparation period. (They were 2.5 times more likely to have urinary incontinence.) (Da Roza et al., 2015a; Da Roza et al., 2015b).

Another study also confirms the high incidence of urinary incontinence, particularly during high-intensity sport activities, in Q9 nulliparous athletes, and also points out that training duration can be a significant predictor of urinary incontinence. Athletes who considered themselves as not having continence dysfunctions showed urine loss during a one-hour training session. The severity and magnitude of urinary loss in the pad test was significantly related to the number of hours spent exercising daily (dos Santos et al., 2018).

The aim of a study was to assess the prevalence of urinary incontinence in fitness instructors and how people respond to incorporating PFM exercises into classes. The survey was completed by 106 participants, of whom 73.6% were female and 52.8% were in the 35–54 years age group. Prevalence of UI was 28.2%, and severity based on ICIQ-UI scores was 'slight' 65.2%, or 'moderate' in 26.1%. Leakage of urine was associated with physical activity in 36%, of whom 31.8% had not taken actions to reduce the impact and 86.4% had not sought professional advice or treatment. There was widespread willingness to incorporate pelvic floor muscle exercise into classes if given appropriate training 86.1%, and 67.1% would be happy to recommend a PFME app (Stephen et al.,2019).

Those who exercise more than 8 hours a week have a statistically significantly higher incidence of anal (wind and stool) incontinence than all other subjects (14.8% vs. 4.9, p = 0.001).In case of anal incontinence, mainly flatus was reported (84%). (Vitton et al., 2011).

Young university athletes were asked if they had ever experienced unexpected loss of urine due to participating in sports, coughing, sneezing, lifting heavy objects, going to the bathroom, sleeping, and the sound of running water. 28% reported at least one episode of urinary leakage during sport / competition (gymnastics 67%; tennis 50%; basketball 44%; shinney 32%; volleyball = 9%; swimming = 6%; softball = 6%; golf = 0%).42% experienced a loss of urine during daily activities and 38% experienced a disturbing situation (Nygaard et al., 1994). It is very important that even small amounts of urine can cause confusion and that 84% of athletes have never talked to anyone about their condition (Caylet et al., 2006). In addition to the type and intensity of exercise, preliminary evidence suggests that eating disorders may increase the risk of urinary incontinence in athletes (Jiang et al., 2004; Bo et al., 2001).

Borin et al. (2013) compared the strength of pelvic floor muscle of 10 handball, 10 volleyball and 10 basketball players and a non-athletic control group and found lower muscle strength in volleyball and basketball players compared to participants of control group. It was also established that lower muscle strength relates with increased symptoms of urinary incontinence. Although the incidence of urinary incontinence is high, many athletes do not perceive urine loss during strenuous activities and a high increase in abdominal pressure.

However, based on the principles of functional anatomy and biomechanics, it is likely that lifting heavy weights and strenuous physical activity can cause these conditions in already vulnerable women. Physical activity can reveal and worsen their condition (Moore et al., 2013). The authors emphasize that further studies are needed to understand the effect of different physical loads on the pelvic floor muscles. Previously examined physically active, nulliparous girls with SUI were diagnosed on upright voiding cysto-urethrography (VCUG) and the researchers

came to the conclusion that they should be considered for non-surgical therapy but will likely require bladder neck elevating surgery later. Non-surgical therapy works for those with minimal bladder descent on cystography (Bauer et al., 2018).

The results of muscle strength exercises have shown to increase muscle thickness, decrease muscle length, reduce the size of the levator hiatus, and raise the levator plate toward the abdominal cavity in pelvic organ prolapse-related diseases (Brækken et al., 2010). If the pelvic floor muscle has a certain "rigidity" (Ashton-Miller et al., 2001; Haderer et al., 2002), it is likely that the muscles can counteract the increased intra-abdominal pressure during exercise. There have also been studies on passive support options. There are tools that can be effective in preventing urine loss during physical activity. (A vaginal swab may be such a device). In a study by Glavind (1997), 6 women with stress incontinence used vaginal devices and they did not show urinary loss during 30 minutes of aerobic exercise. (The authors note that in the event of minor leaks, pads can be used during training and competition.)

However, little is known about the difference in the structure or function of the pelvic floor muscles in athletes. The levator ani muscle of 10 high impact frequent intense training (HIFIT) athletes was evaluated by MRI and researchers found about 20% larger cross-section area in the PFM compared to the age-matched nulliparous control group. HIFIT athletes showed greater mean diameter (0.96 cm vs. 0.70 cm, $P < 0.01$) in the pubo-visceral muscle as well (examined by ultrasonography), but found greater bladder sinking (prolapse) and larger hiatus size during Valsalva maneuver. (There was no difference between the participants at rest or during maximum voluntary contraction.) However, the pelvic floor muscle strength was lower in the athlete group than in the non-athlete group (Kruger et al., 2005; Kruger et al., 2007; Borin et al., 2013).

The highest rate of stress incontinence was found in volleyball players. It was found that cumulative MET did not influence the incidence of stress incontinence, but the type of sport did. As part of the risk assessment for stress incontinence, volleyball players were found to have a 116% chance of stress incontinence. In fitness, basketball and handball, the risk of stress incontinence was lower.

Tennis players, skaters and floorball players had no urine leakage and no evidence of stress incontinence. Stress incontinence (ICIQ-UI SF) (International Consultation on Incontinence Questionnaire Urinary Incontinence Short Form) was rated by participants in fitness, athletics, basketball, volleyball and handball as having a negative impact on quality of life (Hagovska et al., 2018). (The first-line treatment of pelvic floor muscle dysfunction is provided by a set of pelvic floor muscle rehabilitation methods, which has also been used favorably in volleyball players (Ferreira, 2014). The amount of urine lost (45.5%) and frequency (14.3%) were significantly reduced.

Studies, now to date, have shown a 41% prevalence of urinary incontinence in elite female athletes. Body weights of 1.6 and 2.5 fold were measured during moderate speed running (11 km / h) and believed to affect the pelvic floor muscle. Pelvic floor muscles therefore require not only adequate muscle strength but also rapid contractions. So far, research on the pelvic floor muscle function has focused on voluntary and concentric contractions. However, many activities in everyday life that typically cause urinary incontinence, such as running, require involuntary and rapid reflex contraction in the pelvic floor muscles. However, data on the reflex activity and contraction characteristics of the pelvic floor muscles under impact loading are far from complete (Leitner et al., 2017). Knowledge of the eccentric and concentric function of the pelvic floor muscles under impact loads is still inadequate. Very little is known about the eccentric function and the displacement of the pelvic floor muscle during the functional collision load of everyday life (e.g. stair climbing, running) (Leitner et al, 2015). Muscle actions can be classified as isometric (no change in muscle length), concentric (shortening action) and eccentric (lengthening action) (Komi, 2003). The pure form of these types of muscle actions is seldom found. The concentric and isometric muscle actions lead to a lift (elevation) and squeeze (constriction) of the pelvic floor (Bo et al., 2001; LovegroveJones et al., 2009; Raizada et al., 2010). However, knowledge about this combination of eccentric and concentric actions in the PFM during impact load is still inadequate. Not much is known about the eccentric muscle action of the PFM and the displacement during functional impact load activities of daily life (e.g. stair-climbing, running) and several (unexpected) factors may influence the outcome of the tests, such as was not explicitly instructing contraction of the pelvic floor muscle when running on a treadmill, but many stress incontinent women have used preventive "hidden" contractions. It is likely that stress incontinent subjects have consciously activated their pelvic floor muscles to prevent the expected urinary leakage. If stress incontinent women are familiar with the function of the pelvic floor muscles, they might be presumed to have increased awareness and skill in the pre-urinary contraction timing.

A cross-sectional study (n = 397; mean age 22.8 years (14-51 years) 8.6% gave birth) of 8 national sports clubs in Denmark (including ballet dancers) found that 51.9% of participants experienced loss of urine during sport or everyday life.43% in sports (gymnastics 56%; ballet 43%; aerobics 40%; badminton 31%; volleyball 30%; athletics 25%; handball 21%; basketball 17%) (Thyssen et al., 2002). According to some studies, athletes are unfamiliar with the symptoms and the factors leading to urinary incontinence. It is necessary for health professionals participating in sports teams to provide information on pelvic floor muscle disorders (dos Santos et al., 2018).

Physical work/manual labor

Physical activity (PA) includes not only recreational and regular exercise training, but also PA during household tasks and other work-related and transport-related PA (Caspersen et al., 1985). These non-recreational types of physical activity are particularly relevant to women. For example, by including only recreational PA, 26% women met the Centers for Disease Control and Prevention guidelines for sufficient activity. However, this proportion increased to nearly 73% when activity from all domains was included (Schaal et al., 2016).

The link between hard manual work and pelvic floor disorders is evident. In a study about Chinese women, manual labour increased the odds of UI 7-fold compared with no manual labour. Similarly, among rural Thai women, labourers experienced incontinence at a higher degree than other workers (Liu et al., 2014; Manonai et al, 2006).

A study in rural Tanzania (1047 people, mainly women who work in farms - 73%) confirms the possibility of pelvic floor muscle problems on account of heavy physical activity (at least 2 hours a day). 64.6% of the participants had stage 2-4 uterus prolapse. (Researchers have found that with increasing age, multiple vaginal deliveries, unskilled delivery, and lifting and carrying heavy objects, women in Tanzania are at increased risk of uterine prolapse (Masenga, 2018).

In a cross-sectional study, in which all activities (physical activity, work, childcare, elderly care, housework and garden work) were surveyed, researchers found an increased risk of stress incontinence. (Those who did heavy manual labor were 9.6 times more likely to have stage 2- 4 uterus prolapse.)

Discussion and conclusion

Concerning the relationship between PA and UI, a recent review (Nygaard et al., 2016) indicated that current leisure time activity and mild to moderate PA both decreased the risk of having UI, whereas a lack of PA or strenuous exercise/ heavy workload may increase the risk. Computer modeling and simulation provide a potential solution to these challenges in testing. Recent advances in medical imaging allowed the reconstruction of computer models based on high-resolution MR images, maximally preserving anatomical integrity and correctness. Computer simulation provides a reliable tool for characterizing dynamic biological processes that are otherwise difficult to observe through traditional techniques. Several computer models have been developed to study SUI and pelvic organ prolapse, but limited efforts have been made to apply this approach to explore the pathophysiology of SUI in young female athletes (Dias et al., 2017).

The health benefits of physical activity are obvious and the promotion of physical activity is considered a public health priority. However, both elite and leisure athletes tend to reduce their participation in physical activity due

to possible embarrassing consequences of stress incontinence. Stress incontinent women should be encouraged to engage in regular recreational and fitness activities in addition to the pelvic floor muscle exercises (Leitner et al., 2017). Women with high levels of physical activity had a higher manual grip force and a better body composition than those who did not exercise, but their pelvic floor muscle strength was not significantly higher, suggesting targeted pelvic floor muscle exercises may be needed enhancement of pelvic floor muscle strength (Middlekauff et al, 2016).

REFERENCES

Almousa, S., Moser, H., Kitsoulis, G., Almousa, N., Tzovaras, H., Kastani, D. (2015). The prevalence of urine incontinence in nulliparous female athletes: a systematic review. *Physiotherapy.* 2015; 101:e58.

Ashton-Miller, J., Howard, D., DeLancey, J. (2001). The functional anatomy of the female pelvic floor and stress continence control system. Scand. *J. Urol. Nephrol.* (Suppl. 207), 1–7.

Bauer, S.T., Vasquez, E., Cendron, M., Wakamatsu, M.M., Chow, J.S. (2018). Pelvic floor laxity: A not so rare but unrecognized form of daytime urinary incontinence in peripubertal and adolescent girls. *Journal of Pediatric Urology*, 2018; 14 544.e1-544.e7; https://doi.org/10.1016/j.jpurol.2018.04.030

Bo, K. (2004). Urinary incontinence, pelvic floor dysfunction, exercise and sport. *Sports Med*, 34, 451-464.

Bo, K., Borgen, J.S. (2001). Prevalence of stress and urge urinary incontinence in elite athletes and controls. *Med Sci Sports Exerc*, 33(11):1797–1802.

Borin, L.C.M.S., Nunes, F.R., Guirro, E.C.O.G. (2013). Assessment of pelvic floor muscle pressure in female athletes. *Phys. Med. Rehabil*, 5, 189–193.

Bortolini, M.A., Drutz, H.P., Lovatsis, D., Alarab, M. (2010). Vaginal delivery and pelvic flor dysfunction: current evidence and implications for future research. *Int. Urogynecol J. Pelvic Floor Dysfunct,* 21: 1025–1030.

Brækken, I.H., Maijida, M., Engh, M.E., Bo, K. (2010). Morphological changes after pelvic floor muscle training measured by 3-dimensional ultrasonography. A randomized controlled trial. *Obstet. Gynecol,* 115 (2), 317–324.

Caspersen, C.J., Powell, K.E., Christenson, G.M. (1985). Physical activity, exercise, and physical fitness: Definitions and distinctions for health-related research. *Public Health Rep,* 100: 126–131

Caylet, N., Fabbro-Peray, P., Mares, P., Dauzat, M., Prat-Pradal, D., Corcos, J. (2006). Prevalence and occurrence of stress urinary incontinence in elite women athletes. *Can. J. Urol*, 13 (4), 3174–3179.

Coyne, K.S., Sexton, C.C., Clemens, J.Q., et al. (2013.) The impact of OAB on physical activity in the United States: results from OAB-POLL. *Urology*, 82 (4): 799–806. [PubMed: 23953610]

Da Roza, T., Brandão, S., Mascarenhas, T., Jorge, R.N., Duarte, J.A. (2015a). Volume of Training and the Ranking Level Are Associated with the Leakage of Urine in Young Female Trampolinists. *Clin J Sport Med,* 25 (3): 270-5.

Da Roza, T., Brandão, S., Mascarenhas, T., Jorge, R.N., Duarte, J.A. (2015b). Urinary Incontinence and Levels of Regular Physical Exercise in Young Women. *Int J Sports Med*, 36 (9): 776-80.

DeLancey, J.O. (1994.). Structural support of the urethra as it relates to stress urinary incontinence: the hammock hypothesis. *American Journal of Obstetrics and Gynecology*, 170 (6): 1713–1723.

DeLancey, J.O. (2002). Fascial and muscular abnormalities in women with urethral hypermobility and anterior vaginal wall prolapse. *American Journal of Obstetrics and Gynecology*, 187 (1): 93–98.

Dias, N., Peng, Y., Khavari, R., Nakib, N.A., Sweet, R.M., Timm, G.W., Erdman, A.G., Boone, T.B., Zhang, Y. (2017). Pelvic floor dynamics during high-impact athletic activities: A computational modeling study. *Clinical Biomechanics*, 41: 20–27.

Dietz, H.P., Shek, C., (2008). Levator avulsion and grading of pelvic floor muscle strength. *Int. Urogynecol. J. Pelvic Floor Dysfunct,* 19, 633–636.

Dos Santos, K.M., Da Roza, T.H., Da Luz, S.C.T., Hort, J.P., Kruger, J.M., Schevchenco B. (2018). *Quantification of Urinary Loss in Nulliparous Athletes During 1 Hour of Sports Training.* PM&R, 1-8.

Eliasson, K., Larsson, T., Mattsson, E. (2002). Prevalence of stress incontinence in nulliparous elite trampolinists. *Scand J Med Sci Sports*, 12 (2): 106–110.

Fernandes, A., Fitz, F., Silva, A.,Filoni, E., Filho, J.M. (2014). Evaluation of the Prevalence of Urinary Incontinence Symptoms in Adolescent Female Soccer Players and their Impact on Quality of Life. *Occup Environ Med*, 71 (Suppl 1): A59–60.

Glavind, K. (1997). Use of a vaginal sponge during aerobic exercises in patients with stress urinary incontinence. *Int. Urogynecol. J. Pelvic Floor Dysfunct*, 8, 351–353.

Goldstick, O., Constantini, N. (2014). Urinary incontinence in physically active women and female athletes. *British journal of sports medicine*, 48 (4): 296–298.

Good, M.M., Solomon, E.R. (2019). Pelvic Floor Disorders, *Obstet.Gynecol Clin N. Am*. 46, 527–540, https://doi.org/10.1016/j.ogc.2019.04.010

Haderer, J., Pannu, H., Genadry, R., Hutchins, G.M. (2002). Controversies in female urethral anatomy and their significance for understanding urinary continence: observations and literature review. *Int. Urogynecol. J. Pelvic Floor Dysfunct,* 13, 236–252.

Hagovska, M., Švihra, J., Buková, A., Dračková, D., Švihrová, V. (2018). Prevalence and risk of sport types to stress urinary incontinence in sportswomen: A cross-sectional study. *Neurourology and Urodynamics,* 37:1957 –1964.

Hägglund, D., Wadensten, B. (2007). Fear of humiliation inhibits women's care-seeking behaviour for longterm urinary incontinence. *Scandinavian journal of caring sciences*, 21 (3): 305–312. [PubMed:17727542]

Hannestad, Y.S., Rortveit, G., Daltveit, A.K., Hunskaar, S. (2003). Are smoking and other lifestyle factors associated with female urinary incontinence? The Norwegian EPINCONT Study. *BJOG*, 110 (3): 247–254. [PubMed: 12628262]

Hock, M., Ambrus, E., Tóvári, A., Tardi, P., Szilágyi, B., Leidecker, N., Molics, B., Járomi, M., Ács, P. (2019). Az anális inkontinencia diagnosztikája és kezelési lehetőségei. *Fizioterápia,* 28 (3): 3-9.

Hock, M., Farkas, N., Tiringer, I., Gitta, S., Németh, Z., Farkas, B. (2019). Validation and translation of the Hungarian version of the Female Sexual Function Index (FSFI-H) *International Urogynecology Journal*, 30 (12): 2109–2120.

Hock, M., Domány, B., Bódis, J., Garai, J. (2014). Does Surgery Benefit Postmenopausal Overweight Women with Pelvic Floor Dysfunction? *Open Journal of Therapy and Rehabilitation*, 2 (3): 114-119.

Hock, M., Tóth, Sz., Hartmann, G., Hartmann, T., Bódis, J., Garai J. (2015). Quality of Life, Sexual Functions and Urinary Incontinence After Hysterectomy in Hungarian Women. *American Journal of Health Research*, 3 (6): 393-398.

Hock, M., Tardi, P., Ambrus, E., Tóvári, A., Hajnal, B., Szilágyi, B., Leidecker, E., Molics, B., Járomi, M., Kránicz, J., Bódis, J. (2019). Changes of pelvic floor muscle function during pregnancy. *Studia UBB Educatio Artis Gymn.*, 64: (2) 57-68.

Hock, M., Kránicz, J., Bódis, J. (2006). A gátizomerőváltozásáról. *Magyar Nőorvosok Lapja* 69: (4) 347-350.

Islam, R.M., Oldroyd, J., Karim, M.N., Hossain, S.M., EmdadulHoque, D., Romero, L., et al. (2017). Systematic review and meta-analysis of prevalence of, and risk factors for, pelvic floor disorders in community-dwelling women in low and middle-income countries: a protocol study. *BMJ Open*, 7 (6): 01–7.

Jiang, K., Novi, J.M., Darnell, S., Arya, L.A. (2004). Exercise and urinary incontinence in women. *Obstet Gynecol Surv,* 59 (10): 717–721. quiz 745–716.

Lovegrove Jones, R., Peng, Q., Humphrey, V., Stokes, M., Payne, C. and Constantinou, C.E. (2009). Effect of the knack on the pelvic floor: evaluated by 2d real time ultrasound and image processing methods. *International Continence Society Annual Meeting*. 29 Sep - 03 Oct 2009. pp. 662-663.

Krause, C., Wells, T., Hughes, S., Brink, C., Mayer, R. (2003). Incontinence in women: effect of expectancy to regain control and severity of symptoms on treatment outcomes. *Urol Nurs,* 23(1):54

Kruger, J.A., Murphy, B.A., Heap, S.W. (2005). Alterations in levatorani morphology in elite nulliparous athletes: a pilot study. *Aust N Z J Obstet Gynaecol*, 45 (1): 42–47.

Kruger, J.A., Dietz, H.P., Murphy, B.A. (2007). Pelvic floor function in elite nulliparous athletes. *Ultrasound Obstet Gynecol,* 30 (1): 81–85.

Larsen, W.I., Yavorek, T. (2007). Pelvic prolapse and urinary incontinence in nulliparous college women in relation to paratrooper training. *Int Urogynecol J Pelvic Floor Dysfunct*, 18 (7): 769–771.

Leitner, M., Moser, H., Taeymans, J., Kuhn, A., Radlinger, L. (2015). Pelvic floor muscle displacement during voluntary and involuntary activation in continent and incontinent women: a systematic review. *Int Urogynecol J*, 26: 1587–1598.

Leitner, M., Moser, H., Eichelberger, P., Kuhn, A., Radlinger, L. (2017). Evaluation of pelvic floor muscle activity during running in continent and incontinent women: An exploratory study. *Neurourology and Urodynamics,* 36: 1570 –1576.

Liu, B., Wang, L., Huang, S.S., Wu, Q., Wu, D.L. (2014). Prevalence and risk factors of urinary incontinence among Chinese women in Shanghai. *Int J ClinExp Med,* 7 (3): 686–696.

Manonai, J., Poowapirom, A., Kittipiboon, S., Patrachai, S., Udomsubpayakul, U., Chittacharoen, A. (2006). Female urinary incontinence: a cross-sectional study from a Thai rural area. *Int Urogynecol J Pelvic Floor Dysfunct*, 17 (4): 321–325.

Masenga, G.G., Shayo, B.C., Rasch, V. (2018). Prevalence and risk factors for pelvic organ prolapse in Kilimanjaro, Tanzania: A population based study in Tanzanian rural community. *PLOS ONE*, 13 (4): e0195910.

Middlekauff, M.L., Egger, M.J., Nygaard, I.E., Shaw, J. (2016). The impact of acute and chronic strenuous exercise on pelvic floor muscle strength and support in nulliparous healthy women. *Am J Obstet Gynecol*, 215: 316.e1-7.

Monz, B., Pons, M.E., Hampel, C., Hunskaar, S., Quail, D., Samsioe, G., Sykes, D., Wagg, A., Papanicolaou, S. (2005). Patient-reported impact of urinary incontinence—results from treatment seeking women in 14 European countries. *Maturitas,* 52 [Suppl 2]: S24–S34. doi:10.1016/j.maturitas.2005.09.005

Moore, K., Dumoulin, C., Bradley, C., (2013). Committee 12: adult conservative management. In: Abrams, P., Cardozo, L., Khoury, S., et al. (Eds.). *Incontinence: Fifth International Consultation on Incontinence.* European Association of Urology, Arnhem, pp. 1101–1227.

Nygaard, I., DeLancey, J.O., Arnsdorf, L., Murphy, E. (1990). Exercise and incontinence. *Obstet Gynecol*, 75 (5): 848–851.

Nygaard, I., Thompson, F.L., Svengalis, S.L., Albright, J.P. (1994). Urinary incontinence in elite nulliparous athletes. *Obstet. Gynecol,* 84, 183–187.

Nygaard, I., Girts, T., Fultz, N.H., Kinchen, K., Pohl, G., Sternfeld, B. (2005). Is urinary incontinence a barrier to exercise in women? *Obstet Gynecol*, 106 (2): 307–314. [PubMed: 16055580]

Nygaard, I.E., Shaw, J.M., Bardsley, T., Egger, M.J. (2015). Lifetime physical activity and female stress urinary incontinence*. Am J Obstet Gynecol*, Jul; 213(1): 40.e1-40.e10. doi: 10.1016/j.ajog.2015.01.044. Epub 2015 Jan 29.

Nygaard, I.E., Shaw, J.M. (2016). Physical activity and the pelvic floor. *Am J Obstet Gynecol,* 214: 164–171.

Palancsa, M., Damásdi, M., Tardi, P., Gitta, S., Járomi, M., Ács, P., Simon-Ugron, Á., Hock, M. (2018). Pelvic floor muscle exercises for the improvement of male sexual functions *Studia UBB Educatio Artis Gymn.,* 63:(2) 5-9.

Papanicolaou, S., Hunskaar, S., Lose, G., Sykes, D. (2005.) Assessment of bothersomeness and impact on quality of life of urinary incontinence in women in France, Germany, Spain and the UK. *BJU Int,* 96 (6): 831–838.

Raizada, V., Bhargava, V., Jung, S.A., Karstens, A., Pretorius, D., Krysl, P., Mittal, R.K. (2010). Dynamic assessment of the vaginal high-pressure zone using high-definition manometery, 3-dimensional ultrasound, and magnetic resonance imaging of the pelvic floor muscles. *Am J Obste tGynecol* 203 (2): 172.e1–172.e8. doi:10.1016/ j.ajog.2010.02.028

Randolph, J.T., Burleson, L.K., Sheffield, A., Hannan, J.L. (2019). Exercise, Sports, and Men's Health. Effects of Lifestyle on Men's Health. *Elsevier* https://doi.org/10.1016/B978-0-12-816665-9.00019-6

Rosen, R., Brown, C., Heiman, J., et al. (2000). The female sexual function index (FSFI): a multidimensional self-report instrument for the assessment of female sexual function. *J Sex Marital Ther,* 26: 191–208.

Schaal, M.L., Lee, W., Egger, M.J., Nygaard, I.E.,Shaw, J.M. (2016). Physical activity patterns in healthy middle-aged women. *J Women Aging*, 28 (6):4 69-476. Epub 2016 Jul 11.

Stephen, K., van Woerden, H., MacRury, S. (2019). Assessing prevalence of urinary incontinence in Scottish fitness instructors and experience of teaching pelvic floor muscle exercises: an online survey. *Journal of Public Health* | pp. 1–7 | doi:10.1093/pubmed/fdy102 *J Public Health (Oxf).* Mar; 41(1): e44–e50.

Sultan, A.H., Monga, A., Lee, J., Emmanuel, A., Norton, C., Santoro, G., et al. (2017). An international Urogynecological association (IUGA)/international continence society (ICS) joint report on the terminology for female anorectal dysfunction. *Int Urogynecol J*, 28:5–31.

Thyssen, H.H., Clevin, L., Olesen, S., Lose, G. (2002). Urinary incontinence in elite female athletes and dancers. Int. Urogynecol. *J. Pelvic Floor Dysfunct*, 13, 15–17.

Vitton, V., Baumstarck-Barrau, K., Brardjanian, S., Caballe, I., Bouvier, M., Grimaud, J.C. (2011). Impact of high-level sport practice on anal incontinence in a healthy young female population. *J. Womens Health,* 20 (5): 757–763.

Wiegel, M., Meston, C., Rosen, R. (2005). The female sexual function index (FSFI): cross-validation and development of clinical cutoff scores. *J Sex Marital Ther*, 31:1–20.

Zhu, L., Lang, J., Wang, H., Han, S., Huang, J. (2008). The prevalence of and potential risk factors for female urinary incontinence in Beijing, China. *Menopause*, 15 (3): 566–569. [PubMed: 18467955]

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THE CONTRIBUTION OF SPORT TO A HEALTHY LIFE

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ABSTRACT. "Healthy mind in healthy body" has a wide coverage when it comes to personality development as a whole, including self-esteem. Through somatic optimization (better blood circulation, heart rate adjustment, hormonal balance, muscle strengthening, avoiding overweight, etc.), the sport also contributes to a higher self-esteem, through a greater weight of the physical self (perception of one's body), in the general conception of self. If we make a connection between the quality of the overall life of people and the ways of spending their free time it is not difficult to observe that the high percentages of those who systematically practice physical exercise among the total population is itself an indicator of a society of some degree development. The practice of physical exercises was present in the social life of all the social-economic arrangements from the history of human society. The present paper aims to present some theoretical aspects regarding the complexity of the roles of sport: the reciprocal effects between sport and society, the functions of sport, well-being and quality of life, the effects of standard of living and lifestyle on movement practice, organized physical education, but also a practical study regarding the influence of practicing physical exercises as a lifestyle on quality of life thus highlighting the importance of movement in our life.

Keywords: *lifestyle, benefits, life, objectives, sports.*

REZUMAT. ***Contribuția sportului la o viață sănătoasă***. Dictonul „minte sănătoasă în corp sănătos" are o acoperire largă atunci când vine vorba despre dezvoltarea personalității în ansamblu, inclusiv despre respectul de sine. Prin optimizare somatică (mai bună circulație a sângelui, ajustarea frecvenței cardiace, echilibrul hormonal, întărirea mușchilor, evitarea excesului de greutate etc.), sportul contribuie, de asemenea, la o stimă de sine mai mare, printr-o pondere mai mare a sinelui fizic (percepția corpului cuiva), în concepția generală despre sine. Dacă facem o legătură între calitatea vieții oamenilor în general și modalitățile de a-și petrece timpul liber, este ușor să observăm că procentele mari ale celor care practică în mod sistematic exercițiul fizic în rândul populației totale este în sine un indicator al gradului de dezvoltare al unei societăți. Practica exercițiilor fizice a fost prezentă în viața socială a tuturor aranjamentelor social-economice din

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istoria societăţii umane. Lucrarea de faţă îşi propune să prezinte câteva aspecte teoretice cu privire la complexitatea rolurilor sportului: efectele reciproce dintre sport şi societate, funcţiile sportului, bunăstarea şi calitatea vieţii, efectele nivelului de viaţă şi ale stilului de viaţă asupra practicilor de mişcare, educaţia fizică organizată, dar şi un studiu practic referitor la influenţa practicării exerciţiilor fizice ca stil de viaţă asupra calităţii vieţii, subliniind astfel importanţa mişcării în viaţa noastră.

Cuvinte cheie: *stil de viaţă, beneficii, viaţă, obiective, sport.*

Introduction

In the last decades, sport has evolved at the level of society, from the way of leisure, to a major industry, having a direct contribution to the increase of social welfare – through the socialization effects they generate, by improving the biological condition of the members of the company and the economic one – through its contribution to consumption, income, tertiary sector, employment and local, regional and national economic development (Atanasiu & Oprişan, 2015).

The practice of physical exercises was present in the social life of all the social-economic arrangements on the book known to human society (Barbu, 2004).

The culture of all peoples, especially the ancient ones, has left us many testimonies depicting the human body developed harmoniously, strong, fast, resistant and skilful, traits that, although some are genetically conditioned, are acquired through the practice of a set of exercises, physical designed specifically (Barbu & Popescu, 2018).

Human society, in its different stages of development, has been constantly concerned about the physical appearance of the members of the communities, the improvement of the physical development and the motor capacity of the people. The actions in this direction were undertaken through two instruments through which she could act: physical education - predominantly formative - and sport - character enhancing the motor skills of people in the form of competition (Baciu, 2009).

Literature review

The connection between sport and society

Sport is an attractive activity for people and has a positive image. However, the recognized potential of the sports movement to support physical activity meant to improve health is not fully utilized (most of the time), and on the other hand, it must be permanently developed (Balint, 2007).

At no other time in history has sport played a dominant role in everyday life. Due to the prevalence of internet and television, adults and children consume sports at an amazing level (Barbu & Barbu, 2011). When we are not physically involved in sports, we play them through video games or fantasy leagues and watch them on TV. The celebrity status of the top athletes speaks about the importance we attach to sporting events.

Sport is considered a real institution with problems, specific rules and internal operating mechanisms. In the view of some sociologists, sport has positive valences, if we talk about sports/motor activities for recreational purposes, or used as therapeutic means (Boroş-Balint, 2012).

A special place in the discussion about the functions of sport is reserved for socializing and education. Very important in the contemporary social gear are also the economic ones or the sport as a show.

Another major function of sport in society and its effects on the individual is the influence of sport on physical and mental health. The relationship between sports (physical activity) and body health is primarily concerned with medicine and physiology. Psychology is interested in this topic to the extent that physical health is a prerequisite for mental balance and positive thinking, as mental and emotional health can ensure a rational attitude to health and physical illness.

The functions of physical education and sport are as follows (Fillis & Mackay, 2013):

1. The function of perfecting the harmonious physical development of humans

The increase of the work capacity of the people is conditioned by their physical state, by the harmonious development of the body, by the maintenance of its biological characteristics. The efficiency in work is dependent on the physical state of the citizens, on the psychological balance.

The role of physical school education is unanimously acknowledged by specialists in the fields of education and health (Monea et al., 2015). Harmonious indices of physical development are formed from childhood and must be maintained until old age (Stoica & Barbu, 2013). That is why an adequate number of physical education hours must be allocated in the school curriculum. Sport exerts a favourable influence on the morphological and physiological indices of physical development in the young generation, contributing to their specialization.

2. The function of developing people's motor capacity

The availability of movement of people, manifested by the number of skills and motor skills they possess, but also by their degree of manifestation with increased indices of motor qualities, is also an important condition in achieving a well-being. Healthy lifestyle influences this condition, contributing to increased work efficiency, reducing risk factors for health (Jacobson, 2003).

3. Hygienic (health-preserving) or sanogenetic function

The role of this function has been emphasized since ancient times. The sages of these times have advocated for a healthy life, physical exercises being unrelenting to daily activities. The functions of the devices and systems of the human body are improved as a result of practicing physical exercises. They will ensure the physical and psychological balance that people need so much.

4. The educational function

Physical education is a side of education, the development of people's personality being greatly influenced by the practice of physical exercises in all forms. It also exerts influence on the other sides of education, complementing and enhancing their effect. The connections of physical education with intellectual education, with aesthetic education, with professional and moral education are unanimously recognized, a complete education imposing the presence of physical exercises in the educational system of a country (Hansen & Gauthier, 1989).

5. Recreational function

A balanced lifestyle implies the presence of recreational activities in all categories of population. The free time of the people must include leisure activities, especially after an intense work day, and among these activities must be found physical activities. Their presence required the appearance in the field of physical education and sport of some professions directly related to recreation (Bauer et all, 2008).

6. The emulation function

Due to their specific nature, physical education and sport offer the possibility of competition, competition. Physical exercises have always been a challenge, both for self-defense and for defeating an opponent. Emulation, specific to the game, is found in all forms of physical exercise.

This function contributes to the development of the competitive spirit, to the increase of the desire to overtake and to defeat the opponent, but respecting the limits of the regulations, in the spirit of fairness, of fair-play.

The effects of sport

Sports are sources of recreation. They offer relief and a relaxed feeling in a life of monotony, routine marked by misery, hardships and obstacles.

They infuse a sporting spirit to take on the heavy burden of life in a lighter vein and not think of life as a tragedy or a comedy, but as an ordinary business of life.

It is very important to maintain physical health and fitness. Encourages the growth of team spirit. Sports and games bring different methods of fun.

The practice of sport, as shown by studies, statistics and data of opinion barometers targeting lifestyle, apparently seems to be a marginal component of quality of life, although numerous studies have shown that there are strong positive correlations between standard of living, quality of life and standard of living. In agreement with these studies, we consider that the share of professional and amateur sports is an indirect but real indicator of quality of life (Popescu, 2010).

As a corollary of the relationship between the quality of life and physical exercise in modern societies, we can say that with the generalization of the idea of sport as a source of health, a whole "physical activity industry" has developed to serve those who value health, beauty or simply have the pleasure of playing sports (Sabău, 2010). Perhaps due to the growing importance of this industry, correlated with the fact that all schools have included physical education in the curriculum, new trends are emerging to promote the role of physical activities in acquiring a good health and maintaining it.

Thus, there is a real explosion of interest for the profession of trainer or teacher of physical education, as well as in other related fields that deal with body maintenance: aerobics, massage, physiotherapy (Abele & Brehm, 1993).

The need for sport is felt to be so great in life that there is ample justification for it to be introduced into compulsory schools. Sports and games give a sense of discipline, awareness and solidarity. They learn the value of time and how important it is to notice how a minute, a fraction of a minute decides the fate of a young sportsman in the field of competition. With proper training in sports and games, students become active, athletic, daring, daring and adventurous able to face future challenges. Sports and games are the right ways to channel students' energy and vitality and make their leisure time worthwhile. The spirit of competition is rooted in most sports and games (Scarlat & Scarlat, 2002).

The greatest educational value of sports and games is to stimulate study and hard work. Thus, through this theme is presented a statistical survey conducted in order to highlight the increasing importance that is given to the movement today. Heart disease, cancer and digestive tract problems are the main causes of mortality in Romania (Statistical Center of the Ministry of Health).

The causes of these results are, sedentarism and lack of education, chaotic nutrition, poverty and marginalization of some segments of the population.

Mortality rates have risen at alarming rates in recent years, surpassing the birth rate, so there is a continuous natural demographic deficit and an aging population (Romanian StatisticYearbook, 2019):

- In 2018, Romania ranks third in Europe in terms of obesity;
- Romania ranks 1st in Europe in the mortality rate due to liver cirrhosis, based on the excessive consumption of alcohol. Over 70% of the subjects are from the rural area. About 10% of deaths are caused by excessive alcohol consumption with implications in all forms (work and road accidents, domestic violence, various diseases, especially liver cirrhosis);

• Only 6 out of 100 people perform physical exercises constantly (daily or at least 2-3 times weekly) in the urban environment;

• Only 1 person in 100 performs scheduled physical exercises in a calendar month in rural areas;

Lack of physical activity leads to overweight, favours the occurrence of obesity and chronic conditions such as cardiovascular diseases and diabetes, which affect the quality of life, endanger people's lives and create problems for the state's economy and the budget allocated to health (Trial & James, 2001).

If we make a connection between the quality of people's overall life and the ways of spending their free time, it is not difficult to observe that the high percentages of those who systematically practice physical exercise among the total population is itself an indicator of a society of some degree development.

Awareness of the fact that lifestyle (having the component of physical and recreational activities through sports) has a major - if not overwhelming - impact on health and prolonging life expectancy is one of the factors that lead to this situation in advanced states (Şchiopu, 2008).

Findings and discussions

Regarding the practical part of this work, we used a survey in order to gather information and to draw conclusions, being carried out a complex analysis regarding the effects of physical activities on the quality of life that has increased significantly in the last decades and the clearer delimitation of the medium and long term effects of the physical movement on the quality of life.

In order to carry out this study, we conducted a research among the Romanian population, between 20.10.2019-10.12.2019, through a questionnaire on Google Form, which was completed by the respondents.

Due to insufficient in-depth examinations in this area, our paper must be a starting point and a prelude to future investigations that can be based on the existing study.

The participation was performed on a voluntary basis and the verbal agreement of the participants was requested. The participants were assured about the confidentiality of the results but also about the possibility to request the results personally from the researcher. All people participated in the research under the conditions of informed consent.

Analysing the data on respondents we see that 74% are male and 26% are female.

The number of respondents aged 20-30 years was 94 persons, the equivalent of 37.6%, 101 respondents were aged 30-40 years, respectively 40.4%, 36 respondents the equivalent of 14.4% were aged 40- 50 years, and 19 respondents

the equivalent of 7.6% are over 50 years old. The hierarchy of the respondents after the last absolute studies highlighted the fact that 97 respondents (38.8%) have higher education and 67 respondents (26.8%) have post-university studies.

Regarding the number of respondents who practice sports, the majority of 75% make physical movement, as opposed to 62 people who rarely or very rarely make a move.

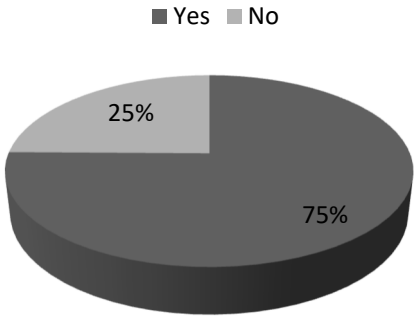

Fig. 1. Distribution by number of respondents practicing sports

At the question What sport do you practice, in the top of the preferences of the questioned people is volleyball, with a percentage of 23%, followed by tennis representing 17.6%, basketball with 11.6%, and on other sports with 6% each.

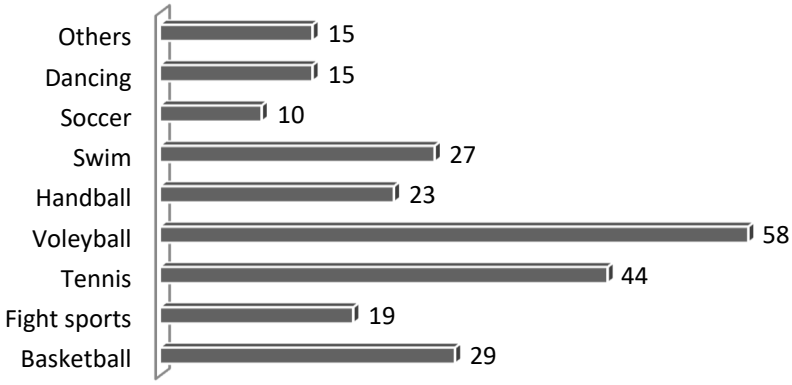

Fig. 2. Sample structure according to the sports practiced

Regarding the time period of practicing the physical exercises, the people participating in this survey are dedicated to movement, 22% do sports for less than 5 years, 35% between 5-10 years and 43% more than 10 years.

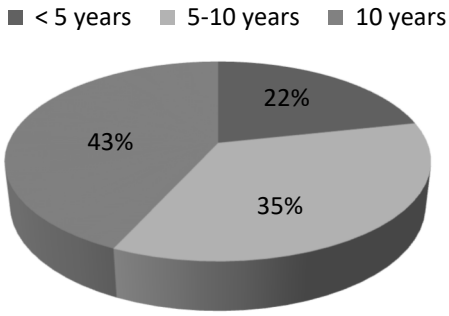

Fig. 3. The structure of the sample after the time period of practicing the physical exercises

To the question Have you practiced performance sports in the past, 66% of the respondents answered positively, representing 166 people, as opposed to 84 respondents who answered negative, 34%.

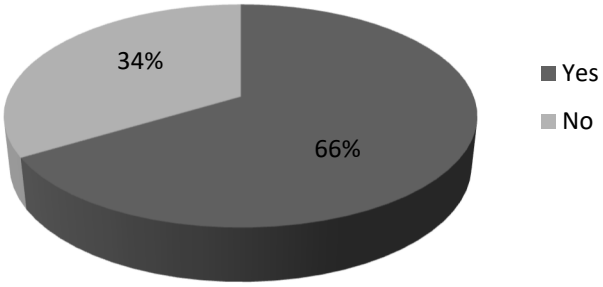

Fig. 4. Structure of the sample according to the frequency of practicing performance sports in the past

To the question Do you regularly do a physical exercise program, the vast majority of the people who are part of this research have responded positively in a proportion of 90%, which indicates that they have become more aware of the importance of sport.

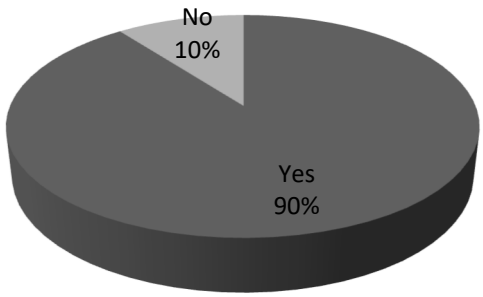

Fig. 5. Structure of the sample after the regularity of the exercise program

It seems that 64% respondents have a daily exercise program that they always respect, 31% follow this program 2-3 times a week, and 0.52% have this routine only once a week.

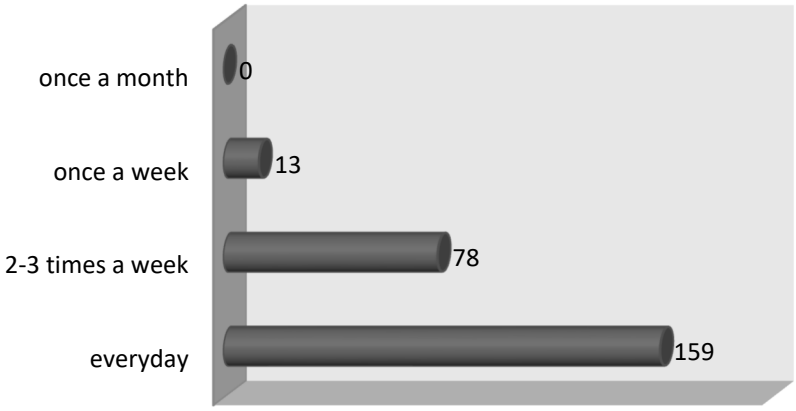

Fig. 6. Structure of the sample according to the frequency of the exercise program

Apparently 90% of the people participating in this study, besides other hobbies, say that sport is part of this category, becoming an important part of their lives.

To the question Does sport represent a way of life for you? In a percentage of 86% the people questioned answered yes, understanding its importance and its effects on multiple planes as opposed to 14% who answered negative.

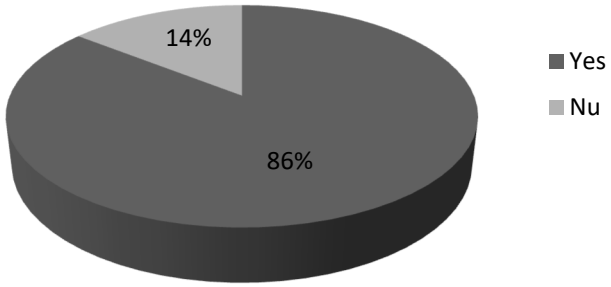

Fig. 7. Distribution of the sample according to the importance of the sport

Among the multiple effects of sport, respondents agree in a proportion of 85% that it also influences health positively, while 15% consider that it has not had major effects on their health.

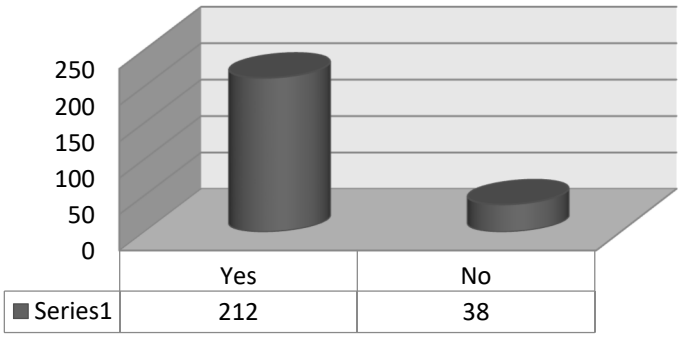

Fig. 8. Sample distribution after the effects of sport

Conclusions

The paper "The contribution of sport to a healthy life" aims to present some theoretical aspects regarding the complexity of the roles of sport: the reciprocal effects between sport and society, the functions of sport, sport, well-being and quality of life, the effects of standard of living and lifestyle on movement practice and organized physics, but also a practical study conducted among a sample of 250 respondents regarding the influence of practicing physical exercises as a lifestyle on quality of life thus highlighting the importance of movement in our life.

Sport improves the brain's functions because it helps the transport of the necessary substances and thus, the nervous connections are healthier, therefore, the intellectual performances increase. Therefore, sport not only helps us ensure a beautiful figure or keep us fit, it also helps us intellectually, especially since we are in a period when our brain is often overloaded.

You may not have heard of the ability to concentrate or the increased IQ with the help of sport. This is true. A study of young people found that those who were in better physical shape were much more cognitively efficient than those who were sedentary. In order not to be like the latter, sport should be on our list of priorities.

The importance of physical effort cannot be described in a few words. It's a fairly broad topic that needs a lot of attention from us. In today's society that is moving towards a more sedentary lifestyle, there is a greater need for increasing the daily level of activity to maintain both cardiovascular capacity and body weight.

Staying active means maintaining your body's functioning at a high level. Regular exercise will maintain your lung and heart performance to burn the most efficient calories and keep weight under control. Introducing movement into our daily, if not weekly, routine will also improve muscles, increase joint flexibility, and improve endurance.

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All authors of this paper contributed equally to the research.

REFERENCES

Abele, A.E., & Brehm, W. (1993). Mood effects of exercise versus sport games: Findings and implications for well-being and health. *International Review of Health Psychology, 2,* pp. 54-80.

Anuarul Statistic al României (2019), Institutul Naţional de Statistică, Bucureşti (www.insse.ro).

Atanasiu, L., & Oprişan, N. (2015). Managementul Stresului, *Revista de comunicari stiintifice a DEFS-UB, Bucureşti, Editura Universitatii din Bucureşti*.

Bauer, H.H., Stockburger-Sauer, N.E., & Exler, S. (2008). Brand image and fan loyalty in professional team sport: A refined model and empirical assessment. *Journal of Sport Management, 22,* pp.205 – 226.

Barbu, M.C.R. (2004). *Istoria educaţiei fizice şi sportului.* Craiova, Editura Universitaria.

Barbu, M.C.R., & Barbu, C.M. (2011). The management of a public funded sport club in times of crisis-a case study at CSM Craiova. *Journal of Physical Education and Sport, 11(4),* pp. 455-460.

Barbu, M.C.R., & Popescu, M.C. (2018). Branding in sport. *Annals of the „Constantin Brâncuşi" University of Târgu Jiu - Economy Series, 5,* pp. 35-41.

Baciu, M. (2009). *Sportul și calitatea vieții*. Cluj-Napoca Editura Napoca Star.

Balint, G. (2007). *Activități sportiv-recreative și de timp liber: paintball, mountain bike și escaladă*. Iaşi, Editura PIM.

Boroş-Balint, I. (2012), *Stresul psihofiziologic și capacitatea de efort fizic*, Cluj-Napoca, Editura Risoprint.

Crăciun, L., & Barbu, C.M. (2014). The Brand as Strategic Asset of the Organization. *Revista de Management Comparat International, 15(1),* pp. 69-77.

Fillis, I., & Mackay, C. (2013). Moving beyond fan typologies: The impact of social integration on team loyalty in football. *Journal of Marketing Management, 30(3-4),* pp. 334–363.

Hansen, H., & Gauthier, R. (1989). Factors affecting attendance at professional sports events. *Journal of Sport Management, 3,* pp. 15-32.

Jacobson, B. (2003). The Social Psychology of the Creation of a Sport Fan Identity: A Theoretical Review of the Literature. *Athletic Insight – The Online Journal of Sport Psychology*, *5(2),* pp. 1-14.

Monea, D., Ormenisan, S., Grosu, E., Apostu, P., & Badea, D. N. (2015). Optimisation of the Selection Process in Football Game for 10-12 Years Old Children, *Studia UBB Educatio Artis Gymn., 60(2)*, pp. 67-74.

Popescu, L. (2010). *Stil de viață sănătos – un ghid de educație pentru sănătate*. Constanţa, Editura Muntenia.

Sabău, G. (2010). *Efectele practicării mișcării fizice organizate asupra calității vieții*. Teza de doctorat, Facultatea de Sociologie și Asistență Socială, Universitatea "Babeş-Bolyai" Cluj-Napoca.

Scarlat, E. & Scarlat, M. (2002). *Educație fizică și sport*, Bucureşti, Editura Didactică şi Pedagogică.

Şchiopu, U. (2008). *Psihologia modernă, către o teorie a vârstelor*. Bucureşti, Editura Romania Press.

Stoica, D., & Barbu, D. (2013). Influence of sports training factors on the instructive education training process concerning the game optimization and the somatic and morpho – functional development to juniors aged between 17 and 18 years attending Gică Popescu Football School. *Journal of Sport and Kinetic Movement, 22(2),* pp. 33-37.

Trial, G.T., & James, J.D. (2001). The Motivation Scale for Sport Consumption: Assessment of the Scale's Psychometric Properties. *Journal of Sport Behavior, 24(1)*, pp.108 – 127.

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USE OF THE 30 M ACCELERATION TEST FOR PREDICTING RESULTS AT ATHLETIC TESTS OF SPEED ON 60, 100 AND 200 M IN CHILDREN WITH A RANGE OF 10 TO 11 YEARS

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ABSTRACT. Introduction: The motor quality speed is not just how quickly someone can run, but is, under the influence of their acceleration, maximal speed of the human movement The human movement speed requires a very good level of strength and power, but also depends on the body weight and resistance The body's ability to accelerate (speed) is one of the main fitness components, important to achieve performance in many sports. **Objectives:** The study analysis and statistical process the results of two samples of 105 children that practice football and children who do not practice sports regularly, aged between 10 and 11 years The analyzed period was from December 2018 to February 2019. **Methods:** Methods used in this inquire where preponderant experimental, it was used as assessment method the acceleration test on 30 m, for statistical interpretation it was used the Student t test, D'agostino & Pearson correlation, Unpaired T test with Welch's correction. **Results:** The results showed that students who practice sports (football or basketball) obtained better results at the 30 m acceleration test than children that don't practice sport at all We obtained statistical significant difference comparing the group of football players and basketball players and the unsportsmanlike children group. **Conclusions:** The conclusion of the research highlighted the results of the two groups and, most importantly, that the 30m acceleration test could predict the results that children may have on other specific athletic tests: 60m, 100m and 200m The results were markedly different between athlete students and non-athletes, the athletes performing much better However, we haven't noticed a big difference between football players and basketball players.

Key words: *speed, acceleration, running, human movement.*

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REZUMAT. ***Utilizarea testului de accelerare pe 30 m în predicția rezultatelor la probele atletice de viteză pe 60, 100 și 200 m la copiii cu vârste cuprinse între 10 și 11 ani.*** **Introducere:** Calitatea motrică viteza nu reprezintă doar capacitatea unei persoane să se deplaseze rapid, ci reprezintă, sub influența accelerației sale, viteza maximă a mișcării umane. Viteza de mișcare a omului necesită un nivel foarte bun de forță și putere, dar depinde și de greutatea corporală și de rezistența acestuia. Capacitatea individului de a accelera (viteza) este una dintre principalele componente de motricitate, importantă pentru a atinge performanța în multe sporturi. **Obiective:** Obiectivul cercetării a fost analiza și procesarea statistică a rezultatelor a două grupe de 105 copii care practică fotbal sau baschet, și copii care nu practică sport în mod regulat, cu vârste cuprinse între 10 și 11 ani. Perioada de desfășurare a studiului a fost cuprinsă între decembrie 2018 și februarie 2019. **Metode:** Metodele utilizate în acest studiu au fost preponderent experimentale, fiind utilizată ca metodă de evaluare testul de accelerare pe 30 m, pentru interpretarea statistică s-a folosit testul Student t, corelația D'agostino și Pearson, testul T nepereche cu corecția Welch. **Rezultate:** Rezultatele au arătat că elevii care practică sport (fotbal sau baschet) au obținut rezultate mai bune la testul de accelerare de 30 m decât copiii care nu practică sport deloc. Am obținut o diferență semnificativă statistic comparând grupul de elevi care practică fotbal sau baschet și grupul de copii care nu practică nici un sport. **Concluzii:** Concluzia cercetării a evidențiat rezultatele celor două grupuri și, cel mai important, faptul că testul de accelerație pe 30 m ar putea prezice rezultatele pe care copiii le pot avea la alte teste atletice specifice: 60m, 100m și 200m. Rezultatele au fost semnificative statistic comparând elevii sportivi și cei care nu practică sport, sportivii performând mult mai bine Cu toate acestea, nu am observat o mare diferență între cei care practică fotbal și cei care practică baschet.

Cuvinte cheie: *viteză, accelerare, alergare, mișcarea umană*

Introduction

From a physiological point of view, motor activity would oppose the term sensitivity (related path) in order to highlight only the motor component (efferent path) of a reflex act, in response of the central nervous system to muscles (Neagu, 2012).

"Motricity is the set of functions that ensure the maintenance of posture and the execution of movements specific to living beings; it is thought in opposition to the repetition and sensory functions" (Neagu, 2012).

The motor activity, besides its biological dimension, acquires a social dimension, the human motricity, respectively, the movement transforming from a socialized activity, to a socializing one. Each individual has its particularities that represent a specific way by which it presents its motor coding, as a constituent element of what we can define, the mark of its own personality (Neagu, 2010).

Psychological particularities: it represents part of the general selection through which the knowledge of the psychological particularities of the children is realized and their correspondence to certain activities with the strictly delimited requirements. A very important thing in the psychological selection is to ensure the correspondence between the attitudes and aptitudes of the individual. On this basis it guarantees the adaptation to the effort and efficiency to the training or to the physical education hours of the individual (Cojocaru & Ionita, 2008).

Some characteristics with varying degrees of hereditary determination are involved in psychic ability. Regarding the nervous system of the analyzers and the sensory-motor structures, the contribution of heredity is higher, while for the skills that involve social adaptation and intellectual organization, exercises and education are decisive (Cojocaru & Ionita, 2008).

The motor development takes place on a stage plan in which we observe different models that include the basic motor purchases, for example: rolling, walking, running, etc It becomes more and more complex, later found in neuromotor development, called coarse and fine motor skills (Cojocaru & Ionita, 2008).

The motor development begins with the motor conduct from the lying position and until the acquisition of the walking. These motor skills are called basic motor purchases. After learning to walk, the child goes to another stage of learning the complex motor skills. Complex motor skills referred to: climbing, jumping, pedaling, swimming, throwing, etc., these skills depend on how motivated his motor development by the environment (Petrut-Barbu, 2012).

Some motor skills are more easily acquired: walking, running, climbing, and others only through a learning organization: swimming, cycling, etc (Petrut-Barbu, 2012).

The motor quality of the speed depends largely on the genetic factors. This is why positive changes in speed are mainly related to the genotype of an individual. Consequently, we cannot develop this motor quality even if we use a long-term training method and an intensive plan for several years. A very important physiological concept, closely related to genetic factors, is the substantial number of fast fibers (white fibers) in the composition of muscles. The ability to selectively excite these fibers is the efficiency of nerve processes, the ability to rapidly pass from excitation to inhibition and vice versa (Djaoui et al., 2017).

The speed of movement has three major components: the speed of reaction, the time of simple movement and the frequency of the movements. Speed is becoming more and more important in contemporary sports activity. The speed of the player is not only related to the level of the physical condition Its structure is much more complex. During a game, it is manifested by the speed of the game actions. As Andrzejewski (2013) has pointed out, the speed of actions is built on the basis of motor and cognitive components that are closely linked. With

the motor component, the speed is controlled neurophysiological (jump, change of direction, sprint, acceleration, dynamic stop, start speed). The cognitive components play a very important role through the processes of receiving and processing information in the analysis centers within the cerebral cortex, e.g (choice of actions, speed of making the right decisions, reaction time, speed of perception and prediction) (Andrzejewski et al., 2013).

Mohr (2016) argued that the new concepts in the training process should emphasize the priority of speed during endurance training. In addition to the development of motor capacity, speed plays an important role in the cognitive components, the process of receiving and processing information in the cerebral cortex occurs invisibly, while movement and speed are observable (Mohr & Krustrup, 2016).

Speed training is based on the genetic availability that infuses this quality very early, during which time it can even be established. The maximum speed point is reached between 18 and 20 years in boys and 15–17 years in girls. After these ages, the speed increases due to other qualities (strength, mobility, coordination, etc.). Due to the increased coordination capacities between 5–7 years, the speed of travel is particularly high. In the first school phase, the frequency and speed of movements (speed of execution) increase dramatically. In the second-level of school, one can intensify the work for speed, especially for the speed of execution and the speed of coordination, but not the speed in the regime of resistance. In the first part of puberty and adolescence, there are significant gains in speed and speed-force (Teodorescu, 2009).

Moving is a fundamental form of human locomotion, a very popular physical activity and the most ubiquitous type of movement in sports. Performance depends on sustained, predominantly aerobic energy production, and the transformation of this energy into forwarding motion, called running/moving economy. Because displacement is a relatively unconstrained movement with many degrees of freedom, the athletes perform the locomotor system using various "techniques". Despite this variability and an intuitive relationship between running technique and performance and effort economy, there is very little objective, robust information on the influence of running technique on performance and / or functional economy (Ahn et al., 2014; Nummela et al., 2012).

Running requires a much more intensive and greater oxygen demand from the body than sedentary life does. The diaphragm contracts to draw air into the lungs, at the same time, the intercostal muscles relax only to contract strongly at the time of expiration while the diaphragm relaxes and is drawn to the chest. The lungs are filled with air and empty to support the runner's need for oxygen with this effort of pulling and pushing. The muscles of the chest besides their action in the breathing mechanisms play an important role in the forward movement (Puleo & Milroy, 2016).

The technical understanding of the functioning economy of the human body has been the focus of many research. Specific factors include, lower members kinematics, spatio-temporal factors, kinetics, neuromuscular factors, shoe surface interaction with soil, and biomechanics of upper and lower member running technique (Moore et al., 2012; Tseh et al., 2008).

Sprint performance is an important factor for many athletic activities and often can define sporting success (Winchester et al., 2008). Specific examples can be seen in track and field such as the sprint events, whereby the fastest athlete usually wins the race. However, sprint performance is not solely important for track and field event outcome (Gomez et al., 2013).

Objectives and Hypothesis of the Research

Our purpose was seeing the difference between a football athlete and a non-athlete with a 30-meter acceleration test and to predict the results on other athletic events. The task of this research is to encourage the children who don't practice any sports to start psychical activity and among them with good results to try to support the practice of any sport on a competitive level.

The present research started from the hypothesis that following the introduction of the acceleration test on 30 meters, we will be able to analyze the speed indices of the subjects, as well as to make a prediction for the 60m, 100m, and 200m tests.

The purpose of the research is, first of all, to see the difference between the subjects who practice a sport and those who do not practice, and then we will orientate towards a sports branch for which the motor speed is important. Secondly, we want to compare the results of the two samples, which practice football and basketball.

Design of the Research

Subjects of the research

The study consisted of the analysis and statistical processing of the results of two samples consisting of children who practice football and children who do not practice sports regularly. This investigation was overseen in accordance with the Declaration of Helsinki (2013) and approved by the Ethics Committee of "Lucian Blaga" University of Sibiu before the beginning of the study. It also met the ethical standards for Sport and Exercise Science Research. Due to the fact that the General data protection regulation entered into the appliance on 25 May 2018 (Regulation (EU) 2016/679).

Place and period of the research

Our study compares the level of speed motor quality, through the 30-meter acceleration test, in primary school children, that practice sports and do not practice sports, was conducted over a period of three months, between December 2018 - February 2019.

Testing description

The subjects took a warm-up for 10 minutes while a 30-meter corridor was drawn. The subjects started in a predetermined order, making a sprint for 30 meters, while we registered each individual result. The test was applied 3 times and recorded the best time. In this research, we analyzed three samples, one of 50 subjects who play football, a sample of 20 subjects who practice basketball and another one of 50 students who doesn't play any sport. The average age was 10–11 years. The 50 football players come from the team of the OSK St George club, the basketball players are from the team I.S.K St George and subjects who do not practice sports are part of the fourth grade of the Mikes Kelemen Theoretical High School of St George City. During the testing, we tried to induce a competitive atmosphere, while eliminating all stressors. The materials used in the test were: cones, whistle, and roulette (https://www.brianmac.co.uk/30accel.htm?fbclid=IwAR0ad-1AffS).

Methods of research

Description of the acceleration test on 30, 60, 100 and 200 m

Testing and measuring are the means of collecting information on the basis of which evaluations and subsequent performance decisions are made, but, in the analysis, we must take into account the factors that could influence the results.

The objective of this test is to monitor the development and level of the speed quality of each subject. We recorded the times of the subjects on 30 meters from standing start position.

The test provides a guide to the performance, the potential of the subjects and a means of monitoring the effect of the training on the physical development of the subject.

Inclusion criteria: In this study were included the students (boys) who: the age of the students, between 10–11 years, they were able to make a physical effort, two samples of sportsmen and one of the subjects who do not practice sports, the consent of the parents or legal guardian to participate in this study.

The research has a prospective character, one of the methods used is the quantitative one, which involves collecting and analyzing the data by carrying out measurements. The study was carried out during the hours of physical education and sports, as well as at football and basketball training.

Results

Table 1. Statistical comparison between groups on 30 and 60 m

Acceleration test on 30 m			Acceleration test on 60 m		
Mean	Non-sportive	Football players	Mean	Non-sportive	Football players
	6.375	5.468		9.883	8.812
Std Deviation	0.6231	0.2814	Std Deviation	0.724	0.3365
D'agostino & Pearson omnibus normality test			**D'agostino & Pearson omnibus normality test**		
Passed normality test (alpha=0.05)?	YES	YES	Passed normality test (alpha=0.05)?	YES	YES
Unpaired T test with Welch's correction			**Unpaired T test with Welch's correction**		
P value	P<0.0001		P value	P<0.0001	
Are means signif different? (P < 0.05)	YES		Are means signif different? (P < 0.05)	YES	

The first step in our research was to compare the groups of children that don't practice sports activities and those that practice football at the acceleration test on 30 m and on 60 m. We used the D'agostino & Pearson omnibus normality test and the Unpaired T test with Welch's correction and **found out that the results were statistically significant at p<0.05**. The results can be observed in Table No 1 and also in Figure No 1.

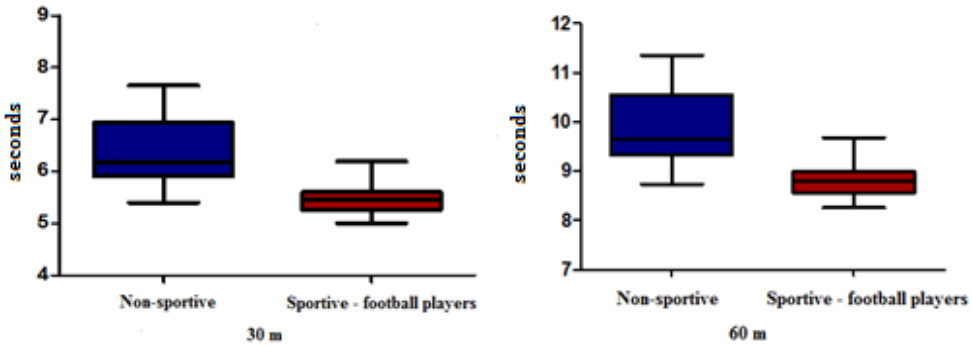

Fig. 1. Statistical comparison between groups on 30 and 60 m

Table 2. Statistical comparison between groups on 100 m and 200 m

Acceleration test on 100 m			Acceleration test on 200 m		
Mean	Non-sportive	Football players	Mean	Non-sportive	Football players
	15.35	13.72		31.17	27.81
Std Deviation	1.097	0.5185	Std Deviation	2.252	1.077
D'agostino & Pearson omnibus normality test			**D'agostino & Pearson omnibus normality test**		
Passed normality test (alpha=0.05)?	YES	YES	Passed normality test (alpha=0.05)?	YES	YES
Unpaired T test with Welch's correction			**Unpaired T test with Welch's correction**		
P value	P<0.0001		P value	P<0.0001	
Are means signif different? (P < 0.05)	YES		Are means signif different? (P < 0.05)	YES	

The results in Table 2 and Figure 2 presented the comparison between unsportsmanlike and football players at the 100 m and 200 m acceleration test. We also used the D'agostino & Pearson omnibus normality test and Unpaired T test with Welch's correction and **discovered a statistical significant difference with p<0.05 between the two groups of children**.

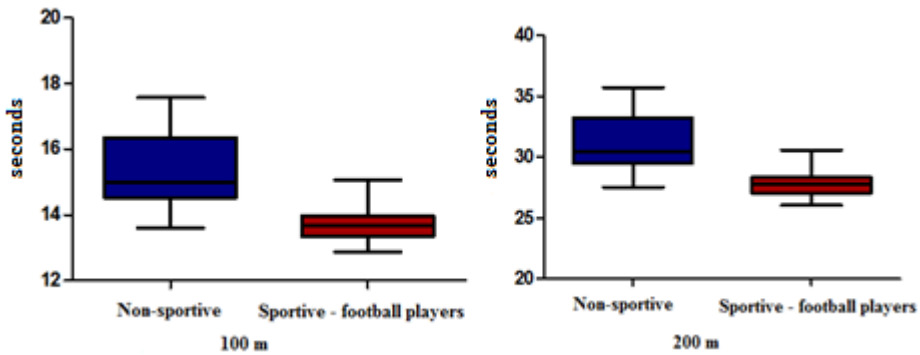

Fig. 2. Statistical comparison between groups on 100 and 200 m

The following steps were to analyze and compare the unsportsmanlike children group and the basketball group of children at the 30 m and 60 m acceleration test. For statistical analysis it was used the D'agostino & Pearson omnibus normality test and the unpaired T test with Welch's correction. The results that can be observed in Table 3 and Figure 3 between those **two groups was a statistical significant difference at p<0.05**.

Table 3. Statistical comparison between groups on 30 and 60 m

Acceleration test on 30 m			Acceleration test on 60 m		
Mean	Non-sportive	Basketball players	Mean	Non-sportive	Basketball players
	6.375	5.500		9.883	8.852
Std Deviation	0.6231	0.3504	Std Deviation	0.7244	0.4195
D'agostino & Pearson omnibus normality test			**D'agostino & Pearson omnibus normality test**		
Passed normality test (alpha=0.05)?	YES	YES	Passed normality test (alpha=0.05)?	YES	YES
Unpaired T test with Welch's correction			**Unpaired T test with Welch's correction**		
P value	P<0.0001		P value	P<0.0001	
Are means signif different? (P < 0.05)	YES		Are means signif different? (P < 0.05)	YES	

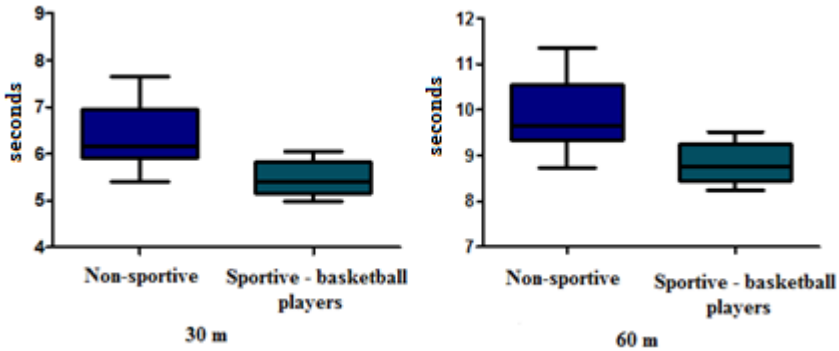

Fig. 3. Statistical comparison between groups on 30 and 60 m

Table 4. Statistical comparison between groups on 100 and 200 m

Acceleration test on 100 m			Acceleration test on 200 m		
Mean	Non-sportive	Basketball players	Mean	Non-sportive	Basketball players
	15.35	13.78		31.17	27.92
Std Deviation	1.097	0.6466	Std Deviation	2.252	1.343
D'agostino & Pearson omnibus normality test			**D'agostino & Pearson omnibus normality test**		
Passed normality test (alpha=0.05)?	YES	YES	Passed normality test (alpha=0.05)?	YES	YES
Unpaired T test with Welch's correction			**Unpaired T test with Welch's correction**		
P value	P<0.0001		P value	P<0.0001	
Are means signif different? (P < 0.05)	YES		Are means signif different? (P < 0.05)	YES	

The next decision was to analyze the difference between unsportsmanlike children and children that practice basketball at the 100 m and 200 m acceleration prediction test. The results presented in Table 4 and Figure 4 were calculated using the D'agostino & Pearson omnibus normality test and the unpaired T test with Welch's correction. **It was found a statistical significant difference at p<0.05, between unsportsmanlike children and children that practice basketball at both prediction acceleration tests.**

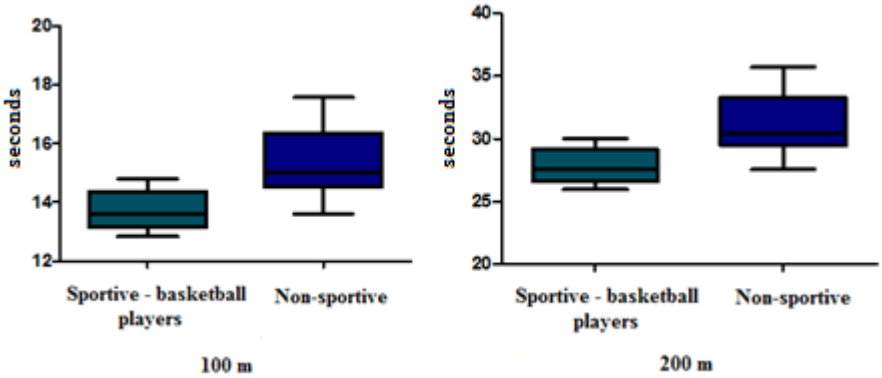

Fig. 4. Statistical comparison between groups on 100 and 200 m

Table 5. Statistical comparison between groups on 30 and 60 m

Acceleration test on 30 m			Acceleration test on 60 m		
Mean	Football players	Basketball players	Mean	Football players	Basketball players
	5.468	5.500		8.812	8.852
Std Deviation	0.2814	0.3504	Std Deviation	0.3365	0.4195
D'agostino & Pearson omnibus normality test			**D'agostino & Pearson omnibus normality test**		
Passed normality test (alpha=0.05)?	YES	YES	Passed normality test (alpha=0.05)?	YES	YES
Unpaired T test with Welch's correction			**Unpaired T test with Welch's correction**		
P value	0.7324		P value	0.7269	
Are means signif different? (P < 0.05)	NO		Are means signif different? (P < 0.05)	NO	

At Table 5 and Figure 5 we calculated the difference between the group of children that practice football and those that practice basketball at the 30 m and 60 m prediction test. The results were calculated using the D'agostino &

Pearson omnibus normality test and the unpaired T test with Welch's correction. **No significant statistical difference was found between the two groups of children at a p-value of 0.7324 and 0.7269 (p<0.05).**

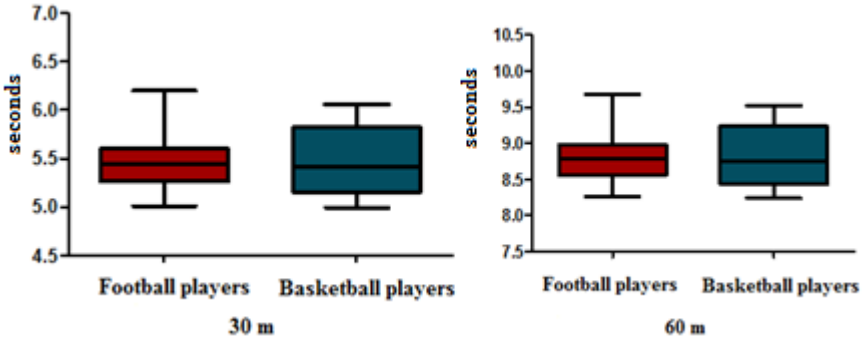

Fig. 5. Statistical comparison between groups on 30 m and 60 m

Table 6. Statistical comparison between groups on 30 and 60 m

Acceleration test on 100 m			Acceleration test on 200 m		
Mean	Football players	Basketball players	Mean	Football players	Basketball players
	13.72	13.78		27.81	27.92
Std Deviation	0.5185	0.6466	Std Deviation	1.077	1.343
D'agostino & Pearson omnibus normality test			**D'agostino & Pearson omnibus normality test**		
Passed normality test (alpha=0.05)?	YES	YES	Passed normality test (alpha=0.05)?	YES	YES
Unpaired T test with Welch's correction			**Unpaired T test with Welch's correction**		
P value	0.7408		P value	0.7480	
Are means signif different? (P < 0.05)	NO		Are means signif different? (P < 0.05)	NO	

The last step was to compare the group of children that practice football and those that practice basketball at the 100 m and 200 m predictions of acceleration test (Table 6 and Figure 6). The results were calculated using the D'agostino & Pearson omnibus normality test and the unpaired T test with Welch's correction, and **no statistical significant difference at p<0.05 was found between the two groups at the 100 m and 200 m acceleration prediction test.**

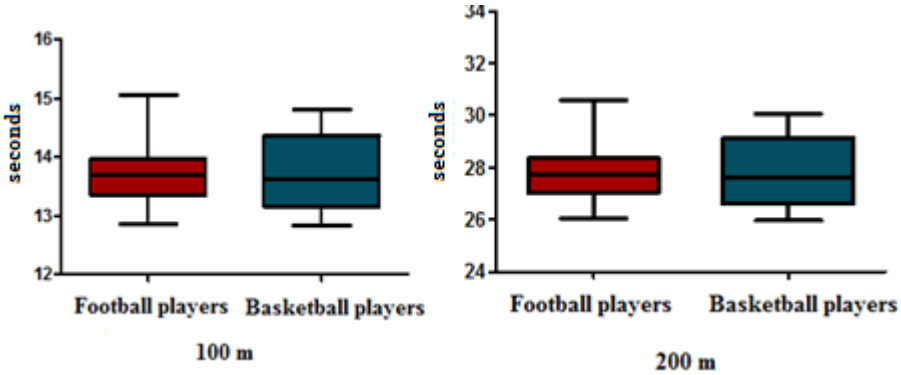

Fig. 6. Statistical comparison between groups on 100 m and 200 m

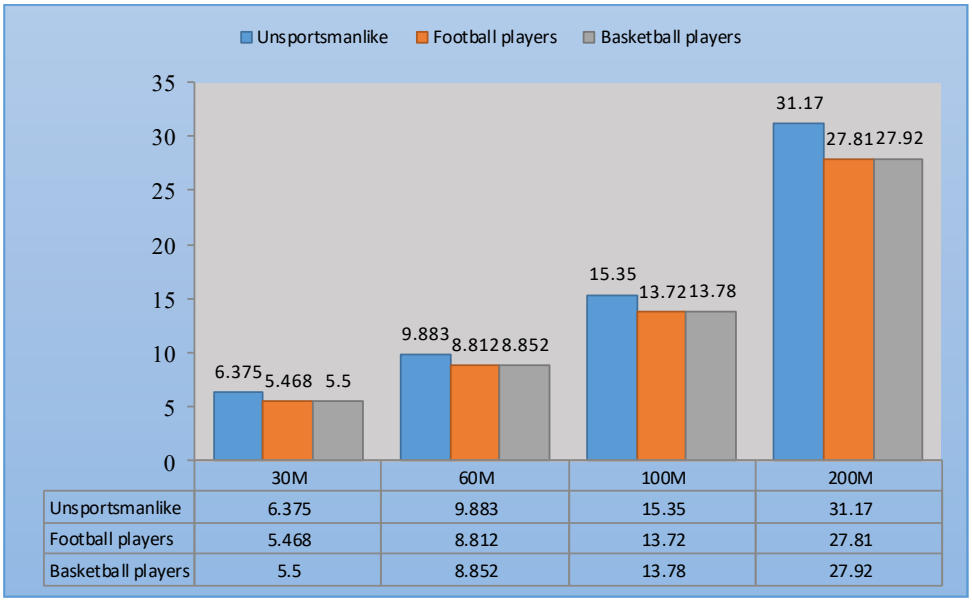

Fig. 7. Graphical representation of differences between 30 m, 60 m, 100 m and 200 m prediction tests at unsportsmanlike children, football players and basketball players

Discussions

Sprint performance has been shown to be an important determinant of match-winning actions in a wide variety of sports such as rugby, soccer and basketball (Alemdarogu, 2012; Schneiker et al., 2006). Faude, Koch and Meyer (2012) found that straight sprinting is the most frequent action in goal situations in professional soccer with 45% of goals in the German League being preceded

by a sprint by the scoring or assisting player (Nummela et al., 2007). For a majority of team sports, the distance covered during a single sprinting bout typically falls within acceleration phase type distances (<30m) (Rumpf et al., 2016; Wild et al., 2011).

The acceleration test on 30m and the development of the speed motor quality even from an early age (between 11 and 14 years) is an increasingly frequent topic in research studies, because the specialists recognize that it is the most advantageous and important motor quality in sports activities.

The results obtained in our investigation were statistically analyzed with the D'agostino & Pearson omnibus normality test and the unpaired T test with Welch's correction.

After the statistical analysis we obtained statistical significant differences at $p<0.05$ at the 30, 60, 100 and 200 m acceleration test at the comparison of unsportsmanlike group of children compared with the group where children practiced football and basketball. Between children that practice football and children that practice basketball, we didn't find any statistical significant difference.

Previous research has accentuated the importance of acceleration for team sports such as professional rugby league in which 68% of all recorded sprints were less than 20m (Gabbett, 2012), and professional soccer in which the average sprint distance lasts 2–4 seconds and typically covers 10–30m (Di Salvo et al., 2010; Wild et al., 2011). However, maximum velocity sprinting is also important for many sports (Wild et al., 2011)

From a static start maximum velocity is usually achieved at 30–40m for team sports athletes (Duthie et al., 2006; Vescovici, 2012; Young et al., 2008) and between 40 and 70m in elite sprinters (Morin et al., 2015). Although longer distance sprints occur much less frequently in team sports than short sprints (Di Salvo et al., 2010; Wild et al., 2011), maximum velocity is usually reached when a sprint is initiated from a moving start (Duthie et al., 2006). Henceforth, as a majority of sports are inclusive of sprinting (Lockie et al., 2014), sprint ability (i.e the ability to accelerate quickly, achieve a high maximal running velocity and also the ability to maintain maximum velocity) can be deemed vital for sporting performance (Morin et al., 2011).

Conclusions

The body's ability to accelerate (speed) is one of the main fitness components, important to achieve performance in many sports. Speed is one of the main fitness components, important for success in many sports.

As a result of our study, we were able to highlight the results of the two groups of children one that practice sports (football or basketball) and, most importantly, to predict the results that these children may have on other specific athletic tests: 30, 60, 100 and 200 m. The results were markedly

different between athlete students and non-athletes, the athletes performing much better. However, we haven't noticed a big difference between soccer players and basketball players.

Our conclusion on the basis of the hypothesis is that there is an observable difference between the subjects who practice sports versus those who do not practice any sport according to the obtained results. The statistics have shown us the significant difference between the non-sports vs football players and non-sports vs basketball players.

REFERENCES

Ahn, A.N., Brayton, C., Bhatia, T., Martin, P (2014) Muscle activity and kinematics of forefoot and rearfoot strike runners, *Journal of Sports Health Science*, *3*(2):102–12 https://doi.org/10.1016/j.jshs.2014.03.007

Alemdaroğlu, U (2012) The Relationship Between Muscle Strength, Anaerobic Performance, Agility, Sprint Ability and Vertical Jump Performance in Professional Basketball Players, *Journal of Human Kinetics*, *31*(1):87–92 DOI: 10.2478/v10078-012-0016-6

Andrzejewski, M., Chmura, J., Pluta, B., Strzelczyk, R., Kasprzak, A (2013) Analysis of sprinting activities of professional soccer players, *The Journal of Strength and Conditioning Research*, *27*(8):2134–2140 DOI: 10.1519/JSC.0b013e318279423e

Cojocaru A., Ioniță M (2008) *Volei Aprofundare,* Editor Foundation "România de Mâine", Bucureşti, page 40–41

Di Salvo, V., Baron, R., Gonzalez-Haro, C., Gormasz, C., Pigozzi, F., Bachl, N (2010) Sprinting analysis of elite soccer players during European Champions League and UEFA cup matches, *Journal of Sports Sciences, 28*:1489–1494 DOI: 10.1080/02640414.2010.521166

Djaoui, L., Chamari, K., Owen, A. L., Dellal, A. (2017) Maximal sprinting speed of elite soccer players during training and matches, *The Journal of Strength and Conditioning Research, 31*(6):1509–1517 DOI: 10.1519/JSC.0000000000001642

Duthie, G., Pyne, D., Marsh, D., Hooper, S (2006) Sprint patterns in rugby union players during competition, *Journal of Strength and Conditioning Research, 20*:208–214 DOI: 10.1519/R-16784.1

Faude, O., Koch, T., Meyer, T (2012) Straight sprinting is the most frequent action in goal situations in professional football, *Journal of Sports Sciences*, *30*(7):625–631 DOI: 10.1080/02640414.2012.665940

Gabbett, T (2012) Sprinting patterns of National Rugby League Competition *Journal of Strength and Conditioning Research*, *26*: 121–130 DOI: 10.1519/JSC.0b013e31821e4c60

Gómez, J., Marquina, V., Gómez, R (2013) On the performance of Usain Bolt in the 100 m sprint, *European Journal of Physics*, *34*(5), 1227–1233 DOI: 10.1088/0143-0807/34/5/1227

Ingebrigtsen, J., Dalen, T., Hjelde, G., Drust, B., Wisloff, U (2014) Acceleration and sprint profiles of a professional elite football team in match play, *European Journal of Sport Science*, *15*:101–110 DOI: 10.1080/17461391.2014.933879

Lockie, R., Murphy, A., Callaghan, S., Jeffriess, M (2014) Effects of sprint and plyometrics training on field sport acceleration technique, *Journal of Strength and Conditioning Research*, *28*:1790–1801 DOI: 10.1519/JSC.0000000000000297

Mohr, M., Krustrup, P (2016) Comparison between two types of anaerobic speed endurance training in competitive soccer players, *Journal of Human Kinetics*, *51*:183-192 DOI: 10.1515/hukin-2015-0181

Moore, I S., Jones, A M., Dixon, S J (2012) Mechanisms for improved running economy in beginner runners, *Medicine Scientific Sports Exercercise, 44*:1756–1763 DOI: 10.1249/MSS.0b013e318255a727.

Morin, J., Slawinski, J., Dorel, S., de villareal, E., Couturier, A., Samozino, P., Brughelli, M., Rabita, G (2015) Acceleration capability in elite sprinters and ground impulse: Push more, brake less? *Journal of Biomechanics*, *48*(12), 3149–3154 DOI: 10.1016/ j.jbiomech.2015.07.009

Morin, J., Edouard, P., Samozino, P (2011) Technical ability of force application as a determinant factor of sprint performance, *Medicine & Science in Sports & Exercise*, *43*(9):1680–8 DOI:10.1249/MSS.0b013e318216ea37.

Neagu, N (2010) *Teoria și practica activității motrice umane,* Editor University Press, Târgu Mureș, page 34–36.

Neagu, N (2012) *Motricitatea Umană Fundamente Psihopedagogice,* Editor University Press, Târgu Mureș, page 23–24.

Nummela, A., Keränen, T., Mikkelsson, L O (2007) Factors related to top running speed and economy, *International Journal of Sports Medicine*; *28*(8):655–61.

Petruţ-Barbu G (2012) *Copilul și motricitatea Program de educare neuromotorie,* Editor Nomina, Ediția a 2-a, Bucharest, page 112–114.

Puleo, J., Milroy, P (2016) *Anatomia alergării,* Editor Lifestyle Publishing, Bucharest, page 47–53.

Rumpf, M., Lockie, R., Cronin, J., Jalilvand, F (2016) Effect of Different Sprint Training Methods on Sprint Performance Over Various Distances, *Journal of Strength and Conditioning Research, 30*(6):1767–1785 DOI: 10.1519/JSC.0000000000001245.

Schneiker, K., Bishop, D., Dawson, B and Hackett, L (2006) Effects of Caffeine on Prolonged Intermittent-Sprint Ability in Team-Sport Athletes, *Medicine and Science in Sports & Exercise, 38*(3): 578–585 DOI: 10.1249/01.mss.0000188449.18968.62

Teodorescu, S (2009) *Antrenament și competiție,* Editor Alpha, MDN, Bucharest, page 64–66.

Tseh, W., Caputo, J L., Morgan, D W (2008) Influence of gait manipulation on running economy in female distance runners, *Journal of Sports Science Medicine*; *7*:91–95 Retrived from: https://www.ncbi.nlm.nih.gov/pubmed/24150139

Vescovi, J (2012) Sprint speed characteristics of high-level American female soccer players: Female Athletes in Motion (FAiM) study, *Journal of Science and Medicine in Sport*, *15*:474–478 DOI: 10.1016/j.jsams.2012.03.006

Winchester, J., Nelson, A., Landin, D., Young, M., Schexnayder, I (2008) Static Stretching Impairs Sprint Performance in Collegiate Track and Field Athletes, *Journal of Strength and Conditioning Research*, *22*(1), 13–19 DOI: 10.1519/JSC.0b013e31815ef202.

Wild, J., Bezodis, N., Blagrove, R and Bezodis, I (2011) A Biomechanical comparison of accelerative and maximum velocity sprinting: specific strength training considerations, *The Journal of the UK Strength and Conditioning Association*, *21*:23-36 Retrived from: https://research.stmarys.ac.uk/id/eprint/336/1/Wild-et-al-Biomechanical-Comparison-of-Accelerative-Maximum-Velocity-Sprinting.pdf

Young, W, Russel, A, Burge, P, Clarke, A, Cormack, S, Stewart, G (2008) The use of sprint tests for assessment of speed qualities of elite Australian rules footballers, *International Journal of Sports Physiology and Performance*, *3*: 199–206 DOI: 10.1123/ijspp.3.2.199

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THE PSYCHOLOGICAL IMPACT OF EMOTIONS IN INCREASING THE PERFORMANCE OF FOOTBALL PLAYERS

FETEAN GHEORGHE[1,2,*], MONEA DAN[2] & MONEA GHEORGHE[2]

ABSTRACT. From a theoretical standpoint, the innovative aspects of the current paper stem from applying a new psychological approach in the training of football players. The psychologically-enhanced training leads to a dramatic increase in the players' performance. Our scientific initiative focuses on new elements which optimize the training of football players in order for them to achieve their full potential. Current theoretical research claims that introducing therapy elements in football training mitigates the effect of dysfunctional emotions and increases the effect of functional emotions, ultimately leading to a proportional increase in the performance of football players aged 7 – 10.

Keywords: *football, emotions, sport performance*

REZUMAT. ***Impactul factorului psihologic de emoție în creșterea performanței sportive la jucătorii de fotbal.*** Importanţa teoretică a lucrării constă în faptul că pune în evidenţă o nouă orientare a procesului de pregătire prin implementarea programului de pregătire psihologică, care contribuie în mod semnificativ la creşterea performanţelor sportive a jucătorilor de fotbal. Demersul ştiinţific aduce o serie de elemente de noutate și originalitate în ceea ce privește programul de pregătire psihologică pentru optimizarea pregătirii jucătorilor de fotbal în vederea valorificării la maximum potenţialul jucătorilor. Conform cercetărilor teoretice deja existente în literatura de specialitate s-a plecat de la faptul că introducerea unei intervenţii terapeutice în cadrul antrenamentul de fotbal cu diminuarea emoţiilor disfuncţionale în favoarea dezvoltării unui nivel mai crescut de emoţii funcţionale va avea ca și consecinţă creşterea performanţei sportive în jocul de fotbal la grupele de 7-10 ani.

Cuvinte cheie: *fotbal, emoţii, performanţă sportivă*

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Introduction

Conceptually speaking, "emotions" define our existence as individuals and as society. However, the concept is hard to define. Emotions refer to a specific state which temporarily pauses the stable functioning of an organism, the resulting exchange having behavioral, physiological and experimental traits (Cashmore, 2008). Emotions are complex feelings which carry mental, behavioral and physical components. Mentally speaking, emotions can be experienced as being pleasant or unpleasant. Behaviorally speaking, emotions can be experienced as a trigger which makes us take action. Physically speaking, emotions can be experienced as a powerful tension or as an awakening (Lynn, 2002).

Most sportsmen are involved in the sport activity they will perform before the sport activity actually begins, in that sportsmen project negative mental images related to the situations they will encounter in the contest. Contests usually have both financial and social stakes. Therefore, emotions are a normal reaction to this kind of situation. Stopping these negative thoughts or beliefs, which anticipate a reality which may never come true, is one solution to achieving the desired level of performance (Holdevici, 2005).

Emotions are fundamental affective reactions which can be primary, spontaneous reactions or more complex processes (Ştefănescu, 2013).

Psychology has been studying emotions and their role in human activity for a very long time, trying to establish whether they support the adoption of a given behavior. It was demonstrated that affection has a huge mobilizing impact which can even resort to disengaging reactions. For sportsmen, controlling one's emotions is a matter of self-education. Being aware of their own abilities, sportsmen must nurture their ability to self-control and self-lead. Emotion has been the focus of extensive scientific research and encompasses several dimensions: subjective, cognitive, physiological and behavioral. It has been suggested to view emotions as a side effect of the operations performed by complex mechanisms. Emotion is an automatism which triggers the correct response. In Western countries, emotion is seen as the opposite of reason. As a result, most psychotherapy interventions are crafted around this observation (Sabău, 2010).

Emotions can be positive or negative. Positive emotions are triggered when what a person wants corresponds to what a person experiences (e.g. sympathy, gratitude, enthusiasm, exaltation, security, confidence, joy, delight etc). Negative emotions are triggered when there is a lack of concordance between what a person experiences or achieves and that person's expectations (e.g. dissatisfaction, fear, anger, regret, sadness, outrage, worry, trouble etc). Of course, this classification is subjective, as it is influenced by the way we distinguish what is pleasant from what is not pleasant. Instead of talking about

positive and negative emotions we might talk about pleasant and unpleasant emotions, since, from a certain point of view all emotions are positive. Emotions could be classified as healthy or unhealthy. For example, being worried ahead of an important contest is a healthy negative emotion, but being panicked is an unhealthy emotion. The joy triggered by a successful exercise is a healthy positive emotion, but being satisfied when someone is in pain is an unhealthy emotion. A person's emotion brings about several changes: biological/physical (e.g. increased breathing rate, increased cardiac rhythm); cognitive („My colleague hit me on purpose!"); behavioral (the way people behave as a result of the education they receive, the way people express themselves at an emotional level). To identify and understand emotions, children must practice them in their social environment (Batiș, 2007).

Objects

We aim at studying the relationship between functional emotions and sport performance. More specifically, we aim at showing that functional emotions are an important predictive factor in achieving football performance starting from the ages of 7-10.

Material and methods

For the purpose of the current research, we conducted a study which includes 90 participants aged 9 from several football groups. The participants were studied before and after our psychological intervention. The participants were selected from the following cities: Cluj-Napoca, Mediaș, Baia-Mare, Gherla, Luduș, all being football club members and all being born in 2006.

The sample size was established based on the Gpower statistical program, setting a 0.05 threshold as the medium effect size in order to obtain a 0.80 statistical correlation. The experiment took place for the duration of one competition year, starting with the 1st of August 2014 and ending with the final assessment on the 20th of June 2015. The training program of the 5 groups comprised of the same number of daily and weekly sessions.

For the technical training we used the following materials:

- Frequency ladder – It is an ideal equipment for a wide range of exercises meant to improve attention and coordination. The ladder is 6-meter long, is made of fabric, and can be used inside or outside the gym.

- SenseBall – It iss ball with a wire developed by CogiTraining. It is a revolutionary football practice technique used by most of the football clubs and federations in the entire world (FA Belgian, AC Milan, RSC Anderlecht and FC Metz to name a few). Recommended by professional football players, SenseBall is specially designed for young players aged 6 to 20. SenseBall practice improves football skills, especially hitting the ball with either leg. The SenseBall technique is based on bilateral activity and coordination. Due to its unique design, a player who trains with SenseBall will perform on average more than 500.000 ball interventions per season.

For the psychological training we used the following tests:

- A structured interview for rational and irrational beliefs;
- A structured interview for emotional control.

In the research, the software product SPSS 23.0 is used specifically for the statistical analysis of data in the field of social sciences (Statistical Package for Social Sciences). In the descriptive statistics part, we used, besides the frequencies, indicators of the central tendency (arithmetic mean, median) and indicators for characterizing the data sharing with the average (standard deviation, dispersion, minimum, maximum).

In the inferential statistics, nonparametric Wilcoxon tests were used. Statistical processing is accompanied by graphical representations with frequencies observed in absolute values and percentages, which illustrate the results and support the conclusions drawn.

Results

Rational beliefs

Table 1. Statistical-mathematical analysis before and after applying the training program, rational beliefs – preliminary research

TESTING	Mean	Medium score difference	Median value	Min. value	Max. value	WILCOXON TEST		Effect size
						Z	P	
Pre	6.79	4.00	5	1	14	-3.833	<0.001	0.62
Post	10.79		11	4	15			

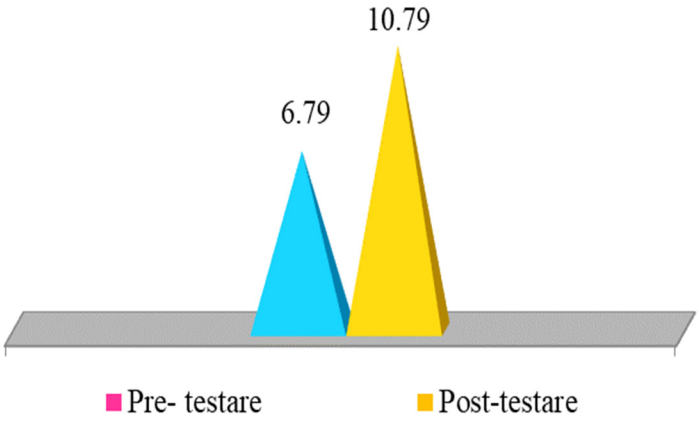

Fig. 1. Mean values – initial testing vs. final testing – rational beliefs

Table 2. Rational beliefs - results

Medium score difference	Progress	P	Statistically significant difference	Large effect size (effect size=0.62)	The null hypothesis
4.0	58.9%	< 0.001	Pre-test vs. Post-test		is rejected.

Irrational beliefs

Table 3. Statistical-mathematical analysis before and after applying the training program, irrational beliefs – preliminary research

TESTING	Mean	Medium score difference	Median	Min. value	Max. value	WILCOXON TEST		Effect size
						Z	P	
Pre	8.21	-4.00	10	1	14	-3.833	<0.001	0.62
Post	4.21		4	0	11			

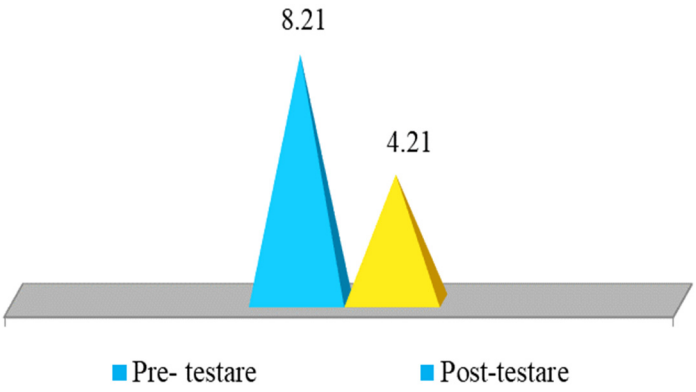

Fig. 2. Mean values initial testing vs. final testing – irrational beliefs

Table 4. Irrational beliefs – results

Medium score difference	Progress	P	Statistically significant difference	Large effect size (effect size=0.62)	The null hypothesis
-4.0	48.7%	< 0.001	Pre-test vs. Post-test		is rejected.

Emotions

Table 5. Statistical-mathematical analysis before and after applying the training program, emotions – preliminary research

TESTING	Mean	Medium score difference	Median	Min. value	Max. value	WILCOXON TEST		Effect size
						Z	P	
Pre	64.53	-23.06	76	0	120	-3.487	< 0.001	0.57
Post	41.47		48	0	84			

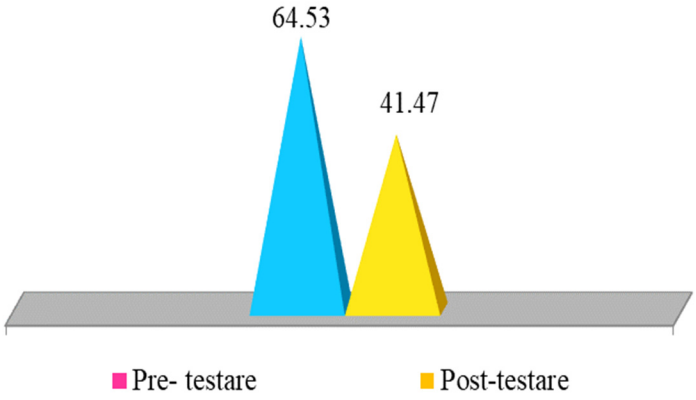

Fig. 3. Mean values initial testing vs. final testing– emotions

Table 6. Emotions – results

Medium score difference	Progress	P	Statistically significant difference	Large effect size (effect size=0. 57)	The null hypothesis
-23.6	35.7%	< 0.001	Pre-test vs. Post-test		is rejected.

Discussion

The role of psychology in sports was discussed in various studies targeting several sports and various participant ages. McCarthy et al. (2013) demonstrates that emotions are important for cognitive interference. Tempering with concentration supports some of the initial findings. Cognitive interference is important for improving the performance of children or junior players.

Predoiu et al. (2016) notes that negative emotions lead to weaker results in the case of working memory and creativity. His study focused on martial arts practitioners and football players.

Studying the basketball game of junior players, Kalloş et al. (2013) concludes that players are the most stressed during competitions, which requires them to undergo psychological training in order to mitigate the effects of stress.

LiWei et al. (1992) studied a group of table tennis players aged 7-10 and notes that the players' technical-tactical execution dramatically improved when execution practice was combined with video recordings. The players found the learning process easier and faster in this context.

As a result of the structured interview for rational beliefs, the medium score for the participants who had rational beliefs increased by 4 points, from 6.79 during pre-testing to 10.79 during post-testing. Percentage-wise the increase correlates to a 58.9% progress. The mean increase in the number of rational beliefs is statistically significant, according to the non-parametric Wilcoxon test, where $p < 0.001 < 0.05$ for $z = -3.833$. The effect size shows (0.62) a large difference between the number of rational beliefs during pre-testing as opposed to post-testing. Figure 1 presents the mean score for rational beliefs in the two tests.

As a result of the structured interview for irrational beliefs, the medium score for the participants who had irrational beliefs decreased by 4 points, from 8.21 during pre-testing to 4.21 during post-testing. Percentage-wise the decrease correlates to a 48.7% progress. The mean decrease in the number of irrational beliefs is statistically significant, according to the non-parametric Wilcoxon test, where $p < 0.001 < 0.05$ for $z = -3.833$. The effect size shows (0.62) a large difference between the number of irrational beliefs during pre-testing as opposed to post-testing. Figure 2 presents the mean score for irrational beliefs in the two tests.

The structured interview targeted at emotional control shows a decrease in the Likert score by 23.06 units, from 64.53 during pre-testing to 41.47 during post-testing. Percentage-wise the decrease correlates to a 35.7% progress. The non-parametric Wilcoxon test shows that the decrease in the mean score of emotional control is statistically significant, $p < 0.001 < 0.05$ for $z = -3.487$. The effect size (0.57) shows a large difference between the emotional control abilities during pre-testing as opposed to post-testing, emotions showing a significant decrease in the post-testing phase. Figure 3 presents the mean score for emotions in the two tests.

Conclusions

The conclusions that we can draw as a result of our scientific study aim at evaluating the hypothesis which targeted the process of reaching a balance between the functional and dysfunctional emotions involved in a football game.

The results obtained by performing the statistical modelling of our data are significant, which confirms our hypothesis according to which: *As a result of psychological intervention, players will have a significantly higher level of functional emotions and an increased sports performance in post-testing settings as opposed to pre-testing settings.*

The results of the semi-structured interview show us that the results of the final assessment are superior compared to those of the initial testing due to the variable that we introduced in our research.

The importance of applying psychological tests at the level of football groups and the intention of mitigating dysfunctional emotions by balancing functional emotions is demonstrated by the results obtained in the context of the semi-structured interview focused on beliefs and emotions.

REFERENCES

Cashmore, E. (2008). *Sport and Exercise Psychology*. New York: Rautlege, p. 145.

Holdevici, I. (2005). *Psihoterapia cognitiv-comportamentală*, Editura Ştiinţelor Medicale, Bucureşti, 90.

Kollos, C., & Tache, S. (2013). Psyhological stress in junior basketball players. *Palestrica of the third millemium- Civilization and Sport,* volum 14 (nr): 2, April-June, 118-122.

LiWei, Z., Qi-wei, M., Orlick, T., & Zitzelsberger, L. (1992). The effect of mental imagery training of performance enhancement, with 7-10 year-old children. *The Sport Psychologist,* volum 6 (nr): 3,230-241.

Lynn-Clark, Ph.D. (2002). *SOS ajutor pentru emoţii: managementul anxietăţii, furiei şi depresiei,* Editura RTS, 10.

McCarthy, P., Allen, M., Janes, M. (2013). Emotions, cognitive interference, and concentration description in youth sport. *Journal of Sports Sciences*, volum 31 (nr): 5, 505-515.

Predoiu, R., Mitrache, G., & Predoiu, A. (2016). The effects of induced emotions on working memory, creativity, repetition speed and precision: A study pilot. *Discobolul,* volumul 12, (nr): 2, 44-51.

Sabău, A.M. (2010). *Strategii privind dezvoltarea inteligenţei emoţionale în gimnastica ritmică.* Teza de doctorat. Bucureşti: Universitatea Naţională de Educaţie Fizică şi Sport.

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THE INFLUENCE OF YOGA POSES AND BREATHING ON MOBILITY OF THE BABEŞ-BOLYAI UNIVERSITY STUDENTS

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ABSTRACT. **Context**: The Hatha-Yoga system aims to improve lung capacity and increase joint mobility. **Purpose:** The purpose of this study was to improve the mobility of the spine in students in year 1 of faculties, without a physical education and sports profile. This study involved 15 students (boys and girls), from the geography profile, first year of Babeş-Bolyai University, Cluj-Napoca. This study aims to assess the effects of 7 weeks of asane, with a number of 12 asane combined under the name Salute of the Sun (Surya Namaskara). **Subjects and Methods:** A total of 15 participants (age: 20.5 years) were divided into a yoga group asana (YA) and non-yoga (NY), who practiced only mobility exercises from the warm up gymnastics exercises in high school curricula. Participants participated in a 50-minute once-a-week session for 7 weeks. The YA Group practiced basic asane with specific breathing instructions (pranayama), while the NY group practiced exercises in the pre-university curriculum. All tests were evaluated at first and after 7 weeks of exercise. **Statistical analysis:** The changes in scores were analysed with the paired t-test for each group. Pre-post results were compared for the measured values. **Results**: Both groups showed significant improvements in spine mobility after 7 weeks. However, group YA recorded values higher than that of the NY group. **Conclusions:** The introduction of yoga exercises, as a complementary form of training, in the 7 weeks, students, improved the mobility of the spine.

Keywords: *Yoga, asana, pranayama, Surya Namaskara.*

REZUMAT. ***Influența unor posturi și respirații din yoga asupra mobilității la studenții Universității Babeş-Bolyai.*** **Context**: Sistemul Hatha-Yoga are ca scop îmbunătățirea capacității pulmonare și mărirea mobilității articulare. **Scop**: Scopul acestui studiu a fost de a îmbunătății mobilitatea coloanei vertebrale la studenții din anul 1 a unor facultăți, fără profil de educație fizică și sport. În acest studiu au participat un număr de 15 studenți (băieți și fete), de la profilul geografie, anul I a Universității Babeş-Bolay, Cluj-Napoca. Acest studiu și-a propus să evalueze

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efectele a 12 asane combinate sub numele de Salutul Soarelui (Surya Namaskar) pe o perioada de 7 săptămâni. **Subiecţi şi metoda:** Un total de 15 de participanţi (vârsta medie: 20,5 ani) au fost împărţiţi într-un grup de yoga asana (YA) şi non-yoga (NY), care practicau doar exerciţii de mobilitate din încălzirea de gimnastică practicare în şcolile de masă. Participanţii au participat la o sesiune de 50 de minute, o dată pe săptămână, timp de 7 săptămâni. Grupul YA a practicat asane de bază cu instrucţiuni specifice de respiraţie (pranayama), în timp ce grupul NY a practicat exerciţii aflate în programa şcolară din sistemul preuniversitar. Evaluările au avut loc la început şi după 7 săptămâni de exerciţii. **Analiza statistică:** Modificările scorurilor au fost analizate cu testul t. Rezultatele pre-post program au fost comparate pentru toate valorile măsurate. **Rezultate**: Ambele grupuri au arătat îmbunătăţiri semnificative ale mobilităţii coloanei vertebrale, după de 7 săptămâni. Cu toate acestea, grupa YA a înregistrat valori superioare celei din grupul NY.

Cuvinte cheie: *Yoga, asana, pranayama, Surya Namaskara.*

Introduction

The term Yoga derives from the Sanskrit word "*yuj*", which means "to attach", "to unite". *(Satyananda, Swami (2008) [1996]*) The system appeared in India and has been practiced since the first half of the millennium Bc. *(Crangle, Edward Fitzpatrick (1994))*

The first presentation of the yoga system outside India was made by Hindu priest Swami Vivekananda (1863-1902) at Harvard University in 1893. (Minor, *Robert Neil (1986)* Yoga is called a system of practices because it encompasses numerous forms of practice, from physical to exclusive meditation. Standard Yoga, Hatha Yoga, combines asana (posture), pranayama (breathing) and meditation, in different percentages: 89.9%, use breathing (pranayama), 54.9% use asana together with meditation. (*Dinesh T*, Gaur *G, Sharma V, Madanmohan T, Harichandra Kumar K, Bhavanani A, et al., 2015*)

Asana refers to the posture of the body, and was first used in *Yoga Sutras, Patanjali* (2nd and 4th century BC). *(Monier-Williams, M. 1899)* Over time there have been numerous research on the effects of yoga practice. Research has followed the effects on stress, anxiety, cardio-vascular diseases, cancer, diabetes, etc. (McCall MC, 2014). In regard to the development of yoga mobility, research confirms the positive effect of this. (*Sharm L., 2015*)

Subjects and Methods

There were 32 volunteers students, who expressed their wish to participate in the research.

Selection criteria: any student who wanted to improve their overall physical fitness, especially mobility.

Exclusion criteria: of the 32 volunteer students were removed from the research program those who regularly practice (2-3 times a week) yoga exercises (hatha-yoga) and those who had certain medical problems related to the spine and/or heart.

In the end the number of volunteers was 15 (7 boys and 8 girls), with an average age of 20.5 years).

Participants were randomly allocated in two groups: YA- those doing the yoga routine and YN- those using the standard exercises in the highs school curriculum. All participants attended a 50-minute training session once a week for 7 weeks and were also advised to exercise at home at least twice a week.

For the YA group exercises were selected from the simplest forms, existing in the Hatha Yoga system, under the name "Salute of the Sun" (*Surya Namaskara*), which has 12 exercises. Each exercise is executed separately. (*Fig. 1*)

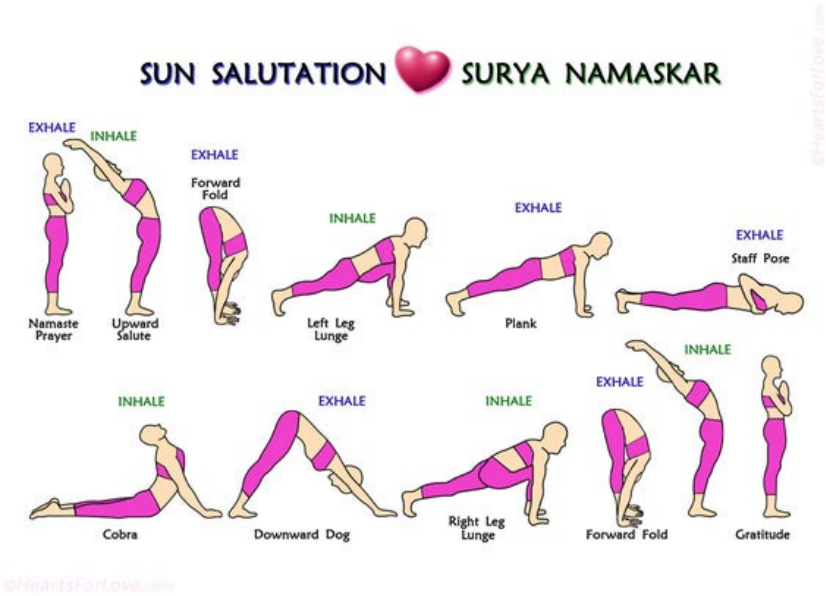

Fig. 1. *Surya Namaskar*
(https://www.etsy.com)

Table 1. YA exercises

No.	Position	Execution
1-3.	Stand. Palms placed on the face of the chest.	1. Inspire on the nose, with the arms lifted above the head. 2. It's the body's extension, with the hips forward and the stretched legs. 3. Exhale, bend down the trunk forward and bring the palms to the ground. The forehead touches the knees.
4.	Forward lunge	Apnea**,** keep the palms on the ground, the left leg moves in the back, and the right leg goes into lunge. The head rises and archs towards the back.
5.	Triangle position	We bring the right foot back, entering the push-up position. We're lifting the hips, imitating the position of the triangle. The heels are placed on the ground. Inspiration.
6.	Position M	Exhale. The knees, chest and chin rest on the ground.
5	Cobra position	Inspiration. The basin goes down the ground. The entire trunk rests on the arms.
7	Triangle position	We bring the right foot back, entering the push-up position. We're lifting the basin, imitating the position of the triangle. The heels are placed on the ground. Inspiration.
8-9	Forward lunge	Exhale. Push the left foot forward, while his right leg stays in the back, going into the lunge, with his palms rested against the ground and his head raised.
10	Stand in flexion	Apnea. We bring the right foot forward, the basin rises, the knees straighten, and the head stays down so that, along with the trunk, it gets as close as possible to the thighs.
11.	Body extension	Inspire on the nose, with the arms lifted above the head.
12.	Stand. Palms placed on the face of the chest.	Return to the position sitting with your palms placed in front of the chest.

For the NY group, the general warm up exercises existing in the pre-university curriculum were selected. (*Table 2*)

Table 2. NY Exercises

Group	Implementation	Number of repetitions
Neckhead	1. Flexi-extensions, 2. Rout (left-right) 3. Head spins (left-right)	32
Arms	1. Forward-to-back spins 2. Twists (left and right) 3. Flexions and extensions	32
Trunk	1. bending (left and right) 2. twists (left and right) 3. Bending 4. rotations of the trunk (right-left)	32 32 32 32
Lower limbs	1. Lunge forward 2. Side lunge 3. Squats	12 12 10

For the mobility test the subjects are standing on a gym bench with a height of 30 cm. they are asked to bend forward and attempt to reach for the floor with their fingertips. The examiner then measures the distance between the subject's right long finger and the bench using a standard measuring tape. If the fingertips are above the bench the score was negative and positive if the fingertips were beneath the surface of the bench. (Table *3* and 4). (*Rikli R, Jones, 2013*)

Table 3. Initial testing (YA)

No.	First name	Result in cm
1	BM	-10.00
2	BE	-15.00
3	AB	-8.00
4	Cm	-12.00
5	CR	-13.00
6	CL	-20.00
7	DD	-13.00
8	GV	-10.00
9	HZ	-12.00
10	TH	-14.00
11	MC	-9.00
12	MM	-10.00
13	RR	-12.00
14	OX	-14.00
15	SB	-8.00

Table 4. Initial testing (NY)

No.	First name	Result in cm
1	DD	-10.00
2	FP	-13.00
3	RS	-21.00
4	RL	-20.00
5	ML	-12.00
6	MS	-10.00
7	MV	-9.00
8	OL	-14.00
9	OS	-15.00
10	LP	-13.00
11	PP	-11.00
12	PPP	-15.00
13	PH	-11.00
14	SH	-9.00
15	ZO	-9.00

Final testing has shown improved values at YA, especially among female subjects. Male subjects have achieved inferior improvements to women, but superior to initial tests. (Table 4)

NY subjects did not achieve higher values than those in the initial test period. (Table 5)

Table 4. Final testing (YA)

No.	First name	Result in cm
1	BM	1.00
2	BE	-1.00
3	AB	3.00
4	Cm	2.00
5	CR	5.00
6	CL	-5.00
7	DD	.00
8	GV	4.00
9	HZ	.00
10	TH	-1.00
11	MC	-2.00
12	MM	1.00
13	RR	2.00
14	OX	-3.00
15	SB	4.00

Table 5. Final Testing (NY)

No.	First name	Result in cm
1	DD	-7.00
2	FP	-10.00
3	RS	-14.00
4	RL	-13.00
5	ML	-5.00
6	MS	-7.00
7	MV	-6.00
8	OL	-9.00
9	OS	-10.00
10	LP	-13.00
11	PP	-6.00
12	PPP	-10.00
13	PH	-9.00
14	SH	-8.00
15	ZO	-7.00

To analyse the data we conducted two paired samples t test for each group and an independent sample t test for the final results of each group.

There were no outliers in the data, as assessed by inspection of the boxplots.

The differences between the final results and initial results for the yoga programme were normally distributed, as assessed by Shapiro-Wilk's test ($p = .308$).

The differences between the final results and initial results for standard programme were normally distributed, as assessed by Shapiro-Wilk's test ($p = .265$).

The final results for the yoga programme were normally distributed, as assessed by Shapiro-Wilk's test ($p = .949$).

The final results for the standard programme were normally distributed, as assessed by Shapiro-Wilk's test ($p = .272$).

The standard programe elicited a mean increase of 3.87 cm, 95% CI [2.65, 5.08] between the final and initial measurement and a statistically significant increase between the final and initial measurement, $t(14) = 6.808$, $p < .001$.

The yoga programe elicited a mean increase of 12.67 cm, 95% CI [11.3, 14.03] between the final and initial measurement and a statistically significant increase between the final and initial measurement, $t(14) = 19.871$, $p < .001$.

Regarding the independent t test there was homogeneity of variances, as assessed by Levene's test for equality of variances ($p = .976$)

Yoga group mean final result was 9.6 cm, 95% CI [7.52 to 11.67] higher than standard group.

There was a statistically significant difference between the mean results in the mobility test between yoga group and standard group, $t(28) = 9.46$, $p < .001$.

Conclusion

The introduction of hatha yoga exercises in the university physical education classes brings meaningful improvements in the mobility of the coxofemoral joint.

REFERENCES

Crangle, E. F. (1994). *The Origin and Development of Early Indian Contemplative Practices*. Otto Harrassowitz Verlag.

Dinesh, T, Gaur, G, Sharma, V, Madanmohan, T, Harichandra Kumar, K, Bhavanani, A, et al. (2015). *Comparative effect of 12 weeks of slow and fast pranayama training on pulmonary function in young, healthy volunteers:* A randomized controlled trial. Int J Yoga; 8:22–6. [PMC free article] [PubMed] [Google Scholar]

Minor, R. N. (1986*). "Swami Vivekananda's use of the Bhagavad Gita".* Modern Indian Interpreters of the Bhagavad Gita, Albany, New York: SUNY Press, ISBN 978-0-88706-297-1

McCall, M.C. (2014). *In search of yoga: Research trends in a western medical database*. Int J Yoga; 7:4–8. [PMC free article] [PubMed] [Google Scholar]

Monier-Williams, M. (1899). "Asana". A Sanskrit-English Dictionary. Oxford Clarendon Press.

Rikli R, Jones, CJ. (2013). Senior Fitness Test Manual. 2nd ed. Champaign, IL, USA: Human Kinetics;

Satyananda, S. (2008). *Asana Pranayama Mudra Bandha* (PDF). Munger: Yoga Publications Trust. ISBN 978-81-86336-14-4.

Sharm, L. (2015). Benefits of yoga in sports – A study. Int. J. Phys. Educ. Sports Health. 1:30–2.

https://www.etsy.com

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BLOCK PERIODIZATION IN SPEED SKATING: EFFECT OF 4 WEEKS ON MAXIMUM FORCE AND POWER IN JUNIORS

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ABSTRACT. Background: Block periodization has experienced a renewed interest in sports specialists due to proven efficiency in recent years with significant implications for optimizing the training programme by improving the methodology used. **Objectives:** The aim of this study was to investigate the effect of block periodization of the force program by combining traditional resistance training with pliometric exercises and induced changes to maximum force and power and its mean, in lower body, in junior speed skaters. **Materials and Methods:** Twelve subjects participated in this study, experiment group (PB) (n = 6) 17.51 ± 1.1 years (1) block periodization, focusing on alternative development of force and power and control (C) (n = 6) 17.89 ± 1.8 years, (2) linear periodization, focusing on the simultaneous development of force and power. **Results**: This indicate a significant increase in total weight lifted (P = 0.04), in (1RM) test during a back squat for both tested groups (PB = 19.6%; C = 10.4%), with a significant difference between this two. For the mean power measured in jump squat, a significant difference was observed between the pre and post-test period (P = 0.02), where the group (PB) had an increase of + 25.3% and (C) a decrease by-15.7%. **Conclusions:** The present study suggests that the block periodization of resistance training induces superior adaptations to the three studied variables respectively, maximum force and power and its mean in experiment group comparable to the control one that has followed a linear periodization, despite the similar volume and intensity.

Key words: *1RM, vertical jump, maximum power, maximum strength*

REZUMAT. ***Periodizarea în bloc în patinajul viteză: efectul a 4 săptămâni de forță asupra forței și puterii maxime la juniori*. Introducere:** Periodizarea în bloc revine în atenția specialiștilor din domeniu datorita eficienței demonstrate în ultimii ani cu implicații semnificative pentru optimizarea programului de pregătire prin îmbunătățirea metodologiei utilizate. **Obiective:** Scopul acestui studiu a

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fost să investigheze efectul periodizării în bloc a programului de forță prin combinarea antrenamentului de forță tradițional cu exerciții pliometrice și modificările induse asupra forței și puterii maxime și media acesteia, la nivelul trenului inferior, la patinatorii de viteză juniori. **Material și metode:** Doisprezece subiecți au participat în acest studiu, experiment (PB) (n = 6) 17.51 ± 1.1 ani (1) periodizare în bloc, cu accent pe dezvoltarea alternativă a forței și puterii și (C) (n = 6) 17.89 ± 1.8 ani, (2) periodizare liniară, cu accent pe dezvoltarea simultană a forței și puterii. **Rezultate**: Acestea indică o creștere semnificativă a greutății totale ridicate (*P* = 0.04), la testul (1RM) în timpul unei semi-genuflexiuni cu bara în spate pentru ambele grupe testate (PB = 19.6%; C = 10,4%), cu o diferență semnificativă între cele două. Pentru media puterii testate la proba săritura în înălțime, s-a observat o diferență semnificativă între perioada pre și post testare (*P* = 0.02), unde grupul (PB) a avut o creștere cu +25.3% și (C) o scădere cu -15.7%. **Concluzii:** Studiul prezent sugerează faptul că periodizarea în bloc a antrenamentului de forță induce adaptări superioare la nivelul celor trei variabile studiate respectiv forță și putere maximă și mediei acesteia la grupul experiment comparabil cu grupul control care au urmat o periodizare liniară, în ciuda volumului și intensității similare.

Cuvinte cheie*: 1RM, săritura în înălțime, putere maximă, forță maximă.*

Introduction

Periodization is the modality for sports coach to design the resistance training programs to reach the set objectives trough manipulation of different parameters (e.g. load, repetitions, sets, order of exercise and their number, rest, training frequency) in order to maximize training adaptations and to prevent the onset of overtraining syndrome (Lorenz, Reiman and Walker, 2010).

Strength is the foundation for all other physical qualities like power, velocity, agility, and so on. This type of organization contributes to proper strength, speed, power development and sports performance (Behringer, Vom Heede, Matthews and Mester, 2011). It appears from the available strength training literature that periodization is usually needed for maximal strength gains to occur (Fleck and Kraemer, 2004). It seems that even that daily planning is more beneficial that the lack of one to record progress at the level of this qualities (Hoffman and Ratamess, 2009).

Block periodization involves highly concentrated, specialized workloads. Each step in the training cycle has a large volume of exercises focused on specific, targeted training abilities to ensure maximum adaptation (Issurin, 2010) and for maintaining the same level of development during the competitive period

and even for long term. The linear periodization model focuses on the development of basic qualities (in the general form) but they tend to decline during a winter competition season such as in the case of speed skating. Issurin, (2010), has proposed that power and strength can be maintained for up to 30 days while peak performance can be maintained for 5-8 days.

Another example of differences in the block approach is the concept of "complex training," whereby a strength exercise is followed by a biomechanically similar plyometric exercise (i.e. back squat followed by a squat jump) (Malisoux, Francaux, Nielens and Theisen, 2006), but in a strict order (there are two different methods of developing force and power addressed separately). However complex training is also used in other forms of periodization that have a longer duration.

The positive results obtained in the studies of Helgerud et al., (2007), Marques, Franchini, Drago, Aoki and Moreira, (2017), Manchado, Cortell-Tormo and Tortosa-Martinez (2018), can partly explained by the fact that the test was short and high in intensity, parameters that have a direct correlation with sports performance. It also seems that this type of training has given superior results for athletes participating on several competitions over the year (e.g. cycling, skiing, and so on.). Conducting more studies in this area is necessary before formulating definitive conclusions.

Our attention in this study was focused on two qualities determinants in speed skating, in a 4-week block training. In a meta-analysis by the authors Harries, Lubans and Callisterr, (2015) they suggested the implementation of working blocks lasting between 2-6 weeks providing an adequate and new stimulus for the development of force overcoming a possible plateau.

The traditional method of measuring maximum force is testing a maximum repetition (1RM). The force is closely correlated with the ability to quickly produce a high level of force and as a results the development of the maximum force should present a first target set for athletes with a lower force level (Cormie, McGuigan and Newton, 2011).

Exercise intensity or load is commonly accepted as one of the critical components for achieving strength based adaptations. This is fairly well supported in the literature and the common recommendation of loads approximately >80% of 1RM in trained individuals should build the foundation of most programming for strength (Peterson, Rhea and Alvar, 2005).

Power development can be subdivided into a focus on muscular strength, rate of force development, and maximal force at high velocities of movement (Cormie et al., 2011). There are excellent arguments for a high load approach (50-70% of one repetition maximum 1RM) as well as for a low load approach (<50% [1RM]) in exclusion but a "mixed methods approach" combining both appears to be the most beneficial (Stone, et al., 2002). By the previous mentioned

author, this approach to training for power has been suggested as optimal since it combines heavy resistance training with higher velocity work in order to develop power production across the entire force/velocity spectrum.

Ballistic exercises e.g. squat jump, throwing ball, jumping over obstacles, have a great impact on the high velocity area of the force-velocity curve. This method is in contrast to force training with heavy loads that have a greater effect on this relationship. The concept of optimal load training indicates that training loads should be chosen to allow for maximal power output as this is the most effective means of further power development (Bride et al., 2002). It seems plausible to perform additional ballistic/plyometric exercises in addition to traditional heavy resistance training, a combination that develops maximum force (1RM) and muscle strength more that it would have been possible through a traditional training alone due to the increase in the rate of force development.

Previous studies have observed associations between skating sprint performance and off-ice performance characteristics, such as vertical jump performance (Farlinger, Kruisselbrink and Flowles, 2007) and muscular strength (Feser et al., 2016), though for the latter, other studies have provided conflicting results (Potteiger, Smith, Maier and Foster, 2010). However, the vertical jump is an accurate way of measuring the ability to produce power of the lower limbs (Bride et al., 2002).

Speed skating requires a high level of performance in many different physical qualities. Those mentioned before muscular strength, power and VO2max are viewed as important physical determinants in ice skating performance (Roczniok et al., 2016), and there qualities should be developed during off season to improve the performance in winter competition season (Farlinger et al., 2007).

During the last years, focus has been shed on the potential benefit of block periodization (Issurin, 2010; 2016), wherein shorter training periods are dedicated to focus on improving a few selected abilities (Ronnestad, Hansen, Thyli, Bakken and Sandbakk, 2016). However, it has also been indicated that block periodization of strength training leads to superior adaptations in strength and power in well-trained athletes (Painter et al., 2012), though this finding does not seem to be universal (Bartolomei, Stout, Fukuda, Hoffman and Merni, 2015).

Objectives

The present study investigates the effects of block periodization of strength and power training, where one intervention group is focusing on alternating block development of strength (2 weeks) and power (2 weeks), while the control group is focusing on simultaneous development of strength and power. Overall, the two

groups performed equal volumes and intensities of both force and power, training during the 4-weeks training intervention. We hypothesized that block periodization would induce superior adaptation in peak power output and mean observed in vertical jumping and maximal force trough total maximum load lifted (1RM).

Materials and Methods

Participants

In this study participated 12 junior speed skaters, experiment group (BP) (block periodization) (n = 6) 17.51 ± 1.1 years with a specific training protocol and control group (C) (n = 6) 17.89 ± 1.8 years. Informed written consent were obtained from all participants prior to participation. Written consents were also obtained from the legal guardians of participants that were under the age of 18 at the time of study start-up.

Training protocol

The training program for the experiment group followed a model of block periodization focusing on the alternative development of the maximum force and power, in which the volume was progressively reduced in detriment of the increase in intensity. The test periods were performed pre and post after the 4-week intervention period. Each week included three resistance trainings with a duration of approx. one hour. The first two weeks assumed the achievement of a specific training for the development of maximum force being divided into two stages. In the first, the subjects performed 3-4 sets of 4-10 repetitions with 70-85% of 1RM previously determined and in the second 3-4 sets of 2-4 repetitions with 85-100% of 1RM.

In the next two weeks the emphasis was on developing power, training consisting in the realization of two classical exercises (performed in the previous two weeks) to which 4 other ballistic and plyometric exercises were added. In the first stage the subjects achieved 3-4 sets of 6-8 repetitions with 30-50% of 1RM and in the second 3-4 sets of 4-6 repetitions with 40-60% of 1RM, exercises in which focus was on the speed and explosive execution.

The plyometric exercises were performed at the beginning of the training followed by the resistance training (American College of Sports Medicine, 2002), 2 sets of a 4-6 repetitions with maximum effort, jumping over obstacles (fence) on one foot forward and sideways (2 min. rest between sets), in length, with elan, side jumping (skaters jump) Table 1. The control group followed a linear periodization

in witch attention was concentrated on the simultaneous development of the two qualities. During the 4-weeks the two groups achieved a similar workload and intensity, the difference consisting of the periodization model.

Table 1. Training protocol for experiment group

Exercise	Stage 1 (2 weeks)		Stage 2 (2 weeks)	
Strength 70-100% of 1RM	Sets *x* repetitions	Rest	Sets *x* repetitions	Rest
Back squat	4 x 6	2 -3 min.	4 x 2-3	3 - 4 min.
Single leg squat	3 x 4	2 -3 min.	3 x 2	3 - 4 min.
Press	3 x 8	2 -3 min.	3 x 4-6	3 - 4 min.
Front squat	3 x 10	2 -3 min.	4 x 6	3 - 4 min.
Sideway squat (single leg)	3 x 4	2 -3 min.	3 x 3	3 - 4 min.
Power 30-60% of 1RM				
Jump squat (30-50% of 1RM)	4 x 8	2 -3 min.	40-60% 1RM 4 x 6	3 - 4 min.
Jump single leg squat	2 x 5	2 -3 min.	3 x 3-4	3 - 4 min.
Lean single leg squat	2 x 6	2 -3 min.	2 x 4	3 - 4 min.
Squat with dumbbell	2 x 8	2 -3 min.	2 x 6	3 - 4 min.
Hang clean	3 x 4	2 -3 min.	3 x 2-3	3 - 4 min.
Sideway push (single leg)	3 x 6	2 -3 min.	3 x 4	3 - 4 min.

Force testing

For testing the maximum force, the 1RM was applied to the subjects of both groups before and after our intervention. The warm-up consisted of 10 minutes cycling with a standard resistance of 105 W (XTPRO Bike 600, Tehnogym Usa Corp., U.S. A) followed by 5 minutes mobility exercises. Prior to the actual testing a specific warm-up with weights was carried out, which assumed a set of 5-8 repetitions performed with 40-60% of the maximum load presumed for each subject. After a 3 minutes rest, 3-4 attempts were allowed (with 2-3 minutes rest) to determine the maximum load. Repetition was considered correct when the angle formed by the knee flexion was 90˚ specific to each subject. During the test, the researcher and coach were present.

Power testing

Power testing was performed 48 hours after strength testing were measured during a vertical jump using Tendo Weightlifting Analyser (TENDO Sports Machines, Trecin, Slovak Republic), data being analyzed with Tendo

Softaware Computer V-5 (Version 6.0.1, Slovak Republic). Before the testing took place, each subject performed a standard warm up – 10 min. cycling on ergometric bicycle. The test consisted in a vertical jump, from a static position (the angle between the calf and the thigh being 90 °) without a previous elan and as high as possible avoiding any complementary movement of the arms (Hoffman et al., 2005). 3 attempts were allowed, the height of the jump, the maximum power and the average of the best jump was recorded for analysis. The additional load used in this test was 30% of 1RM considered optimal by the authors Wilson, Newton, Murphy and Humphries, (1993).

Statistical Analysis

Standard statistical methods were used to calculate means and standard deviations which were used to describe all performance data. A 2 × 2 repeated-measures analysis of variance was used to analyze all performance data. Subsequent Tukey's post hoc tests were used to determine pairwise differences when significant F ratios were obtained. For all statistical tests, a probability level of $P \leq 0.05$ was established to denote statistical significance. The size effect was calculated after the following formula ([Mean (PB) – Media (C)] / SD (standard deviation) of (C). According to the author, Rhea, (2004), a value between 0.5-1.0 represents a moderate effect and > 1.0 great effect. For all statistical tests, a probability level of $P \leq 0.05$ was established to denote statistical significance.

Results

The results showed that subjects of both groups tested, experiment (PB) group with block periodization and control (C) group with linear periodization after 4 weeks, maximum force measured trough (1rm) test, significantly improved. The difference between the two groups and testing periods (pre to post) is statistically different (P = 0.04) to (PB) (pre 89.7 kg vs. post 111.5 kg, with a difference of + 21.8 kg and for (C) (pre 92.3 kg vs. post 102.9 kg with a difference of + 10.6 kg (Fig. 1).

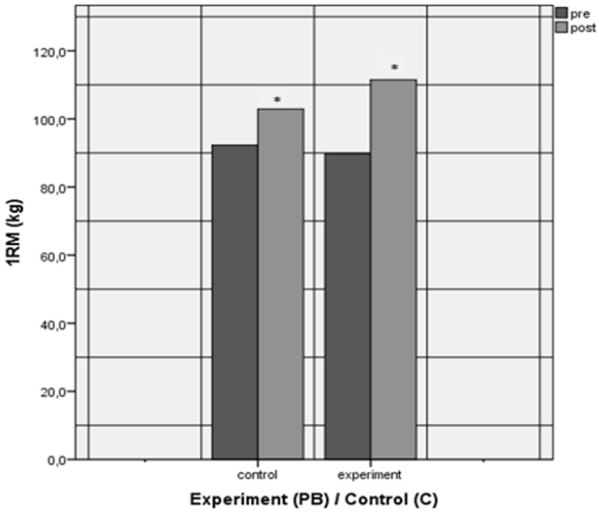

Fig. 1. Difference observed between (PB) and (C) groups in maximum force (1RM).
*Indicating a significance ($P < 0.05$) between pre and post period.

The progress obtained in vertical jump by the (PB) group was significantly between the two periods with + 5.5 cm (pre 18.7 cm, SD = 0.20 vs. 24.2 cm, SD = 0.37) and between the two (PB) and (C) post test (24.2 cm, SD = 0.37 vs. 1 9.8 cm, SD = 0.21), $P = 0.05$, where the size effect is high ES = 1.25 in favor of the (PB).

The mean power and maximum power recorded during the vertical jump between the pre and post period shows a significant difference in mean power ($P = 0.02$), ES = 2.97. The difference observed between the two groups was statistically significant for the mean power with a difference for (PB) group of (+ 367.7 W) and control group (-203.8 W) and for the maximum power difference for (PB) of (+ 233.6 W) and for (C) of (-189.2 W) (Table 2).

Tabel 2. Results obtained by the (PB) and (C) groups for power testing in jump height.

	Experiment (PB)	Control (C)
High jump mean power (W)		
Pre	1087.9 ± 135.2	1303.1 ± 78.8
Post	1455.6 ± 79.7*	1099.3 ± 156.4
High jump maximum power (W)		
Pre	1842.2 ± 141.3	1956.5 ± 112.9
Post	2075.8 ± 89.7	1767.3 ± 103.6

PB = experiment group block periodization; C = control group linear periodization.
*$P < 0.05$ between groups.

Discussion

Following the literature review on this topic, we can say that this is the first study comparing the effect of block periodization specifically quantifying the development of dynamic force, trough combining traditional resistance training and additional plyometric exercises on the maximum force and power and its mean with linear periodization, in junior speed skaters.

The results obtained in the present study indicates that resistance training can lead to increases in maximum force determined by the maximum total load lifted respectively (1RM) (kg). Following the introduction of plyometric exercises, a significant improvement was observed in the maximum power and its mean on the lower body, progress reflected in the results achieved in vertical jump test by the subjects of experiment group.

In our research the results indicates the acceptance of the hypothesis that the block periodization could increase the value of maximum power and its mean observed in vertical jump and maximum force determined by the total load lifted (1RM).

The most relevant discovery of this study was that combining traditional resistance training with plyometric exercises results in a significant improvement in mean power in vertical jump test for the (PB) group with block periodization compared to control group with linear periodization at the post intervention period (PB) 1455.6 W ± 79.7 * vs. (C) 1099.3 W ± 156.4. These differences were evident despite the fact that the study protocol investigated the effect of a 4 weeks training during the dry-land preparation (0ff-season) in junior speed skaters.

The progress observed is similar to the one obtained in a study measuring force and power and the jump height in handball players (Manchado, Cortell-Tormo, & Tortosa-Martinez, 2018). Although there are some methodological differences, the results indicate that block periodization is more effective that the linear model when comes to increasing force (Painter et al., 2012) and could be a reason why the (PB) group in our study has achieved this progress focusing on power at week 3 and 4. Moreover, this model of periodization is in accord with the benefits suggested by Issurin, (2010).

Previous studies have registered improvements in endurance following a block periodization in sports that requires both strength, power and endurance such as athletics (Painter et al., 2016) or judo (Marques, Franchini, D Rago, Aoki and Moreira, 2017) but none of these studies included a control group, which makes it difficult to interpret the efficiency of block vs. linear periodization.

The linear periodization includes a large volume of work as for elite athletes and this can lead to compromising development of muscle strength and power (Wilson, Marin, Rhea, Wilson, Loenneke and Andreson, 2012). It has been

argued that many studies concerning block periodization do not include variations in the variables studied from one week to another so that they evaluate general models and not periodization itself (Bartolomei et al., 2015).

Therefore, the variation in our study assumed the decrease in volume and intensity and exercises performed in the experiment group, while a balance was kept between the two qualities (similar number of sets but different exercises and repetitions) and between the two groups during the intervention period.

In line with our observations, it has been suggested that the ability to achieve high power values and rate of force development is positively interfered with the combination of force and speed rather than applying maximum force at a low velocity (Rhea et al., 2008). The results confirm a great effect size of power development seen between the two tested groups.

Despite the progress, more clearly achieved by the experiment group in vertical jump, a statistically significant difference between the two groups and test periods was observed. A significant difference was seen in vertical jump for mean power where the control group decreased between the two test periods (C) (-203.8 W) and increase in experiment group (PB) (+ 367.7 W). The difference is statistically significant between the two groups (PB) + 25.3% and (C) -15.7%.

The observed progress of mean power in vertical jump showed that combined resistance training with plyometric exercises organized in block training have a positive effect on the development of force and power. Control group was observed a significant decrease in mean power. These results are in agreement with another study that showed, linear periodization in which is addressed alternately the development of force and power (without additional plyometric exercises), Bartolomei, Stout, Fukuda and Hoffman, (2015), and could have a potentially negative impact on power in lower body.

Our results instead demonstrate the importance of including the most specific plyometric exercises in the resistance training for optimum power development. The increase in power observed could in turn increase the probability of reaching the maximum force area by increasing to a greater extent the total load of 1RM.

For the second variable assessed, maximum power, no statistically significant improvement was observed in any of the groups, (PB) + 11.3% and (C)-9.7% at the post intervention time. The lack of statistical significance of maximum power in the intervention group can be attributed to a small number of subjects (PB) n = 6 and to a relatively small significance level *(P* = 0.41) that could mask the increase in mean power observed in the conducted study. In another study by the authors Kraemer, Ratamess, Volek, Mazzetti and Go´mez, (2000), authors they failed to indicate the statistical significance of maximum power value obtained despite the difference of means when the number of subjects was 17 or less. Thus, a larger sample may be necessary to confirm main effects of improving maximum power.

With regard to the assessment of maximum force, results obtained by the both groups investigated recorded progress with (PB) 19.5% and (C) 10.4% improvement showing that the results differ significantly between them. These data are in accord with those of authors Hofman et al. (2005), observing significant improvements for 1RM test in a group of olympic athletes compared to another group that followed a traditional method of resistance training. Subjects researched regardless of the group they were part of, are elite athletes who regularly performed resistance training before the start of the study and had more experience with this type of exercise.

The changes in our study reflected a great familiarity which may indirect suggest that the additional plyometric exercises to the traditional resistance training may have a potentially higher effect when individuals have reached a greater muscular strength level and can be used as an additional incentive technique and sometimes even to prevent the installation of a plateau and may partially explain the progress made by both groups in 1RM test (in particular in control group), but still statistically significantly differ between the two test periods and groups.

Both strength and power of the lower limbs improve the sprint velocity on the ice in speed skaters. These two qualities were previously associated with an increase in speed (displacement) in sprint distances (Felser et al., 2016). The results obtained in our study can have a direct practical implications for speed skaters, as confirmed by the previous mentioned authors that these qualities are important for improving sport performance on ice. Among the limitations of this study, seems to be the duration of intervention period that was limited to 4-weeks and future research should investigate the effects of block periodization in both physical capacity and sports performance on and off ice, but also for a longer period of time.

Conclusion

In conclusion, the present study suggest that block periodization in resistance training (by combining traditional resistance training with plyometric exercises) can induce superior adaptations in both studied variables: maximum force and power and mean compared to linear periodization in which focus is on traditional methods of development the above mentioned qualities (by alternative approach of the two with similar volume work and intensity), to junior speed skaters. The results have positive implications for the inclusion of this type of exercises for coaches and athletes aiming to increase maximum force, respectively 1RM.

REFERENCES

American College of Sports Medicine. (2002.). Position Stand: Progression models in resistance training for healthy adults. *Journal of Medicine Science and Sports Exercise, 34,* 364-380.

Bartolomei, S., Stout, J.R., Fukuda, D.H., Hoffman, J.R., & Merni, F. (2015). Block vs. Weekly Undulating Periodized Resistance Training Programs in Women. *Journal of Strength and Conditioning Research, 29*, 2679-2687.

Behm, D.G., Wahl, M.J., Button, D.C., Power, K.E., & Anderson, K.G. (2005). Relationship between hockey skating speed and selected perforrmance measures. *Journal of Strength and Conditioning Research*, *19,* 326-331.

Behringer, M., Vom Heede, A., Matthews, M., & Mester, J. (2011). Effects of strength training on motor performance skills in children and adolescents: a meta-analysis. *Journal of Pediatrics and Exercise Science, 23(2),* 186-206.

Bride, J.M., Triplett-McBride, T., Davie, A., et al. (2002). The effect of heavy- vs. light-load jump squats on the development of strength, power, and speed. *Journal of Strength and Conditioning Research, 16(1),* 75-82.

Cormie, P. McGuigan, M.R., & Newton, R.U. (2011). Developing maximal neuromuscular power. *Journal of Sports Medicine, 41(1),* 17-38.

Farlinger, C.M., Kruisselbrink, L.D., & Fowles, J.R. (2007). Relationships to skating performance in competitive hockey players. *Journal of Medicine Science and Sports Exercise*, *21,* 915-922.

Felser, S., Behrens, M., Fischer, S., Heise, S., Baumler, M., Salomon, R., & Bruhn, S. (2016). Relationship between strength qualities and short track speed skating performance in young athletes. *Scandinc Journal of Medicine Science and Sports, 26,* 165-171.

Fleck, S.J., & Kraemer, W.J. (2004). *Designing Resistance Training Programs*, (3rd ed). Champaign, IL: Human Kinetics.

Harries, S. K., Lubans, D. R., & Callisterr, R. (2015). Systematic review and meta-analysis of liniar and undulating periodized resistance training programs on muscular strength. *Journal of Strength and Conditioning Research, 29(4),* 1113-1125.

Helgerud, J., Hoydal, K., Wang, E., Karlsen, T., Berg, P., Bjerkaas, M., Simonsen, T., Helgesen, C., Hjorth., N., Bach, R., & Hoff, J. (2007). Aerobic high-intensity intervals improve Vo2max more than moderate training. *Journal of Medicine and Science in Sport and Exercise, 39*, 665-671.

Hoffman, J.R., Ratamess, N.A., Cooper, J.J., Kang, J., Chilakos, A., & Faigenbaum, A.D. (2005). Comparison of loaded and unloaded jump squat training on strength/power performance in college football players. *Journal of Strength and Conditioning Research*, *19*, 810-815.

Hoffman, J., Ratamess, N., Klatt, M., et al. (2009). Comparison between different off-season resistance training programs in Division III American college football players. *Journal of Strength and Conditioning Research*, *23,* 11-19.

Issurin VB. (2010). New horizons for the methodology and physiology of training periodization. *Journal of Sports Medicine, 40(3),* 189-206.

Issurin, V.B. (2016). Benefits and Limitations of Block Periodized Training Approaches to Athletes' Preparation: A Review. *Sports Medicine, 46*, 329-338.

Kraemer, W.J., Ratamess, N.A., Volek, J.S., Mazzetti, S.A, & Go ´mez, A.L. (2000). The effects of the Meridian shoe on vertical jump and sprint performances following short-term combined plyometric/sprint and resistance training. *Journal of Medicine and Science in Sport and Exercise, 14,* 228– 238.

Lorenz, D.S., Reiman, M.P., & Walker, J.C. (2010). Periodization: Current review and suggested implementation for athletic rehabilitation. *Journal of Sports Health, 2(6*), 509-518.

Manchado, C., Cortell-Tormo, J.M., & Tortosa-Martinez, J. (2018). Effects of Two Different Training Periodization Models on Physical and Physiological Aspects of Elite Female Team Handball Players. *Journal of Medicine and Science in Sport and Exercise,* 32, 280-287.

Malisoux, L., Francaux, M., Nielens, H., & Theisen, D. (2006). Stretch-shortening cycle exercises: an effective training paradigm to enhance power output of human single muscle fibers. *Journal of Applied Physiology, 100*, 771-779.

Marques, L., Franchini, E., Drago, G., Aoki, M.S., & Moreira, A. (2017). Physiological and performance changes in national and international judo athletes during block periodization training. *Journal of Biology of Sport, 34,* 371-378.

Painter, K,B,, Haff, G.G., Ramsey, M.W., McBride, J., Triplett, T., Sands, W.A., Lamont, H.S., Stone, M.E., & Stone, M.H. (2012). Strength gains: block versus daily undulating periodization weight training among track and field athletes. *International Journal of Sports and Physiology Performance, 7,* 161-169.

Peterson, M.D., Rhea, M.R., & Alvar, B.A. (2005). Applications of the dose-response for muscular strength development: a review of meta-analytic efficacy and reliability for designing training prescription. *Journal of Medicine and Science in Sport and Exercise*, *19(4),* 950-958.

Potteiger, J.A., Smith, D.L., Maier, M.L., & Foster, T.S. (2010). Relationship between body composition, leg strength, anaerobic power, and on-ice skating performance in division I men's hockey athletes. *Journal of Strength and Conditioning Research, 24*, 1755-1762.

Roczniok, R., Stanula, A., Maszczyk, A., Mostowik, A., Kowalczyk, M., Fidos-Czuba, O., & Zajac, A. (2016). Physiological, physical and on-ice performance criteria for selection of elite ice hockey teams. *Journal of Biology of Sport, 33,* 43-48.

Ronnestad, B.R., Hansen, J., Thyli, V., Bakken, T.A., & Sandbakk, O. (2016). 5-week block periodization increases aerobic power in elite cross-country skiers. *Scandinavian Journal of Medicine and Science in Sports, 26,* 140-146.

Rhea, M.R., & Alderman, B.L. (2004). A meta-analysis of periodized versus nonperiodized strength and power training programs. *Research Quarterly for Exercise and Sport, 75,* 413-423.

Rhea, M.R. (2004). Determining the magnitude of treatment effects in strength training research through the use of the effect size. *Journal of Strength and Conditioning Research, 18,* 918-920.

Rhea, M.R., Oliverson, J.R., Marshall, G., Peterson, M.D., Kenn, J.G., & Ayllon, F.N. (2008). Noncompatibility of power and endurance training among college baseball players. *Journal of Strength and Conditioning Research,* 22, 230-234.

Stone, M.H., Moir, G., Glaister, M., et al. (2002). How much strength is necessary? *Journal of Physical Therapy in Sport, 3(2*), 88-96.

Wilson, G.J., Newton, R.U., Murphy, A.J., & Humphries, B.J. (1993). The optimal training load for the development of dynamic athletic performance. *Journal of Medicine and Science in Sport and Exercise*, *25*, 1279-1286.

Wilson, J.M., Marin, P.J., Rhea, M.R., Wilson, S.M., Loenneke, J.P., & Anderson, J.C. (2012). Concurrent training: a meta-analysis examining interference of aerobic and resistance exercises. *Journal of Medicine and Science in Sport and Exercise*, 26, 2293-2307.