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CONTENTS

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The effects of weekly motivational phone calls on the amount of leisure sports activities and changes in physical fitness

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: The purpose of this study is to investigate whether motivational weekly phone calls are able to promote overall and/or leisure physical activity levels and fitness in an urban population of Romania.

Material: Sixty-five adult subjects (30 males and 35 females) were randomly selected and followed over the 8-month study period. Total physical activity and changes in body mass and body mass index (kg/m^2) were recorded on a monthly basis. Fitness level was assessed by the participants themselves using three standardized motor tests: push-up test, 1-minute sit-up test and 3-minute step test.

Results: The intervention resulted in an increase of physical activity level by approximately 70% in males and females aged 25–39 years. In those aged 40–49 years physical activity levels were enhanced by 77% in males and 18% in females. These changes were associated with improvements (25–31%; $p < 0.01$) in fitness levels. Changes in physical activity over the 8-month intervention period were negatively correlated with body mass index ($r = - 0.721$, $p < 0.01$).

Conclusions: This study demonstrates that motivation by regular phone calls was highly effective in increasing leisure sports activities and improving fitness levels in young and middle-aged adults of both sexes.

Keywords: leisure sports activities, physical fitness, adults, physical activity, body mass index, phone calls.

Introduction[1]

The importance of regular physical activity (PA) is generally recognized in the prevention of many chronic diseases, such as diabetes, cardiovascular diseases and some cancers [1-3]. Additionally, adequate PA and leisure sports activity improves physical performance, self-confidence and physical and psychological independence [4] and contributes to 'quality of life', which comprises perceived global satisfaction and well-being [5]. Physical and leisure sports activities can favor various areas of well-being, such as physical, psychical as well as social well-being [6]. With respect to physical well-being, the type and intensity of physical or sport activity determines the way the human body adapts. Also, frequency and volume of PA are at least equally important. PA at a moderate intensity and engaging large muscle mass (e.g. walking) leads to general adaptations enabling the individual to better cope with the usual challenges of life (e.g. walking tasks, stair climbing) [7]. In contrast, if the goal is to improve physical fitness, sports activities performed at higher intensity are needed; these include, for example, running, jogging, swimming, cycling and aerobic gymnastics [8, 9].

From a health perspective, the World Health Organization (2017) [10, 11] recommends at least 150 minutes of moderate-intensity, or at least 75 minutes of vigorous-intensity aerobic exercise throughout the week or an equivalent combination of moderate and vigorous-intensity activity. The aerobic activity should be performed in bouts of at least 10 minutes duration. For additional health benefits, adults are even encouraged to increase their moderate-intensity aerobic activity to 300 minutes per week, or engage in 150 minutes of vigorous-intensity aerobic exercise per week. Moreover, muscle-strengthening activities should be included involving major muscle groups on 2 or more days a week. As it is essential for PA to be undertaken on a regular basis for sustained improvements in health, ensuring that individuals are participating in activities that are a source of happiness and satisfaction is important for long-term adherence [12].

However, developing positive attitudes toward activity or sport is often a challenging task and strategies helping to overcome personal constraints are needed. Professional and regular counseling might be one strategy to start with. Such approaches, among others, include face-to-face exercise or behavioral/cognitive consultation, or motivational phone calls promoting physical and leisure sports activities [2, 13, 14]. With professional support and repeated contacts, which seem to be important for behavioral changes [8], people might overcome initial inhibitions, start being active or increase their activity level and continue to be active on a regular basis as they experience the benefits of being so (e.g. improved fitness level, health status) [15].

The evidence of regular phone calls to promote physical and/or leisure sports activities is strong, yet the optimal intervention dose (e.g., duration and frequency of telephone contacts) [2, 14] and the effect of the increased PA on physical performance has not yet been well studied. Thus, *this study aimed to investigate* whether weekly motivational phone calls for 8 months were able

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to promote physical and/or leisure sports activities and to increase physical fitness in people aged between 25 and 49 years. We hypothesized that with weekly phone calls the physical and/or leisure sports activity level can be increased and that the individual level of physical fitness is related to active participation in leisure sports activities.

Material and methods

Participants: Overall, 500 adults (229 men and 271 women) aged between 25 and 49 years were randomly selected at different locations (in the region of Braşov, Romania) and were asked to voluntarily participate in the survey. Of these, 318 (149 men and 169 women) subjects were contacted during or after practising organized and non-organized leisure sports activities at different sports facilities (e.g. track and field facility, running trails) and 182 participants (81 men and 101 women) were randomly selected on the streets of Braşov. All subjects were handed out a questionnaire focusing on physical health and participation in leisure sports activities. The participants had to indicate how often they practised leisure sports per week (i.e. less than 1 hour, 1–2 hours, 3–4 hours, 5–6 hours) and only participants practising sports for 1 hour and 1–2 hours were included for further participation as we intended to investigate the effects of increasing leisure sports activities. Finally, 65 adults (30 men and 35 women) were included and these were split into two age categories: (1) 25–39 yrs (N = 27, 12 males and 15 females); (2) 40–49 yrs (N = 38, 18 males and 20 females). Of the 65 selected adults, 20 (10 men and 10 women) have been recruited on the street and the remaining 45 (20 men and 25 women), have been recruited after practicing sport. Baseline characteristics of the participants are shown in Table 1.

Table 1. Baseline characteristics of participants

Variable	Mean (SD) N = 65
Age (years)	35.2 ± 7.3
Male/female	30/35
Height (cm)	166± 8.5
Body mass (kg)	67.2± 10.7
Body mass index (kg/m^2)	25.2 ± 3.7
Leisure activity (total number/week)	2.1± 28

Organization of the research: The study period lasted for 8 months, from April 2013 to November 2013. During this time period participants were handed training logs and asked to daily record the type (what sport activities were attended: walking, running, hiking, fitness etc) and duration (in minutes) of their leisure time activities as well as their actual body weight. Everyday activities such as household, gardening and occupational activities were not questioned. Additionally, every month the participants performed a physical fitness test at home, as outlined in detail below.

After their engagement, participants were called by phone every week to motivate them to practice sport and additionally they received weekly information on all sports activities (e.g. guided classes, sport events) where they could additionally participate during the course of the study. During the weekly phone calls participants were also asked to send their records via e-mail which they followed reliably. Phone calls were done always by the same researcher experienced in motivational phone calls, i.e., B.G.

The training logs were used to calculate the total PA over the 8-month study period as well as to establish changes in body weight and body mass index (BMI) (kg/m^2). The fitness level was assessed by the participants themselves, with three standardized, simple and easy accessible motor tests [16]. The participants were advised/trained to correctly perform the test through written instructions and by video [16] sent via e-mail.

The motor tests were designed to evaluate muscle strength (dynamic) of the upper limbs and the abdominal muscles as well as endurance performance. The first test was a push-up test. After receiving the video, participants were given the following instructions: 'Men should use the standard "military style" push-up position with only the hands and the toes touching the floor in the starting position. Women have the additional option of using the "bent knee" position. To do this, kneel on the floor, hands on either side of the chest and keep your back straight.

Lower the chest down towards the floor, always to the same level each time, either till your elbows are at right angles or your chest touches the ground. Do as many push-ups as possible until exhaustion. Count the total number of push-ups performed [16].

Women were given the option for the simpler test as it was assumed that not every woman would be able to perform the test in its original form.

The second test was a 1-minute sit-up test with the following instructions given to the participants. 'Lie on a carpeted or cushioned floor with your knees bent at approximately right angles, with feet flat on the ground. Your hands should be resting on your thighs. Squeeze your stomach, push your back flat and raise high enough for your hands to slide along your thighs to touch the tops of your knees. Don't pull with you neck or head and keep your lower back on the floor. Then return to the starting position. Count how many you can do in one minute [16].

The endurance performance was assessed by a 3-minute step test. The following instructions were given to the participants: 'Step on and off the box (30.5 cm) for 3 minutes. Step up with one foot and then the other. Step down with one foot followed by the other foot. Try to maintain a steady four beat cycle. It's easy to maintain if you say "up, up, down, down". Go at a steady and consistent pace. At the end of 3 minutes, remain standing while you immediately check your heart rate. Take your pulse for 1 minute (e.g. count the total beats from 3 to 4 minutes after starting the test) [16].

The outcomes of the tests have been rated according to tables presented on the site [16]. For the purpose of analysis the rating for each test has been replaced by numerical numbers (scores) as follows: *very weak* – score 4; *weak* – score 5; *below average* – score 6; *average*

– score 7; *above average* – score 8; *good* – score 9; *excellent* – score 10. A rating of 30 indicates overall excellent physical fitness and a rating of 12 overall very weak physical fitness for the three motor tests.

Statistical analyses: Statistical analyses were conducted by SPSS (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.). Data are presented as means (SD). Normal distribution of data was confirmed by using Kolmogorov Smirnov test. Paired t-tests were used to evaluate changes from pre to post 8 months of intervention. Correlation analyses (Pearson) were used to evaluate the relationship between variables (fitness levels and BMI). A P-value < 0.05 was considered to indicate statistical significance.

Results

Changes in PA, fitness level and body composition in the course of the 8 months intervention period are shown for the two age groups in Table 2. The intervention resulted in a self-reported increase in PA by about 70% in males and females of the younger age group (25–39 years). In the 40–49 years age group, males increased their PA level by 77%, whereas females increased it by only 18%. For the 25-39 years age group, the number of sport activities practiced per week increased from 1.6 to 2.7 in males (N = 12), and from 1.5 to 3.2 in females (N = 15). For the 40-49 years age group, the total number increased from 1.3 to 2.3 in men (N = 18), and from 1.4 to 3.2 in women (N = 20).

After the intervention, the general fitness levels were increased by 25–31% in males and females of both age groups. Prior to the intervention, BMI was slightly elevated in both sexes of the younger age group and in middle-aged males. Increased PA over the 8-month intervention period was associated with a decrease in BMI by about 15% in the groups with elevated BMI and by 5% in middle-aged females with an already normal BMI at the beginning of the study. Changes in PA over the 8-month intervention period were positively correlated with changes in fitness levels ($r = 0.835$, $p < 0.01$) and negatively with BMI ($r = -0.721$, $p < 0-01$).

Discussions

The main findings of this study are: (1) that motivation by phone calls in addition to providing information on sport events and facilities, was highly effective in increasing leisure sport activities in males and females aged 25–49 years and (2) that changes in the amount of leisure sports activities were closely and positively correlated with individual changes in fitness levels and negatively with BMI.

Numerous lifestyle intervention studies investigated the effects of motivational phone calls as well as individual counseling in addition to offering out-of-hospital exercise courses on health outcomes and PA levels [2, 17-19].

Studies reported that telephone intervention may indeed be effective in increasing PA [2, 14]. However, it was also found that well-organized hospital-based exercise programs compared to a home-based training intervention are more effective in improving exercise capacity in patients with heart disease and type 2 diabetes or in patients undergoing heart transplant [20, 21]. In addition, Burtscher et al. (2009) [22] found that in contrast to a non-supervised training programs with only one counseling session, which was not effective in improving physical fitness, weekly advice together with supervised exercise increased adherence, and more importantly also fitness. Present data show that weekly counseling alone, without supervised exercise, is also capable of improving adherence and, as a consequence, physical fitness.

The present findings are in accordance with Philippaerts et al. (1999) [23], who also showed that

Table 2. Amount of leisure sports activity, fitness level and body mass index (BMI) pre and post 8 months of intervention

Variable	Age Group			
	25–39		40–49	
	Male Mean (SD) N=12	Female N=15	Male Mean (SD) N=18	Female N= 20
BMI pre (kg/m^2)	25.37 ± 3.02	25.1±4.05	27.33±3.4	23.05±2.7
BMI post (kg/m^2)	22.57* ± 2.2	21.86*±2.6	23.9* ± 2.5	21.9*±2.4
Total PA pre (total number of sports activities per week)	1.6± 0.7	1.5±0.6	1.3±0.8	1.4±0.7
Total PA post (total number of sports activities per week)	2.7*±0.9	3.2±1.5	2.3*±1.2	3.2*±1.5
Fitness pre (3 motoric tests- summary score)	14.1±1.2	13.8±1.3	13.8±1.1	13.3±1.1
Fitness post (3 motoric tests – summary score)	28.5*±2.2	27.8±2.8	27.2*±2.7	26.9*±2.9

* indicate significant changes from pre to post; all p values < 0.01.

PA = physical activity; BMI = Body mass index.

there is a relationship between PA during work and leisure time and several components of physical fitness. Additionally, Philippaerts et al. found that PA during work was modestly, but inversely related to adiposity. From a health perspective, increasing physical fitness and reducing adipose tissue is important as physical fitness and overweight are considered independent predictors of several cardiovascular diseases, diabetes mellitus and all-cause mortality [24-27]. Thus, the present results indicate that weekly counseling might be one preventive measure to improve health in the general population and hence to also reduce health-care-related costs [25].

Some limitations of the present study have to be mentioned. Our findings are certainly limited by the relatively small sample size and the uncontrolled nature of the study design. Additionally, the self-assessment of physical fitness and PA level might have led to some inaccuracies. Nonetheless, due to the personal and weekly contact with the participants, allowing the buildup of a trustful relationship with the awareness that only true data are the basis for good science, we are confident that the participants honestly reported their PA and performance level.

Conclusions

The presented findings demonstrate that weekly motivation by phone calls in addition to providing information on sport events and facilities was highly effective in increasing leisure sports activities in both sexes of both young and middle-aged adults. Importantly, changes in the amount of leisure sports activities were closely and positively correlated with individual changes in fitness level and negatively with BMI. Therefore, implementation of the outlined practice may be recommended in order to improve performance capacity and health. However, if this implementation is able to reduce health costs cannot be appraised from this study and should be the focus of further investigations.

Conflict of interests

The authors declare that there is no conflict of interest.

References

1. *World Health Organization. Global Strategy on Diet, Physical Activity and Health Physical Activity and Adults.* [Internet] 2018 Jan 2 [updated 2018 Jan 10; cited 2018 Jan 31]. Available from: http://www.who.int/dietphysicalactivity/factsheet_adults/en/
2. Eakin EG, Lawler SP, Vandelanotte C, Owen N. Telephone interventions for physical activity and dietary behavior change: a systematic review. *American Journal of Preventive Medicine,* 2007; 32(5):419-34. doi:10.1016/j.amepre.2007.01.004
3. Eyre H, Kahn R, Robertson RM, American Cancer Society, the American Diabetes Association and American Heart Association. Collaborative Writing Committee. Preventing cancer, cardiovascular disease, and diabetes: a common agenda for the American Cancer Society, the American Diabetes Association, and the American Heart Association. *Diabetes Care*, 2004; 27(7):1812-24. doi:10.2337/diacare.27.7.1812
4. Gislaine V, Valter CB, Natália BM, Valdomiro de O, Oldemar M, Wagner de C. Association between physical activity and quality of life in the elderly: a systematic review, 2000–2012. *Revista Brasileira Psiquiatria*, 2014; 36(1):76-88. doi:10.1590/1516-4446-2012-0895
5. Hőrnquist J.O. Quality of life: concept and assessment. *Scandinavian Journal of Social Medicine*, 1990; 18(1): 69–79.
6. Tudor ID, Tudor M. Leisure Sports Activities Impact on Adults Personal Development and Quality of Life. *Procedia – Social and Behavioral Sciences*, 2013; 84:1090–1094. doi:10.1016/j.sbspro.2013.06.705
7. Brown M, Sinacore DR, Host HH. The relationship of strength to function in the order adult. *Journal of Gerontology, 50A*, 1995; 50:113–119. doi:10.1093/gerona/50A.Special_Issue.55
8. Kenneth H. *Notes on Physical Fitness.* Institute for Aerobics research*,* Dallas; 2011.
9. Jagiełło W, Jagiełło M, Kalina RM, Barczynski BJ, Litwiniuk A, Klimczak J. Properties of body composition of female representatives of the Polish national fencing team – the sabre event. Biology of Sport 2017;34:401–6. doi:10.5114/biolsport.2017.70526
10. *Global Recommendations on Physical Activity For Health, World Health Organization.* [Internet] 2018 Jan 2 [updated 2018 Jan 10; cited 2018 Jan 31]. Available from: http://apps.who.int/iris/bitstream/10665/44399/1/9789241599979_eng.pdf
11. *World Health Organization Romania Physical Activity Factsheet. Monitoring and surveillance.* [Internet] 2018 Jan 2 [updated 2018 Jan 10; cited 2018 Jan 31]. Available from: http://www.euro.who.int/__data/assets/pdf_file/0005/288122/ROMANIA-Physical-Activity-Factsheet.pdf?ua
12. Epuran M. *Motricity and psychism in bodily activities.* FEST Bucharest Publish House; 2011. (in Romanian)
13. Alothman S, Yahya A, Rucker J, Kluding PM. Effectiveness of interventions for promoting objectively measured physical activity of adults with type 2 diabetes: a systematic review. *Journal of Physical Activity and Health*, 2017; 14(5):1–25. doi:10.1123/jpah.2016-0528
14. Goode AD, Reeves MM, Eakin E.G. Telephone-delivered interventions for physical activity and dietary behavior change: an updated systematic review. *American Journal of Preventive Medicine*, 2012; 42(1):81-8.doi:10.1016/j.amepre.2011.08.025
15. Niculescu M, Georgescu L, Marinescu A. *Physical conditions and health*. Publish House Universitaria; 2006. (in Romanian)
16. Canadian Public Health Association Project, Fitness Testing at Home – Cheap and Easy. [Internet] 2018 Jan 2 [updated 2018 Jan 10; cited 2018 Jan 31]. Available from: http://www.topendsports.com/testing/tests/home-step.htm
17. Tuomilehto J, Lindstrom J, Eriksson JG. et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *The New England Journal of Medicine,* 2001; 344(18): 1343–50. doi:10.1056/NEJM200105033441801
18. Mensink M, Blaak EE, Wagenmakers AJ. et al. Lifestyle intervention and fatty acid metabolism in glucose-intolerant subjects. *Obesity Research*, 2005; 13(8):1354–1362.

doi:10.1038/oby.2005.164
19. Diabetes Prevention Program Study Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *The New England Journal of Medicine*, 2002; 346:393–403.
20. Soja A.M, Zwisler AD, Frederiksen M. et al. Use of intensified comprehensive cardiac rehabilitation to improve risk factor control in patients with type 2 diabetes mellitus or impaired glucose tolerance: the randomized Danish Study of impaired glucose metabolism in the settings of cardiac rehabilitation (DANSUK) study. *American Heart Journal*, 2007; 153(4):621–628. doi:10.1016/j.ahj.2007.01.030
21. Karapolat H, Eyigor S, Zoghi M. et al. Comparison of hospital-supervised exercise versus home-based exercise in patients after orthotopic heart transplantation: effects on functional capacity, quality of life, and psychological symptoms. *Transplantation Proceedings,* 2007; 39(5), 1586–8. doi:10.1016/j.transproceed.2007.01.079
22. Burtscher M, Gatterer H, Kuncziky H, Brendstätter E, Ulmer H. Supervised exercise in patients with impaired fasting glucose: impact on exercise capacity. *Clinical Journal of Sport Medicine*, 2009; 19:394–398. doi:10.1097/JSM.0b013e3181b8b6dc
23. Philippaerts RM, Lefevre J, Delvaux K, Thomis M, Vanreusel B, Vanden EB, Claessens AL, Lysens R, Beuneng G. Associations between daily physical activity and physical fitness in Flemish males: a cross-sectional analysis*, American Journal of Human Biology*, 1999; 11:587–597. doi:10.1002/(SICI)1520-6300
24. Myers J, Prakash M, Froelicher V, Do D, Partington S, Atwood JE. Exercise capacity and mortality among men referred for exercise testing. *The New England Journal of Medicine*, 2002; 346:793–801. doi:10.1056/NEJMoa011858
25. Bomberg E, Birch L, Endenburg N, German AJ, Neilson J, Seligman H, Takashima G, Daz MJ. The financial costs, behavior and psychology of obesity: a one health analysis. *Journal of Comparative Pathology,* 2017;156*:*310–325. doi:10.1016/j.jcpa.2017.03.007
26. Gatterer H, Ulmer H, Dzien A, Somavilla M, Burtscher M. High cardiorespiratory fitness is more beneficial in pre-diabetic men than women. *Clinics*, 2011; 66(5):747–51. doi:10.1590/S1807-59322011000500007
27. Bădău D, Prebeg G, Mitić D, Bădău A. Fitness index and VO_{2max} of physical education students. *Science, Movement and Health*, 2015; 15(2):246-–251.

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Young people practicing martial arts and their perception of success

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Abstract

Purpose: The scientific framework for this study is the Humanistic Theory of Martial Arts that provides the specific language and definitions for Combat Sports/Martial Arts manifestations.
The main aim was to describe the "perception of success" in groups in age 15-17, 11,11% girls and 88,89% boys involved in martial arts training. Participants (n = 63) consisted of young martial artists from Poland and the United States.

Material: The instrument used for data collection was the Perception of Success Questionnaire (POSQ) (translated into Polish); Statistical analysis consisted of calculating the Spearman rank correlation for each pair of subgroups being analyzed a Coefficient of variation for comparison between the values of measurement.

Results: 1) A weak correlation between the type of cultivated fighting style and the perceptions of success (Spearman rank correlation = ,35); 2) A moderate relationship between the US participants versus the Polish participants, and the perceptions of success (Spearman rank = ,69); and 3) A weak relationship between sex (as a gender) and the perceptions of success in the martial arts and combat sports (Spearman rank = ,34).

Conclusions: This study concludes that the form or style of cultivated martial art or combat sport being practiced did not have a significant impact on the perception of success expressed by children and young people engaged in it.

Keywords: martial arts, combat sports, success attribution, task orientation, pedagogy.

Introduction

The scientific framework for this study is the Humanistic Theory of Martial Arts and the holistic Anthropology of Martial Arts [1, 2]. This theory provides the language for definitions and understanding all types of CS&MA – Combat Sports and Martial Arts [3]. According to the theory, a person practicing any of these disciplines is treated holistically, encompassing his or her needs and motivations, values and aspirations, body and spirit.

Perceptions of success, along with task/goal orientation, is an important issue in the psychology of sports and modern coaching, as well as for pedagogy and physical education [4, 5]. This approach stems from the psychology of education [6], built on conceptions of goals, tasks, and success; as described by Nicholls [7] in his achievement goal theory. According to Nicholls, there are two types of goal orientation, namely learning orientation and performance orientation. Both types are components or manifestations of the motivational processes affecting learning.

A number of researchers have focused on the philosophical basis of martial arts as the key to explaining their impact on the perceptions of success and the aspirations of those who participate in these disciplines [8, 9, 10]. Various socio-cultural characteristics of the martial arts, which influence the perceptions of participants, leading to the internalization of special ethos are frequently identified and discussed in the literature [11, 12, 13].

This study poses two research problems, the first of which is to determine the effect of the style or form of martial art or combat sport being practiced on the perceptions of success of those youths who practice it. The research question associated with this is, "Is there a relationship between the perceptions of success expressed by the respondents in the study and the form of martial art they practice?" The second research problem concerns the determination of whether differences exist between the perceptions of success among groups of children and young people practicing martial arts in Poland versus in the United States. Hence, the research question for this second problem is, "Are there any differences in the results by country of origin and residence, and of what they can (possibly) result?" In response to the above research questions, this study poses the following hypotheses: 1) There is no statistically significant correlation between the perceptions of success in martial arts and combat sports and the type or form of martial art and combat sport being practiced, and 2) Any differences in the statements of the respondents from different countries may be attributed primarily to cultural differences.

The authors want to analyse the relationship of adolescents' participation of success according the martial arts discipline and country. The first hypothesis was that no statistically significant dependence would be

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found between the perceptions of success and the form of cultivated martial art or combat sport being practiced. The second hypothesis was that the differences in the statements of the respondents from two different cultural backgrounds in the study, the United States and Poland, in terms of their perceptions of success.

Aim

The problem and aim of this study is to explain the "perception of success" among groups of children and young people practicing martial arts. What correlations exist between the answers of respondents and types of martial arts they practice? Is there a relationship between the perceptions of success expressed by the respondents and the specific martial arts discipline? Do differences exist in these results based on the country of origin and residence of the participants, and if so, what are these differences?

Material and Methods

Participants. The number of respondents who had volunteered to participate and were randomly selcted was N = 63 persons (28 from the US and 35 from Poland). The ratio of boys to girls in the study corresponds to the proportion of boys to girls actively engaged in the martial arts group-training in both countries. The data are presented in Table 1.

Table 1. Demographic characteristics of respondents by sex

Sex/ country	United States		Poland		Alltogether	
Sex	N	%	N	%	N	%
Girls	2	3,17	5	7,94	7	11,11
Boys	26	41,27	30	47,62	56	88,89

Source: own research

The statistics contained in the Table 2 are calculated on the basis of data on age diversity found among survey respondents.

Table 2. Average age of respondents by sex (gender)

Sex/country	United States	Poland	Alltogether
Sex			
Girls	16,5	17	16,75
Boys	15,12	15,3	15,21

Source: own research

The average age of the respondents (boys and girls) from the two countries varied. The highest average among those practicing martial arts was that of the Polish girls, followed by the American girls, the Polish boys and the Americans boys.

Research Design.

This project was conducted under the auspices of the International Martial Arts and Combat Sports Scientific Society (IMACSSS), specifically its Division of Sociology and Anthropology, along with its Division of Pedagogy. The research was solicited and sponsored by the IMACSSS under the heading 1A/2011: "Social determinants of participation in schools and clubs of martial arts", and approved by the Ethical Committee of Idokan Poland Association.

The tool used for this study was the Perception of Success Questionnaire (POSQ) [13], adopted for children. The data were collected in Poland and the USA, among children and young people practicing *jujutsu, karate, taekwondo, kung fu,* and mixed martial arts (MMA). The study was conducted between October 2015 and January 2016 in the United States (New York) and in Poland (Rzeszow, Skarzysko-Kamienna, Strzyzow, and Warsaw). It was translated into Polish and explained to the respondents in gyms/training places.

Statistical Analysis.

The data was analysed using the Statistica software (Version 13; StatSoft, Palo Alto, CA, USA). Statistical analysis consisted of calculating the Spearman rank correlation for each pair of subgroups being analyzed a Coefficient of variation for comparison between the values of measurement.

Results

This questionnaire contained twelve affirmative statements, to which the participants indicated their responses of a scale of potential acceptance or rejection of the statement, ie, their degree of agreement or disagreement. These sentences express the following attitudes: 1) "I beat other people", 2) "I am clearly superior", 3) "I am the best", 4) "I work hard", 5) "I show clear personal improvement", 6) "I outperform my opponents", 7) "I reach a goal", 8) "I overcome difficulties", 9) "I reach personal goals", 10) "I win", 11) "I show other people I am the best", and 12) "I perform to the best of my ability" [13]. Of couurse, the POSQ was translated into Polish.

The subjects rated their relationship to the above sentences based on a five-option scale from A (Strongly agree), B (Agee), C (Neutral), D (Disagree), to E (Strongly disagree). Individual responses are assigned corresponding rank (5-1). It should be noted that the questions 4, 5, 7-9, and 12 were classified as *Task orientation*, while 1-3, 6, 10, and 11 were classified as *Ego orientation* [13]. The results were used in the analysis, measuring the acceptance of these attitudes and possibly occurring correlations. It is assumed that those participanting in Poland have a European traditional (Christian) cultural background, while those respondents in the United States have an American cultural background.

The first hypothesis was examined separately for *task orientation* and *ego orientation*. Moreover, in order to thoroughly ascertain the presence or absence of dependence, the statistical analysis made statements and calculations ranks due to types of martial arts classified

as involving either greater or lesser degree of contact. For each of these classifications, the following statistics were calculated: 1) the arithmetic mean, 2) the standard deviation, and 3) the strength of relationships between variables, based on the Spearman rank correlation. The results are presented in Table 3.

The martial arts categories included in this study were *chow gar kung-fu*, *modern jujitsu, jujitsu goshin-ryu, jujitsu* styleless, *jujitsu idokan, karate idokan, karate isshin-ryu*, and *iaido*; the combat sports categories included mixed martial arts (MMA), kickboxing, *judo*, and *taekwondo*. The term limited contact sports was used to include all those forms traditionally described as 'martial arts'.

The data contained in Table 3 indicate a variation in the responses of children and youth training in combat sports versus in martial arts with regard to the subject of success (in terms of purpose and self-development). Respondents representing the martial arts to agree, that success depends on achieving the specific objectives. This outcome was similar to the responses other than "definitely". These participants indicated that they were neutral concerning the claims that their form of practice is equally important orientation for self-development. In the case of respondents practicing martial arts, speifically those varieties involving less contact, these results are presented in the same manner. The standard deviation in individual cases indicate a lack of diversity in the responses given.

The results of the Spearman rank correlation yielded a statistic of ,35, indicating a weak correlation between the type of cultivated fighting style and the perceptions of success on the part of participants. Moreover, because the calculated ratio, 2.83, is higher than ,05, the hypothesis that there is no statistically significant dependence of the perception of success in the martial arts upon the type of cultivated martial art or combat sport being practicing must be accepted.

Again, in testing of the second hypothesis, responses to the categories *task orientation* and *ego orientation* were separated and calculations were ranked with regard to cultural area. The results are shown in Table 4.

The data contained in Table 4 indicate a lack of diversity in the responses of participants in sports and of martial arts, regardless of their respective cultural areas. Respondents from the American cultural area agree, that success depends on achieving the specific objectives and were neutral to claim that self-development is an equally important orientation. In the case of participants representing the European cultural area, the results from their responses were analogous. Furthermore, the standard deviation calculated for the responses given indicate no significant differences.

Coefficient of variation (given in percent) *ego orientation* and *task orientation* are between forty and sixty percent (42.6; 44.2; 52.6; 54.8), and thus there is a great diversity of statistical data.

The result of the Spearman rank correlation was ,69, indicating a moderate correlation between the respondent's being from the American versus the European cultural area and that respondent's perception of success. Because the calculated ratio, 2.22, is higher than ,05, the hypothesis predicting the absence of any statistically significant dependence of the perceptions of success in the martial arts upon the participant's cultural background or country of origin must be accepted.

Also of interesting also are the results of analyzing the perceptions of success based on the sex of (as a gender) the respondents. The data obtained are shown in Table 5.

The data contained in Table 5 indicate a lack of diversity among the responses given by either the girls or the boys in relation to the subjects of achieving objectives and self-development. The girls agreed to the proposition, that success depends on achieving the specified targets, but gave a neutral response to the idea that self-evelopment is an equally important orientation. In a similar fashion, the boys agreed with the statement that success depends on achieving the goal, but expressed a neutral attitude towards the idea that success is associated with self-development. The standard deviations were calculated

Table 3. Perceptions of success and type of cultivated martial arts practiced

Orientation/practicing	Martial arts			Combat sports		
	$\overline{X}$	Sd	V	$\overline{X}$	Sd	V
Task orientation	1,61	0,91	56,5%	1,72	0,83	48,2%
Ego orientation	2,61	1,19	45,6%	2,63	1,2	45,6%

Source: own research. The level of significance is p< 0.05.

Table 4. Perceptions of success and cultural area

Orientation/area	American cultural area			European cultural area		
	$\overline{X}$	Sd	V	$\overline{X}$	Sd	V
Task orientation	1,81	0,8	44,2%	1,57	0,86	54,8%
Ego orientation	2,58	1,1	42,6%	2,49	1,31	52,6%

Source: own research. The level of significance is p< 0.05.

Table 5. Perceptions of success and sex

Orientation/sex	Girls			Boys		
	$\overline{X}$	Sd	V	$\overline{X}$	Sd	V
Task orientation	1,7	0,88	51,8%	1,73	0,84	48,5%
Ego orientation	2,86	1,36	47,5%	2,6	1,18	45,4%

Source: own research. The level of significance is p< 0.05.

and indicate that no significant differences exist in the responses given by boys versus girls.

Coefficient of variation (given in percent) *ego orientation* and *task orientation* are between forty and sixty percent (45.4; 47.5; 48.5; 51.8), and thus there is a great diversity of statistical data.

The result of the Spearman rank correlation was .34, indicating that only a weak relationship between sex and the perception of success. Because the calculated ratio, 1.98, is higher than ,05, the hypothesis that the differences in the statements of the respondents from two different cultural backgrounds in the study, the United States and Poland, in terms of their perceptions of success must be accepted.

Discussion

The tool, Perceptions of Success Questionnaire (POSQ), is used frequently in research that is similar to this study and involves young people who practice and play sports [14, 15, 16]. However, martial arts have their own specific characteristics, setting them apart from other sports with respect to the POSQ. The type of practice itself is not an important determinant of either task orientation or success attribution.

In one study, young CS&MA participants ($n_1 = 477$, *M* age = 14 yr., *SD* = 2.13) who practiced *judo, aikido*, kick-/Thai boxing or *karate* were assessed in terms of their aggressiveness, goal orientations, psychosocial behaviour, and social background, using their responses, as well as those of their parents (n2 = 307). The authors of the study concluded that "differences exist in the characteristics and social background of participants depending on the type of MA&CS being practiced. The fact that differences in these mediating factors can be identified indicates that in future research these and possible other mediating factors should be considered when trying to determine social-psychological outcomes of MA&CS." [16]. However, in the results show above we found only a weak correlation with the type of MA &CS.

The results (shown above) are generally compatible with similar research, conducted in order to assess what affects young people practicing martial arts [17, 18, 19]. However, the works varies in terms of the relationships determined between goal orientation and each of the following factors: 1) the perceived motivational climate in the participant's environment, 2) the perception of ability and attributions of success in sport, 3) the enjoyment of sports practice, 4) the commitment and dedication to learning, and 5) the anxiety experienced in relation to errors and stressful situations. "Ego orientation correlated with ego perceived motivational climate in parents, trainer and partners; with a higher perception of ability; with normative ability and deceit as way to achieve success in sport, and with boredom. Task orientation correlated with motivation-effort in order to achieve success, with sports practice enjoyment, anxiety over stressful situations and with a lower learning commitment and dedication" [19].

In the M. Lochbaum's group, "The ego goal was practically meaningless to small in meaningfulness related to all of correlate categories (…) these small in meaningfulness relations were consistent" [20, 21]. Also, in the Polish-American research the task orientation was pointed predominatingly.

Harwood recognized that the measures described or referred to above may not yield accurate or meaningful information on an athlete's motivational responses in the contexts of competition and practice. In this researcher's study, the contextual sensitivity of the TEOSQ and the POSQ was examined empirically using a sample of 179 high-level team and individual athletes. The results of data analysis involving repeated measures ANOVAs, supported by follow-up paired t-tests, illustrated how performers' goal orientations for competition differed significantly from their overall sport goal orientations. "The findings are discussed with reference to the implications for practitioners and the development of appropriate contextual assessments of achievement goals at nomothetic and idiographic levels" [22].

In another research study utilizing the same data set, a two-stage cluster analysis of the POSQ scores revealed a three-cluster solution when subjected to a multivariate analysis of variance, thereby indicating significant differences among cluster groups in imagery use. Athletes in the Cluster 3 group (higher task/higher ego) used significantly more imagery, regardless of its function than did athletes in Cluster 1 (lower task/moderate ego) or those in Cluster 2 (moderate task/lower ego). "These findings are discussed with reference to the role of achievement motivation in influencing young athletes' behavioural investments in mental strategies" [23].

Other studies of athletes and their orientation to task provide little in the way of conclusive results. For instance, Roberts, Treasure, and Kavussanu examined the relationship between dispositional achievement goal orientations and satisfaction and beliefs about success in sports. In this research, 333 student participants were administered the Perception of Success Questionnaire (POSQ), the Beliefs about Success, and the Satisfaction/

Interest/ Boredom Questionnaires. Among these participants, task and ego goal orientations were found to be orthogonal. "Following an extreme group split of the task and ego subscales of the POSQ, results of a 2×2 (High/Low Ego; High/Low Task) multivariate analysis of variance revealed a significant interaction effect between task and ego orientation. Specifically, participants high in ego and low in task orientation believed effort to be less a cause of success while high task/low ego-oriented individuals were the least likely to attribute success to external factors" [24].

In a similar study, albeit one focusing on recreation activity in general, the purpose was actually to develop and examine the reliability and validity of the Perceptions of Success Questionnaire for Exercise (POSQ-E), and to link goal orientation to self-reported physical activity patterns and perceptions. In this case, the sample consisted of 569 recreation centre participants who utilized the facility 3.77 days a week (SD = 1.94) and were active for an average of 70.18 minutes (SD = 33.3) per session. "Sixty-three percent of respondents (n = 358) self-reported meeting adult guidelines for regular exercise (150 minutes per week). Using a single-item ladder, participants were assigned across the five stages of exercise readiness respectively: precontemplation (6.8%); contemplation (4.9%); preparation (26.2%); action (23.8%); and maintenance (38.3%). Task scores were shown to increase across the stages of change while ego scores decreased slightly. An extreme median split of the goal orientation scores yielded a sub-sample of 235 participants with 76 (32.3%) in the high task/high ego, 49 (20.9%) in the high task/low ego, 47 (20%) in the high ego/low task, and 63 (26.8%) in the low ego/ low task group. The POSQ-E was shown to have good internal reliability, factor validity and convergent validity. Convergent validity linking the trans-theoretical model and self-reported physical activity behaviour with goal orientation theory may provide a new direction for applied research in exercise behaviour" [25].

Conclusions

The present study, reported here, adds to the knowledge based of the literature in the field by indicating that the form or style of cultivated martial art or combat sport being practiced does not have a significant impact on the perception of success expressed by children and young people engaged in it, whether boys or girls. Furthermore, acording to these results, there are no differences in responses, conditioned by the cultural background or country of origin of the respondent.

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None.

Conflict of interests

The authors declare that there is no conflict of interest.

References

1. Cynarski WJ. *Martial Arts Phenomenon – Research and Multidisciplinary Interpretation***.** Rzeszow: Rzeszow University Press; 2012.
2. Zeng HZ, Cynarski WJ, Xie L. *Martial Arts Anthropology, Participants' Motivation and Behaviours. Martial Arts in Chanshu: Participants' Motivation, Practice Times and Health Behaviours*. Saarbrücken: Lambert Academic Publishing; 2013.
3. Cynarski WJ, Skowron J. An analysis of the conceptual language used for the general theory of martial arts -Japanese, Polish and English terminology. *Ido Movement for Culture. Journal of Martial Arts Anthropology*. 2014; 14 (3): 49-66.
4. Ames C. Classrooms: goals, structures, and student motivation. *Journal of Educational Psychology*. 1992; 84(3): 261 -71.
5. Endresen I, Olweus D. Participation in power sports and antisocial involvement in preadolescent and adolescent boys. *Journal of Child Psychology and Psychiatry*. 2005;46(5): 468-78.
6. Elliot A. The Hierarchical Model of Approach-Avoidance Motivation. *Motivation and Emotion*. 2016;30(2): 111-6.
7. Nicholls J. Conceptions of ability and achievement motivation. In Ames R, Ames C, editors. *Research on motivation in education*. San Diego: Academic Press; 1984. p. 39-73.
8. Bäck A, Kim D. Towards a Western philosophy of the Eastern martial arts. *Journal of the Philosophy of Sport*. 1979; 5:19-28.
9. Cynarski WJ. General reflections about the philosophy of martial arts. *Ido Movement for Culture. Journal of Martial Arts Anthropology*. 2013;13(3): 1-6.
10. Cynarski WJ, Lee-Barron J. Philosophies of martial arts and their pedagogical consequences. *Ido Movement for Culture. Journal of Martial Arts Anthropology*. 2014;14(1): 11-9.
11. Obodynski K, Cynarski WJ. Social and Philosophical Determinants of the Lifestyle of a Contemporary Student of Martial Arts. In: Hodan B, editor. *Proceedings from the Czech-Slovak-Polish Symposium Tělesná vychova, sport a rekreace v procesu současné globalizace 2005 Feb 17-18* [Physical Education, Sport and Recreation in the Process of Contemporary Globalization, 2005 Feb 17-18]. Brno. Olomouc: Univerzita Palackeho v Olomouc; 2005. P. 271-81.
12. Zeng HZ, Xie L, Cynarski WJ. Young Martial Arts Athletes' Motivation and their Health-Related Behaviours. *Research Quarterly for Exercise and Sport*. 2013;84(1): A78–9.
13. Roberts G, Treasure D, Balague G. Achievement goals in sport: The development and validation of the Perception of Success Questionnaire. *Journal of Sports Sciences*. 1998;16 (4): 337-47.
14. King L, Williams T. Goal orientation and performance in martial arts. *Journal of Sport Behaviour*. 1997;20(4): 397-412.
15. Gómez-López M, Granero-Gallegos A, Abraldes A, Rodríguez-Suárez N. Analysis of Self-Determined Motivation in Basketball Players through Goal Orientations. *Collegium Antropologicum*. 2013;37(3): 707-15.
16. Vertonghen J, Theeboom M, Pieter W. Mediating factors in martial arts and combat sports: An analysis of the type of martial art, characteristics, and social background of young participants. *Perceptual & Motor Skills: Exercise & Sport*. 2014;118(1): 41-61.

17. Vertonghen J, Theeboom M. The social-psychological outcomes of martial arts practise among youth: a review. *Journal of Sports Science and Medicine*. 2010;9(4): 528-37.
18. Vertonghen J, Theeboom M. Martial arts and youth: an analysis of contextual factors. *International Journal of Adolescence and Youth*. 2012;17(4): 237-41.
19. Salinero Martín J, Ruiz Tendero G, Sánchez Bañuelos F. Goal orientation and motivational climate, achievement motivation, success atribution and enjoyment in an individual sport. *Ciencias Aplicadas a la Actividad Física y el Deporte*. 2006;83(1): 5-11.
20. Lochbaum M, Kazak Cetinkalp Z, Graham K, Wright T, Zazo R., Task and ego goal orientations in competitive sport: A quantitative review of the literature from 1989 to 2016. *Kinesiology*. 2016;48: 3-29.
21. Lochbaum M, Zazo R, Kazak Cetinkalp Z, Graham K, Wright T, Konttinen N. A meta-analytic review of achievement goal orientation correlates in competitive sport: A follow-up to Lochum et al. *Kinesiology*. 2016;48: 159-73.
22. Harwood C. Assessing Achievement Goals in Sport: Caveats for Consultants and a Case for Contextualization. *Journal of Applied Sport Psychology*. 2002; 14(2): 106-19.
23. Harwood C, Cumming J, Hall C. Imagery use in elite youth sport participants: reinforcing the applied significance of achievement goal theory. *Research Quarterly for Exercise and Sport*. 2003;74(3): 292-300.
24. Roberts G, Treasure D, Kavussanu M. Orthogonality of achievement goals and its relationship to beliefs about success and satisfaction in sport. *The Sport Psychologist*. 1996;10 (4), 398-408.
25. Zizzi S, Keeler L, Watson J. The interaction of goal orientation and stage of change on exercise behavior in college students. *Journal of Sport Behavior*. 2006;29(1): 96-110.

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The determination of physical activity, nutrition and self-sufficiency levels of sedanter individuals of fitness club member

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Abstract

Purpose: This study was planned to determine the physical activity (PA), nutrition and self-efficacy levels of sedentary individuals have long been members of fitness clubs.

Material: A total of 80 participants were divided into two groıips according to body mass index (BMI) according to their obesity status: Group 1 (overvveight obesity (OW)) and Group 2 (Normal Weight (NW)). All participants were watched for a year. The stıidy includes questionnaires on PA, eating habits, nutrition knovvledge and self-efficacy. Descriptive statistics including frequency, percentiles, ınean and Standard deviation were used. The T test was used to examine differences between PA, eating habits, nutrition knowledge and self-efficacy. Statistical significance was accepted as P <0.05.

Results: Regarding participants' eating habits, the OW group was less frequent breakfast (P <0.05) and snack (P <0.01), ate more meals (P <0.01). When coınpared with the NW group, they showed less desirable behavior during the meal (P <0.05 for men). OW men spent less time (P <0.01) during vveekdays or weekends while doing less PA (P <0.01). OW woınen sat more in the vveekdays or weekends (P <0.01) and spent less time walking or riding a bicycle (P <0.05) than the NW group. The nutritional information of the OW and NW groups was not significantly different. Especially PA self-efficacy in OW was significantly lower than in NW group (P <0.01).

Conclusions: This study revealed differences betvveen PA, eating habits and self-efficacy betvveen OW and NW individuals. Sedanter individuals who are members of fitness clubs should exercise exercise programs to prevent obesity and to increase the confidence about exercise or physical activity.

Keywords: obesity, fitness club member, physical activity, nutrition information, self-sufficiency.

Introduction

Physical activity has a positive effect on the individual's both physical and functional capacity and health. When the benefits of physical activity are taken into account, optimal exercise provides individuals with healthier communities [1]. Research has shown that physical activity and exercise are essential for health [2-5]. The International Association of Health, Racquet and Sports Club estimates that 151 million people exercise in 187,000 sports and fitness centers worldwide [6]. Exercising in a fitness room exhibits three different forms of behavior on the individual: participation behaviors (when a person enters facility), continuation (an individual participates in a particular program), and eventual exercise (individual time, intensity, true) [7]. Participation in fitness clubs and research on exercise behavior are limited [8], but preliminary studies have identified low exercise sessions in sports clubs with an average of 1.1 sessions per month over a 24-month period. Only 25% of the 259,000 old members were regularly exercised for six months in the 10% and 2.3% did not stop in two years [9]. These frequencies will not affect health well [2, 3].

Self-sufficiency is the belief in one's ability to overcome personal, social, and environmental barriers. There are two important aspects that will influence confidence in adopting and maintaining exercise behavior. The first is activity expectations; belief about their competencies. Second, beyond expectations; beliefs about the results of one's own practice or the results of exercises. According to the self-efficacy theory, human behaviors are strongly influenced by self-regulation, for example, by self-regulation of exercise activities and self-determinative exercise goals [10]. Higher (perceived) self-efficacy further increases the likelihood that the individual will initiate and maintain behavior. A practice habit, for example, makes a call to enter a specific habit to remain motionless. It is conceptually related to self-sufficiency.

There is limited research on exercise behaviors of members of sports clubs [8]. According to [11], 46% of women participate in cardio programs only and 51% of them participate in cardio and strength programs. 60% of men prefer to participate in strength training and cardio programs if only cardio is 33%. In addition, while men (60%) and women (45%) were involved in group exercises, only 31% of women did not participate in group exercise programs. This participation is suggested to be a sign of exercise behavior. In a study of programa participation and exercise behavior in fitness clubs, [12], reported a 17% to 100% change in participation in programs. A study of members of the US sports clubs by DellaVigna and Malmendier [13] on attendance and attendance at the fitness club was conducted. A large number of 7.752 active members attendance have reported dropping from 5.46 to 4.32 in the first 6 months of to fitness clubs.

For this reason, it is very important to actively control obesity in individuals who are members of fitness clubs. Although the cause of obesity is complex, eating habits

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or lifestyle play an important role in the development of obese conditions [14, 15]. Physical activity deficiency and malnutrition are accepted as an important risk factor. Physical activity may continue at any time of life [16, 17]. In particular, it is emphasized that as individuals age, they experience a significant decline in sedentary lifestyle and a significant decrease in their physical activity [18]. Physical inactivity is among the most important causes of the increase in the number of obese people. In addition, there is a close relationship between obesity and cardiovascular diseases, diabetes, osteoporosis, some types of cancer, mental problems and many health problems [19, 20]. Increased physical activity has a positive effect on obesity, and therefore, it is suggested that there are many studies that emphasize the effect of treatment with the preventive effect of the above mentioned diseases [21]. Factors related to eating or physical activity should also be identified to help sedentary individuals adopt healthy behaviors [22]. Knowledge of eating or physical activity is necessary to conduct the behavior, but it must be combined with these skills. Self-efficacy represents the ability to perform behavior and is known to be important in describing health behaviors such as eating and physical activity [14, 23]. This study was designed to determine the physical activity (PA), nutrition and self-efficacy levels of sedentary individuals who have long been members of fitness clubs

Material and Methods

Participants

Before starting to work, necessary legal permissions were taken, the rules to be complied with were signed in detail, clarified to the individual, and an informed consent form. The study was conducted in accordance with the Helsinki declaration. The inclusion criteria are not a chronic disease, and the absence of chronic drug use means that there are no musculoskeletal problems that could affect physical activity. There is also a group of exercise programs already prepared to provide equal quality between the staff and group exercise programs that will carry out the group exercise sessions. This study was initiated by 129 sedanter individuals between 19-42 years of age. The study ended with a total of 80 participants, 35 female and 45 male, who were trying to improve their physical fitness levels in the ffitnes halls for a year. Body mass indexes (BMI) of 80 participants attending ffitness clubs at the end of the first 2 months were divided into two groups according to their obesity status: Group 1 (Overweight Obese (OW)) and Group 2 (Normal Overweight (NW)). At the end of the study, groups were asked about PA, eating habits, nutrition knowledge and self-efficacy.

Procedure

In this study, the same exercise programs were used for both groups. These programs were selected because they were prepared in advance and follow a standard format by the instructors. Exercise program sessions were planned as 3 days a week, 1 hour a day. Exercise programs include frequency and intensity of exercise as well as training [24, 25]. The study questionnaire was based on sedanter individual' eating habits, physical activity and nutrition knowledge, and literature review to determine self-efficacy levels [26-28]. General features include the items of age, gender, height, weight, body mass index (BMI). The body mass index was calculated based on the weight and the dye reported. Participants' height measurements were measured by the millimetric height scale and body weight measurements by electronic scales. Body weight and height measurements were formulated by adding them to personal information forms. BMI = Body Weight (kg) / Boy2 (m). BMI values were obtained by dividing the body length by body weight after taking the length of the body length. Overweight-obese (OW) with BMI ≥ 25 and BMI 18.5 <BKI <25 were determined as those with normal weight (NW).

Data Collection Tools

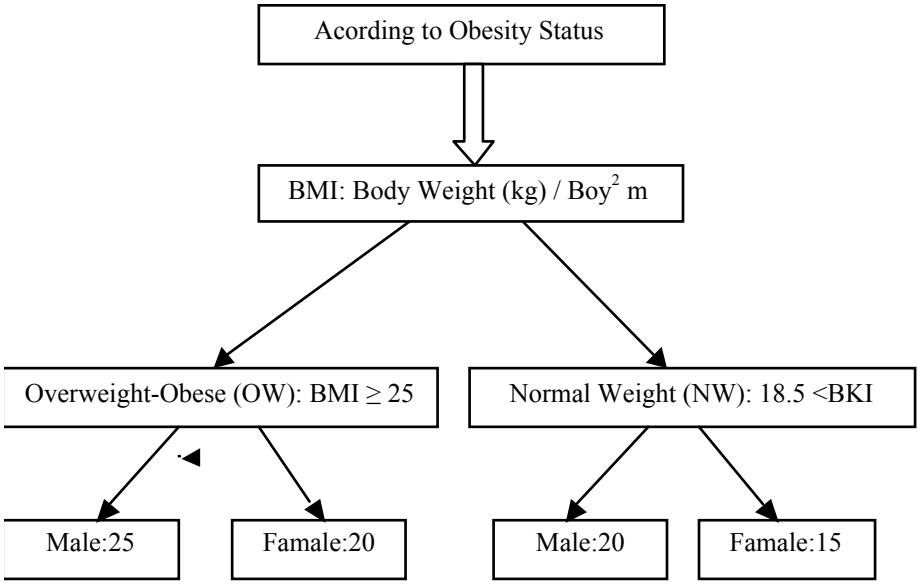

Figure 1. Participation in the study acording to obesity status

Eating Habits

Eating habits included diverse foods, regular meals, size of food, frequency of breakfast meals, eating and snacks, behavior during meals, unbalanced diet and unfavorable food [29,30]. These variables were measured using 5-point scales or by asking them to record the frequency of their behavior or to check the categories.

Physical Activity

Physical activity is measured based on seven factors: the frequency of physical activity for at least 30 minutes per day, the frequency of walking or cycling, the frequency of exercise, weekday or weekend walking times, weekday or weekly moving time, by the number of activities they have performed [31,32]. The time spent walking was measured using four categories: "less than 30 minutes a day" or "more than 2 hours a day." The inactive time spent was measured using the categories "from less than one hour a day" to "no more than 4 hours a day".

Nutrition Knowledge

Nutrition knowledge was measured on 10 items, including general nutrition (six items) and information about obesity (four items) [29,30]. Information about obesity, definition of obesity, adequate weight control, fruit and energy and the effects of regular exercise. For each nutritional information item, the number and percentage of correct answers of the subjects were examined. The total score of the nutrition knowledge was the total score of the correct answers for 10 nutrition knowledge items.

Self-Efficacy

Self-efficacy obesity status in eating or physical activity was assessed using 10 items [27,30,33]. Self-efficacy in physical activity was measured using four items. They regularly participate in sports exercises, perceived efficacy on tired or bad weather conditions, driving at short distances, exercising at lunch or in the malls. Each item was measured on a 4-item scale between 'very difficult' (1) and 'very easy' (4). The total score for self-efficacy was calculated as a total of 10 item points.

Statistical Analysis.

SPSS (PASW Statistics 18.0; SPSS Inc., Chicago, IL, USA) was used for statistical analyses. Descriptive statistics including frequency, percentages, mean and standard deviation were calculated. Body weight and height measurements were formulated by adding them to personal information forms. BMI = Body Weight (kg) / Boy2 (m). BMI values were obtained by dividing the body length by body length after taking the body length. In this study T-test was used for parametric variables to examine the differences between the eating habits, physical activity, nutrition knowledge and self-efficacy according to obesity status. Chi-square analyses were conducted for non-parametric variables. Statistical significance was examined at $P < 0.05$.

Results

Sedanter Individuals Who Are Members of Fitness Clubs were found to be included in the age group 26.3 ± 6.5 Normal Weight (NW) and 28.1 ± 7.6 in the Overweight & Obesity (OW) group. The groups were significantly different according to their obesity status; OW group weight and BMI was higher than NW group while the height length was found to be lower ($P < 0.01$) (Table 1).

The frequency of breakfast with sedentary individuals who were members of Fitnis clubs was average in male OW group (5.6 ± 1.4) and female OW group (5.7 ± 1.6). OW group values were higher than NW group men and women ($P < 0.05$). while the frequency of eating outside did not vary among men OW women ate more food than NW women ($P < 0.01$). The average snack frequency from both sexes was significantly higher in the OW group in males and females ((1.6 ± 1.3); (1.6 ± 1.2). In the NW group men and women, the average frequency of snacks was 1.2 ± 0.8 times daily, OW group (1.6 ± 1.3) per day in men and (1.6 ± 1.2) in women ($P < 0.01$). OW reported that about 12% of men did not eat a wide variety of foods, and 28% said that a wide variety of foods were eaten too often. Approximately 10% of OW women reported that they did not eat a wide variety of foods, and 30% reported that a wide variety of foods were eaten too often. Approximately 20% of OW men and 35% of women were fed with very irregular food, while the rate of regular eating was 28.7% in total participants. The proportion of respondents who responded as 'small' or 'very small' according to the size of the food ratio was 48% in the OW group male, 55% in the OW group women ($P < 0.001$). Participants were observed to exhibit similar behaviors in

Table 1. General Descriptive Characteristics of Sedanter Individuals Who Are Members of Fitness Clubs

Obesity Status[1)]			
Variables	**Normal (n = 35)**	**Overweight & Obesity (n = 45)**	**Total (n=80)**
Age	26.3 ± 6.5	28.1± 7.6[2)]	27.2±7.05
Weight (kg)	66.4 ± 14.8	77,2 ± 11.6**	71.8±13.2
Height (cm)	179,1 ± 8.72	168,8 ± 6.65**	173,9±7.68
BMI	22.6 ± 4.1	28.2 ± 3.4**	25.4±3.7
Male	20 (44.5)	25 (55.5)	45 (100.0)
Famale	15 (42.8)	20(57.2)[3)]	35(100.0)

* P < 0.05, ** P < 0.01; 1) BKİ ≥25 overweight - obesity (OW) ve BKİ 18.5 < BKİ < 25 normal weight (NW); 2) Mean ± SD; 3) n (%).

eating. Approximately 68% of men in OW group and 75% of OW women were fed an unbalanced diet (P <0.001) (Table 2). No significant difference was observed between the participants regarding the unfavorable foods (Table 2).

It was found that 24% of men in the OW group and 40% of the women in the OW group did not do any physical activity at least 30 minutes per day during the week. OW group reported that 40% of men and 35% of women walked no day or did not ride bicycles. 40% of men in NW group and 46.8% of women walked at least 1-2 days per week (P <0.05). During weekday OW group found that 36% of men and 40% of women and during the weekend 32% of OW group men and 50% of women were walking less than 30 minutes a day (P <0.05) (P <0.01). OW and NW group men and women were on weekdays and weekend time spent during was between 30 minutes and 1 hour. The ratio of male and female OW group who had less physical activity on weekdays and weekends than three hours was higher than NW group (Table 3). Approximately 40% of women in the OW group never participated in physical activity in a week. The proportion of OW women exercising more than three hours a week (10%) is lower than NW women. The rate of NW group men and OW group men exercising every other day was significantly similar (Table 3).

Table 2. Eating habits according to obesity status in Sedanter Individuals who are Members of Fitness Clubs

Variables	Male (n=45)		Famale (n=35)		
	Normal (n= 20)	Overweight & Obesity (n =25)	Normal (n= 15)	Overweight & Obesity (n =20)	Total (n= 80)
Breakfast frequency (times/ week)	4.5 ± 1.6	5.6 ± 1.4[3)*]	4.4 ±1.7	5.7 ± 1.6*	5.0 ± 1.6
Frequency of eating out (times/ week)	1.1 ± 0.8	1.3 ± 1.1	1.1 ± 0.8	1.4 ± 0.7**	1.2 ± 0.8
Frequency of eating snacks (times/day)	1.2 ± 0.8	1.6 ± 1.3**	1.2 ± 0.8	1.6 ± 1.2**	1.4 ± 1.0
Variety of foods					
Do not eat a variety of foods at all	2 (10.0)	3 (12.0)[4)*]	1 (6.7)	2 (10.0)*	8(10.0)
Do not eat a variety of foods	3 (15.0)	4 (16.0)	2 (13.3)	2 (10.0)	11(13.9)
Average	6 (30.0)	5 (20.0)	6 (40.0)	5 (25.0)	22(27.4)
Eat a variety of foods	6 (30.0)	6 (24.0)	4 (26.7)	5 (25.0)	21(26.2)
Eat a variety of foods very often	3 (15.0)	7 (28.0)*	2 (13.3)	6 (30.0)*	18(22.5)
Regular meals					
Very irregular	1 (5.0)	6 (24.0)	1 (6.7)	7 (35.0)**	15(18.7)
Irregular	3 (15.0)	7 (28.0)**	2 (13.3)	4 (20.0)	16(20.0)
Neither irregular nor regular	5 (25.0)	4 (16.0)	3 (20.0)	3 (15.0)	15(18.7)
Regular	8 (40.0)	5 (20.0)	6 (40.0)	4 (20.0)	23(28.7)
Very regular	3 (15.0)	3 (12.0)	3 (20.0)	2 (10.0)	11(13.9)
Size of meals					
Very small/ small	6 (30.0)	12 (48.0)**	5 (33.3)	11 (55.0)**	34(42.5)
Adequate	8 (40.0)	8 (32.0)	7 (46.7)	5 (25.0)	28(35.0)
Large/very large	6 (30.0)	5 (20.0)	3 (20.0)	4 (20.0)	18(22.5)
Behavior during meals					
Just eating	5 (25.0)	8 (32.0)	4 (26.7)	7 (35.0)	24(30.0)
Conversation with family members	5 (25.0)	6 (24.0)	5 (33.3)	6 (30.0)	22(27.4)
Playing games or watching TV	6 (30.0)	6 (24.0)	3 (20.0)	4 (20.0)	19(23.9)
Reading a book or others	4 (20.0)	5 (20.0)	3 (20.0)	3 (15.0)	15(18.7)
Unbalanced diet					
Yes	6 (30.0)	17 (68.0)*	5 (33.3)	15 (75.0)**	43(53.7)
No	14 (70.0)	8 (32.0)	10 (66.7)	5 (25.0)	37(46.3)
Foods that they dislike[1)]					
Grains and starches	1(5.0)[5)]	3 (12.0)	1 (6.7)	1 (5.0)	6(21.4)
Meat	2 (10.0)	3 (12.0)	2 (13.3)	2 (10.0)	9(13.2)
Fish	3 (15.0)	2 (8.0)	3 (20.0)	2 (10.0)	10(6.3)
Eggs	3 (15.0)	2 (8.0)	2 (13.3)	3 (15.0)	10(9.5)
Beans	1 (5.0)	3 (12.0)	1 (6.7)	3(15.0)	8(15.5)
Vegetables	2 (10.0)	2 (8.0)	2 (13.3)	3 (15.0)	9(10.0
Fruits	3 (15.0)	3 (12.0)	2 (13.3)	3 (15.0)	11(8.6)
Dairy products	2 (10.0)	3 (12.0)	1 (6.7)	2 (10.0)	8(6.9)
Seaweeds[2]	3 (15.0)	4 (16.0)	1(6.7)	1 (5.0)	9(8.6)

* P < 0.05, ** P < 0.01; 1) Multiple answers; 2) Shellfish, soy bean paste, greasy foods, spicy foods, etc.; 3) Mean ± SD; 4) n (%); 5) The number in parentheses is the percentage of total subjects in each group.

Table 3: The level of physical activity according to obesity status of Sedanter Individuals who are Members of Fitness Clubs

Variables	Male (n=45)		Famale (n=35)		
	Normal (n= 20)	Overweight & Obesity (n =25)	Normal (n= 15)	Overweight & Obesity (n =20)	Total (n= 80)
At least 30 minutes of physical activity per day (days/week)					
No	3(15.0)	6(24.0)[1]*	1(6.6)	8(40.0)**	18(22.5)
1-2	8(40.0)	8(32.0)	6(40.0)	6(30.0)	28(35.0)
3-4	5(25.0)	5(20.0)	4(26.8)	3 (15.0)	17(21.3)
5-6	3(15.0)	4(16.0)	3(20.0)	2 (10.0)	12(15.0)
7	1(5)	2 (8.0)	1(6.6)	1 (5.0)	5(6.2)
Walking or riding a bicycle (days/week)					
No	3(15.0)	10(40.0)*	2(13.3)	7(35.0)*	22(27.5)
1-2	8(40.0)*	4 (16.0)	7(46.8)*	5(25.0)	24(30.0)
3-4	5(25.0)	5 (20.0)	3(20.0)	4(20.0)	17(21.3)
5-6	3(15.0)	4 (16.0)	2(13.3)	3(15.0)	12(15.0)
7	1(5.0)	2(8.0)	1(6.6)	1(5.0)	5(6.2)
Time spent walking during weekdays (hours/day)					
< 30 min	4(20.0)	9(36.0)*	3(20.0)	8(40.0)**	24(30.0)
30 min ≤ < 1 hour	8(40.0)	10(40.0)	6(40.0)	6(30.0)	30(37.5)
1 hour ≤ < 2 hours	5(25.0)	4(16.0)	4(26.7)	4(20.0)	17(21.3)
2 hours ≤	3(15.0)	2(8.0)	2(13.3)	2(10.0)	9(11.2)
Time spent walking during the weekend (hours/day)					
< 30 min	3(15.0)	8(32.0)*	4(26.7)	10 (50.0)**	25(31.3)
30 min ≤ < 1 hour	9(45.0)	10(40.0)	6(40.0)	6 (30.0)	31(38.7)
1 hour ≤ < 2 hours	5(25.0)	5(20.0)	3(20.0)	3 (15.0)	16(20.0)
2 hours ≤	3(15.0)	2(8.0)	2(13.3)	1 (5.0)	8(10.0)
Sedentary activity during weekdays (hours/day)					
< 3	12(60.0)	16(64.0)**	7(46.8)	13(65.0)**	48(60.0)
3 ≤	8(40.0)	9(36.0)	8(53.2)	7(35.0)	32(40.0)
Sedentary activity during the weekend (hours/day)					
< 3	11(55.0)	18(72.0)**	7(46.8)	14(70.0)**	50(62.5)
3 ≤	9(45.0)	7 (28.0)	8(53.2)	6 (30.0)	30(37.5)
Number of days for exercise (times/ week)					
No	2(10.0)	5 (20.0)	2(13.3)	8(40.0)**	17(21.3)
1	8(40.0)	10 (40.0)	6(40.0)	7(35.0)	31(38.7)
2	6(30.0)	6 (24.0)	4(26.7)	3(15.0)	19(23.7)
3 ≤	4(20.0)	4 (16.0)	3(20.0)	2(10.0)	13(16.3)

* P < 0.05, ** P < 0.01; 1) n (%).

There was no significant difference between OW and NW groups in terms of general nutrition knowledge score, obesity knowledge score, and nutrition knowledge total score in both genders. Similarly, there was no significant difference in eating self-efficacy scores between OW and NW groups. OW groups men and women were found to have lower physical activity self-efficacy scores (P <0.01). However, no significant difference was found in physical activity self-efficacy scores of male and female NW group. OW male and female physical activity self-efficacy scores were significantly lower than NW women (P <0.01). However, the OW group was found to be significant in the total self-efficacy score (P <0.01) in women (Table 4).

Discussion

Nowadays industrialization and modern lifestyle reduce physical mobility, which in turn affects the individual in every age and brings serious health problems to the agenda. Physical inactivity, defined as the most insidious disease of our time, is a major public health problem

[34]. Research on different populations of physical activity and exercise (USA and Europe) has shown that less than 5% of adults exercise a minimum amount [35,36]. Moreover research has shown that 50% of those participating in exercise programs in the fitness centers split in the first six months [37]. This study was designed to determine the physical activity (PA), nutrition and self-efficacy levels of sedentary individuals who have long been members of fitness clubs. Sedanter Individuals Who Are Members of Fitness Clubs were found to be included in the age group 26.3 ± 6.5 Normal Weight (NW) and 28.1 ± 7.6 in the Overweight & Obesity (OW) group. The groups were significantly different according to their obesity status; OW group weight and BMI was higher

Table 4: Nutritional knowledge and self-efficacy levels according to obesity status in Sedanter Individuals who are Members of Fitness Clubs

Variables	Male (n=45)		Famale (n=35)		
	Normal (n= 20)	Overweight & Obesity (n =25)	Normal (n= 15)	Overweight & Obesity (n =20)	Total (n= 80)
Nutrition Knowledge					
General nutrition knowledge score[1)]	4.1 ± 0.6	3.6 ± 0.5	4.2 ± 0.7	3.6 ± 0.5	3.8 ± 0.6
Obesity knowledge score	3.3 ± 0.7	3.1 ± 0.6	3.2 ± 0.6	3.0 ± 0.6	3.1 ± 0.6
Nutrition knowledge total score	7.6 ± 1.3	7,7 ± 1.1	7.8 ± 1.4	7.7 ± 1.1	7.7 ±1.2
Self-efficacy					
Eating self-efficacy score	18.1 ± 2.7	18.2 ± 2.6	18.5 ±3.0	19.0 ± 3.1	18.4±2.8
Physical activity self-efficacy score	13.2 ± 2.1	11.3 ± 2.6**	13.1 ±2.3	11.2 ± 2.6**	12.2±2.4
Self-efficacy total score	32.4 ± 4.2	31.9 ± 4.1	31.8 ±4.1	30.7 ± 3.7**	31.7±4.0

Mean ± SD, ** P < 0.01

than NW group while the height length was found to be lower.

According to our research results; the frequency of breakfast with sedentary individuals who were members of Fitnis clubs OW group values were higher than NW group men and women. While the frequency of eating outside did not vary among men OW women ate more food than NW women. The average snack frequency from both sexes was significantly higher in the OW group in males and females. OW reported that about 12% of men did not eat a wide variety of foods, and 28% said that a wide variety of foods were eaten too often. Approximately 10% of OW women reported that they did not eat a wide variety of foods, and 30% reported that a wide variety of foods were eaten too often. Approximately 20% of OW men and 35% of women were fed with very irregular food, while the rate of regular eating was 28.7% in total participants. The proportion of respondents who responded as 'small' or 'very small' according to the size of the food ratio was 48% in the OW group male, 55% in the OW group women 68% of men in OW group and 75% of OW women were fed an unbalanced diet. No significant difference was observed between the participants regarding the unfavorable foods. In a study [38], it was found that the proportion of individuals with regular eating patterns in young Japanese was low. Skipping breakfast is associated with low nutritional status and the risk of cardiovascular disease. It has been reported that inadequate breakfast habits may contribute to the development and further development of obesity [29]. According to many research results; suggest that eating habits, eating disorder, unbalanced diet, and sedentary lifestyle may lead to overweight and obesity [28,40,41].

This study revealed that 24% of men in the OW group and 40% of the women in the OW group did not do any physical activity at least 30 minutes per day during the week. OW group reported that 40% of men and 35% of women walked no day or did not ride bicycles. 40% of men in NW group and 46.8% of women walked at least 1-2 days per week. During weekday OW group found that 36% of men and 40% of women and during the weekend 32% of OW group men and 50% of women were walking less than 30 minutes a day. OW and NW group men and women were on weekdays and weekend time spent during was between 30 minutes and 1 hour. The ratio of male and female OW group who had less physical activity on weekdays and weekends than three hours was higher than NW group. Approximately 40% of women in the OW group never participated in physical activity in a week. The proportion of OW women exercising more than three hours a week (10%) is lower than NW women. The rate of NW group men and OW group men exercising every other day was significantly similar. There is a consensus on whether regular and appropriate physical activity and lifelong exercise can have a great positive impact on health and well-being [42,43]. The current recommendation of the World Health Organization [44] states that adults should collect physical activity for at least 150 minutes per week for at least 10 weeks at medium intensity (or at least 75 minutes for intense intensity). In addition, it is recommended that children and adolescents have moderate physical activity for at least 60 minutes each day [44]. However, despite these recommendations and the adverse effect of inactivity, the data on study indicate that the vast majority of participants did not achieve the recommended daily and weekly physical activity levels. Physical inactivity is among the most important causes of the increase in the number of obese people. In addition, there is a close relationship between obesity and cardiovascular diseases, diabetes, osteoporosis, some types of cancer, mental problems, and many health problems in studies conducted [19,20]. Increasing physical activity has a positive effect on obesity, and therefore it is suggested that there are many studies emphasizing the effect of treatment with the preventive effect on the above mentioned diseases [21].

This study shows that; There was no significant difference between OW and NW groups in terms of

general nutrition knowledge score, obesity knowledge score, and nutrition knowledge total score in both genders. OW male and female physical activity self-efficacy scores were significantly lower than NW women. However, the OW group was found to be significant in the total self-efficacy score in women. Middelkamp et al. [7] reported that only 18% of the members of the fitness clubs continued to exercise. The effects on fitness behaviors of fitness coaches have been suggested to be terminated quickly after the end of the program, even when the coaching protocol stimulates significantly more participants to continue exercising in the same fitness clubs. This indicates that the exercise behaviors of the members of the fitness clubs are gradually declining and the exercise fit is very weak. Other studies that performed similar self-efficacy based interventions with significant results did not test the long term effects of the fitness program after the end of the program [45,46]. Contrary to our expectation, perceived confidence in eating behavior was not significantly different from obesity in was no significant difference between OW and NW groups. This was finding unlike a previous study of self-efficacy for nutritional behavior.

As a result, it was determined that regarding participants' eating habits, the OW group was less frequent breakfast and snack, ate more meals. When coınpared with the NW group, they showed less desirable behavior during the meal for men). OW men spent less time during vveekdays or weekends while doing less PA. OW woınen sat more in the vveekdays or weekends and spent less time walking or riding a bicycle than the NW group. The nutritional information of the OW and NW groups was not significantly different. Especially PA self-efficacy in OW was significantly lower than in NW group. Sedanter individuals are at risk due to lack of nutrition information, TV and peer interaction and so on. Sedanter members who are members of fitness clubs should exercise exercise programs to prevent obesity and to increase the confidence about exercise or physical activity.

Conclusions

Fitness exercise programs should focus on increasing obesity management programs, self-efficacy, changing eating habits, and increasing PA. In this context, fitness exercise programs should include adequate methods of body image, body satisfaction and weight control, and awareness should be created by conveying information to the related individuals. Conclusion: This study revealed differences betvveen PA, eating habits and self-efficacy betvveen OW and NW individuals. Sedanter individuals who are members of fitness clubs should exercise exercise programs to prevent obesity and to increase the confidence about exercise or physical activity.

Conflicts of Interest

There isn't any conflict of interest to be declared regarding the manuscript.

References

1. Miçooğulları O, Cengiz C, Aşçı H, Kirazcı S. Examinations of young adults' exercise self efficacy and decisional balance with regard to gender and exercise stage of change, *Hacettepe J. of Sport Sciences*, 2010; 21 (2): 49-59.
2. *ACSM's guidelines for exercise testing and prescription*. American College of Sports Medicine. 9th revised edition. Wil-liams & Wilkins; 2014.
3. Dishman RK, Heath GW, Lee IM. *Physical activity epidemiology*. 2nd edition. Cham-paign, USA: Human Kinetics Publishers; 2013.
4. Lavie CJ, Johannsen N, Swift D, Sénéchal M, Earnest C, Church T, Hutber A, Sallis R, Blair SN. Exercise is Medicine: The Importance of physical activity, exercise train-ing, cardiorespiratory fitness, and obesity in the prevention and treatment of type 2-diabetes US. *Endocrinology,* 2013; 9(2):95-100.
5. Ross R, Blair SN, Arena R, Church TS, Despr R JP, Franklin BA, Haskell WL, Kaminsky LA, Levine BD, Lavie CJ, Myers J, Niebauer J, Sallis R, Sawada SS, Sui X, Wisl SU. Importance of assessing cardiorespira-tory fitness in clinical practice: a case for fitness as a clini-cal vital sign. *Circulation*, 2016; 134(24): 653-699
6. Baart de la Faille M, Middelkamp J, Steenbergen J. *The state of research in the global fitness industry*. BlackBox-Publishers, Netherlands; 2012.
7. Middelkamp J, Van Rooijen M, Steenbergen B. Attend-ance behavior of ex-members in fitness clubs: A retrospective study applying the stages of change. *Perceptual and Motor Skills*, 2016; 122(1): 350-359.
8. Middelkamp J, Steenbergen B. The transtheoretical model and exercise behaviour of members in fitness clubs: systematic review. *Journal of Fitness Research*, 2015; 4: 43–54.
9. Middelkamp J, Rooijen MV, Wolfhagen P, Steenbergen B. The effects of a self-efficacy ınterventıon on exercise behavior of fitness club members in 52 weeks and long-term relationships of transtheoretical model constructs. *Journal of Sports Science and Medicine*, 2017; (16): 163-171.
10. Bandura A. *Self-efficacy: The exercise of control*. New York: Freeman; 1997.
11. Hover P, Hakkers S, Breedveld K. *Trendrapport fitness-branche 2012*. Mulier Instituut, Den Bosch & Arko Sportsme-dia, Nieuwegein; 2012.
12. Annesi JJ, Mazas J. Effects of virtual reality-enhanced exercise equipment on adherence and exercise-induced feeling states. *Perceptual and Motor Skills*, 1997; 85: 835–844.
13. DellaVigna S, Malmendier U. Paying not to go to the gym. *The American economic review*, 2006; 96: 604–719.
14. Hatfield DP, Chomitz VR, Chui KK, Sacheck JM, Economos CD. Demographic, physiologic, and psychosocial correlates of physical activity in structured exercise and sports among low-income, overweight children. *J Nutr Educ Behav*, 2015; 47:452-458.
15. Lee SY, Ha SA, Seo JS, Sohn CM, Park HR, Kim KW. Eating habits and eating behaviors by family dinner frequency in the lower-grade elementary school students. *Nutr Res Pract*, 2014; 8:679-87.
16. Brown JE, Isaacs JS, Krinke UB, Lechtenberg E, Murtaugh MA, Sharbaugh C, Splett PL, Stang J, Wooldridge NH. *Nutrition through the life cycle*. 4th ed. Belmont (CA): Wadsworth; 2011.

17.Malina RM. Adherence to physical activity from childhood to adulthood: a perspective from tracking studies". *Quest*, 2011; 53:346–355.
18.Leslie E, Fotheringham MJ, Owen N, Bauman A. Age related differences in physical activity level of young adults. *Medicine and Science in Sports and Exercise*, 2001; (33): 255–258, 2001.
19.Kimber C, Abercrombie E, Epping JN, Mordecai L, Newkirk J Jr, Ray M. Elevating physical activity as a public health priority: establishing core competencies for physical activity practitioners in public health. *Journal of Physical Activity and Health*, 2009; 6(6):677-81.
20.Kohl HW, Lee IM, Vuori IM, Wheeler FC, Bauman A, Sallis JF. Physical Activity and Public Health: the Emergence of a Sub Discipline. *Journal of Physical Activity and Health*, 2006; (3): 344– 364.
21.Ryan E. Rhodes, Ian Janssen, Shannon S.D. Bredin, Darren E.R. Warburtonc and adrian bauman. physical activity: Health impact, prevalence, correlates and interventions. *Psychology & Health*, 2017; 32(8): 942–975.
22.Nayera E. Hassan, Saneya A. Wahba, Sahar A. El-Masry, Enas R. Abd Elhamid, Samia A.W. Boseila, Nihad H. Eating Habits and Lifestyles among a Sample of Obese Working Egyptian Women, *Open Access Macedonian Journal of Medical Sciences*, 2015; 15; 3(1):12-17.
23.Keihner AJ, Meigs R, Sugerman S, Backman D, Garbolino T, Mitchell P. The power play! Campaign's school idea & resource kits improve determinants of fruit and vegetable intake and physical activity among fourth- and fifth-grade children. *J Nutr Educ Behav*, 2011; 43: S122-9.
24.Harvey A. Quantifying and comparing activity in group exercise classes: A literature review. *Journal of Fitness Research,* 2012; 1: 50–65.
25.Khan RS, Marlow C, Head A. Physiological and psychological responses to a 12-week Bodybalance training programme. *Journal of Science and Medicine in Sport,* 2008; 11:299-307.
26.Cho YG, Song HR, Kim KA, Kang JH, Song YH, Yun HJ, Kim HS. Effect of a school-based intervention for overweight children "fitness class" performed on elementary schools located in Seoul. *Korean J Obes,* 2009;18:146-57.
27.Kang JH. *Relationship between physical activity and psychological factors in obese children* [doctor's thesis]. Seoul: Korea National Sport University; 2009.
28.Seong AH, Lee SY, Kim KA, Seo JS, Sohn CM, Park HR, Kim KW. Eating habits, physical activity, nutrition knowledge, and self-efficacy by obesity status in upper-grade elementary school students. *Nutrition Research and Practice,* 2016;10(6):597-605.
29.Choi HJ, Seo JS. Nutrient intakes and obesity-related factors of obese children and the effect of nutrition education program. *Korean J Community Nutr*, 2003;8:477-84.
30.Na SY, Ko SY, Eom SH, Kim KW. Intakes and beliefs of vegetables and fruits, self-efficacy, nutrition knowledge, eating behavior of elementary school students in Kyunggi area. *Korean J Community Nutr,* 2010;15:329-41.
31.Centers for Disease Control and Prevention (US). State and Local Youth Risk Behavior Survey. Clifton road Atlanta (GA): Centers for Disease Control and Prevention; 2007.
32.Guthold R, Cowan MJ, Autenrieth CS, Kann L, Riley LM. Physical activity and sedentary behavior among schoolchildren: a 34-country comparison. *J Pediatr,* 2010;157:43-49.
33.Ko SY, Kim KW. Nutrition label use, self-efficacy, snacking and eating behavior of middle school students in Kyunggi area. *Korean J Community Nutr*, 2010;15:513-24.
34.Soyuer F, Soyuer A. Older adults and physical activity. *İnönü University Journal of Medical Faculty*, 2008; 15(3): 219-24.
35.Cavill N, Kahlmeier S, Racioppi F. Physical activity and health in Europe: Evidence for action. Copenhagen, Denmark: World Health Organization; 2006.
36.Garber CE, Blissmer B, Deschenes MR, Franklin BA, Lamonte MJ, Lee IM, Nieman DC, Swain DP. Quantity and quality of exercise for developing and maintaining cardi-orespiratory, musculoskeletal, and neuromotor fitness in appar-ently healthy adults: Guidance for prescribing exercise. *Medicine & Science in Sports & Exercise,* 2011; 43:1334-1359.
37.Berger BG, Pargman D, Weinberg RS. *Foundations of exercise psychology.* Morgantown, WV: Fitness Information Technology; 2002.
38.Sakata K, Matumura Y, Yoshimura N. Relationship between skipping breakfast and cardiovascular disease risk factors in the national nutrition survey data. *Nippon Koshu Eisei Zasshi*, 2001; 48: 837-41.
39.Ortega RM, Redondo MR, Lopez-Sobaler AM. Associations between obesity, breakfast-time food habits and intake of energy and nutrients in a group of elderly Madrid residents. *J Am Coll Nutr*, 1996; 15: 65-72.
40.Lobstein T, Baur L, Uauy R. IASO International Obesity TaskForce. Obesity in children and young people: a crisis in public health. *Obes Rev,* 2004;5 (Suppl 1):4-104.
41.Baek S. Do obese children exhibit distinguishable behaviours from normal weight children? - based on literature review. *Korean J Community Nutr*, 2008;13:386-95.
42.Blair SN. Physical inactivity: The biggest public health problem of the 21st century. *British Journal of Sports Medicine*, 2009; 43(1): 1–2.
43.Trost SG, Blair SN, Khan KM. Physical inactivity remains the greatest public health problem of the 21st century: Evidence, improved methods and solutions using the '7 investments that work' as a framework. *British Journal of Sports Medicine*, 2014; 48: 169–170. doi:10.1136/bjsports-2013-093372
44.World Health Organization (WHO). Global recommendations on physical activity for health. Geneva: Switzerland; 2010.
45.Seghers J, Van Hoecke AS, Schotte A, Opdenacker J, Boen F. The added value of a brief self-efficacy coaching on the effectiveness of a 12-week physical activity program. *Journal of Physical Activity and Health,* 2014; 11(1): 18-29.
46.Annesi JJ. Goal-setting protocol in adherence to exercise by Italian adults. *Perceptual and Motor Skills,* 2002; 94: 453-458.

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The commitment: A determinant basic mental skill in student's performance in Physical Education and Sport

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: Mental skills and motivation are key factors in learning and performance. This study aims to model their influence on performance in physical education and sport among Moroccan high school students.

Material: A sample of 202 high school students including 100 boys and 102 girls participated in this study. In order to assess mental skills, we used the Ottawa Mental Skills Assessment Tool (OMSAT-3) test and to assess different forms of motivation, we used the Sport Motivation Scale (SMS-28). To evaluate the performance in physical education and sport, we chose an individual sport that is the high jump.

Results: The multiple linear regression has as a dependent variable performance in physical education and sport and as explanatory variables mental skills and motivational forms retained only commitment.

Conclusions: The commitment, as basic mental skill, is determinant in student's performance in physical education and sport.

Keywords: mental skills, motivation, commitment, performance, physical education, sport.

Introduction

Research on the issue of motor learning and motor performance is still progressing. Currently, work in the fields of psychology and neuroscience has a significant interest in understanding learning processes and neurocognitive factors that can influence motor performance. In addition to physical and technical qualities, motor practice requires mental qualities [1]. The latter are determining in the motor performance [2]. Mental skills are a set of processes that allow us to control and direct the thoughts, feelings, or emotions that are essential for learning and performance [3]. they are classified in three families: Basic skills, psychosomatic skills, Cognitive skills. Basic skills contain goal setting, commitment, self-confidence. Psychosomatic skills manifested in: stress reactions, control of fear, relaxation, and activation. Cognitive skills contain concentration, distraction control, mental imagery, mental practice, planning [4].

Many research has shown the role of motivation in the success of all learning [5, 6]. Motivation, by definition, is "a process of action directed toward a goal" [7]. It is also "a hypothetical construct used to describe the internal and / or external forces that produce the trigger, the direction, the intensity and persistence of behaviour" [8]. According to the theory of self-determination [9], we distinguish: Intrinsic motivation, Extrinsic motivation and Amotivation. Intrinsic motivation devise to four categories: intrinsic motivation to knowledge, intrinsic motivation to achievement, motivation intrinsic to stimulation. While the extrinsic motivation devise to three categories: extrinsic motivation with identified regulation, extrinsic motivation with introjected regulation, and extrinsic motivation with external regulation.

Hypothesis: Mental skills and forms of motivation, including basic mental skills and forms of intrinsic motivation, significantly explain the variation of performance in physical education and sports.

Purpose: The objective of the current study is to model the influence of mental skills and motivation on performance in physical education and sport among Moroccan high school students.

Materials and methods

Participants: The study was carried out 2 months of year 2015 in Moroccan high school situated in Sidi Slimane province that belongs to Rabat-Salé-Kenitra region in the North West of Morocco. The studied classes were chosen randomly. We conducted our study with a sample of 202 high school students, including 100 boys (mean age = 17 ± 1.2 years) and 102 girls (mean age = 16 ± 1.3 years). They all have a good physical ability that allows them to practice sports and they represent all the academic levels of the high school and all the streams.

Measure of mental skills: To assess mental skills. We used the version 3 of the Ottawa Mental Skills Assessment Tool (OMSAT-3) with 48 Items [4]. It evaluates twelve mental skills ranked by the authors [4] as follows: Fundamental skills (goal setting, self-confidence, commitment), psychosomatic skills (stress reactions, fear control, relaxation and activation) and cognitive skills (concentration, distractions control, imagery, mental practice, competition planning). The scores of the 12 scales correspond to the means of self-evaluation of 4 affirmations, in a Likert scale of 7 choices (from totally disagree to completely agree). The test has good psychometric properties [4].

Measure of motivation: To assess student motivation

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in physical education and sport. We used the Sport Motivation Scale (SMS-28) [10]. This tool consists of 28 items divided into seven subscales to measure different forms of motivation. For each item, the student positions himself on a seven-point Likert scale according to his degree of correspondence with the different statements. For example, it surrounds the number 1 if the affirmation "does not correspond to it at all" and it surrounds the number 7 if it "corresponds to it". The scale has good psychometric properties [10].

Measure of performance in physical education and sport (PES): We chose an individual sport that is the high jump to evaluate the performance. To do this, the subjects underwent twelve learning sessions during which the student technically learns how to perform the jump. We evaluated the process (how the jump was made) and the product (the height in cm). In order to evaluate the process, we established four criteria: The run (trampling or not): 1.75 points; The call (correct or incorrect): 1.75 points; The crossing (dodge or not): 1.75 points and The fall (on the shoulders or not): 1.75 points. The product was scored on 7 points according to a scale drawn from the pedagogical guidelines of physical education and sport .

Statistical analysis

We used Pearson's correlation coefficient to assess the association between mental skills, forms of motivation and performance in physical education and sport. To model the link between performance in physical education and sport, mental skills and motivation, we used a multiple linear regression.

Results

Modelling the influence of mental skills and forms of motivation on performance in physical education and sport

Firstly, we applied correlation tests on the one hand, between mental skills and performance in physical education and sport, and on the other hand, between performance in physical education and sport and the forms of motivation, the results are presented in the tables below.

Correlational analysis showed that performance in physical education and sport as a significantly positive association with the following mental skills: goal setting, commitment, relaxation, activation, mental imagery, mental practice, and planning and with extrinsic motivation with external regulation (table1,2).

Subsequently, we applied multiple linear regression to look for a model that could possibly combine these variables. However, the multiple linear regression (stepwise method) having as dependent variable the performance in physical education and sport and as explanatory variables the mental skills and the forms of motivation retained only the commitment. In fact, the standardized coefficient of the latter, which is 0.26, was found to be statistically significant ($t = 3.89$, $p < 0.001$) whereas those of other mental skills and forms of motivation are not (Table 3).

Therefore, the model of linear regression would be:

$$P(PES) = 0.29COM + 10.71$$

The model is statistically good and expresses the data correctly ($F = 15.16$, $p < 0.001$).

Discussion

The objective of this study was to model the influence of mental skills and motivation on performance in physical education and sport among Moroccan high school students.

The results showed that the effect of commitment is dominant over that of other mental skills and motivation. Indeed, commitment is a basic mental skill related to the determination, perseverance and intensity of the work the subject devotes to accomplishing his goals [11]. The notion of school commitment refers to students' investment in school [12, 13]. It comprises three dimensions: behavioral, emotional and cognitive [14, 15]. With respect to the behavioral dimension, this is the way in which the student interacts in the school environment [16]. This dimension is expressed in three areas: disciplinary, school and extracurricular [14]. The disciplinary field concerns the attendance of the student, the school dominion concerns learning and school tasks and extracurricular field refers to the participation of the student in the activities of the school environment. As for the affective dimension of commitment, it is the feeling that the student feels in the school [14], this dimension concerns the usefulness of the subjects, it's mean, the student's feeling towards each subject [17], and the feeling of belonging to the school [18]. Concerning the cognitive dimension of commitment, two aspects can be distinguished: cognitive investment in learning and self-regulation of learning [16]. The first involves the willingness and effort that the student provides during school tasks [14], and concerns several areas such as learning goals, sense of competence and academic aspirations. The second aspect refers to the metacognitive strategies used in the organization of work [14].

Otherwise, many studies have shown, in general and not only in physical education and sports, that commitment explains success or failure in school [19, 20, 21, 22, 23]. That is, if the student has a high level of commitment, his results will be positive. On the contrary, if he shows a lower level of commitment, remaining passive in front of the school tasks, his performance will be weak and will tend to fail school. Even more serious, student disengagement from school may lead to dropping out of school [24, 25, 26]. In addition, the commitment would positively influence student performance through the mastery goal, which many studies have shown to be involved in the choice of challenging tasks, strong perseverance, the use of deep and appropriate learning strategies [27, 28, 29, 30, 31].

2 Pedagogical orientations and teaching program of the physical education and sport in the qualifying secondary cycle. 2007

Table 1. Correlational analysis between mental skills and performance in physical education and sport

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Goal setting	1												
2. Commitment	0.631**	1											
3. Self confidence	0.584**	0.530**	1										
4. Stress reactions	-0.103	-0.044	-0.095	1									
5. Control of fear	0.090	0.052	0.137	0.232**	1								
6. Relaxation	0.374**	0.382**	0.456**	-0.024	0.076	1							
7. Activation	0.458**	0.351**	0.417**	0.025	0.148*	0.565**	1						
8. Concentration	-0.013	-0.039	-0.007	0.340**	0.365**	0.006	0.017	1					
9. Distraction control	0.110	0.104	0.058	0.310**	0.325**	0.056	0.097	0.423**	1				
10. Mental imagery	0.575**	0.458**	0.596**	-0.080	0.124	0.447**	0.433**	-0.009	-0.009	1			
11. Mental pratice	0.727**	0.577**	0.567**	-0.178*	0.045	0.504**	0.507**	-0.126	0.053	0.682**	1		
12. Planning	0.675**	0.485**	0.552**	-0.197**	-0.012	0.321**	0.342**	-0.137	-0.068	0.612**	0.658**	1	
13. Performance (PES)	0.238**	0.265**	0.088	0.023	0.136	0.141*	0.209**	0.005	0.046	0.141*	0.165*	0.141*	1

**. The correlation is significant at the 0.01 level (bilateral).

*. The correlation is significant at the 0.05 level (bilateral).

Table 2. Correlational analysis between performance in physical education and sport and motivation forms.

Variables	1	2	3	4	5	6	7	8
1. P(PES)	1							
2.MIK	0.032	1						
3.MIA	0.077	0.662**	1					
4.MIS	0.106	0.445**	0.463**	1				
5.EMId	0.077	0.384**	0.357**	0.287**	1			
6.EMIn	0.026	0.421**	0.394**	0.370**	0.406**	1		
7.EMER	0.214**	0.197**	0.228**	0.222**	0.370**	0.282**	1	
8. AM	-0.084	-0.246**	-0.300**	-0.219**	-0.250**	-0.382**	-0.106	1

NOTE: **. The correlation is significant at the 0.01 level (bilateral); *. The correlation is significant at the 0.05 level (bilateral).

P(PES): Performance in Physical Education and Sport; MIK: Motivation intrinsic to knowledge; MIA: Motivation intrinsic to accomplishment; MIS: Motivation intrinsic to stimulation EMId: Extrinsic Motivation with Identified regulation; EMIn: Extrinsic Motivation with Introjected regulation; EMER: Extrinsic motivation with external regulation; AM: Amotivation

Table 3. Standardized coefficients of mental skills and forms of motivation and their Meanings

Variables	Bêta	t	Sig
MIK	-0.079	-1.070	0.286
MIA	-0.009	-0.129	0.897
MIC	0.036	0.505	0.614
EMId	-0.019	-0.261	0.795
EMIn	-0.153	-1.930	0.055
EMRE	0.137	1.883	0.061
AM	-0.009	-0.121	0.903
GS	0.118	1.342	0.181
COM	0.26	3.89	<0.001
SC	-0.074	-0.919	0.359
SR	0.035	0.507	0.613
FC	0.123	1.813	0.071
REL	0.047	0.634	0.527
ACT	0.132	1.828	0.069
CON	0.016	0.228	0.820
DC	0.018	0.268	0.789
MI	0.024	0.317	0.751
MP	0.018	0.219	0.827
POC	0.016	0.205	0.838

NOTE : MIK: Motivation intrinsic to knowledge; MIA: Motivation intrinsic to accomplishment; MIS: Motivation intrinsic to stimulation; EMId: Extrinsic motivation with identified regulation; EMIn: Extrinsic motivation with introjected regulation; EMER: Extrinsic motivation with external regulation; AM: Amotivation.GS: Goal setting; COM: Commitment; SC: Self-confidence; SR: Stress reactions; FC: Fear Control; REL: Relaxation; ACT: Activation; CON: Concentration; DC: Distraction Control; MI: Mental Imagery; MP: Mental practice; POC: Planning of competitions.

Conclusion

At the end of this study, it emerges that commitment, as basic mental skill, is determinant in student's performance in physical education and sport. For this, physical education and sports teachers need to establish a climate that encourages student engagement in its different behavioral, emotional and cognitive dimensions.

Conflict of interest

The authors declare that there is no conflict of interest.

References

1. Vallerand RJ, Losier GF. An integrative analysis of intrinsic and extrinsic motivation in sport. *Journal of Applied Sport Psychology*, 1999;11:142-169.
2. Fournier F. *Evaluation des ressources psychologiques des athlètes de haut niveau.* [Evaluation of psychological resources of high-level athletes.]. Paris: Laboratoire de Psychologie et d'Ergonomie du Sport- INSEP; 2006. (In French)
3. Smith M. Développement des aptitudes mentales pour les athlètes de haut niveau. [Mental Skills Development for High Performance Athletes]. *Science du Sport*, 1993; 13: 1-12. (In French)
4. Durand Bush N, Salmela JH, Green-Demers I. The Ottawa Mental Skills Assessment Tool (OMSAT -3). *The Sport Psychologist*, 2001; 15: 1 -19.
5. *Organisation for Economic Co-operation and Development*. *Comprendre le cerveau: naissance d'une science de l'apprentissage*. [Understanding the brain: birth of a science of learning].Centre pour la recherche et l'innovation dans l'enseignement (CERI); 2007. (In French)
6. Pintrich PR. A motivational science perspective on the role of student motivation in learning and teaching contexts. *Journal of Educational Psychology*, 2003; 95(4): 667-686.
7. Pintrich PR, Schunk H. *Motivation in education. Theory, research, and applications*. New Jersey: Merill Prentice Hall; 2002.
8. Vallerand, RJ, Thill EE. Introduction au concept de motivation [Introduction to motivation concept]. In: Vallerand RJ , Thill EE (Eds.), *Introduction à la psychologie de la motivation.* [Introduction to the psychology of motivation]. Laval: Editions études vivantes – Vigot; 1993. P. 3-39. (In French)
9. Ryan RM, Deci EL. Intrinsic and extrinsic motivations: classic definitions and new directions. *Contemporary Educational Psychology*, 2000; 25: 54-67.
10. Brière NM, Vallerand RJ, Blais MR, Pelletier LG. Développement et Validation d'une Mesure de Motivation Intrinsèque, Extrinsèque et d'Amotivation en Contexte Sportif: L'Échelle de Motivation dans les Sports (ÉMS). [Development and Validation of a Measure of Intrinsic, Extrinsic Motivation and Amotivation in Sports Context: The Scale of Motivation in Sports]. *International Journal of Sport Psychology*, 1995; 26: 465-489. (In French)
11. Orlick T. The psychology of personal excellence. *Contemporary Thought on performance Enhancement,* 1992; 1: 109-122.
12. Mahoney JL. School extracurricular activity participation as a moderator in the development of antisocial patterns. *Child development*, 2000; 71(2): 502-516.
13. McNeal RB. Are students being pulled out of high school? The effect of adolescent employment on dropping out. *Sociology of Education*, 2003; 70(3): 206-220.
14. Fredricks JA, Blumenfeld PC, Paris AH. School engagement: Potential of the concept, state of the evidence. *Review of Educational Research*, 2004; 74(1): 59-109.
15. Furlong MJ, Whipple AD, Jean GS, Simental J, Soliz A, Punthuna S. Multiple contexts of school engagement: moving toward a unifying framework for educational research and practice. *California School Psychologist*, 2003; 8: 99-113.
16. Jimerson SR, Campos E, Greif J.L. Toward an understanding of definitions and measures of school engagement and related terms. *California School Psychologist*, 2003; 8: 7-27.
17. Eccles J, Wigfield A, Harold RD, Blumenfeld P. Age and gender differences in children's self- and task perceptions during elementary school. *Child Development*, 1993; 64(3): 830-847.
18. Janosz M, LeBlanc M. Pour une vision intégrative des facteurs reliés à l'abandon scolaire. [For an integrative view of the factors related to school dropout]. *Revue canadienne de psycho-éducation*, 1996; 25(1): 61-88. (In French)
19. Connell JP, Wellborn JG. Competence, autonomy and relatedness: A motivational analysis of self-system processes. In: Gunnar MR, Sroufe LA (Éds), *Self processes in development*: *Minesota Symposium on Child Psychology*. Hillsdale NJ: Erlbaum; 1991;23: 43-77.
20. Deci EL, Hodges R, Pierson L, Tomassone J. Autonomy and competence as motivational factors in students with learning disabilities and emotional handicaps. *Journal of Learning Disabilities*, 1992; 25(7): 458-469.
21. Ryan RM, Stiller JD, Linch JB. Representations of relationships to teachers, parents, and friends as predictors of academic motivation and self-esteem. *Journal of Early Adolescence*, 1994; 14(2): 226-249.
22. Skinner EA, Belmont MJ. Motivation in the classroom: Reciprocal effect of teacher behavior and student engagement across school year. *Journal of Educational Psychology*, 1993; 85(4): 571-581.
23. Valas H, Sovik N. Variables affecting student's intrinsic motivation for school mathematics: Two empirical studies based on Deci and Ryan's theory on motivation. *Learning and Instruction*, 1994; 3:281-298.
24. Finn JD. Withdrawing from school. *Review of Educational Research*, 1989; 59(2): 117-142.
25. Finn JD, Rock DA. Academic success among students at risk for school failure. *Journal of Applied Psychology*, 1997; 82(2): 221-234.
26. Rumberger RW, Ghatak R, Poulous G, Ritter PL, Dornbush SM. Family influence on dropout behavior in one California high school. *Sociology of Education*, 1990; 63: 283-299.
27. Bouffard T, Boisvert J, Vezeau C, Larouche C. The impact of goal orientation on self regulation and performance among college students. British. *Journal of Educational Psychology*, 1995; 65: 317-329.
28. Dweck CS. *Self-Theories and Goals: Their Role in Motivation, Personality, and Development*. Philadelphia: Taylor & Francis; 1999.
29. Riveiro JMS, Cabanach RG, Arias AV. Multiple-goal pursuit and its relation to cognitive, self-regulatory, and motivational strategies. *British Journal of Educational Psychology*, 2001; 71 (4): 561-573.
30. Smith M, Duda J, Allen J, Hall H. Contemporary measures of approach and avoi dance goal orientations: Similarities and differences. *British Journal of Educational Psychology,* 2002; 72(2): 155-190.
31. Harackiewicz JM, Barron KE, Pintrich PR, Elliot AJ, Thrash TM. Revision of achievement goal theory: Necessary and illuminating. *Journal of Educational Psychology*, 2002; 94(3): 638-645.

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Gender differences of basketball players aged 12-13 years according to the response to a moving object

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Abstract

Purpose: The study aims at the determining gender differences of basketball players aged 12-13 years in response to an object in motion that determines the predominance of excitation and inhibition processes.

Material: The participants of the study are 58 basketball players aged 12-13 years, 35 are male basketball players and 23 are female. Male basketball players had 4-5-year training experience, female had 1,5-2-year experience. All athletes had normal visual acuity and were healthy at the time of the study. Young basketball players were informed about the purpose of the study. The computer program containing visual stimuli, moving with acceleration from different points of the monitor was used for testing.

Results: The deviations from the target data as well the pole were taken into consideration. It demonstrated the predominance of excitation and inhibition processes of basketball players of different sexes. The response accuracy to visual stimuli without taking into account the pole during perception with the left eye and the right eye is shown.

Conclusions: It was found out that the females' response accuracy during monocular perception is more closely related to the response accuracy during binocular imaging, whereas the role of the males' leading eye is increased during perception of objects from a convenient side. This may indicate the peculiar reactions under the conditions of double perception of objects in solving complex spatial problems.

Keywords: spatial, response, accuracy, binocular, monocular, perception, excitation, inhibition.

Introduction

Reactions to a moving object refer to sensomotor functions of a person, which are measured by the accuracy of space-timemotion characteristics [1]. Such characteristics in sports activities affect the motor abilities of athletes [2] as well as their cognitive abilities. Therefore, the use of the reaction to a moving object in sports is a widespread scientific practice. Performing the corresponding motion on a specific signal (visible spatial combination of two or more objects in motion) [1] testifies to the effectiveness of motor activity of athletes [3].

The response accuracy indicators point to the individual differences in the sensomotor response accuracy, as well as the predominance of excitation and inhibition processes [4]. The reaction to a moving object testing (RMO) can be carried out using various modern techniques. The most popular computer programs are the following: "Diagnostician-1" [4], "Multipsychometer-05" [5] and "The Pointer Indicator" [2], which include or are the tests of the RMO determination. These techniques provide the direct or circle movement of the object to the mark in one direction with a given speed, and the indicator is the response time and the response accuracy [1].

"The Sniper" [6] technique differs from the abovementioned. The object moves from different starting positions on the screen and accelerates, approaching the mark. In this test, the response accuracy from the center of the mark is measured in millimetres. Despite the fact that the forms of the test, the number of presentations, stimuli parameters and the criteria of the reaction evaluating are different, they have the same principle of action - the response accuracy to a specific signal. Such a wide range of the RMO test programs indicates the modern technological capabilities of scientific search for precise diagnostics of sensomotor reactions of athletes. These techniques allowed carrying out a number of studies, the results of which demonstrate a scientific interest in the problem.

The areas of the research were the following: the response to a moving object in the complex study of psychophysiological functions of athletes of all ages [4], elite athlete [5], qualifications [7], and sexes [8], high class athletes [9]; the use of response to a moving object for sports specialization [10], the Impact of a sports vision training program [11], for technical and tactical training [12]; development of the testing technique and assessment of the sensomotor response accuracy [13].

The response to a moving object is an important criterion for assessment of the athletes' activity of games-based sports [14]. In games-based sports, a stable accuracy of the reaction to the position change, direction and speed of objects are required from an athlete in various situations.

The probability of error in responding to a moving object can lead to a technical fail of players [2, 3].

The response accuracy to a moving object in the complex of neurodynamic functions characterizes the individual and typological characteristics of athletes [7].

The sensomotor reactivity features, along with

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other psycho-physiological functions, are the effective basis of the sports activity of the games-based sports representatives [15, 16]. Nowadays, the study on the athletes' response accuracy considering the binocular and monocular perception has not been presented yet. Space-time information on approaching of an object is important for coordinating the components of the musculoskeletal system of athletes [17], which affects the accuracy and speed of their response [18].

The reaction to a moving object is used as one of the criteria for the nervous processes balance [1].

However, the predominance of excitation and inhibition processes data essential for young basketball players of both sexes in the account of binocular and monocular perception was not found out.

Purpose: The study aims at the determining gender differences of basketball players aged 12-13 in response to an object in motion that determines the predominance of excitation and inhibition processes.

Materials & methods

Participants

The participants of the study are 58 basketball players aged 12-13 years, 35 are male basketball players and 23 are female. Male basketball players had 4-5-year training experience, female had 1,5-2-year experience. All athletes had normal visual acuity and were healthy at the time of the study. The study protocol was approved by the Ethical Committee of University. In addition, the children and their parents or legal guardians were fully informed about all the features of the study, and a signed informed-consent document was obtained from all the parents.

Instruments

The reaction to a moving object testing was carried out using the computer program "Sniper" [6]. In the center of the screen there is a circle (a target) and several similar targets around its periphery (tools). The background of the screen is white, which is neither distracting nor distracting. Fixed stimulus (central circle) is red in order to attract attention as a target. Moving stimuli (peripheral circles) are green and potentially safe during the multiple perceptions. The diameter of the target and the tool, the motion speed and the tool acceleration can be regulated, depending on age, gender, qualifications or specialization. The informative parameters for the games-based sports athletes aged 12-16 were determined experimentally: the diameter of the target and the tool – 10 mm, the tool speed - 200 mm / s, acceleration to 100 mm /s, the number of moving stimuli – 30.

The function based on the number of accurate responses to the peripheral circles moving right and left on the monitor is also included.

Procedure

Testing of the participants was carried out in a day off from training. The participant settled comfortably in front of the computer, so that he could clearly see the monitor.

After pressing the start key, one of the peripheral circles (the tool) began to move to the central circle (the target) randomly. The participant must press the key at the moment of the possible coincidence of the central and peripheral circles centres.

The release of the key determined the beginning of the movement of the next peripheral circle. Pressing the key during the response was performed by a dominant hand. A non-dominant hand was holding a blind that covered one eye during monocular perception. The participant's right and left eye binocular and monocular perception was tested. After completing the presentation of 30 movable stimuli of each type of perception the testing was stopped and indicators were displayed.

Analysis of sensomotor response data

During the testing of each participant, the distance between centers of peripheral and central circles was recorded in millimeters [19]. The average distance and median were calculated automatically. The similar indicators were determined for the right and the left sides of the peripheral circle movement during the perception of stimuli with both eyes as well as with the left and the right eye separately.

The distance specified may be negative in reactions to the center of the central circle and positive while passing it. The relevance between the nervous processes in condition of their unbalance was performed considering the relative frequency of exact responses. The negative median over 10 mm indicates the predominance of excitation processes. The positive median of more than 10 mm indicates the predominance of inhibition processes. The median up to 1 cm, regardless of the pole, described the relatively balanced nervous system.

Statistical Analysis.

The results of the research were processed using the traditional mathematical statistics program Excel. The arithmetic average and standard deviation of the average values of the distance between centers of stimuli without taking into account the pole were calculated for each group of participants. The median was calculated considering the deviation pole. Differences in the groups of participants indicators were considered to be correct at the point value $P < 0,05$.

Results

The reaction of young basketball players of different sexes to a moving object during binocular perception was studied (Table 1).

According to the indicators of reaction to objects moving from the left zone, male basketball players showed a predominance of excitation processes (Me = -1,69 cm). General indicators and indicators of reaction to objects moving from the right zone indicated the balance of the nervous system of male basketball players (Me = -0,80 cm; Me = -0,58 cm). The indicators of reaction to objects moving from the right zone of female basketball players demonstrated the inhibition processes predominance (Me = 2,01 cm). General indicators and indicators of reaction to objects moving from the left zone indicated the balance of the nervous system of females (Me = 0,81 cm; Me = 0,57 cm). In this case, the response accuracy of young basketball players of different sexes during binocular

Table 1. Reaction indicators of basketball players aged 12-13 years to a moving object during binocular perception.

Indicators	Male (n=35)		Female (n=23)	
	Me	$\overline{X}$ ±S	*Me*	$\overline{X}$ ±S
General average distance of moving objects perception, cm	-0,80	2,00±0,28	0,81	1,84±0,36
General average distance of objects perception, moving from the left zone, cm	-1,69	3,05±0,47	0,57	2,75±0,54
General average distance of objects perception, moving from the right zone, cm	-0,58	2,43±0,31	2,01	2,87±0,39

perception of moving objects was almost identical (P>0,05).

The reaction of the young basketball players of different sexes to a moving object during the left eye monocular perception (Table 2) was studied.

According to the indicators of the reaction to objects moving from the right zone, the results of male basketball players showed a predominance of excitation processes (Me = -1,13 cm). Considering the indicators of the reaction to objects moving from the left zone as well as general indicators, the nervous system of male basketball players may be characterized as balanced (Me = -0,67 cm; Me = 0,03 cm). According to general indicators and indicators of the reaction to objects moving from the left zone, the processes of inhibition (Me = 1,37 cm, Me = 1,66 cm) predominated among female basketball players. During the females' perception of objects moving from the right zone, the balance of nervous processes was detected (Me = 0,60 cm). The response accuracy of male basketball players during the left eye perception was higher than that of the females according to the general indicators of motion of objects from different monitor zones by 0,86 cm (P <0,05). The response accuracy during the perception of objects moving from the right and left zones was compared. The male basketball players showed higher response accuracy than female during the perception of objects moving from the left zone by 1,05 cm (P <0,05).

When perceiving objects moving from the right zone, the indicators of the response accuracy of the males and females were on the same level (P> 0,05).

The reaction of the young basketball players of different sexes to a moving object during the right eye monocular perception (Table 3) was studied.

According to the general indicators and indicators of the reaction to objects moving from the right zone, male basketball players demonstrated the balance of the nervous processes (Me = -0,17 cm; Me = 0,40 cm). According to the indicators of the reaction to objects moving from the left zone, the inhibition processes prevailed (Me = -1,08 cm). According to general indicators and indicators of the females' reaction to objects moving from the right zone,

Table 2. Indicators of the reaction to a moving object of basketball players aged 12-13 aged during monocular perception (the left eye).

Indicators	Male (n=35)		Female (n=23)	
	Me	$\overline{X}$ ±S	*Me*	$\overline{X}$ ±S
General average distance of moving objects perception, cm.	-0,67	1,35±0,21*	1,37	2,21±0,43
General average distance of objects perception, moving from the left zone, cm.	0,03	1,81±0,28*	1,66	2,86±0,47
General average distance of objects perception, moving from the right zone, cm.	-1,13	2,20±0,33	0,60	2,46±0,52

Note: *P <0,05 – in comparison with female basketball players

Table 3. Indicators of the reaction to a moving object of basketball players aged 12-13 years during the monocular perception (the right eye).

Indicators	Male (n=35)		Female (n=23)	
	Me	$\overline{X}$ ±S	*Me*	$\overline{X}$ ±S
General average distance of moving objects perception, cm.	-0,17	1,63±0,29*	1,23	2,36±0,30
General average distance of objects perception, moving from the left zone, cm.	-1,08	2,18±0,29	0,12	2,89±0,49
General average distance of objects perception, moving from the right zone, cm.	0,40	2,31±0,58*	3,53	3,88±0,47

Note: *P <0,05 – in comparison with female basketball players

the inhibition processes prevailed (Me = 1,23 cm; Me = 3,53 cm). During the perception of objects moving from the left zone, the relative balance of the females' nervous processes was detected (Me = 0,12 cm).

The male basketball players showed higher response accuracy than the female during the left eye perception of objects moving from different zones by 0,73 cm (P <0,05).

The response accuracy during the perception of objects moving from the right and left zones was compared. The male basketball players showed higher response accuracy than the female during the perception of objects moving from right zone, by 3,13 cm (P <0,05). During the perception of objects moving from the left zone, the male response accuracy is higher than female by 0,96 cm (P> 0,05).

Discussion

The main task of our research is to determine the gender differences of sensomotor reaction to visual moving stimuli as a component of the technical and tactical readiness of basketball players of different sexes. The study of the response to an object in motion considering gender features contains controversial data.

The obtained sensomotor response rates indicate the dominance of both female [20] and male basketball players [21, 22]. These data indicate the dependence of the response accuracyon the age, sex and sport experience. We also have data on the age-related sensomotor response of young athletes [23], but they do not indicate gender specifics. In our research the innovative testing method of the response to a moving object "Sniper" was applied [6]. It has been developed taking into account the features of team sport games, which consist of the response peculiarities to objects moving from different directions and with acceleration in the process of competitive activities. The principle of methodology operation used in the research is based on a visible combination of two objects. This is a peculiar feature of the programs of this kind [1]. However, unlike other techniques, the "Sniper" program [19] defines an indicator of timely response as an exact coincidence of the target and the moving object. The degree of deviation from the mark and the direction of the reaction are considered.

The response speed is determined by most of the RMO techniques, but the authors underline the importance of the response accuracy as a criterion for a complex sensomotor reaction of athletes [10, 13], which may point to individual differences [1]. The necessity of sensomotor reactivity evaluation of the athletes aged 12-13 is confirmed by N. Makarenko et al. [4]. According to these data, there is an increase in the attention concentration of the athletes aged 12, which depends on the speed of perception and processing of information. The authors believe that "under the influence of physical activity, the nervous control of the reliability of sensomotor reactions increases"[4]. It characterizes the training of the sensomotor system [20]. It should be noted that the sports training of young basketball players aged 12-13 is a stage in the formation of tactical readiness, the basis of which is the interaction with a number of moving objects [23]. According to the sensomotor response accuracy, the degree of difficulty of the athlete's tasks can be determined [24] and the effectiveness of motor actions can be anticipated [25].

Problems solving based on the athlete's motor activity is closely related to the motor response to incentives as well as recognition of their qualities [25]. One of such qualities is a color. In the innovative technique "Sniper", the stimulus (moving element) is red. It operates at a minimum frequency perceived by the human eye and is one of the three "main" colors in the RGB system [26], it attracts attention quickly, stimulates the retina and brings a clear retinal image [27]. The immovable mark color is defined as green. It has been defined as a tranquilize color, an additional color in the RGB system [26]. The choice of such a combination of colors is based on the principles of the relationship between colored energies. Red stimulates excitation and acts as an irritant, and green suppresses irritation [26]. The colors combination is considered to be a strong contrast between energy and tranquility [27], which, in our opinion, will not significantly affect the emotional state of athletes, minimizing the monotony of testing and guaranteeing the high results accuracy. The human sensory input peculiarities can restrict the pass-through function and power of information processing [17]. In sports, the timeliness of actions depends on the speed of information processing and spatial perception is essential [18].

The object motion prediction, especially under the condition of acceleration depends on the spatial estimation accuracy [28]. Each sport is characterized by the perception specificity expressed by the specific forms of the visual analyzer functions [29]. It depends on the eyes position that serves as a spatial index for the visual image [12].

Basketball players use binocular localization of the main objects during perception of game situations [30]. However, athletes' visual analyzers perceive other objects that move from the right and left sides of the player beyond the main focus [11]. In this case, the response accuracy to the spatial deviations of the objects will depend on the leading eye and the stability of the visual asymmetry [31].

It is known that focusing on several moving objects leads to a decrease in the concentration of attention that affects the perception and the subsequent sensomotor response [23, 32].

At the same time, it has been proved that there are two subsystems that take part in the perception of two moving objects, which contributes to the greater effectiveness of information processing [33]. The asymmetry of sensor systems is a children's characteristic feature [34], but under the influence of sports training, these features can acquire signs of symmetry, as there is adaptation to the certain type of mechanisms of spatial localization [29].

The results of our research also demonstrated symmetry of various types of spatial vision of basketball players aged 12-13 (the left and the right eye).

It means that during the 4-5 year-period of basketball

playing, the role of the leading eye during the accented monocular perception of moving objects becomes less expressive due to the plastic nature and the lability of the interaction of monocular systems [29]. However, regardless of the environment perception with both eyes, the activity of basketball players is affected by sensory asymmetry. It is formed at an early age and lasts for a lifetime [35]. Studies have shown that the role of the leading eye of basketball players aged 12-13 was intensified in the process of changing of the visual analyzer to objects moving from different directions. The male basketball players had better perception of moving objects from the left zone (with both the right and the left eye), compared to binocular vision.

The female basketball players' right sensory input was less powerful during the perception of moving objects from the right zone, compared to the binocular and monocular (the left eye) perception. The response accuracy based on the visual asymmetry can characterize the effectiveness of the athlete's actions [24]. That is, the male basketball players while focusing on the main object with both eyes during the active movement of other objects from the left zone can increase the effectiveness of tactical thinking. The effectiveness of tactical thinking of the female basketball players at the moment of focusing on the main object with both eyes and active movement of other objects from the right zone may decrease.

Sensory asymmetry is the basis of tactical thinking [35], the main period of its formation is between the ages of 12 and 16 [16].

This emphasizes the importance of taking into account visual asymmetry as a criterion of neurodynamic peculiarity in the process of multi-year training of young athletes [35]. In our study gender differences in the spatial response accuracy were detected: during monocular perception of moving objects with the left eye from the left and with the right eye from the right. This response is related to the field of peripheral vision horizontally. The peripheral detection of the moving object is more accurate, compared to the detection of the shape, which depends on the characteristics of the visual analyzer [36].

It should be noted that the training experience expands the athletes' field of vision significantly. It contributes to a more accurate perception of the object and increases the speed of information processing [37]. With regard to gender differences, the females' peripheral vision is significantly better than males' [38]. Gender differences of female basketball players aged 12-13 years consists in the wider field of vision[36]. Our study shows, that male basketball players advantages of female basketball players are stipulated by their extensive basketball playing experience (4-5 years vs 1,5-2 years), which greatly affects the field of vision [39].

Probably, female basketball players' results were influenced not only by the speed of information processing, but also by the reduced ability to predict the space-time feature of the target trajectory of a moving object [23].

However, the improvement of the sensory motor response during long training process is common for both female and male basketball players [20, 22]. The vast majority of studies on a moving object response are represented by the time characteristics of the sensomotor reaction [1, 2], while in our research spatial parameters are being analyzed. The reaction to a moving object is a complex sensomotor skill, which is formed not only due to estimation of the motion speed [13], but also due to spatial accuracy [2]. During visual stimuli response, the athlete performs spatial tasks and demonstrates specific abilities in visual space-time orientation that contributes to successful sports specialization [3, 16]. Therefore, regardless of the characteristics of the visual-motor function, it is possible to compare the reaction characteristics according to the exact parameters. The sensomotor functions formation of children especially their spatial and temporal characteristics are significantly affected by the peculiarities of the main nervous processes. Their role in the formation of complex sensomotor functions of children aged 12-13 is weakened [38]. However, the complexity of the visual-motor tasks during the training of young athletes affects the speed of perception and processing of information positively [4]. The authors did not analyze non-athletes' results aged 12-13, since there is a comparison of trained and untrained people results that points to the advantage of the sensory-motor response speed of people with sporting experience and their better efficiency in the use of visual information [21, 37]. In addition, there is information on the positive effects of long-term physical activity on solving complex problems for the development of sensomotor and cognitive functions of athletes [37].

It is also important to understand that the achievement of a high level of space-time characteristics of sensory functions during the laying of technical and tactical readiness foundation (ages of 11 and 16) will affect the quality of the skills implementation in the future [30].

Moreover, the qualified athletes of the game-based sports are characterized by short latent periods of complex visual motor reactions [1, 7] and high response accuracy to a moving object [2, 15]. It refers especially to highly skilled attacking players and affects the result of the game [7]. Analyzing the sensomotor reaction data it is important to take into account the magnitude of the mark deviation. Such a necessity is considered to be significant for the team sports selection [2, 3] as well as for the purposeful formation of athletes' significant professional skills [29].

But the deviation rate also determines the degree of the visual analyzer formation [1]. During binocular perception, the visual analyzers are characterized as mature enough to respond effectively to stimuli in a sporting activity. However, gender differences during binocular perception response were not detected.

The results of our research cannot be compared to other studies, because there haven't been any studies concerning athletes aged 12-13 years.

According to Yongtawee & Woo, the visual and spatial abilities of boys and girls aged 15-16 years did not differ in stimuli response [20]. Studies concerning the adults showed higher rates of male process information ability

to visual stimuli [8]. But during the objects recognition under the condition of barrier perception the response accuracy demonstrated by females was higher [39]. The visual input laterality, as a separate component of the psychological organization of a person [34], determines the peculiarities of the bioelectric activity transformation of the cerebral cortex under the influence of the sport activity [31].

It emphasizes the importance of studying the sensomotor characteristics during monocular perception. Our studies showed the male response accuracy prevalence over female in terms of deviation from the mark during monocular perception: perception of objects moving from the left zone with the left eye and perception of objects moving from the right zone with the right. We believe that this phenomenon can be explained by the cognitive differences in the analysis of the perception of females and males [39]. Solving complex spatial problems, males receive data through the sensor input. Female perception depends on the previous knowledge used to interpret the data [39], so they show their cognitive function better [8]. However, the time characteristics of sensomotor response accuracy of males are higher [8]. At the same time, males have an advantage over females in solving spatial problems, although females are better at handling varied tasks verbally [40]. Females' indicators during monocular perception may also be influenced by the switching attention variability (it's higher than males) [41], which reduces the effectiveness of the perception of moving objects. The stability of the motor reaction is one of the criteria of the nervous processes balance [1].

According to the indicators of the deviation direction of responses of young basketball players aged 12-13 gender features were revealed. Males' response demonstrated the nerve processes balance peculiarities, which, when perceiving the object from an inconvenient visibility distance, transformed into excitement. Females' nerve processes balance during binocular perception transformed to the predominance of inhibition processes during the perception of objects from a convenient visibility distance. In the studies by Khalfina et al. concerning tennis players aged 7-8 years the gender differences were also revealed. However, the data obtained are opposite: the excitation processes dominated among females, and the processes of inhibition prevailed among males [42]. This confirms the importance of taking into account the age of athletes, which depends significantly on the rate of excitability and inhibitory processes [1].

The influence of specialization on the nervous processes peculiarities should not be ignored [25, 29]. Predominance of excitation processes is peculiar for the adult games-based sport athletes [10], especially extroverts [9]. Although skilled basketball players have excitation and inhibition processes balance [43].

Conclusion

No gender differences of basketball players aged 12-13 in the spatial response accuracy to a moving object during binocular perception, regardless of the direction of objects movement were determined, that indicates the visual analyzer maturity to visual stimuli respond during sports activities. Compared to male basketball players aged 12-13, females' response accuracy during monocular perception is more closely related to the response accuracy during binocular visualization. However, the role of the leading eye of young male basketball players increased during the perception from a convenient side. This may indicate the specific reaction during double perception of objects in solving complex spatial problems. It is assumed to use the reaction to a moving object data to obtain the spatial characteristics accuracy of the games-based sport athletes of all ages and sex, taking into account the latent period of the visual motor reaction. The effect of excitation and inhibition processes on the functional state of athletes, depending on the nature of the sport activity and the direction of the training process, taking into account the functional asymmetry is also of great importance.

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Conflict of interests

The authors declare that there is no conflict of interests.

References

1. Makarenko NV, Lizogub VS. Motor reaction steadyness as one of the criteria of the nervous processes balance. *Actual problem of transport medicine.* 2015; 4 (42-I):93-97. (in Russian)
2. Polevshchikov MM, Rozhentsov VV. Accuracy of motor reactions as a criterion for games-based sports selection. *Lesgaft University Academic notes*. 2013; 6 (100):103-108. doi:10.5930/issn.1994-4683.2013.06.100 (in Russian)
3. Polevshchikov MM, Palagina NI, Rozhentsov VV. Response to moving object as a qualification criterion for team sports. *Theory and practice of physical culture*. 2015*;* 10:23.
4. Makarenko MV, Ivaniura IO, Sheiko VI. Research of psychophysiological functions of pupils of middle school age during prolonged physical activity. *Physiological journal*. 2002; 48 (5):56-61. (in Ukrainian)
5. Korobeinykov GV, Korobeinykova LG, Rynok TM, Myshchenko VS. Stareiushchye osobennosty stressoustoichyvosty u эlytnыkh sportsmenov. *Visnyk Cherkaskoho universytetu. Seriia: Biolohichni nauky*. 2015; 2:128-133. (in Ukrainian)
6. Petrenko YO, Kovalenko SO, Frolova LS, Liubchenko KM, Tymofeev AA, Atamas O. *A method of determining excitation and inhibition of the central nervous system.* Ukraine patent 118142. 2017 Aug 1. (in Ukrainian)
7. Lizogub V, Suprunovych V, Pustovalov V, Hrechukha S. Neurodynamic functions of basketball players in different playing roles. *Sports Bulletin of the Prydniprovya*. 2016; 2:81-84. (in Ukrainian)
8. Korobeinikova LG. The manifestation of neurodynamic functions features of elite combat athletes of different sexes. *Bulletin of the Taras Shevchenko National University of Kyiv.* 2014; 3 (68):18-21. (in Ukrainian)
9. Fedorchuk S, Lysenko E. The nature of the response of highly qualified athletes to the moving object under the conditions of psycho-emotional stress. *Sports Science of Ukraine.* 2017; 3(79):47-54. (in Ukrainian)
10. Kovtun AO. Use of computer psychophysiological researches in the study of influence of sports specialization on the level of students' sensomotor reactions. *Scientific and methodological bases of information technologies usage in the field of physical culture and sports*. 2017; 1:53-57. (in Ukrainian)
11. Schwab S, Memmert D. The Impact of a Sports Vision Training Program in the Youth Field Hockey Players. *Journal of Sports Science & Medicine,* 2012; 11 (4):624-631.
12. De Freitas J, Myers NE, Nobre AC. Tracking the changing feature of a moving object. *Journal of Vision*. 2016; 16 (3): 22:1-20. doi:10.1167/16.3.22
13. Familnikova NV, Polevshchikov MM, Rozhentsov VV. Reaction accuracy estimation of a person to a moving object. *Modern science-based technologies.* 2016; 2 (1):176-179. (in Russian)
14. Petrova TG, Khasanova NN, Grechishkina SS, Agirov AA. Analysis of the Influence of Sports Classes in the Section on the Functional State of the Nervous System of Students. *Theory and practice of physical culture*.2014; 11:12-16.
15. Vovkanych L, Dunets-Lesko A, Penchuk A, Kachmar P. Features of sensomotor reactions of athletes of various sports specializations. *Physical activity, health and sports,* 2015; 2 (20):17-26. (in Ukrainian)
16. Frolova L, Glazyrin I, Navaretsky D. Anatomic, functional and psychophysiological criteria of primary and basic sports selection in women's handball. *Physical Education, Sports and Health Culture in Modern Society,* 2008; 3:345-349. (in Ukrainian)
17. Carrasco M. Visual attention: The past 25 years. *Vision Research*. 2011; 51:1484-1525. doi:10.1016/j.visres.2011.04.012
18. Williams AM, Davids K, Williams JG. *Visual Perception and Action in Sport.* London: New Fetter Lane; 2000.
19. Petrenko YO, Frolova LS. Information Technologies in the Human Nervous System Study. *Scientific and methodological foundations of the use of information technologies in the field of physical culture and sports,* 2017; 1:82-85. (in Ukrainian)
20. Yongtawee A, Woo M.-J. The Influence of Gender, Sports, and Training Experience on Cognitive Functions in Adolescent Athletes. *Exercise Science*. 2017; 26 (2):159-167. doi:10.15857/sex.2017.26.2.159
21. Balasubraman M, Sivapala K, Nishanthi V, Kinthusa S, Dilani M. Effect of Dual-Tasking in Visual and Auditory Simple Reaction Times. *Indian J Physiol Pharmacol.* 2015*;* 59 (2):194-198.
22. Notarnicola A, Maccagnano G, Pesce V, Tafuri S, Novielli G, Biagi M. Visual-spatial capacity: gender and sport differences in young volleyball and tennis athletes and non-athletes. *BMC Research Notes*. 2014; 7:57. doi:10.1186/1756-0500-7-57
23. Rothenberg-Cunningham A, Newell KM. Children's age-related speed-accuracy strategies in intercepting moving targets in two dimensions. *Res Q Exerc Sport.*2013; 84 (1):79-87.
24. Mishchenko VS, Korobeinikova LG, Korobeynikov GV. Psychophysiological state of highly skilled athletes with different levels of neurodynamic functions. *The Bulletin of Cherkasy National University*. 2017; 2: 45-53. (in Ukrainian)
25. Gurov MB, Kapilevich LV. Perception of movements features of athletes depending on the orientation of the training process. *Bulletin of Siberian Medicine,* 2013; 12 (2): 195-199. (in Russian)
26. Andrushko LM, Yasinsky VP. Influence of red on human psychosomatics. *Scientific bulletin of Lviv State University of Internal Affairs,* 2014; 1:212-223. (in Ukrainian)
27. Dontsova AY, Verbytska TV. Color perception peculiarities. *Scientific notes of the Central Ukrainian National Technical University,* 2010; 10 (2):165-167. (in Ukrainian)
28. Bennett SJ, Bengui N. Is Acceleration Used for Ocular Pursuit and Spatial Estimation during Prediction Motion? *PLoS ONE*. 2013; 8 (5): e63382. doi:10.1371/journal.pone.0063382
29. Matova MA. Asymmetry and symmetry formation of visual perception in the process of human activity. *Questions of psychology,* 1980; 1:64-72. (in Russian)
30. Grushko AI, Bochaver KA, Kvitchasty AV, Kovalov AV, Kabanov DY, Konstantinova MV, Kasatkin VN. Motor reaction time diagnostics in various sports. *Sports psychologist,* 2016; 1 (40):82-87. (in Russian)
31. Fomina EV. Influence of the dominant side of the visual touch input on the dynamic rearrangements of cerebral interhemispheric asymmetry of the EEG spectral power. *Omsk Scientific Bulletin*, 2006; 1 (34):231-235. (in Russian)
32. Holcombe AO, Chen W.-Y. Exhausting Attentional Tracking Resources with a single fast-moving object. *Cognition,* 2012; 123(2):218-228. doi:10.1016/j.cognition.2011.10.003
33. Oksama L, Hyönä J. Position tracking and identity tracking are separate systems: Evidence from eye movements. *Cognition,* 2016; 146:393-409.
34. Galyuk NA. The phenomenon of asymmetry of a person's visual perception. *Bulletin of the Tomsk State Pedagogical University,* 2006; 2 (53):5-9. (in Russian)
35. Shynkaruk O, Ulan A. Modern views on the manifestation

of the left-handed in sport. *Physical Education, Sports and Health in the Modern Society,* 2016; 3 (35):117-122. (in Ukrainian)
36. Vater C, Kredel R, Hossner E.-J. Detecting single-target changes in multiple object tracking: The case of peripheral vision. *Atten Percept Psychophys,* 2016; 78: 1004-1019. doi:10.3758/s13414-016-1078-7
37. Moreno FJ, Luis V, Salgado F, Garcia AA, Reina R. Visual behavior and perception of trajectories of moving objects with visual occlusion. *Percept Mot Skills,* 2005; 101 (1):13-20. doi:10.2466/pms.101.1.13-20
38. Tkhorevskii VI. *Physiology of a person.* Moscow: Physical education, education and science; 2001. (in Russian)
39. McGivern RF, Adams B, Handa RJ, Pineda JA. Men and Women Exhibit a Differential Bias for Processing Movement versus Objects. *PLoS ONE,* 2012; 7 (3): e32238. doi:10.1371/journal.pone.0032238
40. Li R. Why do women see differently from the way men see it? A review of gender differences in cognition and sports. *Journal of Sport and Health Science,* 2014; 3:155-162. doi:10.1016/j.jshs.2014.03.012
41. Solianik R, Brazaitis M, Skurvydas A. Sex-related differences in attention and memory. *Medicine,* 2016; 52 (6): 372-377. doi:10.1016/j.medici.2016.11.007
42. Khalfina RR, Galimova AS, Danilov AV. Gender peculiarities of psycho-physiological state of young tennis players'. *Bulletin of the Kemerovo State University,* 2014; 1 (57): 18-20. (in Russian)
43. Minhalov OG, Drehval IV. Analysis of the functional state of sensomotor reactions and major nervous processes of athletes playing sports. *Bulletin of Biological and Medical Problems,* 2017; 4-2 (140):268-270. (in Ukrainian)

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Comparative analysis of hematological parameters in well-trained athletes and untrained men

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Abstract

Purpose: The purpose of current study was to investigate the hematology parameters of male athletes who had exercised regularly for five years and sedentary male university students.

Material: The sample consisted of 18 well-trained and 18 sedentary male university students aged between 20 and 22 years old. The peripheral fasting blood samples were collected from each participant. Laboratory analysis was made to determine the red and white blood cells counts and their concentration percentage.

Results: The means of white blood cell, lymphocyte, monocyte counts, and lymphocyte and monocyte percentages were significantly lower in the well-trained group while the means of hemoglobin count, mean cell hemoglobin, red blood cell distribution width were significantly lower in sedentary group ($p > .05$). However, no statistically significant difference between groups was found in red blood cell counts, granulocyte counts, and granulocyte percentages ($p > .05$).

Conclusions: Our findings show that athletes participating in the long-term regular exercise have the high level of the concentration of red blood cells subtypes and the low level of the concentration of white blood cells subtypes when compared to their sedentary peers. Because their hematologic values remain within the reference range for healthy people, these differences do not pose any serious clinical problems for athletes. The high RBC and low WBC subtypes values of athletes may be explained by chronic adaptation to long-term exercise.

Keywords: blood, exercise, hematology, sports, athletes.

Introduction

Nowadays, it is the known fact that physical activity through regular exercise had positive effects on physical, physiological, psychological, and other health outcomes. Scientific evidence exists that these are positive effects caused by the acute and chronic effects of regular exercise on different body systems. Regular exercise leads to increase of physical capacity by improving the efficiency of the cardiovascular, muscular, respiratory and neural systems. Blood is widely used as an indicator to evaluate the effect of exercise on the function of body systems such as the cardiovascular, immune, and endocrine system. Blood is composed of three main cell types including red blood cells (RBCs) or erythrocytes (99%), platelets (< 1%) and white blood cells (WBCs) or leukocytes (<1%) [1, 2]. These cells play an important role in maintaining a homeostatic balance. RBCs have a primary role in the transport of respiratory gases. Hemoglobin (HGB) that contained in the red blood cells carries oxygen from the lungs to the tissues and thereby provides needed oxygen in efficient energy production for muscle contractions and sustained contractions during the prolonged physical activity and exercise. Also, RBCs enable the transport of carbon dioxide out of tissues, normalization of blood pH and they carrier metabolites such as lactate released from skeletal muscles during high-intensity exercise [2, 3]. It has been considered that a reduction in the count of RBCs, HGB concentration, or oxygen-binding capacity of HGB may negatively impact on physical performance. WBC is important components of the immune system [4]. Their primary role is to protect against pathogenic bacteria, viruses, other foreign materials entering the body, infections and damaged cells that threaten the normal function of tissues in the body [5].

Regular exercise and physical activity are considered as an important regulator of blood cells and their functions [6,7]. On the other hand, physical inactivity and sedentary lifestyles is often accompanied by hematologic disorders such as hypovolemia, hematocrit (HCT) and Ph imbalance [8-10]. It was reported that there are different findings that emerge with regard to hematologic parameters in the peripheral blood during and after exercise and physical activity [11]. However, intensity, type, frequency, and duration of exercise, genetic factors, the physiologic characteristics and lifestyle of subjects are closely related to acute and chronic differences in hematologic parameters [12,13]. In scientific researches, these factors might account for the inconsistent results in blood parameters of athletes. In order to make an accurate inference about the effect of physical activity through regular exercise on blood parameters, it should be investigated the long-term effect of regular exercise and physical activity on these parameters for different ages and population groups. In the literature, the many of studies have usually focused the acute and short-term effect of exercise and physical activity on hematologic

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parameters [11,14-17]. The studies conducted in this field dictated an increase in WBC count and a decrease in RBC count as a result of regular exercise [14,15]. On the other hand, some researchers reported opposite or contradictory findings [18-20]. In summary, there are controversial about how exercise affects the hematology. Therefore, it should be investigated in more detail and in different population over different time periods. To this end, the present study compared hematology parameters of male athletes who doing regular exercise for five years and sedentary university students in the same age group and gender. We hypothesized that regular exercise caused the permanent changes in the hematologic parameters of athletes in long-term.

Materials and Methods

Subjects

Eighteen well-trained male athletes from basketball, handball, and volleyball and 18 healthy and sedentary male university students volunteered to participate in this study. Participants' age ranged from 20-22 (mean 21) years old. Trained athletes (TA) were regularly trained at least 5 years, three times a week for about 3-5 hours per session while sedentary students (SS) did not have a history of regular exercise or physical activity. Written informed consent was obtained from each participant.

Procedure

All data were collected in Turkey during the year 2014. The participants were fully informed about the study procedures. Age of participants was determined from the date of birth recorded on their national identification cards. This research was performed in accordance with tenets of Helsinki Declaration.

Data Collection

The peripheral fasting blood samples were collected from both TA and SS. All subjects were given morning appointments and instructed not to eat or drink anything after 22:00 p.m. Their blood samples were taken from the antecubital vein in the at least eight hour period of fasting. 10 ml of blood sample was collected from each participant by using sterile EDTA vacuum tubes. Blood analysis was immediately performed included: RBC, HGB, HCT, mean cell hemoglobin (MCH) and red blood cell distribution width (RDW), WBC, lymphocyte count, lymphocytes (%), granulocyte count, granulocyte percentage, monocyte count and monocyte percentage (%).

Statistical Analysis

Data analysis was performed through the SPSS (SPSS Inc., Chicago, IL, USA) trial version 17.0 statistical package. Means and SD were computed for all quantitative variables and percentages were computed for categorical variables. The Shapiro-Wilk test was used to inspect for the distributions of the variables. Independent samples t-tests were used to test for group differences. Statistical significance defined at $p < .05$.

Results

A comparison of the mean RBC parameters for the TA and SS groups is shown in Table 1. An independent-samples t-test was performed to compare of RBC parameters between the groups. The results of the t-tests revealed that there were significant differences on the HGB (t (34) = 3.27, p = .002, 95% CI [0.44, 1.87], d = 0.10), HTC (t (34) = 2.56, p = .015, 95% CI [0.61, 5.24], d = 0.16), MCH (t (34) = 3.50, p = .001, 95% CI [-0.072, 2.70], d = 0.27), and RDW (t (34) = 5.99, p = .00, 95% CI [1.23, 5.50], d = 0.51). The means of these parameters in the TA group were statistically higher than the SS group. However, the mean of RBC were not significantly different between the two groups ($p > .05$).

A comparison of the mean WBC parameters for the TA and SS groups is shown in Table 2. An independent-samples t-test was performed to compare of RBC parameters between the groups. The results of the t-tests revealed that there were significant differences on the WBC (t (34) = -2.77, p = .010, 95% CI [-1.50, -0.23], d = 0.18), lymphocyte count (t (34) = -4.55, p = .000, 95% CI [-0.95, 0.36], d = 0.39), lymphocyte percentage (t (34) = -5.21, p = .000, 95% CI [-13.66, -5.99], d = 0.44), monocyte count (t (34) = -4.36, p = .000, 95% CI [-0.28, 0.10], d = 0.36), and monocyte percentage (t (34) = -6.19, p = .000, 95% CI [-2.79, -1.41], d = 0.53), The means of WBC, lymphocyte count, lymphocyte percentage,

Table 1. Comparison of RBC parameters for TA and SS groups.

Variables	Group TA (n= 18) M (SD)	SS (n= 18) M (SD)	95% CI for Mean Difference	t(34)	*p*	*Cohen's d*
RBC (10^6/uL)	5.41 (0.62)	5.10 (0.35)	[-0.03, 0.66]	1.87	.070	0.10
HGB (g/dL)	15.83 (1.25)	14.68 (0.83)	[0.44, 1.87]	3.27	.002*	0.24
HCT (%)	46.04 (4.30)	43.13 (2.13)	[0.61, 5.24]	2.56	.015*	0.16
MCH (pg)	29.32 (1.16)	27.61 (1.72)	[-0.72, 2.70]	3.50	.001*	0.27
RDW (%)	13.77 (0.73)	11.90 (1.10)	[1.23, 2.50]	5.99	.000*	0.51

Note: *; p < .05

Table 2. Comparison of WBC parameters for TA and SS groups.

Variables	Group TA (n= 18) M (SD)	SS (n= 18) M (SD)	95% CI for Mean Difference	t(34)	*p*	*Cohen's d*
WBC (x10^9 L^{-1})	6.35 (0.85)	7.21 (1.02)	[-1.50, -0.23]	-2.77	.010*	0.18
LC (x10^9 L^{-1})	2.11 (0.43)	2.77 (0.43)	[-0.95, -0.36]	-4.55	.000*	0.39
LP(%)	30.11 (6.00)	39.94 (5.30)	[-13.66, -5.99]	-5.21	.000*	0.44
GC (x10^9 L^{-1})	3.71 (0.80)	3.39 (0.72)	[-0.21, 0.83]	1.22	.229	0.04
GP (%)	56.45 (7.17)	52.33 (5.17)	[-0.12, 8.35]	1.98	.056	0.10
MC (x10^9 L^{-1})	0.39 (0.15)	0.58 (0.10)	[-0.28, 0.10]	-4.36	.000*	0.36
MP (%)	5.68 (1.19)	7.78 (0.81)	[-2.79, -1.41]	-6.19	.000*	0.53

Note: LC; lymphocyte count, LP; lymphocyte percentage, GC; granulocyte count, GP; granulocyte percentage, MC; monocyte count and MP; monocyte percentage and *; $p < .05$.

monocyte count and monocyte percentage in the SS group were statistically higher than the TA group. However, there was no statistically difference between the two groups in but no statistically significance difference in granulocyte count (t (34) = 1.22, p = .229, 95% CI [-0.21, 0.83], d = 0.04) and granulocyte percentage (t (34) = 1.98, p = .056, 95% CI [-0.12, 8.35], d = 0.10).

Discussion

The hematological response to acute and chronic exercise has recently been reviewed. Although it is commonly accepted that both acute and chronic exercises induce many hematological changes in humans [13], it is unclear how the long-term effect of regular exercise on hematologic parameters of athletes. To date, however, little attention has been paid to the long-term effect of exercise on hematological parameters in athletes. In this study, we investigated the differences in the hematological parameters between TA group who had a history of basketball, handball and volleyball training for a minimum of 5 years and SS group who did not regular exercise except for daily activity. Our findings partially support our hypothesis and show significant differences between the in HGB, HTC, MCV, RDW, WBC, lymphocyte count, lymphocyte percentage, granulocyte percentage monocyte count, and monocyte percentage between the TA and SS groups. In contrast with what would be expected, there were no significant differences in RBC, granulocyte count, and granulocyte percentage between the groups.

Long-term regular exercise had a significant impact on the physical performance in human [22]. Hematological parameters including RBCs and WBCs are associated with the physical performance of athletes. It is thought that an increase in the concentration of the RBCs indicates an improvement in aerobic performance [23]. The findings from this study demonstrated that RBCs values of both TA and SS groups were within normal range for Turkish people [24,25]. The comparison of the mean RBCs values between the TA and SS groups show the means of HGB, HCT, MCH, and RDW values significantly differed in favor of TA group. However, the mean of RBC values did not differ statistically between the groups. Researches within the past few years have demonstrated that exercise stimulates erythropoiesis and tends to increase the RBCs after competition or training [15,26]. Also, Hu et al., (2011) also addressed exercise have a positive effect on RBCs indices in human [22]. These statements support our findings of RBCs except for the mean of RBC values. On the other hand, some studies have reported results contrary to the results of this research. In two studies have revealed that athletes have a lower HCT percentage than sedentary subjects. [27,28]. Novosadova indicated that the ratio of hemoglobin to hematocrit remained unchanged during and after moderate (67 % VO_{2max}) and low (40 % VO_{2max}) intensity aerobic exercise. The results of these studies are inconsistent with our study. In this study, the mean of RBC values did not differ statistically between the groups [29]. The non-significant difference in RBC counts in between groups may be related to several factors. First, it is possible that exercise programs performed to athletes are not as effective for improving RBC outcomes as other forms of exercise.

In this study, hematologic variables including WBC, lymphocyte count, lymphocyte percentage, monocyte count, and monocyte percentage were significantly lower in TA group. Although the granulocyte count and percentage were higher in SS group, these parameters did not differ significantly between the groups. Scientific evidence exists that WBCs play a crucial role in the immune system [7,11]. The high circulating levels of WBCs and their subtypes is closely associated with increased infection or inflammation as well as coronary heart disease and type 2 diabetes [30,31]. All mean values in both groups were within normal range for Turkish people despite the statistically significant differences between the

groups [24,25]. In literature, previous research has shown that there are the inter-relationships between exercise and immune function [32]. Some researcher indicated that the lymphocyte concentration increases during exercise bouts but it may fall baseline values found before exercise after exercise [11]. In addition, other researchers addressed decreased or no changed in WBCs values of athletes both during exercise and after [14,33]. Taken together, these reports and our results revealed that regular exercise has no adverse effect on the immune system in the long term.

Conclusion

In summary, our findings show that athletes participating in the long-term regular exercise may have the high level of RBC subtypes concentration and the low level of WBC subtypes concentration when compared to their sedentary peers. Because their hematologic values remain within the reference range for healthy people, these differences do not pose any serious clinical problems for athletes. The high RBC and low WBC subtypes values of athletes may be explained by chronic adaptation to long-term exercise. As a result, to participate in long-term regular exercise training affects positively the hematological parameters. Future large scale research is needed to further confirm these results in both athletes and other populations.

Highlights

- Regular exercise has no adverse effect on the immune system in the long term.
- Long-term training can effects on concentration of hemoglobin, percentage of hematocrit, mean cell hemoglobin, and red blood cell distribution width.
- White blood cells count, lymphocyte count, lymphocyte percentage, monocyte count and monocyte percentage in sedentary men are higher than well-trained men athletes.

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Conflict of interests

The authors declare that they have no conflict of interest.

References

1. Kenney WL, Wilmore J, Costill D. *Physiology of Sport and Exercise* (6th ed.). Champaign, IL: Human Kinetics; 2015.
2. Nunhuck S. *Physiology*. London: Elsevier; 2008.
3. Gleeson M. *Immune function in Sport and Exercise*. Philadelphia; Elsevier; 2006.
4. Gjevestad GO, Holven KB, Ulven SM. Effects of exercise on gene expression of inflammatory markers in human peripheral blood cells: a systematic review. *Curr Cardiovasc Risk Rep,* 2015;9(34):1-17.
5. Bain BJ. A *Beginner's Guide to Blood Cells* (2th ed.). London: John Wiley & Sons; 2017.
6. Ludlow AT, Ludlow LW., Roth SM. Do telomeres adapt to physiological stress? Exploring the effect of exercise on telomere length and telomere-related proteins. *BioMed Research International*, 2013;1-15.
7. Büttner P, Mosig S, Lechtermann A, Funke H, Mooren FC. Exercise affects the gene expression profiles of human white blood cells. *J Appl Physiol,* 2007;102(1):26-36.
8. Zhu W, Owen N. *Sedentary Behavior and Health: Concepts, Assessments, and Interventions*. Champaign, IL: Human Kinetics; 2017.
9. Myers J, Herbert WG, Humphrey R.H. *ACSM's Resources for Clinical Exercise Physiology: Musculoskeletal, Neuromuscular, Neoplastic, Immunologic, and Hematologic Conditions*. Philadelphia: Lippincott Williams & Wilkins; 2002.
10. Booth FW, Roberts CK, Laye MJ. Lack of exercise is a major cause of chronic diseases. *Compr Physiol,* 2012;2(2):1143–1211.
11. Pedersen BK, Toft AD. Effects of exercise on lymphocytes and cytokines. *Br J Sports Med*, 2000;34(4):246-51.
12. McCarthy DA, Dale MM. The leucocytosis of exercise. A review and model. *Sports Med*, 1988;6:333–63.
13. Wardyn GG, Rennard SI, Brusnahan SK, McGuire TR, Carlson ML, Smith LM, et al. Effects of exercise on hematological parameters, circulating side population cells, and cytokines. *Exp. Hematol*. 2008;36(2):216–23.
14. Carlson LA, Lawrence MA, LeCavalier K, Koch AJ. Salivary lymphocyte responses following acute anaerobic exercise in a cool Environment. *J Strength Cond Res*, 2017;31(5):1236-40.
15. Mairbäurl H. Red blood cells in sports: effects of exercise and training on oxygen supply by red blood cells. *Front Physiol,* 2013;4:1-13.
16. Galun E, Burstein R, Assia E, Tur-Kaspa I, Rosenblum J, Epstein Y. Changes of white blood cell count during prolonged exercise. *Int J Sports Med,* 1987;8(04): 253-55.
17. Ohno H, Sato Y, Yamashita K, Doi R, Arai K, Kondo T, Taniguchi N. The effect of brief physical exercise on free radical scavenging enzyme systems in human red blood cells. *Can J Physiol Pharmacol*, 1986;64(9):1263-65.
18. Ahmadizad S, El-Sayed MS. The acute effects of resistance exercise on the main determinants of blood rheology. *J Sports Sci*, 2005;23(3): 243-49.
19. Shapoorabadi YJ, Vahdatpour B, Salesi M, Ramezanian H. Effects of aerobic exercise on hematologic indices of women with rheumatoid arthritis: A randomized clinical trial. *J Res Med Sci,* 2016;21:9-15.
20. Bodary PF, Pate RR, Wu QF, McMillan GS. Effects of acute exercise on plasma erythropoietin levels in trained runners. *Med Sci Sports Exerc*, 1999;31(4):543-46.
21. Müller UM, Walther C, Adams V, Mende M, Adam J, Fikenzer K, et al. Long term impact of one daily unit of physical exercise at school on cardiovascular risk factors in school children. *Eur J Prev Cardiol*, 2016;23(13):1444-52.
22. Hu M, Finni T, Xu L, Zou L, Cheng S. Effects of resistance training on biomarkers of bone formation and association with red blood cell variables. *J Physiol Biochem*, 2011;67:351–358.
23. Schumacher YO, Schmid A, Grathwohl D, Bültermann D, Berg A. Hematological indices and iron status in athletes of various sports and performances. *Med Sci Sports Exerc*. 2002;34(5):869-75.
24. Tekkeşin N, Bekoz H, Tukenmez F. The largest reference

range study for hematological parameters from Turkey: A case control study. *Journal of Clinical and Experimental Investigations,* 2014;5(4):548-52.
25. Kılınc M, Celik A, Sahin E, Tolun FI. Haematological reference values according to age groups and sex for Kahramanmaras province population. *KSU Tıp Fak.Der,* 2014;9(1):39-44.
26. Ozal M. Effects of a yearlong wrestling training season on biochemical blood parameters of elite wrestlers. *Anthropologist*, 2014;18(3):691-96.
27. Weight LM, Alexander D, Elliot T, Jacobs P. Erythropoietic adaptations to endurance training. *Eur J Appl Physiol Occup. Physiol*, 1992;64(5):444–48.
28. Sawka MN, Convertino VA, Eichner ER, Schnieder SM, Young AJ. Blood volume:importance and adaptations to exercise training, environmental stresses, and trauma/ sickness. *Med Sci Sports Exerc*, 2000;32(2):332–48.
29. Novosadova J. The changes in hematocrit, hemoglobin, plasma volume and proteins during and after different types of exercise. *Eur J Appl Physiol Occup.Physiol,* 1977;36(3):223-30.
30. Madjid M, Fatemi O. Components of the complete blood count as risk predictors for coronary heart disease: in-depth review and update. Tex Heart Inst J 2013:40(1):17-29.
31. Vozarova B, Weyer C, Lindsay RS, Pratley RE, Bogardus C, Tataranni PA. High white blood cell count is associated with a worsening of insulin sensitivity and predicts the development of type 2 diabetes. *Diabetes*, 2002;51(2):455-61.
32. Natale VM, Brenner IK, Moldoveanu AI, Vasiliou P, Shek P, Shephard RJ. Effects of three different types of exercise on blood leukocyte count during and following exercise. *Sao Paulo Medical Journal,* 2003;121(1):9-14.
33. Fry RW, Morton AR, Crawford GPM, Keast D. Cell numbers and in vitro responses of leucocytes and lymphocyte subpopulations following maximal exercise and interval training sessions of different intensities. *Eur J Appl Physiol Occup.Physiol*, 1992;64(3):218-27.

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Construction of rational regimes in motor activity of children aged 3-4 years in pre-school educational institutions of various types

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Authors' Contribution:
A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: to develop rational regimes of physical activity and to determine their influence on the physical condition of children aged 3-4 years attending pre-school institutions of various types.

Material: the research was carried out in pre-school educational institutions of various types in the city of Dnepr (Ukraine) (№ 282, combined type, № 192, sanatorium type, № 28, compensatory type, № 244 and № 404, general development). One hundred and eighty-five children took part in the research, 103 of them were 3-year-olds and 82 - preschoolers of 4-year-old age. Control and experimental groups were formed in each age group in kindergartens of a certain type. The control group consisted of 91 children, the experimental group - 94. In the study we used measurements of anthropometry, pulsometry, spirometry, functional tests. The obtained results were processed by independent t-test to evaluate differences between groups.

Results: the functional conditions of the children's study of the experimental groups (boys and girls) have positive changes in the spirometry indices, respiration rates, pulsometry, Ruffier index with a significant difference with the control groups ($p<0,05$). In addition, in the course of our research, the parameters of the motor activity of children 3-4 years were determined on the base of pacing, while carrying out various organizational forms of physical education. These indicators can be oriented towards the development of a rational motor regimen for younger preschool children.

Conclusions: the proposed regimes and forms of motor activity can be used in the organization of physical education of children in pre-school educational institutions of different types for the improvement of morphofunctional indices and physical activity.

Keywords: children, physical activity, physical education, health technologies, innovative approaches.

Introduction

The development of Ukraine (as an independent state) is accompanied by complex socio-economic problems that have led to a deterioration in the physical, mental and financial situation of most of the country's population. Particular concern is the fact of the decline in the health of preschool children. The data of scientific researches show that 80% of preschool children have diseases of the upper respiratory tract, 60% - have a violation of posture and 50% of children have neurological diseases [1, 2, 3].

One of the leading factors affecting the health level and physical condition is motor activity. It is known that at the preschool age the biological need for movement is leading and has a mobilizing effect not only on the physical, but also on the intellectual, moral and emotional development of the child, his habits and behavior [4, 5, 6].

Especially relevant is the realization of this need at preschool age, since the longest and most complex stage of early ontogeny is the period from 3 to 6-7 years. It is at this age that the mechanisms of personal growth begin to develop [7, 8, 9].

In recent years, studies have been conducted on the issues of increasing the efficiency of physical education in preschool institutions. The organizational, pedagogical and methodological basis for improving the system of physical education of preschool children is presented in the studies of many authors. Researchers Wilchkovsky E.S., Denisenko N.F. [10] revealed the peculiarities of the organization of the motor mode of children in pre-school educational institutions. Also, the authors presented pedagogical conditions for activating the motor mode of preschool children. These include: the development of interest in motor activity, the creation of a sports environment, the management of independent motor activity, the organization of active recreation for children and others.

Pangelova N.E. [2] developed the concept of the formation of a harmoniously developed personality of children aged 4-6. The concept included: the urgency of modernizing the modern system of pre-school physical education; purpose, tasks and principles of technology for the integrated development of the pre-schooler's personality in the process of physical education; organizational and methodological foundations for the implementation of the concept; staffing, the strategy of introducing the concept into the practice of physical education of pre-school educational institutions.

Krutsevich T.Yu. [11] defined the interaction of "child-pedagogue-children's collective" as a leading principle of development of moral qualities of children's personality.

Costa H.J. and others [12] presented the impact of structured programs and physical education classes with pre-school children on physical fitness indicators.

At the same time, the issue of optimizing the motor state of children 3-4-years in pre-school educational institutions of various types was not the subject of special research, but determined the relevance of this study.

The aim of the research is to develop rational regimes

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of physical activity and to determine their influence on the physical condition of children aged 3-4 years attending pre-school institutions of various types.

Material & methods

Participants. One hundred and eighty-five children took part in the research, 103 of them were 3-year-olds and 82 - preschoolers of 4-year-old age. Control and experimental groups were formed in each age group in kindergartens of a certain type. The control group consisted of 91 children, the experimental group - 94.

The control group included 48 children of 3-4-year-old age from pre-school educational institutions (PEI) of general development and combined types and 43 children of 3-4-year-old age from PEI of sanatorium and compensatory types. The experimental group included 50 children of 3-4-year-old age from PEI of general development and combined types and 44 children of 3-4-year-old age from PEI of sanatorium and compensatory types.

Participation of children in the experiment is confirmed by the consent of their parents.

Procedure. The research was carried out in pre-school educational institutions of various types in the city of Dnepr (Ukraine) (PEI № 282, combined type, PEI № 192, sanatorium type, PEI № 28, compensatory type, PEI № 244 and № 404, general development). The experiment lasted 9 months.

The contents of the motor activity of pupils in PEI of general development and combined type was supplemented by author's methods, means of psycho-preventive work, children's fitness and hardening measures. Innovative and health-improving technologies were used in all organizational forms of work on physical education. They are: story-playing physical culture (with elements of fairy-tale therapy [13], eurythmic gymnastics [14], children's fitness [15], techniques "Children's experimentation", "Little wizards", "Training in motion" [16], technologies for the comprehensive development of the child's personality [2]. Classes were held at least twice a week, swimming (in PEI № 404) - twice a week (after noon). Physical culture activities (morning exercises, walking games, gymnastics after a daytime sleep, etc.) included the elements of psycho-gymnastics [17], corrective gymnastics (logarithmic gymnastics, exercises for the development of fine motor skills [18, 19], health running, hardening activities at least three times a week. Active recreation included physical culture holidays (for children in the middle group every 3 months), health days (once a month), physical recreation (twice a month), walking in the forest or the adjoining park (for children in the middle group 2 -3 times a month). Independent motor activity for children was organized on a daily basis, under the guidance of the tutor, taking into account the level of motor activity of children.

For the pupils in PEI of sanatorium and compensatory type, physical education classes were held three times a week. Their content is supplemented by author's methods, such as: "The Theater of Physical Education" [20], "Free Physical Education" [21], "Technology of Integral Development of Psychomotor Abilities of Children 2-5 years" [22]. Elements of psycho-prophylactic work, corrective gymnastics (sets of exercises using therapeutic balls SIT-45) and elements of children's fitness program "Sa-Fi-Dance" [23] were used too. The organization of physical and health activities, along with traditional ones (morning gymnastics, outdoor games and exercises on a walk, etc.) also provided for carrying out the daily recreational and gaming practice. The content of active recreation forms and independent motor activity provided for the use of both traditional and innovative means of preschool physical education.

In our studies we used measurements of anthropometry, pulsometry, spirometry, functional tests.

Statistical analysis. The obtained results were processed using mathematical statistics methods: descriptive statistics, independent t-test to evaluate differences between groups ($p \leq 0,05$).

Results

The increase in the level of the physical condition largely depends on the optimal motor mode in the preschool institution. Its content is a complex of organizational forms in physical education (PE lessons, fitness and recreation in the mode of the day, active recreation, independent motor activity of the child, etc.), which is used in the pedagogical process of preschool institution.

When developing a rational motor regime, it is important not only to ensure the biological need of children for motor activity. It is also necessary to provide a rational content of motor activity based on the optimal correlation of different organizational forms of studies, selected according to the age, individual characteristics of children, and the profile of the pre-school educational institution. These approaches were implemented in the following forms of organization of physical education work in conditions of the pre-school educational institution: PT lessons, sport and recreational activities in the mode of the day, active rest, independent motor activity of children in the mode of the day in PEI.

The construction of a rational motor regime required taking into account the specifics in the activity of a pre-school educational institution.

For preschool institutions of general development we recommend both generally accepted forms of work (PT lessons, fitness activities in the mode of the day, etc.) and such types of motor activities as health-improving running, respiratory gymnastics, logarithmic gymnastics. This is because in kindergartens of general development a significant number of children have low and below average indicators of the functional state of the organism and insufficient development of speech. In PEI № 404, where there is a swimming pool, twice a week, swimming lessons were carried out in combination with hydro massage, gymnastics in the water, hardening activities.

Pre-school institutions of compensatory type are intended for children who need correction of physical and

mental development (with lack of hearing, sight, speech, musculoskeletal system). An analysis of the morbidity of children in PEI № 28 (compensating type) made it possible to state that the overwhelming number of pupils have visual, musculoskeletal system impairments and others; individual functional indicators (heart rate, vital capacity of the lungs) do not correspond to the average age norms. The indices of physical preparedness and motor activity were also lower than the indices of preschool pupils in PEI of general development. All this led to a change in the ratio of the various organizational forms of physical exercise (reducing the number of PT lessons at the expense of health-gaming sessions, the use of varieties of corrective gymnastics, etc.).

The main contingent in preschool institutions of a sanatorium type are children who have early manifestations of tuberculosis infection, often suffer from colds or diseases of the gastrointestinal tract, endocrine and cardiovascular systems. Pupils in PEI №192 are characterized by a high incidence rate in comparison with other groups of children under study. Evaluation of the functional state of children in PEI of a sanatorium type indicates that the adaptive capacity of their body is lower than that of pupils at the general development level. In addition, such a component of the physical state as physical fitness corresponds to a level below the average, and the level of motor activity is low. Therefore, the process of physical education had mainly a health-adaptive orientation. Particular attention was paid to hardening procedures, respiratory gymnastics, and the use of health-saving technologies.

The rational combination of various forms of physical exercise is a whole complex of educational and recreational activities, ensuring optimal motor activity of children (Table 1).

Table 1. Forms of work and types of motor activity of children aged 3-4 years

№	Activities	Features of the organization	*PEI **			
			№244, 404	№282	№192	№28
1. Physical training						
1.1	Physical training lessons	5 times (2 - outdoors) per week in PEI of general development and combined type, 3 times (1-outdoors) in PEI of sanatorium and compensatory type	+	+	+	+
1.2	Swimming classes (if there is a swimming pool)	Twice a week, in the afternoon, subgroups (8-10 children). Duration - 25-30 minutes.	+			
2. Fitness and health activities in the mode of the day						
2.1	Morning exercises	Daily outdoors (in the warm season) or in the hall. Duration: 5-6 minutes. (second junior group); 6-8 min. (middle group). Exercises to correct posture and prevent flat feet. Breathing exercises to improve the drainage function of the lungs and bronchi.	+	+	+ +	+ +
2.2	Moving games and exercise for a walk	Every day during the morning walk in subgroups formed with regard to the motor activity level of children and their physical condition. Duration - 20-25 minutes.	+	+	+	+
2.3	Health running	Twice a week, in subgroups of 5-7 children, during the morning walk. Duration - 3-5 min.	+	+		+
2.4	Individual work on the development of movements	Daily during the evening walk. Duration - 10-12 minutes.	+	+	+	+
2.5	Gymnastics after a daytime sleep	Daily after a daytime sleep. Duration - 5-8 minutes, 4-5 exercises.	+	+	+	+
2.6	Hardening procedures in combination with physical exercises	Daily during active motor activity, after sleep and during other routine activities.	+	+	+	+
2.7	Recreational and gaming practice	Daily after a daytime sleep. Duration - 25-30 minutes.			+	+
2.8	Corrective gymnastics	Daily after a daytime sleep (during the health-game practice). In addition, complexes of corrective exercises can be used in other forms of physical culture and health. It is carried out on doctor's recommendation. Duration - 10-12 minutes.			+	+

Continuation Table 1

№	Activities	Features of the organization	*PEI* *			
			№244, 404	№282	№192	№28
2.9	Breathing exercises	Daily in the process of organized forms of physical education, as well as music classes. Duration - 8-10 minutes.	+	+	+	+
2.10	Logarithmic gymnastics	Twice a week in subgroups (under the guidance of a speech therapist)	+	+	+	+
3. Leisure						
3.1	Walking in the forest or the adjoining park	Two or three times a month during the game and exercise time, organized by the tutor. Duration - 60-80 minutes. (for children of the middle group)	+	+	+	+
3.2	Athletic leisure	Once or twice a month outdoors with peers of one or two groups. Duration - 20-30 minutes.	+	+	+	+
3.3	Physical culture holidays	Twice or three times a year with children of other PEI age groups (starting with the middle group). Duration - 60-80 minutes.	+	+	+	+
3.4	Health day	Once a month. During the day active motor activity of children in the open air. The content is determined by the tutor.	+	+	+	+
3.5	Health Week (vacation)	Twice or three times a year (last week of the quarter)	+	+	+	+
4. Self-study						
4.1	Independent motor activity	Daily under the guidance of a tutor indoors and outdoors. Duration depends on the individual characteristics of the children	+	+	+	+

Notes: * PEI № 244, 404 - general development; PEI №282 - combined type; PEI №192 - sanatorium type; PEI №28 - compensatory type.

Table 2. Indicative figures of motor activity for children aged 3-4 years

Activities	**Indices of motor activity**		
	The volume of movements (the number of locomotions)	**Duration (min.)**	**Intensity of movements (min.)**
Morning exercises	580-750	5-8	48-52
Physical activity	1700-2900	20-30	42-58
Outdoor games and exercises for a morning walk	1600-2500	20-25	40-55
Individual work with children to develop movements for an evening walk	900-1400	10-12	40-50
Gymnastics after a daytime sleep	500-700	5-8	42-50
Recreational game practice	1700-2500	25-30	45-58
Independent motor activity of children for a morning walk	2000-2500	45-50	40-45
Independent movements indoors and other movements in the mode of the day	1100-1400	30-35	38-42
Independent motor activity of children for an evening walk	1200-1400	40-45	30-32
Independent children's games indoors and other movements in the afternoon	1100-1200	30-35	28-32
Total per day	13100-17800	235-280	44-53

Table 3. Parameters of the morphofunctional state of girls of 3 and 4 years of control and experimental groups

Indicators		Before the experiment		After the experiment			
		PEI of general development and combined type (3 years n=30, 4 years n=21)	PEI of sanatorium and compensatory type (3 years n=24, 4 years n=20)	PEI of general development and combined type		PEI of sanatorium and compensatory type	
				CG (3 years n=15, 4 years n=10)	EG (3 years n=15, 4 years n=11)	CG (3 years n=12, 4 years n=10)	EG (3 years n=12, 4 years n=10)
		$\bar{x}$ ±σ	$\bar{x}$ ±σ	$\bar{x}$ ±σ	$\bar{x}$ ±σ	$\bar{x}$ ±σ	$\bar{x}$ ±σ
Body length, cm	3 years	100,00 ± 0,75	97,00 ± 0,94	102,80 ± 0,69	102,60 ± 0,71*	99,50 ± 0,59	99,70 ± 0,61*
	4 years	107,0±1,56	108,5±1,47	109,8±1,51	110,2±1,51*	110,1±1,31	111,0±1,61*
Body weight, kg	3 years	14,70 ± 0,32	13,50 ± 0,32	16,20 ± 0,38	15,90 ± 0,41*	14,60 ± 0,39	14,50 ± 0,42*
	4 years	17,8±0,65	18,8±0,71	19,2±0,68	19,5±0,71*	20,2±0,81	20,3±0,61*
Mass-growth index, g • cm^{-1}	3 years	146,70 ± 2,98	147,60 ± 2,55	164,20 ± 2,67	167,30 ± 2,53*	163,40 ± 2,38	165,70 ± 2,71*
	4 years	166,8±4,22	172,5±5,43	178,7±5,71	181,2±6,12*	183,2±4,71	185,4±5,67*
Heart rate, stroke • min-1	3 years	104,00 ± 0,41	109,00 ± 0,45	103,00 ± 0,61	99,00 ± 0,51*	108,00 ± 0,51	104,00 ± 0,61*
	4 years	95±0,51	102±0,81	94±0,73	91±0,51*	102±0,67	96±0,74*
Vital capacity of the lungs, ml	3 years	910,00 ± 11,40	875,00 ± 10,50	950,00 ± 11,30	1100,00 ± 10,90*	920,00 ± 10,70	980,00 ± 11,20*
	4 years	1020±916,6	890±17,6	1050±7,91	1290±5,83*	920±9,71	1090±8,93*
Respiration rates, cycle • min^{-1}	3 years	27,00 ± 0,53	31,50 ± 0,61	27,00 ± 0,51	23 ± 0,27*	30,00 ± 0,32	25,00 ± 0,21*
	4 years	25±0,61	29,5±0,55	25±0,31	21±0,11*	28±0,21	24±0,12*
The Ruffier Index, points	3 years	10,80 ± 0,67	12,90 ± 0,74	9,20 ± 0,41	6,9 ± 0,31*	11,80 ± 0,31	9,70 ± 0,23*
	4 years	8,5±0,75	12,3±0,80	8,2±0,53	6,9±0,23*	12,0±0,61	9,3±0,47*

Notes: CG - control group, EG - experimental group, * - significant differences at p<0,05.

We proposed to include elements of recreational and innovative pedagogical technologies of physical education in all organizational forms of work on physical education, taking into account the specifics of a pre-school educational institution of a certain type. They contribute to the optimization of the motor regime in PEI in conjunction with the program material for the education and upbringing of children of younger preschool age.

In addition, in the course of our research, the parameters of the motor activity of children 3-4 years were determined on the base of pacing, while carrying out various organizational forms of physical education used in working with children 3-4 years (Table 2). These indicators can be oriented towards the development of a rational motor regimen for younger preschool children attending children's institutions of various types.

Comparison of the data obtained during the educational pedagogical experiment indicates that in the experimental groups children 3-4 years (boys and girls) attending PEI of different types had significantly higher results in terms of physical condition than children in control groups. This confirms the effectiveness of forming a rational motor regime in pre-school educational institutions of different types.

Thus, the results of a study of the functional capabilities of the children's study groups indicate

that in the experimental groups positive changes in the spirometry indices, respiration rates, pulsometry, Ruffier samples with a significant difference with the control groups ($p<0,05$).

The indicators of the physical development of children 3-4 years also significantly changed, which can be explained by the natural growth of the body (Tables 3, 4).

Discussion

Summarizing the results of the study of the functional state, it should be noted that their rates, both at girls and at boys who have certain abnormalities in their health and attend dentistry of sanatorium and compensatory types, are lagging behind the average values for children 3-4 years.

Scientists came to the conclusion about the dependence of mental and physical development of the child on the level of motor activity. They determined that the driving factor in increasing the physical condition of children of preschool age is motor activity, which is within the optimum values [1, 2, 24]. Our studies confirmed the data of scientists [2, 8, 10, 25] on the dependence of the morphofunctional state of children on the level of their motor activity. Consequently, rational construction of the motor regime of the child is one of the most important tasks of the system of preschool physical education.

The organization of a rational mode of physical activity of children of preschool age includes the use of various forms of physical education, means and methods of their application, which correspond to the age characteristics of children. The recommended weekly volume of motor activity of children 3-4 years old is 15-20 hours [10, 26]. However, these recommendations are generalized and do not take into account the specifics of a kindergarten of a certain type.

Thus (taking into account the peculiarities of the morphofunctional state of children 3-4 years old, pupils of different types PEI) we have introduced various traditional and non-traditional means of motor activity into all organizational forms of work for physical education. We also proposed the orientation parameters of the motor activity of children 3-4 years old during the day.

The results of the study have proven the effectiveness of the proposed motor regimens for children who attend PEI of different types. There is a statistically significant improvement in the morphofunctional indices of children in experimental groups as compared to control groups.

Conclusions

Thus, the data confirm the advisability of using the proposed approaches to improve the motor conditions of children in pre-school educational institutions of various types.

Conflict of interests

The authors declare that there is no conflict of interest.

References

1. Krutsevich T, Pangelova N. Content and organization of physical education in the context of formation of integrated harmoniously developed child. *Life and movement.* 2013;1(3):3-7.
2. Pangelova NY. *Theoretical and methodical principles of forming a harmoniously developed personality of a child of preschool age in the process of physical education*. Cand. Diss., Kiev; 2014. (in Ukrainian)
3. Poliakova AV. *Organizational-methodical principles of the motor regime of children aged 3-4 years in preschool institutions of different types.* Cand. Diss., Dnipropetrovsk; 2015. (in Ukrainian)
4. Benčuriková Ľ, Putala M. The influence of motor activity on the swimming ability of preschool aged children. *Journal of Physical Education and Sport,* 2017;17(3):1043 – 1047. doi:10.7752/jpes.2017.03160
5. Marouli A, Papavasileiou G, Dania A, Venetsanou F. Effect of a psychomotor program on the motor proficiency and self-perceptions of preschool children. *Journal of Physical Education and Sport,* 2016;16 (4):1365 – 1371. doi:10.7752/jpes.2016.04218
6. Leng Goh T, Fu Y, Brusseau T, Hannon J. On-task behavior of elementary students during movement integration. *Journal of Physical Education and Sport,* 2018;18(1):103 – 106. doi:10.7752/jpes.2018.01013
7. Vygotskij LS. *Child developmental psychology*. Moscow: EKSMO; 2003. (in Russian)
8. Goldfield GS, Harvey A, Grattan K, Adamo K. B. Physical Activity Promotion in the Preschool Years: A Critical Period to Intervene. *International Journal of Environmental Research and Public Health,* 2012;9 (4): 1326–1342. doi. org/10.3390/ijerph9041326
9. Pica R. Why Preschoolers Need Physical Education. *Young Children*. 2011;66 (2):56-57.
10. Vil'chkovs'kij ES, Denisenko NF. *Organization of motor regime for children in pre-school educational institutions*. Ternopil: Traveler; 2008. (in Ukrainian)
11. Krutsevich T. *Development of the moral component of the personality of senior preschool children in the process of organized motor activity*. *Sportivnij visnik Pridniprov'ia,* 2015;2:93 – 97. (in Ukrainian)
12. Costa HJ, Abelairas-Gomez C, Arufe-Giráldez V, Pazos-Couto JM, Barcala-Furelos R. Influence of a physical education plan on psychomotor development profiles of preschool children. *Journal of Human Sport & Exercise,* 2015;10 (1):126 – 140. doi:10.14198/jhse.2015.101.11
13. Iefimenko MM. *Sporting fairy tales*. Kharkiv: Vesta, Ranok; 2005. (in Ukrainian)
14. Skvorchuk E. Eurythmic gymnastics. *Doshkol'noe vospitanie,* 2008;5:16-19. (in Russian)
15. Sajkina EG. *Fitness in the system of preschool and school education*. Dokt. Diss., Sankt Petersburg; 2009. (in Russian)
16. Shebeko V. Education of the child as a subject of physical culture and recreation. *Doshkol'noe vospitanie,* 2011;4:28-33. (in Russian)
17. Chistiakova MI. *Psychogymism*. Moscow: Education; 2010. (in Russian)
18. Savel'eva NIu. *Organization of health work in pre-school educational institutions*. Rostov on Don: Phoenix; 2009. (in Russian)
19. Ushakova OS, Strunina EM. *Methods of speech development for preschool children*. Moscow: HOUSEHOLD; 2011. (in Russian)

20.Iefimenko MM. *Theater of physical education and rehabilitation of preschoolers*. Kiev: ISDO; 1995. (in Ukrainian)
21.Glazyrina LD, Ovsiankin VA. *Methods of physical education of children of preschool age*. Moscow: HOUSEHOLD; 1999. (in Russian)
22.Lakhno OG. *Innovative technologies of the development of psychomotor abilities in the physical education of children 2nd - 5th years of life.* Cand. Diss. Kiev; 2013. (in Ukrainian)
23.Pangelova NIe, Moskalenko OV. Health-developing program "Sa-Phi-Danse" as a means of correction of the physical condition of children of the senior preschool age. *Sportivnij visnik Pridniprov'ia,* 2010;2:21-24. (in Ukrainian)
24.Axeti G, Gissis I, Vrabas I, Grouios G, Komsis G, Komsis S. Assessment of kinematic characteristics of preschoolers' gait during the implementation of an intervention training program. *Journal of Human Sport and Exercise,* 2017;12(4):1298-1309. doi:10.14198/jhse.2017.124.16
25.Chatoupis C. Young children's divergent movement ability: a study revisited. *Early Child Development and Care,* 2012;183 (1):92-108. doi:10.1080/03004430.2012.655728
26.Stork S, Sanders SW. Physical education in early childhood. *Elementary School Journal,* 2008;108(3):197-206.

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Influence of physical activity of the maximum aerobic power on hemo-dynamic and morpho-biochemical of change of erythrocytes of female volleyball players

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Abstract

Purpose: to study types of the cardio-hemo-dynamic reaction of an organism and morpho-biochemical changes of erythrocytes of peripheral blood of female volleyball players on physical activity of the maximum aerobic power.

Material: 18 female volleyball players with different qualification participated in the experiment (age – 22,0±0,6 years). It is investigated cardio-hemo-dynamic (by functional methods), functional changes (by biochemical methods) and structure of erythrocytes (by means of the scanning electronic microscopy) before and after maximum (3,5 W/kg of body mass) physical activity.

Results: It is determined that the maximum physical activity causes essential changes in cardio-hemo-dynamic. Such changes depend on the morphological reorganization of peripheral blood erythrocytes (increase in the index of erythrocytes deformation) and closely correlate with biochemical changes (decrease of ATP concentration and increase of magnesium concentration in erythrocytes). It is discussed the possible mechanisms of realization of reaction features of the organism of female volleyball players to physical activity of the maximum aerobic power.

Conclusions: the physical activity of the maximum aerobic power finds typological features of the cardio-hemo-dynamic reaction of the female volleyball players' organism. Such features are expressed by conformational changes of erythrocytes of peripheral blood. They depend on the concentration of separate macroelements in these cells and type of cardio-hemo-dynamic.

Keywords: female volleyball players, blood circulation type, macroelements, physical activity, erythrocytes.

Introduction

The defining parameter of different types of cardio-hemo-dynamic is the heart index [1]. Definition of this parameter promoted identification of functionality stocks of students [2] and athletes' organism of different age groups [4]. The longtime jogging also promoted the selection of males and females training tactics [3]. Its fluctuations range in healthy humans is devoted to several types of cardio-hemo-dynamic [1]. At the same time, such heterogeneity is caused by the level of vegetative regulation [4] and is the standard of somatic health of different age human [5] and students of different gender [6].

Physical activity of the maximum aerobic power could cause changes in the central cardio-hemo-dynamic [4]. It creates prerequisites for violation of an erythrocytic part of hemostasis [7]. Such changes of erythrocytes are defined by biochemical and macroelement imbalance which influences on their deformability [8]. The intracellular concentration of ions of magnesium and calcium [7] is important among determination factors of erythrocytes deformation ability. It is known that the interaction of 2,3-diphosphoglycerate and adenosine triphosphoric acid (ATP) with hemoglobin is substantially regulated by these ions. It is also known that magnesium contacts with a molecule of 2,3-diphosphoglycerate. It increases the ability of hemoglobin to keep intracellular oxygen [9]. At the same time, the quantity of intracellular ions of magnesium and calcium creates the significant effect on the cardio-hemo-dynamic level [3]. This fact substantially depends on the type of vegetative regulation of the heart rhythm [10].

There are only several works devoted to a research of types of hemo-dynamic depending on the morpho-biochemical condition of erythrocytes [4]. At the same time, there is no clearness in what ratio of such types meet at healthy humans [11]. Data of several authors indicate identical part of different types of cardio-hemo-dynamic [1]. In other researches advantage of one of them is determined [12] that also depends on a person's age [13] and gender [14]. At the same time out the questions

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of their origin are neglected [11]. It isn't found features of such reaction to physical activity of the maximum aerobic power [15, 16] in athletes: depending on their age [5], gender[16] and specialization [15].

Hypothesis. It is provided that athletes with the different type of cardio-hemo-dynamic reaction to physical activity of the maximum aerobic power could be caused by changes of macroelements' structure and erythrocytes deformation ability.

The work purpose is to study the features of cardio-hemo-dynamic reaction of female volleyball players' organism to physical activity of the maximum aerobic power depending on morpho-biochemical features of peripheral blood erythrocytes.

Material and methods.

Participants. Female volleyball players (n=18, age - 20,0±0,6 years) who gave the letter of consent participated in a research.

Organization of a research. The physical activity of the maximum aerobic power of 3,5 W/kg of body mass was applied during the research. The test was performed on the bicycle ergometer Kettler (Germany). Definition of cardio-hemo-dynamic parameters performed by means of the computer cardiographic complex Cardiolab+ (XAI-Medica, Ukraine).

Cardio-hemo-dynamic changes were estimated according to the following parameters: heart index; systolic blood pressure, diastolic blood pressure, and average arterial blood pressure; changes of heart rate; stroke and minute volume of blood circulation. The power characteristics of heart activity [10] and myocardial oxygen requirement [17] were defined according to the rate pressure product value.

The capillary blood sampling was done for studying of morpho-biochemical changes of erythrocytes. It was determined glucose level in blood plasma before and after 5 minutes of physical activity of the maximum aerobic power. The concentration of hemoglobin was investigated by a standard cyanmethemoglobin method [14]. The number of erythrocytes was determined by the unified method in Gorjaev's chamber [18]. Hematocrit was determined by micromethod with the application of standard heparinized capillaries [19]. The concentration of adenosine triphosphate (ATP) in erythrocytes was defined by means of P.M. Yaverbaum's method [8]. The concentration of adenosine diphosphate (ADP) and adenosine monophosphate (AMP) were defined by means of Bergmeyer's method [8].

Morphological researches of erythrocytes were performed in the scanning electronic microscope "JEOL-25M-T220A" (Japan) [20].

The erythrocytes deformation index was calculated by the formula for the comparison of different forms of erythrocytes and assessment of their morphological comfortability level:

$$EDI = A-B/C,$$

where A – total quantity of erythrocytes, B – quantity of reversibly changed forms of erythrocytes, C – quantity of irreversibly changed forms of erythrocytes. Low level of conformational ability of erythrocytes is defined at values of the erythrocytes deformation index from 1,6 to 2,5, average – within 2,6-3,9, high – at 4,0-6,0.

The electrolytic structure of erythrocytes was defined in the muffle furnace at 800 Co t. For this purpose, 2 ml of erythrocytic mass was turned into ash. Ash was pressed after then the surface of press mould was sputtering by carbon (≈10 nm). It was defined concentration in erythrocytes of such macroelements as following: sodium (Na), potassium (K), iron (Fe), magnesium (Mg) and calcium (Ca). The computer program "SELMI" was applied for this purpose. Accessory for energy dispersive X-ray microanalysis "EDAR" was also applied. Raster electronic microscope REMMA-102E ("SELMI", Ukraine) was applied for this purpose: accelerating voltage – 20 kW; power range from 960 to 19600 kiloelectron-volt (keW).

Statistical analysis. Statistical processing is performed by means of computer software "Statistica 6,0". Data are presented in the arithmetic average, the standard deviation is (M±SD). The received parameters weren't subject of the investigation of normal distribution law by Kolmogorov-Smirnov test. Therefore the statistical significance of intergroup difference was estimated by Mann-Whitney test and nonparametric Kruskal-Wallis test. It was applied Spearman's rank correlation coefficient. The difference was considered statistically significant at level $p<0,05$. It was applied the dispersive analysis of parameters of heart rate variability before and after the physical activity of the maximum aerobic power.

Results

Performed researches demonstrated that at rest female volleyball players have heterogeneity of different types of cardio-hemo-dynamic. The following types of cardio-hemo-dynamic were determined according to the typological analysis: in 7 (38,9%) female volleyball players – hypodynamic; in 6 female volleyball players (33,3%) – eukinetic; in 5 female volleyball players (27,8%) hyperkinetic.

The significantly higher parameters of heart rate, the heart index, stroke and minute volume of blood and rate pressure product ($p<0,05$) were determined in female volleyball players with the hyperkinetic type of cardio-hemo-dynamic. The female volleyball players with the hypodynamic type of cardio-hemo-dynamic had lowest start values. In female volleyball players with the eukinetic type of cardio-hemo-dynamic these parameters were in the interposition.

It is determined that in female volleyball players with the hyperkinetic type of cardio-hemo-dynamic essential increase in systolic blood pressure reaches a maximum until the end of the first minute of physical activity of the maximum aerobic power. In female volleyball players with the hypodynamic and eukinetic type of cardio-hemo-dynamic, the systolic blood pressure reached a maximum in the second minute of physical activity. Further, it practically doesn't change until the end of the

test. Increase in systolic blood pressure during physical activity performing of the maximum aerobic power realized due to increase in stroke volume. It didn't depend on the cardio-hemo-dynamic type. In female volleyball players with the hypodynamic type of cardio-hemo-dynamic, the heart index increased in 2,82 times. In female volleyball players with the hyperkinetic type of cardio-hemo-dynamic, the heart index increased in 3,09 times ($p<0,05$).

In all female volleyball players the parameter of average arterial blood pressure is essentially changed after the first minute of physical activity of the maximum aerobic power. It occurs due to increase in heart rate and a statistically significant decrease of parameter of the rate pressure product ($p<0,05$).

In female volleyball players with the eukinetic type of cardio-hemo-dynamic the tendency to normalization of all cardio-hemo-dynamic parameters appeared in the first minute of the recovery period. In female volleyball players with the hypodynamic and hyperkinetic type of cardio-hemo-dynamic the significance of differences is kept until the end of the fifth minute of rest.

After physical activity of the maximum aerobic power all female volleyball players have statistically significant increase in the hematocrit and level of hemoglobin ($P<0,05$). In hypodynamic type of cardio-hemo-dynamic the increase in the hematocrit and level of hemoglobin comes against the background of increase in number of erythrocytes. It is observed decrease of erythrocytes quantity in female volleyball players with eukinetic type of cardio-hemo-dynamic. In female volleyball players with hyperkinetic type of cardio-hemo-dynamic physical activity of the maximum aerobic power is caused by increase in quantity of erythrocytes in the largest volume (on average in 15,3±0,11 %, $p<0,05$).

It was determined contents of adenosine triphosphate (ATP) decrease and concentration of adenosine monophosphate (AMP) increase in female volleyball players (tab. 1).

The most expressed changes of the studied parameters are registered in female volleyball players with the hyperkinetic type of cardio-hemo-dynamic. Confirmation of this is changes of spectral parameters in female volleyball players with a different type of cardio-hemo-dynamic. It is determined that in female volleyball players with hyperkinetic type of cardio-hemo-dynamic the majority of spectral and hour parameters of heart rate variability significantly differed from similar parameters of volleyball players from eukinetic and hypodynamic type of cardio-hemo-dynamic (tab. 2, 3).

Calculation of nonparametric Spearman correlation coefficient results demonstrate that there is a significantly positive connection between separate parameters of heart rate variability and value of the erythrocytes deformation index (see tab. 3, a mark *).

It is observed restructuring of erythrocytes near these changes. In female volleyball players with eukinetic type of cardio-hemo-dynamic after the physical activity of the maximum aerobic power, erythrocytes are left almost without changes (fig. 1A). In female volleyball players with the hypodynamic type of cardio-hemo-dynamic (fig. 1B) have reversibly changed forms of erythrocytes. In the hyperkinetic type of cardio-hemo-dynamic: it is observed an increase of irreversibly changed forms in 15,0%; the ability of erythrocytes' aggregation increased ($p<0,05$). It is evident as an increase in the amount of "adhesion threads" between separate cells (fig. 1C).

Results of the macroelements analysis argue for the increase in erythrocytes deformation in female volleyball players with hyperkinetic type of cardio-hemo-dynamic (fig. 1). Contents of calcium and magnesium at these female volleyball players were respectively in 11,6% but 36,9% more, than in female volleyball players with eukinetic type of cardio-hemo-dynamic and respectively in 23,7% and 45,6% more, than in female volleyball players with hypodynamic type of cardio-hemo-dynamic.

Table 1. The contents of adenylic nucleotides in erythrocytes of peripheral blood in female volleyball players with different type of hemo-dynamic (M±SD)

Parameter	Hypodynamic type of cardio-hemo-dynamic (n=6)	Eukinetic type of cardio-hemo-dynamic (n=7)	Hyperkinetic type of cardio-hemo-dynamic (n=5)
ATP, mmol/L	1,46±0,18$^{\#}$	1,87±0,14	1,12±0,33$^{*\#}$
ADP, mmol/L	0,68±0,34$^{\#}$	1,17±0,36	0,79±0,42$^{\#}$
AMP, mmol/L	1,4±0,45$^{\#}$	0,89±0,12	1,68±0,63$^{\#}$
ATP/ADP	2,22±0,46$^{\#}$	1,62±0,23	1,62±0,91*
ADP x AMP/ATP	0,74±0,61$^{\#}$	0,56±0,11	1,31±1,07$^{*\#}$

Notes: ATP – adenosine triphosphate; AMP – adenosine monophosphate; * – the statistical significance of the difference in parameters in comparison with female volleyball players with the hypodynamic type of cardio-hemo-dynamic # – in comparison with parameters of female volleyball players with eukinetic type of cardio-hemo-dynamic ($p<0,05$).

Table 2. Value of heart rate variability parameters of female volleyball players with a different type of blood circulation and value of erythrocytes deformation index before the physical activity of the maximum aerobic productivity (M±SD, n=18)

Parameter	Type of blood circulation regulation / erythrocytes deformation index level		
	hypotonic / low	eukinetic / low	hypodynamic / average
HR, bpm	78,1±1,53	71,9±1,43	70,6±1,94
Average mean of RR-interval, ms	0,78±0,04	0,85±0,03	0,88±0,02
SDNN, ms	0,05±0,001	0,06±0,002	0,06±0,006
RMSSD, ms	0,05±0,003	0,05±0,001	0,06±0,012
pNN50, %	27,1±4,57	30,1±1,87	31,7±7,11
TF, ms^2	4003,1±305,33*	4427,3±247,19	5414,9±1281,6*
VLF, ms^2	1093,9±54,31*	1610,5±81,63	1902,8±58,32*
LF, ms^2	1103,3±47,85*	1345,5±92,74	1744,8±52,44*
HF, ms^2	1194,2±66,14*	1081,9±101,32	1089,4±427,08
LF/HF	1,4±0,12*	1,7±0,15	2,4±0,42*
pLF, %	50,7±1,35*	57,4±1,42	64,4±4,32*
pHF, %	49,2±1,04*	42,6±1,02	35,7±4,33*

Notes: 1. * – in comparison with female volleyball players with eukinetic type of cardio-hemo-dynamic the difference is significant at p<0,05; 2. HR – heart rate; LF – spectrum power in the low frequency range; HF – spectrum power in the high frequency range; RMSSD – mean-square residual between duration of R-R intervals; SDNN – a mean square standard deviation of R-R intervals; SDANN –standard deviation of a difference between consecutive R-R intervals; PNN50 – a part of consequent R-R intervals difference between which exceeds 50 ms; TF –general power of spectrum; VLF – spectrum power in the range of very low frequencies.

Table 3. Value of parameters of heart rate variability of female volleyball players with a different type of blood circulation and value of erythrocytes deformation index after the physical activity of the maximum aerobic productivity (M±SD, n=18)

Parameter	Type of blood circulation regulation / erythrocytes deformation index level		
	hypotonic / low	eukinetic / low	hypodynamic / average
HR, bpm	90,8±3,06*	82,6±0,92	78,1±3,43
Average mean of RR-interval, ms	0,68±0,04*	0,74±0,02	0,78±0,04
SDNN, ms	0,05±0,001	0,05±0,001	0,05±0,001
RMSSD, ms	0,03±0,001*	0,04±0,001	0,05±0,001*
pNN50, %	18,7±5,53*	16,9±1,43	20,0±5,94*
TF, ms^2	2208,1±374,33*	3447,8±292,12	5282,6±117,24*
VLF, ms^2	689,1±105,47*	1298,5±181,63	1975,3±157,75*
LF, ms^2	581,2±92,12*	1112,9±77,51	1660,6±297,82*
HF, ms^2	588,8±142,64	649,0±66,33	1017,3±313,15*
LF/HF	1,8±0,32*	2,0±0,11	2,8±0,22
pLF, %	48,6±4,44*	62,9±1,53	65,6±5,44
pHF, %	51,4±4,42*	37,1±1,57	34,5±5,23

Note. see notes to tab. 2.

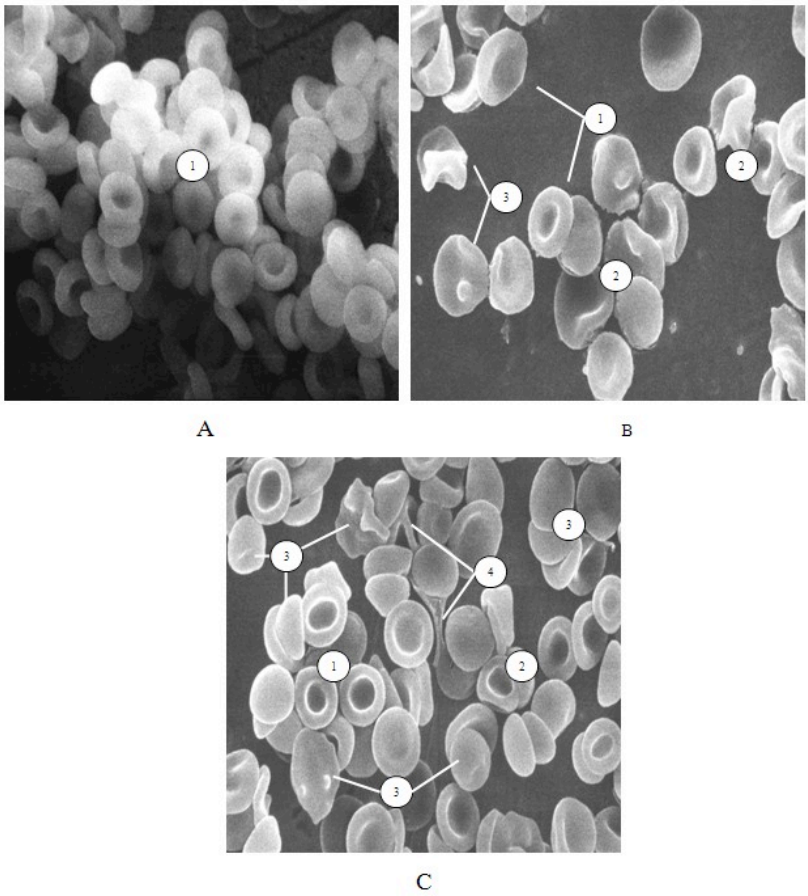

Fig. 1. Restructuring of erythrocytes of peripheral blood of female volleyball players with eukinetic, hypodynamic and hyperkinetic types of hemo-dynamic after the physical activity of the maximum aerobic power: 1 – normal forms of erythrocytes, 2 – reversibly changed forms of erythrocytes, 3 – irreversibly changed forms of erythrocytes, 4 – "adhesion threads". The scanning electronic microscopy. Fig. 1A is increased in 1200 times; fig. 1B and fig. 1C are increased in 1500 times.

Discussion

It is known that different morphofunctional parameters are actively applied in estimating of adaptation potential of a human body. These parameters are integrate and informative in planning training process and predicting the level of physical fitness of athletes [21].

Recognized parameters of the influence of positive and negative factors are the index of functional systems tension and parameters of heart rate variability [10]. However many aspects of this problem remain insufficiently studied. In particular, the hemo-cardioregulation system provides close interrelation between a contour of vegetative regulation and organs of the cardiorespiratory system. It also demands consideration of erythrocytes condition [13]. In scientific literature, we haven't found data concerning studying such interrelation; changes of these components of hemo-cardioregulation system in physical activity of different power.

Aerobic physical activities of different level of intensity play a significant role in the formation of the general endurance of an organism. It is especially important during competitions of female volleyball players [21]. It integrates a large number of processes occurring in the different levels: from cellular and to a complete organism [10]. The leading role in researches of endurance belongs to the determination of factors which promote activization of power exchange and the vegetative systems of its providing: cardiorespiratory and humoral. At the same time, the researches of cellular reactions in physical activity in the course of training which connected with the increase in the general endurance of an organism of female volleyball players remain out of sight are neglected [22, 23].

Erythrocytes are convenient objects for such researches. Erythrocytes take part in the processes connected with homeostasis maintenance at the level of the whole organism [7, 10, 24]. These cells could take part in the regulation of an acid-base balance, water and electrolytic to balance, microrheological blood state. They also connect amino acids, lipids, and toxins. All this is of direct interest in the development of the general endurance of athletes' organism [25].

It is defined that in 57% of female volleyball players with hyperkinetic type of cardio-hemo-dynamic there are negative morphological changes of erythrocytes. It is caused by biochemical violations and intracellular

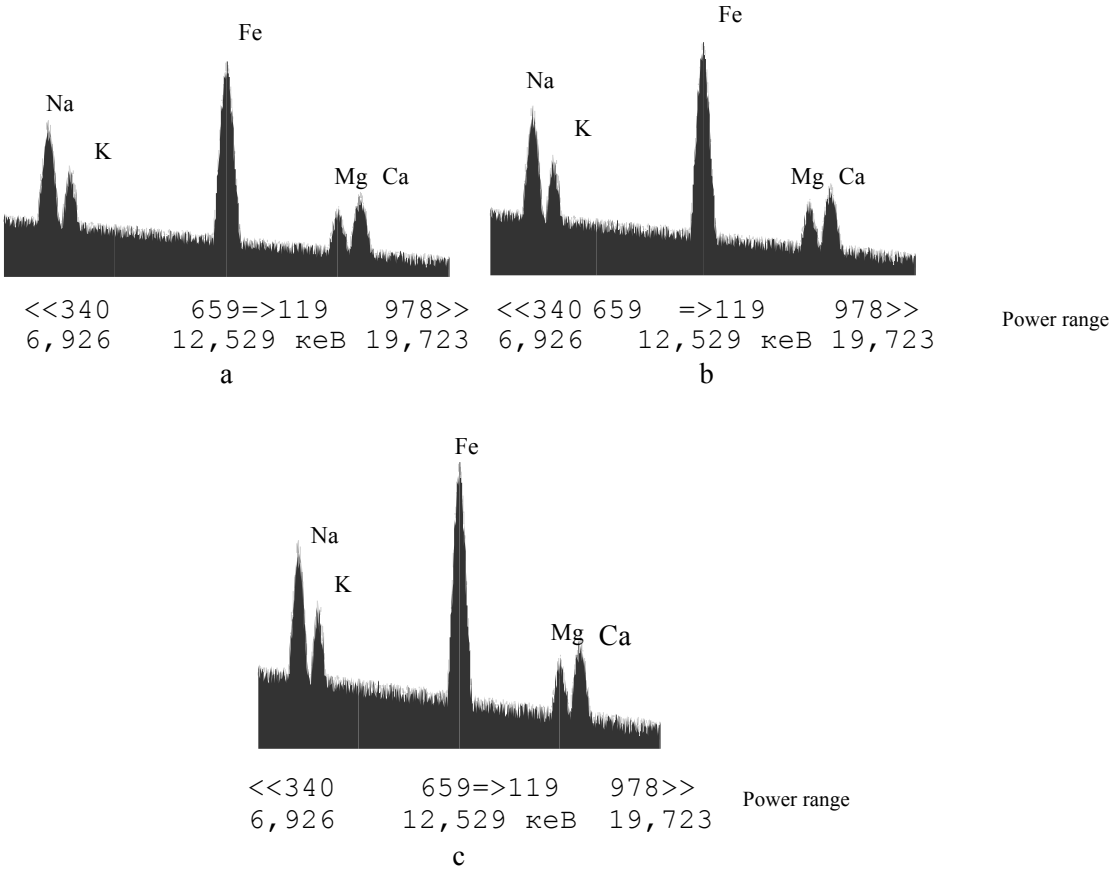

Fig. 2 The histogram of macroelements contents distribution in erythrocytes in female volleyball players with hypodynamic, eukinetic and hyperkinetic cardio-hemo-dynamic types.

prevalence of concentration of magnesium [11] and calcium [26] ions. The obtained data demonstrate that at rest to female volleyball players with hyperkinetic type of cardio-hemo-dynamic higher requirements to the power supply of heart activity. It can be explained by the prevalence of parameters of systolic blood pressure at them. It is followed by increase in need of myocardial oxygen requirement [27].

Female volleyball players with hypodynamic and eukinetic type of cardio-hemo-dynamic performed by more economical heart work. The proof is that they have the highest absolute values of heart work parameters: the waste energy for movement of one liter of minute volume of blood; capacities of left ventricle contraction and stroke volume output.

It is known that the human organism of with different type of blood circulation reacts to physical activity of the maximum aerobic power by the increase in heart index [5, 10, 13, 28]. In a comparison of heart index values was traced the tendency to increase of its values from hypodynamic blood circulation to hyperkinetic type. Female volleyball players with hyperkinetic type of cardio-hemo-dynamic had the highest parameters of heart index. Under such circumstances, there are violations of the structural integrity of erythrocytes. It promotes their intravascular lysis and could lead to the development of anemia [29]. The existence of these changes has a negative impact on the level of somatic health and sports effectiveness of female volleyball players. It demands the corresponding correction of the training process and timely application of adequate actions which are directed to the elimination of development of possible pathological changes in an organism of female volleyball players.

The performed research demonstrated that cardioregulation depends on typological features of human's erythrocytes: deformability and intracellular concentration of macroelements.

Conclusions

It is observed close correlation interrelation (r=0,83) between the type of cardio-hemo-dynamic and biochemical parameters of blood which defines a certain type of erythrocytes deformation and their increased ability to aggregation. Therefore the quantitative definition of back and not back changed forms of erythrocytes of peripheral blood could have practical value: control of a condition of athletes' organism in the training process.

Conflict of interests

The authors declare that they have no conflict of interest.

References

1. Korkushko OV. *Methods of the analysis and age standards of heart rate variability.* Kiev: Health; 2008. (in Russian)
2. Lisovs'kij B. Functional reserves of cardiorespiratory system as parametre of person's health. *Visnik Prikarpats'kogo universitetu,* 2006;2:31-34. (in Ukrainian)
3. Dovganik MS, Chichkan OA, Strel'chenko VV, Iavors'kij OG. Changes in the cardiovascular system of men and women for long jogging sessions. *Slobozhans'kij naukovo-sportivnij visnik,* 2014;2:76-79. (in Ukrainian)
4. Jagiello W, Jagiello M, Kalina RM, Barczynski BJ, Litwiniuk A, Klimczak J. Properties of body composition of female representatives of the Polish national fencing team - the sabre event. *Biology of Sport.* 2017;34(4):401-406. doi:10.5114/biolsport.2017.70526
5. Mikhajlov VM. *Stress testing under control of the ECG.* Ivanovo: publishing house IGMI; 2005. (in Russian)
6. Barker D, Wallhead T, Quennerstedt M. Student learning through interaction in physical education. *European Physical Education Review*. 2016;4: 1-6. doi:10.1177/1356336x16640235
7. Jensen FB. The dual roles of red blood cells in tissue oxygen delivery: oxygen carriers and regulators of local blood flow. *Journal of Experimental Biology*. 2009;212(21): 3387-93. doi:10.1242/jeb.023697
8. Tan Y, Sun D, Wang J, Huang W. Mechanical characterization of human red blood cells under different osmotic conditions by robotic manipulation with optical tweezers. *IEEE Transactions on Biomedical Engineering*. 2010;57(7): 1816-25. doi:10.1109/tbme.2010.2042448
9. Lorente-Catalan E, Kirk D. Student teachers understanding and application of assessment for learning during a physical education teacher education course. *European Physical Education Review*. 2015;22(1): 65-81. doi:10.1177/1356336x15590352
10. Mikhaylova LA. Central hemodynamics indices in senior pupils with increased educational and motive loading. *Siberian Medical Review*. 2013;3,55-8. doi:10.20333/25000136-2013-3-55-58
11. Brock SJ, Rovegno I, Oliver KL. The influence of student status on student interactions and experiences during a sport education unit. *Physical Education & Sport Pedagogy*. 2009;14(4): 355-75. doi:10.1080/17408980802400494
12. Malikov MV, Bogdanovs'ka NV, Svat'iev AV. *Functional diagnostics in physical training and sport*. Zaporozhye: ZNU; 2006. (in Ukrainian)
13. Romanenko VA. *Diagnostics of functional abilities of a human body*. Donetsk: Publ., DNU; 2005. (in Russian)
14. Bergamini C, Gambetti S, Dondi A, Cervellati C. Oxygen, Reactive Oxygen Species and Tissue Damage. *Current Pharmaceutical Design*. 2004;10(14): 1611-26. doi:10.2174/13816120433846 64
15. Svat'iev AV, Malikov MV. *Functional diagnostics in physical training and sport*. Zaporozhye: ZSU;, 2004. (in Ukrainian)
16. Bianchini K, Wright PA. Hypoxia delays hematopoaesis: retention of embryonic hemoglobin and erythrocytes in larval rainbow trout, Oncorhynchus mykiss, during chronic hypoxia exposure. *Journal of Experimental Biology*. 2013;216(23): 4415-25. doi:10.1242/jeb.083337
17. Fuks AI, Elderer J, Ellemunter H. Cardiology clearance index: Normal values, repeatability, and reproducibility in Cardiology system-healthy children. *Pediatric Cardiology*, 2010;43(12): 1180-85.
18. Mytckan B, Popel' S, Vipasniak I. Morpho-functional changes in the oxygen-transport system of students at the testing of cardiorespespiration stability. *Health, Sport, Rehabilitation,* 2017;*3*(4):41-47. doi:10.5281/zenodo.1136083
19. Valbonesi M, Garelli S, Montani F, Cefis M, Florio G. A simple and rapid test for the quantification of osmotic fragility of red blood cells. *Acta Haematologica*. 2009;69(2): 106-10. doi:10.1159/000206863
20. Popel' SL, Mitckan BM, Lapkovskiy EI. Mechanism of changing adaptation potential and morpho-biochemical parameters of erythrocytes in students with different mode of day after physical load. *Regulatory Mechanisms in Biosystems*. 2017;8(2): 124-34. doi:10.15421/021711
21. Lambert MI. *General Adaptations-Exercise: Acute Versus Chronic and Strength Versus Endurance Training. Exercise and Human Reproduction.* New York, London: Heidelberg Dordrecht; 2016. doi:10.1007/978-1-4939-3402-7_6
22. Kang M. Should the physical educator be held accountable for student physical activity levels beyond physical education? *Physical Education, Recreation & Dance*. 2016;87(6): 55-56. doi:10.1080/07303084.2016.1192930
23. Koumantakis GA, Watson PJ, Oldham J. A. Supplementation of general endurance exercise with stabilisation training versus general exercise only. *Clinical Biomechanics*.2005;20(5), 474-82. doi:10.1016/j.clinbiomech.2004.12.006
24. Mairbäurl H. Red blood cells in sports: effects of exercise and training on oxygen supply by red blood cells. *Frontiers in Physiology*. 2013;4: 34-36. doi:10.3389/fphys.2013.00332
25. Mohanty JG, Nagababu E, Rifkind JM. Red blood cell oxidative stress impairs oxygen delivery and induces red blood cell aging. *Frontiers in Physiology*. 2014;5: 1-5. doi:10.3389/fphys.2014.00084
26. Chang Y, Bo B. Effects of exhaustive exercise on the ATP-sensitive potassium channel of rat cardiac sinoatrial node. *Journal of Science and Medicine in Sport*. 2015;19: 65. doi:10.1016/j.jsams.2015.12.159
27. Sassen B, Cornelissen VA, Kiers H. Physical fitness matters more than physical activity in controlling cardiovascular disease risk factors. *European Journal of Cardiovascular Prevention & Rehabilitation*. 2009;16(6): 677-83.
28. Soares-Miranda L, Sandercock G, Valente Y. Vigorous physical activity and vagal modulation in young adults. *European Journal of Cardiovascular Prevention & Rehabilitation*. 2009;16(6): 705-11.
29. Matarrese P. Peroxynitrite induces senescence and apoptosis of red blood cells through the activation of aspartyl and cysteinyl proteases. *FASEB Journal*. 2005;19(3): 416-18. doi:10.1096/fj.04-2450fje

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Conclusions
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