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CONTENTS

PEDAGOGY of Physical Culture and Sports (Pedagogics, psychology, medical-biological problems of physical training and sports)

The effects of smoking addiction and physical activity on some respiratory functions in female university students

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

Abstract

Purpose: The aim of this study is to examine the effects of smoking addiction and physical activity on some of the respiratory functions in female university students.

Material: 103 female students who did not have any health problems, who had an average age of 20,00 (years), average height of 163,6 (cm) and average weight of 55,88 (kg) participated in the study voluntarily. Female students who participated in the study were grouped according to their states of having smoking addiction (athlete, sedentary) and doing exercise (athlete, sedentary) and later some of the respiratory functions were measured. SPSS program was used in the statistical analysis of the data obtained. Shapiro-wilk test was used to find out the normality distribution of the data. Kruskal Wallis test was used in the analysis of the data which were not normally distributed and Mann-Whitney U test was used in sub-groups.

Results: FVC(Forced Vital Capasity), FEV1(Forced Expiratory Volume in 1 second), FEV1(Forced Expiratory Volume in 1 second)/FVC(Forced Vital Capasity), PEF(Peak Expiratory Flow), FEF25-75% (Forced Expiratory Flow at 25-75%), VC(Vital Capacity) and MVV(Maximal Voluntary Ventilation) values of the female students who were engaged in sports were found to be significantly higher when compared with the groups which were not engaged in sports ($p<0,05$).

Conclusions: In addition, in terms of the variable of smoking addiction, statistically significant difference was found between the FEV1, FEV1/FVC(%), PEF (L/s), FEF25-75% (L/s) and MVV values of the female student groups in favour of sedentary and athlete students who were not smokers.

Keywords: respiratory functions, woman, exercise, smoking addiction, physical activity.

Introduction

Smoking has a great number of negative effects on the systems in the human organism. Respiratory system is one of the systems most affected by smoking. Smoking addiction is an important risk factor that causes hypersensitivity in the bronchi, congestion or contraction of airways and diseases such as asthma and lung cancer [1, 2]. Diseases caused in the lungs by smoking spread from small airways to large airways [3]. Respiratory system is one of the systems that exercise and physical activity directly affect [4].

Exercise and physical activity cause the development of strength and endurance of respiratory muscles, decrease in the resistance in airways in lungs and increase in the volume and capacity of lungs and also increases the elastic properties of lungs [5]. Healthy lung capacity and strong respiratory muscles are very important for athletes [6]. Cardiorespiratory capacity is one of the important factors determining athlete performance [7]. A great number of previously conducted studies have reported that lung capacity influences athlete performance [8].

Although there are studies in the literature which have addressed the effects of smoking addiction and physical activity in adult women on respiratory capacity, there are few studies examining the effect of both factors together on respiratory functions. In the light of the data obtained from our study, we believe that a better understanding of the effects of smoking addiction and physical activity simultaneously on the adult female population will contribute to increasing awareness about protection from fatal lung diseases and sportive performance.

The aim of this study is to examine the effects of smoking addiction and physical activity on some of the respiratory functions in female university students.

Material and Method

Participants. 103 female students who did not have any health problems, who had an average age of 20,00 (years), the average height of 163,6 (cm) and an average weight of 55,88 (kg) participated in the study voluntarily. Female students who participated in the study were grouped according to their states of smoking (athlete, sedentary) and doing exercise (athlete, sedentary). Prior to the study, criteria that could affect the study were determined and the subjects who did not meet the criteria were excluded. Inclusion criteria were as follows:

- For the group with smoking addiction, not having any substance and alcohol addiction and having smoked at least for three years,
- For the group doing exercise, having a sport age of at least two years or more and doing sport regularly at least for an hour a day for five days a week.

SpirometricMeasurements

Respiratory function values of the female students who participated in the study were found by using a spirometer (Pony Fx, Italy). Before conducting the test, the subjects

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were informed about the rules to follow (not having a heavy meal two hours before the test, not smoking an hour before the test, not drinking alcohol 4 hours before the test, not doing intense exercise 30 minutes before the test, not wearing clothes that can tighten the rib cage, not using bronchodilator, etc.) and the procedure for a healthy measurement. After getting the voluntary consents of the participants, 10879717-050.01.04 numbered and 06/11/2019 dated ethical board approval report was taken from MuşAlpaslan University Ethical Board.

All of the measurements were made when the students were in sitting position. The tests were conducted after the students were adjusted by making them aspirate a few times with a mouthpiece attached to a spirometer while their noses were closed with a latch. The measurements were repeated three times and the best value was recorded.

Statistical Analysis.

SPSS program was used in the statistical analysis of the data. Shapiro-wilk test was used to find out the normality distribution of the data. Kruskal Wallis test was used in the analysis of the data which were not normally distributed and the Mann-Whitney U test was used in sub-groups.

Results

Respiratory functions can differ according to body composition and anthropometric measurements [9]. When Table 1 is reviewed, it can be seen that the groups show a homogeneous distribution.

When Table 2 is examined, it can be seen that FVC, FEV1, FEV1/FVC(%), PEF (L/s), FEF25-75% (L/s), VC and MVV values of female athlete groups were significantly higher when compared with sedentary groups ($p<0,05$). In addition, a statistically significant difference was found in favor of non-smoking sedentary and athlete groups between FEV1, FEV1/FVC(%), PEF (L/s), FEF25-75% (L/s) and MVV values of female student groups in terms of smoking addiction.

Table 1. BMI values of female university students

Parameters	Group		N	Ave.	S.D.	Rank Mean	Chi-Square	P	Significance
BMI (kg/m²)	1	Athlete	25	20.15	1.54	47.84	1.374	0.712	p>0,05
	2	Athlete, smoking addict	26	21.30	3.40	54.79			
	3	Non-athlete	27	20.99	2.18	55.80			
	4	Non-athlete, smoking addict	25	20.96	3.51	49.16			
		Total	103	20.86	2.77				

Table 2. Respiratory function analyses of female university students

Parameters	Group		N	Ave.	S.D.	Rank Mean	Chi-Square	P	Significance
FVC(L)	1	Athlete	25	3.93	0.54	66.42	13.512	0,004	1-3, 1-4
	2	Athlete. smoking addict	26	3.69	0.35	58.63			
	3	Non-athlete	27	3.54	0.64	43.87			
	4	Non-athlete. smoking addict	25	3.44	0.51	39.46			
		Total	103	3.65	0.55				
FEV1(L)	1	Athlete	25	3.47	0.41	75.70	27.400	0,000	1-2, 1-3, 1-4, 2-4, 3-4
	2	Athlete. smoking addict	26	3.06	0.33	51.63			
	3	Non-athlete	27	3.05	0.51	49.09			
	4	Non-athlete. smoking addict	25	2.72	0.48	31.82			
		Total	103	3.08	0.51				
FEV1/FVC% (%)	1	Athlete	25	89.33	4.24	68.94	21.726	0,000	1-2, 1-4, 3-4
	2	Athlete. smoking addict	26	83.09	6.21	41.90			
	3	Non-athlete	27	86.73	8.09	61.61			
	4	Non-athlete. smoking addict	25	79.24	10.56	35.18			
		Total	103	84.62	8.42				
PEF (L/s)	1	Athlete	25	6.35	1.04	82.34	47.069	0,000	1-2, 1-3, 1-4, 2-4, 3-4
	2	Athlete. smoking addict	26	4.55	1.17	46.35			
	3	Non-athlete	27	4.92	1.13	54.22			
	4	Non-athlete. smoking addict	25	3.52	1.07	25.14			
		Total	103	4.83	1.48				

Table 2 Cont.

Parameters	Group		N	Ave.	S.D.	Rank Mean	Chi-Square	P	Significance
FEF25-75% (L/s)	1	Athlete	25	4.26	0.64	79.60	37.914	0,000	1-2, 1-3, 1-4, 2-4, 3-4
	2	Athlete. smoking addict	26	3.30	0.65	46.73			
	3	Non-athlete	27	3.49	0.78	53.44			
	4	Non-athlete. smoking addict	25	2.80	0.66	28.32			
		Total	103	3.46	0.85				
VC (L)	1	Athlete	25	3.68	0.52	65.38	9.985	0,019	1-3, 1-4
	2	Athlete. smoking addict	26	3.46	0.33	56.35			
	3	Non-athlete	27	3.34	0.58	44.69			
	4	Non-athlete. smoking addict	25	3.26	0.44	42.00			
		Total	103	3.43	0.50				
MVV (L/min)	1	Athlete	25	96.58	22.73	67.20	26.208	0,000	1-4, 2-4, 3-4
	2	Athlete. smoking addict	26	87.85	15.79	55.62			
	3	Non-athlete	27	88.84	16.22	58.07			
	4	Non-athlete. smoking addict	25	67.56	15.44	26.48			
		Total	103	85.30	20.47				

NOTES. Parameters: FVC(L) - Forced Vital Capasity; FEV1(L)- Forced Expiratory Volume in 1 second; FEV1/FVC (%)-Forced; Expiratory Volume in 1 second)/Forced Vital Capasity; PEF (L/s)- Peak Expiratory Flow; FEF25-75% (L/s)- Forced Expiratory Flow at 25-75%; VC (L)- Vital Capacity; MVV (L/min)- Maximal Voluntary Ventilation

Discussion

The results of our study in which the effects of smoking addiction and physical activity on some respiratory functions in female students were examined are discussed respectively below.

VC value shows the amount of gas let out with maximal expiration following maximal inspiration [10]. FVC value decreases when there is blockage or contraction in airways [11]. In our study, differences were found in VC and FVC values of groups only in terms of the variable of physical activity. In a study in which the effects of different training methods on respiratory functions of adult women were examined, FVC and VC values of athletes were found to be significantly better when compared with sedentary individuals [12]. It can be said that FVC and VC values in female students were influenced by the variable of doing sports rather than the variable of smoking.

FEV1 value generally gives information about the state of large airways, PEF values shows the function of large airways. FEF(25-75) value gives information about airflow in medium and small-sized bronchi [13,14]. In our study, a significant difference was found in FEV1, PEF, FEF(25-75) values in favor of the groups doing physical activity and not smoking in terms of the states of both smoking addiction and doing physical activity ($p<0,05$). In a previously conducted study, it was reported that PEF and FEF (25% - 75%) values of women who were doing sport were significantly higher than those of sedentary women and there were no statistically significant differences in FEV1 values [13]. In another study, a statistically significant increase was found in the PEF value following running training [15]. In a study conducted on female judokas, no statistically significant difference was found between groups in terms of FEV1, PEF, FEF (25-75) values [16]. In some studies, it has been reported that smoking addiction causes contraction of large and middle airways and that this contraction was directly proportional to the duration of smoking [17]. We believe that the results of our study are due to the positive effects of physical activity such as increasing the elasticity of respiratory muscles, lung capacity and lungs and decreasing the airway resistance and also due to the common effect caused by the increase in airway resistance because of smoking.

Statistically significant difference was found in FEV1/FVC values between athlete group and non-smoking group and non-smoking and sedentary group ($p<0,05$). In a study conducted on university students, FEV1/FVC values of students who were smokers were found to be lower [18]. We think that this is a combined effect of the positive effect of physical activity on FEV1 value and the negative effect of smoking addiction on FEV1 value.

MVV value decreases in situations when airway resistance increases, respiratory muscles are influenced and lung and thoracic compliance increase and decrease and respiratory control mechanisms are disrupted [19, 20]. In our study, it was found that MVV values of smoking addict sedentary female students were statistically significantly lower when compared with the other groups ($p<0,05$). In some studies, it has been reported that smoking individuals produce more phlegm

(11). We believe that this may be due to the combined effect of physical activity and smoking addiction on the lungs.

Conclusion

Our study results show that the respiratory functions of female students who do sports are better than sedentary female students and that respiratory functions of non-smoking sedentary female students are better when compared with smoking addict sedentary female students. Thus, it can be seen clearly that physical activity improves respiratory functions, while smoking addiction clearly disrupts respiratory functions. In this context, it can be said that both factors have a significant effect on respiratory functions.

As conclusion, due to the fact that smoking addiction and exercise had separately distinct effects on respiratory functions in female university students, we believe that sports and physical activity are not enough to prevent the damage that occurs in respiratory functions due to smoking.

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Conflict of ınterest

The authors do not have any conflict of interest.

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The citizenship and its relationship with the social responsibility among physical education teachers

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

Abstract

Purpose: The study aimed to know the level of citizenship and the level of social responsibility among the teachers of physical education and examine the relationship between the citizenship and the social responsibility.

Material: The participants were 49 physical educations teachers' (male) from middle schools. The citizenship and the social responsibility scales were used as search tools.

Results: the level of citizenship and social responsibility is high among teachers of physical education, and there is a positive correlation between citizenship and social responsibility.

Conclusions: To enrich the results of this study it is better to do other studies in the future, such as a comparative study on citizenship among teachers of physical education in the middle and secondary stage, a study on citizenship and its relationship to cultural and social background.

Keywords: citizenship, social responsibility, physical education, teachers, middle schools.

Introduction

The concept of citizenship is defined as a systemic concept that refers to fundamental human rights, civil and political rights, social, economic and cultural rights [1]. The concept of citizenship is defined by its linkage to time and space [2], as well as collective rights, they relate to all areas of personal, private, public and political human activity [3]. Affiliation to a homeland means that citizens have full membership, and that there is equal rights and duties between them [4] and consolidating the principle of tolerance and respect despite diversity and difference in custom, religion, thought, financial status and political affiliation [5].

Social responsibility is the commitment of the individual to his / her actions towards society by contributing a range of social activities related to community service [6]. Social responsibility is associated with several concepts including rights and duties, identity and citizenship, ethics and values, individual and collective conscience [7].

It is inconceivable that a society with a whole slice does not fulfil its role at home [8]. It is inconceivable that a society lacks conscience and responsibility towards themselves and those around them, and lacks a sense of community and home issues, believing in the important role and practice of personal, social and legal responsibility is part of the continuation and survival of societies and individuals and the maintenance of their balance [9, 5]. Society cannot appoint an observer for each individual in the execution of his duties, what is required of him in his work, in the role he plays in serving the society, and in following public order, everyone must have a certain amount of responsibility in the performance of their duty, and do their part before there is accountability or legal question [10]. The sense of citizenship values is the intergenerational struggle over citizenship that every generation has belonging to the homeland more than others [11], and that some people are less belonging to the homeland and this is due to the selfish and individualistic behaviors of many members of the homeland and reluctance to participate seriously in building the homeland, which is represented in the natural environment, human environment and technological environment [5, 7].

Teacher of physical education, like other teachers must exercise his affiliation in front of his students and the community [12], emphasizing his identity and proud of his culture and traditions, tolerant, opposed for everything that threatens his identity and doubts his affiliation [13]. Physical education teacher must assume multiple social responsibilities, such as instilling a culture of citizenship for students and raising awareness for the members of the community in which he lives [14], one of his most important roles is to modify and develop students behavior in line with the customs, ethics, and social traditions prevailing in society [15, 16, 17].

The aim of this study is to know the level of Citizenship and Social responsibility, to investigate relationship between Citizenship and Social responsibility among physical education teachers, no research studies to date have combined this unique set of variables specifically in the field of physical education and sports.

For the purpose of this study, the research study hypotheses were as follows:

HYP.1 There is high level of Citizenship among physical education teachers.

HYP.2 There is high level of Social responsibility among physical education teachers.

HYP.3 There is (positive) correlation relationship between Citizenship and Social responsibility among physical education teachers.

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Material and methods

Participants

The statistical community in our study represents all teachers of physical education in the middle schools of the city of Ouargla, after conducting the exploratory study on ten (10) teachers (psychometric characteristics) were among the sample to be studied, and after retrieving the questionnaires the number of members of the sample of the basic study were (49) teachers.

Procedure

This field study started in February 2019 until April 2019 ,the researcher distributed the scale of citizenship and social responsibility in the form of a questionnaire based on a set of questions addressed to (59) teachers from the middle schools of Ouargla city , These questionnaires were retrieved in order to carry out the necessary statistical operations (49 questionnaires were returned).

Instruments

In this study, two scales were used to collect data. The first scale is citizenship was prepared by Labouz [18], the scale consisted 102 items, was distributed according to the Likert type scale, to three dimensions: A- Independence and critical thinking (includes 37 items).B- Tolerance, solidarity and acceptance of the other (includes 22 items).C- Openness and liberation from political and social hatred (includes 43 items). During the study, the researcher used only dimension A and B they serve the purpose of the study. Cronbach alpha reliability value of the scale was found (0.80). The second scale is social responsibility was prepared by Bakar [19], the scale consisted 78 items, was distributed according to the Likert type scale. Cronbach alpha reliability value of the scale was found (0.92).

Data analyses

Data analyses were carried out by means of statistical packet for social sciences (SPSS) 25.00 software program. The Mean, Std. Deviation and Pearson Correlation were used in the main study. In addition, alpha-Cronbach was used in the exploratory study.

Results

Level of citizenship among physical education teachers

In Table 1, it was found that the highest arithmetic mean of citizenship scale was estimated at (*M*=2.95) at standard deviation (*SD*=0.19), while the lowest arithmetic mean of citizenship scalewas (*M*=1.38) at standard deviation (*SD*=0.67), it was also found that the value of the total arithmetic mean of the citizenship scale was estimated at (*M*=2.21) with a standard deviation of (*SD* 0.16), which shows that the level of citizenship is somewhat high among physical education teachers.

Table (02) shows that the highest arithmetic mean of the social responsibility scale was estimated at (*M*=3.79) at standard deviation (*SD*=0.45), the lowest arithmetic mean of the social responsibility was (*M*=1.93) at the standard deviation (*SD*=1.19), it was also found that the value of the arithmetic mean as a whole of the social

Table 1. Shows the means and standard deviations of theLevel of Citizenship among physical education teachers citizenship scale among physical education teachers

Item	N	Mean(M)	SD	Item	N	Mean(M)	SD
1	49	2.51	.810	23	49	1.93	.870
2	49	2.57	.760	24	49	2.75	.560
3	49	2.71	.610	25	49	1.55	.790
4	49	2.87	.330	26	49	2.20	.880
5	49	2.00	.930	27	49	2.67	.680
6	49	2.83	.470	28	49	2.26	.860
7	49	2.85	.400	29	49	1.38	.670
8	49	2.26	0.860	30	49	1.57	.790
9	49	2.69	.680	31	49	2.71	.570
10	49	2.73	.670	32	49	1.32	.710
11	49	2.77	.510	33	49	1.53	.760
12	49	2.16	.740	34	49	1.55	.700
13	49	2.77	.510	35	49	1.97	.940
14	49	2.48	.640	36	49	1.87	.780
15	49	1.69	.890	37	49	1.87	.800
16	49	2.46	.790	38	49	1.89	.820
17	49	1.63	.750	39	49	1.75	.850
18	49	1.71	.840	40	49	2.46	.760
19	49	1.61	.860	41	49	2.61	.570
20	49	2.63	.690	42	49	2.26	.830
21	49	2.95	.190	43	49	1.61	.730
22	49	2.36	.780	**Total**	**49**	2.21	.160

Table 2. Shows the mean and standard deviations of the social responsibility scale among physical education teachers

Item	N	Mean	SD	Item	N	Mean	SD	Item	N	Mean	SD
1	49	3.44	.810	23	49	3.46	.910	45	49	3.32	**1.00**
2	49	3.75	.590	24	49	3.34	.960	46	49	2.20	**1.15**
3	49	3.79	.570	25	49	3.71	.640	47	49	3.28	**1.02**
4	49	3.36	.830	26	49	3.79	.570	48	49	3.71	**.610**
5	49	3.65	.770	27	49	3.79	.450	49	49	3.61	**.750**
6	49	3.67	.740	28	49	2.73	1.07	50	49	3.65	**.720**
7	49	3.61	.860	29	49	2.26	1.07	51	49	3.75	**.630**
8	49	3.59	.810	30	49	3.08	1.11	52	49	3.53	**.790**
9	49	3.65	.720	31	49	3.46	.950	53	49	3.87	**.380**
10	49	3.51	.790	32	49	3.18	.830	54	49	3.67	**.680**
11	49	2.95	.990	33	49	2.67	1.10	55	49	3.75	**.480**
12	49	3.22	.790	34	49	3.46	.950	56	49	2.16	**1.21**
13	49	3.04	1.01	35	49	3.44	.760	57	49	3.36	**.830**
14	49	3.38	.780	36	49	3.06	.960	58	49	3.16	**1.08**
15	49	3.10	1.02	37	49	3.44	.790	59	49	2.83	**1.23**
16	49	3.53	.760	38	49	3.40	.970	60	49	3.63	**.720**
17	49	3.63	.660	39	49	3.34	1.05	61	49	2.53	**1.20**
18	49	2.83	1.02	40	49	1.93	1.19	62	49	3.87	**.380**
19	49	3.65	.770	41	49	2.95	1.11	63	49	3.67	**.550**
20	49	3.67	.770	42	49	2.20	1.02	64	49	3.83	**.550**
21	49	3.00	1.00	43	49	3. 24	.900	65	49	3.81	**.520**
22	49	2.55	1.04	44	49	3.12	.970	**Total**	**49**	**3.32**	.280

Table 3. Shows the Pearson correlation coefficient between the scales of citizenship and social responsibility among physical education teachers

Citizenship scale social responsibility scale	N	Correlation coefficient	Significance level
	49	0.61	0.01

responsibility scale was estimated at (*M*=3.32) with a standard deviation (*SD*=0.28).Thus, it was found that the level of social responsibility is somewhat high among physical education teachers.

The relationship between Citizenship and Social responsibility among physical education teachers

It is clear from table (03) that there is a positive correlation between citizenship and social responsibility amongphysical education teachers, where the value of the correlation coefficient Pearson was (0.61) at the level of significance (0.01), meaning that the greater the awareness of the concept of citizenship, the more sense of social responsibility.

Discussion

In this study, we sought to investigate the level of f citizenship and social responsibility among physical education teachers, and to know the correlation between citizenship and social responsibility.

As results of this study, it was concluded that the physical education teachers had high level of citizenship, this shows the spirit of patriotism they enjoy, as well as their possession of the values of citizenship and love and ending their homeland and carrying out their duties towards him. It also shows that this category of teachers seeks in various ways and methods to gain and instill such values and others in the personality of the student, it contributes significantly to the preparation of a good citizen in the community to serve his community and his homeland. These findings coincided with the study of Labouz [18] which concluded that the level of citizenship is high among teachers in the intermediate education level, as well as the study carried out by Bouziane [20], which confirmed that the Algerian school contributes effectively in establishing the pillars of citizenship at the level of principle and application. Citizenship or education is not only a set of constitutional texts, laws and articles that define the rights and duties of members of society, individuals must be made aware as citizens, since it is considered a primary point of conducting their activities in daily life.

Results were concluded that the physical education teachers had high level of social responsibility, it is an important characteristic of the teacher, whether it is his responsibility towards the family, or towards the institution in which he works, his colleagues, friends,

neighbors, and other people who mix with them, towards society in general, or to humanity at large. Cooperation, sacrifice, altruism, love and help of others are behaviors, which reflect on the nature of society and the degree of stability of the positive. These results coincided with the results of Musharraf [21] study, which concluded that students of the Islamic University of Gaza have a high level of social responsibility.

Results were concluded that significant correlation between citizenship and social responsibility. among physical education teachers, the result is logical because the concept of citizenship is reinforced by a sense of social responsibility and the opposite is true; whenever teachers realize the rights and duties of citizenship, this puts on them the burden of the responsibility of the homeland, which shows through their social responsibility, it is the same conclusion reached by Al-Asfoor [22] when he examined a survey of citizens' opinions on the factors that increase the sense of citizenship, the most important of these factors is the citizen's capability to shoulder his responsibility towards the country and the other citizen.

Conclusion

Through the descriptive study about citizenship and social responsibility among physical education teachers in the middle school, which is a sensitive subject considering the changes taking place in the world today in general and the Arab world in particular, it was concluded through the study that the level of citizenship and social responsibility is high among teachers of physical education, and there is a positive correlation between citizenship and social responsibility.

Conflict of interest

The authors declare that there is no conflict of interest.

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The effect of sports shoes on flat foot

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

Abstract

Purpose: This study was conducted to determine the effects of participation in sports on the structural deformities of the foot.

Material: A total of 2013 athletes (1301 males, 712 females) who had regularly participated in sports for a minimum of three years were included in the study. Screening of the sole was performed using a podoscope as it is a reliable and practical device. The structure of the sole was evaluated with the highly valid Staheli index.

Results: A significant relationship was detected between the ages of the athletes, years in sport, branch of sports variables and the prevalence of flat foot. However, no significant relationship was found between the athletes' gender and the prevalence of flat foot.

Conclusions: It is thought that the training regimes, the floor on which the sports is performed and the shoes used in sports had effects on flat foot deformity. Based on our results, we assert that redesigning the competition shoes and using sports shoes with arch support during warm-ups, running and other sportive and educational drills outside the routine activities of the sports branch may be beneficial for foot health.

Keywords: branch of sports, flat foot, pes planus, sports shoes.

Introduction

The foot is an important organ in our body that bears the entire weight of the body, initiates the chain of motion, forms a support base for an upright posture of the body and is the most mechanically forced limb [1]. Therefore, structural and biomechanical problems of the foot are the key factors in determining the functions of the lower extremities and the etiology of recurring injuries [2, 3].

Several studies regarding the analysis and evaluation of the footprint can be found in the literature [4-6]. Flat foot deformity, also known as pes planus, is usually described as a decrease in the height or loss of the medial longitudinal arch (MLA) or as the malalignment of the hindfoot (hindfoot valgus) [4]. Although the prevalence of the disorder increases with the loosening of the ligaments in the foot, not all flat foot deformities are the same [7]. Therefore, in diagnosing the disorder, assessment of the loss of height in the MLA [8, 9], clinical examination [10], ultrasonography [11], somatometric measurements [12], inked or digital foot printing [4], pedobarography [9] and photographic imaging [13] techniques are used. Individuals with flat foot deformity are more susceptible to foot and knee pain, stress fractures, foot injuries and low performance while exercising [14]. Such occurrences are more evident among athletes as the repetitive movements used in competitive sports exerts a higher load on the feet than usual [15, 16]. Although participation in sports leads to musculoskeletal adaptations and results in significant changes in the structure and plantar pressures of the foot, the different athletic tasks performed in various sports may have an impact on the injury risk factors [17].

Previous studies reported significant differences between plantar pressure patterns of athletes and non-athletes when the playing surface and gender were taken into account [18-21]. However, studies investigating the foot structure of the athletes are limited. Thus, the effects of different branches of sports on foot structure have not yet fully been understood. Therefore, a study with a population of athletes may provide information regarding age and gender-related differences and help to determine the effect of sports participation on the foot structure.

Consequently, the objective of this study was to investigate the effects of different branches of sports on the structure of the foot in amateur athletes.

We hypothesized that amateur athletes who participate in various sports are more likely to have structural foot disorders due to repetitive mechanical loads on the foot.

Materials and Methods

Participants

The study included a total of 2013 amateur athletes (1301 males, 712 females) who regularly participated in sports for a minimum of three years and who exercised at least three days a week. Individuals with foot disorders, open wounds, any co-existent musculoskeletal pathologies, concurrent use of in-shoe orthotics or a previous spinal/lower limb surgery were excluded. Demographic data of the participants including age, gender, years active in sport and branch of sports were recorded. Of the participants, 603 were wrestlers (536 males, 67 females), 259 were soccer players (133 males, 126 females), 146 were swimmers (98 males, 48 females), 146 were handball players (65 males, 81 females), 137 were boxers (114 males, 23 females), 125 were judo players (72 males, 53 females) and 56 were race-walkers (32 males, 24 females) (Table 1).

Research Design

Many methods have been used, such as the measurement of height loss in the medial longitudinal arch have been used in classification [22], the toe raise 'Jack' test or the Hubscher maneuver are most commonly used for the

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Table 1. Demographic data of the participants.

Variable	f	%
Gender		
Male	1,301	64.6
Female	712	35.4
Total	2,013	100
Branch of sports		
Wrestling (Freestyle)	327	16.2
Wrestling (Greco-Roman)	276	13.7
Soccer	259	12.9
Taekwondo	247	12.3
Volleyball	160	7.9
Handball	146	7.3
Swimming	146	7.3
Boxing	137	6.8
Basketball	134	6.7
Judo	125	6.2
Race-walking	56	2.8
Total	2,013	100
Age range		
14-18	589	29.3
19-24	996	49.5
25-29	293	14.6
30 and over	135	6.7
Total	2,013	100
Participation in sports		
3-5 years	441	21.9
6-8 years	882	43.8
9-11 years	294	14.6
12-14 years	212	10.5
15 years and over	184	9.1
Total	2,013	100

classification of the flat foot as 'flexible' or 'rigid' [23]. The footprint method, the second most common technique, calculates the ratio between the narrowest width of the foot arch and the widest width of the heel region [4, 6]. The use of a podoscope devise have made measurements and evaluation of the footprint more accurate and quicker to perform. This method accurately identifies pressure problems and is capable of offering visual information on disorders such as flat foot, high arch, excessive pronation, early detection of hallux valgus, hammertoes, etc. [24]. Compared with other devices, a podoscope also carries the advantage of increased visibility of the foot since the pressure point information is fused with the rest of the plantar surface [24]. Therefore, in the current study the relationship between the sole and the stepped-on surface was assessed using a podoscope (Chinesport S.p.a., Udine, Italy). In this method, the person stands stable on a glass surface and the image of the foot is reflected onto a mirror beneath it. The image is then recorded on the computer and the planimetric index values calculated with supreme precision to determine whether the foot arch is normal, cavus or flat [3, 6, 24].

Informed consent was obtained from all participants and the study was approved by the Ethical Committee of Inonu University. All pre-measurement conditions such as the time spent between taking the shoes off and starting the test, the hardness of the surface stood on barefoot and the temperature of the test platform were identical for all participants. After thoroughly cleaning their soles with alcohol, the participants were asked to stand still in an upright normal orthostatic position on the podoscope and distribute their body weights equally on both feet. Their heads were positioned to look straight forward according to the Frankfurt plane.

The obtained image of the sole was analyzed using the Global Postural System/PODATA software. Generally, Staheli's plantar arch index (SI), Clarke's angle (CA) and the Chippaux-Smirak index (CSI) are used in analyzing the footprints. In our study, the structure of the sole was assessed using the highly valid SI [25]. The SI is the ratio obtained by dividing the narrowest width of the central foot to the widest width of the heel region (Fig. 1). The

range between 0.50 and 0.70 was considered normal, whereas a ratio of over 0.70 was accepted as pes planus [4].

Fig. 1. The footprint method.

Fig. 2. Schematic representation of the regions of measurement in the calculation of the Staheli index (SI=a/b; a: the narrowest width of the central foot, b: widest width of the heel region).

Statistical Analysis

As the data did not show a normal distribution according to the Shapiro-Wilk test, non-parametric tests were applied. Associations between characteristics of the participants and prevalence of flat foot were analyzed using the chi-square test. All data were analyzed using the " IBM SPSS Statistics for Windows, (Version 21.0. Armonk, NY: IBM Corp.)" The level of significance was accepted as $p<0.05$.

Results

Demographic characteristics of the participants are presented in Table 1. The prevalence of flat foot was 7.5% in the 14-18 age range group, 12.9% in the 19-24 age range group, 16.2% in the 25-29 age range group and 19.1% in the 30 years and above age group. The results of the chi-square test revealed a significant relationship between the athletes' age and the prevalence of flat foot ($\chi^2_{(3)}=3.133$, $p<.05$). In other words, the prevalence of flat foot increased as the age of the athletes increased (Table 2).

The prevalence of flat foot was 6.3% among the athletes who participated in sports for 3 to 5 years, 12.2% among those who participated in sports for 6 to 8 years, 15.6% among those who participated in sports for 9 to 11 years, 17.9% among those who participated in sports for 12 to 14 years and 20.1% among those who participated in sports for 15 years or more. Based on the results of the chi-square test, there was a significant relationship between the number of years the athletes participated in sports and the prevalence of flat foot ($\chi^2_{(2)}=6.042$, $p<.05$). The prevalence of flat foot increased as the years spent in sports increased (Table 3).

The prevalence of flat foot based on gender was 11.7% among female athletes and 13.4% among male athletes (Table 4). No statistically significant relationship was found between the athletes' gender and the prevalence of flat foot ($\chi^2_{(1)}= .056$, $p>.05$), that is, the gender variable had no impact on the prevalence of flat foot (Table 4).

The prevalences of flat foot based on the branch of sports were as followings: 22% among freestyle wrestlers, 18% among Greco-Roman style wrestlers, 19% among judo players, 16% among boxers, 13% among taekwondo and handball players, 12% among swimmers, 9% among basketball players, 7% among volleyball players and 6% among soccer players. No flat foot was detected among race-walkers. A statistically significant relationship was established between the branch of sports and the prevalence of flat foot ($\chi^2_{(1)}=13.342$, $p<.05$) (Table 5).

Discussion

This study was performed to determine the effects of different branches of sports on the structure of the foot in amateur athletes. The results of the study support our hypothesis that the prevalence of flat foot among amateur athletes is associated with age, time spent participating in sports and the branch of sport, but not with gender.

It is well known that structural deformities in the foot have adverse effects on the physical and mental state of individuals [26]. Athletic activities, whether amateur or professional, bear a tremendous physical burden on the locomotor system of athletes [27]. Studies have shown that intensive training begun at early ages, especially in performance sports, caused significant changes in the postures of the athletes since the musculoskeletal system has not sufficiently matured [27, 28]. Despite the lack of consensus on the prevalence of flat foot, some authors suggested that the prevalence of flat foot decreased by age [29, 30]. Wojtys et al. [28] reported negative effects caused

Table 2. Prevalence of flat foot based on age.

Age		Presence of Flat Foot		Total
		None	Yes	
14-18 years	n	545	44	589
	%	92.5	7.5	100
19-24 years	n	869	127	996
	%	87.1	12.9	100
25-29 years	n	237	56	293
	%	83.8	16.2	100
30 years and over	n	105	30	135
	%	80.9	19.1	100
Total	n	1,756	257	2,013
	%	87.2	12.8	100

$\chi^2_{(3)}=3.133$, $p=.046$

Table 3. Prevalence of flat foot based on the years spent in sports.

Age		Presence of Flat Foot		Total
		None	Yes	
3-5 years	n	413	28	441
	%	93.7	6.3	100
6-8 years	n	774	108	882
	%	87.8	12.2	100
9-11 years	n	248	46	294
	%	84.4	15.6	100
12-14 years	n	174	38	212
	%	82.1	17.9	100
15 years and over	n	147	37	184
	%	79.9	20.1	100
Total	n	1,756	257	2,013
	%	87.2	12.8	100

$\chi^2_{(2)}=6.042$, $p=.042$

Table 4. Prevalence of flat foot based on gender.

Gender		Presence of Flat Foot		Total
		None	Yes	
Female	n	629	83	712
	%	88.3	11.7	100
Male	n	1,127	174	1,301
	%	86.6	13.4	100
Total	n	1,756	257	2,013
	%	87.2	12.8	100

$\chi^2_{(1)}=.056$, $p=.864$

by intensive training begun at early ages on the structure of the foot, whereas Aydog et al. [27] stated that intensive training of gymnasts from early ages on had no negative effects on the structure of their foot and associated this with the exercises that strengthen and flex the muscles in the foot. Similarly, Kuo and Liu [31] stated that there was no age-related variation in the structure of the foot.

However, Redmond et al.'s study revealed a u-shaped relationship between the age and structure of the foot since individuals aged over 60 years or under 18 years of age had a tendency toward a more pronated foot posture [32]. Some other studies [25, 32, 33] also found that the structure of the foot varies with age. Therefore, age might be a confounding factor on the prevalence of flat foot in athletes. Sport-specific training and repetitive movements have been reported to have an impact on the structure of

Table 5. Prevalence of flat foot according to the branch of sports.

Branch of sports		Presence of Flat Foot		Total
		None	Yes	
Wrestling (Freestyle)	n	223	71	327
	%	68	22	100
Wrestling (Greco-Roman)	n	227	49	276
	%	82	18	100
Soccer	n	244	15	259
	%	94	6	100
Taekwondo	n	215	32	247
	%	87	13	100
Volleyball	n	149	11	160
	%	93	7	100
Handball	n	128	18	146
	%	87	13	100
Swimming	n	129	17	146
	%	88	12	100
Boxing	n	115	22	137
	%	84	16	100
Basketball	n	122	12	134
	%	91	9	100
Judo	n	102	23	125
	%	81	19	100
Race-walking	n	56	0	56
	%	100	0	100
Total	n	1,756	257	2,013
	%	87.2	12.8	100

$\chi^2_{(1)}=13.342, p=0.44$

the foot and to cause substandard height of the transverse arch among soccer and tennis players and flat foot among runners and alpine skiers [34]. In other words, as the years spent playing these sports and as the age of the athletes increases, the prevalence of flat foot increases as well. Incorrect or extreme loadings or trainings exert excessive and unbalanced forces on the foot [16], resulting in the weakening or strain of the muscles, tendons and ligaments in the lower extremities and thus leading to structural deformities on the foot [29]. Our findings were similar with those studies. We thought that exposure to repetitive mechanical loading over time and using inappropriate sports shoes may cause a gradual decrease in tension of the supporting ligaments and also increase joint laxity that results in flat foot. Because of the inconsistent results reported in previous studies, the degree of mechanical loading in various sports branches on the foot posture should be investigated in detail.

While some authors suggested the importance of gender on the prevalence of flat foot [25, 33], others [35, 36] could not establish a significant relationship between the gender and prevalence of flat foot. Our study results did not determine a relationship between gender and flat foot and were in line with these studies. The results of our study were not consistent with the study conducted by Frey [37] and Hashimoto et al. [38]. Both authors reported that women had flatter feet than men. On the other hand, Staheli et al. [25] indicated that males have flatter feet than females. The inconsistencies between these studies and our study may be due to the age, ethnicity and cultural differences of the participants and the differences between the measurement and categorization methods of flat foot.

The higher prevalence of flat foot among freestyle wrestlers in comparison to Greco-Roman performers was another finding of our study. It was interesting to find out that although the wrestlers performed various exercises to strengthen their foot and leg muscles, they had the highest prevalence of flatfoot among the athletes studied. We relate this to the sole of wrestling shoes. We believe this may be due to the fact that, the inclination between the heel and the toe of wrestling shoes is almost the same level and the insole has no orthopedic arch. Tying the shoelaces tightly around the ankles may also be another reason for flat foot since this causes pressure on the Achilles' tendon thus resulting in straining of the muscles in the lower leg and poor functionality of the tibialis posterior muscle [39, 40]. In addition, the deformities may have been caused by excessive loadbearing on the inner edge of the foot to balance the forward-shifted center of gravity due to the wrestlers' stance. Furthermore, during the pressing and pulling from the opponent, the body weight of the wrestler pushes the talus vertically toward the ground with a greater

force, limiting the ability of the soft tissues and the joint to resist such stress and thus inferiorly displacing the talus and causing flat foot [41]. This situation is thought to lead to misalignment of the lower extremities, changes in the traction angles of the muscles and pathological loading on the lower extremities that in turn cause pain.

Considering that some athletes, such as judo and taekwondo players, do not wear shoes, flat foot and other postural deformities in these athletes may be associated with performing the sport on non-standard tatami mats or polyurethane floors with varying hardness. Mat or floor stiffness also deteriorates in time due to repetitive low or high-impact loads. All of these factors cause excessive load-bearing on the inner edge of the foot and results in flat foot.

Another interesting finding of our study was the prevalence of flat foot in swimmers. Although flat foot may be a problem and disadvantage for athletes who are involved in land sports, it is actually an advantage for swimming. As the foot is plantar flexed, it provides a larger surface area and creates high hydrodynamic forces which act mostly in the vertical direction on the water and reduce the effort required to swim and boost the speed of the swimmer by minimizing the drag [42]. We thought that swimming did not cause flat foot since there was no pressure put on the sole of the foot. On the contrary, individuals with flat foot tended towards swimming as they moved more comfortable and easily in the water than in land activities. For this reason, we may have encountered flat feet swimmers in our study.

In conclusion, the training regimes may be a reason for feet deformities in some sports. Furthermore, based on the results of our study, we can assert that age, time spent participating in sports and the branch of sport have an impact on the higher prevalence of flat foot among the competitive amateur athletes.

Recommendations

In light of our findings, we strongly recommend the modification of training programs, redesigning of wrestling and boxing shoes in particular and using shoes with arch support in warm-ups, runs and in branch-specific educational and athletic activities and competition shoes in branch-specific trainings and competitions for a healthy foot structure. As no shoes are worn in judo and taekwondo, producing the training and competition floors with standard materials that would protect the foot structure and appropriate shoe design would be the right approach.

Further detailed investigation of the subject in multidisciplinary studies is advised. Finally, in order to avoid a possible discomfort or anatomical disorder in structure of the foot, we recommend adding special exercises that strengthen the muscles, tendons and ligaments to routine training programs.

Authors' Contributions

All authors have read and approved the final version of the manuscript, and agree with the order of presentation of the authors.

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Conflict of Interests

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Effect of organizational climate upon the job performance of instructors' physical education

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

Abstract

Purpose: The current study was conducted to examine the effect of organizational climate on the Job Performance of Instructors' Physical Education.

Material: A quantitative method was employed for this purpose; a survey research design was used. There was 169 Instructors' Physical Education preferred through stratified sampling technique. A structured questionnaire was administered to collect the data. The data was analyzed using inferential statistics (linear and multiple regression).

Results: The results of the study indicated that organizational climate affect job satisfaction significantly. All the dimensions of organizational climate contribute to increasing the Instructors' Physical Education performance.

Conclusions: The current study concluded that Instructors' Physical Education not only feel comfortable in a healthy organizational climate but also increase their level of performance. The study also depicted that effective communication structure, reward system, teamwork, career development, and effective planning and decision making strategies are the valuable ingredients to enhance the performance of Instructors' Physical Education. Keeping in view the results of the current study, it is recommended that head of the institution may focus or promote supportive culture in their respective educational institutions to enhance the performance of instructors' physical education.

Keywords: organizational climate, job performance, instructor, physical education.

Introduction

The ultimate development and survival of an organization depend upon the competency of the employees in today's competitive environment. The required knowledge, skills, and behavior are essential for an organization to reaching its goals. Jing et al. [1] stated that only those employees concentrate on their tasks, demonstrate creativity and committed who feel comfortable in the environment of an organization. The high expectations from the employees are linked with a suitable environment in the organization. School is like an organization in which different people having different positions working in the same conditions to achieve the desired objectives. Organization Climate (OC) is essential among all these conditions since OC includes many dimensions associated with School. According to Lazaridou and Tsolakidis [2] organizational climate refers to the environment in which employees perform their tasks in the working environment. The present study aimed to examine the effect of OC upon the JP of IPEs of KP.

Organizational climate: According to Ali and Patnaik [3] there are various popular subjects for research and organizational climate is one of them. Research is very useful in this field if it would be conducted in the field of education. The organization has a great role in the development of society and the well-being of the people in an organization, different people have a different role, and some have a more important role as compared to other people who are working with them. But every person has their own particular role in the organization. So, every individual plays a vital role to run the organization. Individuals who are working in an organization can be evaluated according to their assigned responsibilities. While evaluation, several factors could be involved. Such factors involve resources, the structure of the organization, rule and regulation, reward structure, the role of the leadership, hinders whether hob is satisfied or not and conflict management.

DeConick [4] states that organizational climate as members of the organization perceived it and describe its feature according to their climate. In any organization, leadership has a vital role and a leader can change the climate of an organization. Chen and Hung [5] expressed that various factors have their own role and influence the organizational climate. There are several elements in the organizational climate such as control autonomy, reward, respect, and procedure and role expectation. Such elements contribute a significant role in any organizational climate. According to De Conick [4] organizational climate plays an important role in the learning process. The congenial atmosphere has definitely in any educational environment and it could be effective in the learning process. It is the responsibility of the School manager to provide opportunities to the teachers to develop their hidden abilities. According to human resources, structure and symbolic frames have essential organizations and managers should concentrate on such frames in order to achieve organizational goals. Attkinson and Frechette [6] refer to organizational climate as a set of characteristics specific to the organization that may be

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made from the organization, treatment with the employees and its atmosphere.

Job Performance: According to Griffin [7] the term job performance may be defined as an act of completing the given task. Oxford Dictionary [8] spells out the meaning of Performance is to carry out fulfil the task. Raza and Shah (2010) associate performance with the outcome. If the teacher achieved the desired outcome then performance would be up to the mark. According to Oguntimehin Kuewumi and Adeyemi [9] Teacher job Performance referred to as responsibilities performed by a teacher in a specific time limit in the school environment to accomplish the school objectives. According to Griffin [7] there are different indicators to measure the job performance of teachers (IPEs) include subject matter knowledge, instructional planning, and management, communication and assessment skills. The teacher role is important and crucial in the teaching-learning process. Different strategies used by a teacher while transmitting the knowledge to his students. A good teacher always uses strategies that are more suitable and fruitful for the purpose of obtained school objectives. According to Zia-Ul-Islam and Khan [10] a teacher's way of questioning, instructions, directions, explanation, and attitude towards his profession play a significant role in achieving classroom objectives. According to Balkar [11] every student has own mental capability level of understanding. Besides this, there exist individual differences among the students, so it is the responsibility of the teacher to comprehend each student so that learning objectives could be achieved. So the teacher role is not less important in school. If the teacher is equipped with the required skills then the school objective can be easy to achieve. According to Gera and Beri [12] if the teacher's satisfaction level is high then he is more committed to his profession and it might increase the performance. Theory X and Y developed by McGregor in 1960. Oguntimehin Kuewumi and Adeyemi [9] argue that according to theory X, negative characteristics cause low performance while theory Y hypothesized the positive characteristics cause high performance. According to Balkar [11] there are some reasons which cause low performance in any organization includes low salary, lack of career opportunities, and lack of reward system, poor facilities, role ambiguity and behavior of a leader. The main focus of this study is organizational climate which is one of the factors which has an effect on job performance. The following two null hypotheses are generated associated with objectives: -

Hypotheses: There is no significant effect of Organizational Climate (OC) upon Job Performance (JP) of IPE; there is no significant effect of Ten (10) dimensions OC upon JP of IPEs

Objectives: To examine the effect of OC upon the JP of IPEs of KP, to investigate the Ten (10) dimensions of OC on the IPEs' Job Performance.

Materials and Method

Population and Sample: There are 294 Instructors of Physical Education (IPEs) working in Government Higher Secondary Schools in Khyber Pakhtunkhwa was constituted population (Education Management Information system [EMIS], 13). A sample of 169 IPEs was chosen as a sample by using the Stratified probability sampling method. The strata were based on gender. Yamane [14] formula was used for the sample selection.

$$n= N/(1+Ne^2]= 294/(1+294*0.05^2)=16$$

*Design***:** The positivist approach was used while conducting this research. The result of the study is drawn through statistical analysis and then the conclusion was made. Additionally, the deductive approach was employed because it is based on the belief that the world is an observable phenomenon of different things processes and actions that work coherent and in a controlled way [15]. Based on the positivist approach, a Survey research design was applied. According to Kothari [16] survey research design is the process of collection of information from the sample individuals about some phenomenon by the response.

Instrumentation: An adapted questionnaire was used for data collection. The organizational climate scale was adapted from the instrument developed by Furnham and Goodstein [17] while Job performance scale was adapted from the tool developed by Atta [18].

Validity and Reliability: Validity and reliability are two important phases in instrument development. The validation of content validity was done through experts. For this purpose, content validity Ration (CVR) was used. The accepted criteria for each statement are ranging 0.3-1 [19]. The formula is given, CVR=[(E-(N/2)/(N/2)] E denote to relevant item and N denote to total expert.

Statistical Analysis. The Table 2 indicates that all the items fulfil the criteria for retaining in the final instrument. The reliability of the questionnaire is measured by using Cronbach's Alpha. The table 3 shows the reliability score of the questionnaire.

Table 1. Showing sample size

Respondents	Gender	Population	Percentage	Required sample
IPEs	Male	186	63%	169*63%=106
	Female	108	37%	169*37%=63
Total	-----	294	100	169

Results

Table 4 indicates the Correlation analysis matric between the Ten (10) dimensions of OC and Job Performance. The table indicates that Positive correlation between the different dimensions of OC and Job Performance of IPEs. The table shows that there is a week correlation between Role clarity and Job Performance (r=.316**), Reward and Job Performance (r=.322**) Communication and Job Performance (r=.322**) and Conflict and Job Performance (r=.294**).

The table 5 shows the regression output regarding the effect of OC upon JP of IPEs. The table reveals that R^2 =.429 indicates that 42% of the variance in IPEs job performance predicted by the organizational climate. The Beta value (.41) indicates that if there is one-unit increase in the independent variable then .41 unit increases in the dependent variable (JP). The F- value is 14.19 with P=.000<.05 which provides strong evidence to reject the

Table 2. Showing Content Validity Ratio (CVR)

Scale	No. of Item	CVR Score
OC	44	0.3-0.8
JP	39	0.6-0.8

Table 3. Showing reliability score of the instrument

Scale	No. of Item	Cronbach' Alpha Score
OC	44	.847
JP	39	.819

Table 4. Correlation Analysis Matric of Organizational Climate and Job performance

	RC	Rspt	Com	Rwd	CD	PDM	Inv	TW	QS	CM	JP
RC	1										
Rspt	.567**	1									
Com	.529**	.762**	1								
Rwd	.359**	.575**	.682**	1							
CD	.376**	.356**	.535**	.570**	1						
PDM	.413**	.551**	.742**	.627**	.630**	1					
Inv	.372**	.504**	.723**	.453**	.689**	.588**	1				
TW	.497**	.513**	.688**	.530**	.655**	.536**	.708**	1			
QS	.529**	.605**	.668**	.541**	.407**	.483**	.586**	.580**	1		
CM	.492**	.560**	.595**	.499**	.259**	.183**	.210**	.378**	.391**	1	
JP	.316**	.575**	.322**	.289**	.449**	.759**	.682**	.510**	.778**	294**	1

RC=Role Clarity, Rspt=Respect, CD=Career Development, PDM=Planning & Decision Making, Inv=Innovation, QS=Quality Service, CM=Conflict Management, JP=Job Performance

Table 5. Regression model regarding effect of Organizational Climate upon Job Performance

			Unstandardized coefficients		Standardized Co-efficient		
Model	R	R^2	B	Std. Error	Beta	F	Sig
Constant			3.068	.381	8.647	14.19	.000
OC	.510	.429	.390	.094	.510		.000

Dependent variable: JP

Table 6. Multiple Regression regarding Impact of Ten (10) dimensions of OC on the JP

Model	R	R Square	Adjusted R Square	F- value	Sig	Durbin-Watson (DW)
1	.581	.492	.317	8.67	.009	1.42

Dependent Variable: JP

Table 7. Co-efficient

Model	Unstandardized Coefficient		Standardized Coefficient	t	Sig	Collinearity Statistics	
	B	Std.Error	B			VIF	Tolerance
(Constant)	3.014	.653		4.616	.000		
RC	.312	.181	.612	.069	.945	.412	2.424
Respect	.278	.177	.218	1.233	.223	.245	4.077
Communication	.273	.156	.140	.257	.798	.156	6.404
Rewardsystem	.173	.102	.343	.415	.680	.404	2.474
CD	.207	.116	.113	.974	.334	.276	3.623
PlngDmaking	.369	.169	.226	1.340	.186	.165	6.070
Innovation	.282	.112	.244	.393	.696	.284	3.523
Teamwork	.188	.137	.132	-.966	.339	.329	3.036
Qservice	.380	.124	.245	.366	.716	.264	3.784
CManagment	.195	.119	.163	.530	.599	.392	2.549

null hypothesis. Thus null research hypothesis (H01) is rejected.

The table 6 indicates the impact of Ten (10) dimensions of OC on Job Performance. The table reveals that R^2 =.492 indicates that 49% of the variance in IPEs job performance predicted by different dimensions of organizational climate. The F- value is 14.19 with P=.009<.05 which provides strong evidence to reject the null hypothesis. Thus second null hypothesis (H02) is rejected. The value of Durbin Watson (1.42) shows that there is no autocorrelation issue in data.

The table 7 shows the regression coefficient of predictor variables of dimensions of OC and Predicted JS. The result indicates that beta (β), standardized coefficient regression of each predictor generated some degree of contribution in predicted (JS). The variation in JP associated with a given change in Role clarity (β = .612), respect (β = .218), Communication (β = .140), reward system (β = .343), Career development (β = .113), Planning and Decision making (β =.226), Innovation (β = .244), Teamwork and support (β = 132), Quality service (β = .245) and Conflict Management (β = .163). The table also indicates the multicollinearity statistic which is one of the basic assumptions while using multiple regression analysis. The multicollinearity issue can be detected through the Variance Inflation Factor (VIF) and Tolerance. All the values fall in an acceptable range, so there is no issue of multicollinearity in independent variables.

Discussion

Organizational Climate is considered is one of the prime factors which directly or indirectly affect the performance of Instructors of Physical Instructors (IPEs). The basic purpose behind the study was to investigate the effect of Organizational climate upon the Job performance of IPEs working in Khyber Pakhtunkhwa. The result of the study shows that there is a significant relationship between different dimensions of OC and Job Performance. Week correlation was found between Respect and Job Performance, Communication and Job Performance and Conflict and Job Performance. The same result was mentioned by Adeyemi [9] He found that less importance given to effective communication channels, Reward system and role clarity in the organization. School is an organization and teachers working without any reward negatively influence the performance of IPEs. The result of the study depicts that the effect of OC on Job Performance is significant. The result of the study is in line with Balkar [11] and Salemat, Samsu and Kamalu [20]. They found that a conducive organizational climate plays a crucial role in the Performance of IPEs. The work behavior of the IPEs is improved through a supportive organizational climate. The result of the study is consistent with Jing, Avery, and Bergsteiner [1]. They found that the performance of the IPEs is improved by providing necessary resources and supportive climate since the working conditions of the organization they require physically and psychologically is presented in a proper manner.

Conclusion

The study concluded that IPEs feel comfortable in a healthy organizational climate and cause an increase in performance. Effective communication structure, reward system, teamwork, career development, and effective planning and decision making strategies are implemented in the schools which enhance the performance of the teachers.

Recommendations:

The result of the study shows that Organizational Climate has a significant impact on the IPEs' Job Performance. Thus, it is recommended that the Principal may create a supportive climate in the school in order to enhance the IPE performance. For this purpose, School principal may lead from the front and build teamwork in the school to achieve short and long term goals. This may increase the level of satisfaction and a sense of belongingness to the organization. Government of Elementary and Secondary Education Khyber Pakhtunkhwa may conduct a workshop to train School Heads by hiring renowned trainers and scholars.

Conflict of interest

The authors declare that there is no conflict of interests.

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Physical condition of pupils of pre-school educational establishments of different types

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Abstract

Purpose: The purpose of the study is to determine the physical condition of the pupils of pre-school educational establishments of various types for improving the quality of the educational process of physical education.

Material: The study involved 3-4 year-old children. The children attended preschool institutions of various types in the city of Dnipro. They were the children's educational establishment №282 of the combined type, the children's educational establishment №192 of the sanatorium type, the children's educational establishment №28 of the compensating type, children's educational establishment №244 and №404 of general development. Control (n = 90) and experimental (n = 95) groups were created in each age group of a particular type of institution. The differentiation of pupils of institutions of different types into two subgroups was caused by their differences in functional indicators and health status. At the beginning of the experiment, the homogeneity of the studied groups of children was noted (p> 0.05).

Results: The model of organization of rational motor mode of 3-4 year-old children has been substantiated and developed. Organizational and methodological bases of realization of the model of rational motor mode of 3-4 year-old children in preschool educational institutions of various types have been developed. The influence of the developed model on the physical condition of pupils of pre-school educational institutions of different types has been determined. The study of the anthropometric parameters of children after the implementation of the developed model showed no differences in these parameters. These differences were observed in children of different types of kindergartens in all sex-age groups. The determination of functional abilities of children resulted in a significant improvement in spirometry, respiratory rate, heart rate, Ruffier test in experimental groups of children of both sexes (p <0.05). The indicators of the functional state of the cardiovascular system and physical performance of the pupils of preschool educational establishments of the sanatorium type and the compensating type were lower than the similar indicators of the pupils of general development establishments. The indicators of heart rate of real rest and respiratory rate of children of experimental groups of institutions of the sanatorium and compensating type corresponded to the average level.

Conclusions: The obtained result of this empirical study confirms the hypothesis that the organization of rational movement mode for 3-4 year-old children contributes to improving of their physical condition. The obtained results indicate the improvement of the quality of the educational process of physical education of children in pre-school educational establishments of different types.

Keywords: physical condition, schoolchildren, motor, physical education.

Introduction

Nowadays, the development of the world society is accompanied by complex social and economic problems. These problems have led to the deterioration of the physical, mental and financial status of most of the population. In particular the concern is about the health declining of preschool children [1, 2]. This leads to the development of new approaches to achieve the primary goal of physical education which is health promotion. In particular, Canada, South Africa, Kenya and Louisiana have summarized data from studies of children's involvement in various forms of locomotor activity. [3]. Marouli with co-authors determined the impact of the psychomotor program on motor knowledge and self-perception of pre-school children in Greece [4]. Savich considered the issue of motor movement of children from the medical point of view [5]. Moskalenko and her co-authors have proposed modern approaches to the organization of physical and recreation work in preschool institutions of Ukraine [6]. Suporosova implemented the methods of organization of motor mode for children with visual impairment in Russia [7].

Scientists emphasize the presence of interconnection between motor activity and physical development of the child. This determines the feasibility of using a training system with maximum health, educational and educational effects [1, 2, 7]. Attention is drawn to the uneven and irregular process of physical development of children. This is connected with the first rounding period of children aged 1 to 4 years old. This age is characterized by an annual increase in weight with a relatively small body height. Exactly at this age the mechanisms of personal growth also begin to develop [8].

In recent years, studies have been conducted on improving the efficiency of physical education in preschool institutions. The organizational pedagogical

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and methodological basis for improving the system of physical education of preschool children is given in the researches of Vil'chkovs'kij et al. [1]. Theoretical and methodological foundations of the formation of a harmoniously developed personality of a preschool child in the process of physical education are given in the studies by Panhelova [8]. The analysis of the indicators of physical and motor readiness of children of preschool age was carried out in the works of Gonchar et al. [9]. Stork et al. considered some issues of physical education in early childhood [10]. The peculiarities of the use of oriental health systems in the physical education of older preschool children are reflected in the studies by Panhelova et al. [11, 12]. Innovative technologies of development of psychomotor abilities in physical education of children from the 2nd to the 5th years of life are revealed in the work of Lakhno [13]. Bondar [14] investigated the condition of the musculoskeletal system of children aged 3-4 years old.

The analysis of the literature shows that scientists are interested in finding unexplained problems of the physical education of preschool children and the ways to solve them. However, the issues of optimization of the motor mode of 3-4 year old pupils of preschool educational institutions of different types are still unclear. This has made the topic under research relevant.

Hypothesis. It was envisaged that the organization of rational movement mode of 3-4 year old children will contribute to the improvement of their physical condition and quality of the educational process of physical education.

The purpose of the study is to determine the physical condition of the pupils of pre-school institutions of various types for improving the quality of the educational process of physical education.

Material and methods.

Participants. The study involved children aged 3-4 years old. They visited preschool educational establishments of various types in the city of Dnipro. They were the children's educational establishment №282 of the combined type, the children's educational establishment №192 of the sanatorium type, the children's educational establishment №28 of the compensating type, children's educational establishment №244 and №404 of general development. Control and experimental groups were established in each age group of the kindergarten of a certain type. The control groups consisted of 90 children, the experimental groups of 95. The differentiation of pupils of institutions of different types into two subgroups was due to their differences in functional indicators and health status.

At the beginning of the experiment, the homogeneity of the studied groups of children was noted ($p > 0.05$). The parents of the participants of the research gave the written consent to their children's participation in the study. All permits for the scientific research in the preschool institutions were obtained.

Organization of the research. Anthropometric and index methods were used to assess the physical development and harmony of the physique of preschoolers. At the beginning of the experiment, the homogeneity of the studied groups of children of all types of preschool institutions was noted in terms of height, body weight and chest girth ($p > 0.05$). The average values of anthropometric indicators according to the standards table corresponded to the average level of development. The condition of the musculoskeletal system of children was evaluated by a preschool establishment doctor.

To assess the functional state of the cardiovascular and respiratory systems physiological methods (heart rate, spirometry) were used [15, 16]. To determine the physical performance of the organism of preschoolers the Ruffier test was used [17]. The Ruffier test was conducted as follows. The first measurement of the child's pulse after a five-minute rest was made. Then the child does 30 squats in 45 seconds. The pulse was recorded in 15 seconds. After one minute of rest, the last pulse measurement is performed. On the basis of the values obtained, the doctor calculated an individual indicator of the child's heart capacity.

Physical education classes with children of experimental groups were conducted according to the developed model of organization of rational motor mode of children aged 3-4 years old with different level of physical condition. The content of this model includes the content of their motor activity. It has been experimentally tested in the process of conducting of various organizational forms of physical education in the conditions of work of preschool educational institutions of different types. These are physical education, physical and health activities in the day mode, active rest, and independent activity of children.

In experimental groups of preschool educational institutions of different types, the motor mode was constructed on the basis of the developed parameters of motor activity, content and organizational and methodological principles of motor activity of younger preschool children. They corresponded to the profile of these preschool institutions. It was suggested to include elements of recreation and innovative pedagogical technologies of physical education. These elements contribute to the optimization of the motor mode in the conditions of preschool education, in combination with the program material of education and upbringing of children to all organizational forms of work in physical education. The specificity of a preschool educational institution of a certain type was also taken into account.

The content of the motor activity of the pupils of institutions of general development and of the combined type was supplemented by the author's methods, means of psychoprophylactic work, children's fitness, hardening measures. We have proposed integrating innovative and recreational technologies into all organizational forms of physical educational work. The game class of physical culture was held at least twice a week. Such classes contained elements of fairytale therapy, eurhythmic gymnastics, and children's fitness. The techniques of

"Children's experimentation", "Little wizards", "Learning in motion" and technologies of complex development of the child's personality were involved.

In the preschool institution №404 a physical training in swimming was held in the afternoon twice a week. The main physical and health activities were morning gymnastics, motion games on a walk, gymnastics after afternoon`s sleep. They included elements of psycho-gymnastics, correction gymnastics, recreational running. Hardening events were held at least three times a week. Corrective gymnastics included elements of logarithmic gymnastics, exercises for the development of fine motor skills. Active rest for children of the middle group included holding of physical culture festivals once every 3 months. Health days were held once a month. Twice a month sports fun activities took place. For the children of the middle group 2-3 times a month hiking walks in the woods or the nearest park were offered. Independent motor activity of children was organized daily under the guidance of the tutor, taking into account the level of motor activity of the children.

The pupils of preschool educational institutions of the sanatorium and compensating type had physical training sessions three times a week. Their content has been supplemented by author`s techniques. These are "Theater of physical education", "Free physical education", technology of integral development of psychomotor abilities of the children aged 2-5 years old. Elements of psycho-prophylactic work, elements of Sa-Phi-Dance children's fitness program [18] and corrective gymnastics were involved. Corrective gymnastics contained training complexes using SIT-45 healing balls. The organization of physical and health events, along with the traditional ones, provided daily conducting of health and play classes. The content of forms of active rest and self-motor activity provided the use of traditional and proposed innovative means of preschool physical education. During the organization of all forms of physical education work in preschool educational institutions of different types, we took into account the proposed parameters of physical activity.

In all groups, physical education classes were conducted by a physical education instructor. Physical and health activities in the day mode were conducted by the tutor. The active rest of the children in the experimental groups was organized and conducted by the tutor of the groups and the instructor of the physical culture of the institution. The correction of independent physical activity of children was managed by the tutor.

The classes were conducted with the observance of all methodical recommendations concerning movement training and development of physical abilities.

In control groups physical training and recreation were conducted according to the plan of the institution, taking into account the regulatory requirements.

Statistical analysis. Statistical processing of the study materials was conducted using Microsoft Excel 2010. The arithmetic mean and the bias of the arithmetic mean were calculated. The credibility of differences between sample rates was tested using the Student's t-test and considered statistically significant at $p < 0.05$.

Results

Assessment of the musculoskeletal system of children revealed an increase in the number of postural disorders in all categories of children. It was found out that 50% of boys and girls of the age 3 years old among the pupils of the combined type preschool educational establishments have postural disorders. The number of violations was 67-69% among the children of the sanatorium and compensatory type. It was recorded that 4-year old children have 65% and 71% of cases of musculoskeletal disorders, respectively. The kyphotic type of postural disorders is most often found in 40% of preschool children of sanatorium and compensatory types. 21.2-24.1% of children with poor health and 19.1-23.5% of pupils of pre-school educational institutions of combined type were found to have a disorder of the posture of scoliotic type.

Adaptation capacity of the organism of the pupils of the institutions of sanatorium and compensatory types was lower than that of the pupils of the preschool institutions of general development.

The results of the comparative analysis of testing data of children aged 3-4 years old from control and experimental groups confirmed the effectiveness of the proposed measures (Table 1-4). At the beginning of the study, no statistically significant difference between the groups was observed.

The dynamics of indicators of physical development was one of the criteria for the effectiveness of the proposed model of the organization of rational motor mode of children aged 3-4 years old in preschool institutions of various types.

Comparisons of the average values of anthropometric parameters showed the absence of differences of children of control and experimental sex-age groups of different types of preschool institutions

According to the Kettle weight-height index, the children of the studied groups mostly had already had the average level of physical development.

The study of the functional abilities of the studied groups of children resulted in a significant improvement in the spirometry, respiratory rate, heart rate, Ruffier test in the experimental groups of children aged 3 and 4 years old of both sexes ($p < 0.05$).

The pupils of sanatorium and compensating types of institutions proved to have lower indicators of the functional state of the cardiovascular system and physical performance than the pupils` of general development establishments similar indicators. The indicators of heart rate at real rest and respiratory rate of children from experimental groups of institutions of the sanatorium and compensating type corresponded to the average level.

Discussion

The analysis of literary sources on the problem of research and generalization of practical experience allowed to establish the basis of the system of physical

Table 1. The indices of functional condition of 3 year-old girls (n=60)

Indices	Type of the establishment	At the beginning of the research		At the end of the research	
		CG	EG	CG	EG
		$\bar{x}$ ± m		$\bar{x}$ ± m	
Length of the body, sm	general development** and combined type	100.0±0.75	99.8±0.86	102.8±0.69	102.6±0.71*
	sanatorium and compensating type***	97.0±0.94	96.8±0.78	99.5±0.59	99.7±0.61*
Weight of the body, kg	general development and combined type	14.7±0.32	14.3±0.22	16.2±0.38	15.9±0.41*
	sanatorium and compensating type	97.0±0.94	96.7±0.78	99.5±0.59	99.7±0.61*
Weight-height index, r • sm^{-1}	general development and combined type	146.7±2.98	145.2±2.45	164.2±2.67	167.3±2.53*
	sanatorium and compensating type	147.6±2.55	146.6±2.34	163.4±2.38	165.7±2.71*
Heart rate at real rest beats min^{-1}	general development and combined type	104±0.41	104±0.23	103±0.61	99±0.51*
	sanatorium and compensating type	109±0.45	109±0.34	108±0.51	104±0.61*
Vital capacity of the lungs, ml	general development and combined type	910±11.4	905±11.2	950±11.3	1100±10.9*
	sanatorium and compensating type	875±10.5	835±11.0	920±10.7	980±11.2*
Frequency of respiratory cycles, min^{-1}	general development and combined type	27±0.53	26±0.57	27±0.51	23±0.27*
	sanatorium and compensating type	31.5±0.61	31.1±0.49	30±0.32	25±0.21*
Ruffier Index, points	general development and combined type	10.8±0.67	10.2±0.43	9.2±0.41	6.9±0.31*
	sanatorium and compensating type	12.9±0.74	13.1±0.13	11.8±0.31	9.7±0.23*

Notes: * - p <0.05 compared to the values recorded in the control and experimental groups at the beginning and end of the experiment; ** - number of children in the institution of general development and combined type in the control group (n = 15), in the experimental group (n = 15); *** - number of children in the sanatorium and compensatory type institution in the control group (n = 15), in the experimental group (n = 15); EG - experimental group; KG control group.

education in pre-school educational institutions. This is motor mode. It is a collection of different tools and organizational forms of working with children. These forms should be rationally combined and consistently used according to the age of the children and their physical condition. The leading factor in increasing of the level of physical condition of children is motor activity within the optimal values. At present, there is insufficient certainty in the scientific and methodological literature regarding the content, organizational and methodological features and parameters of the motor activity of children in the mode of day of preschool educational institutions of various types.

The research conducted was based on the data of Stork et al. [10] on particular issues of physical education in early childhood.

The model of organization of rational motor mode of 3-4year-old children in preschool educational establishments of different types is substantiated and developed. This model has the purpose, objectives, content, pedagogical conditions of optimization of physical activity in the mode of day of the kindergarten. We have developed the organizational and methodological foundations for the implementation of the model of rational motor mode of children aged 3-4 years old. The advantage of our research is in the implementation of the motor mode of children, taking into account the specific pre-school educational institution of a certain type. We have proposed the inclusion of elements of recreation and innovative pedagogical technologies of physical

Table 2. The indices of functional condition of 3 year-old boys (n=49)

Indices	Type of the establishment	At the beginning of the research		At the end of the research	
		CG	EG	CG	EG
		$\bar{x}$ ± m		$\bar{x}$ ± m	
Length of the body, sm	general development and combined type**	101.6±0.83	1014±0.76	102.9±0.79	103.1±0.82*
	sanatorium and compensating type***	100.0±0.94	99.6±0.91	102.1±0.91	102.4±0.83*
Weight of the body, kg	general development and combined type	14.7±0.34	14.3±0.41	16.1±0.37	16.3±0.44*
	sanatorium and compensating type	14.9±0.60	14.2±0.56	16.4±0.71	16.7±0.63*
Weight-height index, r • sm^{-1}	general development and combined type	144.3±2.91	143.8±2.67	162.7±3.71	164.7±2.47*
	sanatorium and compensating type	149.3±6.35	149.6±6.21	167.1±4.21	169.2±3.71*
Heart rate at real rest beats min^{-1}	general development and combined type	102±0.44	102±0.23	101±0.32	97±0.31*
	sanatorium and compensating type	108±0.43	108±0.27	106±0.41	102±0.23*
Vital capacity of the lungs, ml	general development and combined type	933±9.53	932±9.34	950±6.41	1100±4.4*
	sanatorium and compensating type	850±5.13	851±5.24	870±4.17	990±7.21*
Frequency of respiratory cycles, min^{-1}	general development and combined type	27±0.63	27±0.49	27±0.43	22±0.21*
	sanatorium and compensating type	32±0.71	32±0.65	31±0.37	24±0.31*
Ruffier Index, points	general development and combined type	10.6±0.71	10.2±0.89	10.0±0.53	7.0±0.37*
	sanatorium and compensating type	13.6±0.96	13.1±0.53	12.1±0.58	9.7±0.31*

Notes: * - p <0.05 compared to the values recorded in the control and experimental groups at the beginning and end of the experiment; ** - number of children in the institution of general development and combined type in the control group (n = 12), in the experimental group (n = 14); *** - number of children in the sanatorium and compensatory type institution in the control group (n = 11), in the experimental group (n = 12); EG - experimental group; KG control group.

education.

It was proposed to supplement the content of motor activity of pupils of general development and combined types by author's methods, means of psycho-prophylactic work, children's fitness, and hardening measures. The recommended elements of innovative and recreation technologies are the elements of fairytale therapy, eurhythmic gymnastics, and children's fitness. It is advisable to conduct physical training in swimming. It was advised to include the elements of psycho-gymnastics, correction gymnastics, recreational running into morning gymnastics, moving games walks, gymnastics after afternoon's sleep. It is worth carrying out hardening at least three times a week. The content of correction gymnastics should include elements of logarithmic gymnastics, exercises for the development of fine motor skills.

It was suggested to conduct physical training by the author's methods for the students of sanatorium and compensating institutions. It is recommended to include the elements of psycho-prophylactic work, elements of Sa-Phi-Dance children's fitness program and corrective gymnastics.

Polyakova [19] motor activity parameters were taken into account while organizing all forms of physical education work in pre-school educational institutions of different types.

The results of our research were supplemented by the data of Suporosova [7] concerning the organization of locomotor mode in preschool institutions. We supplemented the data of Holubeva [20] on the absence of a significant difference between the parameters of motor

Table 3. The indices of functional condition of 4 year-old girls (n=41)

Indices	Type of the establishment	At the beginning of the research		At the end of the research	
		CG	EG	CG	EG
		$\bar{x}$ ± m		$\bar{x}$ ± m	
Length of the body, sm	general development and combined type**	107.0±1.56	106.8±1.45	109.8±1.51	110.2±1.51*
	sanatorium and compensating type***	108.5±1.47	108.1±1.32	110.1±1.31	111.0±1.61*
Weight of the body, kg	general development and combined type	17.8±0.65	17.7±0.76	19.2±0.68	19.5±0.71*
	sanatorium and compensating type	18.8±0.71	18.1±0.56	20.2±0.81	20.3±0.61*
Weight-height index, r • sm^{-1}	general development and combined type	166.8±4.22	166.1±4.01	178.7±5.71	181.2±6.12*
	sanatorium and compensating type	172.5±5.43	171.3±4.65	183.2±4.71	185.4±5.67*
Heart rate at real rest beats min^{-1}	general development and combined type	95±0.51	95±0.43	94±0.73	91±0.51*
	sanatorium and compensating type	102±0.81	102±0.72	102±0.67	96±0.74*
Vital capacity of the lungs, ml	general development and combined type	1020±916.6	1020±911.3	1050±7.91	1290±5.83*
	sanatorium and compensating type	890±17.6	890±16.8	920±9.71	1090±8.93*
Frequency of respiratory cycles, min^{-1}	general development and combined type	25±0.61	25±0.49	25±0.31	21±0.11*
	sanatorium and compensating type	29.5±0.55	29.15±0.24	28±0.21	24±0.12*
Ruffier Index, points	general development and combined type	8.5±0.75	8.1±0.25	8.2±0.53	6.9±0.23*
	sanatorium and compensating type	12.3±0.80	12.6±0.12	12.0±0.61	9.3±0.47*

Notes: * - p <0.05 compared to the values recorded in the control and experimental groups at the beginning and end of the experiment; ** - number of children in the institution of general development and combined type in the control group (n = 10), in the experimental group (n = 11); *** - number of children in the sanatorium and compensatory type institution in the control group (n = 10), in the experimental group (n = 10); EG - experimental group; KG control group.

activity of boys and girls of the related age groups (3-4 years old) in one health group.

The opinion of Panhelova [8] on the fact that to solve the problem it necessary to optimize the motor mode of children with deviations of health state, to enhance specific forms and means of rehabilitation, rather than to increase the frequency of physical education per a week was confirmed.

The ideas of Marouli et al. [4] on the impact on motor skills and self-perceptions of preschool children were expanded.

The data of Lakhno [13], Panhelova [8] about specificity of development concerning the ontogeny of physical abilities of 3-4 year-old children and also the data of Bondar [14] on the condition of the musculoskeletal system of 3-4 year-old children were confirmed.

Harrington and co-authors [3] research on the involvement of preschool children in various forms of locomotor activity was further developed.

Conclusions

The result of this empirical study confirms the hypothesis that the organization of rational movement mode of children aged 3-4 years old contributes to improving their physical condition. The results obtained indicate the improvement of the quality of the educational process of physical education of children in kindergartens of different types.

Acknowledgments

The research was carried out in accordance with the

Table 4. The indices of functional condition of 4 year-old boys (n=49)

Indices	Type of the establishment	At the beginning of the research		At the end of the research	
		CG	EG	CG	EG
		$\bar{x}$ ± m		$\bar{x}$ ± m	
Length of the body, sm	general development and combined type**	104.2±1.33	104.1±1.35	106.7±0.97	106.9±0.83*
	sanatorium and compensating type***	109.1±0.82	108.8±0.76	111.3±0.78	112.3±0.85*
Weight of the body, kg	general development and combined type	16.6±0.44	16.3±0.89	18.3±0.35	18.2±0.39*
	sanatorium and compensating type	17.4±0.49	17.1±0.56	18.7±0.22	18.9±0.47*
Weight-height index, r • sm^{-1}	general development and combined type	162.6±4.22	161.9±4.13	167.2±3.71	181.7±2.15*
	sanatorium and compensating type	156.4±2.26	156.1±2.18	164.1±4.11	178.2±3.67*
Heart rate at real rest beats min^{-1}	general development and combined type	96±1.2	96±1.3	95±0.97	90±0.63*
	sanatorium and compensating type	101±1.11	101±1.23	100±0.91	95±0.57*
Vital capacity of the lungs, ml	general development and combined type	1010±19.7	1010±18.8	1060±11.2	1280±9.67*
	sanatorium and compensating type	900±21.3	900±20.8	920±12.1	1230±10.7*
Frequency of respiratory cycles, min^{-1}	general development and combined type	25±0.66	25±0.34	24±0.51	20±0.41*
	sanatorium and compensating type	30±0.76	30±0.89	30±0.51	26±0.32*
Ruffier Index, points	general development and combined type	8.9±0.65	8.8±0.91	8.7±0.51	7.0±0.49*
	sanatorium and compensating type	11.8±1.02	11.7±1.14	11.6±0.63	9.2±0.52*

Notes: * - p <0.05 compared to the values recorded in the control and experimental groups at the beginning and end of the experiment; ** - number of children in the institution of general development and combined type in the control group (n = 12), in the experimental group (n = 14); *** - number of children in the sanatorium and compensatory type institution in the control group (n = 11), in the experimental group (n = 12); EG - experimental group; KG control group.

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Conflict of interests

The authors state that there is no conflict of interest.

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The impact of the program of basketball, volleyball and handball on the situation-motorized capability of the first classes of the elementary school

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Abstract

Purpose: Determining the state of the student and his situational-motor skills, and their comparison, enables the teacher to control his work in an immediate manner, and he programmes and implements well planned and additional contents in order to realize the set goals. In order to achieve these functions, it is necessary to determine the current state of the students, as well as the state after the implemented specific contents and programs. The aim of the research was to determine the partial changes (differences) of situational-motor abilities that were created under the influence of a four-month program of basketball, volleyball and handball in the pupils of the fifth grades of elementary school.

Material: The study included N = 106 class V students, aged 10 to 11 years. The sample of respondents was divided into two subgroups, an experimental group (53 students), who conducted physical and health education classes according to the modified plan and program of sports games (basketball, volleyball and handball) for a half-year and control group (53 students) who attended regular classes from physical and health culture according to the current curriculum. 9 variables were used to assess situational-motor abilities. Descriptive statistics and discriminatory analysis were used to determine the changes (differences) in situational-motor skills.

Results: The results of the research at the descriptive level showed certain differences between the groups in the final versus the initial measurements on the individual variables of situational motors. Based on the results of the discriminatory analysis, the relative contribution of each of the variables of the situational motor in the final measurement is seen. The SMKVLS (Running the ball with your hand in the slalom) and SMRBLZ (Throwing the ball against the wall for 30 seconds) variables are the biggest contributors, and the smallest SMOGCPM (Aiming the goal over the net from the basic stand) and SMOSD (Lower frontal serve).

Conclusions: Physical and health culture in schools has the primary task of influencing positive transformation processes in all dimensions of students by applying appropriate content.

Keywords: experimental program, sports games, situational-motor skills, pupils.

Introduction

Previous research on the student population shows that properly programmed teaching or training processes contribute and help to the overall correct growth and development of children [1, 2, 3, 4]. For this reason, it is very important to monitor the effects of teaching or training processes in each phase by appropriate instruments. All of this presupposes relevant information on the basis of which it would be more precisely determined, first of all, the initial state, and in the further process and adequate monitoring of the effects of the programmed activities applied, and afterwards, the final state.

Determining the condition of the students, but also of the group as a whole, allows the teacher to control their work, as well as the planned contents that are implemented to achieve the set goals. In order to achieve the expected results, it is necessary to determine the initial state of the students, at the beginning of the year for programming work, and finally for analyzing the performance of work. Thus, the determined initial state and the predicted desired final state of the students would enable the teachers to determine the state of the students during the year, from the initial to the final state, and in the end to the final analysis and assessment of the effectiveness of the applied model of training, i.e. basketball, volleyball and handball content [5].

Nikšić et al. [5] in his master's thesis on the sample of 50 boys 12-14 years old who are involved in the training process and 50 examinees of the same age who are not involved in the football training process determines the level of differences in basic and situational motor skills. The greatest quantitative differences in space with situational motor skills have been achieved by the following variables: the speed of running the ball at 20 m with start from the place, the speed of running the slalom, running speed with right angle direction and the ball speed per semicircle for the benefit of children who deal with systematic sports, in this case football.

Ražanica [6], on a sample of 127 high school students, aged 15 to 17 years, determines the relations and magnitudes of the influence of some motor skills on the success of performing situational motor tests in sports

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games. In the area of motor skills, eight tests were carried out according to Eurofit, which evaluated five latent hypothetically defined motor dimensions. The results of the regression analysis suggest that the success in sports games is guaranteed by those students whose ability lies in the effectiveness of the regulation system for movement.

Lakota [7] in his master's thesis on the sample of 82 handball players 11-14 years of age tried to determine qualitative and quantitative changes in basic situational motor skills created under the influence of the three-month program of handball. A 52-course handball program produced statistically significant changes in the treated areas.

Hadžikadunić [8], on a sample of 146 male students, identified transformation processes under the influence of programmed physical and health education for 69 hours of instruction in basic motor, situational and motor skills and functional abilities of students of the eighth grade. A system of variables of 8 tests for basic motor abilities and 9 tests for the assessment of specific motor abilities was used, and one test for the evaluation of functional abilities. It was found that programmed teaching has a positive effect on improving basic motor, situational and functional abilities between two measurements.

Bajramović et al. [9] on a sample of 103 footballers aged 12-14 years tried to determine the levels of transformation of motor skills and the success of footballers under the influence of six-month programmed work. Using the t-test for dependent samples at the univariate level, it was noted that the football program caused a number of significant changes after the final measurement. Using factor or discriminatory analysis at the multivariate level, the author concludes that significant global quantitative changes have occurred in the space of situational motor skills and success in the game, while weak changes were observed in the area of basic motor skills.

Lakota et al. [10] determined the qualitative level of transformation of situational motor skills in handball players aged 11-14 years in duration of three months. The sample consisted of 82 male entities. Factor analysis isolated 73% of the total variability. The results indicate that qualitative changes have been shown when hitting the goal with the ball, as well as the speed of movements related to ball control.

Mladenović [11], in his paper "Structural changes in sports games in the teaching of physical education" on the sample of 152 students, implemented the contents of sports games in the teaching of physical education for the duration of one school year. By applying the treatment, the level of structural changes in basic and specific motors was attempted. The results of this program have shown a general, systematic, continuous reconstruction of general and specific motor abilities, therefore the transfomation process is responsible, although not in all situations to the same extent. The worst effects are recorded in the case of football.

Malacko, & Pejić [12] have studied the changes of biomotor pupils aged 11 years under the influence of experimental program of sports games in relation to the standard bodybuilding program. The sample was made up of 252 male students, who were divided into a control and experimental group. A system of 33 variables (12 morphological and 21 for estimation of motor and functional abilities) was used. The experimental program was saturated with the contents of sports games. The results indicate that the morphological system contributes to the same differentiation of the group, while the experimental group showed better results in the motor space, of which 14 variables showed a statistically significant difference in 13 variables, the experimental group was better.

Džumhur [13], investigated changes in motor skills and performance in a small soccer game using the situational method of work. On a sample of 81 subjects, aged 12-14 years. He established that the program with the application of the situational method of work revealed changes in the coordination segment, the speed of movement and the segment of equilibrium. It has positively influenced the improvement of situational performance in the soccer game.

The aim of the research was to determine the partial changes (differences) of situational-motor abilities that were created under the influence of a four-month program of basketball, volleyball and handball in the pupils of the five grades of elementary school.

Material and Methods

Participants

The study was conducted on a sample of n = 106 pupils in the fifth grade, female, aged 10 to 11 years, clinically and mentally healthy, and with no pronounced morphological and locomotor impairments. The sample of respondents was divided into two subgroups, an experimental (53 pupils) and a control group (53 students). The experimental group conducted classes according to the changed curriculum. The program included sports games from handball, basketball and volleyball. The control group carried out the teaching according to the current curriculum.

Research Design

The variables used in this study consisted of 9 situational-motor variables: basketball 3 variables, volleyball 3 variables and handball 3 variables.

- BASKETBALL (Throwing the ball with both hands against the wall and catching it for 30 seconds - SMKBLRZ; Running the ball with your hand in the slalom - SMKVLS; Throwing the ball into the basket for 30 seconds - SMKBLK).
- VOLLEYBALL (Lower frontal serve - SMOSD; Aiming the goal over the net from the basic stand - SMOGCPM; Forearm pass in circle for 30 seconds - SMOOLPK).
- HANDBALL (Throwing the ball against the wall for 30 seconds - SMRBLZ; Running the ball in the slalom - SMRVLS; Performing sevens - SMRIS).

Work program

During the first semester, three teaching units were processed as part of regular classes: athletics, basketball and volleyball. A total of 35 teaching hours of regular

physical and health education were held, of which 12 hours of athletics, 12 hours of basketball, 11 hours of volleyball. The program of additional classes through the basketball, volleyball and handball sports games consisted of a modified curriculum from basketball: adding and catching balls from basketball, running a ball with a stop, a basketball technique, a low-lead technique, a kick-off practice with zipper positions, zigzag guiding, one - handed addition, moving the ball with arms in motion, running the ball with stop in the position of the shot, ball manipulation, pivoting technique with the ball, straight line guidance from high to low, and vice versa. From the volleyball sports, some teaching units worked, for example: hammer hit, passing with fingers over the net, training a school service, mini volleyball, hammering overhead, refusing to throw a ball out of the wall, adding alternate fingers - a hammer, school service with six and nine meters, jumping with both legs from dockyards on the net, shooting a basket with a hammer. From the handball, the teaching units worked as follows: foreclosure, lateral addition, jumping, kicking on the goal, slalom, handball, straight tracking, mini handball, goal kicking - seven, manipulation with a handball, Shade Adding, Adding To The Triples Game 1: 1 Shot on goal. Only girls were involved in this program and for this reason football was not taken as a spot game.

Statistical Analysis

A descriptive statistical procedure was applied in the data processing process.

The following descriptive parameters are calculated:

- Arithmetic mean (Mean);
- Standard deviation (Std. Deviation).

At the multivariate level, changes were made:

- A discriminatory analysis was used to determine the changes and differences between the experimental and control group under the influence of the experimental program in the situational-motor tests.

Results

Display of the collected data by the given characteristics.

Table 1 above presents the average values and measurements of the deviation of the results of the control and experimental group on the variables of the situational motors in the initial measurement. At the descriptive level, there are noticeable differences between groups.

Table 2 above gives an overview of the average values of the control and experimental group on the individual variables of the situational motor in the final measurement. In this case, the differences between the groups are noticeable at the descriptive level.

In the following section, a discriminatory analysis was made to determine the intergroup differences in the individual components of situational motors in the initial and final measurement.

Based on the results of the discriminatory analysis, one significant discriminatory function was identified, the coefficient of the canonical coalition being 0.60. It can be said that this is a significant and moderate correlation

Table 1. Values of arithmetic meanings and standard deviations of situational-motors initial measurement

Variables	Group	N	Mean	Std. Deviation	Std. Error Mean
SMKBLRZ	1	53.00	23.38	5.20	0.71
	3	53.00	22.19	5.89	0.81
SMKVLS	1	53.00	10.32	1.39	0.19
	3	53.00	11.41	2.64	0.36
SMKBLK	1	53.00	4.17	2.52	0.35
	3	53.00	3.83	2.42	0.33
SMOSD	1	53.00	6.72	3.07	0.42
	3	53.00	6.83	3.34	0.46
SMOGCPM	1	53.00	4.34	2.36	0.32
	3	53.00	4.98	2.23	0.31
SMOOLPK	1	53.00	18.34	4.93	0.68
	3	53.00	20.13	6.65	0.91
SMRBLZ	1	53.00	21.42	3.86	0.53
	3	53.00	23.32	4.55	0.63
SMRVLS	1	53.00	11.05	1.73	0.24
	3	53.00	11.90	2.33	0.32
SMRIS	1	53.00	3.36	1.67	0.23
	3	53.00	3.92	2.06	0.28

NOTES: 1 - Control group, 3 – Experimental group; SMKBLRZ - Throwing the ball with both hands against the wall and catching it for 30 seconds; SMKVLS - Running the ball with your hand in the slalom; SMKBLK - Throwing the ball into the basket for 30 seconds; SMOSD - Lower frontal serve; SMOGCPM - Aiming the goal over the net from the basic stand; SMOOLPK - Forearm pass in circle for 30 seconds; SMRBLZ - Throwing the ball against the wall for 30 seconds; SMRVLS - Running the ball in the slalom; SMRIS - Performing sevens.

Table 2. Values of arithmetic meanings and standard deviations of situational-motors final measurements

Variables	Group	N	Mean	Std. Deviation	Std. Error Mean
SMKBLRZ	2	53.00	26.66	4.02	0.55
	4	53.00	24.89	5.59	0.77
SMKVLS	2	53.00	9.24	1.00	0.14
	4	53.00	10.21	1.97	0.27
SMKBLK	2	53.00	6.58	2.56	0.35
	4	53.00	5.51	2.85	0.39
SMOSD	2	53.00	8.89	2.49	0.34
	4	53.00	9.06	2.94	0.40
SMOGCPM	2	53.00	6.30	2.05	0.28
	4	53.00	6.68	2.06	0.28
SMOOLPK	2	53.00	21.83	5.36	0.74
	4	53.00	24.83	7.22	0.99
SMRBLZ	2	53.00	23.45	3.94	0.54
	4	53.00	25.81	4.21	0.58
SMRVLS	2	53.00	10.15	1.43	0.20
	4	53.00	10.57	1.80	0.25
SMRIS	2	53.00	5.09	1.89	0.26
	4	53.00	6.06	2.32	0.32

NOTES: 2 - Control group, 4 – Experimental group

of the structural latent component variants of situational motions in the initial measurement.

According to the value and significance level of the Box test, it can be concluded that there are significant uneven elements matrices of variance-covariance of manifest variables of situational motors in the control and experimental group.

In the described analysis, one discriminatory function was isolated with a canonical correlation value of 0.60 and the value of the characteristic root of 0.57. On average, the factors of the latent canonical variation, ie, functions can explain 57% of the variability in the individual situation motors variables.

According to the Willks lambda indicator and the level of significance of the Hi-squared (which is less than 1%), it can be concluded that the isolated-discriminating function is statistically significant and that selected manifestation variables of situational motors in the initial measurement significantly contribute to the discriminatory function of the classification prediction of the control group and the experimental group in the initial measurement.

Table 3. Box's M test initial measurement

Box's M		**90.56**
F	Approx.	1.83
	df1	45.00
	df2	35532.53
	Sig.	0.00

Table 4. Significance of isolated discriminant functions initial measurement

Function		Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
dimension0	1	.57[a]	100.00	100.00	.60

Table 5. Wilks' Lambda initial measurement

Test of Function(s)		Wilks' Lambda	Chi-square	df	Sig.
dimension0	1	0.64	44.96	9.00	0.00

Table 6. The structure of the discriminatory function of the initial measurement

Variables	Function 1
SMKVLS	0.35
SMRBLZ	0.30
SMRVLS	0.28
SMOOLPK	0.20
SMRIS	0.20
SMOGCPM	0.19
SMKBLRZ	-0.14
SMKBLK	-0.09
SMOSD	0.02

Table 7. Centroids group initial measurement

GROUP		Function 1
di	1	-0.75
	3	0.75

Table 6 above, it can be seen that some situational-motors variables in initial measurement in different ways contribute to an isolated discriminative function, and according to individual values of the coefficients. In doing so, the greatest contribution to the maximum intergroup distinction is given by the variables SMKVLS - Handling the ball by hand in the slalom and SMRBLZ - Throwing the ball on the wall for 30 seconds, while the smallest relative contribution has the variables SMKBLK Throwing the ball into the basket for 30 seconds and SMOSD - Service bottom.

When it comes to centroid groups, they represent standardized near-zero variants in the structure of which are differentiated weighted combinations of situational motions variables. Given the centroid value, it can be seen that the cross-sectional criterion is important in the middle between the centroid values and that the centroids are fairly uniform. This means that there is no difference in the correct classifications and distinctions between the control and the experimental group, as in both groups the percentages of the correct classification are uniform.

In this discriminative analysis, one discriminatory function is also isolated, as can be seen from the following tabular displays.

Table 8. Box's M test final measurement

Box's M		66.51
F	Approx.	1.34
	df1	45.00
	df2	35532.53
	Sig.	0.06

The Box's test is not statistically significant, and it can be said that in the final measurement, the elements of the variance-covariance matrix of the components of the situational motor are mutually uniform, while in the previous, initial measurements they are not. This indicates a higher homogeneity of the groups in the situation after the work program in relation to the measurement before the work program.

An isolated discriminating function has a characteristic root value greater than 1 which indicates that the factors of the latent structure of a discriminant function can explain, on average, the overall variability of one manifest variable of situational motoring. A canonical correlation of 0.71 indicates a high connection between the variants of latent factors. This correlation is higher than in the initial measurement, which indicates a greater possibility for the model to achieve better distinctions between groups.

A model with one discriminative function is statistically significant, which is confirmed by the statistically significant Willks Lmbda expression and Hi-square.

Discussion

Previous research on the student population shows that properly programmed teaching or training processes contribute and help to the overall correct growth and development of children [14 2, 4]. Therefore, it is very important to monitor the effects of teaching or training processes with appropriate instruments.

Hadžikadunić [8], on a sample of 146 male students, identified transformation processes under the influence of programmed physical and health education for 69 hours of instruction in basic motor, situational and motor skills and functional abilities of students of the eighth grade. A system of variables of 8 tests for basic motor abilities and 9 tests for the assessment of specific motor abilities was used, and one test for the evaluation of functional abilities. It was found that programmed teaching has a positive impact on improving basic motor, situational and functional abilities between two measurements (initially and final).

Hadžikadunić [8] determined the qualitative level of transformation of situational motor skills in handball players aged 11-14 years in duration of three months. The sample consisted of 82 male subjects. Factor analysis isolated 73% of the common variability.

The results indicate that qualitative changes have been shown when hitting the goal with the ball, as well as the speed of movements related to ball control.

Hadžikadunić [8], in his paper "Structural changes in sports games in the teaching of physical education" on the sample of 152 students, implemented the contents of sports games in the teaching of physical education for the duration of one school year. By applying the treatment, the level of structural changes in basic and specific motors was attempted. The results of this program have shown a general, systematic, continuous reconstruction of general and specific motor abilities, therefore the transformation process is responsible, although not in all situations to the same extent. The worst effects are recorded in the case of football.

Table 9. Significance of isolated discriminatory functions Final Measurement

Function	Eigenvalue		% of Variance	Cumulative %	Canonical Correlation
dimension0	1	1.01[a]	100.00	100.00	.71

Table 10. Wilks' Lambda final measurement

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
dimension0 1	0.50	69.59	9.00	0.00

Table 11. The structure of the discriminating function of the final measurement

Variables	Function 1
SMKVLS	0.31
SMRBLZ	0.29
SMOOLPK	0.24
SMRIS	0.23
SMKBLK	-0.20
SMKBLRZ	-0.18
SMRVLS	0.13
SMOGCPM	0.09
SMOSD	0.03

Tabela 12. Centroids group final measurement

GROUP		Function 1
di	1	-0.99
	3	0.99

Malacko, & Pejić [12], investigated the changes of pupils aged 11 years under the influence of the experimental program of sports games in relation to the standard program of physical education. The sample was made up of 252 male students, who were divided into a control and experimental group. A system of 33 variables (12 morphological and 21 for estimation of motor and functional abilities) was used.

The experimental program was saturated with the contents of sports games. The results indicate that the morphological system contributes to the equal differentiation of the group, while the experimental group showed better results in the motor space, of 14 variables, which showed a statistically significant difference in 13 variables, was an experimental group.

Based on the results of the arithmetic meanings in the tests for the assessment of situational-motor abilities, at the beginning and at the end of the programmed exercise from volleyball, and on the basis of the significance of the changes tested with the T-test for the dependent samples, it is clearly visible that the programmed exercise from volleyball produced significant partial effects. In tests for assessment of situational-motor abilities, presented in this research by the variables SMJAPT - Japanese test, SMTESJ - seating test, SMPRSE - precision of serving, SOPKNZ - rejection of the ball in a circle on the wall and SOPPOZ - rejection of the ball with forearms on the wall, there is a statistically significant positive shift in the value of the arithmetic mean in all tested variables at the final measurement at the statistically most significant level [14].

Analyzing the results of the final with respect to the initial situation of situational - motor abilities, there has been a rewriting of the variables and an increase in the number of factors, which shows that there have been qualitative changes in the structure, as well as the transformation of some numerical indicators of situational - motor abilities of the respondents. Looking at the whole, the program of regular and additional teaching with its contents and training exercises and loads had a significant influence on the qualitative changes in situational and motor skills [15].

Conclusion

This research was conducted with the aim of determining the partial change (difference) of situational-motor skills created by the influence of a four-month program of basketball, volleyball and handball in the pupils of the five grades of elementary school. The sample of respondents included 106 pupils in the fifth grade, aged 10 to 11 years, clinically and mentally healthy, and with no pronounced morphological and locomotor impairments. The sample of respondents was divided into two subgroups, an experimental group (53 pupils), who carried out physical education classes according to the modified plan and program of sports games (basketball, volleyball and handball) for a semester and a control group (53 pupils) who attended regular classes from physical education according to the current curriculum. The variables applied in this study consisted of 9 variables for assessing situational motor performance in sports games and variables for assessing situational motor performance

from basketball (Throwing a hand with a hand on the wall and capturing for 30 seconds - SMKBLRZ; Handling the ball by hand in the slalom - SMKVLS; Throwing the ball into the basket for 30 seconds - SMKBLK), variables for assessing situational motor performance from volleyball (Service bottom chess - SMOSD; Targeting the target through the net from the base bet - SMOGCPM; SMOOLPK), variables for assessing situational motor performance from the handball (Throwing the ball on the wall for 30 seconds - SMRBLZ; Running the slalom ball - SMRVLS; Performing the seven-meter - SMRIS). Descriptive statistics and discriminatory analysis were used to determine the changes in the situational-motor abilities. The results of the research at the descriptive level showed certain differences between the groups in the final versus the initial measurements on the individual variables of situational motors. Based on the results of the discriminatory analysis, the relative contribution of each of the variables of the situational motor in the final measurement is seen. The SMKVLS and SMRBLZ variables have the greatest contribution, and the smallest SMOGCPM and SMOSD. These coefficients indicate the relative contribution of these variables of the model's ability to distinguish between members of one or the other group. Centroid values are higher than in initial measurements, which means that the model has better distinctions than in the initial measurement. Because of this, it can be said that there are indications that the effect of the work program has led to changes in the latent structures of the groups, which lie at the basis of the values of the manifest variables of situational motions. The results obtained can be of benefit to teachers, as well as professors of physical and health culture in conceiving similar programs and their implementation in everyday teaching practice.

Conflicts of Interest

The authors declare no conflict of interest.

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Preparation of athletes in cyclic sports taking into account the functional state of the external respiratory system and cardiovascular system

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Abstract

Purpose: The purpose of the study is to investigate the preparation of athletes in cyclic sports, taking into account the functional state of the external respiratory system and cardiovascular system (on the example of academic rowing).

Material: The study involved 13 athletes aged 19-22 years old. Athletes went for academic rowing in the Dnipropetrovsk region. A control and experimental group of 6 and 7 people were created, respectively. At the beginning of the experiment, there were no significant differences in fitness, physical development, and functional status between groups ($p > 0.05$). All study participants gave written consent to participate in the study. The studies were carried out at the specialized school of the Olympic reserve in rowing of the Dnepropetrovsk regional organization of the sports society "Ukraine", the regional school of higher sportsmanship. Medical and biological testing was conducted at the scientific laboratory of the Pridneprovsk State Academy of Physical Culture and Sports.

Results: The dynamics of the indicators of the functional status of light weight rowers in rowing academic after using the experimental method was shown. It has been determined that under the influence of the experimental methods the cardiovascular system parameters underwent positive changes. These are the indices of variation range, vegetative rhythm index, pressure index, PWC170 test, maximal oxygen consumption, cardiovascular system response to exercise, recovery period. The introduced technique had a positive effect on the performance of athletes. In the experimental method, it was proposed to change the load in the complexes of exercises for the development of strength, maximum force, strength and speed endurance. The proposed technique of improving physical fitness was reflected in the formation of the plan of the annual training cycle. In accordance with the tasks of the period and mesocycles, exercises aimed at developing the leading qualities of light weight rowers were included.

Conclusions: The analysis of the literature on the problem of research and generalization of the training of athletes in cyclic sports at the stage of preparation for higher achievements has revealed problematic issues. On the example of academic rowing these questions relate to the peculiarities of improving the process of physical preparation of rowers with light body weight, the peculiarities of functional state, the study of indicators of their physical and functional fitness. The dynamics of the functional state of the external respiratory system and cardiovascular system of athletes in cyclic sports (on the example of academic rowing) has been investigated. Some positive changes in the results of the vegetative index of the rhythm of the athletes were revealed. These indicators have approximated the value of the autonomic balance of athletes in the direction of parasympathetic regulation. There is a tendency to decrease the index of pressure. There was a decrease in heart rate, an increase in the maximum oxygen consumption and the level of physical performance.

Keywords: athletes, academic rowing, functional state, respiratory system, cardiovascular system.

Introduction

An important condition for getting high results in the sport of higher achievement is having complex theoretical and practical knowledge by the athletes. A number of specialists were engaged in the problems of studying the functional state of the system of external respiration and cardiovascular system of athletes [1], So, Savchenko et al. [2] proposed modern methods of research in physical culture and sports. The features of the training process in cyclic sports were considered by such authors as Mitchell et al. [3]. The information on the functional state of an athlete's body is necessary to identify the features of his or her body's activity [3, 4].

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In academic rowing these issues were studied by Barykinsky [4], Dyachenko [5], Omelchenko [6], Thompson et al. [7]. So, Dyachenko proposes a system for improving the special endurance of qualified athletes, taking into account the indicators of functional state. Barykinsky [4] proposes the use of functional status assessment as a criterion for predicting training performance. Omelchenko [6] considered organizational and methodological aspects of a training program for light weight athletes. Thompson et al. [7] dealt with the issues of increasing the efficiency of the training process. Danziger [8], Brown [9], Ivanova [10] associate athletic performance with athletes' fitness level.

The functional state of the external respiratory system and cardiovascular system plays an important role in sports

with a predominant role of endurance [11-14]. In these sports, athletic performance depends on endurance. These kinds of sports include academic rowing. In this sport, for the rational planning and control of physical fitness, it is necessary to determine the level of functional status of the above systems [15-19]. According to scientists, the practical solution of the problem outlined is the most possible due to the search for new ways to increase the physical preparedness of rowers in different periods of the annual cycle [20-23]. This leads to the development of new training programs. These programs should take into account the level of correlation between rowers' fitness and functional state [24-26].

According to Lukovskaya [27], Savchenko et al. [2] the most promising approach for improving the fitness of athletes in cyclic sports is to take into account their current functional state of the external respiratory system and cardiovascular system. The analysis of the literature indicates that there is no research regarding the influence of certain methods of training athletes in cyclic sports, taking into account the functional state of the external respiratory system and cardiovascular system.

Hypothesis. It was assumed that the use of experimental methods of improving the physical fitness of athletes will have a positive effect on their functional state of the system of external respiration and cardiovascular system.

The purpose of the study is to investigate the training of athletes in cyclic sports, taking into account the functional state of the external respiratory system and cardiovascular system (on the example of academic rowing).

Material and methods.

Participants. The study involved 13 athletes aged 19-22 years old. They were engaged in academic rowing in Dnepropetrovsk region. A control and experimental group of 6 and 7 people were created, respectively. At the beginning of the experiment, there were no significant differences in fitness, physical development, and functional state between groups ($p > 0.05$). All study participants gave written consent to participate in the experiment.

Organization of research. The research was carried out at the specialized rowing school of the Olympic reserve of the Dnepropetrovsk regional organization of the sports society "Ukraine", the regional school of higher sportsmanship. Medical and biological testing was conducted at the scientific laboratory of the Pridneprovsk State Academy of Physical Culture and Sports. The participants of the experiment were trained 11 times a week. The duration of one session was 180 minutes.

The training process of the control group was planned according to the "Curriculum for children's and youth sports schools, specialized children's and youth Olympic reserve schools, schools of higher sportsmanship and specialized educational institutions of sports profile".

The pedagogical experiment was to introduce and determine the effectiveness of the developed method of improving the fitness of athletes in cyclic sports at the stage of preparation for higher achievements (as an example of academic rowing).

The common features of the training and control process of the control and experimental groups were one-cycle planning during the year, construction of meso and microcycles. The number of mesocycles was 9, the number of microcycles was 52. The total number of hours planned for general and special physical training in accordance with the "Curriculum for children and youth sports schools, specialized children's and youth schools of the Olympic reserve, schools of higher sportsmanship and specialized educational institutions" academic rowing was 900 hours.

The experimental method of improving physical state, taking into account the functional state of athletes, was based on the basic points of the training system. The methodology took into account the general and specific principles of sports training, the task of the stage of preparation for higher achievements, scientific approaches to the planning of the training process [6].

In the experimental method, it was proposed to change the load in the complexes of exercises for the development of strength, maximum force, strength and speed endurance. In accordance with the tasks of the period and mesocycles, exercises for the development of leading qualities were included.

During the performance of the exercises for maximum strength development, 2 schemes were applied.

The first scheme: performing exercises with increasing weights from 85% to 97% with the number of repetitions 7-5-3-1 and performing the same exercises with decreasing weights from 97% to 85% with the number of repetitions 1-3-5-7. Maximum force development exercises were performed with a capacity of 85 to 97%. In the training session 2-4 approaches were conducted. The rest breaks were 3-4 minutes. In exercise mode after doing the exercise the projectile was put on the rack for a few seconds to relax the muscles. This mode of work maximally contributed to the improvement of the ability for "explosive" display of the effort. This is important for rowers while rowing during the start speeding of the boat.

The second scheme: 5 series (with 4-5 exercises) with 2-3 repetitions with a load of 95% of the maximum and a recovery period of 4-6 minutes are performed.

For development of power qualities were used squats with a barbell, lifting a barbell, exercises with dumbbells with a load of 40-50% of the maximum, and the number of series was increased from 3-4 to 5-7.

For the development of endurance in the performance of exercises with the barbell weight load was reduced from 45 to 40 kg. The number of series increased from 8-10 to 11-12. The development of power endurance during rowing on the water occurred by reducing the power of the rowing machine with increasing the speed of rowing from 12-16 to 14-18 rowing per minute. For the development of speed endurance at rowing on the ergometer «Concept-II» the speed of rowing was increased from 28-32 to 33-34 rowing per minute, while rowing on water - from 32-35 to 36-38 rowing per minute respectively. In the experimental group, boats with lower displacement and

lighter and shorter oars were used.

Means for improving the general and special fitness of athletes were formed in 5 blocks of 5-7 exercises. The volume, intensity and mode of exercise were determined taking into account differences in athletes' physical and functional fitness.

In order to increase the overall fitness, we used general developmental exercises, jogging, skiing, swimming, barbell exercises, strength exercises with a partner, sports games. Special physical training was aimed at the development of special physical qualities. For this purpose such exercises as rowing with a hydraulic brake, rowing with weights, rowing on elements, rowing on the ergometer «Concept-II», rowing in a rowing pool, lifting of a bar were applied. Auxiliary training included exercises for shaping special motive actions: catching the ball (to form the correct grip of the paddle) and jumping on a 25 cm high platform (to form the correct kicking in the boat).

The proposed methodology was reflected in the preparation of the annual training cycle plan. In accordance with the tasks of the period and mesocycles, exercises for the development of leading qualities of rowers were included. An annual training cycle plan has been drawn up. The preparatory period lasted 20 weeks and consisted of three mesocycles - retractable, basic and control-preparatory.

The task of the preparatory period of the annual cycle was the individualization of physical training. It was aimed at improving endurance, strength endurance and maximum strength of light weight rowers.

The retractable mesocycle of the preparatory period was aimed at gradual bringing the body to the effective performance of specific training loads and increasing the functionality of the main systems of the body. Its tasks were to stimulate adaptation processes in the body of the athlete, to solve the basic tasks of all types of training, to improve the overall physical qualities (endurance and strength). The contents of the mesocycle consisted of barbell exercises. They were performed with a power of up to 50% of the maximum and at a heart rate of 150-160 beats per minute. Rowing on the Concept-II ergometer was performed with similar heart rate indicators. During the exercise with the barbell the number of series increased from 8-10 to 11-12 with a reduction in load capacity by 5 kg. During the rowing on the Concept-II ergometer the length of the sections was 250 m. The speed of rowing was increased to 36-38 rows per minute. In this mesocycle we used general training and special preparatory exercises with the use of continuous, interval, repeated training methods.

The basic mesocycle was aimed at enhancing the functionality of the body of athletes and the development of endurance, strength endurance and maximum strength. The main means of the mesocycle were jogging, rowing on the Concept-II ergometer, barbell exercises using continuous, repeated and interval methods. The power of exercises with the barbell and during rowing on the ergometer was 90% of the maximum at a heart rate of 170-180 beats per minute. The length of the rowing course on the ergometer was 250 m with a speed of 36-38 rows per minute.

The control and training mesocycle was aimed at integral training of the athlete. The tasks of this mesocycle were to stimulate adaptation processes, increase the level of physical training and the implementation of integrated training. Its contents included jogging and rowing exercises with the use of lightweight equipment. Continuous, repeated, and interval methods were used. Rowing exercises were performed with a power of 80-90% of the maximum at a heart rate of 170-180 beats per minute.

The focus of the annual cycle competition period was to maintain and further enhance the level of special preparedness and maximize sports performance.

The racing period lasted for 24 weeks. It consisted of pre-race, racing and test-preparation mesocycles. During the competition period, 50-60% of the time was devoted to the use of special preparatory exercises. The volume of special physical training increased to 30%. Total physical training was reduced from 15% to 10%, respectively. During this period, exercises to develop maximum strength and endurance were excluded.

In pre-race and control mesocycles, athletes worked to eliminate individual gaps in technical preparedness. Lightweight equipment was used during water trainings. The speed of rowing training stretches was increased to 36-38 rows per minute with a decrease in load capacity.

The racing mesocycle was aimed at achieving the highest possible result in competitive activities. The volume and load intensity were reduced by 30%. The number of special-purpose exercises was increased. Short distance rowing, race distance rowing, maximum speed distance rowing was used.

The transition period lasted for 6 weeks. It consisted of reducing microcycles. It was aimed at restoring the physical potential of athletes after training and competitive workouts.

The study of the functional state of the external respiratory system and cardiovascular system of rowers was carried out after the preparatory period and was evaluated by the indicators of cardiointervalography and bicycle ergometry. Special fitness testing was conducted during the competition period.

Statistical analysis. Statistical processing of the study materials was carried out using Microsoft Excel 2010. The arithmetic mean and the violation of arithmetic mean were calculated. The reliability of the differences between the sample rates was checked using the White test and the criterion of characters and has been considered statistically significant at $p < 0.05$.

Results

The indicators of cardiointervalography of athletes make it possible to trace the dynamics and evaluate changes in the cardiovascular system after the implementation of the experimental method (Table 1). Heart rate (heart rate) in the experimental group remained unchanged (65.57 ±

8.93 bpm). In the control group, a decrease of 3 beats / min was observed, which was 4% by White's criterion, p> 0.05.

Positive changes in the indicators of the amplitude mode in both researched groups were not pronounced. This indicator changed by only 5% according to White's criterion (p> 0.05). The coefficient of variation decreased from 23.85% to 18.71%. This testifies to the activity of the sympathetic department of the autonomic nervous system and the interconnection of the nervous and humoral channels of stimulation of the heart rhythm and informs about the unchanged state of the department of this system.

The optimization of the cardiovascular system of the athletes of the experimental group of the experimental group was confirmed by the results of the analysis of the values of the variation range (X). They changed by White's criterion by 8% (p <0.05) and amounted to 341.71 ± 80.71 $. This indicates an improvement in the adaptive response of the body of the athletes of the experimental group to exercise.

In the vegetative index of the rhythm of the athletes of the experimental group observed some positive changes by 7%. The values of these indicators approximated the vegetative balance of athletes toward parasympathetic regulation (p <0.05 by White's criterion). Voltage index indices in both groups tended to decrease (by 12% in the control group and by 30% (p <0.05) in the experimental group). The value of this indicator in the experimental group was 59.37 ± 32.34 USD. There was a decrease in indices of the voltage index within the autonomic equilibrium (51-199 $). This indicates an improved resistance of the body of athletes to stress reactions and the preferential regulation of the sympathetic nervous system. The coefficient of variation (V = 44.16%) for this indicator indicates a large divergence of indicators due to the individual characteristics of the athlete's reaction.

The heart rate in rowers of the experimental group decreased by 5% and amounted to 70.50 ± 2.86 beats • min (p> 0.05 according to White's criterion). The coefficient of variation marked a greater homogeneity of results compared to the previous ones and amounted to 4.05%.

Also the results of a comparative analysis of the features of changes in cardiovascular system parameters were of great interest. In the PWC_{170} test data, the coefficient of variation in the athletes of the experimental group was halved to 12.25%. This indicates more uniform results of the athletes after the experiment (Table 2).

The performance of the PWC170 test of the athletes of the experimental group decreased by 9.3% and after the experiment amounted to 1472,14 ± 180,39 kgm • min-1 (Table 2). In control group athletes, the changes were 3% and amounted to 1541.17 ± 159.00 kgm • min-1.

A convincing proof of optimization of the training process of rowers of the experimental group was the results of the analysis of the values of maximum oxygen consumption. They improved by 7 ml · kg^{-1} · min^{-1} (p <0.05). The results of the control group changed significantly and remained at the same level - 54.17 ± 3.90 ml · kg^{-1} · min.

In both groups of patients, the response of the cardiovascular system after the introduction of our technique has become normotonic.

The recovery period of the cardiovascular system of rowers of the experimental group underwent positive changes and amounted to 9.17 ± 2.79 min. (p <0.05). This

Table 1. Indicators of cardiointervalography of athletes of the control and experimental groups before and after the experiment

Indicators	CG(n=6) $\bar{x}$ ± S		EG (n=7) $\bar{x}$ ± S	
	Before the experiment	After the experiment	Before the experiment	After the experiment
Heart rate beats per $minute^{-1}$	63.88±5.00	60.17±2.90	64.86±4.86	65.57±8.93
Arithmetic mean NN-intervals, c. u.	950.00±65.00	993.67±52.67	931.43±62.43	940.71±128.21
Standard deviation of NN-intervals, c. u.	62.00±10.00	60.43±2.,43	60.43±21.43	59.14±13.43
Standard deviation of difference of consecutive NN-intervals, c. u.	60.00±16.77	62.67±14.48	47.57±20.46	54.86±19.25
% of adjacent NN intervals, the difference between which exceeds 50 ms, c. u.	32.00±13.00	42.67±10.38	21.43±17.29	29.00±16.50
Mode, c. u.	990.00±55.00	979.56±44.29	926.29±68.96	920.71±134.46
The amplitude of mode, c. u.	10.66±3.55	10.10±2.74	9.97±2.38	8.57±1.60
Variation swing, c. u.	330.83±45.00	319.00±42.29	319.00±80.75	341.71±80.71
Total heart rate variability, c. u.	23.00±7.88	22.50±4.86	22.14±6.18	24.57±5.07
Vegetative Equilibrium Index, c. u.	135.00±36.00	113.15±24.29	147.47±68.05	125.29±52.36*
Vegetative rhythm indicator, c. u.	3.69±1.10	3.38±0.54	3.99±1.17	3.73±1.10*
Pressure Index, c. u.	83.00±16.65	73.23±14.06	85.57±40.45	59.37±32.34*

Note. * - p <0.05 compared to the values recorded in the control and experimental groups at the beginning and end of the experiment; KG - control group, EG - experimental group.

Table 2. Indicators of functional reserve and condition of the cardiovascular system of light weight rowers when performing dosed physical exercise after the forming experiment of control and experimental groups

Indicators	CG(n=6) $\bar{x}$ ±S		EG (n=7) $\bar{x}$ ±S	
	Before the experiment	After the experiment	Before the experiment	After the experiment
F rest beats per min ^{1} **	73.95±4.50	73.80±4.20	73.86±3.39	70.50±2.86*
f_1, beats per min^{-1}**	142.00±7.55	141.50±7.29	135.29±7.29	131.33±7.14
f_2, beats per min^{-1}**	168.00±9.77	172.17±7.86	164.43±11.07	166.14±7.36*
PWC170, kgm per mi^{n-1}	1590.00±175.00	1541.17±159.00	1622.14±348.18	1472.14±180.39
Assessment of the level of physical performance	low	low	low	Lower the average
Maximum oxygen consumption, ml.kg^{-1}·min^{-1}	55.00±4.00	54.17±3.90	55.33±3.71	61.86±5.36*
Reaction of the cardiovascular system	normotonic	normotonic	hypertensive	normotonic
Recovery period, min.	11.85±2.00	10.71±0.71	12.86±3.89	9.17±2.79*

Note. * - p <0.05 compared to the values recorded in the control and experimental groups at the beginning and end of the experiment; ** - F (f) - heart rate; KG - control group, EG - experimental group.

is 16% better than the previous data. The coefficient of variation decreased from 30 to 26%.

The results obtained indicate an increase in the fitness level of athletes. This was facilitated by the developed experimental method of improving the physical training of light weight rowers at the stage of preparation for higher achievements. This gives reason to recommend it for practical use.

Discussion

The analysis of the scientific and methodological literature has revealed problematic issues regarding the peculiarities of the process of training athletes in cyclic sports. In particular, there is no academic research on the impact of individual training methods on athletes, taking into account their functional state. We have investigated the functional state of athletes in cyclic sports (on the example of academic rowing) according to the indicators of cardiointervalography and cycling ergometry of light weight rowers.

Studies have shown the positive impact of physical training techniques for light weight athletes at the stage of preparation for higher achievement. This technique takes into account the requirements of program-normative documents, features of competitive activity, anthropometric indicators of athletes, their functional state and physical state. The distribution of training loads in meso and microcycles of the annual cycle of training for athletes with light body weight with the definition of the volume of general and special training is developed. This technique is intended exclusively for rowers with light weight. It takes into account their weight category and load capacity. Changes of loading in complexes of exercises on development of power qualities, maximum force, force and speed endurance were suggested. When performing exercises for the development of maximum strength, 2-4 approaches were performed with pauses of 3-4 minutes: loading up to 97% (7-5-3-1 repetitions), loading up to 85% (1-3-5-7 repetitions). There were performed 5 series (4-5 exercises, 2-3 repetitions) with the load 95% of the maximum, recovery period was 4-6 minutes. For the development of power qualities we used the load 40-50% of the maximum, the number of series was increased to 5-7. For the development of power endurance the load was reduced to 40 kg, the number of series was increased to 11-12. During rowing on the water the power of the paddle was reduced, the speed of rowing was increased to 14-18 paddles per minute. For the development of speed endurance at rowing on the ergometer "Concept-II" the speed of rowing was increased to 33-34 rows per minute; during rowing on the water - up to 36-38 paddles per minute. Boats with less displacement and lighter and shorter oars were used. The analogues of the existing methodology have not yet been identified.

The introduction of this technique contributed to the realization of individual capabilities of athletes. The revealed data testify to optimization of work of cardiovascular system and improvement of adaptation reaction of an organism of athletes to physical activity (by indicators of cardiointervalography and bicycle ergometry). This demonstrates the superiority of this technique as opposition to the traditional training program.

The data of Dyachenko [5] on a system of improving the endurance of qualified athletes, taking into account the indicators of functional status were confirmed.

The data of Barykinsky [4] on the use of functional status assessment as a criterion for predicting training effectiveness were supplemented. These indicators may be a prerequisite for enhancing the specialized orientation of the training process of qualified academic rowers.

The data of Omelchenko [6, 28] on the features

of organizational and methodological aspects of the training program for light weight athletes and the data of Thompson et al. [7] on improving the efficiency of the training process, taking into account the functional state were supplemented.

Platonov's [1] ideas on the basic aspects of the modern system of training of qualified athletes in rowing academic and Ivanova [10] and Simpson's [29] views on the peculiarities of changes in the functional status of rowing athletes were further developed.

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Conclusions

1. The analysis of the literature on the problem of research and generalization of the training of athletes in cyclic sports at the stage of preparation for higher achievements has revealed problematic issues. On the example of academic rowing these questions relate to the peculiarities of improving the process of physical preparation of rowers with light body weight, the features of functional state, the study of indicators of their physical and functional fitness.

2. The dynamics of the functional state of the external respiratory system and cardiovascular system of athletes in cyclic sports (on the example of academic rowing) is investigated. Some positive changes in the results of the vegetative index of the rhythm of the athletes were revealed. These indicators have approximated the value of the autonomic balance of athletes in the direction of parasympathetic regulation. There is a tendency to decrease the index of pressure. There was a decrease in heart rate, an increase in the maximum oxygen consumption and the level of physical performance.

Prospects for further research are the scientific study of the dynamics of rowing spirography and electrocardiography in academic rowing.

Conflict of interests

The authors state that there is no conflict of interest.

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Improving technical fitness of race walkers on the basis of special exercises to focus on key parameters of movements

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Author contribution: A – study design; B – data collection; C – statistical analysis; D – manuscript preparation; E – fundrising

Abstract

Purpose: In race walking, the reliability of competitive activity, the risks of disqualification are determined by athlete's stable control of the key motion characteristics at a distance, especially in the face of fatigue. Therefore, the formation of specialized sensations in an athlete to control these movements is an important condition for sports technique improvement. Hypothesis of study: the use of special exercises to increase the analytical perception of motion key parameters will increase the effectiveness of race walking technique, control for fatigue development. Objective of study: to show the possibilities of increasing special fitness in race walking through the use of special exercises, improvement of the analytical perception of motion key parameters.

Material: 10 athletes aged 17-20 years and engaged in sports training for 4-6 years participated in the study. Special exercises, assessment of race walking technique (video shooting) before and after their performance within three weeks (10 sessions) were used.

Results: it is shown that the targeted use of special exercises with the analysis of subjective sensations creates conditions for the activation in the athlete of specialized perceptions for the basic sports technique elements. After the use of special exercises, the increase in speed was due to an increase in the stride length - 1.14 m (S = 0.04), relative to the initial one - 1.09 m (S = 0.03) ($p < 0.01$). The stride length increase in athletes occurred at the expense of the length of the "rear" stride ($\bar{x}$ = 0.43 м; S = 0.02) at statistically significant differences from the initial indices. This created the prerequisites for improving athletic performance.

Conclusions: Special exercises focusing on key parameters of movements contribute to increase of technical fitness of race walkers. The proposed approach creates the prerequisites for further research on the formation of the motor composition of the skill of body position accuracy, the development of sensations of free movement, inertia, liberation from excessive degrees of freedom in the parts of the body with account for the functional state of the athlete.

Keywords: race walking technique, fatigue, specialized sensations, work capacity increase.

Introduction

An important aspect of race walking training is associated with the improvement of specialized sensations. The characteristics of movement, the formation of skill motor composition during fatigue development are scarcely presented in special literature. Professional sport means early specialization. Much attention is paid during the initial training at motion technical elements. In modern sport, the level of development of specific sensorimotor qualities is the mainstay of sports and technical mastery. Their indices hold the important place in the complex system of functional diagnostics. Race walking is the sports event, which requires a high level of functional preparation, a delicate "muscle sense" and developed "motor memory". Of great importance are the individual feature of the distinctive sensitivity of the main kinematic and dynamic parameters of movement, operative thinking and attention [1].

Considerable attention was paid to the study of psychomotor system in sport. In recent years, there has been an increased interest in the scientific development of diagnostics and formation of psychomotor capacities in highly skilled athletes. It has been demonstrated that "sports" talent is a combination of intellectual and psychomotor capacities that gives a person the opportunity to successfully, independently and originally perform and create in complex sports motor activity [2]. Some works partially reveal the problem of the methods of directional correcting the race walking technique [3]. Studies of the coordination structure and its changes in respect of other informative indices of athletes' fitness are presented; the spatio-temporal organization of movements of skilled race walkers is shown [4]. The educational process involving psychomotor system is sometimes presented as the formation of "motor skills", which requires attention already at the initial stages [1]. Then ensues the cognitive phase of motor skill training with demonstration and gestures, followed by the associative phase. It is long, practical, fixing and autonomous for unconscious realization according to the classification of P. Fitts [5]. There are known methods, in which psychomotor training is demonstrated by physical skills: coordination, dexterity, manipulation, grace, strength, speed and includes educational goals: perception - the ability to use sensory signals to control motor activity; readiness to act - mental, physical and emotional affirmations; guided response - the early stages of learning a complex skill; it includes

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imitation, trial and error method [6]. The next method - computer assisted instruction (CAI) is used in educational technology [7]. Today, modern computer assisted instruction of psychomotor skills is used in sports. The development of e-sports educational programs can provide a positive impact on the study of psychomotor skills, assist in finding young sports talents, in track and field included [5]. Such technologies should be used in sports more often [8]. The psychomotor aspects of improving and teaching race walking technique are insufficiently represented in special literature. Activation of psychomotor abilities of athletes is not fully implemented; elaborations for improving the technique of race walking and training are scarcely represented [9]. This area of studies is quite actual, since the IAAF Council decided (March 2019, Doha) to introduce technology (RWECS) to assist judges in identifying athletes who have lost contact with the ground. The trials on the introduction and distribution of chips in the insoles of athletic shoes of athletes competing in race walking are near completion.

Hypothesis of study: special exercises tend to activate the athlete's analytical perception of motion key parameters. This increases the efficiency of race walking technique. The determinants of the "sense of differentiation and presentation" of the motion temporal characteristics are specified: duration, pace, rhythm, speed, time sequence of movements. *Objective of study*: to show the possibility of increasing special fitness in race walking while using special exercises, improving the athlete's analytical perception of motion key parameters.

Material and methods

Participants

The study involved 10 athletes aged 17-20 years (males) and engaged in sports training for 4-6 years: one Candidate Master of Sports, six first-rate and three second-rate athletes.

All athletes agreed to participate in the experiment.

Organization of study.

Video shooting was used. The "Lumax" hardware-software complex was used for video content analysis, the main technical characteristics and capabilities of which are detailed in the publications of the developers [10]. The registration of the body positions of athletes during competitive exercise performance was carried out by "Sony HDR-PJ50E" video camera at a speed of 50 frames per second. All metrological requirements, the placement of the camera were taken into account, which minimized systematic and random errors. A 20-link model of human body was used to digitize the kinematics of athletes' biolinks. Point interpolation had a standard sequence. The result in race walking is directly proportional to the average speed of movement and depends on stride length and frequency. These parameters and their ratios are the main characteristics for assessment of race walking technique [4, 9].

Fig. 1 illustrates the main constituents of stride length in race walking.

Realization of the study objectives required elaboration of exercises for the development of specialized sensations in race walkers. They are focused on improving the analytical perception of motion key technical parameters in this sports event.

During three weeks of the preparatory period of training, three technical, specially targeted sessions per week have been conducted (10 sessions every other day)

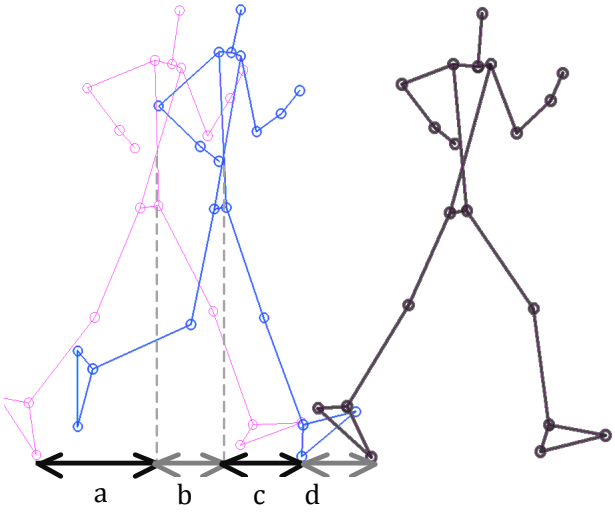

Fig. 1. Characteristics of stride length constituents in race walking: a - rear stride; b - flight distance; c - front stride; d - support transition (foot length) [9].

The exercise program presented below to improve race walking technique was used without changing the general direction of preparation. Race walking technique was evaluated (video shooting, frame-by-frame analysis of the technique) before experimental 3-week period and after its completion in the course of covering a 10 km distance in its final part at a stadium.

The basics of classical instruction in race walking technique are presented in special literature [9, 11, 12]. Exercises are performed in the form of covering 100 m interval segments to work out the rhythm structure and accentuate technical parameters [13]. They are presented, with minor differences, by the following tasks: 1. To create an idea of race walking technique. 2. To teach the correct leg movements during race walking. 3. To teach the pelvis motions while walking. 4. To teach the arm and shoulder movements while walking. 5. Complex improvement of race walking technique.

In contrast to this method, athletes were offered walking at a slow, average, fast and competitive pace at distances of 30-50 meters in a straight line. The distance was covered in a certain sequence according to mastering the movements of walking. 5 special exercises were used. Athletes were trained in concentration and switching attention to the movements of the right and left sides of the body, so that to "liberate" the opposite body side for mental, automatic rational movement of the free links.

The appearance of *sensation 1* - "liberation of the body links" along the length of the kinematic chain of

pelvis – foot, determined the search for *sensation 2* - the inertia of free motion. Task solution followed by rest, HR recovery to 80-90 beats / min. The pause was considered as a factor of psychomotor stimulation.

During exercise performance, the construction of movements in race walking included determining semantic corrections:

- *objectives:* to feel the support reaction when the foot touches the surface in places of training, competition, its depreciation, "recoil";

- *tasks:* to focus on motor sensations, form the basic skill of take-off after a vertical with straight supporting leg in the wake of the "recoil" of the bearing surface after depreciation;

- *technical details:* to feel and use the action of reactive and ballistic forces in the direction of the foot-lower leg-thigh-pelvis-thigh-lower leg-foot of the other leg to correct the sensations of inertia of the "free motion" in the process of walking.

Special exercises for development of the sensations of the bearing surface during walking, the "feeling of the track" on which training or competitions are held.

Exercise 1. Walking at a slow pace, 2-3 × 40-50 meters in a straight line. A preliminary simulation is performed. Hand movements for walking, straight, bent, half-bent, search for a comfortable position. Apply walking with eyes closed and open; blocking the auditory analyzer.

Close the athlete's eyes, use ear plugs (SureFire EP10 Sonic Defenders® Ultra Max Large), and reduce the impact of environmental sound. Athlete "plunges into the inner body."

Athlete straightens legs in knee joints and visualizes pelvis movements from top to bottom and from back to front, along stretched forward elipsoid. This technique is quite effective for the formation of kinesthetic images of motions at the expense of activation of proprioreceptors [9]. Focus on the beginning of "movement in the sacral region, which should remain calm and firm, being the fundamental pillar" [14]. In each phase of the movement the equilibrium should be achieved. It is necessary to maintain focus on sensations in the area of the suggested center of gravity.

In case of center of gravity displacement, one should control the *sensation 3* - "fullness, profuseness" of the supporting leg and that part of the body on which the body weight is transferred, respectively, the *sensation 4* - "emptiness" in the opposite, support-free leg.

To control breathing: a calm rhythm, shoulders relaxed and lowered, neck muscles without tension, determine the head position.

To train the athlete to move at the expense of active movement of the" pelvis-thigh" link. The knees and feet are "off" to the extent of the level of development of individual coordination and do not enter into active movement.

Continue walking at a slow pace. 2-3 × 40-50 meters in a straight line. The athlete concentrates on the appearance of *sensation 5* - "pelvis-thigh", body forward orientation. Every 7-10 strides, after passing the vertical in the support phase, perform elastic movement in the knee joints, minimal in amplitude, feel depreciation.

Straight leg walking, concentration of attention shifts from the pelvis and thigh to the knees, athlete weight pressure on the support contributes to the depreciation of the surface coating, its "recoil". The next stage in the formation of new sensations begins to work when, after depreciation of the road pavement, the forefoot becomes involved. Focus on the *sensation of 6th* - link "thigh - knee - foot - forefoot".

Exercise 2. Walking at a slow pace 2-3 × 40-50 meters in a straight line. The exercise is performed by an athlete with eyes closed, an attempt is made to control the stride length by the symmetry of efforts. The coach is next to the athlete and corrects the movement in a straight line. Change the angle of foot bending by 5°, the athlete designates and remembers the springy movement of the pelvis, knee, middle part of the foot.

Muscle tension occurs, the athlete expects a "recoil" of the road pavement without participation of visual and auditory analyzer. Control of subjective sensations, inaccuracy of movements, photo and video shooting was made to clarify the angles of flexion in the joints of an athlete.

Exercise 3. Walking at a slow pace at the same distances. Visual and auditory control is present. The athlete increases the angle of flexion in the knee joints to 20° (half-squat), until the feeling of tension in the lower back, pelvic joints, ankle and metatarsal joints. To sustain a pause until appearance of *sensation 7* – the road pavement reactive response along the length of all lower extremity links.

Exercise 4. Walking in a natural position, visual and auditory control is present.

2-3 × 40-50 meters in a straight line. The athlete accentuates the movement of the pelvis from top to bottom and forward, pelvis - knee - foot - road pavement. Concentration of attention works on "proactive reflection", the take-off, forward movement through the foot of the whole body, acceleration of movement are predicted. It is important to sustain a short pause for "turning on" the depreciation and recoil of the road pavement to accelerate the movement of the leg links (stride length).

In this exercise, it is necessary to include a roll from the outer arch of the foot to the forefoot and the big toe, promoting the sensation of a ballistic wave throughout the whole leg to the pelvis and backward.

Exercise 5. Trunk twisting should be added to the lower extremity motions. Emphasize the left hand (elbow) movement towards - forward to the right knee. Depreciate the spine after a reaction of the support; perform the same with the right half of the body. The vertebral column is located at the top of the right and left kinematic chains of the lower extremities. Ascending loads are transmitted to it from bottom to top. Compensating counter-directed torsion loads of the shoulder girdle are directed from top to bottom along the spinal column, and usually meet at the XI thoracic vertebra. The axial position of the spinal column makes it the target for ascending effects of the

right and left kinematic chains of the lower extremities, pelvis and descending impacts of the shoulder girdle. In the traceable unified structural and functional kinematic chain "lower extremity - pelvis - spinal column", the structure and function of the underlying links determine those of the overlying ones. Within this framework, the shape of the vertebral bodies is formed under the influence of lifetime loads, their values and trajectories and depends on the plastic properties of the osseous tissue of the vertebral bodies. The causes of plastic deformations of the vertebral bodies should often be sought outside the spine, in the underlying links of the kinematic chains. The spinal column changes its shape during walking. The shape of a bent flat spiral with the right direction of the whorls alternates with that of a bent flat spiral with the left direction of the whorls, depending on the support on the left and right lower extremities. The vertebral column being at the top of the kinematic chains of the lower extremities concentrates relatively symmetrical or asymmetric loads on itself, partially compensating them [15].

HR should be recovered to 80-85 bt/min (in 3-4 min) after exercise completion. Motivational and cognitive components, objectives, their significance, personal beliefs, emotional resources were discussed during pauses. Psychological assessments of the state perceived by athletes were determined by athletes' interpretation of the efficiency of achievement drive; similar practice is known [16].

Statistical analysis. MS Excel licensed software was used for analysis of findings. Indices of descriptive statistics were determined: arithmetic mean ($\bar{x}$), standard deviation (S) and coefficient of variation (V). The significance of differences in the group in the result of experimental studies (dynamics of sports result and the technique kinematic characteristics) was evaluated by means of the Statistica-10 program (StatSoft, USA) using the nonparametric sign test for dependent samples (Z), at a significance level of p = 0.05.

Results

Comparison of the main biomechanical characteristics of athletes' technique in the course of experimental studies demonstrated their impact on walking speed increase.

Table 1 presents technical characteristics of movements before and after performance of the complex of special exercises, which were obtained in the course of covering 10 km distance.

As seen in Table 1, the average stride length of athletes increased to 1.14 m (S = 0.04) after applying the complex of exercises, which is higher than that at the beginning of the experiment - 1.09 m (S = 0.03) ($p < 0.01$). On the other hand, the stride frequency also increased to 3.17 stride·s^{-1} (S = 0.08), however no statistically significant difference was found ($p > 0.05$). The increase in stride length occurred at the expense of the length of the rear stride ($\bar{x}$ = 0.43 m; S = 0.02) and flight (= 0.20 m; S = 0.02) at statistically significant differences from the indices observed before using the complex of special exercises.

The increase of these indices largely depended on the efficiency of take-off. Index of its duration = 0.28 s (S = 0.009), which was on the average 0.011 s better than at the beginning of experimental studies, is indicative of more efficient take-off technique at the end of experimental studies.

An important point is that the reduction of the take-off time occurs, above of all, at the expense of the decrease of the depreciation duration at the single support phase by 0.12 s. All this indicates a higher efficiency of force interaction with the support, which is due to respective manifestation of speed-strength qualities. Therefore, the improvement in speed occurred at the expense of stride length increase to the fullest extent.

Table 1. Kinematic characteristics of the technique of athletes specialized in 10 km race walking before and after experimental training cycle (n = 10, body height: $\bar{x}$ = 1.74 m; S = 0.09; body mass: $\bar{x}$ = 63.20 м; S = 5.41).

Indices	Period of measurements						Z	p*
	Beginning of cycle			End of cycle				
	$\bar{x}$	S	V	$\bar{x}$	S	V		
Result, min:sec	46:12	01:07	2.4	48:50	01:38	3.3	2.846	p<0.01
Average speed, m·s^{-1}	3.61	0.09	2.4	3.42	0.11	3.3	2.846	p<0.01
Stride length, m	1.14	0.04	3.5	1.09	0.03	2.7	2.846	p<0.01
Rear stride length, m	0.43	0.02	5.0	0.40	0.01	3.0	2.214	p<0.05
Flight length, m	0.20	0.02	9.7	0.17	0.02	12.5	2.214	p<0.05
Front stride length, m	0.22	0.03	13.2	0.25	0.02	6.2	1.581	p>0.05
Length of support transition, m	0.28	0.01	4.8	0.28	0.01	3.9	0.500	p>0.05
Stride frequency, stride·s^{-1}	3.17	0.08	2.7	3.12	0.05	1.4	1.581	p>0.05
One stride duration, s	0.316	0.009	2.7	0.320	0.005	1.4	1.581	p>0.05
Single support duration, s	0.280	0.009	3.2	0.298	0.011	3.8	2.214	p<0.05
Depreciation duration at single support phase, s	0.120	0.006	4.6	0.130	0.010	7.6	2.214	p<0.05
Knee joint angle at the moment of foot placement on the support, degr.	179.04	0.40	0.2	178.54	0.94	0.5	0.949	p>0.05

* - sign test was used

Discussion.

The findings confirm previously obtained results that during walking with presented affirmations, athletes were trained to feel the support of the surface, the ability to adjust to it with account for the speed-strength, power capacities of athlete and his working body mass [1, 3, 17]. This is confirmed by the fact that the take-off along the direction of movement was mastered and improved as a basic skill with apparent variable properties [9].

There are known facts of differentiating information from articular receptors (reaches the higher parts of the brain) and that from tendon receptors. This is of independent importance, since the magnitude of the angular displacement (changing angles from 5° to 20°) causes a switch from the magnitude of muscular tension to controlling joint movement. For instance, it is thought that in order to keep the balance in case of minimal oscillation a person uses an "ankle" strategy at the expense of changes of the ankle joint angle, whereas in case of large and frequent oscillations – that of "hip" one [18].

Presented methodology contributed to individual improvement of a new movement image; the motive and purpose led to perfection of technical skill in race walking. Obtained data confirm that before performing suggested exercises, the athlete should visualize the position of the head, arms, trunk and vertical moment.

Studies have shown that usage of specially designed exercises, performed in a standard sequence, helps to form a muscle sensation, which can be described as a "reactive response of the road pavement". Athletes were trained to form seven consecutive sensations: 1 - liberation of the body links; 2 - inertia of free motion; 3 - fullness, profuseness of the supporting leg; 4 - emptiness in the support free leg; 5 - pelvis - thigh, body forward orientation; 6 - thigh - knee - foot, forefoot; 7 - reactive response of the road pavement.

In such a sequence, "building sensations" can be recommended in order to use the impulse of force of reactive-mechanical origin, the inertia of free motion at competitive speed, when the role of elastic deformation and the use of swing movements through the strength muscular component become more and more important.

The findings confirm the results of the key factor significance in the structure of special fitness of skilled race walkers, when technical fitness is put first, followed by physical work capacity and athlete's psychomotor system state [3]. Formation of new movement images in the athlete necessitates the activation of his cognitive processes for better mastering technical parameters of movement [19]. The effectiveness of training work while improving race walking techniques is closely associated with the athlete's special endurance with account for the stability of special sensations of the motion key characteristics during fatigue development.

Therefore, to improve the quality, reduce time and increase the reliability of training, the traditional approaches to improving the coordination complex movements may be supplemented with the presented exercises to form specialized sensations of the motion characteristics.

New technologies and research methods exist today. For instance, some NBA teams use wearable sensors to monitor training and recovery. The possibility of non-invasive and continuous monitoring of saliva or sweat biomarkers, electrodermal activity (EDA) refers to changes in the activity of sweat glands, which reflect the emotional state intensity. Their utilization can be useful for measuring the level of stress, a way to assist in the "athlete quantitative assessment" of physical load, physical condition, fatigue. For instance, Kitman Labs use motion technology training to diagnose the athlete's responces to various movements [20].

Suggested approach creates prerequisites for further research on the formation of the motor composition of skill of body position accuracy. The development of sensations of inertia of free motion, liberation from excessive degrees of freedom in the body links with account for the athlete functional state envisages the use of new technologies. It is planned to develop and apply special means under conditions of preparation process intensification for improving the race walking technique and effective maintaining technical capabilities of athletes during fatigue development.

The data obtained show the possibility of forming a stable technique during fatigue development on the basis of targeted improvement of athletes' special sensations.

Conclusions

1. The use of special exercises to focus on motion key parameters contributes to enhancement of technical fitness of athletes in race walking.

2. The use of a complex of suggested exercises for three weeks to develop special sensations in an athlete focused on the key components of sports technique resulted in significant increase of walking speed.

3. The increase of speed occurred at the expense of stride length increase after applying the complex of exercises. At the same time, the increase of stride frequency was not observed; stride length increase occurred at the expense of the "rear" stride length, as a result of applying a complex of special exercises.

4. Reduction of take-off time occurred at the expense of decrease in depreciation duration at single support phase, which may be indicative of higher efficiency of strength interaction with the support.

5. The findings allow to assume that the usage of special exercises for enhancing special sensations of motion key parameters may be the important factor for technical fitness improvement in race walking.

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Conflict of interest

The authors declare that there is no conflict of interest.

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