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Table of Contents

The Impact of Training Efforts of Various Focuses on the Development of the Function of the Visual Memory of Student-Athletes of 17-20 Years Old High Schools of Physical Culture

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Abstract

The article refers to the "Sports science" section of this magazine. Introduction: It is known that the function of visual memory is an active process in the activities of athletes, and therefore may suffer significant changes. There are also data indicating the fact of the specificity of the influence of training of various focuses on the psychophysiological functions of the organism of adolescent athletes. However, we did not find works that dealt with the problem of studying the impact of training efforts of various focuses on the dynamics of the formation and development of the function of the visual memory of athletes in adolescence. Objective: to investigate the impact of training efforts of various focuses on the development of the function of the visual memory of student-athletes 17–20 years old, specializing in various sports. Research methods: 110 athletes from the Brovarsky Higher School of Physical Culture (Kyiv region), 17- 20 years old, participated in the experiment, which were divided into two experimental groups:
group A (n = 56) - speed-strength sports (boxing, wrestling, athletics: sprint, hurdling, jumping, shot put and discus throwing) Group B (n = 54) - endurance sports (skiing, cycling, swimming 200, 400 and 1500 m) and one control group (n = 83) - peers of higher educational institutions who are involved in sports. The research of the individual characteristics of short-term visual memory was performed according to the method "memory for geometric shapes". When performing this test, the research subject was presented with forms with the image of geometric figures in the amount of 7 pieces. The research subject must remember their location for 30 seconds and then for 45 seconds to reproduce the figures on an empty registration form. The test task was performed twice using similar forms.
Statistics methods: the significance of differences between athletes of each group separately (in dynamics), between athletes of different groups (A and B) and between representatives of the experimental and control groups was determined using the Student's t-test. Results of the research: it was revealed that under the impact of physical efforts of speed-power nature, insignificant changes in the mean values of the function of short-term visual memory are observed, while under the impact of efforts on endurance there is a statistically significant improvement in the dynamics of this function.
Keywords: physical activity, visual memory function, research, athletes, adolescence.

1. Introduction

It is known that the state of the psychophysiological sphere of a person, which also includes mental functions (memory, attention, perception, thinking), directly affecting the effectiveness of sports activities [1, 2]. It is also proved that the function of short-term visual memory is an active process in human activity [3, 4, 5], and therefore may experience significant changes in the ontogenesis of both persons who engage in various sports and those who do not play sports or physical education.
Thus, it was revealed that athletes of different ages have higher indicators of the function of visual and auditory memory than non-athletes [6, 7, 8, 9]. There is also evidence of a positive, but uneven in nature, the

impact of training efforts of various focuses on the development of this mental function in children and adolescents involved in sports [10, 11 et al.].

2. Literature review

Modern researches of M.V. Makarenko, V.S. Lizohub [10] establish that the function of short term visual memory is closely related to the state of properties of the basic nervous processes (strength and functional mobility), which, in turn, determine the nature of individual sports activity: the higher the level of development of functional mobility nerve processes, the more effective is the activity of an athlete in speed-strength sports; whereas a high level of development of the strength of nerve processes leads to successful sports activities in sports that primarily develop the quality of endurance. To the above, we'll add that high athletic result, for example, in representatives of sports of speed-strength nature, depends equally on the state of the actual muscle strength components and the properties of the main nervous processes of individuals [12, 13, 14, 15, 16, 17].

In our previous work [18], an analysis of changes in the function of short-term visual memory in young athletes aged 13–16 years was given, specializing in various sports. The main conclusion of such researches is the establishment of the fact of the specificity of the impact of training of various types on the psychophysiological functions of the organism of adolescent athletes. However, we did not find works that dealt with the problem of studying the impact of training efforts of various focuses on the dynamics of the formation and development of the function of the visual memory of athletes in adolescence. After all, it is known that the formation and development of mental functions take place non-equally at different age stages of human ontogenesis [10]. Therefore, the above-mentioned prompted us to conduct a series of researches on the study of this problem among student-athletes of 17–20 years of specialized sports institutions (high schools of physical culture, Olympic Reserve colleges, etc.).

3. Methods

The purpose of the research – to investigate the effect of training efforts of various focuses on the development of the function of the visual memory of student-athletes 17–20 years old who specialized in various sports. *Research methods*: theoretical analysis and generalization of scientific and methodical literature, pedagogical observation, testing, statistical methods.

3.1. Participants

The research involved young athletes (boys) 17–20 years old (n = 110) of the Brovary Higher School of Physical Culture (Kyiv region), who according to the classification of sports on A.G. Dembo [19] were divided into two groups: group A (n = 56) - speed-strength sports (boxing, wrestling, athletics: sprint, hurdling, jumping, shot put and discus throwing); Group B (n = 54) - endurance sports (skiing, cycling, swimming 200, 400 and 1500 m). The control group consisted of students aged 17–20 years (n = 83) of the Physical Education and Sports Faculty of the National Pedagogical Dragomanov University (n = 40) and the Faculty of Health, Physical Education and Sports of the Borys Hrinchenko Kyiv University (n = 43) who did not play sports.

3.2. Materials

The research of the individual natures of short-term visual memory was performed according to the method "memory for geometric shapes" [20]. When performing this test, the research subject was presented with forms with the image of geometric figures in the amount of 7 pieces. The research subject must remember their location for 30 seconds and then for 45 seconds to reproduce the figures on an empty registration form. The test task was performed twice using similar forms. They counted the number of correctly drawn and placed figures on the registration form (correct answers) and the number of mistakes (units) research subject for the entire period of work. According to the results of two tasks, the state of the visual memory of the individual was estimated in conditional points. When conducting a direct assessment of this function, we adhered to the following position: the more the research subject could correctly reproduce the geometric shapes in each of the two forms, which, as a result, automatically impacts the reduction in the number of mistakes made by him, the higher was his indicator of the function of visual

memory. Evaluation of the test results was performed according to the scheme of the above-mentioned authors [20]:

Score, points	9	8	7	6	5	4	3	2	1
The correct answers, quantity	13	12	11	9–10	7–8	5–6	4	3	2

The evaluation of the research results was performed according to a comparative analysis of the first and second (in a year) research stages of the research subject according to the following scheme: separately for each sport, separately by groups of athletes according to the classification of sports by A.G. Dembo and the perform of comparative analysis of the experimental group) with a control group (peer-students of higher education institutions not involved in sports).

3.3. Procedure

Testing was conducted in the room of psychophysiological control in the first half of the day (from 9 to 12:00, no earlier than 2:00 after meals). One or two days before the conducted research, research subjects were asked to reduce physical exertion in terms of volume and intensity by 50%, not to drink tonic and soothing pharmacological preparations, and on the day of testing - strong tea or coffee. Each research subject voluntarily participated in the research. For the period of the survey, all individuals were healthy.

4. Results

The analysis of the function of the visual memory of speed-strength sports students (group A) in dynamics (according to the first and second stages of the research) indicates an insignificant change in the number of mistakes made in the process of conducting psychological testing ($p > 0.05$) (table 1). However, as you can see, there is a tendency to decrease the above-mentioned indicator among athletes of this group.
And, as a result of the above, there is no significant improvement in the function of short-term visual memory in boxers, wrestlers and athletes.

Table 1. *Indicators of the function of visual memory of student-athletes, sports of speed-strength nature (group A) according to the first (I) and second (II) stages of the research (n = 68), X ± m*

Indicators	I	II	t	p
		Boxers		
	(n=23)	(n=23)		
Number of mistakes, units	3,7 ± 0,48	3,4 ± 0,42	0,47	>0,05
Evaluation of the function, points	6,2 ± 0,44	6,4 ± 0,37	0,35	>0,05
		Wrestlers		
	(n=21)	(n=20)		
Number of mistakes, units	3,6 ± 0,45	3,3 ± 0,40	0,50	>0,05
Evaluation of the function, points	6,3 ± 0,39	6,5 ± 0,35	0,38	>0,05
		Track athlete		
	(n=24)	(n=22)		
Number of mistakes, units.	3,7 ± 0,51	3,4 ± 0,44	0,45	>0,05
Evaluation of the function, points	6,2 ± 0,48	6,4 ± 0,40	0,32	>0,05

The direct opposite character of changes in the indicator of the number of mistakes in dynamics is observed in athletes who mainly develop the quality of endurance (cyclists, skiers, swimmers) (table 2). Thus, in all of the above-mentioned athletes, an improvement in the function of visual memory was observed according to statistically reliable data ($p < 0.05$) on the decrease in the number of mistakes. The latter significantly affects

the overall evaluation of the above function. As you can see, there is a statistically significant improvement in this function in all athletes of group B (p <0.01).

Table 2. *Indicators of the function of the visual memory of student-athletes of endurance sports (group B) according to the first (I) and second (II) stages of the research (n = 59), X ± m*

Indicators	I	II	t	p
		Cyclists		
	(n=23)	(n=21)		
Number of mistakes, units	3,3 ± 0,42	2,2 ± 0,28	2,18	<0,05
Evaluation of the function, points	6,4 ± 0,39	8,0 ± 0,26	3,41	<0,01
		Skiers		
	(n=16)	(n=16)		
Number of mistakes, units	3,4 ± 0,44	2,1 ± 0,38	2,24	<0,05
Evaluation of the function, points	6,3 ± 0,41	7,9 ± 0,36	2,93	<0,01
		Swimmers		
	(n=20)	(n=20)		
Number of mistakes, units	3,3 ± 0,38	2,1 ± 0,34	2,35	<0,05
Evaluation of the function, points	6,4 ± 0,35	8,0 ± 0,29	3,52	<0,01

And finally, almost the same type with athletes who mainly develop speed-strength qualities (group A), the nature of changes in the indicators of short-term visual memory is recorded in their peers - non-athletes students (group K) (table 3). Representatives of this group also show only a tendency to improve the function of visual memory, while non-significant differences remain in the values of the error rate indicators and the function evaluation according to the data of the first (I) and second (II) research stages (p <0.05 in all cases) .

Table 3. *Indicators of the function of the visual memory of students not involved in sports (group K), according to the first (I) and second (II) stages of the research (n = 83), X ± m*

Indicators	I	II	t	p
		Student - non-athletes (control group)		
	(n=83)	(n=76)		
Number of mistakes, units	3,7 ± 0,45	3,5 ± 0,38	0,34	>0,05
Evaluation of the function, points	6,2 ± 0,39	6,3 ± 0,37	0,19	>0,05

Table 4 shows the analysis of longitudinal changes in the indicators of the function of visual memory separately for student-athletes of sports of speed-strength nature (group A) and sports for endurance (group B).

As it should be expected, representatives of group A show insignificant differences in the values of the indicators of the number of mistakes and the overall evaluation of the mentioned mental function (p> 0.05), whereas athletes of group B show a statistically significant improvement in this function according to an increase in the number of correct answers or, respectively, a decrease in the number of mistakes and an increase in the value of the overall evaluation of the function of visual memory (p <0.01 in both cases).

Table 4. *Indicators of the function of visual memory of student-athletes, sports of speed-strength nature (group A) and sports for endurance (group B) according to the first (I) and second (II) stages of the research(n = 127), X ± m*

Indicators	I	II	t	p
		Experimental group A		
	(n=68)	(n=65)		
Number of mistakes, units	3,7±0,44	3,4±0,35	0,53	>0,05

Evaluation of the function, points	6,2±0,38	6,4±0,34	0,39	>0,05
	Experimental group B			
	(n=59)	(n=57)		
Number of mistakes, units	3,3 ± 0,33	2,1 ± 0,26	2,86	<0,01
Evaluation of the function, points	6,4 ± 0,32	7,9 ± 0,30	3,42	<0,01

Interesting, in our opinion, can be the results of a comparative analysis of the indicators of the function of short-term visual memory of student-athletes of speed-strength sports (group A), endurance sports (group B) and students not involved in sports, according to the first (I) and the second (II) stages of the research.

So, from the data of table 5 we find the following: at the first stage of the research, no statistically significant differences were found in the nature of changes of the indicator of the number of mistakes made by the three groups surveyed (p> 0.05), whereas according to the data of the second (one year) of the study, a statistically significant decrease in the number of mistakes was observed made by athletes of group B in comparison with their peers, some of whom represent the experimental group (group a), and others, respectively, the control group (group K) (p <0.01 in all cases). Note also that significant differences were found in the values of the number of mistakes between athletes of group A and students not involved in sports (p> 0.05).

Table 5. *Comparative analysis of changes in the indicator of the function of visual memory - the number of mistakes made by student-athletes of sports of speed-strength nature (group A), sports for endurance (group B) and students not involved in sports (group K), according to the first (I) and second (II) stages of the research (n = 210), units*

Stages	Group A [1]	Group B [2]	Group K [3]	t; [p1–p2]	t; [p1–p3]	t; [p2–p3]
I	(n=68) 3,7±0,44	(n=59) 3,3±0,33	(n=83) 3,7±0,45	0,73; >0,05	0,00; >0,05	0,72; >0,05
II	(n=65) 3,4±0,35	(n=57) 2,1±0,26	(n=76) 3,5±0,38	2,98; <0,01	0,19; >0,05	3,04; <0,01

One-type with the above-mentioned, the nature of changes in the average values of the function of visual memory (in points) is registered between students-athletes of speed-strength sports (group A), endurance sports (group B) and students not involved in sports (table 6).

The following is summarizing: a reliable improvement in the above-mentioned function (according to the data of the second stage of research) is observed in students of sports for endurance compared with their peers, some of whom are engaged in speed-speed sports (p <0.01), while others do not play sports (p <0.01); no significant differences were found in the nature of the changes in the mentioned function between the athletes of group A and the students of the control group (p> 0.05).

Table 6. *The average values of the function of visual memory and the reliability of the difference between student-athletes of sports of speed-strength nature (group A), sports for endurance (group B) and students not involved in sports, according to the first (I) and second (II) stages of the research (n = 210), points*

Stages	Group A [1]	Group B [2]	Group K [3]	t; [p1–p2]	t; [p1–p3]	t; [p2–p3]
I	(n=68) 6,2±0,38	(n=59) 6,4±0,32	(n=83) 6,2±0,39	0,40; >0,05	0,00; >0,05	0,40; >0,05
II	(n=65) 6,4±0,34	(n=57) 7,9±0,30	(n=76) 6,3±0,35	3,31; <0,01	0,20; >0,05	3,47; <0,01

5. Discussion and Conclusion

Analyzing the nature of the changes in the visual memory function of student-athletes, some of whom are engaged in speed-strength sports (group A) and other endurance sports (group B), we conclude that despite the fact that the function of visual memory is similar other mental functions (perception, attention, thinking) are characterized by expressed genetic heredity and are poorly corrected by means of physical education, we believe that the focus of the training process is specifically specializing features of the development of the above-mentioned functions. So, if athletes under the impact of training efforts of speed-strength nature did not reveal significant differences (p> 0.05) in the mistakes rate (although there is a

tendency to decrease this indicator in the dynamics), whereas under the impact of endurance training, is registered a statistically significant a decrease in this indicator ($p < 0.05$), which indicates a significant improvement (in average values) of the short-term visual memory function ($p < 0.01$). In students who are not involved in sports, as it should be expected, there were no significant differences in the nature of changes in the indicators of this mental function ($p > 0.05$). The one-type of changes in the function of short-term visual memory was also revealed during a comparative analysis of two groups of athletes with different focuses of the training process. So, in athletes of group A, there is a statistically unreliable nature of changes in indicators of the function of visual memory ($p > 0.05$) according to the data of the first and second stages of research, whereas in athletes of group B, on the contrary, there is a significant (at $p < 0.01$) improvement of this function. And finally, a comparative analysis of changes in indicators of short-term visual memory in three groups of research subjects indicates that athletes under the impact of training efforts, which are mainly aimed at developing the quality of endurance, recorded significantly better values of the above function compared to athletes who mainly develop speed-strength qualities, as well as with students who are not involved in sports ($p < 0.01$ in both cases). Thus, the above-mentioned indicates the fact of the specific impact of training efforts of various focuses on the mental functions of the organism, one of which is short-term visual memory. The specificity of the training process, its focus is equally specifically specific features of the development of the function of the visual memory of student-athletes 17-20 years of specialized sports institutions (high schools of physical culture, Olympic Reserve colleges, etc.). So, if under the impact of physical efforts of a speed- strength nature, insignificant changes in the average values of the function of short-term visual memory are observed, while under the impact of efforts on endurance there is a statistically significant improvement in the dynamics of this mental function.

One-type, with student-athletes of speed-strength sports, the nature of changes in the function of visual memory are also students of higher education institutions who do not involve in sports.

Prospects for further research in this direction. It is expected to investigate the impact of training efforts of various focuses on the development of the attention function of student-athletes aged 17–20 years specializing in various sports.

Conflicts of interests. The authors report no conflicts of interest.

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