Influence of physical load on the cognitive sphere of athletes-orenters

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Abstract

Objective of the study was to evaluate the effect of physical activity on the cognitive sphere (memory, attention and thinking) in orienteers.

Methods and structure of the study. The experiment involved male students of three specializations: "cross-country skiing", "general physical training" and "orienteering", aged 18 to 24 years, a total of 45 people. Students of the specializations "cross-country skiing" and "orienteering" attended training sessions in their sports more than five times a week from 60 to 120 minutes and were in the preparatory period of training. Students of the specialization "general physical training" attended classes at the university twice a week for 60 minutes.

Results and conclusions. It was shown that the values of cognitive qualities before the load differed insignificantly between the groups. The exception was the indicator of attention in terms of the number of errors - it was initially significantly lower in the group of orienteers than in both control groups. After physical activity, there was an improvement in most indicators in the group of orienteers, while in the control groups, an improvement was noted in only one indicator.

The data obtained made it possible to conclude that orienteers, against the background of intense physical exertion, have an increase in indicators characterizing conative qualities. It can be assumed that this is the result of the formation of technical preparedness in this sport.

Keywords: *orienteering, cross-country skiing, cognitive sphere, physical activity.*

Introduction. Orienteering is a unique sport where athletes, using a map and compass, have to mark all certain checkpoints in the shortest possible time. The peculiarity of this sport is that the distance is not familiar to the participants, and it is impossible to pass it without a map. The training of athletes in orienteering differs from similar sports such as cyclo-cross disciplines, cross-country skiing and athletics, primarily in that there is no map in front of the participants in these sports, and they can look at the distance before the competition.

An orienteer during the race has to drastically change his pace of movement, since various obstacles can be encountered along the way in the form of dense vegetation, windbreak, swamps, etc. The competitor needs to slow down in order to avoid injuries and mistakes, and in well-run areas, the athlete can develop a high running speed. In addition to physical training, coaches and athletes include technical training in the training process aimed at improving the level of card possession [1, 6]. According to Ivan Sirakov, PhD. from the University of Veliko Tarnovo (Bulgaria), most professional athletes note that technical training is an integral part of the orienteering training process [7]. With the help of technical training, cognitive mental processes develop. In working with the map, the athlete uses attention in order to have time to switch between landmarks, memory in order to look at the map as little as possible and not slow down the pace of movement; analysis - to determine the optimal variant of movement. Thus, orienteering classes impose increased demands on both physical fitness and cognitive qualities, and both types of activity are implemented simultaneously.

Objective of the study was to evaluate the effect of physical activity on the cognitive sphere (memory, attention and thinking) in orienteers.

Methods and structure of the study. The study involved male students of three specializations: "cross-country skiing", "general physical training" and "orienteering", aged 18 to 24 years, a total of 45 people. Three groups were formed: experimental (orienteering), 1st control (cross-country skiing) and 2nd control (general physical training), 15 people each.

Students of the specializations "cross-country skiing" and "orienteering" attended training sessions in their sports more than five times a week from 60 to 120 minutes and were in the preparatory period of training. Students of these specializations had the 2nd sports category and above. Students of the specialization "general physical training" attended lessons at the university twice a week for 60 minutes.

The research program consisted of three stages: testing of cognitive qualities before exercise, physical activity, testing after exercise. The testing was aimed at assessing attention, memory and thinking and included the following tests:

1. ***B. Bourdon's correction test.*** This test is aimed at studying the features of attention, namely its characteristics such as stability, concentration, switchability, volume. The subjects were given forms with rows of random letters 40 rows of 40 letters each. Prior to testing, participants were not allowed to look at the form. After the examiner calls the letter, the participants turned the form over and the time was cut off. The task was that in each row the participant must cross out the named letter. Mistakes were considered incorrectly crossed out letters, missing letters. The task completion time is 5 minutes [2].

2. ***Testing short-term visual memory for numbers.*** The subjects were given a form with three rows of numbers, four random numbers in each. For 20 seconds, the subjects had to remember as many numbers as possible. After the original form with numbers was removed. In the form of answers, it is necessary to display the memorized numbers in their places [4].

3. ***Testing short-term visual memory for images.*** The rules for testing are the same as in the previous task. The subjects were given forms with different images 3×5. In 20 seconds, it is necessary to remember the largest number of images and display them in the form of answers [4].

4. Scale of progressive matrices. Raven test. The test is aimed at determining the level of development of mental abilities and logical thinking. The subjects were given forms with 30 drawings, divided into five groups. The figures are graphic representations of "certain dependencies". Each image is missing a section. Its variations are at the bottom of the figure. The task of the participants is to choose the logically correct version of the missing fragment. The complexity of tasks increases within the group and between them. Participants were given 10 minutes to solve 30 tasks [5].

The Harvard step test was used as a load. Participants stepped onto a step 50 cm high for 5 minutes at a frequency of 30 times per minute [3].

Statistical data processing was carried out using the statistical analysis package STATISTICA 10.0. The level of significance in testing the hypothesis that two samples belong to the same general population was estimated using the Kruskal-Wallis ANOVA test. Data are presented as Xav±SE.

The study was approved by the local ethical committee of the biological institute of Tomsk State University (protocol No. 33 of December 02, 2019).

Results of the study and their discussion. The results of testing the cognitive qualities of the three groups before and after the load are displayed in Table 1.

From the data in Table 1 it can be seen that the values of cognitive qualities before the load differed insignificantly. The exception was the indicator of attention by the number of errors - it was initially significantly lower in the experimental group than in both control groups. After exercise, there was an improvement in most indicators in the experimental group, while in the control groups, an improvement was noted in only one indicator.

Conclusions. The data obtained allow us to conclude that orienteers have an increase in indicators characterizing conative qualities against the background of intense physical exertion. It can be assumed that this is the result of the formation of technical preparedness in this sport.

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Table 1. *Indicators of testing the cognitive mental processes of orienteers, skiers and students of physical fitness specialization before and after exercise*

Indicators	Stage experiment	Experimental group (Sports orientation, n=15)	1st control group (cross-country skiing, n=15)	2nd control group (GFT (general physical training), n=15)
Attention (sec)	Up to load	221,3±39,8	247,2±46,5	231,1±35,6
	After loading	165,5±30,8 *#@	222,3±62,0 @	226,8±15,0
Attention, errors (number)	Up to load	2,9±2,5 #@	8,0±4,8	7,1±4,1
	After loading	1,0±0,8 *#@	3,8±1,6 *	3,1±3,8 *
Memory, images (number)	Up to load	5,6±1,8	4,0±1,6@	7,1±1,9
	After loading	7,0±1,8*	5,6±1,8	6,8±2,0
Thinking, mistakes (number)	Up to load	12,3±2,8	13,0±3,2	13,3±2,4
	After loading	11,1±2,4	13,4±1,7	13,1±2,4
Memory, numbers (qty)	Up to load	4,0±1,4	5,0±1,9	5,0±1,8
	After loading	4,8±2,3*	3,8±0,8	4,5±2,6
Average heart rate after exercise (bpm)		101@	98@	130

* - reliability of changes after exercise, $p<0.05$.
\# - significance of differences with the 1st control, $p<0.05$.
@ – significance of differences with the 2nd control, $p<0.05$.

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