

Psychophysiology of gymnasts: specifics of sports specialization

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Abstract

Objective of the study was to investigate the psychological and physiological traits of the young athletes from the Tyumen region who participate in cheerleading, gymnastics, and aerobics, aged between 12 and 14, and 15 and 17.

Methods and structure of the study. A psychophysiological analysis was conducted on female athletes from the Tyumen region who participate in cheerleading, gymnastics, and aerobics. The assessment of their psychophysiological characteristics was conducted during the 2023-2024 sports season, utilizing the UPFT 1/30 – Psychophysiological device and the psychomotor test module.

Results and conclusions. It was found that the members of the regional cheerleading team tend to have a set of traits associated with a weak nervous system, while the members of the gymnastics team tend to have a medium-weak nervous system, and the members of the aerobics team tend to have a strong nervous system. At the same time, the members of the cheerleading and aerobics teams tend to have a very high level of functional mobility of their nervous processes, while 40% of the gymnastics team members had a low level in this regard. Despite these differences, all the members of the teams share a tendency towards inhibition of nervous processes, which suggests that the members of the Tyumen region national teams in gymnastics are resilient to stress.

Keywords: *gymnastics, psychophysiology, cheerleading, sports reserve, aerobics, female gymnasts.*

Introduction. Issues of support and guidance for talented youth, including in sports, have always occupied a special place on the agenda of the Government of the Russian Federation, and in recent years, in connection with the introduction of sanctions on the participation of citizens of our country in international competitions, they have become extremely relevant.

The field of sports is unique, since in addition to strengthening health and developing the physical qualities of a person, it is one of the effective means of forming traditional spiritual and moral values in young people. Most often, one of the first types of physical activity for children is gymnastics due to the diverse beneficial effects on the child's body and the development of an arsenal of basic motor actions. However, further specialization involves the formation of such a level of physical fitness and psychophysiological sta-

tus in athletes that, to a greater extent, meet the requirements of a particular type of gymnastics (sports, rhythmic gymnastics, acrobatics, cheerleading or aerobics).

For example, the level of functional mobility of nervous processes often determines the predisposition of athletes to quickly master new complex coordination movements and constructive interactions with a partner. The type of nervous system and the shift in the balance of nervous processes towards inhibition or excitation predetermine the stability of the performance of gymnastic combinations [1, 2]. In team gymnastics disciplines, the functional asymmetry of the hemispheres of the athletes' brains (right-handed/left-handed) requires high-level personalized creation of the exercise composition from the coaches-choreographers to design a single and understandable con-



cept of the movement pattern for the viewer, otherwise this only leads to chaos on the court and a decrease in the competitive assessment [3]. At the same time, premature retraining of left-handers when mastering specialized motor actions can lead to a slowdown in the biological development of the body. At the same time, based on the level of athletic skill, experience in competitive activities, as well as the social status and role of the athlete in the team, we can talk about differences in the psychophysiological cost of performing a competitive exercise by each athlete, that is, not only from the standpoint of human biological energy expenditure, but also from the standpoint of psychological stress of the central nervous system, which will predetermine the type of warm-up, duration and methods of mental preparation before going out on the platform, the speed of fatigue, the nature of rest before the next load [4]. Thus, the study of the psychophysiological characteristics of athletes, including in sports gymnastics, allows coaches to take into account the genetic predispositions and age-related changes of their students for early correction of the training process based on the personal psychophysiological data of athletes.

Objective of the study was to investigate the psychological and physiological traits of the young athletes from the Tyumen region who participate in cheerleading, gymnastics, and aerobics, aged between 12 and 14, and 15 and 17.

Methods and structure of the study. The study of psychophysiological indicators of girls – members of the Tyumen region national teams in sports gym-

nastics was conducted in the 2023-2024 season at specialized training bases using «UPFT 1/30 – Psychophysiologicalist» and a module of psychomotor tests. The study involved 25 female athletes aged 12 to 17 years, of which 8 girls are cheerleaders (4 girls aged 12-14, 3 of the 1st sports category, 1 of no category, and 4 girls aged 15-17 (3 of CMS, 1 of no category)), 7 are gymnastics (4 of 12-14 years, 2 of the 1st sports category, 2 of CMS, and 3 of 15-17 years (2 of MS, 1 of CMS)), 10 are sports aerobics (5 of 12-14 years of the 1st sports category, 5 of 15-17 years, all candidates for Master of Sports). It should be noted that of the 25 girls, 80% study at schools and colleges with a «good» grade, 16% with an «excellent» grade (8% cheerleaders and sports aerobics each), and only 4% with an «excellent» grade «satisfactory» (gymnastics).

Results of the study and discussion. At the beginning of the psychophysiological study with members of the Tyumen Region national teams in sports gymnastics, an assessment of subjective well-being was conducted, according to the results of which it was determined that 75% of girls from cheerleading, 80% of sports aerobics and 85% of sports gymnastics defined their well-being as good, the rest of the girls of the regional teams were in satisfactory health. In the complex visual-motor reaction test in response to a light combination, only girls from sports gymnastics were able to give the maximum number of correct reactions (20 pcs.) among girls aged 15-17, 19 correct reactions were performed by aerobic athletes and 18 correct answers were given by girls from cheerleading (Figure 1A). At the same time, girls from cheerleading

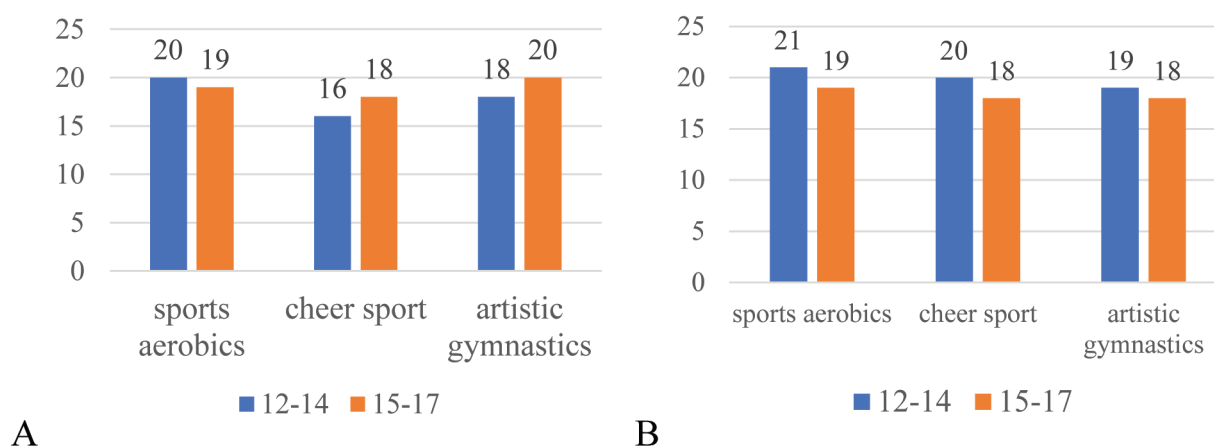


Figure 1. Results of testing female gymnasts using the methods «complex visual-motor reaction» – A and «reaction to a moving object» – B.



demonstrated the best average time of a complex visual-motor reaction – 478,5 ms, while aerobic athletes needed an average of 561 ms, and gymnasts – 630 ms. Among girls aged 12-14, the most accurate were aerobic athletes – 20 correct responses to the light combination, gymnasts – 18 responses, and cheer leaders – 16 responses. At the same time, cheer girls aged 12-14, as well as their older teammates, showed the best average time of a complex visual-motor reaction of 558 ms, gymnasts coped with the response in an average of 600 ms, and aerobic athletes aged 12-14 needed the most time – 719 ms. Analysis of the results of testing girls aged 15-17 using the «reaction to a moving object» (RMO) method showed that aerobic athletes had a slight advantage in the number of correct reactions (19 pcs.) compared to the number of correct reactions of cheer girls and artistic gymnastics (18 each). It should be noted that in all types of gymnastics (presented in the study), girls aged 12-14 coped better with the RDO method than their older teammates. Thus, aerobics girls aged 12-14 performed 21 correct responses to a moving object, cheerleaders and gymnasts – 18 and 19 responses. In addition, not a single girl from the Tyumen Region national teams aged 12-17 was found to have a shift in nervous processes towards excitation (Figure 1B).

As a result of testing girls aged 15-17 using the «functional mobility of nervous processes» method, a significant advantage was determined for athletes involved in cheerleading and sports aerobics, who were able to give 262 (144 correct and 118 incorrect) and 260 (142 correct and 118 incorrect) responses

to light stimuli, while girls involved in sports gymnastics demonstrated 184 responses (102 correct and 82 incorrect). Thus, we can say that cheerleading and sports aerobics classes are aimed to a greater extent at developing the ability of athletes to quickly respond to changes in external conditions and more easily «switch» to a new task (Figure 2A). The results of the tapping test showed that among girls aged 15-17, cheerleaders were able to perform the greatest number of wrist movements in 30 seconds – 199 pcs., aerobics demonstrated a similar result of 194 touches, and the girls from artistic gymnastics had lower indicators by 20 touches (179 pcs.), compared to the result of cheerleading girls. Among girls aged 12-14, the picture is similar, the indicators of cheerleading and artistic aerobics girls do not differ significantly (188 and 190 touches), and the indicators of girls in artistic gymnastics were lower by 18 touches (172 pcs.). At the same time, in the «tapping test» method, the dynamics of indicators in each five-second segment of the method is more important than the number of maximum movements.

Thus, only the girls in sport aerobics and gymnastics achieved higher results by the second five-second segment (from 31 to 33 and from 30 to 32 sec), after which the gymnasts' results decreased by one touch in each subsequent segment, while the aerobics girls maintained the same work tempo of 33 touches from the 5th to the 25th second. The cheerleaders demonstrated a significantly higher result in the first segment of work – 37 touches, significantly exceeding the average result in sport aerobics and gymnastics (31 and

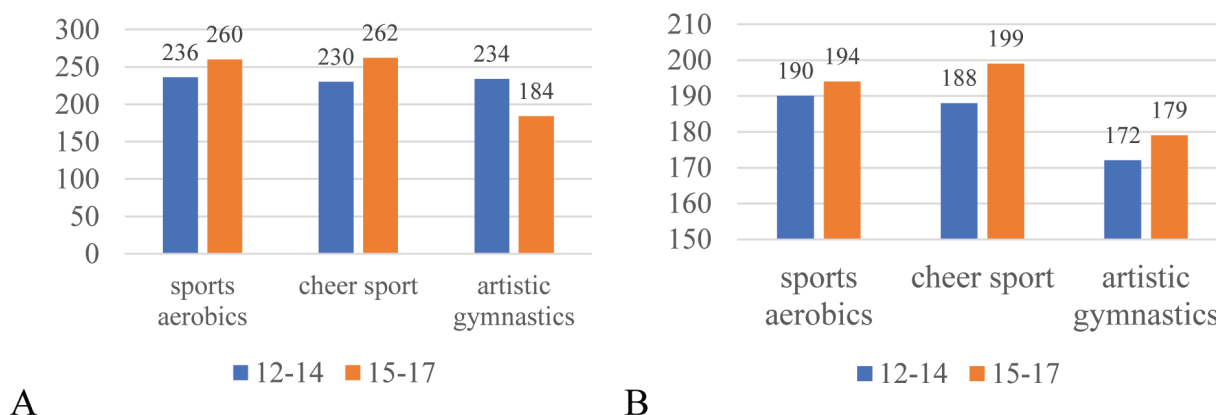


Figure 2. Results of testing female gymnasts using the methods «functional mobility of nervous processes» – A and «tapping test» – B.



30), however, the difference between the first and final segments was more significant (from 37 touches to 31) than that of the girls in sport gymnastics (from 30 to 27). Only the girls in sport aerobics showed an increase in results between the first and final segments (from 31 to 32 touches).

Conclusions. Thus, the girls of the Tyumen Region Cheerleading Team, based on a combination of indicators, can be characterized as athletes with a very high level of functional mobility of nervous processes, a weak nervous system, higher speed, but insufficient accuracy of complex visual-motor reactions relative to the results of girls in artistic gymnastics and aerobics.

In the Tyumen Region Cheerleading Team, girls correspond to the average level of functional mobility of nervous processes, have a moderately weak nervous system, high accuracy rates, but low speed of complex visual-motor reactions. Girls of the Tyumen Region Cheerleading Team are characterized by a very high level of functional mobility of nervous processes and have a strong nervous system, and at the age of 12-14 years have higher accuracy rates of complex visual-motor reactions compared to their peers in cheerleading and artistic gymnastics. It should be noted that all the examined girls had a shift in nervous processes towards inhibition, which indicates restraint and emotional stability of the gymnasts of the regional national teams. These results will allow the formation of a database of psychophysiological indicators of

the best gymnasts of the Tyumen region, and will also form the basis of an educational and developmental digital service with a virtual assistant for coaches, athletes and their parents in sports gymnastics.

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