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RISK FACTORS FOR THE DEVELOPMENT AND PROGRESSION OF SCOLIOSIS IN ADOLESCENT ATHLETES IN RHYTHMIC GYMNASTICS: A LITERATURE REVIEW

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Annotation. The article deals with the problem of structural and functional changes in the spine in the form of scoliosis in athletes involved in rhythmic gymnastics. The results of a theoretical analysis of literary sources revealed that adolescence of 12-14 years among athletes specializing in rhythmic gymnastics, on the one hand, is the most vulnerable in terms of imbalance in various body systems under the influence of specific loads, considering morpho-anatomical and physiological parameters. On the other hand, it is extremely important when building the training process, since it is at this time that the development and improvement of physical qualities, artistic and aesthetic abilities and the formation of sportsmanship takes place. The data obtained made it possible to form a theoretical basis in identifying the risk factors of scoliosis's development in adolescent athletes specializing in rhythmic gymnastics.
Keywords: scoliosis, rhythmic gymnastics, sports, health, musculoskeletal system, asymmetric loads.

Introduction. Since 1984, rhythmic gymnastics are an Olympic sport [1]. It is a complex coordination, aesthetic sport, which is constantly developing and increasing requirements to the technical complexity of performed elements. Despite this fact, it is one of the most popular sports among girls.

Frequently, young athletes have to endure extreme loads in order to achieve mastery in this field. However, the training method is not always constructed taking into account the age, anatomical and physiological features of a growing body. This also applies to the early specialization in gymnastics, which implies a large monotonous asymmetric physical load on the spine and ligamentous muscular apparatus of young athletes.

The training process in rhythmic gymnastics involves the implementation of complex coordinated elements that require athletes to have increased flexibility in the joints. Meanwhile, performance of asymmetric movements leads to the uneven work of the muscles and ligaments around the spine, which consequentially leads to disorders of statnamic characteristics in the spine of functional nature, then – to pathologically locked torsion changes of the spine in form of scoliosis. An increased injury rate in rhythmic gymnastics, developmental, anatomical and physiological features of a child's body that are a priority in sports selection are additional risk factors for the development and progression of scoliosis in young athletes.

The purpose of the study – theoretical analysis of risk factors for the development and progression of scoliosis in adolescent athletes in rhythmic gymnastics.

Methods and organization. We have used the content analysis of domestic and foreign scientific works, presented in peer-reviewed scientific publications, Russian and foreign databases. Total of examined references – 32, we have selected 20 among them.

Results and discussion. Scoliosis is an orthopedic disease characterized by a complex three-plane deformation of the spine [2] accompanied by a disorder in organ and system function which is a reason for severe physical and mental suffering among children [3].

Most frequently, the problem of scoliosis is registered among 7-12 years old girls (in 75%) [4-5]. Occurrence and progression of scoliosis is most frequently seen in childhood and adolescence, and it's related with an active stage of children's growth [6] and the fact that during this exact period the spine is the most flexible and, accordingly, subject to deformation.

The highest peak of physical loads in rhythmic gymnastics is noted at the stage of sports specialization at the age of 11-14 years and at the stage of sports improvement and high sportsmanship from 14 years [7]. This age is considered as "critical": puberty occurs, development of the endocrine system functions continues, the neurohumoral regulation forms and rearranges [6]. During this period, intense physical loads that are put on the growing body can be a cause of disorders in the reproductive system accompanied by hormonal shifts that contribute to the development of changes in the bone system [8].

Specificity of rhythmic gymnastics as asymmetric sport, the sessions of which are carried out without considering developmental, anatomical and physiological features of a child's body and following methodological guidelines and recovery measures, is attributed to high risks of asymmetric disorders of the musculoskeletal systems [9]. For example, the structure of the competitive program mainly consists of asymmetric exercises: most of the elements are performed with the "dominating leg", performance of tossing elements and work with objects (jumping rope, hoop, ball, Indian clubs, ribbon) are most frequently done with one hand. In addition, in order to master the program, the gymnast also performs correction of mistakes independently between practice runs, which in terms of repeating asymmetric movements leads to changes and redistribution of the muscle tone. There is also a unilateral predominance of the strength of the back muscles in the lumbar region and an opposite strengthening of the muscles in the thoracic spine.

Other important factors of occurrence and development of scoliosis in gymnasts are the excessive mobility in joints and asymmetric loads on the spine [10-12].

It must be kept in mind that development of scoliosis and posture disorders in young athletes occurs due to asymmetric loads during the most intense body growth period, which also aggravates the pathogenic profile.

A great number of asymmetric elements connected to the spine bend to one side is deemed as the most dangerous. This is the reason why researchers [8, 10] recommend to increase a set of symmetrical physical exercises during training or to use a set of correcting exercises after training in order to level the negative impact of asymmetric loads on the musculoskeletal system.

Moreover, the repetitive impact, as well as extreme spinal extensions performed for a long period of time, lead to the development of spondylolytic stress reaction, fatigue injuries and different diseases of the musculoskeletal system (scoliosis, osteoporosis, spondylosis, spondylolisthesis et al) [8, 13].

When achieving high sportsmanship, rhythmic gymnasts already have typical pathological processes [14-18], such as the degenerative processes in intervertebral cartilages and joints [8]. Meanwhile, the incidence of spondylolisthesis is 4 times higher in gymnasts than in total population.

Another number of factors can influence the development and progression of scoliosis, such as deceleration of skeletal maturity and bone mineralization compared to peers, later closure of bone growth zones [19]. Early engagement in sports and rigid diets, occurrence of pain sensations, disorders in the state of the musculoskeletal system also lead to a decreased density of bone tissue [20]. The aforementioned fact also proves a need for careful sports selection [21-22], ongoing and stage-by-stage control in order to preserve the health of gymnasts and timely inclusion of preventive measures to correct emerging deviations.

Conclusion. On the one hand, adolescent age of 12-14 years among rhythmic gymnasts is the most vulnerable according to morphological, anatomical and physiological parameters in

terms of balance disturbance in different systems of the body influenced by specific activities. On the other hand, it is extremely important when building the training process, because it is at this time that the development and improvement of physical qualities, artistic and aesthetic abilities and the formation of sportsmanship takes place. The literary data analysis has formed a theoretical basis in identifying the risk factors of scoliosis in adolescent rhythmic gymnasts. It will serve as a base for developing methodological guidelines and implementing recovery measures in order to level the negative influence of intense specific loads mainly of the asymmetric nature in the training process of adolescent rhythmic gymnasts.

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