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MONITORING THE QUALITY OF LIFE OF ADOLESCENT ATHLETES: A CROSS-SECTIONAL STUDY

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Introduction. Professional sports are associated with significant physical and psychological loads, which can impair athletes' health, increase anxiety, negatively affect sleep, and ultimately lead to a decline in their quality of life. This may be particularly pronounced in children and adolescents during periods of active growth and pubertal changes. Assessments covering quality of life and other psychoemotional parameters in adolescent athletes are an important diagnostic direction, allowing comprehensive analysis of the health status of young athletes and adjustment of the effectiveness of therapeutic and diagnostic measures.

Objective. To assess the quality of life, levels of trait and state anxiety, and sleep quality in adolescent athletes of the national teams of the Russian Federation.

Materials and methods. A cross-sectional single-center study was conducted, involving 203 young athletes (40 males (19.7%) and 163 females (80.3%) aged 13–18 years (mean age 15.0 [13.0; 17.0] years), who were members of the national teams of the Russian Federation in 13 sports (volleyball, freestyle wrestling, Muay Thai, synchronized swimming, softball, sports acrobatics, artistic gymnastics, dance sports, taekwondo, wushu, figure skating, field hockey, rhythmic gymnastics). Assessment of quality of life in the children of the study groups was performed using the Russian version of the Pediatrics Quality of Life Inventory (PedsQL™ 4.0); self-assessment of anxiety levels was performed using the Spielberger–Hanin State-Trait Anxiety Inventory. Assessment of sleep quality and evaluation of insomnia severity were performed using the Insomnia Severity Index (ISI). Statistical data processing was performed using Statistica 10.0 software.

Results. In athletes practicing rhythmic gymnastics ($p = 0.001$), figure skating ($p = 0.008$), and softball ($p = 0.014$), lower values of physical functioning were observed compared to representatives of other sports. In figure skaters, lower values of emotional ($p = 0.005$) and role functioning ($p = 0.001$) were recorded compared to athletes in other sports. In softball players, lower values of emotional ($p = 0.005$) and role functioning ($p = 0.001$) were recorded compared to athletes in other sports. In figure skaters, the highest levels of trait and state anxiety were noted ($p < 0.05$).

Conclusions. Low scores of physical and emotional functioning were identified in athletes practicing figure skating, rhythmic gymnastics, and softball compared to representatives of other sports, as well as high levels of trait and state anxiety in female figure skaters, which allows them to be identified as a risk group during screening for quality of life impairments and anxiety levels. Further studies are needed to clarify the cutoff points of the questionnaires in the context of diagnosing quality of life and assessing trait and state anxiety in adolescent athletes, which will contribute to early detection of these impairments, improvement of quality-of-life, and reduction of anxiety levels within the framework of medical and biological support for high-performance sports.

Keywords: young athletes; adolescent athletes; quality of life; trait anxiety; state anxiety; sleep; insomnia; Pediatrics Quality of Life Inventory; PedsQL™ 4.0; Spielberger–Hanin State-Trait Anxiety Inventory; Insomnia Severity Index; ISI; high-performance sports

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Compliance with the ethical principles. The study was approved by the Ethics Committee of the Federal Scientific and Clinical Center for Children and Adolescents (Minutes No. 1 dated 13.02.2025). Parents/guardians or legal representatives of the athletes, as well as athletes over 15 years of age, signed voluntary informed consent to participate in the study.

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МОНИТОРИНГ КАЧЕСТВА ЖИЗНИ НЕСОВЕРШЕННОЛЕТНИХ СПОРТСМЕНОВ: ПОПЕРЕЧНОЕ ИССЛЕДОВАНИЕ

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Введение. Профессиональный спорт связан с серьезными физическими и психологическими нагрузками, что может ухудшать здоровье спортсменов, повышать тревожность, негативно сказываться на сне и в итоге приводить к снижению качества их жизни. Особенно это может проявляться у детей и подростков в период активного роста и пубертатных изменений. Оценка качества жизни и других психоэмоциональных показателей у несовершеннолетних спортсменов является важным направлением диагностики, позволяющим комплексно проанализировать состояние здоровья юных атлетов и скорректировать эффективность проводимых лечебно-диагностических мероприятий.

Цель. Оценить качество жизни, уровень личностной, ситуативной тревожности и качество сна несовершеннолетних спортсменов сборных команд Российской Федерации.

Материалы и методы. Проведено одномоментное одноцентровое исследование, в котором участвовали 203 юных спортсмена (40 мальчиков (19,7%) и 163 девочки (80,3%) в возрасте 13–18 лет (средний возраст 15,0 [13,0; 17,0] года)), входящих в состав сборных команд Российской Федерации по 13 видам спорта (волейбол, вольная борьба, тайский бокс, синхронное плавание, софтбол, спортивная акробатика, спортивная гимнастика, танцы, тхэквондо, ушу, фигурное катание, хоккей на траве, художественная гимнастика). Оценка качества жизни у детей исследуемых групп была выполнена с использованием русской версии опросника Pediatrics Quality of Life Inventory (PedsQL™ 4.0), самооценка уровня тревожности — с помощью опросника Спилберга — Ханина. Определение качества сна и оценка тяжести бессонницы осуществлялись по опроснику инсомнии ISI (Insomnia Severity Index). Статистическая обработка данных проведена с применением пакета прикладных программ Statistica 10.0.

Результаты. У спортсменов, занимающихся художественной гимнастикой ($p = 0,001$), фигурным катанием ($p = 0,008$) и софтболом ($p = 0,014$), отмечаются более низкие значения физического функционирования по сравнению с представителями других видов спорта. У фигуристок фиксируются более низкие значения эмоционального ($p = 0,005$) и ролевого функционирования ($p = 0,001$) по сравнению со спортсменами других видов спорта. У представительниц софтбола регистрируются более низкие значения эмоционального ($p = 0,005$) и ролевого функционирования ($p = 0,001$) по сравнению со спортсменками иных видов спорта. У спортсменов, занимающихся фигурным катанием, отмечается наиболее высокий уровень личностной и ситуативной тревожности ($p < 0,05$).

Выводы. Выявлены низкие показатели физического и эмоционального функционирования у спортсменов, занимающихся фигурным катанием, художественной гимнастикой и софтболом, по сравнению с представительницами других видов спорта, а также высокий уровень личностной и ситуативной тревожности у девушек-фигуристок, что позволяет выделить их в качестве группы риска при проведении скрининга нарушений качества жизни и уровня тревожности. Необходимо проведение дополнительных исследований для уточнения значений отрезных точек опросников в аспекте диагностики качества жизни и оценки личностной и ситуативной тревожности у несовершеннолетних спортсменов, что будет способствовать раннему выявлению данных нарушений, улучшению качества жизни и снижению уровня тревожности в рамках медико-биологического обеспечения спорта высших достижений.

Ключевые слова: юные спортсмены; несовершеннолетние спортсмены; качество жизни; личностная тревожность; ситуативная тревожность; сон; инсомния; опросник Pediatrics Quality of Life Inventory; PedsQL™ 4.0; опросник Спилберга — Ханина; опросник инсомнии; ISI; Insomnia Severity Index; спорт высших достижений

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Финансирование. Исследование выполнено в рамках прикладной научно-исследовательской работы «Развитие персонализированного подхода в ведении несовершеннолетних спортсменов спортивных сборных команд Российской Федерации» (шифр «Дети в спорте-25/27»).

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Соблюдение этических стандартов. Исследование одобрено этическим комитетом при ФГБУ «ФНКЦ детей и подростков ФМБА России» (протокол № 1 от 13.02.2025). Родители/опекуны или законные представители спортсменов, а также спортсмены старше 15 лет подписали добровольное информированное согласие на участие в исследовании.

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INTRODUCTION

Health-related quality of life is understood as the individual's perception of their position in life in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards, and interests¹ [1]. Thus, it is a multidimensional category encompassing physical, psychological, and social well-being. Studies show that in athletes engaged in professional sports, quality-of-life indicators can both significantly exceed and, under certain circumstances, fall below population norms [2, 3]. Achieving high results in modern sports requires intense physical and psychological loads, increasingly exceeding the adaptive capacity of the body [4]. In studies conducted by foreign researchers, comparisons between adolescent athletes and their non-athlete peers revealed advantages for athletes in terms of physical functioning, general health, social functioning, and mental health [5]. This is consistent with the view that regular physical activity positively affects the physical component of quality of life. However, certain factors associated with the professional nature of sports may also exert a negative influence on quality of life. For instance, a systematic review [6] demonstrated that sports injuries, which frequently accompany professional sports activity, negatively correlate with athletes' quality of life, especially with life satisfaction (100% of studies showed a negative association), bodily pain (71.4%), and the physical component of health (75%).

The study of quality of life in children engaged in sports is a developing direction of interdisciplinary research in Russian healthcare, since it allows assessment not only of their physical health but also of psychosocial well-being, taking into account the specifics of sports loads and injury risk [7]. Of particular importance is the analysis of quality of life in adolescents (12–18 years) involved in professional sports. The age of 12–18 years is a critical developmental stage: during this period, extensive physiological and psychological transformations occur, personal interests and worldview are actively formed, and intensive social adaptation takes place, including in the school environment. At the same time, adolescents face an increasing volume of academic and sports loads, a rising level of personal responsibility, which, combined with professional training, creates a particular burden on the body and psyche. Therefore, quality-of-life assessment in this age range makes it possible to account for the characteristics of this transitional stage and identify key factors affecting the well-being of young professional athletes.

Psychological characteristics of young athletes, reduced quality of life, increased anxiety, and sleep disturbances may be components in the development of relative energy deficiency (RED). This syndrome involves

impairment in multiple physiological processes, such as metabolism, protein synthesis, and bone remodeling; it is accompanied by changes in the reproductive, immune, endocrine, and cardiovascular systems, as well as alterations in the psychological sphere [8]. The key pathophysiological mechanism is low energy availability — a condition in which, after subtracting the energy expended on physical exercise, insufficient calories remain to support normal physiological processes [9]. A prolonged energy deficit in professional athletes increases levels of anxiety, irritability, and mood lability, which causes impaired concentration and reduced athletic performance; therefore, creating a psychologically safe environment in elite sport is one of the current priorities of modern sports psychology [10]. An athlete experiencing inadequate (high) anxiety may feel unprotected, experience feelings of loneliness, isolation, hopelessness in difficult situations, and limitation in choice, and may find it difficult to assess priorities in significant life situations. Inadequate anxiety may contribute to the development of psychosomatic disorders and neuroses. At the same time, an adequate level of anxiety plays an important role in an athlete's life, as it contributes to emotional-volitional regulation, prepares for stressful loads, and represents a significant internal factor in the formation of a mature sports personality.

Assessment of quality of life, levels of state and trait anxiety in adolescent athletes is an important diagnostic direction, allowing a comprehensive evaluation of the health status of young athletes, as well as determination of the effectiveness of the therapeutic and diagnostic measures performed. However, studies in the pediatric population of highly qualified athletes are few and contradictory, which served as the rationale for conducting this study.

The study purpose was to assess the quality of life, levels of trait and state anxiety, as well as sleep quality in adolescent athletes of the national teams of the Russian Federation.

MATERIALS AND METHODS

A cross-sectional single-center study was conducted, involving young athletes of the national teams of the Russian Federation who underwent comprehensive medical examination at the Federal Scientific and Clinical Center for Children and Adolescents of the FMBA of Russia. A total of 203 young athletes were included in the study (40 males (19.7%) and 163 females (80.3%) aged 13–18 years (mean age 15.0 [13.0; 17.0] years). The participants were members of the national teams of the Russian Federation in 13 sports (volleyball, freestyle wrestling, Muay Thai, synchronized swimming, softball, sports acrobatics, artistic gymnastics, dance sports, taekwondo, wushu, figure skating, field hockey, rhythmic gymnastics), divided into groups:

¹ Shevchenko YuL, Novik AA, Ionova TI. Guide to Quality of Life Research in Medicine. Moscow: ZAO "OLMA" Media Group; 2007.

cyclic, team, complex-coordination sports, and combat sports.

Quality of life assessment was performed using the generic version of the Pediatrics Quality of Life Inventory (PedsQL™ 4.0 Generic Core Scale) adapted for research in the pediatric population. The questionnaire has three versions for completion by children in age categories 5–7, 8–12, and 13–18 years [11] and includes 23 items grouped into four domains:

- Physical functioning scale (PF) — 8 items assessing pain and the child’s ability to move (run and walk);
- Emotional functioning scale (EF) — 5 items assessing mood, sleep quality, level of worry, as well as the severity of fear and sadness;
- Social functioning scale (SF) — 5 items assessing the respondent’s interaction with other children;
- Role functioning scale — school life (RF) — 5 items assessing how the child copes with role tasks in the school environment.

To obtain results for each of the functioning scales, the arithmetic mean is calculated using the formula: $X = (X1 + X2 + \dots + Xn) / n$, where X is the final value for each scale, $X1, X2...Xn$ are the scores obtained after scaling for each item, and n is the number of items for each functioning scale. To obtain overall results for psychosocial functioning, the sum of the mean values obtained across all questionnaire scales (physical, emotional, social, and role functioning) is calculated.

A 5-point Likert scale was used to assess the responses (0 — never, 1 — almost never, 2 — sometimes, 3 — often, 4 — almost always). If more than 50% of responses were missing, the total score for the scale was not calculated. Following the recoding procedure (converting raw data into quality-of-life scores), the overall score is calculated on a 100-point scale; a higher final value indicates a higher quality of life for the child.

Anxiety assessment. State anxiety is expressed as tension, agitation, worry, and nervousness and is determined by the situation at a given moment in time. Trait anxiety is an individual property of perceiving

events as threatening, with a response to them in the form of an anxiety state.

Anxiety was assessed using the Spielberger–Hanin State-Trait Anxiety Inventory (STAI), designed for adolescents and consisting of two parts: state anxiety and trait anxiety [12]. Each part contains 20 short statements; the subject is asked to rate their current state at the time of the survey on a 4-point scale. As the final test result, two values were determined: the sum of scores for the 20 items related to state anxiety; and the sum of scores for the 20 items related to trait anxiety. Results were evaluated separately for trait and state anxiety. If the patient scored less than 30 points, anxiety was considered low; 30–45 points — moderate; above 45 points — high.

Sleep quality. To assess sleep quality and evaluate the severity of insomnia, the Insomnia Severity Index (ISI) questionnaire was used [13]. The questionnaire consists of 7 items. For each item, the respondent was asked to select the answer that best characterized their sleep over the past 2 weeks. Each answer was rated on a scale from 0 to 4. Scores were summed. With a total score of: 0–7 — no clinically significant insomnia; 8–14 — subthreshold insomnia; 15–21 — insomnia (moderate severity); 22–28 — insomnia (severe).

Statistical data processing was performed using Statistica 10.0 software (StatSoft Inc.). Since most of the studied parameters did not have an approximately normal distribution, all data are presented as median and interquartile range. Categorical parameters were described with absolute values and percentages. Comparison of percentages in the analysis of multi-field contingency tables was performed using the Pearson chi-square test. The critical level of significance for differences was set at $p \leq 0.05$.

RESULTS AND DISCUSSION

According to the questionnaire results, 80% ($n = 32$) of male athletes and 58.9% ($n = 96$) of young female

Table 1. Quality of life indicators in young athletes across different sports groups

Sports groups	Physical functioning, score	Emotional functioning, score	Social functioning, score	Role functioning, score	Total score
Cyclic sports ($n = 35$)	82	70	92	83	327
Team sports ($n = 34$)	90	65	93	78	325
Complex-coordination sports ($n = 110$)	87	71	92	83	334
Combat sports ($n = 24$)	89	72	94	78	333
Mean value	87	69	93	80	329

Table prepared by the authors based on their own data
Note. n — number of athletes.

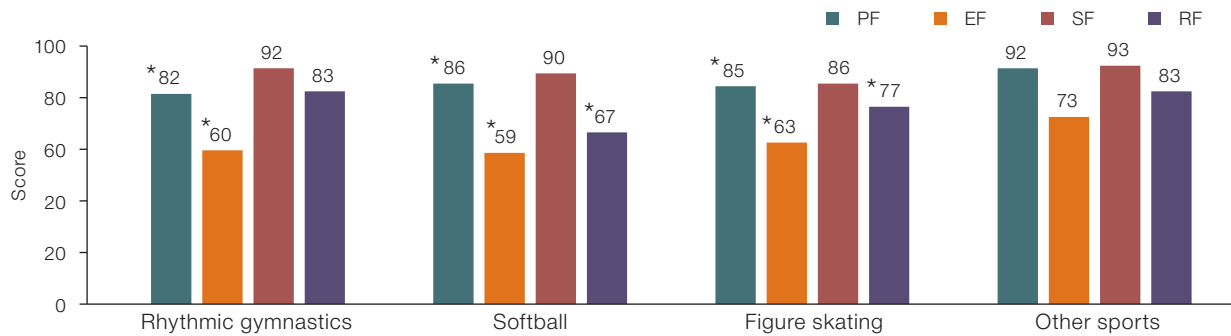


Figure prepared by the authors based on their own data

Fig. Quality of life assessment among young athletes in various sports. PF — physical functioning; EF — emotional functioning; SF — social functioning; RF — role functioning; * — $p < 0.05$ (statistically significant difference compared to other sports groups)

athletes rated their health as excellent; 17.5% ($n = 7$) of males and 35.8% ($n = 58$) of females rated their health as good; 2.5% ($n = 1$) of male athletes and 4.9% ($n = 8$) of female athletes reported a satisfactory health rating; 0.6% ($n = 1$) of female athletes rated their health as unsatisfactory.

When assessing quality of life by sports groups, no statistically significant differences were found (Table 1). However, among representatives of different sports, statistically lower values of the physical functioning parameter were observed in athletes practicing rhythmic gymnastics ($p = 0.001$), figure skating ($p = 0.008$), and softball ($p = 0.014$) (Fig.). This may be related to several factors: extreme loads from an early age without adequate recovery, an excessive prevalence of chronic musculoskeletal injuries (especially of the spine, ankles, and knees), the prevalence of eating disorders and energy deficiency, which impairs tissue recovery and reduces bone mineral density [14], and early specialization, which cumulatively increases injury risk [15].

The results of our study indicated that female figure skaters ($p = 0.005$) and softball players ($p = 0.001$) showed statistically lower values of emotional and role functioning compared to athletes in other sports. This is consistent with the findings that female athletes in sports with high body-shape demands (figure skating, gymnastics) reported higher levels of eating disorder symptomatology and poorer body image, correlating with increased emotional distress [16, 17].

Softball, as a less “feminine” sport (especially in comparison with figure skating, gymnastics, or dance), may cause role conflict in female athletes. Some publications showed that in team sports such as softball, female athletes often suppress their emotions “for the team,” which can lead to emotional exhaustion; they practice self-censorship and emotional control to maintain team dynamics, creating additional emotional burden. Female athletes in general face particular difficulties, including higher levels of anxiety and depression, as well as eating disorders [18].

Table 2. Anxiety levels in young athletes by type of sport

Anxiety level		Groups of athletes by type of sport			
		Rhythmic gymnastics, % (n) ($n_{\text{total}} = 44$)	Figure skating, % (n) ($n_{\text{total}} = 30$)	Softball, % (n) ($n_{\text{total}} = 20$)	Other sports, % (n) ($n_{\text{total}} = 68$)
State anxiety	Low	54.5 (24)	33.3 (10)	50.0 (10)	60.3 (41)
	Moderate	38.6 (17)	56.7 (17)*	40.0 (8)	32.4 (22)
	High	6.8 (3)	10.0 (3)*	10.0 (2)*	7.4 (5)
Trait anxiety	Low	34.1 (15)	13.3 (4)	20.0 (4)	50.0 (34)
	Moderate	52.3 (23)	53.3 (16)	60.0 (12)	41.2 (28)
	High	13.6 (6)	33.3 (10)*	20.0 (4)	8.8 (6)

Table prepared by the authors based on their own data

Note. n — number of athletes, n_{total} — total number of athletes in the group, * — the differences in indicators are statistically significant ($p < 0.05$).

Table 3. Insomnia levels in young athletes by type of sport

Categories	Groups of athletes by type of sport			
	Rhythmic gymnastics, % (n) (n _{total} = 44)	Figure skating, % (n) (n _{total} = 30)	Softball, % (n) (n _{total} = 20)	Other sports, % (n) (n _{total} = 68)
Normal	86.4 (38)	76.7 (23)	71.4 (15)	88.2 (60)
Subthreshold insomnia	13.6 (6)	23.3 (7)	19 (4)	8.8 (6)
Insomnia	–	–	4.8 (1)	2.9 (2)
Severe sleep disturbance	–	–	–	–

Table prepared by the authors based on their own data
Note. $p = 0.234$; n — number of athletes; n_{total} — total number of athletes in the group; “–” — not identified.

Testing using the Spielberger–Hanin STAI found that figure skaters had higher levels of trait and state anxiety compared to representatives of rhythmic gymnastics, softball, and other sports (Table 2). Elevated trait anxiety directly correlates with the presence of neurotic conflict and with emotional and nervous breakdowns [19]. Our results are consistent with data from other researchers: figure skaters and gymnasts are characterized by high levels of perfectionism, which is closely associated with anxiety and the risk of eating disorders [20]. Girls and young women engaged in these sports are distinguished by excellent posture, well-developed coordination and flexibility, and a supple body.

On the other hand, these sports carry potential threats to the physical and psychological well-being of young female athletes oriented toward high sports performance [18]. In a classic study of elite figure skaters, five sources of stress were identified: negative aspects of competition, negative relationships with significant people (coaches, parents), demands and costs of sport, personal factors (internal conflicts), and traumatic experience [21]. Similar studies conducted later [22] confirmed the findings of the authors [21]. It was shown that participation in aesthetic sports during adolescence is associated with worse health outcomes in adulthood, including psychological well-being [22].

Sleep is one of the most important, yet often underestimated, components in athlete preparation. Scientific research over recent decades has convincingly demonstrated that sleep quality and duration have a direct impact on physical performance, cognitive functions, post-exercise recovery, injury risk, and overall mental

health of athletes [23, 24]. When sleep duration is restricted to 4 h per day, athletes show a decrease in maximal power output and an increase in heart rate during submaximal exercise [25]. Athletes with shorter nocturnal sleep duration exhibit higher levels of anxiety and cope worse with stressful situations [25, 26]. In our work, we analyzed sleep quality in young athletes (Table 3) and did not find statistically significant impairments ($p = 0.234$). The highest level of subthreshold insomnia was observed in figure skaters (23%), which may be associated with higher trait and state anxiety in girls engaged in this sport.

CONCLUSIONS

When assessing quality of life, athletes engaged in figure skating, rhythmic gymnastics, and softball scored the lowest on physical functioning compared to representatives of other sports. Furthermore, female athletes engaged in softball and figure skating more frequently exhibited lower scores in emotional and role functioning, which allows them to be classified as a risk group during screening for quality-of-life impairments. When assessing anxiety, female figure skaters were also classified as the most vulnerable group, as they were found to have elevated levels of both trait and state anxiety.

Further studies are needed to clarify the cutoff points of the questionnaires for assessing quality of life and trait and state anxiety in adolescent athletes, which will contribute to the early detection of these impairments, improvement in quality of life, and reduction in anxiety levels within the framework of medical and biological support for high-performance sports.

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