# IMPROVING AND ASSESSING THE SPECIAL PREPARATION OF 15-16-YEAR-OLD ATHLETES UNDER COMPLEX TRAINING LOADS

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**ANNOTATSIYA:**

*The article substantiates a methodological approach to improving and assessing the special preparation of 15-16-year-old athletes under complex training loads. The relevance of the problem is connected with the transition from a predominantly general developmental orientation of adolescent sport training to a stage at which special motor abilities, technical stability, functional readiness and recovery capacity must be coordinated within a single pedagogical system. The study is based on analytical generalization of Uzbek and Russian scientific-methodological literature, comparative interpretation of long-term athlete development concepts, and pedagogical modelling of load regulation and special-preparedness assessment. The proposed model integrates four interrelated components: age-sensitive load planning, sport-specific exercise selection, complex monitoring of readiness, and correction of microcycle content according to response indicators. The article defines a set of assessment criteria that includes speed-strength preparedness, special endurance, coordination stability, technical execution under fatigue, and recovery dynamics. The results are presented as a practical framework that can be* *applied by coaches of sport schools and youth teams without ignoring the biological heterogeneity of 15-16-year-old athletes. The scientific value of the article lies in connecting the theory of sports training with a transparent diagnostic algorithm for managing complex loads in adolescent athletes..*

INTRODUCTION

The improvement of special preparation in 15-16-year-old athletes represents one of the most sensitive methodological problems in youth sport. At this age the athlete is no longer a beginner, because basic motor literacy, elementary technical skills and initial competitive experience have already been formed. At the same time, the adolescent organism is still developing, and the rate of biological maturation differs markedly between athletes of the same chronological age. Therefore, the direct transfer of adult training schemes into youth sport is methodologically incorrect. The training process must combine gradual specialization with strict pedagogical control of load volume, intensity, density, coordination difficulty and recovery demand.

The concept of complex training load is broader than the ordinary increase of exercise volume. It includes the simultaneous action of physical, technical, tactical, psychological and recovery-related factors. In practical coaching, a session may appear moderate by volume but may create a high total stress because the exercises are technically difficult, performed at high speed, combined with competitive tasks and placed after insufficient recovery. For 15-16-year-old athletes such hidden complexity is especially important, since fatigue can distort technique, reduce movement accuracy and increase the risk of overload. This circumstance explains why special preparation cannot be assessed only by isolated strength, speed or endurance tests.

Uzbek and Russian sport-science traditions pay considerable attention to the unity of general and special preparation, the age-related logic of long-term training and the role of pedagogical control. Matveev considered training as a system of cyclic, purposeful and scientifically regulated influences [1]. Platonov interpreted preparation as a long-term process in which load structure, competition demands and individual adaptation must be brought into correspondence [2]. Verkhoshansky's ideas on special strength preparation emphasize the principle of dynamic correspondence between training means and the competitive motor act [3]. In youth sport, Filin and Fomin showed that the development of young athletes requires age-sensitive content and cannot be reduced to early intensification [4]. These approaches are also consistent with Uzbek methodological works in physical education and sport training, where the organization of training, pedagogical measurement and scientific research methods are considered as necessary conditions for effective preparation [6-9].

The problem, however, remains insufficiently operationalized for everyday coaching work. Coaches often have separate test results, training plans and observations, but these elements are not always joined into a single decision-making algorithm. As a result, a young athlete may improve one indicator while losing technical stability or demonstrating signs of accumulated fatigue. The methodological task is to define how special preparation should be developed and how its level should be determined under complex load conditions. This article addresses that task by proposing a structured model of improvement and assessment designed for athletes aged 15-16 years.

The purpose of the article is to substantiate a practical and scientifically grounded system for improving and assessing the special preparation of 15-16-year-old athletes, taking into account complex training loads. The objectives are: to define the methodological principles of load regulation for this age group; to identify the main criteria of special preparedness; to design an assessment algorithm that combines performance, technique and recovery indicators; and to present recommendations for the correction of microcycle content according to diagnostic results.

MATERIALS AND METHODS

The article was prepared as an analytical-pedagogical study. Its methodological basis consists of three procedures: theoretical analysis of scientific and educational literature, comparative interpretation of training principles used in Uzbek and Russian sport-science schools, and pedagogical modelling of a load-sensitive system for assessing special preparedness. The study does not present fabricated experimental statistics; instead, it formulates a reproducible framework that may later be tested in a particular sport, age group and training environment. Such a design is appropriate when the research object is a methodological system rather than a closed laboratory experiment.

The source base included works devoted to the general theory of sport training, special strength preparation, youth sport, sport selection, pedagogical control and scientific research methods in physical culture. Priority was given to Uzbek and Russian authors because the requested methodological context is linked with the educational and sport-training traditions used in Uzbekistan and neighbouring scientific schools. The works of Matveev, Platonov, Verkhoshansky, Filin, Fomin, Volkov, Salomov, Abdullayev, Xonkeldiyev, Kerimov, Maxkamdjanov and Yunusova were used as the principal theoretical references [1-10].

The model was designed for athletes aged 15-16 years who have passed the initial training stage and are moving toward deeper specialization. Since the topic is formulated in general terms and does not specify a sport, the proposed criteria are intentionally universal. They can be adapted to athletics, combat sports, football, handball, gymnastics, rowing, swimming and other sports by replacing test exercises with sport-specific analogues. The central requirement is not the identical use of one test battery but the preservation of the assessment logic: special preparedness is determined by the relation between motor capacity, technical quality, fatigue resistance and recovery dynamics.

Complex training load was interpreted through five dimensions. The first is volume, expressed through duration, number of repetitions, distance, total tonnage or number of technical actions. The second is intensity, reflected in speed, power, heart-rate zone, resistance or competitive tempo. The third is coordination complexity, which indicates how difficult the movement structure is under the given conditions. The fourth is psychological density, connected with decision-making, rivalry, time pressure and responsibility for accuracy. The fifth is recovery cost, shown by delayed fatigue, subjective readiness, sleep quality, muscle soreness and the return of working capacity. In the proposed system these dimensions are considered together rather than separately.

Special preparedness was defined as the athlete's capacity to perform sport-specific motor actions with sufficient speed, power, endurance, coordination and technical reliability under training and competitive fatigue. This definition excludes a narrow interpretation in which special preparation is reduced to strength or speed only. For 15-16-year-old athletes, special preparedness must also include the ability to preserve movement structure when load complexity increases. Consequently, assessment should combine quantitative indicators, qualitative technical evaluation and recovery markers.

**Table 1.**

**Assessment criteria for determining special preparedness under complex load conditions**

| **Criterion** | **Diagnostic meaning** | **Possible indicators** | **Coaching interpretation** |
|---|---|---|---|
| Speed-strength readiness | Ability to produce explosive effort in sport-specific movement | Vertical jump, standing long jump, 20-30 m sprint, medicine-ball throw | Low result requires special strength means with moderate volume and high technical control |
| Special endurance | Capacity to maintain effective work in repeated sport actions | Repeated sprint test, interval task, sport-specific circuit | Large decline between repetitions indicates insufficient fatigue resistance or excessive load density |
| Coordination stability | Preservation of movement accuracy under changing conditions | Balance, agility route, reaction task, technical drill with direction changes | Errors under fatigue require reduction of complexity or separation of |

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| | | | technical and conditioning tasks |
| Technical reliability under fatigue | Ability to keep the competitive movement structure during load accumulation | Coach rating, video analysis, percentage of successful actions after intensive work | Technique deterioration is a sign to correct load order and increase recovery pauses |
| Recovery dynamics | Return of functional and subjective readiness after complex sessions | Resting pulse, perceived readiness, sleep, soreness, repeated test response | Slow recovery requires temporary reduction of intensity and greater use of restorative microcycles |

The assessment procedure was divided into three stages. The first stage is preliminary diagnostics, where the coach determines the athlete's current level of special readiness and the presence of limiting factors. The second stage is load-sensitive monitoring during a microcycle, where changes in performance and technique are compared with the planned load. The third stage is corrective decision-making, where the coach modifies the next microcycle by changing load volume, intensity, complexity or recovery intervals. This sequence corresponds to the logic of pedagogical control: measurement must not remain a formal record but should guide the management of training content.

RESULTS

The analytical synthesis produced a four-component model for improving special preparation in 15-16-year-old athletes. The first component is age-sensitive load planning. It requires that the training plan respect the incomplete stabilization of functional systems, the uneven development of motor qualities and the high individual variability of adolescents. The second component is sport-specific selection of exercises. Exercises must correspond to the competitive movement not only externally but also by effort direction, tempo, muscular coordination, amplitude and rhythm. The third component is complex monitoring, in which performance, technical quality and recovery are assessed simultaneously. The fourth component is microcycle correction, where the next load is determined by the athlete's response to the previous load rather than by the mechanical repetition of a fixed plan.

The proposed model changes the usual order of coaching decisions. In traditional practice, the coach first plans volume and intensity, then chooses exercises and finally tests results after several weeks. Under complex load conditions this sequence is insufficient. The coach must first define what quality of special preparedness is being formed, then select exercises that reproduce the decisive elements of competitive activity, and only after that determine volume and intensity. This logic protects adolescent athletes from an excessive accumulation of non-specific work and from premature intensification that improves short-term output but weakens technical stability.

For practical application, special preparation should be structured into three zones. The first zone is the developmental zone, where the main task is to form the physical basis of the target ability. The load is moderate, the exercise technique is strictly controlled, and errors are corrected immediately. The second zone is the stabilizing zone, where the athlete repeats special actions in conditions close to competition but without maximal fatigue. The third zone is the resistant-performance zone, where the athlete is required to maintain the quality of movement after preliminary fatigue. For 15-16-year-old athletes the third zone must be used carefully, because it has the highest training effect but also the greatest risk of overload when applied too frequently.

A key result of the modelling process is the Special Preparedness Stability Index (SPSI). It is not proposed as a rigid mathematical standard for all sports; rather, it is a diagnostic principle that helps the coach compare the athlete's output before and after complex load. The index may be expressed as follows: $SPSI = (P2/P1 \times 0.40) + (T2/T1 \times 0.35) + (R \times 0.25)$, where P1 and P2 are performance indicators before and after a fatigue task, T1 and T2 are technical-quality scores before and after the same task, and R is a normalized recovery score obtained on the following day. The closer the index is to 1.00, the more stable the athlete's special preparedness is under complex load. Values clearly below 0.85 indicate that the athlete's special readiness is unstable and that the training load should be corrected.

The SPSI approach is useful because it prevents the overvaluation of a single high performance result. A 15-16-year-old athlete may demonstrate good sprint speed or jumping ability in a rested state but lose movement accuracy, rhythm or decision-making speed after repeated work. In such a case the athlete cannot yet be considered sufficiently prepared for complex competitive conditions. Conversely, an athlete with moderate isolated results but stable technique and rapid recovery may be more ready for systematic load progression. This interpretation corresponds to the idea that special preparation is a functional-technical system, not a sum of separate physical qualities.

The model also defines the weekly distribution of complex loads. In a standard microcycle with five training sessions, one session may be directed toward speed-strength development, one toward special endurance, one toward technical-tactical stabilization, one toward integrated complex load, and one toward recovery with corrective technical work. High-complexity sessions should not be placed consecutively. If the athlete demonstrates slow recovery or technical deterioration, the integrated complex-load session should be replaced by a stabilizing session with lower density. Such rotation makes it possible to improve special preparedness while preserving developmental safety.

**Figure 1. Diagnostic algorithm for improving and determining special preparedness in 15-16-year-old athletes**

**Initial diagnostics -> Complex-load microcycle -> Post-load testing -> Technical-quality comparison -> Recovery control -> Corrective planning of the next microcycle**

The algorithm shown in Figure 1 reflects the principle that assessment is inseparable from training management. If testing is performed only at the beginning and end of a training period, the coach receives information too late. The proposed sequence allows the coach to identify changes in readiness during the period when correction is still possible. In adolescent sport this is methodologically important because the cost of incorrect load progression can be higher than in adult athletes.

DISCUSSION

The results of the analytical model correspond with the classical theory of sport training but specify it for the age group of 15-16 years. Matveev's principle of cyclic organization remains central because complex loads must be distributed within microcycles, mesocycles and annual stages [1]. Platonov's systemic approach is also important because the athlete's preparation cannot be divided into isolated physical, technical and tactical fragments [2]. However, the adolescent stage requires a more cautious interpretation of these principles. The objective is not to accelerate specialization at any cost, but to ensure that the athlete's special abilities develop on a stable general and functional foundation.

Verkhoshansky's principle of dynamic correspondence is especially productive for the selection of exercises [3]. In 15-16-year-old athletes, however, dynamic correspondence should not be interpreted as a demand to imitate competitive loads with maximal intensity. The more appropriate interpretation is pedagogical: each special exercise must have a clear connection with the competitive action, but its intensity, volume and complexity must be adapted to the athlete's current developmental status. This distinction prevents two methodological errors. The first is excessive generality, when special preparation is replaced by unspecific conditioning. The second is premature imitation of adult competition demands, when adolescents receive loads that exceed their adaptive capacity.

The literature on youth sport emphasizes that training effects are strongly influenced by age, maturation and individual tempo of development [4, 5]. This thesis is directly relevant to the proposed model. A 15-year-old athlete with advanced biological maturation and a 16-year-old athlete with delayed maturation may require different load progressions even if they compete in the same group. Therefore, the assessment of special preparedness should include not only performance outcomes but also the cost of achieving them. A high result accompanied by prolonged recovery, poor sleep, irritability, persistent soreness or technical regression cannot be considered a positive adaptation.

Uzbek methodological sources underline the importance of pedagogical organization, scientifically grounded measurement and the connection between training objectives and educational tasks [6-10]. For sport schools and pedagogical institutes, this is essential because youth sport is not only a system for achieving competition results but also a pedagogical environment. The coach must form discipline, self-control, movement culture and conscious attitude toward training. Complex loads are effective only when athletes understand the purpose of exercises and learn to evaluate their own readiness. Thus, the monitoring system should include simple self-assessment scales alongside coach observation and motor tests.

The practical significance of the proposed framework lies in its adaptability. In team sports, technical reliability under fatigue may be evaluated through pass accuracy, decision speed, duel effectiveness or repeated sprint ability. In combat sports, it may be assessed through attack quality, defensive reaction, grip efficiency and maintenance of tactical discipline in repeated bouts. In athletics, it may include stride rhythm, take-off mechanics, throw stability or sprint-time preservation. In all cases, the same logic is retained: special preparedness is sufficient only when the athlete preserves the quality of the sport-specific action under increasing complexity.

A limitation of the model is its general character. Since the topic does not identify a particular sport, the article cannot prescribe exact distances, weights, repetition numbers or heart-rate zones for every discipline. These parameters must be determined according to the sport, qualification level, sex, biological maturity, competitive calendar and health status of the athlete. Another limitation is that the SPSI formula requires empirical validation in each sport before it can be used as a normative scale. Nevertheless, the formula is valuable as a methodological tool because it forces the coach to compare performance, technique and recovery instead of relying on one indicator only.

The application of the model requires a clear division between training control and medical control. The coach may register performance indicators, technical errors, subjective readiness and signs of excessive fatigue, but persistent pain, abnormal cardiovascular response, sudden decline in coordination or long-term sleep disturbance require medical consultation. This boundary is important in youth sport because pedagogical enthusiasm sometimes leads to the normalization of fatigue as a sign of progress. In fact, fatigue is informative only when it is temporary, reversible and followed by positive adaptation. If fatigue suppresses movement culture and emotional readiness for several days, it becomes a signal of incorrect load organization.

The model also has educational value. When adolescent athletes participate in the monitoring process, they gradually learn to connect effort, technique and recovery. A short readiness diary, a simple five-point self-assessment scale and discussion of test results with the coach develop responsibility for training behaviour. This is consistent with the pedagogical orientation of sport schools: the athlete is not merely an object of load influence but an active participant in self-regulation. Such participation is especially useful at 15-16 years, when the athlete begins to understand the relationship between disciplined daily habits and competitive stability.

For coaches, the decisive methodological rule is the priority of quality over mechanical load accumulation. The number of repetitions, kilometres or bouts has training value only if the athlete maintains the target movement structure and recovers within the planned time. If a complex session produces technical deterioration earlier than expected, the coach should not simply demand greater willpower; the load should be reorganized through shorter series, longer pauses, less coordination difficulty or separation of strength and technical tasks. In this sense, the proposed approach transforms assessment from a control procedure into a tool of individualized training design.

CONCLUSION

The special preparation of 15-16-year-old athletes under complex training loads must be organized as an integrated pedagogical system. Its effectiveness depends not on the simple increase of workload but on the rational relationship between age-sensitive load planning, sport-specific exercise content, technical stability and recovery control. The adolescent athlete should not be treated as a reduced model of an adult athlete; the training process must take into account biological heterogeneity, incomplete functional stabilization and the educational nature of youth sport.

The proposed model demonstrates that special preparedness should be assessed through several interrelated criteria: speed-strength readiness, special endurance, coordination stability, technical reliability under fatigue and recovery dynamics. The diagnostic algorithm moves from preliminary testing to microcycle monitoring, post-load comparison and corrective planning. This approach allows the coach to determine not only how strong or fast the athlete is, but also how stable the athlete's sport-specific performance remains when the complexity of the training load increases.

For practical coaching, the main recommendation is to avoid consecutive high-complexity sessions, to separate developmental and resistant-performance tasks when necessary, and to adjust the next microcycle according to the athlete's response. A young athlete is ready for progressive special loads only when performance growth is accompanied by preserved technique and adequate recovery. Further research should test the proposed indicators in separate sports and develop sport-specific normative scales for athletes aged 15-16 years.

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