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STUDY OF AGE-RELATED CHARACTERISTICS OF YOUNG BASKETBALL PLAYERS AND RATIONAL LOAD DISTRIBUTION IN THE TRAINING PROCESS

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Abstract. This article examines the age-related morphofunctional and psychomotor characteristics of young basketball players aged 10–17 and their significance for planning training loads. Based on the analysis of scientific and methodological literature as well as pedagogical observation, three age stages are identified, with priority tasks, allowable volumes, and load intensities defined for each. It is demonstrated that exceeding age-appropriate load norms and ignoring the non-uniformity of biological development increase the risk of overtraining and injury. Conversely, a differentiated load distribution across stages and microcycles promotes a sustainable increase in physical and technical fitness. A load distribution model applicable to youth sports schools is proposed.

Keywords: young basketball players, age-related characteristics, training load, sensitive periods, periodization, biological age.

Introduction. Basketball places high demands on speed-strength qualities, coordination, endurance, and rapid decision-making skills. The multi-year training of a player spans a period of intensive growth and pubertal maturation, during which the body is particularly sensitive to both developmental and excessive training loads [1, 3]. Planning errors at this stage lead to two opposite consequences: insufficient load misses sensitive periods for developing motor abilities, while excessive load causes overfatigue, decreased motivation, and injury [5, 8].

In practice, training loads are often dictated by calendar age and competitive team goals rather than by individual levels of biological maturity and the functional state of athletes. The difference between biological and chronological age in adolescents of the same birth year can reach two to three years [6], rendering identical group training loads ineffective.

The relevance of this topic stems from the need for a scientifically grounded approach to structuring the training process of young basketball players, taking into account the age dynamics of physiological development.

The aim of the study is to examine the age-related characteristics of young basketball players and to substantiate a rational distribution of training loads at the stages of multi-year preparation.

Research tasks:

1. Analyze scientific and methodological literature on the age-related characteristics of children and adolescents engaged in basketball.
2. Identify age stages and determine priority training directions for each.
3. Develop a model of load distribution based on volume, intensity, and microcycle structure.

Research Methods. The study was conducted using the following methods: analysis and synthesis of scientific and methodological literature; pedagogical observation of the training process;

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timing and structural analysis of training sessions; heart rate (HR) monitoring using heart rate monitors; evaluation of subjective effort using the RPE scale and session load calculation ($\text{RPE} \times \text{duration in minutes}$) [9]; pedagogical testing (20 m sprint, standing long jump, 3×10 m shuttle run, vertical jump, ball dribbling with shot); determination of biological age by peak height velocity (maturity offset) [6]; methods of mathematical statistics.

The study involved young basketball players across three age groups: 10–12 years ($n = [ ]$), 13–14 years ($n = [ ]$), and 15–17 years ($n = [ ]$), training at $[\text{name of school/section}]$ for $[ ]$ months. Parents (legal representatives) and athletes were informed of the study goals; all participants passed medical clearance. Statistical processing was performed in $[\text{software}]$, with differences considered significant at $p < 0.05$.

Age-Related Characteristics of Young Basketball Players. Literature analysis and observations allowed us to identify three distinct stages that differ significantly in terms of physiological response to training loads.

10–12 Years Stage (Initial Preparation): A period of relatively steady growth. The nervous system is plastic, enabling a high capacity for acquiring new motor skills; coordination abilities and speed develop intensively [4, 7]. Aerobic capabilities increase, but anaerobic capacity is limited, and the cardiovascular system fatigues quickly during monotonous work. Attention spans are unstable, and motivation heavily relies on game-based exercises.

13–14 Years Stage (Pre-pubertal and Pubertal Growth Spurt): Body length increases faster than muscle mass and the cardiovascular system develop, which temporarily impairs coordination, jump/running mechanics, and increases stress on joints and bone growth plates [6, 7]. Significant individual variation in maturation rates is observed. Susceptibility to speed-strength qualities and general endurance increases, but fatigue resistance drops; emotional instability requires pedagogical flexibility.

15–17 Years Stage (Specialized Preparation): Growth rates slow down, muscle strength and anaerobic capacities take shape, and the body becomes capable of tolerating substantial volumes of specialized work [1, 3]. Tactical thinking, team interactions, and psychological resilience play an increasing role. However, the risk of overload remains during periods of high competitive activity.

Load Distribution Model. Based on these identified characteristics, a tentative load distribution model is proposed (Table 1). Values serve as recommended ranges and should be adjusted according to individual athlete indicators.

Indicator	10–12 Years	13–14 Years	15–17 Years
Sessions per week	3	3–4	4–5
Session duration (min)	60–90	90	90–120
Priority tasks	Coordination, speed, basic technique, movement skills	Speed-strength qualities, technique during growth, general endurance	Special endurance, tactics, strength training, competitive stability
Main HR zone	140–160 bpm, briefly up to 170	150–170 bpm	150–180 bpm

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Share of game/outdoor drills	Predominant	High	Moderate; share of special drills increases
Strength work	Bodyweight only, no weights	Bodyweight and light weights, focus on technique	Weight training under coach supervision
Competitive load volume	Minimal	Moderate	Gradually increasing

In the structure of a weekly microcycle, it is recommended to alternate days of high, medium, and low loads, avoiding two consecutive high-intensity sessions for athletes aged 10–14. For adolescents experiencing peak height velocity, it is advisable to reduce jumping and running loads by 20–30% while increasing exercises focusing on flexibility, stabilization, and technique. A unloading microcycle every 3–4 weeks and at least 1–2 days of complete rest per week are also recommended. Weekly load increases should proceed gradually without sharp spikes, as spikes are directly linked to elevated injury risks [10].

Discussion. The obtained results align with long-term athlete development theories, which state that training content must correspond to age-related physiological laws and sensitive periods of motor quality development [1, 2, 4]. At the initial stage, game-based methods and multilateral coordination development are most effective, whereas early specialization and high volumes of repetitive work decrease children's interest without yielding long-term benefits [5, 8].

The 13–14 age period warrants special attention. Disproportion between body growth rate and muscle system development explains temporary drops in coordination, which coaches frequently misinterpret as a loss of ability and attempt to compensate for by increasing training volume. Utilizing biological age indicators allows coaches to differentiate loads within a group and reduce injury risks for early and late maturers [6]. This aligns with modern youth physical development models, where training impact types are determined by maturity status rather than chronological age alone [5].

At the specialized preparation stage, load increases are justified provided functional state monitoring is maintained. Combining objective (HR) and subjective (RPE) indicators allows coaches to make prompt plan adjustments and identify overtraining signs in a timely manner [9]. The practical significance of this study lies in the fact that the proposed model can be implemented by youth sports school coaches when designing annual and weekly plans.

Study Limitations: Limited sample size, duration of observations, and lack of accounting for non-training factors (sleep, nutrition, academic stress). Future research directions include longitudinal studies on indicator dynamics following the implementation of this model.

Conclusions

1. Young basketball players aged 10–12, 13–14, and 15–17 differ significantly in maturation rates, functional capabilities, and physiological responses to load; therefore, uniform group loads are ineffective.
2. At the initial stage, priority must be given to coordination, speed, and game methods; during the growth spurt (13–14 years) — to reducing impact loads, refining technique, and gradually developing speed-strength; at the 15–17 stage — to special endurance, strength, and tactical preparation.

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3. Rational load distribution requires alternating high-, medium-, and low-load days, implementing unloading microcycles, gradually building volume, monitoring HR and RPE, and taking the athlete's biological age into account.

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