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ANALYSIS OF PLANNING LOADS DIRECTED AT DEVELOPING STRENGTH AND SPEED-STRENGTH IN THE ANNUAL TRAINING CYCLE OF 16–17-YEAR-OLD FOOTBALL PLAYERS

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ABOUT ARTICLE

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Abstract: This article analyzes the structural composition of training and competitive loads of 16–17-year-old football players training in a football academy. Indicators of load volume, direction, specialization, and coordination complexity were evaluated using the "Polar Team Pro" technology. The results indicate that the volume of training loads aimed at developing speed-and-strength qualities is not sufficiently prioritized, with a distinct emphasis remaining on mixed-direction loads. Furthermore, a low level of coordination complexity and a lack of individualization in training loads were observed. Accordingly, the necessity of introducing specialized microcycles based on individual physiological parameters to optimize the training load structure is substantiated.

Introduction. In recent years, training sports reserves for professional football teams has emerged as a critical issue not only nationally but also on an international scale. In particular, systematic scientific research is being conducted to improve the targeted training system for young football players, shape their physical, technical, and tactical potential, and enhance the quality and efficiency of the training process. An effective solution to this problem is primarily achieved through a deep scientific analysis of the entire structure of the training system and each of its constituent components. In this regard, the rational use of available resources and the organization of training processes based on an individual approach are of paramount importance.

An analysis of recent World, European, and Asian championship matches reveals a sharp increase in the intensity of football games. This trend is evidenced by the growing number of duels across all areas of the pitch, an expanded volume of high-speed movements by players, and the intensification of pressing tactics. Today, many teams initiate defensive actions in the opponent's half immediately upon losing possession, effectively utilizing "high" or "mid" pressing strategies. This demands a high level of physical conditioning (athleticism) from players, particularly superior development of strength and speed-strength qualities. Consequently, scientifically structuring the development of strength and speed-strength qualities in elite football training unlocks the full potential of young athletes. This factor establishes both the scientific and practical significance of the topic.

Performance indicators of Uzbek national team players across various official tournaments demonstrate that most players lack the level of strength and speed-strength development required by modern football. This deficiency is particularly pronounced among 16–17-year-old players, specifically during the transition period from youth football to professional football. Insufficient development of strength and speed-strength qualities hinders players from demonstrating elite sports mastery and competing effectively against older players in the national championship. This factor is also reflected in the performance of Uzbekistan's national and Olympic teams. In recent years, these teams have struggled to secure qualification for the final stages of major football tournaments organized by the Asian Football Confederation (AFC) and the Federation of International Football Associations (FIFA).

This situation indicates that achieving a high level of strength and speed-strength fitness solely through specialized exercises is unattainable. Notably, many coaches and specialists working with 16–17-year-old players prefer using ball-based exercises in training. Such exercises are known to replicate match situations in *certain aspects; however, their impact is insufficient for the comprehensive development of strength and speed-strength qualities. This implies that relying exclusively on specialized exercises in the training process does not yield a high level of strength and speed-strength conditioning.

Furthermore, executing technical and tactical actions continuously under time constraints facilitates the formation of spatial-temporal anticipation abilities and reduces the duration of both latent and motor components of complex visual-motor reactions. However, studying the physiological workload indicators of strength and speed-strength exercises—including the analysis of workloads observed during training, official, and control matches—

reveals a lack of full alignment between them. This prevents 16–17-year-old players from reliably demonstrating their technical-tactical skills and hinders them from attaining a high level of strength and speed-strength fitness.

An analysis of the training process of 16–17-year-old football players indicates that the current utilization of innovative technologies to plan strength and speed-strength workloads and evaluate their effectiveness remains extremely low. In coaching practice, subjective observation and traditional training methods generally prevail, which fail to provide an accurate workload distribution or a monitoring system based on individual adaptation. This situation leads to inadequate development of strength and speed-strength qualities, incomplete manifestation of technical-tactical mastery, and poor performance indicators in competitive activities. For 16–17-year-old players transitioning from youth to professional football, this deficiency represents a serious barrier to the advancement of their sports mastery.

This reality has created a necessity to revise existing approaches and methodologies, and to develop enhanced training programs based on modern technologies. At the same time, determining the level of strength and speed-strength fitness, uncovering its correlation with competitive performance indicators, and developing effective training programs to cultivate these qualities emerge as vital scientific and practical tasks.

Accordingly, the scientific problem of this research is formulated as follows: to evaluate the level of strength and speed-strength fitness of 16–17-year-old football players, to study it in correlation with competitive performance indicators, and to develop effective training programs based on innovative technologies aimed at developing and improving this fitness.

The modern developmental dynamics of football require it to be classified not only as a sport but also as a highly complex, multi-component socio-physical activity. Today, intense high-speed actions, technical-tactical maneuvers, the continuity of movements, and their physiological cost are increasing significantly. In particular, during a single match, football players cover a distance of 10–13 km, with a 20% increase in short-distance high-intensity sprinting, as well as high-intensity intermittent movements performed under intense time and space constraints [Verkhoshanskiy Yu.V., 1990; Buchheit M., 2014].

Under such volatile and highly competitive conditions, the development of physical fitness components, particularly strength and speed-strength (power-oriented, explosive) qualities in 16–17-year-old football players, is of paramount importance. At this stage of ontogenesis, features of muscle mass shaping, the strengthening of the musculoskeletal system, and its central regulation establish the foundation for a sustainable sports career. Therefore, the scientific and pedagogical modeling of the training and competitive loads for 16–17-year-old players within the annual training cycle remains an urgent scientific task.

According to sports literature, the structure of planning sports training must incorporate long-term, medium-term, and short-term periodization models (macrocycles, mesocycles, and microcycles) [Matveev L.P., Platonov V.N.]. In utilizing these structured approaches, the distribution of training loads, their volume, intensity, specificity, and coordination complexity within the competitive phase must match the incoming match load dynamics—specifically requiring a complex combination of strength, speed-strength, agility, speed, and endurance qualities, which must be systematically controlled.

This study was conducted with 16–17-year-old football players training at the Tashkent City Football Academy to analyze the relative distribution of training and competitive loads, their volume, coordination complexity, physiological intensity, and criteria regarding the presence of specific opposition. The study aimed to implement modern technological monitoring options to individualize and optimize training. The findings serve to develop sound methodological frameworks for enhancing the competitive efficiency of 16–17-year-old football players during the competitive period.

Materials and methods. The effective organization and monitoring of the football training process represents one of the most prominent fields in sports pedagogy and training theory. Based on the concept of physiological orientation developed by A.P. Zolotaryov (1997), a deep emphasis is placed on the energy supply systems supporting muscle activity during football training loads. G.S. Lalakov (1998) demonstrated the efficiency of using heart rate (HR) monitors to control functional readiness.

M.A. Godik (2006) isolated four key metrics characterizing the structure of training loads: specificity, direction, coordination complexity, and volume. These identical parameters enable an Objective assessment of a football player's training workload. A.G. Sidelnikov (2005) developed specialized models for organizing training loads in youth sports. S.Yu. Tyulen'kov (2007) successfully applied digital monitoring systems (such as "Polar Team Pro", "Catapult", "Wyscout") to measure and regulate load volumes and intensities in practice.

In international literature, the classical training periodization guidelines proposed by Thomas Bompa (Canada), alongside modern recommendations on training monitoring and load physiology by G. Haff and N. Triplett, as well as M. Buchheit, occupy a central position. Their research indicates that physical qualities—especially strength and speed-strength—must be systematically integrated across successive stages, utilizing individual monitoring within mesocycles and microcycles.

Research methodology. This study examined the annual training structure of 16–17-year-old football players. Data were collected from the Tashkent City Football Academy during the 2024 training and competitive periods. The subject group comprised 25 football players, tracking their technical mastery and general preparation. The following methods were applied:

Observation and Protocoling: Direct monitoring of training sessions, recording load duration, utilized equipment, and intensity levels.

Biomonitoring: Heart rate (HR) was recorded using the "Polar Team Pro" system. This served as the primary physiological index for evaluating training intensity.

Structural Analysis: Training loads were broken down by direction (aerobic, anaerobic-glycolytic, anaerobic-alactic, anabolic), intensity, specialization, and coordination complexity.

Statistical Processing and Summary: Monthly training data, total training minutes, and target specialized loads were entered into specialized tables.

The relative distribution of training and competitive loads from Tables 1 and 2 was verified. The overall training structure examined aspects of specific match contexts, coordination complexity, player density, and opposition availability. The physical preparation boundaries for 16–17-year-old football players during the preparatory period are provided in **Table 1.**

Table 1. Structure and direction of training period loads for 16–17-year-old football players at the Tashkent City Academy (2024)

Indicators	**Months**			**Total**	**%**
	1	**2**	**3**		
Number of training days	24	25	26	75	-
Number of training sessions	22	19	22	63	-
Training volume (minutes)	3540	4850	4400	12790	-
Time allocated for matches (min)	360	1080	720	2160	16.9
Technical –tactical exercises	2220	2790	2700	7710	60.3
Highly specialized physical prep.	960	980	980	2920	22.8
Load Directions (minutes):					
Anaerobotic –alactic load	40	50	60	150	5.1
Anaerobotic-glycolytic load	240	260	220	720	24.6
Aerobic-anaerobic load	490	480	530	1500	51.3
Aerobic load	150	160	140	450	3.5
Anabolic load	40	30	30	100	3.4

***Note:** Anaerobic-alactic – speed attributes; Anaerobic-glycolytic – speed endurance; Aerobic-anaerobic – combined qualities; Aerobic – general endurance; Anabolic – strength and power qualities.*

Analyzing the structural breakdown of the competitive period loads for 16–17-year-old football players also provides critical operational insights (Table 2).

Table 2. Structure and direction of competitive period loads for 16–17-year-old football players at the Tashkent City Academy (2024)

Indicators	Months							Total	%
	4	5	6	7	8	9	10		
Number of training days	22	23	22	14	23	22	23	149	
Number of training session	22	23	22	18	23	22	23	153	
Training volume (minutes)	2020	2090	2020	1500	2090	2020	2090	13830	
Technical-tactical exercises	1210	1265	1210	990	1265	1210	1265	8415	61.0
Highly specialized physical prep	330	345	330	270	345	330	345	2295	16.5
Time allocated for matches	480	480	480	240	480	480	480	3120	22.5
Load Directions (minutes)									
Anaerobic-alactic load	30	45	45	30	35	25	30	240	10.4
Anaerobic-glycolytic load	60	50	40	50	30	30	25	285	12.4
Aerobic-anaerobic load	185	200	190	120	230	230	250	1405	61.2
Aerobic load	25	25	20	30	20	20	20	160	7.0
Anabolic load	30	25	35	40	30	25	20	205	9.0

The "Polar Team Pro" system, utilized as a monitoring technology, enabled the tracking of football players' physiological responses in real-time during training sessions. It also allowed for the determination of load volume and intensity, the modeling of individual training loads, and the monitoring of recovery-phase dynamics. Based on the heart rate (HR) zones provided by this system, low, medium, and high-intensity characterizations of the training session were performed.

The data obtained via this methodological approach are statistically and pedagogically analyzed in the subsequent section, "Results and Discussion," and the effectiveness of the players' strength and speed-strength preparation is evaluated.

Results and discussion. According to the results of the conducted analysis, during the preparatory period, the total training load of 16–17-year-old football players amounted to 12,790 minutes, of which 2,920 minutes (22.8%) were allocated to highly specialized physical preparation. Out of this total, only 100 minutes, or 3.4 percent, corresponded to an anabolic direction—specifically targeting the development of strength and speed-strength qualities. These figures indicate that during the preparation period, specific speed-strength capabilities are not sufficiently developed to adequately foster the explosive power actions (starting acceleration, physical dominance in tackles, high jumping) necessary for youth football players during match play.

An analysis of training load direction indicates that the primary emphasis during the preparation period was placed on the aerobic-anaerobic zone (51.3%), while in the competitive period, it reached 61.2%. This focus is crucial for preserving baseline aerobic conditioning. However, considering the nature of modern football—which relies heavily on high-speed short bursts, quick changes of direction, and explosive tackles—the low percentages of anaerobic-alactic (5.1% in the preparation period, 10.4% in the competitive period) and anabolic stimuli limit the maximal realization of speed-strength potential.

The evaluation of coordination complexity revealed that during the preparatory period, 37.5% of the total time, and during the competitive period, 40.1% of the time, was executed under high coordination demand conditions. The remaining drills were low-complexity tasks lacking high-speed or tactical variability. This shows that coaches do not pay sufficient attention to developing complex tactical execution capacities under strict spatial restrictions and high match speeds.

Physiological monitoring data (via "Polar Team Pro") showed that a high heart rate zone (HR over 160 beats/min) was achieved only by a limited number of players. Specifically, during standard microcycles, only 3 players operated within 55–63% of high-intensity zones, while the remaining players fell into intermediate (35–54%) or low (<34%) zones. This highlights a clear gap in individualizing physical loads, where uniform exercises fail to trigger identical physiological adaptations due to differing organic responses.

The proportion of highly specialized exercises was also examined. In the preparation period, general preparation and multi-sport exercises accounted for 32.5%, whereas specialized football exercises made up 67.5%. While this structure supports general technical-tactical skills, it falls short of maximizing explosive and power-oriented capabilities. Due to the uneven distribution of stress in game-like exercises, certain players remain under-stimulated.

Loads under complex coordination environments usually demand high tactical precision, rapid execution, and cognitive speed under opponent pressure. The absence of such demanding scenarios prevents optimal psychomotor development. The current load structures do not fully align with modern requirements.

In summary, across the annual training cycle, speed-strength preparation lacks a systematic, specialized framework. The reliance on mixed, non-specific exercises preserves base conditioning but does not foster the explosive, high-intensity power capacities required to unlock peak athletic performance.

Conclusion. The volume and intensity of specialized training drills aimed at developing speed-strength attributes in 16–17-year-old football players during the annual cycle are insufficient. The predominant reliance on mixed-direction loads acts as a barrier to explosive movements and high-speed actions.

The combination of training loads does not strike a healthy equilibrium between general and specialized physical qualities. The low representation of anaerobic-alactic and anabolic directions hinders the progression of specific speed-strength variables.

The low level of coordination complexity prevents players from adapting to rapidly evolving match environments, compromising their tactical agility and spatial problem-solving skills under high fatigue conditions.

Training load individualization is not properly implemented. Monitoring via HR metrics reveals that uniform training stresses lead to highly variable physiological strains, showing that a single template fails to optimize individual functional capacities.

It is crucial to develop specialized microcycles (weekly plans) specifically targeting strength and speed-strength qualities. Within these plans, the volume, intensity, and coordination complexity of the loads must be precisely calibrated based on individual biometric and physiological indicators.

Ultimately, achieving elite status in modern football requires academy coaches to shift toward systematically structured strength and speed-strength training supported by modern technological diagnostics. Continuous physiological monitoring, microcycle engineering, and individual load calibration represent the definitive pathways to elevating youth player performance to international standards.

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