NATIONAL UNIVERSITY OF PHYSICAL EDUCATION AND SPORT BUCHAREST

DOCTORAL SCHOOL

ABSTRACT OF THE DOCTORAL THESIS

Title of the doctoral thesis: OPTIMIZE PERFORMANCE CAPACITY BY IMPLEMENTING A PROGRAM OF INTEGRATED PHYSICAL TRAINING IN THE U16 NATIONAL BASKETBALL TEAM

PhD Student: TRIFAN MIRUNA ELENA

Scientific coordinator: Prof. Univ. PhD. STOICA MARIUS

Keywords: integrated physical training, U16 basketball, performance capacity, motor skills, athletic development, anaerobic conditioning, anthropometric profiles.

Introduction

In recent years a number of scientific researches have appeared, which address fitness and technical-tactical aspects in youth basketball. Physical conditioning is becoming more and more important in basketball, players are more agile and stronger, regardless of their size. On the other hand, the game of basketball imposes certain motor, but above all somatic, rigors. The above aspects become challenges for specialists in the field in terms of player preparation and selection. In the last decades, basketball has developed significantly, the number of adolescents involved in this sport is constantly increasing, thus the selection of the most talented becomes all the more necessary (Marić, et al., 2013).

An important element in the selection of young basketball players, as well as in the progress of their game performance, is the level of motor skills. The motor, physiological as well as performance aspects of basketball players have recently been analyzed by specialists in the field (Dawood, 2014; Torres-Unda, et al., 2013; Silva, et al., 2013); where it has been shown that all these characteristics are to some extent influenced by the anthropometric characteristics of the athletes (Popovic, et al, 2013; Marić, et al., 2013; Paulauskas, 2013).

Internationally, researchers have increasingly emphasized studies that can influence motor, physiological and anthropometric factors, as well as other performance factors specific to basketball. This is necessary, not only for proper player selection, tracking which players are most eligible for the game, but also to select the most viable training tools to enable players to reach their optimal potential.

Motivation and purpose

In recent years, the demand for effective physical preparation in youth sports, particularly in basketball, has intensified due to the sport's evolving physical and technical requirements. Modern basketball places a premium on agility, strength, and speed, demanding specialized training approaches that begin early in an athlete's development. For junior athletes, especially those in the Under-16 (U16) category, an integrated physical training program is crucial not only to improve immediate performance but also to establish a foundation for long-term athletic growth.

The need to develop a comprehensive physical training model for U16 basketball players in Romania was identified through direct experience and collaboration with the Romanian Basketball Federation. Initiating this project was motivated by the recognition that Romania’s

youth athletes lacked access to tailored, scientifically grounded training regimens that align with the best practices seen internationally. This program was specifically requested by the Romanian Basketball Federation, who saw the value in establishing a model that could serve as a standardized approach across national junior teams.

In 2021, as part of an effort to establish this model, collaboration began on a project that aimed to create an integrated training regimen. This program not only addressed the specific physical development needs of U15 players but also focused on designing somato-functional profiles tailored to each playing position (e.g., guard, forward, center). This level of specificity helps in aligning training with the unique demands of each position, thus maximizing the potential of each athlete. The program rolled out trial events over 2021-2022, where top junior players from across Romania were evaluated for selection in the extended national teams. These trials not only provided an evidence-based foundation for the training model but also allowed for real-time refinement based on observed strengths, weaknesses, and individual development needs.

Participating in this project as a physical training assistant provided an opportunity to work directly with the U16 national team players, assessing their physical capabilities and tracking improvements across several metrics. The core objective of this thesis, therefore, is to optimize performance capacity for U16 basketball players by implementing an integrated physical training program. This approach encompasses a full spectrum of conditioning aspects, including strength, endurance, agility, and flexibility, while remaining adaptable to the age and developmental stage of the athletes. The goal is to create a replicable, impactful training framework that can help elevate Romanian youth basketball to meet international standards.

The purpose of this research extends beyond short-term performance gains. By implementing this program, the study aims to provide a structured path for skill development and physical growth that aligns with the physiological and technical demands of basketball at a competitive level. The thesis aims to answer fundamental questions regarding the effectiveness of integrated training approaches and the specific motor and functional capabilities required to succeed in competitive youth basketball.

In sum, this research is driven by both a practical need within the Romanian basketball community and a scientific interest in exploring optimized training methodologies for youth athletes.

Part I of the thesis

The theoretical background

The first part of this thesis provides the theoretical context, structured into three key chapters that are essential for understanding performance optimization through integrated physical training in youth basketball. In the first chapter, we detailed the reflection of the topic in the literature with a special focus on youth basketball. It highlights the advantages of an integrated approach, which combines strength, speed, and coordination exercises to improve performance compared to traditional, isolated methods.

In the second chapter, examines the effects of modern physical training on sports performance, exploring how combined aerobic and anaerobic exercises support basketball's dynamic demands. The importance of integrated training in maintaining young athletes' motivation and preventing injuries is emphasized, with continuous adaptation to meet both their physical and psychological needs in a high-intensity sport.

In the third chapter, analyzes the bio-motor profile of players, identifying essential physical and motor characteristics for performance, such as strength, speed, and agility. It discusses the role of somato-functional evaluation in selecting optimal team positions and in adapting physical training to individual needs, aligning with contemporary performance and intensity standards in basketball.

Part II of the thesis

Constative study on somatic, motor, and technical evaluation in youth basketball for identifying specific standards.

The present study aims to establish the motor, somatic and technical level of the U15 players, in order to constitute the Romanian U16 extended junior squad for the U16 European Championship next year.

Research Questions

1. Are there differences between the values obtained in the motor evaluation of Romanian U15 basketball players compared to the standards of a superior international team in terms of somatic and motor parameters?
2. Do basketball players with higher values of somatic parameters show superior technical results?
3. Do somatic and motor parameters correlate with the level of performance ability?

Results

The answer to the first question is that the comparative evaluation of U15 basketball players from Romania and Turkey revealed significant differences in motor and somatic parameters. The Romanian athletes achieved a better time in the 20m sprint test (3.12 s vs. 3.22 s), but showed a lower aerobic capacity, with a score of 10.21 in the Beep test, below the Turkish average of 11.3. Also, the vertical clearance was lower for the Romanian athletes (36.64 cm vs. 40.39 cm), indicating a lower explosive force. In terms of somatic parameters, the average weight of the Romanian athletes was lower (78.93 kg vs. 83.22 kg), although the height and wingspan were similar between the two groups.

In relation to the second question of our research, the results obtained did not reveal a clear link between higher somatic parameters and the technical performance of the players. Analyzing the somatic data, for example, the average height of the Romanian athletes (M = 1.91 m) was almost identical to the international one (M = 1.92 m), and the difference was not statistically significant ($t = 0.228$, $p = 0.821$). However, technical performance in events such as free throws or indoor scoring did not strongly correlate with somatic parameters. In the "free throws scored/time" event, the average of Romanians was 3.07, below international standards, with no direct relationship with wingspan or weight. This indicates that, in the context of the technical events, it cannot be concluded that superior somatic parameters significantly influence technical performance.

Statistical analysis revealed a moderate correlation between motor parameters and performance level, especially in jumping and explosiveness tests. The very strong correlation between flight time in the repeated jump test and jump height ($r = 0.973$, $p < 0.001$) suggests that a longer flight time is associated with a higher jump height, a critical factor for basketball performance. Also, jump power showed a moderately positive correlation with flight time ($r = 0.633$, $p < 0.001$), emphasizing the importance of explosive force in repeated jumps. In contrast, the correlations between somatic parameters, such as BMI, and performance in basketball-specific tests were not significant, indicating that motor parameters play a more important role in influencing sports performance than somatic ones.

integrated physical training program for the u16 national basketball team

The purpose - The aim of this investigation is to develop and implement an optimized training program, characterized by the integration of physical training in a synergistic manner with technical-tactical training. The main objective aims to maximize sports performance and to identify appropriate training strategies, thus contributing to the consolidation of the team's success in the FIBA U16 European Championship, Division B.

Research hypothesis

The integrated means improve conditional capabilities and collective technical skills being factors for an overall increase in the efficiency of the game.

The implementation of an integrated physical training program in the general training program leads to improved technical skills of players in a real game environment.

The means of integrated physical training applied in the training, leads to a superior performance result in the FIBA U16 European Championship FIBA U16 Division B competition.

Results

The implementation of an integrated physical training program resulted in substantial improvements in the athletes' technical skills, evidenced in particular by the integration of the ball in training, which facilitated the development of quick and accurate decision-making in competition-like conditions. Agility and accelerated running tests showed a steady progression, confirming a significant increase in collective efficiency. The results showed a stability in performance as well as a continued evolution in strength and agility, underlining the positive impact of the integrated program on the overall team performance.

The integration of the ball and the simulation of real game situations in the training sessions facilitated the adaptation of the athletes to the competitive pressure and dynamics, with a significant impact on the development of technical and tactical skills. This approach enhanced the athletes' performance, particularly in shooting and passing. The progress observed in physical tests, such as Squat Jump and Counter Movement Jump, correlated with the technical improvements, underlines the effectiveness of the integrated physical training program in preparing athletes for the competitive context, thus supporting the validity of the hypothesis.

The Romanian team placed 4th out of 21 teams participating in the FIBA U16 European

Championship, Division B, a significant improvement on previous years' performances. Romania stood out as one of the efficient teams, alongside the national teams of Croatia, Hungary and Denmark. The team's outstanding two-point shooting performance and overall team efficiency, especially in matches such as the one against Iceland, reflect the positive impact of the integrated physical training program, demonstrating a significant increase in the team's performance in the competitive context.

To achieve success at the international level, it is essential to tailor physical training to each player's individual needs and potential. Tailoring training to the demands of elite competition helps maximize athletes' performance in the long term.

Personal contributions

Our approach is distinguished by the fact that the ball is present in the training from the very beginning, contributing to the development of technical and tactical skills in the real context of the basketball game.

We distinguish ourselves by approaching physical training as an integrated system, in which basketball-specific elements such as agility, endurance, strength and speed are synergistically integrated with technical-tactical aspects.

Our study focuses on the practical implementation of the integrated physical training program in the centralized training, considering the Romanian U16 national U16 squad in the FIBA European Championship. Thus, our research is not limited only to theoretical aspects, but aims at effectiveness and direct impact on performance in a real competitive context.

Conducting state-of-the-art tests with modern equipment is a significant contribution to our research, providing an accurate assessment of the level of physical preparation of U16 players.

The innovative approach at the batch level represents a novelty in the context of research in Romania, as it focuses on the integration of the values obtained in the physical training tests and the dynamics of match results. By analyzing the collected data in detail and relating them to match performances, our research brings a novel perspective on how integrated physical training directly influences athletes' development and results.