

**MINISTRY OF EDUCATION NATIONAL UNIVERSITY
OF PHYSICAL EDUCATION AND SPORT
FACULTY OF PHYSICAL EDUCATION AND SPORT IN BUCHAREST
DOCTORAL SCHOOL**



ABSTRACT OF THE DOCTORAL THESIS

Title of the doctoral thesis: **TECHNICAL AND PHYSICAL TRAINING MODEL IN THE TRIPLE JUMP FOR ELITE ATHLETES**

Scientific coordinator,

PROF. UNIV. PhD. MONICA STĂNESCU

PhD Student,

LENUȚA BÎRZU (DRAGOMIR)

**BUCHAREST
2024**

Keywords: athletics, triple jump, elite athletes, training model, injury prevention, optimization of physical and technical preparation

INTRODUCTION

The introduction provides an overview of athletics, highlighting its global popularity and the diversity of sports events, with a special focus on jumping events. Triple jump, one of the most spectacular yet demanding disciplines, is analyzed in terms of its technical complexity and high physical requirements. It emphasizes the role of technical and physical preparation, as well as the contribution of advanced technologies and new training methods in optimizing athletes' performance. The motivation behind the choice of the topic reflects the author's desire to develop an efficient training model for triple jump based on professional experience and results achieved with elite athletes, thus contributing to raising the level of Romanian athletics on the international stage.

PART I: THEORETICAL AND METHODOLOGICAL FOUNDATION OF THE TOPIC

CHAPTER 1: CHARACTERISTICS OF THE TRIPLE JUMP

Chapter 1 details the fundamental components of the triple jump, including technique, biomechanical analysis, and the specific requirements of the event. The technique involves a set of complex movements tailored for each athlete and requires specific training to optimize parameters such as horizontal speed, take-off angle, and jump phase coordination. Biomechanics provide a detailed analytical framework for performance enhancement, including trajectory analysis and forces involved. The chapter also highlights the energetic and psychological characteristics of the event, underscoring the importance of physical and mental training in achieving peak performances. It offers a solid foundation for understanding the specific demands of this complex event.

CHAPTER 2: PARTICULARITIES OF TRAINING IN MEN'S TRIPLE JUMP

Chapter 2 analyzes the complexity of specific training for men's triple jump, emphasizing biomechanical, physical, and psychological requirements. It describes the importance of interdisciplinary collaboration involving experts from various fields to optimize performance. Physical and technical training is fundamental, and detailed planning is essential for maximizing performance. The chapter discusses modeling and rationalizing training methods, effective utilization of strength, speed, and coordination, as well as modern technologies and methods for

developing jump height and balance. It proposes a training model adapted to the specific needs of elite athletes.

CONCLUSIONS REGARDING THE THEORETICAL AND METHODOLOGICAL FOUNDATION

Triple jump is an extremely complex event requiring an optimal integration of physical, technical, psychological, and tactical training. It emphasizes the rational and comprehensive application of training factors for performance optimization, highlighting the importance of detailed preparation at each stage of the jump technique and the body's adaptation to the intense demands of competition. Improving technique and developing motor qualities such as speed and power are essential for achieving goals in elite competitions. Furthermore, a balanced planning between training demands and recovery is considered crucial for maintaining performance throughout the competitive season.

PART II: STUDIES AND PERSONAL RESEARCH REGARDING THE OPTIMIZATION OF ELITE ATHLETE TRAINING IN TRIPLE JUMP

CHAPTER 3: STUDY ON THE PARTICULARITIES OF TRAINING IN TRIPLE JUMP FOR MAJOR COMPETITIONS

The study developed in Chapter 3 aims to create a training model for triple jumpers based on analyzing training plans and their performances over a competitive year. The main objectives are to identify specific training methods, integrate performance indicators into training assessments, and create a training model for elite athletes in this event. The study tasks include analyzing the training plans of the top 10 Romanian athletes from the last 20 years, examining performance dynamics, evaluating specialists' opinions in the field, and collecting relevant data. Fundamental research questions focus on the proportion of training methods in the annual plan and the impact of the number of competitions on performance. Research methods used include bibliographic study, case study, and statistical-mathematical methods. The target group comprises 10 Romanian athletes from the triple jump, selected for their top performances in the last 20 years. The study was organized in three stages: literature documentation and athlete selection (October 2021 - January 2022), applying research methods and data collection (February - April 2022), and analysis and conclusions formulation (May - June 2022), being conducted in Bucharest over a duration of 9 months. This study aims to identify the most effective training methods, thus contributing to the rationalization and standardization of training for senior men's triple jump.

The somatic model of a triple jump athlete relies on essential parameters such as height, weight, body mass index (BMI), mobility, and lower back strength. These parameters are crucial for

performance and are based on data from the medical records of the athletes involved in the study. Performance is influenced by the athlete's age and the timing of when they achieve elite results, typically between 22 and 29 years, depending on their training stage. Although height and weight are important, they are not decisive factors for top performance. Mobility and lower back strength are relevant indicators, significantly impacting jump technique and injury prevention. A triple jump athlete must combine speed, strength, and technique for excellent results, requiring highly advanced physical preparation to withstand the enormous forces upon landing.

Athletic preparation for triple jump events in major competitions involves setting precise goals within the annual training plan. Athletes' performances depend on detailed analysis of the previous year and a balanced approach to training factors (physical, technical, psychological). Causes for not achieving performance objectives include incorrect forecasts by coaches, injuries, a chaotic competitive calendar, and insufficient assessment of the athlete's training condition. An important factor is setting an appropriate number of competitions, avoiding overload or lack thereof. Preparation must be scientifically grounded, and the recovery process must be observed to prevent overtraining and performance stagnation. These aspects are essential for optimizing performance and avoiding failures in major competitions.

Analysis of the number of competitions and performances achieved by the study subjects shows that they participated in 2-4 competitions during the indoor season and 4-6 competitions during the outdoor season, with fewer competitions compared to international top athletes. Additionally, the annual training plans of the subjects were analyzed, highlighting their volume and structure throughout the competitive year, including a varied number of training stages and specific activities for each athlete.

The results of the Pearson correlation analysis applied to the training methods and control tests of athletes OM and GRC during the 2007-2008 and 2018-2019 competitive periods reveal significant differences in training effectiveness. For athlete OM, very high correlations were observed between repeated running over 80 - 150m distances and accelerated running tests over 30m and 50m, while the correlation between the triple jump control test with a 5-step run and the full run standard was also very strong. In contrast, for athlete GRC, high correlations between long-distance running and control tests were essential, with correlations obtained for improving triple jump and strength demonstrating training effectiveness. These correlations allow for the identification of key program elements that can be optimized for superior performances.

The correlation analysis between the methods used in the training of athletes BAG, DAA, and VFA and the control tests shows variability in their effectiveness depending on the athlete and the type of test. For athlete BAG, many correlations are weak or nonexistent, suggesting a need to adjust training methods or the selection of control tests. Athlete DAA demonstrates some

significant correlations with strength exercises and triple jump techniques, but a review of the training program is recommended to increase effectiveness. For VFA, correlations between training and control tests indicate a weaker relationship with strength and flexibility exercises, while negative correlations with some tests suggest a need to reevaluate training strategies and test selection. In conclusion, for all analyzed athletes, training effectiveness can be improved by adjusting approaches and control tests.

In the training periods for competitive years 2016-2017, 2017-2018, and 2019-2020, correlations between training methods and control tests varied, with some showing no significant relationships. For athletes TAG and BCN, there were both positive and negative correlations between various exercises and control tests, indicating possible deficiencies in the selection and dosing of training. Additionally, for athlete CC, most training methods did not correlate with control tests, suggesting the need to adjust training and control tests to better meet performance goals. Overall, these analyses emphasize the importance of proper correlation between training and control tests for effective preparation.

According to the study's conclusions, the subjects' age and somatic parameters suggest performance potential in the triple jump, but their progression has not always met expectations, except for a few athletes. Moreover, analysis of training plans and competitions they participated in shows that the number of competitions is too low compared to international standards. Weak correlations and discrepancies between training methods and control tests highlight the need to adjust training and the selection of control tests to enhance performances.

CHAPTER 4: CASE STUDY ON OPTIMIZING PREPARATION IN MEN'S TRIPLE JUMP

The case study in Chapter 4 aimed to analyze and optimize the training of an athlete in the triple jump over two competitive years, with the goal of creating an effective training model. The research objectives included evaluating the training program for the years 2023-2024 and the dynamics of performances achieved to improve the training strategy. Various methods were used in the research, including bibliographic studies, video analysis, direct observation, measurement and evaluation tests, and statistical-mathematical methods. The study was conducted over 23 months and involved analyzing data from training and competitions, as well as formulating conclusions for optimizing preparation in the triple jump at the seniors level.

RESULTS AND THEIR INTERPRETATION

This chapter presents the physical characteristics of athlete GRC, a top athlete in men's triple jump. The somatic analysis, based on his medical and physical data, highlights important

parameters such as height, weight, body mass index, and lower back strength. It also discusses the importance of posture and mobility in achieving maximum performance, emphasizing the need for continuous development of these parameters to reach excellence levels in triple jump. Additionally, the strengths of the athlete, such as age and motor capacity, are detailed along with vulnerabilities related to physical preparation and associated injury risks.

The training stages for the 2023 competitive year were structured into several phases, each with specific objectives and time frames. Preparation began with the autumn-winter phase (October-December 2022), focusing on developing maximal strength and basic motor qualities. Subsequent phases included specific physical and technical training, with an emphasis on perfecting the triple jump technique, alongside testing intensities and work volumes. In the pre-competitive and competitive phases, training focused on adapting the athlete to the specific conditions of international competitions while maintaining a balance between physical training and recovery. Control tests were also implemented to assess progress and adjust training based on achieved performances.

In 2023, athlete GRC underwent intense and varied training, totaling 306 training days and 698 training hours. Although injuries affected preparation for certain competitions, the results achieved were notable, with a 1st place finish at the National Senior Championships in Craiova and a personal best performance of 16.62 m. Despite a calf injury and various physical and psychological challenges, the athlete managed to secure 6th place at the Universiade World Games, achieving a performance of 16.08 m.

The analysis of correlations between training methods and the performances of athlete GRC during the 2022-2023 competitive year indicates a significant relationship between short-distance accelerations and various control tests. Control tests, including accelerated running over 50 meters and triple jump using 9 - 11 steps, showed very high correlations, suggesting the effectiveness of the employed methods. However, weak or negative correlations with other training methods, such as strength and various types of running, highlight the need to review the training planning, possibly influenced by frequent injuries of the athlete. In conclusion, the selection and adaptation of training methods are essential for improving performance in triple jump.

Athlete GRC, with a height of 184.2 cm and a weight of 76-78 kg, did not fully meet his goals planned for 2023 due to unforeseen events and an insufficient number of competitions compared to international standards. Analysis of the training plan highlighted 9 common methods with others studied, indicating well-grounded planning, but the negative and weak correlations for most methods indicate a need to review training strategies. Only two methods showed high correlations with all control tests, underscoring their utility in optimizing performance in the triple jump. In

conclusion, the adaptation of methods and training planning is essential for improving the athlete's performances.

TRAINING STRATEGY FOR ATHLETE GRC IMPLEMENTED FOR 2024

In 2024, the training strategy for athlete GRC includes changing the triple jump technique from using one arm to both arms simultaneously, allowing him to apply more force on the ground and enhance performance. A partnership with Medisport SRL clinic has also been initiated to prevent injuries and improve posture.

In conclusion, after 7-8 months of training with the new technique, the athlete achieved notable results, qualifying for the European Championships and winning international competitions, highlighting the efficiency of the new training approach.

CHAPTER 5: STUDY ON THE USE OF THE OPTOJUMP NEXT SYSTEM IN EVALUATING AND DIRECTING TRAINING IN TRIPLE JUMP

Chapter 5 focuses on utilizing the OptoJump Next system for evaluating and directing the training of athletes practicing the triple jump. The study emphasizes the importance of monitoring and assessing specific motor parameters such as explosive strength, contact and flight times, aiming to optimize training. The research objective is to determine and analyze these parameters through 12 tests integrated into the OptoJump Next system, with the aim of achieving superior competition performances. Four senior athletes were involved in the study, conducted in two phases, an initial one and a final one, to evaluate their progress. The subjects' demographic data shows an average height of 185.25 cm and an average weight of 74.5 kg. In conclusion, using the OptoJump Next system allows for an objective assessment of performances, contributing to the continuous improvement of athletes' skills.

The analysis of the parameters measured by athletes during tests conducted using the OptoJump Next aimed to evaluate explosive and reactive strength, as well as specific power. Results were compared between the initial test (T1) and the final test (T2), identifying progress or regress for each athlete.

Athlete GRC demonstrated significant improvements in measured parameters, including average power, jump height, and flight time, while BCN experienced regression in performance during the competitive period. In analyzing tests, athlete CD saw constant regression, suggesting insufficient training, while athlete PM, despite achieving better results in T1, showed no remarkable progress in T2. The conclusions suggest that left and right members of athletes influence performance, with GRC holding an advantage due to superior power.

Analysis of the parameters obtained by athletes in Test 5 showed that GRC had a significant improvement in T2, leading the group, likely due to training with Backfix Technology, while BCN displayed consistent results. In Test 6, GRC continued to excel, ranking second concerning average power, while CD demonstrated exceptional use of the right leg but needed more ambidextrous development. Tests 9 and 10 highlighted that CD was the strongest athlete in T1 and T2 but showed regression in T2 despite initial performances; PM remained constant, with better indicators compared to GRC in most tests. In conclusion, the conducted training had a significant impact, but variability in athletes' performances requires continuous adjustment of training.

The statistical analysis of the 12 tests applied to the athlete group showed that most parameters, such as contact time, flight time, average height, average power, rhythm, and RSI, did not exhibit significant differences between participants in tests and in progression between T1 and T2. However, values for rhythm (Pace) were significantly higher in T2 compared to T1, suggesting improved jump speed during the competitive period. Tests 7 and 8, involving consecutive jumps on the left and right legs, provided data on proprioception, stability, and asymmetry, showing significant progress for athletes, especially GRC, who recorded the best results in T2. Conversely, athletes CD and PM faced difficulties improving their triple jump performance, despite better average values in tests. In summary, results suggest that although athletes demonstrated good training, there are still opportunities for technical and physical performance improvement, especially in the context of competitions.

Statistical analysis of athletes who participated in tests 7 and 8 showed that while most parameters, including contact time, height, and propulsion phase, did not present significant differences between participants in both T1 and T2, some developments were remarkable. Flight time values and average height were significantly lower in T2, whereas average distance, inclination angle, and average speed were significantly higher. This dynamic suggests that athletes become faster during the competitive period, yet jump height is negatively affected. In conclusion, maintaining contact time and propulsion phase values at the same level between the two tests indicates that athletes did not lose power, a positive aspect of their overall performance.

The research utilized the OptoJump Next system to assess athletes' strength and performance in triple jump, providing objective data about their training levels during training and competition periods, confirming the importance of personalizing training programs. Tests 7 and 8 proved relevant for a better understanding of athletes' technical and physical capabilities, revealing significant performance differences and highlighting the need for detailed training planning to maximize results in international competitions.

CHAPTER 6: EFFECTS OF IMPROVING TRUNK STABILITY THROUGH THE BACKFIX METHOD ON INJURY PREVENTION IN THE TRIPLE JUMP - CASE STUDY

Chapter 6 analyzes the effects of improving trunk stability via the BackFix method on injury prevention in triple jump, using athlete GRC's case, who faced various muscular and joint issues. The study highlights the implementation of a training strategy based on BackFix technology, which included 18 physiotherapy sessions, focusing on increasing trunk stability, correcting posture, and preventing injuries. Initial and final test results demonstrated a significant improvement in postural stability and weight distribution, contributing to a more precise execution of jumps. The results analysis suggests a correlation between the improvement of trunk stabilizer functionality and athletes' performance enhancement, highlighting the importance of injury prevention in high-performance sports.

After 18 physiotherapy sessions with the BackFix method, there were reports of pain disappearances, improved trunk stability, and significant increases in strength and functional symmetry, leading to the recovery of competitive performances but requiring long-term monitoring to evaluate effects on injury prevention and performance enhancement.

CHAPTER 7: THESIS CONCLUSIONS

The doctoral thesis analyzes the effects of applying a modern training model for athlete GRC in triple jump, noting significant improvements in strength, mechanical work, and balance, as well as technical successes in international competitions. The implementation of the BackFix technology and method contributed to injury prevention and optimization of athlete preparation, culminating in his participation in the 2024 European Championships with superior performance compared to the previous year. Furthermore, long-term monitoring is necessary to confirm the effects of this approach on performance and injury prevention.

PERSONAL CONTRIBUTIONS

The thesis provides significant contributions to the training of athletes specialized in triple jump, emphasizing the effectiveness of applying a training model tailored to the psychological and physical characteristics of the athlete, and the technical trends in this sport, aiming for world-class performance. The use of technology and the Backfix method allows for injury prevention and optimization of physical preparation, thus improving the quality of training. However, the research faces limitations due to the decreasing number of senior athletes in triple jump, affecting the possibility of expanding testing and obtaining more relevant data.