

**MINISTRY OF NATIONAL EDUCATION**  
**NATIONAL UNIVERSITY OF PHYSICAL EDUCATION AND SPORTS**  
**BUCUREȘTI**

**DOCTORAL THESIS ABSTRACT**

by

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***THE ROLE OF THE PLYOMETRIC TRAINING IN  
OPTIMIZING THE FEMALE JUNIORS III  
PREPARATION FOR TRACK & FIELD SPRINT EVENTS***

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**BUCUREȘTI, 2014**

## INTRODUCTION

Plyometric exercises gained popularity in the sports world has resulted in the retrieval of their training programs in most branches of sport. At a careful analysis we can see that plyometric drills are suited to the present and differentiated according to the branch of sport (often of sport sample), physiological characteristics and age-specific kinantropologic and athletic training level, gaining a character of specificity due to their variety, structure and manner of determination of the degree of intensity and complexity. The role of plyometric exercises is to develop speed, power, coordination, to improve agility and ultimately to improve sports performance.

Psychophysical development and morpho-functional peculiarities of pre-pubertare and adolescence periods of sportswomen aged 12-15 years, recommends that this period of transition from the small age methodology that starts to split up the directions of training, as the period in which they are biological and social conditions created for starting a constant, specialized sports training, performance-oriented.

It is the age at which the orientation of the sportswomen to the athletic tests, is the recommended age for the first exposure to a great plyometric exercise method of developing speed, force, and last but not least much-needed power in the escalation of sprint. Plyometric training is recommended in a greater measure women sprinters since, unlike men, tendon system-apparatus is more exposed to the risk of injury in the conditions in which we want to develop explosive force.

Why " ***THE ROLE OF THE PLYOMETRIC TRAINING IN OPTIMIZING THE FEMALE JUNIORS III PREPARATION FOR TRACK & FIELD SPRINT EVENT*** "? Because the experience gained over the past 11 years as athletic trainer specializing in sprint and jumping samples, provided me the opportunity to put into practice, to study and record the effect of plyometric training exercises had in the evolution of their sports at the age of maximum importance in the development of their psycho-morph-functional.

Why plyometria? Because it is the most effective method of developing explosive muscular power and force, training method which explores and exploits the best potential elastic muscle energy, and last but not least is the method that can be dashed in the least athletic of Romania bibliography.

### Stages of research

Preliminary research on design was made up of the following proposed steps to be performed:

***Phase I of the*** -consisted of research activities targeted mainly towards the accumulation of knowledge and evaluating them according to the plan of studies undertaken for the purpose of:

- Documentation on aspects of theoretical and practical novelty that appeared on the national and international level, addressing the

issues relevant in particular or general approach and enlightenment theme;

- The delineation aspects of theoretical and practical problems and restricted to research theme;
- Deepening theoretical knowledge on the basics of the research;
- Establish interdisciplinary relationships;

All these have been achieved within the framework of the doctoral training, during November 2012-February 2013, a period that was established through the support in March 2013 the "Research Project, with the title-role of training study on optimizing performance in pliometric groups sprint athletic girls (10-14 years)".

**Phase II of the** -established the theoretical, conceptual and methodological basis of the research, research activities with the following objectives:

- Introduction in the context of the approach to work;
- Determining the motivation of choosing the theme, scope, objectives and tasks of the research;
- To establish in detail the methodology and timing of work activity;
- Outlining theoretical framework through the establishment of a documentation and selective on the fundamental aspects of the design and execution of advertising, focusing on theoretical and practical innovations occurring nationally and internationally in relation to research topic;
- Knowledge of particularities of somato-psyche and motor functional of youth;
- Distribution of tasks during the deployment of the study;
- Setting the level of operation and selection of subjects to be included in research, establishing experimental sides.

This phase was completed in September 2013, with the support of the progress Report No.1, with the title "the theoretical Argument about using plyometric exercises in the training of junior sports groups III, in athletic sprint." The results obtained from completion of this stage of the research we have guided the Organization and holding of the third phase of the research.

**Stage III** -is the stage of preliminary investigation, having regard to the time limit for completion in may 2014. This step is detailed in the Progress report No.2, activities undertaken during this period with the following objectives:

- Establish goals, tasks, phases of research and preliminary research methods;
- The establishment of groups of the experiments;
- Selection and establishment of procedures and specific driving tests for evaluating the subjects, both in respect of the testing of the

initial motivating preliminary research and its expected final at the end of the experiment itself;

- Analysis of the results obtained from the tests and their interpretation;
- Development of the content and designing of the plyometric training programs of youth sprint female athletes.

**Stage IV** -having regard to the time limit for completion September 2014, is the stage at which the experiment itself began, the experimental group was subjected to testing and initial cinematic neuromuscular, which are coming to bring an extra weight in scientific argumentation of our study and that led to changes designed to prepare plyometric programs.

This phase ended with the presentation of the progress Report No. 3.

**Phase V of** -is the stage at which the experiment itself was completed, the sample of subjects has undergone tests and final cinematic neuromuscular and motor testing finale. The statistical analysis and interpretation of the results obtained.

This phase was completed with the drafting of the thesis, with the deadline for completion late October 2014.

## **THE METHODOLOGICAL FRAMEWORK OF PRELIMINARY RESEARCH**

### **The purpose of the preliminary investigation**

In our study, through the motive tests at which will undergo both sample of unengaged subjects in the performance sport and those engaged in sprint performance, we'll try to prove through specific plyometric motive trials and specific velocity trials, that there is a correlation between the performance of the two sets of tests. The existence of a correlation will demonstrate on the one hand the importance of plyometric in development speed at that age, and on the other, will certify the viability of applying the experiment itself.

### **Preliminary research on premises**

The starting premise is that plyometric research, as a method of developing power, can be successfully applied and at the level of athletic groups started with sprint.

### **Preliminary research hypothesis**

Evaluation of strength of Association (correlation) between the results obtained from the specific velocity tests and the jumping test, plyometric can assign an important role as the main method to influence the motive capabilities of the specific groups should be started with junior III in athletic sprint.

## **Research methods used in preliminary research**

- The study method of specialized bibliography
- Curricular research method
- The experimental method
- Mathematical statistics method
- Graphical method

## **The sample investigated**

The research took place in the city of Bistrița, research subjects being consisting of 18 female athletes, of junior III, legitimated at Sports Program Highschool, from Bistrița and 20 schoolgirls in Class VII and VIII of the General School No. 1 Bistrița.

The 18 female athletes practiced track and field at least a year, acting in three separate sprint groups coordinated by different coaches. Following discussions with sprint coaches, at their recommendation, each proposed 6 athletes to participate in this study.

The 20 pupils from the General School No. Bistrița 1 were selected on the recommendation of physical education teacher.

As regards the material basis of our subjects that operate educational activity and sports preparation, mention that School No. 1 owns as material basis for practicing hours of physical education and sports, the following: gym and outdoors has soccer fields, handball and basketball courts covered with asphalt and a synthetic football pitch.

Sports Program Highschool athletes, from Bistrița prepare under both its own school material (composed of three sports halls, four sports fields, of which two are with a synthetic surface and a force equipped with modern equipment), as well as in the sports complex "Jean Pădureanu", filled with both a synthetic an-homologated 400 m track, with five lanes well as a track and field with a length of 50 m, equipped with a synthetic surface.

It was agreed with the coaches and physical education teacher, that initial tests and measurements of the preliminary research to be conducted in the premises of the sports complex "Jean Pădureanu" and motive tests to be made up of 7 samples: sprint on 10mp, 30mp, 50mp, long jump without Moose, pentasalt, vertical jump from bending and semi vertical jump.

## **The preliminary conclusions of the study**

After completing the preliminary investigation were dislodged the following conclusions of theoretical and practical:

- According to the results obtained by the two samples it can be seen that the results of athletes women, are superior in average with 15,29% than those of the schoolgirls results, so the sample of

legitimate athletes is superior regarding to the level of development of the driving qualities, i.e. speed and force;

- The upper level of development of speed and force, in the sample of the legitimate athletes, primarily due to specific training programs for the development of these two motive qualities in the process of preparing specialized sports athletic groups of sprint;
- Noting the close correlation between the performance in speed and jumping, we consider that specific tests of speed and the jumping were according to the theme chosen for our study and that they reflect the correct performance differences between the two samples in athletics practice differently, both quantitatively and qualitatively.
- Analyzing the correlation between dynamics and performance in sprints and the jumping through Scatterplot graphs method, it can be seen that the development of speed, of acceleration capacity, determines the improvement in performances in jumping and reverse, improving the performances in jumping positively influences the velocity in speed samples.
- Therefore, our preliminary research hypothesis is confirmed, thus evaluating the strength of association (correlation) between the results obtained from specific tests of speed and jumping, it can assign to plyometric an important role as the main method to influence specific motive capacity, speed and explosive force needed in female juniors III for athletic sprinting groups.

## **THE OPERATIONAL FRAMEWORK OF THE EXPERIMENTAL RESEARCH**

**The objectives of the experimental research** of this study have been identified as:

1. Determination through the initial and final samples of the neuromuscular muscle groups profile of the lower limb muscle by assessing the muscles composition;
2. Determination through the initial and final samples the kinematic parameters related with morpho-functional characteristics of muscle groups;
3. Drafting the conclusions thereof, on the basis of the initial laboratory tests, possible changes we must make in the plyometric.
4. Scroll through the stages of the preparation and completion of the plyometric program.
5. Determination of changes in the performance of the subjects of the experiment via the motive final test.

6. Elaboration of theoretical findings and those detached from experiment relating to efficiency and training role in the preparation of female juniors III for athletic sprinting groups.

### **The purpose of this experimental**

- Adjusting the "Training plyometric program", based on the lucrative conclusions generated by the initial neuromuscular and cinematic test results, so that the application in practice of the training of such a training program to determine the effectiveness of the development of motive abilities in question.
- Scroll through the stages of the plyometric training program and elaboration of the theoretical conclusions and those detached from the experiment.

### **Research hypotheses**

1. Application of a plyometric training program can improve significantly the performance indicators for speed, explosive power and force at junior III female athletes.
2. Adjustment of plyometric training program of junior III female athletes on the basis of the results of analyses based on strain gauge regarding the contractile properties of the lower limbs striated muscles, correlated with cinematic analysis of starting blocks, can significantly improve the level of training of sprinters.

### **Research methods and techniques used**

- The study method of specialized bibliography;
- The experimental method;
- Mathematical statistics method;
- Graphical method;
- Tensio-myographical method (TMG);
- Kinematic motion analysis method.

### **Organization of research**

Experimental research was scheduled to take place in two locations. Training of sportswomen under the plyometric training will be held in the city of Bistrita, home location, location where research subjects performed the initial and final motive tests. The experimental determinations were conducted within the Faculty of Physical Education and Sports - Centre for Study and Research of Human Motricity from University of Craiova, where the subjects were subjected to of preliminary and final neuromuscular and kinematic experimental analyses.

## **The sample included in research**

Study of the experimental group comprised a lot of sports, 10 junior III, practicing of 100m sample, legitimated in groups of Sports Program High School in Bistrița with 14.1 years average age, with body mass index (BMI) of between 12.6-19.2.

## **Experimental research findings**

In relating to driving tests we can conclude the following:

- From the analysis of the results obtained as a result of the driving tests and comparing them with those of the initial driving tests, it can be affirmed that the percentage in the case of the control group, the final benefit has generated a fall in overall performance, average for all control samples, of 0,04%, while in the case of the experimental group, a group of athletes sprinters that followed a plyometric training program during 12 weeks the final benefit has generated an increase in the overall average performance for all control samples, of 4,43%;
- Whereas this increase in performance was achieved in the conditions in which the whole period of 12 weeks have not addressed in the training process of developing general and specific muscle strength, entitles us to affirm the role and the positive effect of the plyometric training in the development of speed (under all its forms of manifestation specific to the sprint) and power of sportswomen.

In relating tensio-miographyc tests we can conclude the following:

- Analyzing the group studied in terms of the evolution of Tc, we note that the level of muscle groups previous thigh regions presents moderate decreases, while the posterior regions of the lower limbs is observed that there are relatively Tc decreases;
- As regards evolution of the displacement values of muscle groups studied ( $D_m$ ) is a broad-based growth in all muscle groups, which in the context of a greater or less decrease of the Tc, denotes a rise in the number of rapid muscle fibers in the muscle groups studied;
- In terms of muscle tone is observed that there is an increase in the level of the posterior region of the thigh and lower leg to previous region, which certifies the efficiency of muscle training program, thus protecting the knee joint during its extension by taking the effort by the anterior tibial muscle groups;
- Analyzing the initial and final values of the intramuscular driving speed, it has been noted that as a result of completing the twelve weeks of plyometric preparation, it falls to the all muscle groups at bilateral level.



The kinematic tests relating to we conclude the following:

- The experimental group improved the lag time from initial assessments, value averaging with 3,24%, which shows a significant improvement of these values, which indicates a developing explosive strength at the level of lower limb muscle groups;
- As regards the development of linear and angular velocities it can be observed an increase of cinematic parameter, increase which is explained by the increase in explosive force of the lower limb muscles, specifically the muscular previous groups (RF and TA), which increases the percentage of type II muscle fibers.

Thus, the first hypothesis in our study launched by claiming that "*the application of a plyometric training program can significantly improve performance indicators for speed, explosive strength and power athletes junior III*", according to the results obtained in the tests in the control group and the experimental been verified and is valid.

In the second case launched in this study stating that "*adjustment of plyometric training programs based on the results of analyzes junior III strain on skeletal muscle contractile properties related lower limb kinematics analysis can start down optimize significant level of specific training of athletes sprint*" we consider as validated because adjusting training program and by new exercises introduced, the direct action was to increase the number of type II muscle fibers in the lower limb muscles, which resulted in increased muscle contraction speed, explosive strength and not least power and thus improve performance athletes.

## **Original contribution**

The main original contributions to the research topic through this study are:

- In the present study through the motive test who underwent the subjects of the study, we attempted to demonstrate using specific jumping and speed samples, there is a correlation between the performances of the two sets of samples. The existence of this correlation and that the explosive force is found as a common element of these two types of motive tests and also as a central objective of plyometric training, allow us to say that this kind of test driving closely reflects plyometric effects on subjects covered;
- Classification of plyometric exercises depending on a number of factors that manage to group of these exercises in easily selected and used categories;

- Projecting the "plyometric training program" for a period of 12 weeks and staging the preparation and selecting the specific exercises drives so that they act specifically on specific muscle groups of the legs samples sprint in athletics;
- Adjusting the "plyometric training program", based on the lucrative conclusions generated by neuromuscular test results and initial kinematics.