

Study concerning the proprioception training in 110 m hurdles event technique optimization

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Published online: November 30, 2018

(Accepted for publication November 20, 2018)

DOI:10.7752/jpes.2018.s5290

Abstract:

The aim of the study is to make the technical execution of the hurdle step through the biomechanical analysis, based on the analysis of the kinematic records, correlated with the improvement of the coordination capacities on the basis of an individualized proprioceptive training program.

The topicality of the theme is given by the increasingly aggressive and global intrusion of technology into sports training in all sports and all age groups, but especially in high performance sports and technical issues, as well as high efficiency news training based on proprioception and the development of coordination skills. Ownceptive training is a novelty in sports training, with remarkable results in training athletes worldwide. Improvement of coordinating capabilities and correction of execution errors by kinematic parameters analysis and an appropriate engine program achieve better lower limb grouping with a faster passage as well as a more balanced and efficient landing, optimizing the trajectory of the center of gravity to the hurdle plane and ideal space-time positioning for the next steps between hurdles.

Key words: 110 m hurdles, biomechanical analysis, coordination capacities, kinematic recordings, proprioceptive training.

Introduction

We aim to highlight through this research, the close connection between the kinesthetic sense, the motor memory achieved by individualized proprioceptive training that leads to the optimization of the coordination capacities, and the technique of execution of the hurdle runner.

The present study has started from the idea that training in the 110m hurdle test should lead to the implementation of a most accurate and economical technique by analytical training based on quantified research of the movement, played by the computer, since the research should be in line the requirements of modern research. For the technique of the hurdle treadmill to be optimally absorbed, besides the essential conditions provided by the sport training, modern techniques that add value to athletes training are also needed, and here we refer to cinematic recordings performed with performance cameras. Analyzing and monitoring technical executions with the help of high-performance, video-based video recordings with specialized software will lead to the correction of the executable errors that can not be observed with the naked eye, thus improving the detail of the execution technique.

Research Methods

The general purpose of our basic research is to objectify the technical execution of the hurdle through biomechanical analysis, based on the recording of kinematic parameters correlated with the improvement of the coordination capacities on the basis of individualized proprioception training.

The general objective of the basic research on the 110m hurdle test, defined by the purpose, direction and causes of technical execution errors, is oriented towards a systematic and staged achievement achieved through the achievement of intermediate and operational objectives.

We start from the assumption that improving coordinate capabilities and correcting execution errors by kinematic parameters analysis leads to better clustering, a faster and more balanced passage, and a safer and more efficient landing, a space-time positioning with the optimal trajectory of the CGM to the hurdle plan. We assume that by analyzing the component of the registered cinematic parameters, the execution errors can be detected and the optimal performance of the technique will be objectified after a biomechanical investigation. Performance sports research is based on computerization through the methods and devices introduced in sports, as it supports highlighting and refinement that leads to high performance.

The inclusion of biomechanical analysis or a complex motor action on a film, on a computer by measurable parameters, using a human motor analysis software, detects biomechanical parameters of the subject's movement. (Nechita, Mihăilescu, 2010).

In this way, some execution errors can be eliminated which leads to the recording of the essential progress of the technical execution in the studied sample. Also, the recorded and analyzed data can lead to the improvement of the errors, which supports a certain optimal performance of the sports technique, in this case the running in the 110 m hurdle test.

In the research, the study is based on a kinematic analysis of recorded spatial and temporal parameters. Several components of step biomechanics will be measured over the hurdle:

- the magnitude of attack angle
- the size of the landing angle
- the horizontal distance from which the attack on the hurdle is triggered
- the horizontal landing distance to the hurdle

The basic research involved two subjects, one of them several national champion, component of the national team with Olympic perspectives, the other national champion in the junior category III with perspectives to enter the national lot. Subjects undergoing research participated in training and competitions dedicated to juniors and youth at national level.

Information on the experimental study of anthropometric data and individual performance are presented in the following table:

Tabel 1. Somatic-anthropometric data and performance evolution of baseline subjects

	<i>S1 (jun. Cat. I)</i>	<i>S2 (jun. Cat. III)</i>
<i>Height</i>	1.96 m.	1.78 m.
<i>Weight</i>	81 kg.	72 kg.
<i>Foot size</i>	46	44
<i>Performance</i>	14,28 sec.	16,00 sec.
<i>Personal record</i>	I st place junior Nat. Champ 2016 – 14,88 sec. 2017 – 14,67 sec. I st place youth NC indoor III rd place senior NC ind. 2018 – 14,28 sec.	IV th place – 60 mh. Youth NC 2016 – 16,78 sec. 2017 – 16,40 sec. V th place 110 mh. NC Jun. I cat. 2018 – 16,00 sec.

The recordings were made on hurdles with a height of 0.991 m for S2 and 1.067 m for S1 under the same conditions in both initial testing and final testing.

The experiment was assisted by the coach Dragoș Ionescu Bondoc.

According to the parameters recorded in the preliminary experiment, basic research was conducted on each subject and in order to keep the confidentiality of the athletes presented as Subject 1, Subject 2. The initial testing and final testing were presented on each subject in part under the initial and final test.

Subjects undergoing the research participated in the training, according to a program proposed to participate in the competition at national level. Between the Initial Testing and the Final Testing, a training program based on specific technique of the hurdle runner technique was applied to the 110 m hurdles and non-specimen sample, which were developed in the Preliminary Testing. The motor program applied between the initial test and the final test is based on a training optimization adjustment system, focusing on the balance of the passage and the reassessment of the kinetic sensations from impulse to landing, taking into account a series of transformations made during the two tests through which the athlete consciously corrects the technical mistakes and implicitly improves them.

In the longitudinal basic experimental research parameters analyzed by the Dartfish software, were recorded on each of the four moments of the technical execution provided for preliminary research, which contributes to the optimization of the hurdle running step technique. In the first phase, the overhang, the impulse and the attack of the hurdle, the distance from which the detachment is made is 2.21 m, and the impulse angle between the detachment foot and the ground is 118°, with a difference rather than the reference model (130°), which causes the athlete to have a higher gravity center rise over the hurdle and a higher passage at 0.38 m.

In the landing phase, the angle is 81.3° which also causes a horizontal landing distance to the larger hurdle of 1.54 m. The flight time is also 0.02 sec. higher than that of the reference model, also determined by the rise of gravity center in F2 to 1.43 m from the ground, the ideal being 1.29 m. In F4 the impulse for the next step between the hurdle is made at an angle of 120, 2°, and we will later see that it is quite high and unbalanced.



Fig.1. Vector representation of the angular parameters of the subject 1 - front plan - initial test



Fig.2. Vector representation of the distal and angular dimensions of the subject 1 lateral plan - final test

In F1 we can see that the detachment was made from a distance of 2.28 m, and an angle of 120° , which allows the subject a better grouping in the flight phase. In the third phase of the crossing over the hurdle, the landing took place only 1.20 m and at an angle of 82.4° , which indicates that the athlete has lowered the attack after the hurdle and the angle is approaching more than the 90° of the absolute model allows for a better departure on the next treadmill, at an angle of 130.4° .



Fig.3. Vector representation of the angular parameters of the subject 1 frontal plane - final test

Significant correction of the landing angle can be observed, following the proprioceptive training program, reaching 88.4° , even 90° (Figure 4), the ideal for a safe and balanced landing. Improvement of the coordinative capacities, essential in the driving forces of the hurdle passage, was accomplished by proprioceptive exercises that act on stimulating kinetic sensations, equilibrium, mobility and automation of speed movements.

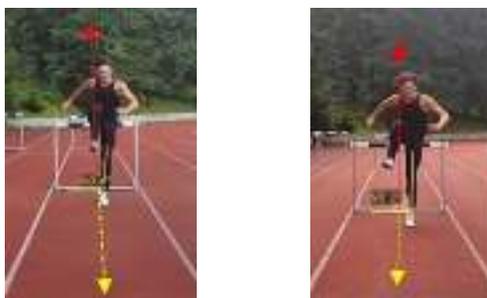


Fig.4. Vector representation of the angular parameters of the subject 2 frontal plan - initial test



Fig.5. Vector representation of distal and angular parameters of subject 2 - final test



Fig.6. Vector representation of the angular parameters of the subject 2 frontal plane - final test

Conclusions and proposals

Research carried out through a program of analysis of the main parameters recorded at the moments of the hurdler stage highlighted the interpretation of the results, that the overall hypothesis was confirmed by correction of technical errors and optimization of hurdle crossing.

It was found that sports training in the 110 m hurdle at the junior age is of particular importance in the proprioceptive training based on the information developed by the analysts, who by practicing the selected means within this modern method lead to the development and improvement of the control of the specific optimal technical execution based on the formation of the combining, coupling and segmental coordination capacity, the spatio-temporal orientation capacity, the kinetic and static dynamic dynamics.

Based on the results obtained on the basis of experiments, the technical-methodical training sessions are as follows:

- On the basis of the study of the vectorial kinematic record, the values of the parameters studied (the impulse angle, the landing angle, the distance from which the attack is triggered, the distance to which the landing after the hurdle is made) have been corrected;
- As a result of the research and analysis of the registered parameters, it is ascertained that by applying the proprioceptive program, athletes improve their execution speed, balance, mobility, coordination skills.
- On the basis of the analysis of the monitoring of the areas monitored during the crossing over the hurdle, it is noticed that by correcting the technical faults in the final test, the flight time has decreased which will lead to better performance in the competitions.
- The analytical use of kinetic parameters through video recording complements and argues scientifically the direct guidance of the technicians through individual technical training programs in order to obtain an individual yield of the procedures and the technical elements specific to the 110 m hurdle.

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