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RESEARCHES CONCERNING THE ANALYSIS OF SOME TECHINCAL ASPECTS OF THE MALE TRIPLE JUMP IN COMPETITION

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Abstract
Purpose. The competition evolution of athletes show the ability of learning the content of the training process emphasizing how they express themselves in conditions of adversity and various environmental factors. The aim of this research was to analyze a series of technical aspects specific to the triple jump event in competition conditions by using the Dartfish© motion kinematic analysis software.
Methods. The research was conducted by using the following research methods: references method, kinematic analysis method, case study, table and graphic method and it was focused on the participants at the Athletics National Championship specialized in the triple jump event.
Results. The technical aspects analyzed, and the values of the kinematic indicators that were used showed similarities with the existing technical theoretical model of the specialty literature on the specific angles of this event recorded in the first hit phase.
Conclusions. The results obtained in this research emphasize the fact that the aimed technical aspects can represent objective indicators of the quality level of the technique specific to this event having in mind the theoretically model from the Romanian and foreign specialty literature.
Key words: competition, kinematic analysis, technique, triple jump event.

Introduction

The competition evolution of athletes show the ability of learning the content of the training process emphasizing how they express themselves in conditions of adversity and various environmental factors.

The analysis of the technical development is one of the main instruments that can influence the training process orientation towards advanced sportive techniques, taking into account at least two aspects: „the first is the performance macro-area, meaning that a gesture must always be as effective and efficient as possible; the second consists in the different morphological conformation of athletes, therefore a particular executive technique can work for an individual but not for another." (R. Izzo, 2010)

"The triple jump includes the specificity of complex coordinative and technical abilities, particularly the jumping rhythm and time management, good take-off coordination into the hop, step and jump as well as the balance (equilibration) during jumping flight" (M. Niessen *et.al*., 2003).

"In order to achieve his aim the triple jumper requires a precise approach with an optimal, almost maximum approach speed with which he produces kinetic energy. A successful triple jump performance is characterized by the athlete using a good technique which permits the maintenance of horizontal velocity and therefore, kinetic energy during the three jump segments". *

The **aim** of this research was to analyze a series of technical aspects specific to the triple jump event in competition conditions by using the Dartfish© motion kinematic analysis software.The accomplishment of this aim was possible by achieving the following objectives:

- the establishment of the technical aspects which will be analyzed in the research;
- the establishment of the analyze method which will be used in order to analyze the technical spects of the of the male triple jump event
- the establishment of the kinematic parameters which will be used to obtain information regarding the chosen technical aspects from the research.

Method

The research was conducted by using the following research methods: references method, kinematic analysis method, case study, table and graphic method and it was focused on the participants at the Athletics National Championship specialized in the triple jump event.

The images were captured during the triple jump event by using a Sony video camera and then

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were analyzed by using the Dartfish© motion kinematic analysis software.

The kinematic parameters used were the following: the distance, the position and the angle.

The technical aspects covered in this research were: the length of the last step of the approach running , the body mass center position during the first hit, the distance from the projection of the body mass center on the ground and the foot contact point in the first hit achiving moment, the contact angle, the hit angle and the take-off angle of the firts hit (the hop).

Results

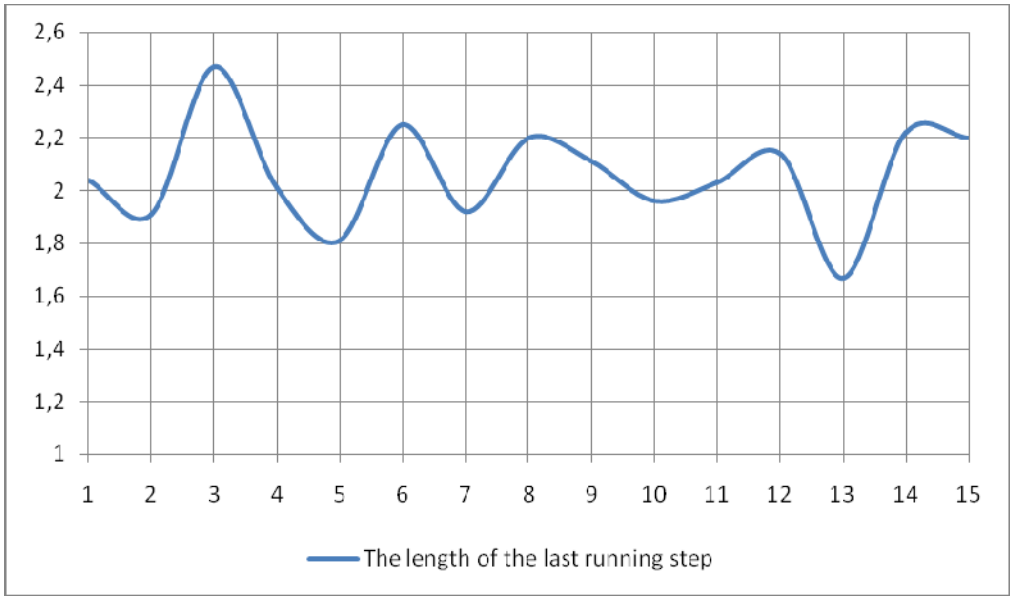
As a result of the kinematic analysis of the technical aspects aimed in research and after processing the statistical data obtained I noticed the following issues:

- refering to the length of the last step of approach running , it has been recorded a dynamic whose average was 2.06 m with a standard deviation of ± 0.19 m (Table 1, Figure 1)

Table 1. The value of the kinematic indicators analysed during the last step of the approach running

No.	The length of the last approach running step (m)	The position of the body mass center during first hit (m)	The distance from the projection of the body mass center on the ground and the foot contact point in the first hit achiving moment (m)
1	2,04	0,91	0,53
2	1,91	1,11	0,35
3	2,47	0,94	0,40
4	2,01	0,91	0,28
5	1,81	0,94	0,25
6	2,25	1,06	0,36
7	1,92	1,07	0,27
8	2,20	0,99	0,43
9	2,11	0,95	0,30
10	1,96	1,05	0,30
11	2,03	1,05	0,29
12	2,14	0,98	0,21
13	1,67	0,93	0,33
14	2,22	1,05	0,29
15	2,20	1,04	0,34
$\bar{\chi}$	2,06	1,00	0,33
σ	±0,19	±0,06	±0,08

Figure 1. The length dynamic of the last approach running step



- refering on the position of body mass center during the first hit, we can observe that the recorded values had an average of 1.00 m, and a standard deviation of ± 0.06 m (Table 1, Figure 2);

- the distance from the projection of the body mass center on the ground and the foot contact point showed an average value of 0.33 m, while the standard deviation was ± 0.08 m (Table 1, Figure 3);

Figure 2. The position of the body mass center during the first hit

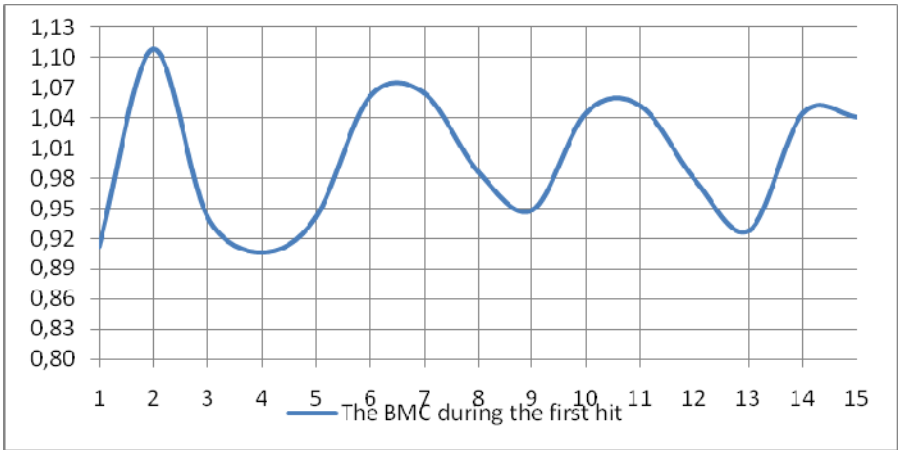


Figure 3. The dymanic of the distance between the contact point and the BMC projection during the first hit

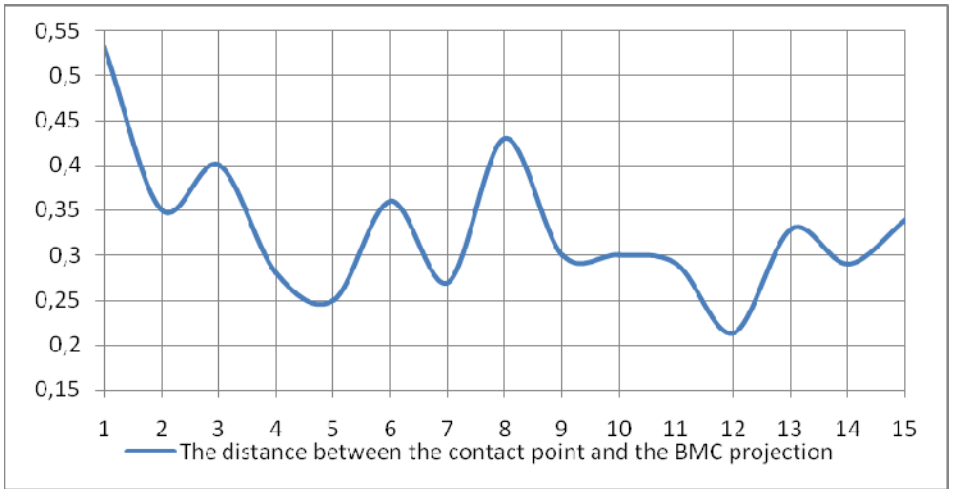
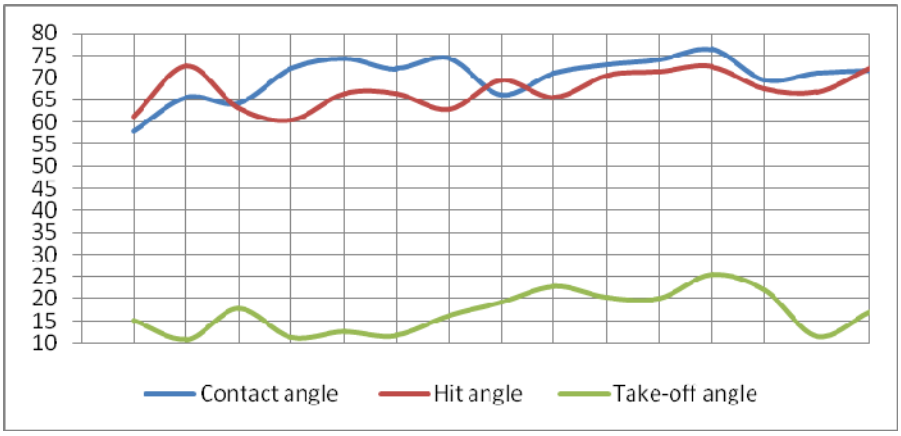


Figure. 4. The dynamic of the contact, hit and take-off angles values



• refering on the contact, hit and take-off angles achieved during the first hit, the average values were 70,23^0, 67,22^0, respectively 16,92^0 with values of standard deviation of ± 4,67^0, ± 4,01^0, respectively ± 4,50^0 (Table 2, Figure 4).

Table 2. The values of the specific angles attributed to the first hit

No.	Contact angle (degrees)	Hit angle (degrees)	Take-off angle (degrees)
1	58,00	61,10	15,05
2	65,60	72,70	10,90
3	64,30	63,00	17,90
4	72,00	60,30	11,30
5	74,30	66,40	12,60
6	72,00	66,40	11,80
7	74,40	62,80	16,30
8	66,20	69,40	19,10
9	71,00	65,60	22,80
10	73,00	70,50	20,20
11	74,10	71,30	20,02
12	76,40	72,53	25,37
13	69,53	67,41	21,94
14	71,00	66,80	11,50
15	71,60	72,10	17,01
$\bar{\chi}$	**70,23**	**67,22**	**16,92**
σ	**±4,67**	**±4,01**	**±4,50**

Discussions and conclusions

From the recorded data it can be stated that 66.66% of the analyzed jumps were performed with a length of the last step of the approach running of more than 2 m.

In terms of body mass center position during the performance of the first hit, the recorded value is higher than shown in the Romanian and foreign literature (P. Susanka *et. al*., 1990), mentioning that one of the factors that may cause this difference can be the difference in the height of the athletes, knowing that the position of the body mass center is influenced by height size.

At the same time, it can be appreciated that a high position of the body mass center during the hit phases occurs due to an insufficient flexion at the knee joint, action that may lead to an inefficient grazing trajectory determining a modest value in the length of the final triple jump.

The distance from the projection of the body mass center on the ground and the foot measured during the performance of the first hit (the hop), we can say the following aspects:

- *the contact angle* shows an average value fits, with a slight gain, in the trends presented in the specialty literature (70.23^0, respectively $65 - 70^0$) (L. Mihailescu, N., Mihailescu, 2006); the location of this angle at the superior limit presented by specialists in the field may be influenced by an insufficient lowering of the body mass center during the contact between the hit foot with the ground (hit board) because of a superficial flection at the knee joint; mass center at the contact moment I order to realize the hit phase.

This value is lower than the technical theoretical model presented in the specialtuy literature (0.33 m compared 0.49 m).

contact point highlights a value which supports the previous statement about the insufficient lowering of the body

Regarding to specific angles of the athletic jumping events (contact, hit and take-off angle),

- *the hit angle*, by its average value (67.22^0), is located outside the limits shown in the literature - $60 - 65^0$ (L. Mihailescu, N. Mihailescu, 2006; M. Alexei, 2005);

- the average of the take-off angle (16.92^0) fits in the values presented in various studies and specialized research that indicate values between $14\text{-}18^0$ (L. Mihailescu, N. Mihailescu, 2006; M. Alexei, 2005; Athletics Omnibus, fa; E. Luna, fa; H. Hommel, et. al. 2009).

The results obtained in this research emphasize the fact that the aimed technical aspects can represent objective indicators of the quality level of the technique specific to this event having in mind the theoretically model from the Romanian and foreign specialty literature.

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