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RESEARCHES CONCERNING THE KINEMATIC ANALYSIS OF THE HOP IN THE MALE TRIPLE JUMP EVENT

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Abstract

Purpose. The purpose of this research was to emphasize the technical aspects specific to the hop triple jump event by kinematic analysis.

Methods. In order to elaborate this research paper we used some research methods that gave us the opportunity to achieve a scientific approach based on quality and precision: case study, kinematic analysis, experiment.

Results. By this research we wanted to measure of the following kinematic parameters: the time of the hit phase, the trajectory (height) of the body mass center and the distance between the projection of the B.M.C on the ground and the contact point of the hit foot during the hit phase.

Conclusions. The data and the means that were used in order to process the kinematic parameters obtained by achieving this scientific approach represent real and objective instruments of technique monitoring that can be used in order to provide quality and efficiency to the training process – technical factor.

Key words: hop, kinematic analysis, triple jump,.

Purpose

A real knowledge of the human movement aspects is fundamental from the perspective of a variety area of domains that interacts in order to provide the necessary support for some objectives

The information obtained by kinematic measurement and evaluation represents important indicators in the sportive technical monitoring activity, being a support in the correct learning, consolidation and improvement of the different component of this modern sportive training factor.

The movement analysis in real time, on kinematic characteristics, represents an essential instrument in the monitoring of the sportive technique and assumes the existence of an operational system by whom the figure data, recorded by using software technologies, will be processed, interpreted and used to describe and become more aware and exact the technical aspects. [C.J. PAYTON & R.M, BARTLETT 2008]

„The kinematics studies the geometrically, spatial and temporally description of the movement by the framework of the following parameters: time, position, trajectory, angles, linear velocity, linear acceleration, angular velocity, angular acceleration. The kinematics analyses suppose the utilization of these parameters in order to obtain some objective information, concerning the technique elements and proceedings, as well as the base mechanism, specific to some sportive discipline or event." [I, Mihai, 2009]

Knowing the kinematic features of the practiced sportive event represents on objective element of achievement having general and particular character: physical exercises and sport science, physical education, medicine, psychotherapy, occupational therapy, medical assistance, etc. [B. ABERNETHY, and colab., 2008]

orientation of the training and in the same time an evaluation mean of the technical behavior evolutions' providing stringency and efficiency to the sportive training process.

The aim of this research was to emphasize the technical aspects that are specific to the hop of the triple jump event by kinematic analysis.

The achievement of this aim was possible by fulfilling the following objectives:

- the establishment of the kinematic parameters that will be measured and analyzed;
- the delimitation of the moments when the kinematic parameters will be measured and analyzed;
- the dynamic determination of the kinematic parameters used in this research that are specific to each athlete.

Method

In order to elaborate this research paper we used some research methods that gave us the opportunity to achieve a scientific approach based on quality and precision: case study, kinematic analysis, experiment, table and graphic and it was focused on the National and Olympic Team components of the Romanian Track and Field Federation, specialized in the triple jump event.

Table 1. The time of the hit phase

Athlete	Jump phase	Time (ms)
Oprea Marian	Hop	140
Anghel Alin	Hop	120
Daianu Adrian	Hop	140

The data from the table 1 indicate the fact that the time of the hit phase recorded by the three athletes during the hop phase has values between 120 and 140 milliseconds. So, it can be seen that the value of the hit time realized by Oprea and Daianu has similar values, respectively 140 ms, while the value of the hit phase time achieved by Anghel is 120 ms.

Table 2. The height of the B.M.C. during the hop (m)

The moments of the hop								
Oprea Marian			Anghel Alin			Dăianu Adrian		
Contact	Hit	Take-off	Contact	Hit	Take-off	Contact	Hit	Take-off
1.05	1.26	1.26	1.09	1.26	1.26	0.93	1.16	1.16
1.02	-	1.28	1.05	-	1.29	0.94	-	1.19
1.02	-	1.31	1.05	-	1.32	0.94	-	1.23
1.03	-	1.34	1.08	-	1.35	0.96	-	1.25
1.05	-	1.38	1.1	-	1.38	0.97	-	1.28
1.09	-	1.40	1.15	-	1.41	1.01	-	1.31
1.17	-	1.43	1.21	-	1.43	1.07	-	1.34
1.19	-	1.45	-	-	1.47	1.12	-	1.37
-	-	1.48	-	-	1.48	-	-	1.38
-	-	1.49	-	-	1.49	-	-	1.4
-	-	1.50	-	-	1.49	-	-	1.4
-	-	1.49	-	-	1.47	-	-	1.4
-	-	1.49	-	-	1.45	-	-	1.4
-	-	1.47	-	-	1.44	-	-	1.39
-	-	1.47	-	-	1.41	-	-	1.38
-	-	1.46	-	-	1.39	-	-	1.36
-	-	1.45	-	-	1.37	-	-	1.34
-	-	1.44	-	-	1.34	-	-	1.34
-	-	1.42	-	-	1.31	-	-	1.32
-	-	1.39	-	-	1.27	-	-	1.29
-	-	1.37	-	-	1.25	-	-	1.27
-	-	1.34	-	-	1.22	-	-	1.24
-	-	1.32	-	-	1.19	-	-	1.21
-	-	1.29	-	-	1.18	-	-	1.18
-	-	1.25	-	-	1.15	-	-	1.15
-	-	1.21				-	-	1.11
-	-	1.17				-	-	1.08
-	-	1.13						
-	-	1.08						

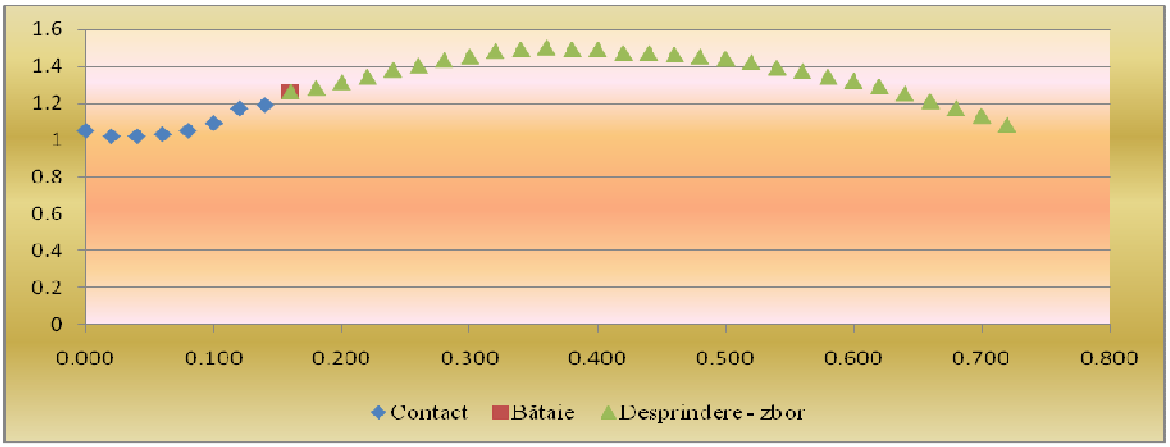
Table 2 and graphics 1, 2 and 3 show the position of the BMC emphasizing for each athlete the trajectory during the hop, too.

From the values showed in the mentioned table we can see the fact that the height of the BMC presents vertical oscillations with values between: 0.12 and 0.19 m in the ground contact moment, 0.28 and 0.42 m from the moment of take-off until the highest point of the flight and between 0.32 and 0.42 m in his descendent phase. The average of the BMC height recorded during the hop is between 1.22m (Daianu) and 1.30m (Oprea and Anghel). The standard deviation has the following values ± 0. 14 m (Anghel), ± 0. 15 m (Daianu), respectively ± 0. 16 m (Oprea).

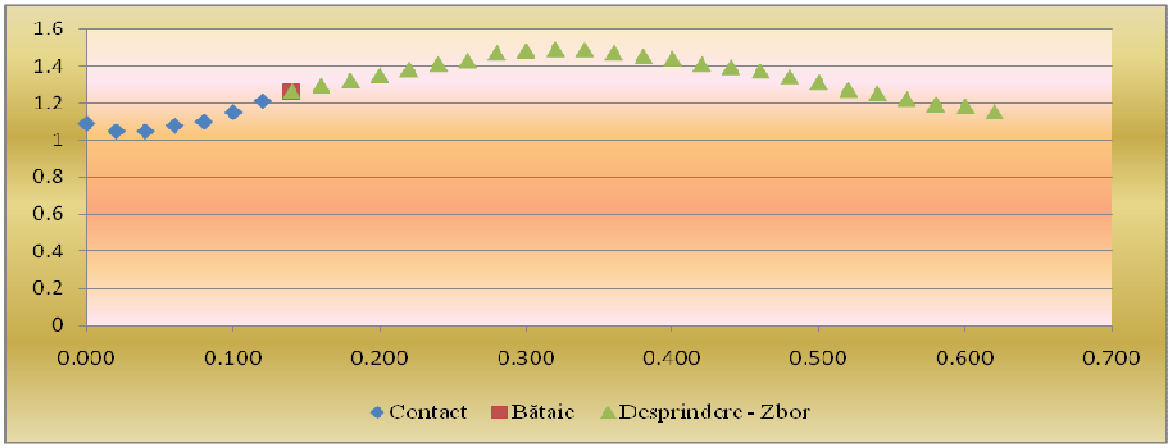
The maximum point of the BMC (graphic 1) has a value of 1.50 m, the difference between his position in the contact moment (1.05m) and the maximum point of the flight being 0.45m. The variation of the BMC on his trajectory, after the take-off and until the ground contact moment is in average of 2.6 cm.

The maximum height of the BMC trajectory (graphic 2) has a value of 1.49 m, the difference between his position in the contact moment (1.09m) and the maximum moment of flight being 0.40m. The variation of the variation of the BMC on his trajectory, after the take-off and until the ground contact moment is in average of 2.3m.

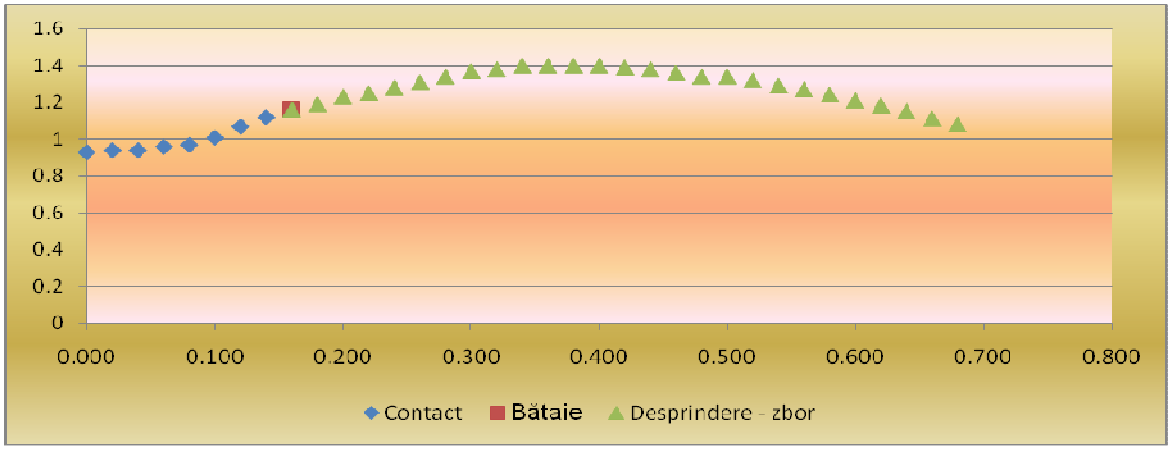
On the graphic 3 we can see that the maximum point of the BMC position has a 1.40 m value. The difference between his position in the contact moment (0.93 m) and the maximum point of the flight is 0.47 m. The variation of the variation of the BMC on his trajectory, after the take-off and until the ground contact moment is in average of 2.07m.



Graphic 1. The trajectory of the BMC during the hop
- Oprea Marian -



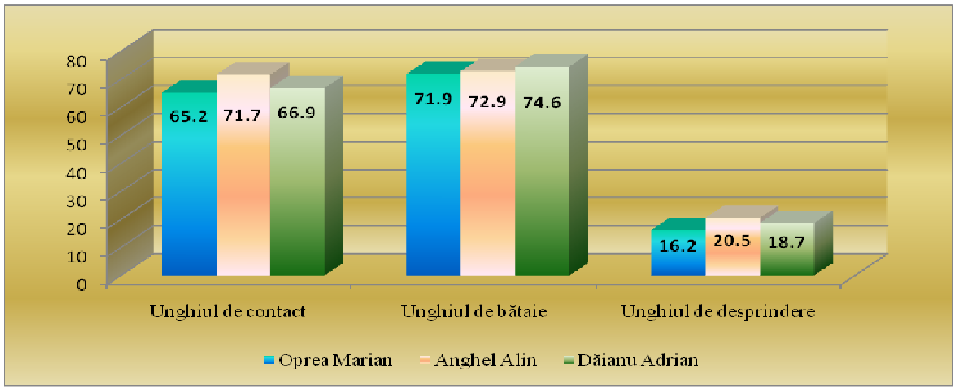
Graphic 2. The trajectory of the BMC during the hop
- Anghel Alin -



Graphic 3. The trajectory of the BMC during the hop
- Daianu Adrian -

Table 3. The value of the contact hit and take-off angles – the hop

Athlete	Contact angle	Hit angle	Take-off angle
	The hop	*The hop*	*The hop*
Oprea Marian	65.2^0	71.9^0	16.2^0
Anghel Alin	71.7^0	72.9^0	20.5^0
Dăianu Adrian	66.9^0	74.6^0	18.7^0

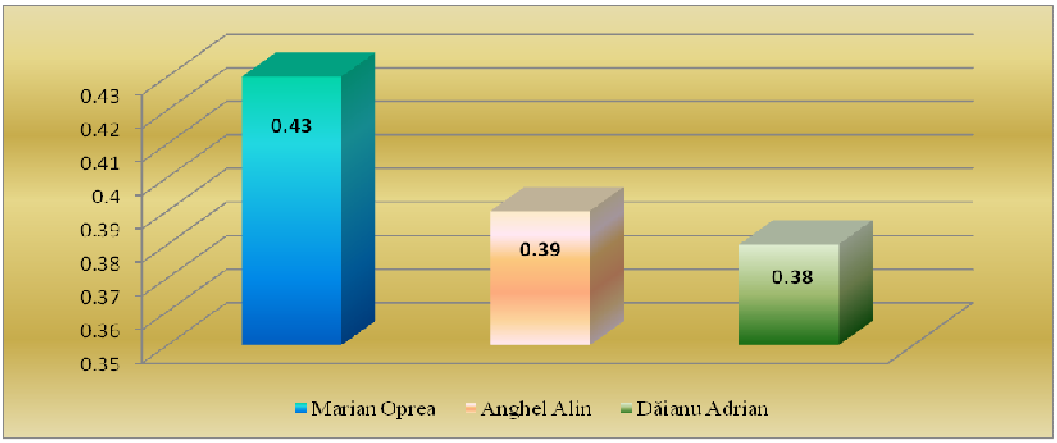


Graphic 4. Dinamica valorilor unghiurilor de contact, bătaie, desprindere

Analyzing the values of the contact, hit and take-off angles (tables 3 and graphic 4) we can observe the following aspects: the contact angle has $65,2^0$ (Oprea), $71,7^0$ (Anghel), respectively $66,9^0$ (Daianu); referring to the hit angle, the values of the three athletes have an ascendant trajectory starting with Oprea and finishing with Daianu; in the take-off angle case, as the contact angle, Anghel has the highest value followed by Daianu and Oprea.

Table 4. The distance between the hit leg and BMC projection on the ground in the hit moment

Athlete	Position of the hit leg (m)
Marian Oprea	0.43
Anghel Alin	0.39
Daianu Adrian	0.38



Graphyc 5. The dynamics of the hit leg position and the BMC projection on the ground in the hit moment

Referring to the hit leg position and the projection of the BMC projection on the ground (table 4) in the contact moment of the hit phase of the hop, we can observe that he presents a value between 0.43 and 0.38m, before BMC. As we can see in the graphic 5, the highest distance between the contact point of the hit leg and the projection of the BMC is in Oprea case, followed by Anghel and Daianu.

Discussion and conclusion

By achieving this scientific approach we can say that by processing the video images and by the

kinematic analysis of the evolution of the three athletes we emphasized the specific aspects of the hop – male triple jump event – these data being appreciated from the following perspectives:

- The data referring to the hop execution time presents real and precise information concerning is duration, helping the coach in monitoring the time of the structural components of the event knowing that the more time for the base mechanism elements execution is needed (especially the three hits) the bigger are the velocity loss and that determines the obtaining of low performances;

- the determination of the contact point position of the hit leg given the projection of the M.G.C. of the body on the ground in the moment of the performance of the three successive phases of the hit, offers exact information about the distance where the athlete put his leg before projection of M.G.C. If this distance is longer than 1,5 feet, it becomes a limiting element in gaining the optimum speed needed for the achievement of the whole jump in optimum conditions.

- The determination of the contact, hit and take-off angles, specific to the hop, allows the emphasizing of some information that, by their values, represents elements of appreciation regarding to the technical behavior, offering the tends of the approach and exit from the hit phase. .

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