European Journal of Physical Education and Sport Science
ISSN: 2501 - 1235
ISSN-L: 2501 - 1235
Available on-line at: www.oapub.org/edu

doi: 10.5281/zenodo.1221435
Volume 4 | Issue 3 | 2018

IMPACT OF THE COLLISION AND PUSH ANGLES ON THE PHASES HOP, STEP AND JUMP IN THE TRIPLE JUMP AND THEIR RELATIONSHIP TO THE STAGE OF TAKE-OFF

Guebli Abdelkader[1,2i],
Reguieg Madani[2],
Sbaa Bouabdellah[1]
[1]Laboratory APS, Society, Education and Health,
Faculty of Physical Education and Sports,
Hassiba Benbouali University of Chlef, Algeria
[2]SMAH Laboratory, Faculty of Physical Education and Sports,
Abdelhamid Ibn Badiss University of Mostaganem, Algeria

Abstract:
The purposes of this study were to revealing correlation between the angles of body in the motor performance and stages take-off (time of phase & push angle) in each phases (hop, step and jump) for elite Algerian in triple jump. Our study based on the kinematic analyzes of the phases triple jump in the collision and push stages, through the Kinovea programmer. For this study, we have chosen the analysis of correlation (the Pearson correlation "R") in each of the phases (hop, step and jump) in the collision and push stages. Based on the practices and weaknesses of elites in practice; we confirm: 1) there is a statistically significant the correlation in the collision stage (hop phase; the angle of trunk°) with the time and angle of push, 2) the problem of our elites is in the hop phase, and its relationship with; the step and jump phases, 3) Improve achieve horizontal vertical velocity in hop phase and preservation in next phases (step and jump) as solution.

Keywords: triple jump, kinematics variables, motor performance

1. Introduction

The triple jump has dates to the ancient Greek Olympics. The long jump was indisputably part of the Greek games, but some jumpers recorded leaps of more than 50 feet, leading sports historians to conclude that these were actually a series of jumps[1]. The triple jump has been a part of the Olympics - for men, at least - since the first modern Games in 1896, when the event consisted of two hops with the same foot,

[i] Correspondence: email abdelkader85@windowslive.com

followed by a jump. It was soon changed to the modern "hop, step and jump" pattern. The Americans and Europeans dominated the early contests[2], two early Olympic competitions included a standing triple jump event, in addition to the standard version, which was then called the "hop, step, and jump." American Ray Ewry won both Olympic standing triple jump gold medals, in 1900 and 1904. Read more about the 1904 Summer Olympic Games[3]. Jonathon Edwards of Great Britain broke the triple jump world record three times in 1995, with the last two occurring at the World Championships. He opened the Championship final by leaping 18.16/59-7. In the second round, he extended his world mark to 18.29/60-¼.[4]. The current record male Africa 17.37 m (56 ft.113⁄4 in) by Tarik Bouguetaïb (MAR). The best record of Algerian male is 16.92 m by Lotfi Khaïda Monaco Herculis games in August 7, 1993 [5]. For the reason that our elites does not exceed 17-meter, our goal is to introduce the biomechanics evaluation before explaining the reason scientific of the absence of the Algerian performance elite in world festivals by discussing the importance of the angles of the motor performance in the triple jump and its relation to the kinematics parameters for the successive stages of performance (hop, steps and jump). In this regard, Jensen, Hirst & Simonin point out that achieving objectivity in the study of human movement is very difficult because of the complexity and interplay of factors affecting performance, the Different kinetic patterns [6]. Where the kinetic analysis enabled athletes to adjust their technical performance to them correctly and Away naked eye, by using scientific and technical means In order to analyze the movement of the athlete [7].

In addition, our research analyzed the performance of Algerian elites to analyzed the correlation between the kinematics' variable's and the angle of push (take-off) and time of each phase to illustrate the importance of the motor performance in stages of collision and push in all phases hop ,step and jump on the results. Our motive is to highlight the biomechanical assessment for Algerian coaches to plan the choice of the right assessment technique to their athletes. In a previous study, Aek, Guebli asserts the importance of the angle of push and the time of each phase (hop, step, and jump) in digital level achievement [4]. This is evidenced by the strong correlation between these variables and the digital level achievement during all stages of the triple jump.

2. Materials and methods

For the purposes of analysis, we have kinematics analyzed for the angles of Foot°, Leg° ,Knee°, Hip°, Trunk°, Takeoff° (push angle) and time of push in phases collision (hop, step and jump), in two-dimensional. The analysis of the present study was with the software Kinovea, the capture and measure variables of each phase of triple jump. Sites of two cameras depended digital for photography on a distance 12m forward (or on the pit side), the 5.43m of 3.4m consecutive of the panel of the jump on the right side, besides the indicators of use of visual; the subjects were the athletics champions of elite Algerian 2015 (5 athletes); we have made analysis of their performances in similar study as (Table 1). The data analysis procedures used in this study consisted of the computation of the means, standard deviations, the Pearson correlations of all the variables identified in based of the theoretical model in the similar studies

Figure 1: The method chosen to calculate the angles of performance

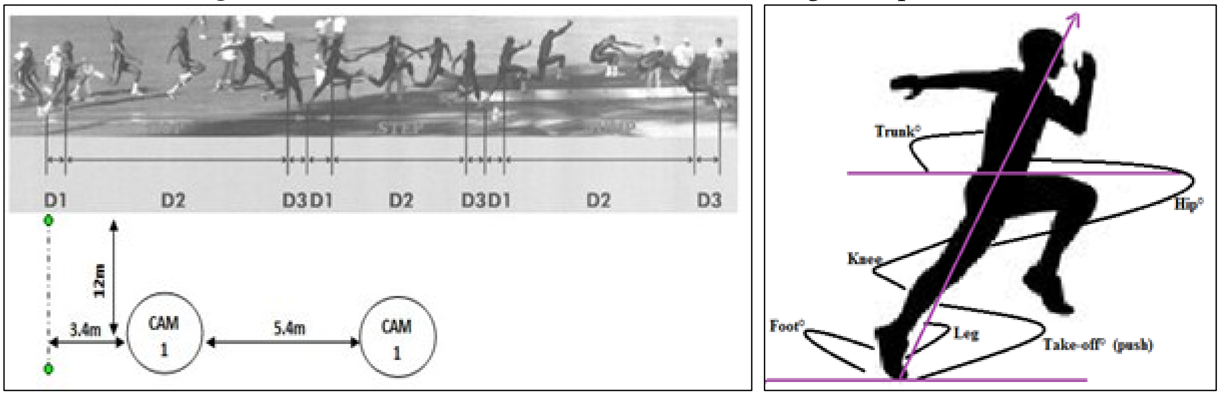

Table 1: Description of The Acquired Results of Our Samples Algerian Champions

	Mean	Std. Deviation	Variance	Range	Skewness		Kurtosis	
						Std. Error		Std. Error
Age	29.00	3.316	11.00	9.00	.685	.913	1.132	2.000
Length	1.856	.0181	.00	.05	-.267	.913	1.074	2.000
Weight	76.20	.8366	.70	2.00	-.512	.913	-.612	2.000
Digital Level	16.468	.8478	.719	1.97	2.202	.913	4.880	2.000

3. Results and discussion

Table 2: Description The Results of Algerian Champions after the kinematics analysis

The stages	Variables (Angles)	Hop phase		Step phase		Jump phase	
		Mean	Std. D	Mean	Std. D	Mean	Std. D
Collision	Foot °	34.80	.836	45.60	2.073	39.00	1.414
	Leg °	112.00	1.224	129.80	1.788	119.80	8.497
	Knee °	145.20	1.303	161.60	3.286	171.60	2.701
	Hip °	122.00	7.106	127.20	5.630	134.40	9.016
	Trunk °	74.20	22.027	87.20	3.346	91.00	11.135
Push	Foot °	56.80	1.303	26.20	2.588	59.20	6.099
	Leg °	142.80	3.768	123.80	1.303	133.20	15.073
	Knee °	144.20	1.095	146.60	3.286	150.20	13.330
	Hip °	161.00	3.674	152.00	4.242	158.20	10.134
	Trunk °	86.80	3.420	87.40	2.302	88.00	1.732
	Takeoff °	51.80	1.788	52.40	3.286	47.60	3.049
	Hop-time	.6360	.023	.588	.0455	.820	.0187

Table 3: The connectivity relationships between variables in order to study (hop phase)

	Collision					Push				
	Foot °	Leg °	Knee °	Hip °	Trunk °	Foot °	Leg °	Knee °	Hip °	Trunk °
Takeoff angle°	.468	-.685	.772	-.787	.883*	-.772	-.638	-.868*	-.761	-.703
Sig.	.213	.101	.063	.057	.024	.063	.123	.028	.068	.093
Hop-time	.597	-.975**	.783	-.947**	.880*	-.783	-.905*	-.753	-.857*	-.679
Sig.	.144	.002	.059	.007	.025	.059	.017	.071	.032	.104

*Correlation is significant at the 0.05 level (0.811), ** Correlation is significant at the 0.01 level (0.917).

Table 4: The connectivity relationships between variables in order to study (step phase)

	Collision					Push				
	Foot °	**Leg °**	**Knee °**	**Hip °**	**Trunk °**	**Foot °**	**Leg °**	**Knee °**	**Hip °**	**Trunk °**
Takeoff angle°	.139	-.281	-.792	.386	-.850*	.400	-.969**	-.792	-.771	-.687
Sig.	.412	.324	.055	.260	.034	.252	.003	.055	.063	.100
step-time	-.435	-.467	.395	-.057	.479	-.038	.582	.395	.337	.368
Sig.	.232	.214	.255	.464	.207	.476	.152	.255	.290	.271

*Correlation is significant at the 0.05 level (0.811), ** Correlation is significant at the 0.01 level (0.917).

Table 5: The connectivity relationships between variables in order to study (jump phase)

	Collision					Push				
	Foot °	**Leg °**	**Knee °**	**Hip °**	**Trunk °**	**Foot °**	**Leg °**	**Knee °**	**Hip °**	**Trunk °**
Takeoff angle°	-.522	-.515	-.752	.007	.486	.731	-.607	-.656	-.474	-.947**
Sig.	.184	.187	.071	.495	.203	.080	.139	.115	.210	.007
jump-time	-.945**	-.535	-.544	.652	.084	.811*	-.754	-.862*	.013	-.540
Sig.	.008	.177	.172	.117	.447	.048	.071	.030	.492	.174

*Correlation is significant at the 0.05 level (0.811), ** Correlation is significant at the 0.01 level (0.917).

From Table 3, through the results of correlations the hop phase for our samples at the 0.01 level (1-tailed) and degrees of freedom (n-1), the correlations is strong negative significant in collision stage; foot angle with hop-time, and in push stage; trunk angle with take-off angle. While the results of correlations for our samples at the 0.05 level (1-tailed), the correlations is negative significant in push stage; knee angle with hop-time, and the correlations is positive significant in foot angle with hop-time also.

From Table 4, through the results of the Pearson correlation the step phase at the 0.01 level (1-tailed) and degrees of freedom (n-1) is negative significant in collision stage; trunk angle with take-off angle. And strong negative significant in push stage; leg angle with take-off angle.

From Table 5, through the results of the Pearson correlation the jump phase at the 0.01 level (1-tailed) is negative significant in push stage; foot and knee angles with jump-time. And strong negative significant in collision stage; foot angle with jump-time. And in push stage; trunk angle with take-off angle.

Based on the results obtained, we referred to the errors in the motor performance of the corners of the knee; trunk and leg during the end of the hop phase Contributes to performance deviations of the time and angle variables during push (takeoff).(Table 2)

The value of the knee angle in collision stage is very important in the preparation of the push process and contributes to the production of positive momentum for the second take-off in the step and jump phases [8]. Breadth of the knee angle to 170 degrees contributes to the digital level achieved significantly [9]. And our study of this research sample we see which that whenever the trunk angle closer to a 90-degree angle, the digital level increased. The trunk angle of the athlete contributes to maintaining the center of the body gravity, moving straight ahead horizontal and towards top the vertical, this is for preparation the push stage, for proper take-off [10]. The leg angle is important for pushing in all phases (hops, step and jump), where the leg angle is to add the most appropriate for motor performance the body, which varies between 24 and 47 degrees[11]. Paul B explained the objective of the hop phase is to achieve horizontal vertical velocity (going forward and up) of the takeoff board, not vertical horizontal velocity (up and forward as in the long jump) and any change should minimally in the step[12]. The study showed that, the contribution of the hip angle is important to maintain the centre gravity of body and direct it forward and upward, maintaining the value of the hip angle, ranging from 145° to 150°, contributes to the digital level. [13]. That all successive steps in triple jump begin by decreasing the horizontal speed. Where Bober mentioned, that the athlete compensates for horizontal loss of speed by increasing the push (take-off) in hop phase [14]. Miller issued a report that the time for longest triple jump had a fixed decrease at the step phase. While the average horizontal velocity decreases from one stage to another (9.59, 8.44, 6.93 m/s) respectively. The lowest average vertical velocity was in the step phase (1.88 m/s), then the jump phase (2.60 m/s) and the hop phase (3.89 m/s) [15].

4. Conclusions

From the purposes of this study, we recommend our coaches and their athletes the mean most used in assessment and scientific analyze in the triple jump, because the all phases in triple jump is related with the digital level achievement, allows us not only to analyses the different kinematic variables in the triple jump but also define the errors of practice in motor performance. Our results and recommendations: 1) there is a statistically significant the correlation in the collision stage (hop phase; the angle of trunk°) with the time and angle of push, 2) the problem of our elites is in the hop phase, and its relationship with; the step and jump phases

Our recommendations, for the national elites and their technical steps:

- using the biomechanics to determine the errors, and practice in scientific models theoretical, with Integrated the modern scientific methods into the program monitoring sports.
- respect the modality of the motor performance in each phases of the triple jump (collision and push) to improve the performances, and especially,
- maintaining horizontal and vertical velocity with improved routing during payment at each stage

References

[1] C. Beinke, Modelling Long Jump and Triple Jump Using Matlab. 2007.

[2] Z. Mohammed, M. M. Idriss, B. Ali, B. M. Nasreddin, and G. Abd-el-kader, “Relationships with the Finale Results,” J. Sport. Sci., vol. 3, pp. 179–185, 2015.

[3] L. Mendoza, E. Nixdorf, R. Isele, and C. Günther, "Biomechanical analyses of selected events at the 12th IAAF World Championship in Athletics, Berlin 15-23 August 2009," Nsa, vol. 26, no. 1, pp. 8–19, 2009.

[4] A. Guebli, M. M. Idriss, M. Zerf, and B. Ali, "Effect of angles (collision, absorption, dash) and their relationship with the Finale Results in triple jump," in THE 2IÈME CONGRÈS INTERNATIONAL DE L'ASSOCIATION AFRICAINE DES SCIENCES DU SPORT, 2016, pp. 1–59.

[5] J. G. Hay and J. A. M. Jr., "Techniques Used in the Triple Jump," Int. J. Sport Biomech., vol. 1, no. 2, pp. 185–196, 1985.

[6] R. Bartlett, Introduction to Sports Biomechanics. 2007.

[7] G. H. G. Dyson, B. D. Woods, and P. R. Travers, The mechanics of athletics. Holmes & Meier Publishers, 1986.

[8] J. A. M. Jr and J. G. Hay, "Kinematics of a World Record and Other World-Class Performances in the Triple Jump," Int. J. Sport Biomech., vol. 2, no. 4, pp. 272–288, 1986.

[9] C. Wilson, S. E. Simpson, R. E. A. Van Emmerik, and J. Hamill, "Coordination variability and skill development in expert triple jumpers," Sport. Biomech., vol. 7, no. 1, pp. 2–9, 2008.

[10] J. G. Hay, "The biomechanics of the triple jump: A review," J. Sports Sci., vol. 10, no. 4, pp. 343–378, 1992.

[11] S. Fukashiro, Y. Iimoto, H. Kobayashi, and M. Miyashita, "A biomechanical study of the triple jump," Med. Sci. Sports Exerc., vol. 13, no. 4, pp. 233–237, 1980.

[12] M. Ramey, "Biomechanics of the long jump and triple jump," Ann. Int. Symp. Biomech. Sport., no. C, pp. 251–265, 1982.

[13] S. Fukashiro and M. Miyashita, "An estimation of the velocities of three take-off phases in 18-m triple jump," Med. Sci. Sports Exerc., vol. 15, no. 4, pp. 309–312, 1983.

[14] J. Perttunen, H. Kyrolainen, P. V Komi, and A. Heinonen, "Biomechanical loading in the triple jump," J. Sports Sci., vol. 18, no. 5, pp. 363–370, 2000.

[15] B. Yu, "Horizontal-to-vertical velocity conversion in the triple jump," J. Sports Sci., vol. 17, no. 3, pp. 221–229, 1999.