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Effect of Using a Contemporary Method to Some Biomechanical Variables and Record Level in the Discus Throw

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Abstract: Throwing competition is considered one of the field events in athletics, where the competitors aim is to achieve the greatest horizontal distance. Each stage of the movement stages has great importance in achieving the motor outcome, the athletics international regulations verifies that the throwing circle diameter is 2.50 meters, where the player performs a turn and a half. When developing the record level the world is directed to develop the physical fitness level or reaches the technical performance mechanism, therefore the progress in the record level is slow due to the close level of fitness among the players in all countries. The researcher endeavored to simulate the evolution of the record level through introducing Novelty technical performance to the throwing discus competition where the record level could be developed in a manner which depends less on the progress of the physical fitness level and mechanically increase the level of skill performance to increase the record level and in the same time does not conflict with the competition's regulations, represented in linking between the hammer turn and the discus turn as a Novelty technical performance. The descriptive method was used on a sample of one compound player.

Key words: Projectile % Acceleration distance % Engineering path

INTRODUCTION

The throwing discus competition is considered one of field events in athletics, where the competitors aim is limited in achieving the greatest horizontal distance. Each competition has its technical stages that enable the player to achieve the desired goal, thus the discus stages are (holding the tool, preliminary swinging and posture, turning, throwing posture, throwing and balancing) each of these stages have great importance in achieving the motor outcome [1]. The athletic international regulations verify that the throwing circle diameter is 2.50 meters, where the player performs a turn and a half with a speed enables him to prepare well for throwing in order to record the greatest horizontal distance. Turning is the third technical stage that directly affects the correctness or failure of the attempt. The researchers will review the problem of the research that provoked them to conduct the recent study [2]. When developing the record level, the world is directed to develop the physical fitness level and attempts to reach the technical performance mechanism. Therefore, the progress in the record level is simple due to the close level of fitness among the players in all countries.

The researcher endeavored to simulate the evolution of the record level through introducing contemporary technical performance to the throwing discus competition where the record level could be developed in a manner which depends less on the progress of the physical fitness level. The research aims to:

- Identify the validity of applying the contemporary technique according to the legal specifications.
- Compare between the traditional method (1.5 turnovers) and the contemporary method (2.5 turnovers), in light of the technical stages, foot work, discus's movement engineering path and the mechanical factors affecting the throw distance and the record level.

Terminology of the Research

Projectile: Any object acquired primary speed and left to move under the impact of an external force such as gravity or air resistance [3].

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The Motor Path: The connected line drawn by the center of gravity during the body movement concerning a group of coordinates [4].

Displacement: The outcome of the distances moved by a body away of the starting point [5].

Acceleration Distance: The distance moved by the tool from the beginning to move until the moment of push off' (operational definition).

Turnover Movements: The movements where the body paths draw curved paths [1].

Factors Affecting the Throwing Distance

Projection Angle: The angle between the aviation curve tangent and the parallel line to the horizontal level [1].

Projection Speed: The speed of the ballistic [1].

The Height of the Projection Point: The maximum height the ballistic can reach from the surface of the earth at the moment before push off (operational definition) [4].

MATERIALS AND METHODS

The researchers have depended on two methods. The descriptive method was used for the motor analysis and the experimental method to ensure the impact of the contemporary method on some of the biomechanical variables and the record level in discus throwing. A classified deliberately sample was selected of one decathlete, who holds the second place of the first degree at the republic's level on 2007 (1.91 m height, 82 kg weight, 21 years old and 41.80 meters registered record level).

The factors affecting the throwing distance are represented in the height of the projection point, projection angle and projection speed. The height of the projection point depends on the player's anthropometric measurements; the projection angle depends on adjusting the technical performance, where the projection speed depended on the player's physical ability which is affected by the training process. Moreover there is the displacement that represents the distance moved by a tool starting from moving to projection, as the distance increases a high projection speed can be generated at the end of the stage [6]. Therefore, the discus throw competition needs acceleration distance to project the discus with high speed as speed of the affecting factors to throwing distance.

Considering the preliminary stage of the discus throw is anti-turnover direction (back swinging), the main movement in the direction of moving starts from a static position, thus the tool's speed starts from zero and increases during turning until the tool projected out from the thrower arm in direction of the section, this means as the turnover time decreases the projection speed increases. When performing the 1.5 turnovers, the beginning speed is zero and the finish speed is X, while when performing 2.5 turnovers there would be 1 hammer turnover + 1.5 discus turnovers and thus the starting speed within the 1.5 turnovers is greater than zero and the finishing movement speed at push off is (greater than X) that is required to be conducted when developing a biomechanical variable affecting the record level (the tool's projection speed) which physical training seeks to develop along with the stability of other variables.

RESULTS AND DISCUSSION

While conducting the motor analysis process of the two methods (traditional and contemporary), concentration was paid to main two parts as follows:

First: Applicability: Good movement is characterized with streamline performance in terms of the absence of any performance's technical obstacles during the motor path. Thus, linking between hammer turnover and discus turnover may need high skill in balancing as the player pivots during transferring on the lateral first quarter of the foot front, where the inside turnover takes place in its direction. Moreover, streamline performance can be detected through the speed rates of the discus. This is verified from Table 1. Table 1 illustrates that when the discus starts spinning at the traditional method the speed was 0.00 m/s, meaning a momentum stop of the discus when starting spinning as swinging was conducted anti-direction of movement, while at the contemporary technique speed was 4.58 m/s, that means the discus has a speed at the start of this stage resulting in that the discus starts spinning speed in the contemporary method is greater than the traditional method.

Fig. 1 illustrates the speed semi-linear increase and the non-refraction of the curve during performing the two methods (traditional - contemporary) which is a logic outcome where contemporary technique streamline can be proved, as well as the player was able to perform the skill inside the circle without losing balance or stepping out of the circle.

Table 1: The gained speed (m/s) of the discus starts spinning stage at both methods (contemporary–traditional)

Time (s)	Stage	Traditional (m/s)	Time (s)	Stage	Contemporary (m/s)
			---	Preliminary swinging anti-direction.	2.58
					1.33
					0.75
					0.25
			1.08	Hammer turnover stage (1turnover)	0.00
					0.40
---	Preliminary swinging anti-direction.	3.00			1.08
		1.60			1.67
		1.00			2.33
		0.53			3.00
		0.25			3.67
2.28	Discus turnover stage (1.5 turnover)	0.00	1.32		
	Discus turnover stage (1.5 turnover)	4.58			
		0.72			5.33
		1.78			6.17
		3.04			7.08
		4.29			8.00
		5.73			8.92
		7.28			10.00
		9.01			11.13

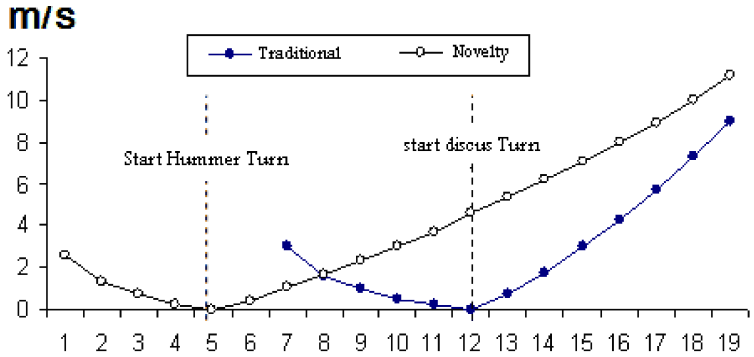


Fig. 1: The gained speed of the discus starts spinning stage at both methods (traditional, contemporary)

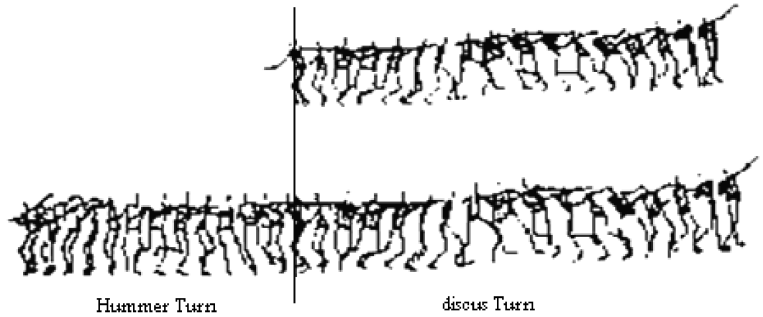


Fig. 2: Division of motor sequence (for the contemporary technique)

Table 2 illustrates the increase in the technical stages number at the contemporary technique (7 stages) than in the traditional method (6 stages), hammer turnover followed by discus turnover to become 2.5 turnovers.

Table 3 illustrates that hammer turnover that precedes discus turnover led to decreasing the time which the discus spins at the contemporary technique (1.08 s) than the traditional technique (1.48 s) with a difference of 0.4 s, that resulted in an increase in the turning speed at the contemporary technique. When the researcher explained this phenomenon (the small time of discus turnover at the contemporary technique) found out that the discus turnover (1.5 turnovers) at the traditional method starts from a static posture where the discus turnover at the contemporary technique starts from movement represented in the hammer turnover.

Table 2: The technical stages at both methods (contemporary–traditional)

No.	Traditional	No.	Contemporary
1	Holding discus	1	Holding discus
2	preliminary swinging and posture	2	preliminary swinging and posture
---	----------	3	Hammer spinning (1turnover)
3	Discus spinning (1.5 turnover)	4	Discus spinning (1.5 turnover)
4	Throwing posture	5	Throwing posture
5	Throwing	6	Throwing
6	Balancing	7	Balancing

Table 3: Time differences (in seconds) of the technical stages at each of the two methods (contemporary 2.5 turnovers - 1.5 Traditional turnovers)

	Contemporary		Traditional		
No.	Stages	Time	Stages	Time	Differences
1	Preliminary swinging	-----	Preliminary swinging	-----	-----
2	Hammer turnover	1.08	-----	-----	-----
3	Discus turnover	1.08	Discus turnover	1.48	-0.4
4	Throwing posture and throwing	0.24	Throwing posture and throwing	0.28	-0.04
5	Balancing	0.72	Balancing	0.52	0.2
Total	3.24	Total	2.28	0.96	

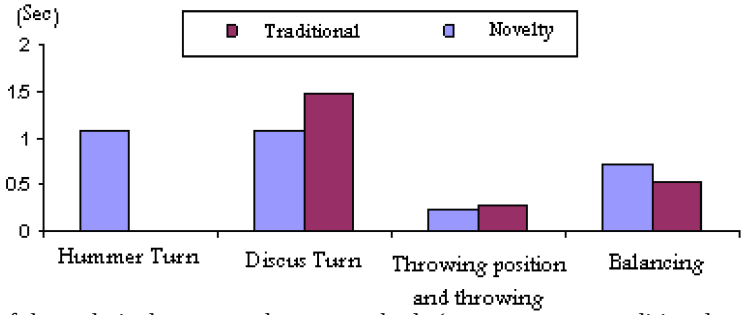
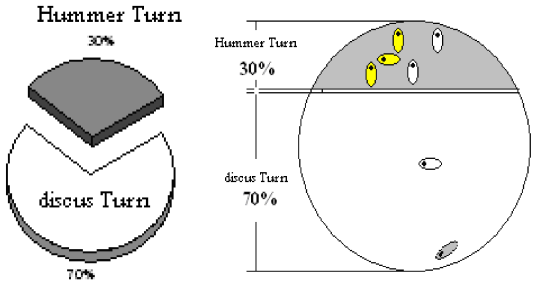
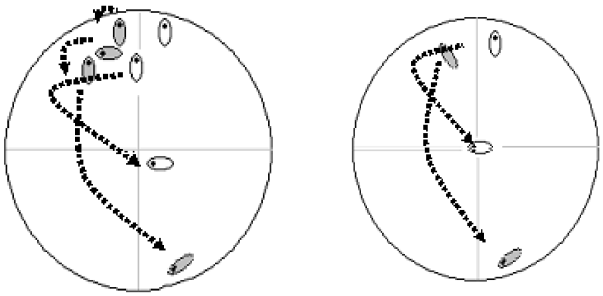


Fig. 3: Time differences of the technical stages at the two methods (contemporary- traditional



Percentage Foots

Fig. 4: Contribution percentage of the foot work inside the circle at the contemporary technique



Contemporary (2.5 turnover) Traditional (1.5 turnover)

Fig. 5: Foots pivoting positions in the circle at both methods the traditional and the contemporary technique

Table 4: Contribution percentage of the foot work inside the circle at the contemporary technique

The method	Distance (mete)	Percentage (%)
Hammer turnover	0.75	30 %
Discus turnover	1.75	70 %
Total	2.50	100 %

Table 5: The length of the engineering path of the discus movement at the traditional method and the contemporary technique

The method	Path length (meter)	The increased percentage of the contemporary
The traditional	8.43	1.66 %
The contemporary	14.03	

Table 6: Differences in factors that affect throwing distance in the two methods (traditional-contemporary)

The method	Projection speed (m/s)	Projection angel (‘2) (degree)	Projection height (h) (meter)	Record level (meter)
Contemporary	19.36	30.05	2.13	44.28
Traditional	17.84	41.42	2.23	41.80
Differences	1.88	-11.37	-0.10	2.48

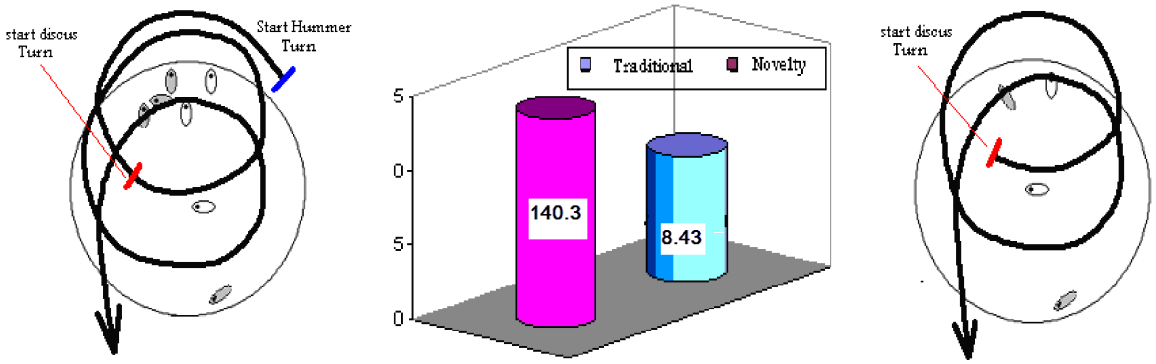


Fig. 6: The engineering path shape of the discus movement both the traditional method and contemporary technique

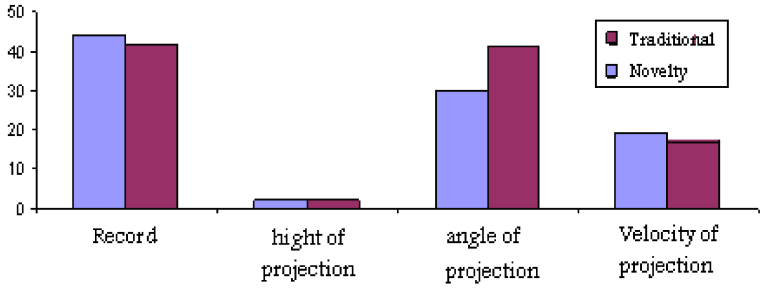


Fig. 7: Factors affecting throwing distance in the two methods (traditional-contemporary)

Table 4 illustrates that the contemporary technique works on the integration of foot works together at each of the hammer and discus turnovers. Figure 5 shows the contribution percentage of the foot work at the contemporary technique as 30% for the hammer turnover (1 turnover) and 70% to the discus turnover (1.5) turnover, respectively. Therefore, the turnovers at the contemporary technique are 2.5 turnovers.

Table 5 illustrates that the record level of the contemporary technique reached 44.28 meters, where the player scored an increase of 2.48 meters than his record of the traditional method (41.80 meters) with a percentage of 5.93%; the researcher attributed that to the discus speed at the moment of projection at the novelty technique.

Table 5 illustrates the increased engineering path length of the contemporary technique (14.03 m) than the traditional method (8.43 m), which was followed by an increase in the record level reached (2.48 m) as shown in Table 6.

Second: the Factors Affecting the Throw Distance: These factors are represented in projection speed, projection angel and projection point height.

CONCLUSION

- The Novelty technique is applicable.
- The Novelty technique increases the record level (6%) than the previous state without developing the physical abilities.
- The engineering path length of the discus increased at the Novelty technique than the traditional method.
- The hammer turn represents (30%) where the discus turn represents (70%) at the Novelty technique.
- The Novelty technique characterized at the final projection speed by (10.75%) than the traditional method.

RECOMMENDATIONS

- The importance of caring for developing techniques at the track and field competitions, in order to improve the record level.
- As the player reaches the mechanical performance at the traditional method (1.5 turns) must train the Novelty technique (2.5) turns, in order to develop the record level.
- Caring for developing techniques at the track and field competitions in order to improve the record level.
- As the player reaches the mechanical performance at the traditional method (1.5 turnovers), he must train the contemporary technique (2.5 turnovers) in order to develop the record level.

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