

The Effect of Specific Training Program on Some Mechanical Variables of Javelin Release Phase

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Abstract

Abstract. This study aimed at identifying the effect of specific training on some mechanical variables of javelin release phase of students of Athletics major, Faculty of Physical Education for boys and girls, Port Said, Egypt. The research sample included 5 students selected by intentional method. Both researchers used the experimental method, applying the experimental design of one experimental group through pre and post-test. They also filmed on photo video both pre and post-tests, using a single camera frequency 25 field/sec. The kinetic analysis is applied by using Maxtraq on line Manual Version 5.5. They, additionally, used SPSS in statistical data processing. The findings of the study resulted in illustrating the positive effect of the proposed training program on improving the performance level of javelin throw event, release angle and release velocity, horizontal release velocity, vertical release velocity, and the height of release.

Key Words

Athletics – Javelin – Specific Training – Mechanical Variables

Preface

The javelin throw event considers one of the basic competitions in athletics, which aims at throwing the javelin to the farthest possible horizontal distance. Javelin is like any projectiles influenced by the release angle, release velocity, and the height of projectile at the moment of release [1, 2]. A gap between the Egyptian record and the rest of the international records is cleared through researchers pursuing the track of digital levels to qualify athletes for the Olympics and International championships, as well as standard digital level in various international championships. This could be due to the scarcity of quality training programs that depend on the form of performance and the effect of these programs on the mechanical performance of the javelin. The researchers also noticed, during the survey of related studies in the javelin competitions, that the objectives of these studies are different. One of these studies, on one hand, concerned about evaluating kinematics variables, statistically processing, and utilizing them for the development of performance technique [3, 4, 5, 6, 7, and 1]. Another one concerned about physical characteristics of javelin players [8, 9, and 10]. While a study concerned about studying physical and body characteristics and their relationship to the digital performance level of javelin. The other one concerned about studying physical characteristics and their impacts on kinematics performance of javelin [11, 12]. Both researchers found, according to their knowledge, no study focused on the effect of specific training programs on the mechanical variables of jav-

elin release phase, and then the research problem highlights.

Research Objective. The research seeks to identify the effect of specific training on some mechanical variables of the phase of javelin release and the digital performance level of javelin.

Research Hypothesis. There are statistically significant differences between each of pre and post-tests of research sample in mechanical variables and the performance level of javelin throwing in favor of the post-test.

Research Methodology Both researchers used the experimental method, applying the experimental design of one experimental group through pre and post-test.

Research Sample. Research sample was intentionally selected of major fourth-year students. Sample size was 5 Students enrolled in the Egyptian Federation of Athletics. Each of them has performed six attempts, and failed attempt was excluded while the best right ones were chosen. Homogeneity among the members of the research sample was considered in mechanical variables under study.

Data Collection Tools.

Photo Video: Both researchers filmed video of pre and post-test in the Faculty of Physical Education for boys and girls, Said University, using Panasonic video camera with Frequency of 25 field/sec.

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The camera was placed on a tripod on a distance of 10 M and a height of 1.5m from the ground as in the form (1).

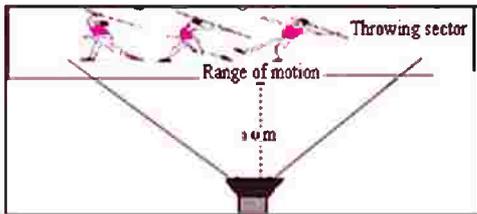


Figure (1) Scheme of the location of the camera during filming

Video Film Analysis: Kinetic analysis of skill under discussion has been conducted in both pre and post-tests, using Maxtraq on line Manual Version

5.5. Both researchers extracted the mechanical variables according to the kinetic analysis model of the skill under study as in form (3). They also calculated the torque through the equation $T = D \cdot W$. While (T) represents the torque, (W) is the body weight and (D) is the horizontal distance from the vertical line of the point of the center of the body gravity until the front pivot foot [13, 14, 15, and 16].

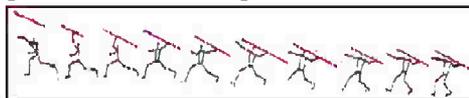


Figure (2): Sequential photos of the javelin release phase

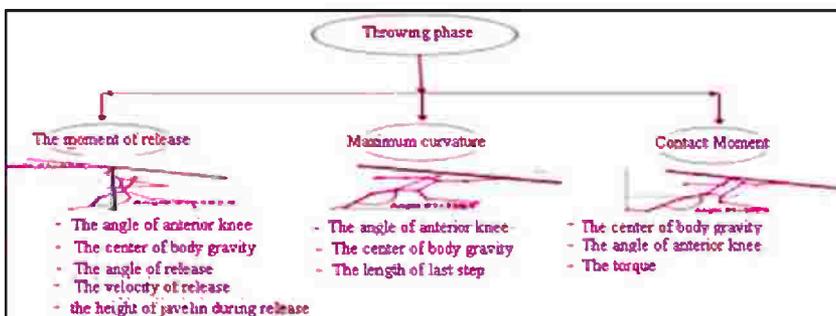


Figure (3): Schematic model of mechanical variables extracted from the kinetic analysis of the skill under study

Training Program.

The period of the program was one month involving 6 training modules per week. The time of each module was about 120 minutes.

Training loads were mostly in the maximum limits and less than the maximum.

The objective of the training program was to develop the velocity of the

javelin throw event, develop both special ability and strength, and achieve the ideal technique of courses. In addition to developing the special arm strength of javelin thrower, improving agility and flexibility in general, accessing to optimal technique, and reducing kinetic errors during the performance.

The program involved training similar to the performance, training

to strengthen the legs' muscles, by using medical balls, training using throwing by rubber. It also included training to develop the capacity of the legs muscles, the ability of the

back and abdomen muscles, weights training, ABC training; moreover, training to develop the technique and training to develop the ability of thrower's arm.

Results

Table (1)

the significance of statistical differences of Wilcoxon signed-rank test between pre and post-test and the improvement ratio of the mechanical variables at moment of foot contact of initial javelin release phase. n = 5

Variables	Measurement Unit	Pre-test		Post-test		Total signals		Z value	Sig. level	Progress ratio
		Q	±P	Q	±P	-	+			
Akt	Degree	163.80	7.85	169.20	3.38	-	15	-2.060	*0.039	3.30
T	n.m	2067.96	389.92	2349.51	437.98	-	15	-2.032	*0.042	13.61

* Statistically significant at the level of 0.5

Table (1) indicates the Significance of statistical differences of Wilcoxon signed-rank test of the experimental sample between pre and post-test of mechanical variables during the moment of foot contact at the beginning of javelin release phase. The calculated z value of Wilcoxon signed-rank test

ranged between -2.060 and -2.032. It was less than the tabulated z value in the angle of anterior knee (Akt), and torque (T), which indicates that there are statistically significant differences in these variables. The improvement ratio was confined between 3.30 and 13.61%.

Table (2)

the significance of statistical differences of Wilcoxon signed-rank test between pre and post-test and the improvement ratio of the mechanical variables during maximum knee flexion during javelin release phase. n = 5

Variables	Measurement Unit	Pre-test		Post-test		Total signals		Z value	Sig. level	Progress ratio
		Q	±P	Q	±P	-	+			
Ls	cm	158.20	17.27	165.80	10.06	-	15	-2.032	*0.42	4.80
AKB	Degree	143.60	7.83	152.0	6.67	-	15	-2.041	*0.041	5.85

* Statistically significant at the level of 0.05

Table (3)

the significance of statistical differences of Wilcoxon signed-rank test between pre and post-test and the improvement ratio of the mechanical variables at moment of foot contact of initial javelin release phase.

n = 5

Variables	Measurement Unit	Pre-test		Post-test		Total signals		Z value	Sig. level	Progress ratio
		Q	±P	Q	±P	-	+			
AR	Degree	43.81	2.20	38.56	1.43	15	-	-2.023	*0.042	11.98
VR	M/sec	17.49	2.05	19.43	1.81	-	15	-2.023	*0.043	11.09
Vx	M/sec	12.59	1.26	15.18	1.34	-	15	-2.023	*0.043	20.75
VY	M/sec	12.13	1.74	12.12	1.31	10	5	-	0.50	-
LR	c.m	164	9.62	173.20	11.12	-	15	-2.121	*0.034	5.61
t	sec.	0.48	0.03	0.43	0.02	15	-	-2.032	*0.042	10.42
Record	m	50.28	1.53	53.28	1.64	-	15	-2.023	*0.043	5.97

* Statistically significant at the level of 0.5

Table (3) indicates the Significance of statistical differences of Wilcoxon signed-rank test of the experimental sample between pre and post-test of mechanical variables during the moment of javelin release phase. The calculated z value of Wilcoxon signed-rank test ranged between -0.67 and -2.121 . It was less than the tabulated z value in the release angle (AR), release velocity (VR), horizontal release velocity (Vx), the height of javelin during release (LR), the time of release phase, horizontal distance to throw the javelin (Record). This indicates that there are statistically significant differences in these variables. The improvement ratio was confined between 0 and 20.75%.

Results Discussion

The results of table (1) indicates that there are statistically significant differences in each of the angle of anterior knee during the moment of foot contact at the beginning of javelin release phase, and torque of the members of research sample in favor of post-test. The researchers concludes these results of the members of the research sample in post-test to the training program, which included training similar to the performance and also targeted the development of the core muscles to perform the skill. Both researchers also took into account the principle of individual differences of each player as each player lead training on the basis of his/her maximum force. The program includ-

ed training to strengthen the muscles of the legs, such as broadband jump, weightlifting (the snatch) and weights half squat, hops and triple jump, and ABC training, resulting in increase the strength of legs muscle, which in turn led to the ability to curb the movement during the pivot step through the extension of anterior knee. This helped the thrower to stop and control the use of the kinetic energy the player gained by approximate running and converted into potential energy during the stop and then be transferred to the kinetic energy making the javelin earn more velocity during release [10].

The program; in addition, included exercises using medical balls of different weights, exercises using throwing by rubber, weightlifting, which in turn led to an increase in the angle of knee and increase the distance of the center of body gravity of the line pivot. To do so, the torque increases and thus contributes to increase the velocity of javelin release, which refers to the increase of the velocity of javelin release, but be positively affected by increasing the torque due to increased horizontal distance between the feet of pivot and center of body gravity. Thus, this provides the player a great base that can be relied on as a counter strength to the segments of torso, hand and those throwing the javelin. And thus, they provide kinesthetic through increasing the movement of torso and hands; in addition, the thrower hands earned high peripheral velocity with increasing radius [13, 14].

The results of table (2) indicate that there are statistically significant differences in each of the angle of anterior knee and step length at the moment of maximum curvature during the javelin release phase of the members of the experimental research sample for favor of post-test. Both researchers contribute these results of the research sample in the post-test to the training program, which included exercises led to improve the ability of the legs' muscles and the ability of the muscles of the back and abdomen. Moreover, it resulted in the flexibility and the ability of the muscles involved in skill performance, which led to an increase in angle of the knee and lower the center of body gravity, leading to enlarge the pivot base and increase the length of stride. Thus, a space of time has become available contributing to the transmission of correct movement from the trunk of the throwing arm [14].

The results of table (3) indicate that there are statistically significant differences in each of the angle of release and velocity of release and velocity of horizontal release and the height of javelin during release and the time of release phase and the horizontal distance to throw the javelin of the members of the experimental research sample for favor of post-test. Both researchers attribute these results of the members of the research sample in the post-test to the training program. It involved exercises to develop performance technique and improve the special ability of thrower's arm, which helped in achieving the objective physical and mechanical mo-

tor duty. The average of javelin release angle was reduced from 43.81 degree to 38.56 degree, which approaches the optimum angle of javelin release [2].

Lower average of release angle also led to increase the velocity of the horizontal release at the expense of the velocity of vertical release, which contributed in improving the horizontal distance of javelin throw where:

It becomes clear the effect of both the release angle (θ), the velocity of release (VR), the velocity of horizontal release (V_x), the velocity of vertical release (V_y), the height of javelin during release (h), and gravity wheel (g) on the horizontal distance of the javelin (R). These procedures were developed for the experimental sample where the average of the velocity of javelin release increased in the post-test from 17.49 degree to 19.43 degree. As the continuation of the player at full velocity gained during the approach is the basic mechanical variable of the velocity of javelin release. However, some relative decline in velocity resulting from body bending to the back, the rotation of the upper part about transverse and longitudinal axes, and at the same time, increase the determination of weight as a result of increasing the length of pivot step are all variables working to reduce velocity. Therefore, the player must have the ability to control body position so that she/he can maintain the acquired

velocity of the arms of researchers in the training program taking into account these factors.

The average height of the javelin during release was from 164 cm to 173.20 cm. Both researchers attribute this improvement in the height of javelin during release to the training program. It included exercises similar to the performance technique, taking into account the mechanical principles during motor performance. As well as the program included exercises to strengthen the muscles of the legs, which in turn contributed to the increase the pivot base by increasing length of the last step. This helped the player in getting large fulcrum base that increased the muscular balance of the player [17].

The average of horizontal distance of javelin throw also increased from 50.28 m to 53.28 m. The researchers attribute the improvement in the horizontal distance of javelin throw to the training program and its components. They contribute to develop the factors that affect the horizontal distance of javelin throw such as release angle, release velocity, and release height [18, 16, and 15]. Thus, the research hypotheses are achieved indicating that there are statistically significant differences between each of pre and post-tests of the research sample in the mechanical variables and the performance level of javelin throw in favor of the post-test.

Conclusions

In light of the research sample, the accuracy of data collection tools, and results achieved by both researchers, it could be concluded the following:

1- Specific training program contributed in developing the completion level of javelin throw.

2- Specific training program contributed in developing mechanical variables.

3- There are statistically significant differences between pre and post-test of the experimental group and in favor of post-test in all research mechanical variables except vertical velocity at the moment of javelin release.

Recommendations

1- Specific training program are used to develop the level of javelin throw.

2- Using specific training program contributes in developing mechanical variables of different aspects of the technical performance of the javelin.

3- Similar researches must be conducted on more competitions in the track and field.

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