RESEARCH ARTICLE

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An Analytical Study of Some Biomechanical Variables and Achieving Fingerprinting in Discus Throwing for Applicants

Haider F. Alamiri and Maher J. Ameen

ABSTRACT

The effectiveness of discus throwing is one of the activities that require special physical abilities and mechanical conditions aimed at achieving the best horizontal distance for this competition, and performance is associated with achieving the highest instantaneous strength and rapid strength in the muscles of the working body, especially the trunk, legs and arm shooting, and the researchers believe that the amounts of these forces can give a good indication of what is supposed to be achieved from the integration of skill performance, which aims to achieve the highest speed at the end of the arm shooting, so the control of the values of these The forces, especially the two legs through the device (Dyna foot) can help the researcher to make the right decision if these forces are optimally exploited to achieve integration of performance, as well as monitoring the amount of pressure and force affecting the weight of the thrust and the extent to which these variables are used to identify errors and develop solutions to improve the exertion of the appropriate special force for them, and the researchers assumed that there is a significant correlation between the momentary force exerted by the two legs when placing the throw with the biomechanical variables of the throwing performance, The researchers used the descriptive analytical approach to process data and information related to the nature of the problem. The researchers chose a sample of Iraqi heroes with a number (4) elite disc shooters, and the researcher concluded that there is a significant correlation between the momentary force and the pressure exerted by the feet and the momentary force in the trunk and arms with some biomechanical variables to perform in the discus throw, as well as between the rapid strength of the legs with the variables of the disc launch.

Keyword: biomechanical variables, fingerprint, discus throw, motion analysis.

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I. INTRODUCTION

Analyzing the athlete's movements and obtaining results and data on performance effectively entered into detecting errors and identifying defects, preparing special exercises, through the application of mechanical laws and investing them during movement performance (Alamiri *et al*., 2020), and revealing strengths and weaknesses in performance to reach the best technique for motor performance, as Kinetic analysis contributes to the development of appropriate treatments by correcting performance by choosing special and appropriate exercises, which contributes to raising the level of sports.

The discus throw is an activity that requires special physical specifications aimed at achieving the best achievements, and these physical characteristics include the instantaneous explosive force in both arms and legs as well as the rapid strength of the legs (Bartlett, 1992), so that the performance is integrated, strong to achieve a level of distinctive motor compatibility. The emphasis on achieving the required biomechanical variables associated with instantaneous thrust and integration in the muscles working with the legs, trunk and arms at the moment of throwing or rapid force, which is an important necessity in achieving the required acceleration when switching from the stage of preparation for throwing to the stage of throwing while maintaining as much as possible the momentum gained during this period with the least possible decrease in it and the implementation of the throw with the highest amount of performance and correct mechanics, with the aim of achieving the farthest horizontal distance of the disk (Schmidt, 2003), and this requires that the magnitudes of the types of instantaneous forces be compatible in achieving the best paths and biomechanical variables to harness them in controlling the required force and placing the foot of the front arm legs in the shortest possible time to ensure the achievement of The best mechanical position of the body parts and the continuation of the acquired angular momentum and its transfer

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between the parts of the body until the throw and disposal of the disc with high movement compatibility to ensure success in performing the technical stages of the competition (Balakrishnan and Wernerfelt, 1986).

The discus throw event is an event with complex technical performance and takes time to develop the achievement. Therefore, it needs effective training based on measurements and the foundations of regular training, especially if we know that the effectiveness of discus throwing requires athletes with high speed and strength to be highly physically capable and this can only be done through exercise. It is also known that the mechanical goal of discus throwing activity is to achieve the fastest discus speed while rotating up to the throwing and throwing mode (Pavlović, 2020), to achieve the level that the discusser wants to achieve, which is to reach the disc to the maximum possible horizontal distance without decreasing this speed during throwing, which is related to the weakness of the mechanical conditions of the disc thrower and the starting variables, which affect the non-continuation of the speed of body parts, and the magnitude of The pressure exerted on the foot on the ground, and the instantaneous force of other parts of the body (Van der Tol *et al*., 2003). Hence the importance of research in the study of some biomechanical variables that are related to the magnitudes of the force at the moment of throwing the disc and the compatibility of these forces with the position that the front and back legs of the foot are supposed to take at the moment of launching the disc (A.P.D. H. F. Alamiri, 2020). And the relationship of this to the achievement, in order to reach the best biomechanical conditions for the position of the legs and the appropriate momentary thrust, which is associated with achieving the best angle momentum for the parts of the body contributing to performance and to ensure that the speed and angular momentum do not decrease before and after the launch of the disc, and the researchers were keen to obtain data using technical devices that are characterized by accurate measurement, and these devices (Dyna foot) (Sironić, 2017) which is a device for analysis in detecting the values of the amount of pressure, force exerted and contact time and the extent to which these variables are used to identify errors and develop the necessary exercises and develop appropriate special exercises for them (Holzman *et al*., 2007), and this is what implies the importance of research as a serious attempt to identify the current mechanical situation of throwing to weaking and studying the smallest details of this case, and taking advantage of modern scientific devices and tools to indicate weaknesses and strengths and diagnose errors on the basis of which special exercises are built without neglecting any important aspects of the performance mechanism (Krishnan *et al*., 2020), the study aimed to identify some biomechanical variables of the fingerprint and the completion of the research sample, using the Dyna foot system through an analytical study of discus throwing for applicants. , and the researchers assumed that there is a significant correlation between the momentary force exerted by the two legs when placing the throw with the biomechanical variables of the throwing performance.

II. Materials and Methods

A. Methodology

The researcher used the descriptive analytical approach to process data and information related to the nature of the problem. The causal method is the one in which the researcher tries to determine the cause of the differences in the behavior or condition of a group of individuals (H. F. ALamiri, 2020), the researcher chose a sample of Iraqi heroes amounting to (4) archers in the discus throw competition for Iraqi champions, for the time period from 9/11/2019 to 8/12/2019 . In the field arena and field at the Faculty of Physical Education and Sports Sciences / University of Kufa, the researcher used the device and system (Dyna foot) produced by (TECHNO CONCEPT) French, a global company in the manufacture of mechanical devices that simulate sports performance, an integrated system to give an integrated set of motor and motor variables (Alcocer *et al*., 2012), It is easy to use as well as navigate and data can be given by broadcasting information remotely, as well as there are multiple measurements of the body of the device commensurate with different sneakers and the measurements of the variables are recorded according to the readings of the device (Dyna foot), the system consists of a foot pedal equipped with With sensors placed directly under the foot and on the base of the shoe, giving us the amount of mechanical pressure and force distribution as well as other motor parameters related to the balance of the feet and the difference between them, as well as the location of the foot and the pressure with the feet, both heel and metatarsal, both for the left or right foot (Roberts, 2014). The sensors contain a system that integrates speed and gravitational field, and allows us to detect biomechanical variables that accompany the movement of the feet in real time with the movement of the body and give selected schematic models, and the system consists of four parts, namely a data delivery base and a signal receiver that connects to the laptop and receives the signal from a distance of 20 meters, and an electronic clock and the system works after wearing the device with the player's tested leg and fixing it on the opponent's leg, installing the step sensor on the player's foot and entering Data on the player's age, height, weight and gender, the

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system measures the strength exerted by each man, the strength of the force, its time, the pressure expended, the image of the foot, the curves of strength and pressure (Bergmann and Irschick, 2006), and as shown in Fig. 1.

III. RESULTS

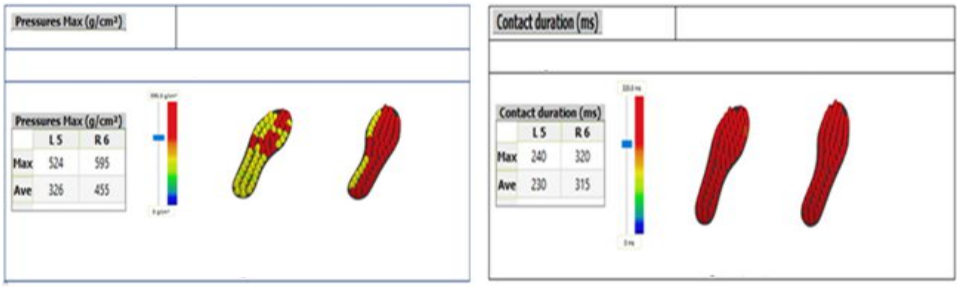

Fig 1. Pressure max. for print foot at contact direction.

TABLE I: CORRELATION BETWEEN INSTANTANEOUS FORCE AND PRESSURE VARIABLE S WITH ACHIEVEMENT OF THE RESEARCH SAMPLE

Variables	Unit of measurement	Going to-	Standard deviation	Link	Themorale	Significanc e
Front leg strength	Newton	1985	0.101	0.88	0.026	D
The time of the front leg force	Second	0.39	0.123	0.75	0.034	D
Rear leg strength	Newton	1234	1.250	0.91	0.001	D
Rear leg power time	Second	0.354	0.150	0.71	0.012	D
Front leg compression	Pascal	74.,88	56.277	0.86	0.002	D
Back leg compression	Pascal	685,00	53.344	0.79	0.028	D
Achievement	Meter	50.40	0.80			

The arithmetic media of the variables of instantaneous force, its times, compressive force and instantaneous thrust efficiency indicate that the sample members have instantaneous muscle strength, especially at the moment of throwing, which corresponds to the improvement of the values of the arithmetic mean in these biomechanical variables, and that the exercises used by the sample members in accordance with the scientific foundations associated with biomechanics have achieved their goal, which is to develop the instantaneous forces and the associated effort of the instantaneous force and reduce the time of exerting this force. As well as creating a state of adaptation by the workforce to body parts contributing to the instantaneous performance of disc throwers (Dello Iacono & Seitz, 2018), from the results presented in Table I, it was found that the instantaneous force variables of both the front leg (brakes) and the rear leg (driving leg), as well as in the index of compressive force applied to the front foot and the efficiency of immediate thrust (Fulford *et al*., 2013), The researcher attributes this by controlling the values of the resistance arm when training with these tools and devices, which were applied by the members of the research sample that worked to develop the torque force for different parts of the body (arms, legs, and trunk), taking into account the time of skill performance during the use of these resistances, where the researcher confirmed that the momentum of pushing the force was appropriate for the momentary force exerted in the legs, arms and trunk during the last throwing moment (Kang *et al*., 2015), and that all the exercises that were used to develop these moments in the body parts improved the efficiency of muscle contraction force, the strength of the ligaments in producing torque force and the principle of adding weights to body parts when applying motor performance and according to the angles required for performance with changing points of impact of resistance and their distance from the axis of rotation showed the superiority of increasing strength and muscle mobilization and efficiency (Croix, 2007), as well as the nervous instructions associated with this effect in the player, and this affected the development of the ability to feel strong in dealing with these weights to finally be a great control over the performance of muscular work during performance, and to emphasize the application of good technical performance and this is what served the technical performance and the angles achieved in it, which made the efficiency of immediate payment develop. On the other hand, heavily used weights are below the maximum when training, which increased speed with constant resistance, all this gave a positive effect on the development of instantaneous strength and its time. This development improved the speed of body parts and tool as well as attention to mechanical aspects of performance when applying (Beilock *et al*., 2002). From the above, the researcher believes that paying attention to the level of development of muscle strength surrounding the joints of the body is important to be taken into account by workers in the field of training according to the theory of moments, taking into account the technical aspects of performance (Adams, 2013), and knowing the impact of the correct

application of torque training on the development of performance indicators according to the relevant biomechanical indicators in order to reach the best achievement in the effectiveness of discus, since the human body is a set of levers and levers, Use biomechanical principles to develop and conform to strength level when performing these exercises based on these principles (Hay & Yu, 1995). This suggests that it is possible to emphasize the development of momentary strength and skill by one when training and in proportion to the achievement of flow in movement and speed when performing discus throwing skill. One of the results indicated in the same table was an improvement in the position of the brace on a smaller area in the front foot, which affected the increase in Instantaneous thrust and a relative decrease in the base of the final support foot at the moment when the disc jug prepares which helps the shooter to continue the speed and the least possible stop at this moment and achieve a good and fast movement of movement that allows the shooter to exert the required and fast force to achieve the speed and angle of firing, as the small area of the support foot is indicated by the increase in the pressure value (force/area) Improve the transfer of the final speed result they gained to the speed in body parts Then transferred to the disk device (Chen *et al*., 2005), and this achieved an improvement in the efficiency of instantaneous thrust between the instantaneous force exerted by the two men and the forces exerted at the upper end and the good transfer of the center of gravity in this step to the members of the research sample if we observe that the time of exerting these forces has also developed in the tests, therefore, all the factors that achieve the total speed seem to be consistent with what the force exerted by the sample members in The final throwing moment. This means the development of instantaneous thrust efficiency and the result of training the working muscles and the applications of strength exercises both with body weight and with added weights, where body weight forms resistant forces of the working muscles during performance and the tool forms the disc and weights added to the body parts additional weight during training, which gives a positive reaction in the development of types of momentary forces. The achievement was achieved after improving the special strength and some other biomechanical indicators, and this is what happened among the members of the research sample, where the exercises used had a very important role, as some scientists point to the need to pay attention to internal mechanical analysis of the same importance as external mechanical analysis. From previous scientific discussions of the total research variables (Chen *et al*., 2005), the researcher attributes the evolution of the variables to the effect of exercises related to angular movements (Muscle Moments), which were among the exercises used according to the parts of the skill performance related to the moment of the final throwing position with weighted belts, heavy chest and rubber cords, due to the ability of the muscles to contract at a faster and more explosive rate during the range of motion of the throwing arm. The increase in explosive muscle force has two benefits, one of which is the muscular force is directly proportional to the anatomical section of the muscle and muscle size, and the second is the body's ability to invest the reaction of the earth in a better investment in throwing the discus in the desired direction. Body weight is one of the factors that play a key role in achieving a good shot. This requires neuromuscular coordination and the development of separate and connected momentary force, the implementation of which is associated with the compressive force with the dominant foot of the leg, and in the shortest possible time and without significant braking of the foot of this leg, contributes to the achievement of a large percentage, which affected the motor system in general, which led to the development of the ability to achieve the required motor duty and in line with the correct mechanical path of the movement of the disc towards the mechanical target of the head at an appropriate angle and firing speed, as the researcher believes that the individuals The research sample applied the correct mechanical position to the corners of the body parts at the moment of final thrust at the appropriate angles to achieve the desired effective performance. (Container, 2022, pp. 257-263) (Tahir, 2020, pp. 50-55) (Khudair and Al-Fadhli, 2020, pp. 97-103)

The hypothesis of the research has been achieved in achieving the statistically significant relationship between the variables of momentary force and the rapid force of the legs, arms and trunk, which means that the transfer of momentum between the parts of the contributing body was very smooth, and that the trainers must sustain the improvement of strength in these parts in order for the shooter to continue to achieve the highest values of momentum and transfer them in a way that ensures the transfer of force between the parts of the body contributing to performance, and that monitoring the values of these variables using technical devices helps to correct these values This ensures high and good mobility transmission.

IV. CONCLUSION

1) The distribution of pressure and force on the surface of the main man’s foot was consistent with the achievement achieved.
2) The achievement of the least possible contact with the land was significantly correlated with the achievement achieved.

3) The instantaneous strength variables of both legs with the pressure indicator exerted in the foot (front and back) had a great impact in achieving the achievement
4) The relationship was statistically significant between the throw distance and the momentary force of the torso.

REFERENCES

Adamsd. (2013). *Improvements to the progressive formation of a single point through electric-assisted modulation, contact area prediction and tool development.* Queen's University. *http://hdl.handle.net/1974/8491*.

Al-Ameri, A. B. D. H. F. (2020). Analytical study of the variable of maximum strength on the walkway (100, 1500 and 5000 m runners for applicants). *Indian Journal of Forensic Medicine and Toxicology*, 14 (2), 1056–1061.

Al-Ameri, H. F. (2020). The effect of corrective exercises according to biomechanical indicators of the fingerprint of the paralyzed. P*rof. (Dr.) R.K. Sharma*, 20(3), 77.

Al-Ameri, H. F., Issa, J. S., and Hassan, M. (2020). *An analytical study of some biomechanical variables on the treadmill for short, medium and long distances of Iraqi heroes*. *Journal of Human Sport and Exercise.* 15(2).

Alcoser, W., Villa, L., Blanco, A., Gonzalez, J., & Oliver, M. (2012). The main trends in the development of ankle rehabilitation devices. *Dina*, 79 (176), 45–55.

Balakrishnan, S., & Wernervelt, P. (1986). Technical change, competition and vertical integration. *Journal of Strategic Management*, 7 (4), 347–359.

Bartlett, R. M. (1992). Biomechanics of discus: a review. *Journal of Mathematical Science*, 10 (5), 467–510.

Bellock, S.L., Carr, T. H., McMahon, C., & Starks, J.L. (2002). When attention becomes counterproductive: the effect of split versus skill-focused attention on beginner and experienced performance of sensory skills. *Journal of Experimental Psychology: Applied*, 8 (1), 6.

Bergman, B., and Ershek, D. J. (2006). Temperature effects on maximum acceleration, deceleration and power output during vertical operation in geckos. *Journal of Experimental Biology*, 209(8), 1404–1412.

Chen, G., Patten, C., Kothari, D. H., and Zagak, F. E. (2005). Gait differences between individuals with post-stroke hemiplegia and non-disabled controls at identical speeds. *Gait and posture*, 22 (1), 51–56.

Croix, MDS (2007). Advances in child strength assessment: changing our view on strength development. *Journal of Mathematical Science and Medicine*, 6 (3), 292.

Delo Iacono, A., and Seitz, L.P. (2018). Effects of hip-based PAP on sprint performance of footballers: heavy energy development protocols versus optimal energy development protocols. *Journal of Mathematical Science*, 36 (20), 2375–2382.

Fulford, J., Wynyard, P.J., Vanhatalo, A., Billy, S.J., Blackwell, J.R., & Jones, A.M. (2013). Effect of nitrate supplementation on human skeletal muscle metabolism and force production during extreme voluntary contractions. *Pflügers Archives-European Journal of Physiology*, 465 (4), 517–528.

Hay, J. J., Yu, B. (1995). Critical characteristics of the technique in discus. *Journal of Sports Science*, 13 (2), 125–140.

Holzman, R., Day, S. W., Wainwright, B.C. (2007). Timing is everything: the coordination of strike movement affects the force exerted by the suction that feeds the fish on the attached prey. *Journal of Experimental Biology*, 210 (19), 3328–3336.

Kang, S. J., Ha, J.B., and Humbrick, M.E. (2015). A mixed approach methods to explore the motivations of sports-related mobile applications among college students. *Journal of Sports Management*, 29 (3), 272–290.

Krishnan, S., Krishna, A., Nordin, A., Amirtham, F., Rani, A., and Rao, T. (2020). *Design and manufacture of a parallel mechanism for the development of foot/ankle rehabilitation therapy in emerging technologies and engineering applications* (pp. 133–141): Springer.

Pavlovich, R. (2020). Biomechanical Analysis Hammer throw: the effect of kinematic parameters on the results of World Championship finalists. *American Journal of Sport Science and Medicine*, 8 (2), 36–46.

Roberts, C. J. (2014). Concepts and misconceptions in the biomechanics of the cornea. *Journal of Cataracts and Refractive Surgery*, 40 (6), 862–869.

Schmidt, R. A. (2003). Kinetic schema theory after 27 years: reflections and implications of a new theory. *Exercise and Sports Quarterly Research*, 74 (4), 366–375.

Van der Toole, B., Metz, J., Nordhuisen Stassen, E., Buck, W., Bram, C., Wiggs, W. (2003). The strength of the vertical ground reaction and the distribution of pressure on the claws of dairy cows while walking on a flat substrate. *Journal of Dairy Science*, 86 (9), 2875–2883.

Khudair, Khudair, K.A., and Fadhli, F.A. (2020). Immediate qualitative observation of performance information and its impact on some kinetic variables javelin throwing and achievement in javelin shooters under 18 years. *Journal of Physical Education*, 31(3), 97–103. doi: https://doi.org/10.37359/JOPE.V31(3)2019.864.

Tahir, F. R. (2020). The effect of the training device to improve the explosive ability and flexibility of the working muscles in the female hammer throw rotation phase. *Journal of Physical Education* , 32(2), 50–55. doi: https://doi.org/10.37359/JOPE.V32(2)2020.993.

Wadah, A. (2022). The effect of special exercises using rubber ropes on the development of some physical abilities and achievement in the category of F56 disc launchers. J*ournal of Physical Education*, 34(3), 257–263. doi: https://doi.org/10.37359/JOPE.V34(3)2022.1303.

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