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**The Effect of Different Rates Weight Drills on Muscular Balance for Push Arm and some Kinematic Variables in Shot Put Release Phase.****Dr. Khalid Waheed Ibrahim****Assistant Professor, Sports training department, Faculty of Physical Education, Mansoura University, Egypt.****Abstract**

*The purpose of this study is to identify the effect of different rates weight drills on muscular balance for flexor and extensor muscles for push arm and some kinematic variables in glide style shot put release phase. Experimental approach was used with one experimental group sample was intentionally selected form under 20 years Shot Putters at Mansoura Sports Stadium and consisted 6 shot putters. Weight training program applied in special preparation phase for 10 weeks 3 trainings session a week with repetitions from 8 to 12 in 3 sets to 5. Through results presentation and discussion it was possible to conclude the different rates weight training drills led to increase strength of push arm flexors muscles to 359.2 N, and extensors muscles strength to 326 N, which helped to improve muscular balance between them and different rates weight training drills helped to increase release height to 233.33 cm, speed to 11.10 m/s, and angle to 39.83 degree, and pushing distance to 14.15 m. in glide style shot put.*

**Key word:** *weight drills - muscular balance - kinematic variables - shot put release phase*

**Introduction:**

The primary objective of shot put competition is tool arrival to farthest distance possible without violating competition rules; and this is done through acquiring the shot maximum speed upon releasing it; with getting benefit of most important kinematic variables affect technical performance. So, the maximum speed rate depends on technique used, assembling forces, work to increase shot acceleration during going inside throwing circle (Sloan, 1995) and, about 80 % - 90% of throwing distance comes through pushing position; therefore appropriate feet pivot distance should be taken during push position to allow access the largest momentum possible as well as get longer path for shot acceleration (Turk, 1997). Pushing position is of the most important and difficult stages of shot put, that is because shot is moved to throwing direction it should go in a straight line and do not veer to one side as shot center of gravity should be in the same direction (Zaki Darwish, Adel Abdel Hafez , 1994( and the release phase begin with right foot and knee rotation forward and then expanding them, buttock moves to outside, right shoulder raise and rotate forward, trunk put (Ballesteros and Alvarez , 1991) . The release height, angle and speed are of raise with simple arching, then the right arm put the Shot forward and throwing movement is completed on left leg, which extended when right arm finish extension and shot the most important factors that have greatest impact on shot put distance. Release speed is the key factor affecting distance ( Khalid Wahid, 2004), (Frossard, & al, 2003) ( Linthorne, 2001) where the shot put distance considered as fixed, release speed decrease (1.7 m/sec) for each (1m) increment in release height, shot put distance decrease (1.7 m) (

degree) increment in release angle and increase (1.3 m) for each (1 m) increment in release height and ideal release angle is 42 degrees (Hubbard et al, 2001. (

Muscles control body flexion and extension movement, the more powerful muscles the most contractions effectiveness, as this increases power and speed outcome, thus increasing the capacity (Abdul Aziz Elnemr, Nariman ElKhatib, 1996) and there are working muscles and other corresponding muscles regulate motion direction and make movement balanced and accurate; through fixing other parts of body so that required parts can be moved strong and fast (Essam Elwashahi, 1994) .The strong muscles enable athlete to move quickly and increase joints stability by balancing strength of around joints muscles. (Issam Helmi, Mohammed Gaber Briqa,1997). These muscles are working normally in dual form; when a muscle or muscle group contract, the corresponding muscle or muscle group extract at the same time; and at the party moving arrival to ultimate limit to the joint movement, the muscle or muscle group instantaneously contract with what commensurate with the power and speed of moving muscle to stop joint movement in order to protect it from injury. When group of muscles around a certain joint is relatively stronger than the corresponding muscle group around the same joint, this called lack of muscular balance (muscular imbalance ) (Fearing and Lincoln, 1997(

Muscular balance is the strength of a single muscle or muscle group and its relative correlation with other muscle or muscle group (Abu Ela Ahmed, 1997), brachial biceps muscle and the brachial triceps muscle work at the same time while elbow joint movement whether by flexing or extending, but in a counter work method for each muscle

(Fellows, S, J. & Rack, P. M, 1987) , brachial triceps muscle is responsible for elbow joint extending during push stage in shot put competition and elbow joint extension is very fast; so attention must be given to power drills for arm muscles, especially brachial triceps muscle as they have a positive relationship to performance (Terzis et al, 2003), many activities cause strength increase for one muscle group without coincided increase in the corresponding muscles, therefore corresponding muscles should be more trained in order to improve performance and prevent injury (Wathen, 1993), muscular balance development leads to reduction of side distractions and improve record achievement in triple jump ( Raafat Abdel Monsef , 2004), physical preparation drills should include muscular balance drills and tests for each major muscle groups and identify muscular imbalances and work to strengthen it (Chandler and Roetert 1998 (

There is positive correlation between strength balance for flexor and extensor muscles and speed; so when designing strength programs, it is important to choose drills that work to strength muscle groups on both body sides so that competitor joints are surrounded by muscles development in balanced; as maintaining muscles in true balance with strength increase is the first requirement for development of muscles ability to produce maximum strength with maximum movement range of the highest speed rate .(Abdul Aziz Elnemr, 1993

The most important benefits of weights training is to increase muscle strength and improve around joints muscular balance and positive effect on athletic performance (Mohamed Abdel Rahim , 1998) and the following weightlifting drills (Bench Press, Half Squat and Power Snatch) improve muscle ability (Reis and Ferreira, 2003), weight training should be used whenever possible, which includes movements performance with full joint movement range. particular brachial biceps and triceps strength development drills (Mohamed Mahmoud Abdel Dayem, 1993), and through the pilot study conducted by the researcher on (6) under (20) years shot putters in Mansoura Stadium; It is noticed that a difference of approximately 78.4 N between the strength of brachial biceps responsible

for flexing pushing arm 313.6 N approximately and that for brachial triceps muscle responsible for extension of pushing arm 233.6 N approximately which means that brachial triceps muscle strength is approximately 75% of brachial biceps strength. So this study objective is to identify the effect of different rates weight drills on muscular balance for flexor and extensor muscles for push arm and some kinematic variables in glide style shot put release phase. While hypotheses are that different rates weight drills positively affect muscular balance for flexor and extensor muscles for push arm and some kinematic variables in glide style shot put release phase.

#### Research procedures:

Experimental approach was used with one experimental group and pre-post measurement in Mansoura University Olympic Village and Mansoura stadium athletic hall, and track and field, pilot studies, pre and post measurements, and main study different rates weight drills has been conducted during the special preparation period within shot putter training program, in the period from September 1st till December 17th, 2012 .sample was intentionally selected from under (20) years Shot Putters at Mansoura Sports Stadium and consisted (6) putters.

Strength measure of arm extensors and flexors muscles: Shot putter stands and back touching wall wooden pieces and his body fixed to it using leather belts from shoulders , trunk and upper arm for measured arm is fixed near the elbow joint and the fist is closed and pass through the leather belt connected to dynamometer which the forearm to be measured fixed to it with ( 90 ) degrees angle, and when measuring flexing muscles strength, dynamometer to be located below the forearm and connected to a series of metal chain fixed with metal crossbar to wall wooden pieces from bottom , and when measuring extensors strength dynamometer to be fixed top of the forearm. (Ahmed Mohammed Khater , Ali Fahmy ElBek, 1996) , (11 ) (Mohammed Ibrahim Shehata , Mohammed Gaber Briqa 1995), ( see figures (1, and 2(

**Figure (1)**  
**Strength Measuring method**



**Figure (1) Strength Measuring method**



**Figure (2) Strength Measuring method**

**for forearm flexor muscles**

Kinetic analysis done using PC and video point program where (6) attempts filmed for each shot putter, imaging field includes release phase beginning and ending with registration of putters numbers, according to the order of their performance and identify successful and failed attempts and then selecting best successful attempts for each putter in research sample and then these attempts used as

**for forearm extensor muscles**

inputs to the computer software to start the process of kinetic analysis and to define kinematic variables for release phase.

Pre measurements : conducted in the period October 3rd, and 4th, 2012, then researcher confirmed research variables values normal distribution before starting the experiment as shown in tables (1) , (2) , (3)

**Table (1)**

**Statistical characterization of study sample in basic and physical variables (under study) n = 6**

Variables	Measurement unit	Mean	Standard Deviation	Skewness coefficient
Age	year	19.033	0.497	0.201
Height	cm	188.17	2.563	0.195
Weight	kg	82.167	2.483	0.201
training the	year	4.667	0.606	-0.413
Muscle strength for back extensors	N	181.67	7.528	0.664
Muscle strength for legs extensors	N	273.33	17.795	-0.702
Wide jump from stability	cm	257.50	17.672	-0.170
High jump from stability	cm	51.500	5.206	0.288
shot put in front of body	m	11.867	0.125	-0.200
shot put in back of body	m	13.792	0.292	-0.855

Table (1) show the basic and physical variables for study sample are normally distributed

**Table (2)**

**Statistical characterization of study sample in muscle strength of pushing arm flexors and extensors muscles in glide style shot put**

Variables	Measurement unit	Mean	Standard Deviation	Skewness coefficient
Strength of brachial biceps for pushing arm	N	313.6	10.983	-0.268
Strength of brachial triceps for pushing arm	N	233.6	7.658	-0.448

Table (2) show the values of muscle strength of pushing arm flexors and extensors muscles in glide style shot put variables for study sample are normally distributed

**Table (3)**

**Statistical characterization of study sample in kinematic variables in release phase glide style shot put**

Variables	Measurement unit	Mean	Standard Deviation	Skewness coefficient
Release height	cm	225.500	4.135	0.725
Release speed	m/sec	8.842	0.794	-0.315
Release angle	degree	35.333	1.211	-0.413
Putt distance	m	12.20	0.518	-0.241

Table (3) show the values of kinematic variables in release phase glide style shot put variables for study sample are normally distributed

Main study: Conducted during special preparation period of shot putters training program in the period from October 10th, 2012 to December 15th, 2012 for a period of (10) weeks with (3) trainings session a week with repetitions

from 8 to 12 in 3 sets to 5, session time (2 hours) where following weights have been used:

- (Standing. Face Multi Gem. Wight pulling device caught with both hands in front of body) bend arms.
- (Standing. Face Multi Gem. Wight pulling device caught with right hand in front of body) bend arms.
- (Standing. Face Multi Gem. Wight pulling device caught with left hand in front of body) bend arms.
- (Standing. Face Multi Gem. Wight pulling device caught with both hands upper) bend arms.
- (Standing. Face Multi Gem. Wight pulling device caught with right hand upper) bend arms.
- (Standing. Face Multi Gem. Wight pulling device caught with left hand upper) bend arms.
- (Standing. Arms bent behind head, catching the bar with tight grip) arms extended upper.
- )Standing on the left-leg. Right leg on bench, slant, dumbbells caught with right hand ) bend arm

The ratio of strength training using weights in training session was done with different and counterproductive rates according to amount of muscle strength, where the ratio of drills to develop strength of brachial biceps which work to flex forearm is equivalent to 75% of those drills for develop strength of brachial triceps muscle, as well as the weights training in different proportions of free arm muscle to consider muscular balance for the two arms together.

**Post measurements:**

After completion of main study post-measurements were conducted on December 16th, and 17th, 2012.

**Statistical coefficients and factors:**

Mean - standard deviation – Median – skewness coefficient – Wilcoxon test – Z critical value

**Results and discussion:**

***Results of the pushing arm flexor and extensor muscle strength in glide style shout putt competition after experiment:***

**Table (4)  
Differences significance between pre and post measures of arm flexor and extensor of glide style shot putt competition**

Variables	Measurement unit	Pre measurement		Post measurement		Wilcoxon value	Z value
		Mean	Standard deviation	Mean	Standard deviation		
Strength of brachial biceps for pushing arm	N	313.6	10.983	359.2	9.931	0.000	2.201
Strength of brachial triceps for pushing arm	N	233.6	7.658	326	13.158	0.000	2.201

Wilcoxon significant at 0.05 = 17

Z significant at 0.05 = 1.96

Table (4) results reveal presence of statistically significant differences at 0.05 level between pre and post measurements for strength of brachial biceps and brachial triceps for pushing arm, where Wilcoxon values were less than its

significance value at 0.05 level while Z value was greater than its significance value at 0.05 level.

***Results of kinematic variables in release phase glide style shot put after experiment:***

**Table (5)  
Differences significance between pre and post measures in kinematic variables in release phase of glide style shot putt competition**

Variables	Measurement unit	Pre measurement		Post measurement		Wilcoxon value	Z value
		Mean	Standard deviation	Mean	Standard deviation		
Release height	cm	225.5	4.135	233.33	4.633	0.000	2.207
Release speed	m/sec	8.84	0.794	11.10	0.535	0.000	2.201
Release angle	degree	35.33	1.211	39.83	1.273	0.000	2.207
Putt distance	m	12.20	0.518	14.15	0.370	0.000	2.201

Wilcoxon significant at 0.05 = 17

Z significant at 0.05 = 1.96

Table (5) results reveal presence of statistically significant differences at 0.05 level between pre and post measurements for kinematic variables in release phase of glide style shot putt competition, where Wilcoxon values were less than its significance value at 0.05 level while Z value was greater than its significance value at 0.05 level.

Figures (3), (4) show release height and angle for one shot putter before and after the experiment.

**Figure (3)**  
release height and angle for one shot putter before the experiment.



**Figure (4)**  
release height and angle for one shot putter after the experiment



#### **Discussion of pushing arm flexor and extensor muscle strength in glide style shout putt competition results of study sample :**

Table (4) results reveal presence of significant differences at 0.05 significance level, in favor of post measurement in strength of brachial biceps for pushing arm; with a mean of 359.2 N and in strength of brachial triceps for pushing arm, with a mean of 326 N. Researcher return this to the positive impact of different rates weight training, which have been applied during special setup period for shot putters (study sample) which helped to increase strength of arm extensor and flexor muscles; where strength training volume ration in groups used in session was different and counterproductive , according to the amount of muscle strength , where the ratio of drills to develop strength of brachial biceps which work to flex forearm is equivalent to 75% of those drills for develop strength of brachial triceps muscle, weight drills

proportion increased in training session according to this ratio resulting in improved muscular balance between pushing arm flexors and extensors, and this is consistent with what mentioned by (Chandler and Roetert 1998) (Abdul Aziz Elnemr,1993) (Mohamed Abdel Rahim, 1998 (

#### **Discussion of results of kinematic variables in release phase glide style shot put for study sample :**

Table (5) results reveal existence of significant differences at 0.05 level in favor o post measurements of kinematic variables of release phase of glide style shot put, where release height mean was 233.33 cm; researcher return this to the effectiveness of different rates weight training, which have been applied during special setup period for shot putters (study sample) which helped to increase strength of arm extensor and flexor muscles and achieve muscular balance between it, which helped to improve pushing arm movement, increasing elbow joint movement range, pushing arm extension to maximum possible height while shot releasing, and organize pushing arm movement in accurate and balanced manner. This is consistent with what mentioned by (Wathen, 1993) (Essam Elwashahi, 1994) (Issam Helmi and Muhammad Briqa, 1997 ) (Mohamed Mahmoud, 1993) (Terzis et al, 2003). Release speed mean was 11.10 m / s, researcher return this to the effectiveness of different rates weight training, which have been applied during special setup period for shot putters (study sample) which helped to improve muscle contraction effectiveness, increase strength outcome, and in turn increase speed, ability and movement volume, this is consistent with what referred by ( Abdul Aziz Elnemr, and Nariman al-Khatib, 1996) Release angle mean was 39.83 degree, researcher return this to the effectiveness of different rates weight training, which have been applied during special setup period for shot putters (study sample) which helped to increase strength of arm extensor and flexor muscles and achieve muscular balance between it, which helped to improve pushing arm movement, increasing elbow joint movement range, pushing arm extension to maximum possible height while shot releasing, and organize pushing arm movement in accurate and balanced manner. This consistent with what mentioned by (Wathen, 1993) (Essam El Washahi, 1994). Push distance mean was 14.15 meters, researcher attributes this to the the effectiveness of different rates weight training, which have been applied during special setup period for shot putters (study sample) which helped to increase strength of arm extensor and flexor muscles and achieve muscular balance between it, which helped to improve release height, speed and angle, which in turn increased push distance. This is consistent with what mentioned by (Khalid Wahid Ibrahim, 2004), (Frossard et al, 2003) (linthorne, 2001).

## Conclusions

Through results presentation and discussion it was possible to conclude that the different rates weight training drills led to increase strength of push arm flexors muscles to 359.2 N, and extensors muscles strength to 326 N, which helped to improve muscular balance between them and they helped to increase release height to 233.33 cm, speed to 11.10 m/s, and angle to 39.83 degree, and pushing distance to 14.15m in glide style shot put.

## Recommendations

In light of research conclusion researcher recommends that the using different rates weights training for pushing arm flexors and extensors muscles, according to each muscle's strength, to improve muscular balance between it in shot put training programs, using various weight training programs with same movement path for pushing arm flexors and extensors muscles during shot put competition due to its effectiveness on technical performance. It is necessary to focus on diversity of methods and means to develop muscle ability of shot putters due to their importance in improving technical performance.

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