

# A STUDY OF CORRELATION BETWEEN BIOMECHANICAL RELEASE PARAMETERS AND PERFORMANCE OF MALE AND FEMALE SHOT PUTTERS

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*Abstract—Sport like Shot put requires all of the joints in the kinetic chain to move simultaneously in one single movement. To improve the movements for better performance, the analysis and impact of angular displacement of different parts of the human body is very crucial. The aim of the study was to assess the performance and to identify some of the most relevant biomechanical parameters defining the completion result in glide shot-put technique. The subjects for the study were selected from sports hostel in SAI (Salt Lake City). 05 male and 05 female national athletes were selected randomly and aged from 18 to 28 years. Each of them were given six trials and that best trial result was recorded for the analysis of various parameters. Such as: height of release, speed of release and performance. The above parameters were analysed and calculated with the help of tracker 4.92 software. The actions of athletes were captured using cannon camera with 120fps speed and parameters like release velocity was calculated. The horizontal distance was calculated by reference tape. Result suggested that height of release showed a negative relationship to the speed of release because the achievable release speed decreases with increasing release height.*

## I. INTRODUCTION

Today technique is equally the key to better performance, although we cannot escape the facts that “style” will always be an integral aspect in ultimate performance. Attain this motive they always make their best efforts to improve the performance of participants in various competitive games and sports. Hence improvement in performance is the main key, to tackle the competition. So, all sports persons always search for a technique which is much more helpful and that expense less energy. Sometimes they refine the technique and try to improve performance.

Shot put is one of the throwing events in track and field that involve the putting of a heavy metal ball. In order to achieve good performance in shot put, demonstrating an accurate shot put technique is one of the keys. Among the shot putters, glide and spin are the two most common technique used. Glide shot put technique is characterized by very complex movements performed at high speed in a confined space. Many factors determine the results in the track and field event, of which the most important are morphological characteristics, motor abilities and technique.

Research studies in the shot put have multifaceted dimensions that include training, investigation of performance determinants and of course the mechanical analysis of techniques. In the common trends of motion analysis in shot put the power position of putters has not been given much importance. Few studies are cited below by the researched to expose present trends research in motion analysis of shot put.

A.R. Kamalpure, Yashwant and D. kalepawar (2012) conducted a study on two-dimensional quantitative analysis of shot put throw among inter university athletes. The results of the study showed that the shot put depended on optimal peak height, angle of release, height of release and initial velocity.

K. Lee, W.K. Hong, C.G. Yun, M.Y. Choi and J.E. Kim (2011) conducted a study on kinematic analysis of women’s shot-put final round at IAAF World Championships, Daegu 2011. The result showed that the throwing distance increased with an increase in the release speed, and a significant correlation ( $p < .01$ ) was observed between the throwing distance and release speed. It was also shown that an increase in release speed is required to improve the record.

R. Stankovic and S. Bubanj (2011) conducted a study on the comparative kinematic analysis of release of the Serbian shot putters. The result of the shot put mostly depends on the athlete to make the throw with the best combination of velocity, the optimum angle, height and release distance.

## II. OBJECTIVES OF THE STUDY

The purpose of the study was to examine the relationship between i) height of release and speed of release and ii) speed of release and performance and also relationship between iii) height of release and performance.

### III. METHODOLOGY

The subjects for the study were selected from sports hostel in SAI (Salt Lake City). Five male and five female national athletes were selected randomly and aged from 18 to 28 years. Two cannon video camera were used for the purpose of the study. The camera was placed at a distance of 4 mts at frontal plane from center of the shot put circle. The height of camera (lenses) fixed at a height 1.32 mts from the ground. Five male and Five female national shot putters were selected for the analysis of data. Each of them were given six trials and that best trial result was recorded for the analysis of various parameters. Such as: height of release, speed of release and performance.

The above parameters were analyzed and calculated with the help of tracker 4.92 software. The action of athletes was captured using cannon camera with 120fps speed and parameters like release velocity was calculated.

### IV. RESULTS AND DISCUSSION

<b>Table 1: Correlation on Biomechanical Release parameters &amp; Performance of Female Shot Putters</b>			
	Height of Release	Speed Of Release	Performance
Height of Release	1		
Speed Of Release	-0.086	1	
Performance	0.047	<b>0.999*</b>	1
<b>r.05 (3) = 0.878</b>		<b>*. Significant at 0.05 level</b>	

Table 1. shows that the performance of putting the shot has a significantly positive correlation to the speed of release as calculated 'r' value 0.999 is higher than tabulated 'r' value as 0.05 level of confidence. The female shot putters the distance put is significantly related to the speed of release positively.

<b>Table 2: Correlation on Biomechanical Release parameters &amp; Performance of Male Shot Putters</b>			
	Height of Release	Speed of Release	Performance
Height of Release	1		
Speed of Release	0.076	1	
Performance	0.190	<b>0.992*</b>	1
<b>r.05 (3) = 0.878</b>		<b>*. Significant at 0.05 level</b>	

Table 2. expose that the performance of putting the shot has a significantly positive correlation to the speed of release as calculated 'r' value 0.992 is higher than tabulated 'r' value as 0.05 level of confidence. The male shot putters the distance put is significantly related to the speed of release positively.

### V. DISCUSSION

Table 1 and Table 2 indicate that speed of release is highly correlated to the performance in shot put as obtained 'r' value 0.999 and 0.992 for female and male respectively are higher than tabulated 'r' value of 0.05 level of confidence. However, height of release showed non-significant relationship to the distance thrown.

A shot putter's aim is to attain maximum range of the shot. Release angle, Release height and Release speed are three mechanical factors which determine the ultimate performance. The male and female shot putters, though they have structural differences try to develop optimum speed of release with a target of maximum horizontal distance travelled by the shot. The structure of the human body favours the production of putting force in the horizontal direction more than vertical direction.

All attempts from initial stance to final release are met to maximise speed of release of the shot to impart into it a greater horizontal momentum but increasing either the athlete or the implement's speed at one phase the throw will not necessarily increase the speed of release. It is also most likely that increasing speed prematurely can result in instability, technical problem, decreased muscle loading or inefficient sequential muscle contraction. Therefore, maximum speed at the instant of release is always a principle contributing factor in shot put performance.

Height of release showed a negative relationship to the distance thrown because the achievable release speed decreases with increasing release height. Mont Hubbard et, al. Investigated two shot putter and found that the release speed of the putter decreases by 0.8 m/sec for per metre increase of height. The reason may be the increment of the height of release with the proportionate decrease in the angle of release may not hamper the achievable speed of release which ultimately becomes the reason for a lower horizontal momentum of the shot at the instant of release, which in term result into a decreased horizontal distance of the shot.

## VI. CONCLUSION

1. To achieve good performance Putting with a high release speed is more important.
2. The result of the shot put mostly depends on the athlete to make the throw with the best combination of Speed of Release and Height of Release
3. Among all five subjects there was a significant relationship between Performance and Speed of release.

## VII. REFERENCES

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