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Effect of Distance and Position on Accuracy among Different Type of Throws

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Abstract
The present study was examined the effect of distance and position on accuracy among different type of throws. A total of thirty subjects from different sports namely cricket, handball and softball with mean age 20 ± 0.57 years and mean height 167 ± 2.5 cm respectively were selected as a sample for this study. For this purpose white target board and Nivia light weight ball was used. Each subject was provided three chance of each type from the nine configured position, best of three trials was considered as final. For accuracy score the distance was measured in inches from point of hit on the board to the centre of the board. Analysis of variance (ANOVA) was employed to find out the effect of position and distance on accuracy. Further, LSD was employed for pair-wise comparison among significant cases. Results showed that, On the basis of results it was concluded that angular throwing doesn't had any significant effect on accuracy. Further, Throwing accuracy decreases with increase in distance.
Keywords: Accuracy, Throws, Position.

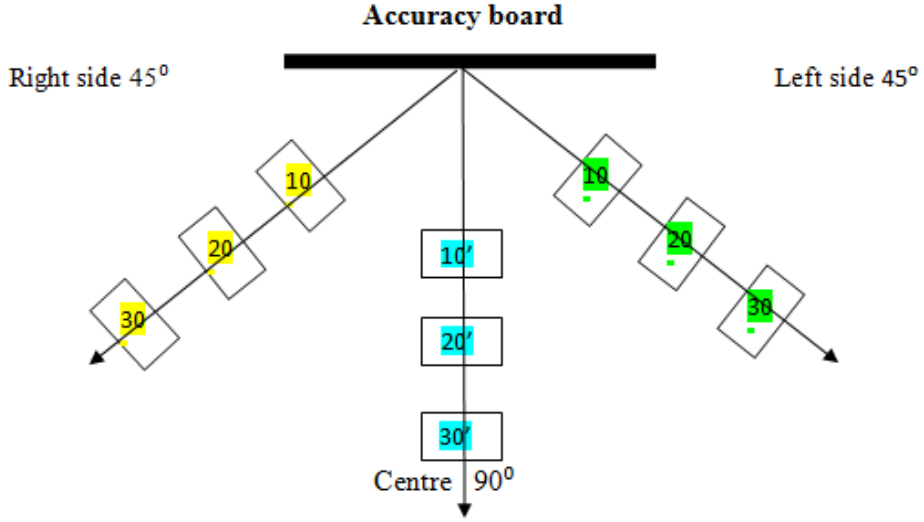
INTRODUCTION

Throwing plays an important role in many sports, and the faster and further the ball is thrown, the better. If an athlete's throwing is impaired, it puts him/her disadvantage when compared to other athletes with better throwing power. [1]To be (Luttgens & Hamilton 1977) a successful netball, baseball, softball, handball, basketball and cricket player, it is necessary for the athlete to be capable of throwing the ball with power and accuracy from one point to the next point of play. Although all these game have different throwing techniques, but the same muscle actions are used in throwing action. It is possible that the physical factors and other factors affect the powerful and accurate throw in different games and sports. However, an effective throw is the result of good technique and the contribution of several physical factors. Technique does indeed play a major role in the throwing motion. But the efficiency of the force passed onto the ball is judged in terms of the speed, distance, and direction of the ball after its release. The speed and distance of the ball that is thrown is directly related to the magnitude of the force used in throwing and to the speed of the moment of the ball release. Because the joint actions in the shoulder, elbow, wrist, and fingers contribute to approximately 50% of the ball speed. Therefore, the purpose of the study was to find out the effect of distance and position on accuracy among different type of throws with age 18 to 21 years.

METHODOLOGY

A total of thirty male physical education students were recruited as the subjects for this study with mean age 20 ± 0.57 years and mean height 167 ± 2.5 cm respectively. All thirty subjects were right handed and belonged to different throwing sports namely cricket, softball and handball with more or less equal arm length and without any anatomical deformity. None of the subjects were suffering from any systemic disease or musculo-skeletal disorder. Consent form was employed for basic information. A white target [2]board (kolakowski and malina's test of throwing accuracy 1974) was placed vertically with two concentric circles of 6 inch radius and 30 inch radius marked black. The smaller circle was filled with colour Red. Standard Nivia light weight tennis ball was used. The subjects were asked to sit on a Stoll with adjustable height and height up to shoulder axis was equated with height of centre of the board. Each subject was provided three chance of each type from the nine configured position (Fig.1), best of three trials was considered as final. For accuracy score the distance was measured in inches from point of hit on the board to the centre of the board. Analysis of variance (ANOVA) was employed to find out the effect of position and distance on accuracy. Further, LSD was employed for pair-wise comparison among significant cases.

Figure 1 FIELD LAYOUT



RESULTS

Table 1
MEAN POSITIONAL ACCURACY SCORE OF OVERARM THROW

Overarm Throw	**3.1071**	**3.1429**	**2.8357**
	6.3214	**5.9929**	**5.4500**
	7.9000	**6.2214**	**6.2571**

Figure 2

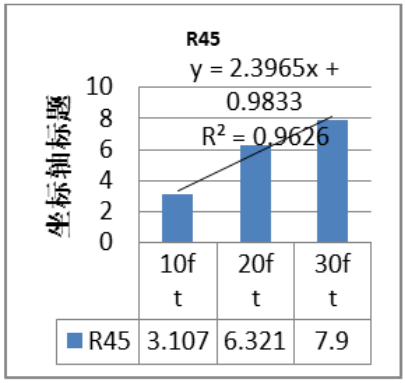


Figure 3

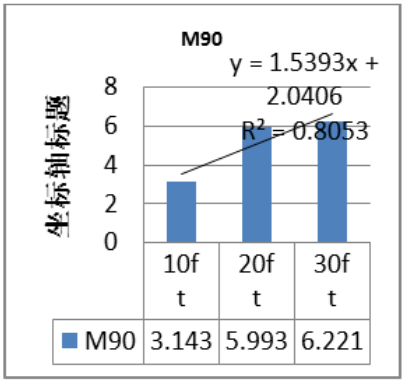


Figure 4

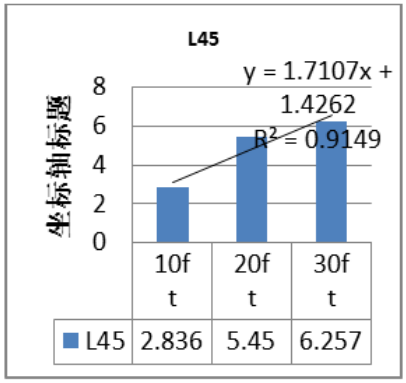


Table 2
MEAN POSITIONAL ACCURACY SCORE OF UNDERARM THROW

Underarm Throw			
	2.6714	**3.9500**	**3.8643**
	5.3071	**5.4143**	**5.7500**
	11.7643	**10.5071**	**8.0714**

Figure 2

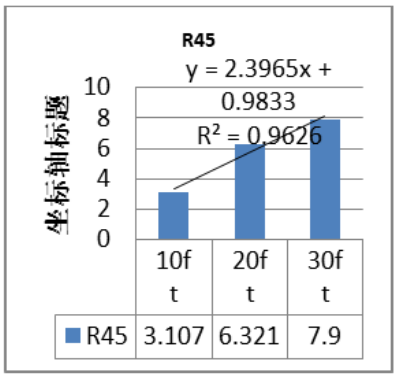


Figure 3

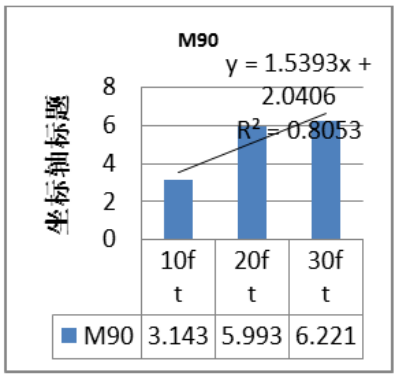


Figure 4

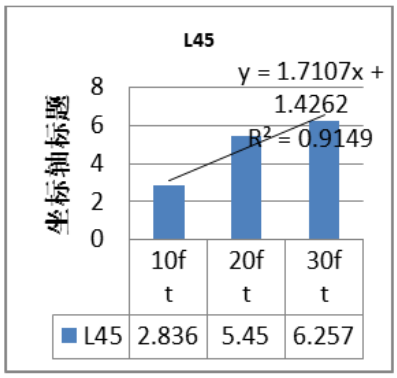
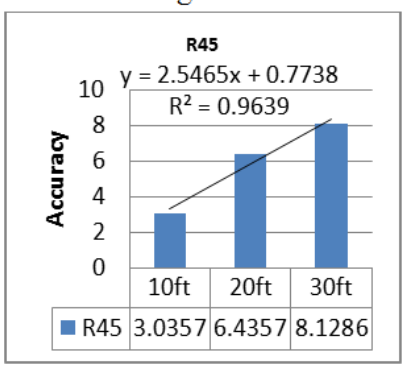


Table 3
MEAN POSITIONAL ACCURACY SCORE OF SIDEARM THROW

Sidearm Throw			
	3.0357	2.6643	2.6214
	6.4357	5.6857	5.0643
	8.1286	7.3571	6.0000

Figure 8



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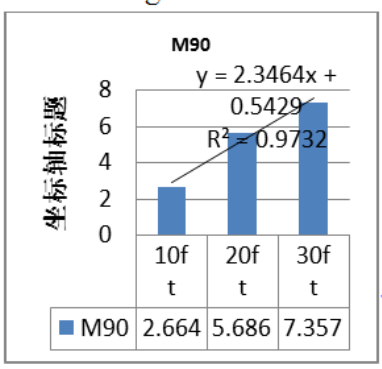

Figure 10

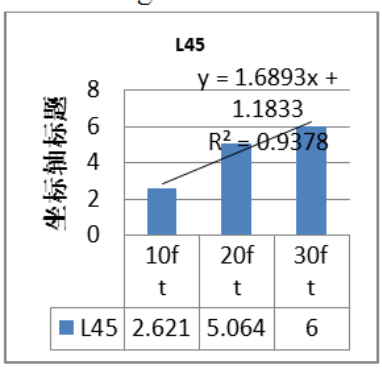

Table 4

Over Arm Throw	EQUATION	R^2	Side Arm Throw	EQUATION	R^2	Under Arm Throw	EQUATION	R^2
R45	y = 2.396x + 0.983	0.962	R45	y = 2.546x + 0.773	0.963	R45	y = 4.546x - 2.512	0.944
90	y = 1.539x + 2.040	0.805	90	y = 2.346x + 0.542	0.973	90	y = 3.278x + 0.066	0.907
L45	y = 1.710x + 1.426	0.914	L45	y = 1.689x + 1.183	0.937	L45	y = 2.103x + 1.688	0.996

Note: Y=Accuracy Score (1 Unit=1 inch); X=Throwing Distance (1 Unit=10ft)

Table 1 to 3 reveals that mean accuracy score was constantly increasing over distance in all the type of throws which signifies that accuracy was constantly decreasingly over distance and very little variation was present between different angles at a particular distance.

Table 4 reveals that R^2 value for all the relationship is very high i.e. there exists a high degree of relationship between throwing and accuracy.

Table 5
ANALYSIS OF VARIANCE OF ANGULAR ACCURACY OF DIFFERENT THROWS

		Sum of Squares	df	Mean Square	F	Sig.
Overarm	Between Groups	19.149	2	9.574	.892	.413
	Within Groups	1320.926	123	10.739		
	Total	1340.074	125			
Underarm	Between Groups	19.593	2	9.796	.586	.558
	Within Groups	2055.415	123	16.711		
	Total	2075.008	125			
Sidearm	Between Groups	35.763	2	17.882	1.553	.216
	Within Groups	1416.109	123	11.513		
	Total	1451.872	125			

Table 6
ANALYSIS OF VARIANCE OF POSITIONAL ACCURACY OF DIFFERENT THROWS

		Sum of Squares	*df*	Mean Square	F	p-value
AS_L45_10	**Between Groups**	**1.529**	**2**	**.765**	**.289**	**.751**
	Within Groups	**103.290**	**39**	**2.648**		
	Total	**104.819**	**41**			
AS_L45_20	**Between Groups**	**10.806**	**2**	**5.403**	**.563**	**.574**
	Within Groups	**374.465**	**39**	**9.602**		
	Total	**385.271**	**41**			
AS_L45_30	**Between Groups**	**131.616**	**2**	**65.808**	**4.059***	**.025**
	Within Groups	**632.341**	**39**	**16.214**		
	Total	**763.956**	**41**			
AS_90_10	**Between Groups**	**11.823**	**2**	**5.912**	**1.906**	**.162**
	Within Groups	**120.941**	**39**	**3.101**		
	Total	**132.765**	**41**			
AS_90_20	**Between Groups**	**2.346**	**2**	**1.173**	**.155**	**.857**
	Within Groups	**295.204**	**39**	**7.569**		
	Total	**297.550**	**41**			
AS_90_30	**Between Groups**	**138.039**	**2**	**69.019**	**4.252***	**.021**
	Within Groups	**633.067**	**39**	**16.232**		
	Total	**771.106**	**41**			
AS_R45_10	**Between Groups**	**12.360**	**2**	**6.180**	**1.490**	**.238**
	Within Groups	**161.768**	**39**	**4.148**		
	Total	**174.128**	**41**			
AS_R45_20	**Between Groups**	**3.309**	**2**	**1.654**	**.213**	**.809**
	Within Groups	**302.402**	**39**	**7.754**		
	Total	**305.711**	**41**			
AS_R45_30	**Between Groups**	**35.693**	**2**	**17.847**	**1.124**	**.335**
	Within Groups	**619.183**	**39**	**15.876**		
	Total	**654.876**	**41**			

*significant at 0.05 level

Table 6 revels that a significant difference was present among throws from left and central position at 30 feet distance as $p<0.05$.

Table 7
MULTIPLE COMPARISON OF POSITIONAL ACCURACY OF DIFFERENT THROWS AT LEFT AND CENTRAL POSITION (30 ft.)

Dependent Variable	(I) THROW	(J) THROW	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
AS_L45_30	OVERARM	UNDERARM	-3.86429*	1.52193	.015	-6.9427	-.7859
		SIDEARM	-.22857	1.52193	.881	-3.3070	2.8498
	UNDERARM	OVERARM	3.86429*	1.52193	.015	.7859	6.9427
		SIDEARM	3.63571*	1.52193	.022	.5573	6.7141
	SIDEARM	OVERARM	.22857	1.52193	.881	-2.8498	3.3070
		UNDERARM	-3.63571*	1.52193	.022	-6.7141	-.5573
AS_90_30	OVERARM	UNDERARM	-4.28571*	1.52280	.008	-7.3659	-1.2056
		SIDEARM	-1.13571	1.52280	.460	-4.2159	1.9444
	UNDERARM	OVERARM	4.28571*	1.52280	.008	1.2056	7.3659
		SIDEARM	3.15000*	1.52280	.045	.0698	6.2302
	SIDEARM	OVERARM	1.13571	1.52280	.460	-1.9444	4.2159
		UNDERARM	-3.15000*	1.52280	.045	-6.2302	-.0698

Table 7 revels that at left 45^o (30ft) significant difference was present between over arm and underarm ($p<0.05$) and also between sidearm and underarm ($p<0.05$). However there was no significant difference between over arm and sidearm ($p>0.05$). Similar pattern was also repeated at central (30ft).

DISCUSSION

The purpose of the study was to find out the effect of distance and position on accuracy among different type of throws. There are not enough literature which describe this phenomenon, as most of studies were relating velocity and speed with accuracy.The major findings of the study were the high negative correlation of throwing distance and accuracy and non-occurrence of significant at 10ft and 20ft difference at 30 ft distance.

There is several limitation of the study which should be noted. Firstly a low number of samples (14) were used in this study and outliers were not checked for the data. Secondly, the subjects were asked to throw the ball from the sitting position to minimise the effect of lower body muscles but in real game situation lower body position also plays an important role in generating force as van den Tillaar and Ettema(2007) have indicated that other kinetic and kinematic variables play an important role in throwing velocity. Given the fact that accurate throwing is a highly complex motor skill, a single test that could account for nearly all the variability in accurate throwing is unlikely.

CONCLUSION

Within the limitations of the present study it has also been observed that, Throwing accuracy Score increases continuously with increase in distance i.e. throwing accuracy decreases continuously with increase in distance. The trend line of the graph reveals that the pattern is almost linear in nature. Further R^2 value all the 9 case (3 types of throw from 3 different angles) is very high, which reveal a very high degree of relationship.

Table 5 revels that angular throwing has no effect on throwing Accuracy as $p>0.05$ for all the throws (Overarm, Sidearm & Underarm) which implies that throwing angle do not have significant impact on Throwing Accuracy.

It can be concluded that variation of throwing do not have any significant effect in accuracy for a distance up to 20 ft since $p>0.05$ at all the positions up to 20ft, which implies that in all those game which demand throwing from a shorter distance, any of the three type of throw may be applied, depending on the ball position i.e. height of the ball from the ground and game situation. Further it has been observed that accuracy started varying significantly at 30ft as $p<0.05$ at L45 and Straight position. With highest accuracy for over arm throw followed by side arm throw and then underarm throw. However in this two position also significant difference occurs between Over arm-Under Arm and Side Arm-Under Arm as $p<0.05$ but there was no

significant difference between Over Arm and Side Arm . This leads to a conclusion that the velocity factor starts affecting accuracy at or around 30 ft As Hussain, 2010 found that velocity of the ball lead to throwing accuracy. The velocity of the ball affects the projectile and is direct resultant of the force applied on the ball by the muscles. Thus suggesting that- to increase accuracy of throwing from a distance of 30ft or more, over arm throw should be preferred.

Further analytical research is required to find out the in depth cause of such trend including muscular and biomechanical analysis and also relation of such finding in context of velocity of throwing. Electromyographical analysis of muscles is also recommended to determine the role of particular muscles for an accurate throw.

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