Contribution of arm swing to performance of standing broad jump

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Abstract

The purpose of this study was to examine the contribution of arm swing to performance of standing broad jump. The subordinate purpose was to predict the performance of standing broad jump by arm length and arm strength. Fifty collegiate male, under the age group 18-22 years with a mean and SD of 21.56±1.25 from Sports Authority of India, Lakshmibai National College of Physical Education were selected as subjects for the study. The test variables used were standing broad jump with full arm-swing, standing broad jump with partial arm-swing, standing broad jump with no arm-swing, arm length and arm strength. The performance of standing broad jump is the criterion measure used in this study. Roger's physical fitness index using push-ups and pull-ups was used to compute arm strength. To compare the performance of SBJ performed with full arm-swing, partial arm-swing and no arm-swing, one way analysis of variance was used a measure. As there was significant difference, Scheffes' Post-Hoc Test was computed to compare between the pairs of means. It was concluded from the study that arm-swing and upper body contributes to jumping performance, and further researches are recommended to find the proportional contribution of these segments in jumping performance. It clearly indicates that standing broad jump performance not only depends on the explosive leg power but also in the segmental contributions of the upper body.

Key Words*: - **S**tanding broad jump, arm-swing, arm strength, arm strength*

Abbreviations: SBJ – Standing broad jump, AS – Arm strength, AL- Arm length.

Introduction

Successful sporting performance at elite levels of competition often depends heavily on the explosive leg power of the athletes. Some experts say that jumping performance is purely dependent on leg power but others say it is a combination of technique and explosive leg power. The literature shows that this factor is still in a state of debate. Different jumping styles also involve very different approaches and run ups which increase or decrease the velocity of the movement performed depending on the type of jump (Van et.al. 1985, Young W. 1995). It has been suggested that different styles of jumping require different strength properties and that training for one type of jumping technique will not necessarily improve performance in another style of jumping (Young, 1995)

Many athletic endeavors require specific and propulsive motions. While performing the standing broad jump, the forceful arm swing aids in the body's trajectory in the sagittal plane (Robertson and Fleming, 1987). In contrast, a broad jump without an arm swing may possibly decrease the maximum horizontal displacement as well as the vertical height.

Disabled athletes without arms must rely on compensatory movements from the trunk and hip regions. This is interesting because many times arm movement gives an athlete added momentum during the execution of a skill. Weber and Cafarelli (1973) concluded that performance of a broad jump depended partially on body size and the muscular strength involving forceful action of the upper body. However, very little research exists on doing broad jumps without arm swings. The fact that an arm swing is so important to vertical jumping performance, may indicate that there is a technique or skill component to vertical jumping, rather than just leg power (Young, 1995).

The subordinate purposes of the study were:

- to examine the contribution of arm-swing to performance of Standing Broad Jump.
- to predict the performance of Standing Broad jump by Arm Length and Arm Strength.

Material & Methods

Participants

For the purpose of the present experiment fifty collegiate male in the age group 18-22 years with a mean and standard deviation of 21.56 $\pm$ 1.25 were selected as subjects. The sample subjects were randomly selected from Lakshmibai National College of Physical education, Kerala. All the subjects were physically active and involved in regular sports activities. The participants were clearly oriented about the study and effort required from them.

Test variables

The test variables chosen for the study were: -

1) Standing broad jump with arm-swing
2) Standing broad jump with partial arm-swing
3) Standing broad jump with no arm-swing
4) Arm Length
5) Arm Strength

Criterion Measures

The performance of Standing Broad Jump was the criterio measure for this study. SBJ was performed in three different actions of the arm i.e. jump with no arm-swing, jump with partial arm-swing and jump with full arm-swing. Arm strength was calculated using Roger's Physical Fitness Index using push-ups and pull-ups.

Arm Strength = (Push-ups+pull-ups)[weight/10 + height(in) – 60]

Procedure

The subjects were asked to perform the SBJ in three different variations of arm-swing i.e. jump without arm-swing, jump with partial arm-swing and jump with full arm-swing. Three trials were given and the best were recorded in each variation. In case of the subject falling behind after jump, the test was taken again. Standing height was measured on a smooth wall with marked scale, a standard weighing machine was used to measure the body weight, and a standard anthropometer with extension rods were used to measure the arm length.

Before the test, the subjects were oriented and given practice trials in each variation. The tests were conducted on a mat with marked scale.

Result & Discussion

To compare the performance of Broad Jump performed with full arm-swing, partial arm-swing and no arm-swing One way analysis of variance was used as a measure. Comparison of performance among broad jump performed with full arm-wing, partial arm-swing and no arm-swing are highlighted in Table 1 & 2.

In table 1 the descriptive statistics of the present investigation is presented. The table itself is self-explanatory. The mean scores are presented graphically. The comparison of means among the jumps with no arm-swing, partial arm-swing and full arm-swing has been illustrated in fig.1

*** > . 05 (2, 147 df) 3.06**

Table –1

MEAN, SD, RANGE OF THREE VARIATIONS OF SBJ, ARM STRENGTH AND ARM LENGTH

Serial No.	Variable	Mean	SD	Range
1	Jump with arm-swing (inches)	93.1	8.363	36.5
2	Jump with partial arm-swing (inches)	85.24	7.672	26.5

3	Jump with no arm-swing (inches)	72.62	7.086	28
4	Arm Length	30.98	1.01	5
5	Arm Strength	188.32	96.61	451

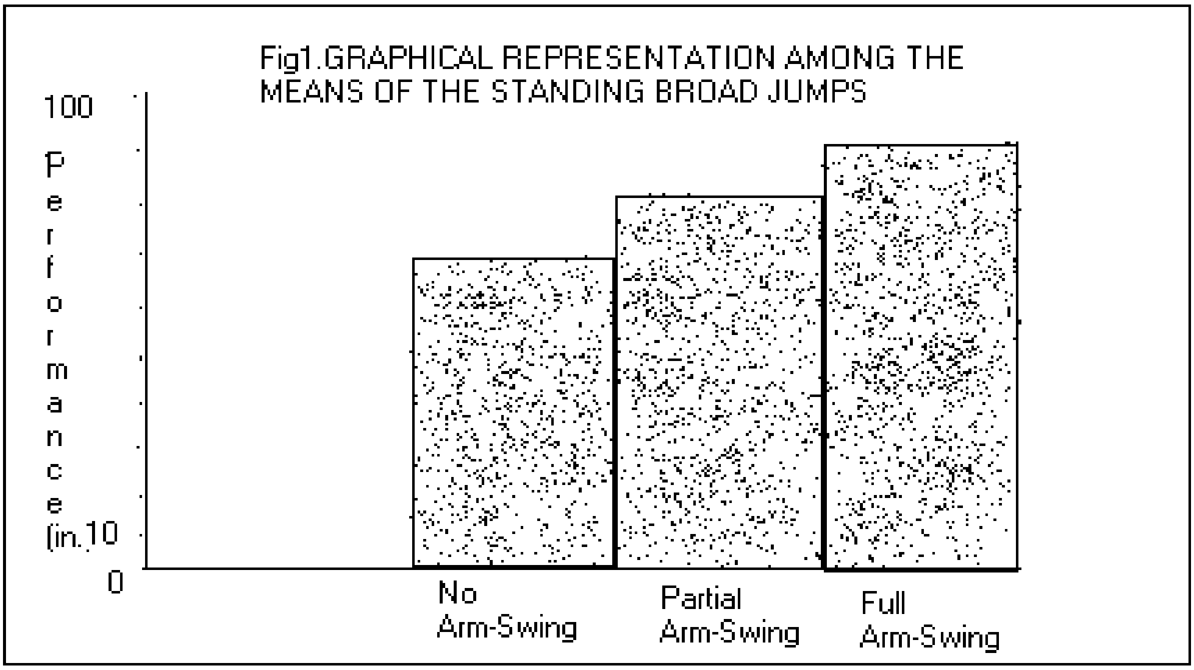


Table –2
COMPARISON OF THREE VARIATIONS OF STANDARD BROAD JUMP

Source of Variance	Degree of Freedom	Sum of Squares	Mean Squares	'f' ratio
Between sets	2	10674.6	5337.3	3.65*
Within sets	147	8772.4	1462.067	
Total	149	19447		

Tabulated f.05 (2,147) = 3.06 <
*Significant at .05 level of significance

From the above table it is evident that there is significant differences among the three Broad Jump performances as the calculated "f" value of 3.65 is greater than the tabulated value of 3.06 (2, 147 df) at .05 level of significance. As the f value was found significant the calculation was extended to Scheffes' Post-Hoc test and it is found that the significant mean difference was only between the performances of Broad Jumps performed with no arm-swing and full arm-swing. Scheffes' Post Hoc test is shown in Table-3

Table –3
SCHEFFES POST-HOC TEST OF DIFFERENCE AMONG THREE JUMPS

Means of three Standing Broad Jumps				
Jump with full Arm-Swing	**Jump with partial Arm-Swing**	**Jump with no Arm-Swing**	**Mean Difference**	**Critical Difference (.05 level of significance with 147 df)**
93.1	85.24		7.87	15.14
93.1		72.62	25.49*	15.14
	85.24	72.62	12.62	15.14

*significant difference between the pairs of means

From the above table it is evident that there is no significant difference between the performance of Standing Broad Jump performed (SBJ) with full arm-swing and performance of SBJ performed with partial arm-swing. There is also insignificant difference between the performance of SBJ performed with partial arm-swing and jump performed with no arm-swing. However, there is significant difference between the performance of Broad Jumps performed with no arm-swing and full arm-swing.

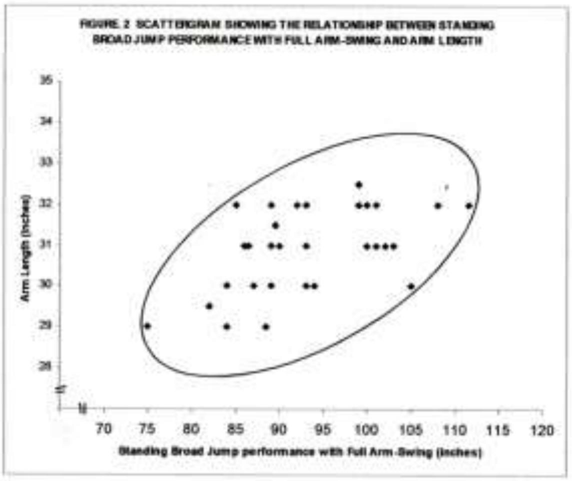
Relationship of independent variables arm strength and arm length was computed using partial correlation and it is shown in Table -4.

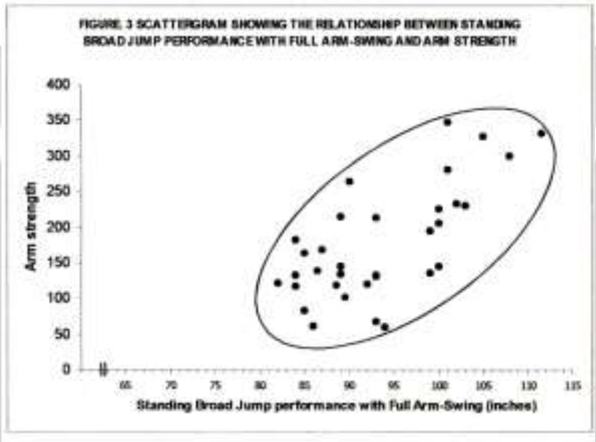
Table –4
PARTIAL CORRELATION BETWEEN SBJ PERFORMANCE WITH FULL ARM-SWING AND INDEPENDENT VARIABLES

Serial No.	**Partial Correlation**	**Constant Variable**	**Co-Efficient of Partial Correlation**
1	r12.3	Arm Length	0.357*
2	r13.2	Arm Strength	0.284*

*significant
Where. 1-SBJ with full arm-swing, 2-Arm Strength, 3- Arm Length
>r.05 (47) = 0.280, N=50

From the above table it is evident that there is significant relationship between SBJ performance with full arm-swing and arm length when the effect of arm strength over the jumps is eliminated. It also indicates that there is significant relationship between SBJ performance with full arm-swing and arm strength when the effect of arm length over the jumps was eliminated. The scattergram showing the relationship of these two independent variables on the performance of SBJ are shown in Figure 2 & 3.





Coefficient of multiple correlation was computed to find out the relationship between standing broad jump performance with full arm-swing and the combined effect of arm strength and arm length. As the multiple correlation was significant enough to construct regression line the formula of regression equation was employed in score form to predict the SBJ performance from the two selected variables under study.

The Regression Equation is as follows:

Y – 0.196 (X1) + 0.025 (X2) + 9.44

Where,
Y – The score of predicted SBJ performance
X1 – Arm Length
X2 – Arm Strength

Conclusion

In closing, it would appear obvious that more research into this area is required before any conclusion can be drawn. Presently we can only make educated guesses and hypothesizes to why these differences exist in jumping ability. This study makes it clearer that arm-swing and upper body plays a vital role in jumping performance, and further researchers are recommended to find the proportional contribution of these segments in jumping performance.

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