Journal of Advances in Developmental Research 1 (2) 2010 : 195-198

Research Article

Available online at www.journal-advances-developmental-research.com

Journal of Advances in Developmental Research

ISSN: 0976-4704 (Print), e-ISSN: 0976-4844 (Online)
J.Adv.Dev.Res. Volume 1, No.2, December 2010

A Study on Differences in Sitting Height-Stature Index, Thigh Length - Lower Leg Length Index and Upper Arm Length-Lower Arm Length Index of Indian Elite Male Throwers of Different Throwing Events

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Abstract

The relationship of length to breadth, height to thickness, length to length etc. of various parts of body represents proportions. In this study we had compared the sitting height-stature index, thigh length- lower leg length index and upper arm length–lower arm length index of Indian elite male throwers. The 25subjects for each (shot put, discus, javelin, and hammer throwers) were selected from national and international tournaments, India camp, sports authority of India (SAI) and state hostels. Analysis of variance (ANOVA) was used to find out the significant difference among four types of throwers on the above said variables, where significant differences were observed the L.S.D. test was used to compare mean difference. The results of the analysis had shown that mean sitting height-stature index and thigh length–lower leg length index are having insignificant difference among all four throwing groups. However lower arm length-upper arm length index of the four groups differ significantly.

Key words: Sitting height-stature index, thigh length–lower leg length index, upper arm length-lower arm length index.

Introduction

The relationship of length to breadth, height to thickness, length-to-length etc. of various parts of body represents proportions. This importance of proportion becomes evident, when we want to compare particular body parts of two persons who are otherwise different in overall size. The proportions or ratio keeps one measurement constant in all subjects compared and evaluate the differences in the other measurements. The body proportion can be studied in various ways, but indices method is best for determining body proportions.

The Throws (shot put, discus, javelin, and hammer) are field events in athletics. They are measure for explosive strength (power) in a human being from ancient time. The throwers of shot put, discus, javelin and hammer differed greatly in physique from the other athletes. As a group, they are taller and heavier, with longer arms in relation to their legs. They had broader shoulders and broader hips even for their trunk size, and are somewhat fatter than the track athletes[1].

It was found that discus, hammer and shot put (DHS) throwers to be significantly taller (182.4cm) and heavier (88kg) than all other field event athletes[2]. On the other javelin throwers are the shortest (172.3cm). The throwers in D.H.& S. group have the largest sitting height, biacramial diameter, bicristal breadth, and chest circumference than those of the controls and all other groups of athletes. Most of these

measurements are significantly, greater at 5% level. The javelin throwers and pole-vaulters do not show much difference in trunk measurements. The category of jumpers (Length, height and thickness-L. H. & T.) have evidently smaller trunk diameters than those of throwers, except the bicristal breadth which is 0.7 cm shorter in the case of javelin throwers. The S.,D.,H. throwers, who have the largest trunk and upper extremity measurements, approximate the L.,H.&T. group in the lower extremity length. The javelin throwers have been found to have significantly the least average values of lower extremity length in this group of field athletes. However, among them the circumferences are significantly largest in the case of D.,H.&.S. throwers and smallest in the case of L.,H.,T. jumpers.

It was concluded[3] that discus, hammer and shot putter to be taller, heavier and posses longer extremities and broader knees with *a* larger amount of lean body mass. It was observed that the throwers of discus, shot, javelin and hammer differed greatly in physique from the other athletes[4]. As group, they were taller and heavier with longer arms in relation to their legs. They had broader shoulders and broader hips even for their trunk size, and were somewhat fatter than the track athletes.

It was suggested[5] that a nation with people whose general physique is limited to the characteristics of champions in certain events must concentrate their sports training on those specific events.

The purpose of this research work is to assess the significant differences existing in various segmental proportions of Indian male elite shot put, discus, javelin and hammer throwers.

Experimental

For the purpose of the study 25 elite male throwers for each javelin, shot put, discus and hammer throws were selected from various national and inter-national tournaments, state and SAI hostels and India camp.

Anthropometrical measurements from 25 Elite male shot putters were collected from

- Eight shot putters from All India Police Athletic championship, Kolkata date. 20-11-2004
- Two shot putters from SAI Hostel Kolkata, dated- 23-11-2004.
- Five shot putters from Delhi SAI Hostel, dated 11-03-2005.
- Two shot putters from SAI Hostel Patiala, dated 27-01-2005.
- Three shot putters from India camp, dated- 05-02-2005.
- Two shot putters from State Hostel Allahabad, dated-27-12-2004.
- One shot putter from Indo-Pak Punjab competition, dated -18-02-2005.
- Two shot putters from State Hostel Lucknow, dated- 30-12-2004.

Anthropometrical measurements from 25 Elite male discus throwers were collected from

- Seven discus throwers from All India Police Athletic championship, Kolkata, dated- 20-11-2004
- Two discus throwers from SAI Hostel Kolkata, dated -23-11-2004.
- Five discus throwers from Delhi SAI Hostel, dated 11-03-2005.
- Three discus throwers from SAI Hostel Patiala, dated 27-01-2005.
- Four discus throwers from India camp, dated-05-02-2005.
- Two discus throwers from State Hostel Allahabad, dated-27-12-2004.
- One discus thrower from State Hostel Lucknow, dated- 30-12-2004.
- One discus thrower from Indo-Pak Punjab competition, dated-18-02-2005.

Anthropometrical measurements from 25 Elite male javelin throwers were collected from

- Eight javelin throwers from All India Police Athletic championship, Kolkata, dated- 20-11-2004
- Three javelin throwers from SAI Hostel Kolkata, dated -23-11-2004.
- Three javelin throwers from Delhi SAI Hostel, dated 11-03-2005
- Four javelin throwers from SAI Hostel Patiala, dated 27-01-2005.
- Three javelin throwers from India camp, dated-05-02-2005.
- Two javelin throwers from State Hostel Allahabad, dated-27-12-2004.
- Two javelin throwers from State Hostel Lucknow, dated- 30-12-2004.

Anthropometrical measurements from 25 Elite male hammer throwers were collected from

- Seven hammer throwers from All India Police Athletic championship, Kolkata, dated- 20-11-2004
- Three hammer throwers from Delhi SAI Hostel, dated 11-03-2005.

- Three hammer throwers from SAI Hostel Patiala, dated 27-01-2005.
- Three hammer throwers from India camp, dated- 05-02-2005.
- Six hammer throwers from State Hostel Allahabad, dated-27-12-2004.
- One hammer thrower from State Hostel Lucknow, dated- 30-12-2004.
- One hammer thrower from Indo-Pak Punjab competition, dated -18-02-2005.

The selected subjects belonged to the 15 states of India viz. U.P, Punjab, Haryana, Delhi, Bihar, Chhatishgarh, Jharkhand, Karnataka, Kerala, M.P, Maharashtra Uttaranchal, J&K, West Bengal, Andhra Pradesh, and Tamilnadu.

Collection of Data

The data in the form of ratios was the criterion measure of the study and following indices method were used to achieve it.

Proportionalities

The following indices[2] were used to determine various body segmental proportionalities**.**

- Sitting height-Stature index = $\frac{SittingHeight}{Stature} x100$
- Thigh length-Lower leg length index = $\frac{Thigh\ Length}{Lower\ leg\ length} \times 100$
- Upper arm length-Lower arm length index = $\frac{Upper\ arm\ length}{Lower\ arm\ length} \times 100$

Statistical Procedure

Reiterating the objective of the study, we have to point out that we intend to investigate the body proportionality differences among four types of throwers. Thus we had used Analysis of variance to found out the significant difference among the four types of throwers. Where the difference was significant, we had used L.S.D. test to analyze which groups mean was greater than other. The significance of differences among four groups of throwers was tested at 0.05 level of significance[6].

Results and Discussion

Table 1. Sitting height-stature index

S. V.	d.f.	SS	MSS	F-Value
Treat.	r-1=3	0.163091	0.054364	
Error	N-r=96	3.76416	0.03921	1.386475

Since calculated F value is lesser than tabulated F value (2.70), we are able to conclude that there is no significant difference in the mean sitting height–stature index of hammer, shot put, discus and javelin throwers (Table 1 and Fig 1).

Table 2. Thigh length –lower leg length index

S. V.	d.f.	SS	MSS	F-Value
Treat.	r-1=3	35348.8	11782.93	
Error	N-r=96	970266.3	10106.94	1.165826

Since calculated F value is lesser than tabulated F value (2.70), we are able to conclude that there is no significant difference in the mean thigh length–lower leg length index of hammer, shot put, discus and javelin throwers(Table 2 and Fig 2).

Table 3. Upper arm length-lower arm length index

S. V.	d.f.	SS	MSS	F-value
Treat.	r-1=3	8701.801	2900.6	
Error	N-1=96	6522.424	67.9419	42.69235*

*Significant at 0.05 level

Since calculated F value is greater than tabulated F value, we conclude that significant difference exist in the mean upper arm length–lower arm length of shot put, discus, javelin and hammer throwers (Table 3 and Fig 3). To further find out which group is having greater mean upper arm length–lower arm length, pair wise mean analysis is done through LSD test.

Table 4. Treatment means arranged in order of magnitude

Throwing groups				Mean difference	CD
Shot put	Javelin	Hammer	Discus		
130	123.09			6.91*	
130			107.18	22.82*	0.923
130		110.13		19.87*	
	123.09	110.13		12.96*	
		110.13	107.18	2.95*	
	123.09		107.18	15.91*	

*Significant at 0.05 level

Comparing the pair wise mean difference with critical difference we are able to conclude that mean upper arm length–lower arm length of shot putter is significantly greater than mean upper arm length–lower arm length of javelin, hammer and discus throwers (Table 4). Further, mean upper arm

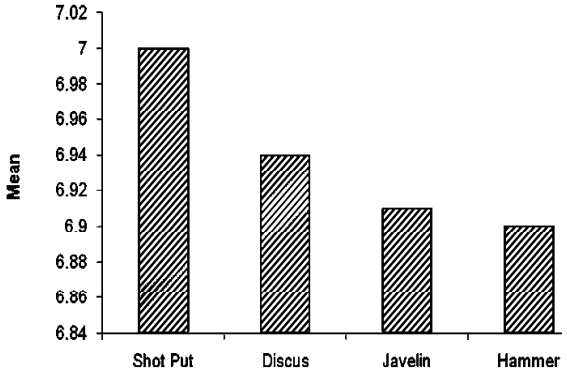

Fig. 1 Mean sitting height-stature index

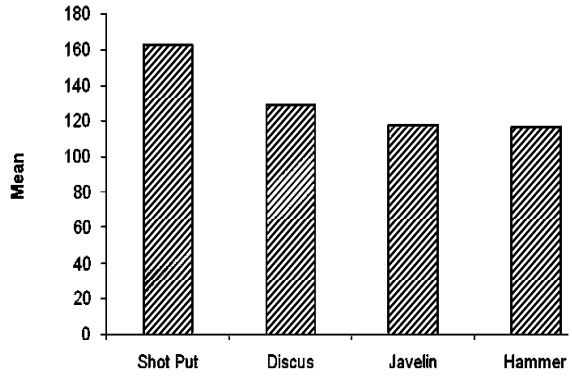

Fig. 2 Mean thigh length-lower leg length index

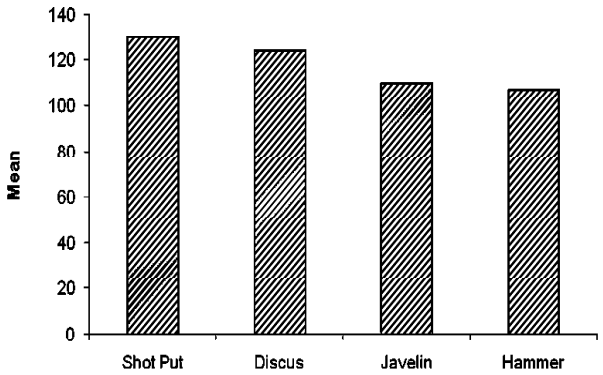

Fig. 3 Mean upper arm length-lower arm length index

length-lower arm length of javelin throwers is also significantly greater than mean upper arm length-lower arm length of hammer and discus thrower and mean upper arm length-lower arm length index of discus thrower is significantly the least of all the three groups.

Discussion and Finding

Results of the study had showed us insignificant differences in sitting height- stature index and thigh length–lower leg length index. However significant differences are observed in mean upper arm length–lower arm length index of the four groups.

Comparing the pair wise mean difference with critical difference we are able to conclude that mean upper arm length–lower arm length index of shot putter is significantly greater than mean upper arm length–lower arm length index of javelin, hammer and discus throwers. Further mean upper arm length–lower arm length index of javelin throwers is also significantly greater than mean upper arm length –lower arm length index of hammer and discus thrower and mean upper arm length–lower arm length index of discus thrower is significantly the least from all the three groups.

Shot putters had greater upper arm length-lower arm length index, which means that, they had greater upper arm length than lower arm length; shot putters need maximum strength to execute linear propulsion force on the shot which is propelled through powerful and longer deltoid and biceps muscles.

The javelin throwers' greater lower arm length gives them a greater force arm, which helps them in giving powerful jerk to the Javelin during throw.

Further greater lower arm length of hammer and discus throwers also increase the force arm, which create greater range of movement and centrifugal force during throw. It is propounded that while throwing the discus, the speed of the discus at the moment of release is of prime important in determining how far it will go, and to give angular velocity (dependent on how fast the 'lever' throwing the discus, i.e. to the distance of the discus from the axis of the thrower) hence the desirability of having long and powerful arms**.**

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