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ORIGINAL PAPER (ARTIGO ORIGINAL)

# ANTHROPOMETRIC MEASUREMENTS, BODY COMPOSITION AND SOMATOTYPING OF HIGH JUMPERS

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## ABSTRACT

SINGH, S.; SINGH, K.; SINGH, M. Anthropometric measurements, body composition and somatotyping of high jumpers. *Brazilian Journal of Biomotricity*, v. 4, n. 4, p. 266-271, 2010. The purpose of this study was to find out anthropometric measurements, body composition and somatotyping differences in high performer and low performer high jumpers. 20 male university level high jumpers were assessed for the present study during the All India Inter University Athletic Meet. The age of athletes was between 18 to 25 years. All subjects were assessed for height, weight, breadths, girths and skinfold thickness. Percentage of fat was calculated from the sum of 4 measurements of skinfold thickness. The independent samples t-test revealed that in high performer high jumpers had significantly higher height ( $p<0.01$ ), weight ( $p<0.01$ ), body mass index ( $p<0.05$ ), total leg length ( $p<0.01$ ), total arm length ( $p<0.01$ ) as compared to low performer high jumpers. The high performer high jumpers also had significantly greater all three circumferences, bi-humerus ( $p<0.01$ ) and bi-femur ( $p<0.01$ ) diameters, lean body mass ( $p<0.01$ ) and mesomorphic score ( $p<0.01$ ) as compared to low performers whereas the low performer high jumpers were found to have significantly higher % body fat ( $p<0.05$ ) and endomorphic ( $p<0.01$ ) score than the high performers. It is concluded that in most of the parameters there were significant differences between high performer and low performer high jumpers, and the high performer athletes showed better anthropometric measurements and somatotyping scores.

**Keywords:** Somatotyping, anthropometric measurements, % body fat, high jumpers, lean body mass.

## Introduction

In the endeavour to achieve excellence in sport, all of the possible concomitants of performance have been subject to scientific research. Modern sport science is characterized by the purposefulness of its endeavour to improve elite athletes and to discover talents as precisely as possible. There is evidence to support the concept that an individual's physique greatly limits or enhances successful participation in physical activity (WILMORE e HASKELL, 1972; WILMORE e BROWN, 1974; FAHEY et al., 1975; WICKKISER e KELLY, 1975; PIPES, 1977). Elite and world class athletes have different physiques than individuals in the non athletic population (TANNER, 1964). The body composition and anthropometry of elite athletes has been the subject of much research. The practicing athletes might be expected to exhibited structural and functional characteristics that are specifically favourable for the sport and thus separate him from the general population and athletes involved in other sports. Such differences in body physique might reflect (a) genetic characteristics that have been selective in determining athletic pursuit and (b) changes due to the conditioning effect of high level of training.

Specific physique or morphological features play a major role, arguably critical role in competition success. The size, shape and proportions of athletes are important considerations in player performance and better the performance more critical the relationship (BELL e RHODES, 1975; TORIOLA et al., 1987). In track and field athletics, several papers have investigated anthropometric variables in relation to event participation (De GARRY et al., 1974; THORLAND et al., 1981; CARTER et al., 1982; KELLET et al., 1983; HOUSH et al., 1984; HOLLINGS e ROBSON, 1991; LANGER 2007) etc. However few studies have investigated the track and field athletes in India. The present study, therefore, is an attempt to investigate physical characteristics, body composition and somatotyping of high jumpers in India.

## Material and methods

The present study was conducted on 20 high jumpers (10 high performers and 10 low performers). The age of athletes was between 18 to 25 years. The data of athletes were collected during the All India Inter University Athletic Meet held at Manonmaniam Sundaranar University, Trinelveli, Tamilnadu, in January 2006. The high performer athletes were selected among the first 12 positions in the All India Inter University Athletic Meet and low performers were selected from those who could not qualify in first 12 positions. Body weight was measured with portable weighing machine to the nearest 0.5 kg. Height measurements were taken by using the standard anthropometric rod (HG-72, Nexgen ergonomics, Canada) to the nearest 0.5 cm. Widths and diameters of body parts were measured by using sliding calliper. Girths and lengths were taken with the steel tape to the nearest 0.5 cm. Skinfold thickness measurements were taken with Harpenden Skinfold Caliper (British Indicators, UK) to the nearest 0.1 mm. Total body fat was estimated from the sum of four skinfold values taken at the biceps, triceps, sub-scapular and suprailiac as recommended by Durnin and Rahaman (1967) and using Durnin and Womersley equation (1974). Somatotyping components (endomorph- mesomorph- ectomorph) were calculated according to Carter and Heath method (1990).

### *Statistical analysis*

Values are presented as mean values and SD. Independent samples t tests were used to test if population means estimated by two independent samples differed significantly. Data was analyzed using SPSS Version 16.0 (Statistical Package for the Social Sciences, version 16.0, SSPS Inc, Chicago, IL, USA).

## RESULTS

Anthropometric characteristics of high performer and low performer high jumpers are shown in table 1. The high performer high jumpers were significantly taller ( $p < 0.01$ ) and heavier ( $p < 0.01$ ) than low performer high jumpers. The high performer high jumpers had significantly greater value of body mass index ( $p < 0.05$ ) as compared to low performer high jumpers. Leg length ( $p < 0.01$ ) and arm length ( $p < 0.01$ ) were found significantly higher in high performers when compared to the low performers. High performer high jumpers also had significantly greater upper arm ( $p < 0.01$ ), thigh ( $p < 0.01$ ) and calf ( $p < 0.01$ ) circumferences and bi-humerus ( $p < 0.01$ ) and bi-femur ( $p < 0.01$ ) diameters as compared to low performer high jumpers. Table 2 presents the various components of body composition of the high performer and low performer high jumpers. The low performer high jumpers were found to have significantly higher body density ( $p < 0.05$ ) and % body fat ( $p < 0.05$ ) than the high performers whereas high performer high jumpers had significantly higher lean body mass ( $p < 0.01$ ) as compared to low performer high jumpers. Table 3 shows the somatotype scores of the high performer and low performer high jumpers. The low performer high jumpers had significantly higher endomorphic score ( $p < 0.01$ ) as compared to high performer high jumpers whereas the high performer high jumpers had significantly higher mesomorphic score ( $p < 0.01$ ) than the low performer high jumpers. No significant difference was reported between the two groups in relation to ectomorphic component.

**Table 1.** Anthropometric Measurements of high performer and low performer high jumpers.

Variables	High performers (N=10)		Low performers (N=10)		t-Value
	Mean	SD	Mean	SD	
Height (cm)	182.50	1.63	179.00	1.26	5.35**
Body Weight (kg)	69.30	2.79	63.00	4.60	3.69**
BMI ( $\text{kg}/\text{m}^2$ )	20.80	0.83	19.66	1.49	2.11*
Leg Length (cm)	103.47	1.06	101.13	0.88	5.34**
Arm Length (cm)	80.68	0.88	79.11	0.59	4.64**
Upper Arm Circumference (cm)	26.50	0.46	24.00	1.72	4.43**
Thigh Circumference (cm)	50.37	1.28	46.78	1.92	4.90**
Calf Circumference (cm)	34.25	0.62	32.00	1.83	3.66**
Elbow Diameter (cm)	6.92	0.078	6.60	0.11	7.68**
Knee diameter (cm)	9.68	0.13	8.85	0.35	7.01**

(\*) indicates  $p < 0.05$ . (\*\*) indicates  $p < 0.01$ .

**Table 2.** Components of Body Composition of high performer and low performer high jumpers.

Variables	High performers (N=10)		Low performers (N=10)		t-Value
	Mean	SD	Mean	SD	
Body Density	1.07	0.002	1.06	0.0017	2.41*
% Body Fat	12.56	1.04	13.55	0.77	2.41*
Total Body Fat (kg)	8.72	1.00	8.56	0.99	0.37
Lean Body Mass (kg)	60.57	2.004	54.44	3.71	4.59**

(\*) indicates  $p < 0.05$ . (\*\*) indicates  $p < 0.01$ .

**Table 3.** Somatotyping of high performer and low performer high jumpers.

Variables	High performers (N=10)		Low performers (N=10)		t-Value
	Mean	SD	Mean	SD	
Endomorphy	2.29	0.19	2.56	0.20	3.02**
Mesomorphy	2.76	0.19	1.56	0.90	4.09**
Ectomorphy	3.95	0.46	4.38	0.86	1.39

(\*\*) indicates  $p < 0.01$ .

## DISCUSSION

The results of the present study show that the high jumpers competing in the All India Inter-university Athletic Meet differed in most of the somatometric variables studied with regard to their performance level. The height of the high performer high jumpers in the present study is greater than the Indian high jumpers reported by Sodhi (1991) and is comparable with the jumpers from New Zealand (HOLLINGS e ROBSON, 1991) and Olympic level jumpers studied by de Garry et al. (1974) and Carter et al. (1982) whereas the high jumpers in the present study are shorter than Czech, Slovak and Danish high jumpers (LANGER, 2007). The weight of the high jumpers is lower than their counterparts from New Zealand, Czechoslovakia, Denmark and Czech Republic (LANGER, 2007; HOLLINGS e ROBSON, 1991). But they have greater weight than the Indian high jumpers reported by Sodhi (1991). The high performer high jumpers have less % body fat than low performer high jumpers whereas they have greater lean body mass (muscle mass) as compared to low performers and therefore achieve better performance since more the lean body mass the greater will be the energy output and higher will be the cardio respiratory fitness (BANDYOPADHYAY e CHATTERJEE, 2003; CHATTERJEE et al., 2005). The somatotype scores of high performer high jumpers are 2.2-2.7-3.9 which accords with the somatotyping scores of Olympic level jumpers ranging between 2-5-3 and 2-3-5 reported by Tanner (1964). The high jumpers in the present study are ectomorphic mesomorph. The endomorphic, mesomorphic and ectomorphic scores of jumpers are comparable with the high jumpers from Czechoslovakia, Denmark and Czech Republic (LANGER, 2007). Considering that in most of the parameters there were significant differences between high performer athletes and low performer athletes, and the high performer athletes showed better anthropometric measurements and somatotyping scores, it is concluded that various anthropometric characteristics, components of body composition and somatotyping scores has clear impact on the performance of the athletes. This investigation indicate the need for further research on the effect of diets and training regime on body composition since it is associated with athletes performance.

## PRACTICAL APPLICATIONS

1. The findings of the study will help to understand the anthropometric characteristics and body composition and somatotyping of high jumpers.
2. The data regarding body composition will help the coaches to adjust the training programme for high jumpers
3. The data in the present study will serve as reference data for physical education teachers and coaches for the selection of young athletes.
4. This will help to understand the relationship of variables under study with each other.

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