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Comparative study on selected anthropometric variables among university men sprinters, throwers, jumpers and long distance runners

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Abstract
The purpose of the study was to compare the selected Anthropometric variables such as height, weight, among university men sprinters, throwers, jumpers and long distance runners. This study, 160 university athletes consisting of 40 sprinters, 40 jumpers, 40 throwers, and 40 long-distance runners were selected as the subjects at random and their age was between 18 and 25 years The objective of undertaking this research was to assess the anthropometric variables of university level sprinters, jumpers, throwers and long distance runners and to find out the differences between anthropometric variables among the athletes.. The collected data were subjected to statistical treatment using Analysis of Variance (ANOVA). In all cases 0.05 level was fixed to test the hypothesis of this study.

Keywords: Anthropometric variables, height, weight, sprinters, throwers, jumpers.

Introduction

"The human body is a machine of wondrous complexity capable of strong and violent movements. This machine is made up of slightly more than two hundred bones to which are attached better than six hundred muscles" (Eston, R., and Reilly, T. 2008) [3].

There are numerous factors, which are influencing performance of sportsman of the physical including shape, size, weight and height. Each and every nation wants to show their supremacy in any sports and games. The Olympic motto itself shows "Faster, higher and stronger". The challenges inspire the entire nation to exhibit greater performance in sports through application of research in modern science any technology.

Anthropometric Measurements

Anthropometric measurements have been a part of physical education research and evaluation since its inception. The earlier research was in the area of anthropometry was with the emphasis on changes in muscle size, brought about through exercises (Clarke and Clarke, 1989).

Physical educators have long realized that the performance of men and women is greatly influenced by such factors of age, height, arm length, leg length and body structure.

The sculpture of Greece and Rome preserve the ideas of that civilization concerning the idea proportions of the human figure. It is interesting to see in their sculpture the swing of the pendulum of approval from athlete who where broad shouldered, thick set square chested and very muscular, to athletes who are leaner, more supple, and whose figure are more representative of the skills of the finer coordination. Since, the early times there has been continued use of anthropometric measurement to determine its relationship with performance in different games and sports.

Anthropometric variables such as weight, standing height, sitting height, foot length, fore leg length, thigh length, leg length and shoulder width are related to optimum and skilful performance in team as well as individual sport.

Physique is a factor insert of success that may lead to inclusion in the Olympic team or more negatively that lack of proper physique may make it almost impossible for an athlete to reach that degree of success. Thus sports anthropometry has emerged as a special branch not only as a parameter or selective diagnostic procedure, but also as a performance prediction tool. Sports scientists and psychologists have been of the opinion those anthropometric measurements and physical components of the athletes have a lot to do with her/his performance in any ground sport. Body measurements vary within the game as well as between the game and sport.

Importance of Anthropometric Variables

Sports scientists and physiologists have been of the opinion those anthropometric measurements and physical components of an athlete have a lot to do with his performance.

Structure of body is one of the related variables of human motor performance. Science of anthropometry has developed primarily in the play fields of physical anthropologists. Scientific anthropometry began with Johann Friedrich Blumenbach who laid the foundation of craniology.

Anthropometric measurements are dimensions of structure of human body taken at specific sites to give measures of length, girth and width. The results can be used to appraise body build, nutritional status and posture. Certain anthropometric consideration somatotype features and racial traits are identified as advantageous for performance in top sports. An individual for superior performance in any sports is selected based on physical structure of body size he possesses (Carter, 1982) [4].

These specific measurements of limb length, circumference, breadth, build indices can reveal the relationship between the anthropometry of the athlete and his motor fitness. Measurement of body size included such descriptive inscription as height, weight, and surface area while measures

of body proportion describe the relationship between height, weight and arm length, width and circumference of various body segments. It has been found that top athletes in some sports tend to have those proportions that bio mechanically aid the particular performance required (Zeigler, 1982) [5].

Human performance is a composition of many variables such as structure of the body, the specific measurements of the limb's circumferences, breadth and body build. Since motor performance is an outcome of various variables, there may be a direct relationship between certain specific measurements and motor performance. The type of individual's structure is an essential factor in his motor performance. Evidence of this is quite common: observe the well proportionate physique of boxers and gymnasts, the super structure of great basketball players, the muscularity of top class football players, the wiriness of champion distance runners and massive built of shot-put and discus throwers. Therefore, anthropometric measurements of an individual player play a dominant role in high level sports performance.

Objectives of the Study

Anthropometric measurements of the individual athlete play a dominant role in high level sports performance. Human performance is a composite of many variables such as structure of the body, the specific measurements of the limbs' circumferences, breadth and body build. The anthropometric measurements such as height, weight, are likely to influence skill development and performance in the game or sport. No attempt have been made to compare the anthropometry variables of university level sprinters, jumpers, throwers and long distance runners. Further, it is learned from the results that a particular anthropometry quality is necessary to excel in that event. So it will be interesting and useful to find out the difference in anthropometry affect the university sprinters, jumpers, throwers and long distance runners.

Statement of the Study

The purpose of the study was to compare the selected Anthropometric variables such as height, weight. Among university men sprinters, throwers, jumpers and long distance runners.

Methodology

Selection of subjects, selection of variables, reliability of data, reliability of the questionnaire, tester's reliability and tester's competency, orientation of subjects, administration of questionnaire, collection of anthropometric measurements and statistical techniques employed for analyzing the data that have been described.

Selection of Subjects

For the purpose of this study, 160 university athletes consisting of 40 sprinters, 40 jumpers, 40 throwers, and 40 long-distance runners were selected as the subjects at random and their age was between 18 and 25 years.

Selection of the Variables

The study was taken to make a comparative analysis of selected anthropometric variables among the university men sprinters, jumpers, throwers and long distance runners. The investigator reviewed the available scientific literature pertaining to the study, resulting from the review of literature and in consultation with the experts and also considering the feasibility of the study, the following variables were selected keeping in mind the availability of the equipment etcetera.

Dependent Variables: Anthropometric variables

1) Body height 2) Body weight**.**

Research Design

The objective of undertaking this research was to assess the anthropometric variables of university level sprinters, jumpers, throwers and long distance runners and to find out the differences between anthropometric variables among the athletes.

Random group design was followed in this study. Randomly selected 160 University level athletes (N: 160), consisting of 40 sprinters, 40 jumpers, 40 throwers and 40 long distance runners were measured of their selected anthropometric variables, using standard tests prescribed for this purposes. The collected data were subjected to statistical treatment using Analysis of Variance (ANOVA). In all cases 0.05 level was fixed to test the hypothesis of this study.

Criterion Measures: The criterion measures chosen were:

1. Height was measured by Statiometer rod and scored in centimeters (Yobu, 1983) [8].
2. Weight was measured by weighing machine and scored kilogram (Yobu, 1983) [8].

Test Administration

Height: It measures the erect body length from the sole of the foot to the tip of the head.

Equipment: A standardized stadiometer

Procedure: The subject was asked to stand bare foot on the platform, with heels, buttocks, back and head touching the upright on the stadiometer. The feet are placed parallel to each other and head was held in the Frankfurt horizontal plane. That is, tragion and right orbital lying in the same plane. The shoulders were held comfortably and arms hung to maximum with palms touching the thighs. The sliding caliper of the stadiometer was lowered slowly so that it touched the vertex of the head in the mid sagittal plane. The measurement was recorded to $1/10^{th}$ of a centimeter (Yobu, 2000) [9].

Weight.

Equipment: A standard weighing machine.

Procedure: The subject was asked to stand bare foot at the centre on the platform exerting equal pressure on both the feet without any movement thereafter. The subject was allowed minimum possible clothing (shorts only). The weight was recorded to the fraction of $1/10^{th}$ of a kilogram (Yobu, 2000) [9].

Results and Discussions.

Computation of Analysis of Variance and Post-Hoc Test.

Results on Height

The comparison results on the anthropometric variable. Height among the University level men sprinters, jumpers, throwers and long distance runners is presented in Table-I.

Table-I shows that the mean values in Height for University level men sprinters are 171.75, jumpers are 172.80, throwers

are 176.45 and long distance runners are 169.03. The differences were subjected to statistical analysis and it was found that the obtained F-value 7.87 was greater than the required F-value of 2.63 to be significant at 0.05 level. Hence, it was found that there were significant differences between the groups tested.

Table 1: Showing the Analysis of Variance on the Means Obtained from Sprinters, Jumpers, Throwers and Long Distance Runners on Height

Means Values of Athletes of				Source of Variance	Sum of Squares	df	Mean Squares	F
Sprinters	Jumpers	Throwers	Long Distance Runners					
171.75	172.80	176.45	169.03	Between	1133.22	3	377.74	7.87*
				Within	7484.78	157	47.98	

Table F-ratio at 0.05 level of confidence for 3 and 157 (df) =2.63. * Significant at 0.05 level

Table 2: Multiple Paired Mean Comparisons using Scheffe's Confidence Interval Test Scores on Height

Means					Required C.I.
Sprinters	Jumpers	Throwers	Long Distance Runners	Mean Difference	
171.75	172.80			1.05	4.35
171.75		176.45		4.70*	4.35
171.75			169.03	2.72*	4.35
	172.80	176.45		3.65	4.35
	172.80		169.03	3.78	4.35
		176.45	169.03	7.42*	4.35

***** Significant at 0.05 level

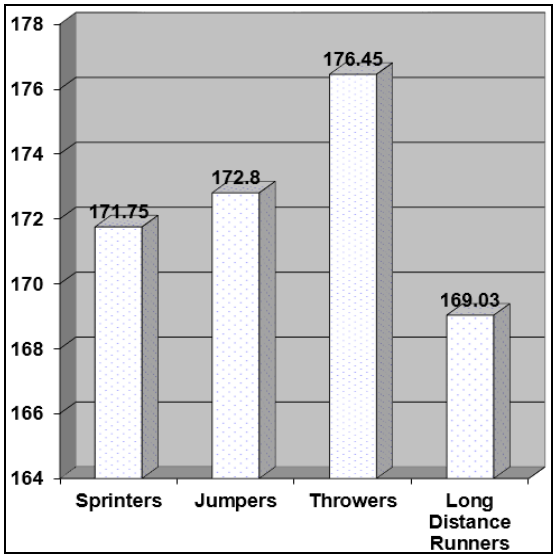
Since significant differences were obtained the data were further subjected to statistical treatment using Scheffe's confidence interval and the results are presented in Table-II.

The results presented in Table-II showed that the following mean differences were significant at 0.05 level, as the mean difference obtained was greater than the required confidence interval of 4.35.

Sprinters *Vs* Throwers MD: 4.70. Throwers *Vs* Long distance runners MD: 7.42. The results presented in Table-IV showed that the following mean differences were not significant at 0.05 level as the mean difference obtained was lesser than the required confidence interval of 4.35.

Sprinters *Vs* Jumpers MD: 1.05.Sprinters *Vs* Long distance runners MD: 2.72. Jumpers *Vs* Throwers MD: 3.65. Jumpers *Vs* Long distance runners MD: 3.78

The mean values presented in Table-I were presented through a bar diagram in Figure-I for better understanding of the results.



Graph 1: Bar Diagram Showing the Mean Values in Height among University level Men Sprinters, Jumpers, Throwers and Long Distance Runners

Results on Weight: The comparison results on the anthropometric variable. Weight among the University level men sprinters, jumpers, throwers and long distance runners is presented in Table-III.

Table 3: Showing the Analysis of Variance on the Means Obtained From Sprinters, Jumpers, Throwers and Long Distance Runners on Weight

Means Values of Athletes of				Source of Variance	Sum of Squares	df	Mean Squares	F
Sprinters	Jumpers	Throwers	Long Distance Runners					
61.83	63.20	78.70	57.28	Between	10417.45	3	3472.48	46.54*
				Within	11640.55	157	74.62	

Table F-ratio at 0.05 level of confidence for 3 and 157 (df) =2.63. *Significant at 0.05 level

Table-III shows that the mean values in Weight for University level men sprinters are 61.83 jumpers are 63.20 throwers are 78.70 and long distance runners are 57.28. The differences were subjected to statistical analysis and it was found that the obtained F-value 46.54 was greater than the required F-value of 2.63 to be significant at 0.05 level. Hence, it was found that there were significant differences between the groups tested.

Since significant differences were obtained the data were further subjected to statistical treatment using Scheffe's confidence interval and the results are presented in Table-IV

Table 4: Multiple Paired Mean Comparisons using Scheffe's Confidence Interval Test Scores on Weight

MEANS					Required
Sprinters	**Jumpers**	**Throwers**	**Long Distance Runners**	**Mean Difference**	**C.I.**
61.83	63.20			1.38	5.43
61.83		78.70		16.88*	5.43
61.83			57.28	4.55	5.43
	63.20	78.70		15.50*	5.43
	63.20		57.28	5.93*	5.43
		78.70	57.28	21.43*	5.43

***** Significant at 0.05 level.

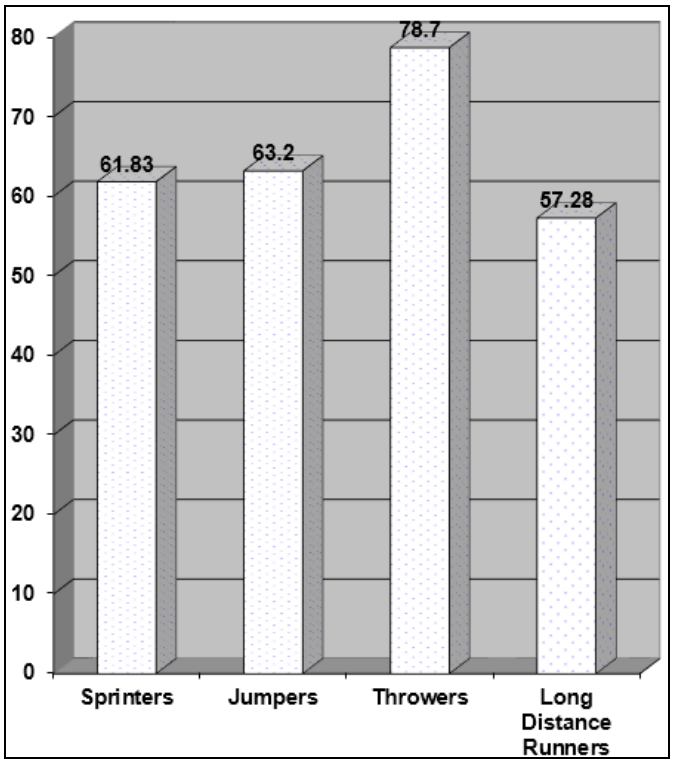
The results presented in Table-IV showed that the following mean differences were significant at 0.05 level as the mean difference obtained was greater than the required confidence interval of 5.43.

Sprinters *Vs* Throwers MD: 16.88. Jumpers *Vs* Throwers MD: 15.50. Jumpers *Vs* Long distance runners MD: 5.93. Throwers *Vs* Long distance runners MD: 21.43

The results presented in Table-IV showed that the following mean differences were not significant at 0.05 level as the mean difference obtained was lesser than the required confidence interval of 5.43.

Sprinters *Vs* Jumpers MD: 1.38. Sprinters *Vs* Long distance runners MD: 4.55

The mean values presented in Table-III were presented through a bar diagram in Figure-II for better understanding of the results.



Graph 2: Bar Diagram Showing the Mean Values in Weight among University level Men Sprinters, Jumpers, Throwers and Long Distance Runners

Discussion on Findings: Height

The findings of the study also show that there is significant difference in heights among the university sprinters, jumpers, throwers and long distance runners. The university throwers are taller (176.450 cms) than sprinters (171.75 cms) and long distance runners (169.025 cms). The sprinters, due to the explosive nature of this event, need their Center of Gravity to be as low as possible to maintain their speed along with balance. Whereas the throwers propel their implement into the air for greater distance and so they need a comparatively higher position of the Center of Gravity.

Giampietro, M., Pujia, A. and Bertini, I. (2003) examined the anthropometric features and body composition of athletes practising karate at a high and medium competitive level and found differences between the groups. The findings of this study is in agreement with finding of the above studies as there were differences in height among university level sprinters, throwers and long distance runners.

Body Weight

The findings of the study show that there is significant difference in body weight among the university sprinters, jumpers, throwers and long distance runners. The body weight of the university throwers (78.200 kg) is greater than the sprinters (61.83 kg) jumpers (63.200 kg) and long distance runners (57.275 kg). Further, the body weight of university jumpers is greater than that of sprinters and long distance runners, and the body weight of sprinters is greater than that of the long distance runners.

A look at the national records in the various throwing events would also justify the fact that it has been biomechanically proved that body weight is a contributory variable to the performance in all the throwing events. A look at the morphological structure will also give a significant idea regarding the above findings.

Mall (1987) [6] found that the variables such as height, weight, arm length and leg length influence the performance in swimming. Leone, M., Lariviere, G., and Comtois, A.S. (2002) [7] found that elite adolescent female athletes show physical and biomotor differences that clearly distinguish them according to their particular sport. Thus, the above findings suggest that weight have a definite say on the performance of the athletes and their type of particular sports activity. The findings of this study proved that there were significant differences among the university level athletes,

namely, sprinters, jumpers, throwers and long distance runners. Thus, the findings of this study were in agreement with the findings of the studies of Mall (1987) [6] and Lariviere G. and other (2002) [7].

Discussion on Hypothesis

It was hypothesized that there would be significant difference in the selected anthropometric variables height, weight, among university men sprinters, throwers, jumpers and long distance runners.

The results presented in Table I and III, on anthropometric variables, height, weight, respectively proved. There was significant difference among University men sprinters, jumpers, throwers and long distance runners, as the F-values were greater than the required table F-value to be significant at 0.05 level. Thus, the formulated hypothesis No. 1 that there would be significant difference in the selected anthropometric variables height, weight, among university men sprinters, throwers, jumpers and long distance runners was accepted at 0.05 level,

Conclusions

1. It was concluded that there were significant differences on anthropometric variable, such as height among University men sprinters, jumpers, throwers and long distance runners and it was found that throwers were significantly taller than sprinters and long distance runners.
2. It was concluded that there were significant differences on anthropometric variable, such as weight among University men sprinters, jumpers, throwers and long distance runners and it was found that throwers were significantly heavier than sprinters and long distance runners.

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