

## **Relationship of Anthropometric Measurements with Performance of Collegiate Kho-Kho Players of Amravati University**

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### **Abstract**

The sports performance of Kho-Kho players which depends upon the Anthropometric Measurements of the players, it is felt that there may be a positive relationship of these variables with the performance in Kho-Kho. The purpose of the study is to find out the relationship of Anthropometric Measurements with Performance of Collegiate Kho-Kho Players and to develop a Prediction Equation for the forecasting of the performance of a Kho-Kho player depending upon the Anthropometric Measurements.

It was hypothesised that there would be significant relationship of the Anthropometric Measurements with performance of Collegiate Kho-Kho Players. The data pertaining to the present study were collected from the 200 players of the best eight teams and extras of Sant Gadge Baba Amravati University inter-collegiate Kho-Kho (Men) tournaments.

The data were collected by administering the tests for the selected variables viz. Body Weight, Standing Height, Foot Length, Leg Length, Lower Leg Length, Arm Length, Palm Length, Thigh Girth., Calf Girth, Wrist Girth, Chest Girth and Upper Arm Girth.

On the basis of finding and within the limitation of present study it was found that there is little coorelation between Anthropometric Variables and Total Performance in Kho-Kho.

**KEYWORDS:** Anthropometric Measurements, Performance in Kho-Kho

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### **Introduction:**

With the promotion of civilization, human approach has become more scientific in nature. Consequently, better and more accurate base of measurement has been developed. Inspire of the history of measurement of man being quite old and dating back to ancient civilization, the subject of test and measurement is still in infancy and some of the evaluations are still based on tests without establishing the validity, reliability and objectivity of these testy.

In ancient India and Egypt, the earliest anthropometric studies were undertaken to find one part of the body which would predict or become a common

measurement of all other body parts. For example, the length of middle finger was considered a common measure of body proportion in Egypt. Thus a proportional body was considered to have five finger lengths up to knee, ten finger lengths up to pubic arch etc.

Hippocrates was the first Greek expert in test and measurement who introduced a 'method of body classification in which the human beings were divided into two body types: Phthisis dominated by the vertical dimension and Apoplectic dominated by horizontal dimension. Hippocrates studied human physical types for medical purposes while Greek sculptors were doing so for their interest in physical perfection. Rostan a French man developed a classification method of dividing all humans in three physical types namely Digestive, Musculaire and Cerebral which became forerunners of Sheldon's three somatotype components (Endomorphy, Mesomorphy and Ectomorphy).

Anthropometric measurements are the best applicable means for studying body, size, shape and composition. It helps greatly in sports talent selection, sports counseling and measurement of obesity for health related physical fitness.

One of the most important tasks for physical educationists is to measure different parts and components of human body. The scientific terminology given to the measurement of man is "Anthropometry" which is a word synthesized from two Greek words- 'Anthropos' means man and 'metreein' means to measure. Hence, anthropometry means - the measurements of human body.

Anthropometry may be defined as the measurement of human body and its parts with standardized techniques. Kinanthropometry is defined as the measurement of body and those body part which are related to body kinetics and kinematics. These variables are of great importance for good performance in Kho-Kho.

The performance of the Kho-Kho player depends on many factors related to skills viz. (1) Sitting In The Square, (2). Giving 'Kho', (3) Simple 'Kho', (4) Judgement 'Kho', (5) Late Kho, (6) Tapping, (7) Covering, (8) Running Dive, (9) Side Dive, (10) Spot Dive, (11) Pole Dive, (11) Running Pole Dive, (12) Sudden Change Of Target, (13) Trapping, (14) Pole Turning, (15) Entering The Field Of Play, (16) Positioning On The Post, (17) Single Chain, (18) Single Six-Up Chain, (19) 3 Six-Up Chain, (20) Ring Game, (21) Dodging, (22) Pulty/Sudden Turn and (23) Counter Action For Judgement 'Kho'.

Multiple regression equation describes the path of the mean values of the dependent variable Y, for all combinations of the independent variables  $X_1, X_2, X_3, \dots, X_k$ . The principal advantage of multiple regression equation is that it allows us to utilise more of the information available (independent variable) to us to estimate the dependent variable.

Multiple regression equation is expressed as:

$$Y = \alpha + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 + \dots + \alpha_k X_k$$

in which  $\alpha$  is a constant,  $\alpha_1, \alpha_2, \dots, \alpha_k$  are constants known as partial regression coefficients,  $Y$  is the variable taken to be dependent and it is to be predicted/estimated and  $X_1, X_2, X_3, \dots, X_k$  are the independent variables.

### **Statement Of The Problem:**

The present researcher is serving in an Arts, Science and Commerce College at Chikhaladara. He himself is an NIS Coach and giving special coaching in Kho-Kho to the inter-collegiate players of the college as well as to the players of the local colleges. Due to his personal curiosity in knowing the sports performance of Kho-Kho players which depends upon the Anthropometric Measurements of the players, it is felt that there may be a positive relationship of these variables with the performance in Kho-Kho. To verify the relationship in a scientific way the problem is stated as “Relationship Of Anthropometric Measurements With Performance Of Collegiate Kho-Kho Players of Amravati University”.

### **Purpose Of The Study:**

The purpose of the study is to find out the relationship of Anthropometric Measurements with Performance of Collegiate Kho-Kho Players and to develop a Prediction Equation for the forecasting of the performance of a Kho-Kho player depending upon the Anthropometric Measurements.

### **Significance Of The Study:**

The significance of the study is justified on the grounds that (i) The present study would be the first of its kind in Sant Gadgebaba Amravati University, Amravati and perhaps in Maharashtra; (ii) The relationship of Anthropometric Measurements with Performance Of Collegiate Kho-Kho Players would made known; (iii) The Prediction Equation under study for the forecasting of the performance of Kho-Kho players considering the Anthropometric Measurements, would be helpful to the coaches of Kho-Kho; and (iv) The present study will motivate the future research scholars to undertake similar study in other games and sports at different level of participation.

### **Hypothesis:**

It was hypothesised that there would be significant relationship of the Anthropometric Measurements with performance of Collegiate Kho-Kho Players.

### **Delimitation Of The Study:**

The scope of the present study were delimited to (i) The study was delimited to the male Kho-Kho players only; (ii) The study was further delimited to the players of the best eight teams of Amravati University inter-collegiate Kho-Kho (Men) tournaments; (iii) The anthropometric measurements were delimited to (a) Body Weight

(b) Standing Height (c) Foot Length (d) Leg Length (e) Lower Leg Length (f) Arm Length (g) Palm Length (h) Thigh Girth (i) Calf Girth (j) Wrist Girth (k). Chest Girth and (l) Upper Arm Girth.

### **Limitation Of The Study:**

The present study had the limitations like (i) The Socio-Economic-Status of the students might be different (ii) The present research scholar did not consider the dietary and nutritional practices of the students; (iii) The variation in age of the students were not be taken into consideration and (iv) The climatic condition of different measurements were different.

### **Reviews Of Related Literature:**

A summary of the writings of recognized authorities and of previous research provides evidence that the researcher is familiar with what is already known and what is still unknown and untested. Since effective research is based upon past knowledge, this helps to eliminate the duplication of what has been done, and provides useful hypotheses and helpful suggestions for significant investigation.

The research scholar made an attempt to go through the related literatures in libraries of Sant Gadgebaba Amravati University, Amravati; Degree College of Physical Education, Amravati and Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur. From the **5 reviews** it was very clear that not even a single study was found which was directly related to the present study on the Prediction of Kho-Kho playing ability on the basis of Anthropometric Measurement. Hence the topic is a claimed to be a New One and has a greater scope to work with it as far Maharashtra State is concerned.

### **Method of study:**

The data pertaining to the present study were collected from the 200 players of the best eight teams and extras of Sant Gadge Baba Amravati University inter-collegiate Kho-Kho (Men) tournaments.

No sampling method was used to select the players i.e. all the players of the best eight teams of of Sant Gadge Baba Amravati University Inter-Collegiate Kho-Kho (Men) competitions were selected.

The data pertaining to the study was collected by administering the tests for the selected variables. Before Collection of data, the subjects was given a chance to practice the prescribed tests so that they should become familiar with the tests and know exactly what is to be done to ensure uniform testing condition the subjects was tested during morning/evening and data were collected.

The details of the criteria are given below:

### **Anthropometric Measurements:**

The following variables were considered as sub-criteria of anthropometric measurements:

- |                 |                      |                     |
|-----------------|----------------------|---------------------|
| a. Body Weight  | b. Standing Height.  | c. Foot Length.     |
| d. Leg Length.  | e. Lower Leg Length. | f. Arm Length.      |
| h. Palm Length  | i. Thigh Girth.      | i. Calf Girth.      |
| j. Wrist Girth. | k. Chest Girth.      | l. Upper Arm Girth. |

The reliability of data was ascertained by confirming the reliability of instruments and the reliability of the testers. Reliability of the instruments was assured by the reputed manufacturers of the instruments. The tester's reliability was guaranteed by assessing the coefficient of correlation (reliability of coefficient) between the tester's data and the data collected by experts. The Coefficient of Correlation for all the above criteria was found significant.

### **Description of the Tests:**

#### **Anthropometric Measurements:**

##### **1. Body Weight:**

**The description:** The weights of the subjects were taken on a weighing machine. The subjects wearing short and vest only stand on the weighing machine. The weight was read and recorded nearest to half a Kilogram.

##### **2. Standing Height:**

**Test description:** Standing height was measured without shoes, using the stadiometer marked in centimeters with the individual standing crest. The subject was asked to step out by lowering the head and the reading indicated by the hard board's lower and read on the scale. The standing height was recorded to the nearest 0.1 c.m.

##### **3. Foot Length:**

**Test description:** The Measurement of foot length was made with a small sliding Caliper from the systolic process of the radius to the lip of middle finger. The subjects stand with equally on the both foot. The foot length was recorded to the nearest 0.1 Centimeter.

##### **4. Leg Length:**

**Test description:** Leg length was measured without shoes, using Anthropometer. Leg length is the distance between the hip joint and floor when the subject stands erect. The lower extremity length was recorded to the nearest 0.1 Centimeter.

##### **5. Lower-Leg-Length:**

**Test Description:** The measurement of lower leg length was measured without shoes, using anthropometer and a base for the anthropometer. Lower leg length distance

between knee-joint to the sole of the foot was taken. The lower length was recorded to the nearest 0.1 Centimeter.

#### **6. Arm Length.**

**Test Description:** The measurement was with a small sliding caliper from the styloid process of the radius to tip of the middle finger. The subject sits or stands with arms hanging relaxed and the fore arms extended horizontally. The hand and fingers palm up are extended in the direction of the longitudinal axis of the arm. The arm length was recorded to the nearest 0.1 Centimeter.

#### **7. Palm Length.**

**Test Description:** The measurement was made with a small sliding caliper from the styloid process of the bottom of the palm to tip of the middle finger. The subject sits or stands with arms hanging relaxed and the fore arms extended horizontally. The hand and fingers palm up are extended in the direction of the longitudinal axis of the arm. The palm length was recorded to the nearest 0.1 Centimeter.

#### **8. Thigh Girth:**

**Test description:** The subject stands with the feet about 20 cm. apart and weight distributed equally on both feet. A steel tape measure was positioned horizontally around the thigh and moved up and down to locate the maximum girth in a plane perpendicular to the long axis of the thigh. The zero end of the tape was placed below the measurement value. The maximum thigh girth was recorded to the nearest 0.1 centimeter.

#### **9. Calf Girth:**

**Test description:** The subject stands with the feet about 20 cm. apart and weight distributed equally on both feet. A steel tape measure was positioned horizontally around the calf and moved up and down to locate the maximum girth in a plane perpendicular to the long axis of the calf. The zero end of the tape was placed below the measurement value. The maximum calf girth was recorded to the nearest 0.1 centimeter.

#### **10. Wrist Girth:**

**Test description:** The standing subject flexes the forearm at the elbow, keeping the forearm vertical and near the side of the chest. The measurer stands facing the subject. A steel tape measure was positioned horizontally around the wrist and moved up and down to locate the maximum girth in a plane perpendicular to the long axis of the forearm. The zero end of the tape was placed below the measurement value. The wrist breadth was recorded to the nearest 0.1 centimeter.

#### **11. Chest Girth:**

**Test description:** The subject stands with the feet about 20 cm. apart and weight distributed equally on both feet. A steel tape measure was positioned horizontally around the chest and moved up and down to locate the maximum girth in a plane perpendicular to the long axis of the chest. The zero end of the tape was placed below the measurement value. The maximum chest girth was recorded to the nearest 0.1 centimeter.

## 12. Upper arm Girth:

**Test description:** The measurement for the arm girth was taken with a steel tape. It was measured at the center of the shoulder and elbow joint. This level was marked on the skin first then the tape was placed around so, that it was in light contact with the skin all round. The arm, which hung down loosely the side, was relaxed. Upper arm girth was recorded to the nearest 0.1 centimeter.

### Measurement of Kho-Kho Performance:

The performance of the Kho-Kho players was made on the basis of (1) Sitting In The Square, (2) Running ‘Kho’, (3) Sitting ‘Kho’, (4) Judgement ‘Kho’, (5) Late ‘Kho’, (6) Tapping, (7) Covering on Cross lane, (8) Running Dive, (9) Side Dive, (10) Spot Dive, (11) Sitting Pole Dive, (12) Running Pole Dive, (13) Sudden Change Of Target, (14) Trapping/Clubbing, (15) Pole Turning, (16) Entering The Field Of Play (17) Positioning On The Post,; (18) Single Chain, (19) Single Six-Up Chain, (20) 3 Six-Up Chain, (21) Ring Game (22) Dodging, (23) Pulty and (24) Counter Action For Judgement ‘Kho’. For this the subjective judgement by the experts of Kho-Kho was made. There were five judges for this purpose. The mean performance of the players was recorded as the performance for the development of the Prediction equation of Kho-Kho playing ability.

### Compilation Of Data:

The data pertaining to the study were collected by administering the tests for the selected variables. The data were collected in the prescribed proforma made for this purpose. After collection they were entered in Microsoft Excel for further processing. After the collection of the data, correlational statistical techniques were applied. To find the relationship of anthropometric measurements with performance of collegiate Kho-Kho players, the research scholar used Pearson’s Product Moment Correlation. Multiple Regression Analysis was applied to form the Regression Equation which was the core of the study.

The details of the analyses are given in the following tables:

Table No. - 1  
Showing Inter-Corelation Among Anthropometric Variables

	Ht	Wt	FL	LLL	AL	TG	CaG	WRG	UAG	ChG	PL	Total
Height	1.000											
Weight	0.335	1.000										
FL	0.400	0.286	1.000									
LLL	0.326	0.090	0.107	1.000								
AL	0.417	0.027	0.445	0.106	1.000							
TG	0.091	0.494	0.307	0.182	0.059	1.000						
CaG	0.223	0.360	0.296	0.154	0.362	0.447	1.000					

WRG	0.081	0.214	0.127	0.141	0.123	0.315	0.305	1.000				
UAG	0.184	0.455	0.335	0.135	0.243	0.563	0.647	0.277	1.000			
ChG	0.140	0.253	0.259	0.207	0.162	0.282	0.270	0.198	0.337	1.000		
PL	0.334	0.159	0.311	0.053	0.241	0.063	0.159	0.213	0.165	0.044	1.000	
Total	0.041	-	0.045	0.022	0.149	-	0.116	0.064	0.103	0.056	0.141	1.000

From the above table it is observed that the correlation between Height and Weight is 0.335; Height and Foot Length is 0.400; Height and Lower Leg Length is 0.326; Height and Arm Length is 0.417; Height and Thigh Girth is 0.091; Height and Calf Girth is 0.223; Height and Wrist Girth is 0.081; Height and Upper Arm Girth is 0.184; Height and Chest Girth is 0.140; Height and Palm Length is 0.334 and Height and Total Performance is 0.041.

It is also observed that the correlation between Weight and Foot Length is 0.286; Weight and Lower Leg Length is 0.090; Weight and Arm Length is 0.027; Height and Thigh Girth is 0.494; Height and Calf Girth is 0.360; Weight and Wrist Girth is 0.214; Weight and Upper Arm Girth is 0.455; Height and Chest Girth is 0.253; Weight and Palm Length is 0.159 and Weight and Total Performance is -0.005.

Further it is observed that Foot Length and Lower Leg Length is 0.107; Foot Length and Arm Length is 0.445; Foot Length and Thigh Girth is 0.307; Height and Calf Girth is 0.296; Height and Wrist Girth is 0.127; Foot Length and Upper Arm Girth is 0.335; Foot Length and Chest Girth is 0.259; Foot Length and Palm Length is 0.311 and Foot Length and Total Performance is 0.045.

The correlation between Lower Leg Length and Arm Length is 0.106; Lower Leg Length and Thigh Girth is 0.182; Lower Leg Length and Calf Girth is 0.154; Lower Leg Length and Wrist Girth is 0.141; Lower Leg Length and Upper Arm Girth is 0.135; Lower Leg Length and Chest Girth is 0.207; Lower Leg Length and Palm Length is 0.053 and Lower Leg Length and Total Performance is 0.022.

The correlation between Arm Length and Thigh Girth is 0.059; Arm Length and Calf Girth is 0.362; Arm Length and Wrist Girth is 0.123; Arm Length and Upper Arm Girth is 0.243; Arm Length and Chest Girth is 0.162; Arm Length and Palm Length is 0.241 and Arm Length and Total Performance is 0.149.

It is seen that the correlation between Thigh Girth and Calf Girth is 0.447; Thigh Girth and Wrist Girth is 0.315; Thigh Girth and Upper Arm Girth is 0.563; Thigh Girth and Chest Girth is 0.282; Thigh Girth and Palm Length is 0.063 and Thigh Girth and Total Performance is -0.020.

It is observed that the Calf Girth and Wrist Girth is 0.305; Calf Girth and Upper Arm Girth is 0.647; Calf Girth and Chest Girth is 0.270; Calf Girth and Palm Length is 0.159 and Calf Girth and Total Performance is 0.116. Correlation between Wrist Girth and Upper Arm Girth is 0.227; Wrist Girth and Chest Girth is 0.198; Wrist

Girth and Palm Length is 0.213 and Wrist Girth and Total Performance is 0.064. It is found that the Correlation between Upper Arm Girth and Chest Girth is 0.337; Upper Arm Girth and Palm Length is 0.165 and Upper Arm Girth and Total Performance is 0.103.

Table No. - 2  
Showing Regression Analysis Among Physiological Variables

Regression Statistics				
Multiple R	0.228	SE	8.092	
R Square	0.052	Observations	236	
	Coefficients	SE	t-Stat	P-value
Intercept - $\beta_0$	42.734	18.445	2.317	0.021
Height - $\beta_1$	-0.082	0.128	-0.635	0.526
Weight - $\beta_2$	-0.025	0.095	-0.263	0.793
Foot Length - $\beta_3$	-0.240	0.416	-0.576	0.565
Lower Leg Length - $\beta_4$	0.025	0.113	0.222	0.825
Arm Length - $\beta_5$	0.147	0.104	1.408	0.160
Thigh Girth - $\beta_6$	-0.146	0.132	-1.104	0.271
Calf Girth - $\beta_7$	0.148	0.237	0.624	0.533
Wrist Girth - $\beta_8$	0.124	0.504	0.246	0.806
Upper Arm Girth- $\beta_9$	0.327	0.351	0.930	0.353
Chest Girth- $\beta_{10}$	0.034	0.077	0.443	0.658
Palm Length - $\beta_{11}$	0.729	0.420	1.737	0.084

From the previous table it is observed that the Multiple R for the selected variables is 0.228 and the R Square is 0.052 which are not significant at the 0.05 level of significance. The  $\beta_0$  for the Prediction Equation is 42.734 and  $\beta_1$  weight for the Height is -0.082, for Weight is -0.025, for Foot Length is -0.240, for Lower Leg Length is 0.025, Arm Length is 0.147, for Thigh Girth is -0.146, for Calf Girth is 0.148, for Wrist Girth 0.124, for Upper Arm Girth is 0.327, for Chest Girth is 0.034 and for Palm Length is 0.729. Hence the Prediction Equation for the above variables can be constructed as given below:

$$\text{Performance} = 42.734 + (-0.082 \times \text{Height}) + (-0.025 \times \text{Weight}) + (-0.240 \times \text{Foot Length}) + (0.025 \times \text{Lower Leg Length}) + (0.147 \times \text{Arm Length}) + (-0.146 \times \text{Thigh Girth}) + (\text{Calf Girth} \times 0.148) + (\text{Wrist Girth} \times 0.124) + (\text{Upper Arm Girth} \times 0.327) + (\text{Chest Girth} \times 0.034) + (\text{Palm Length} \times 0.729)$$

The Inter-Corelation Among Selected Anthropometric Variables is shown in

Figure-1.

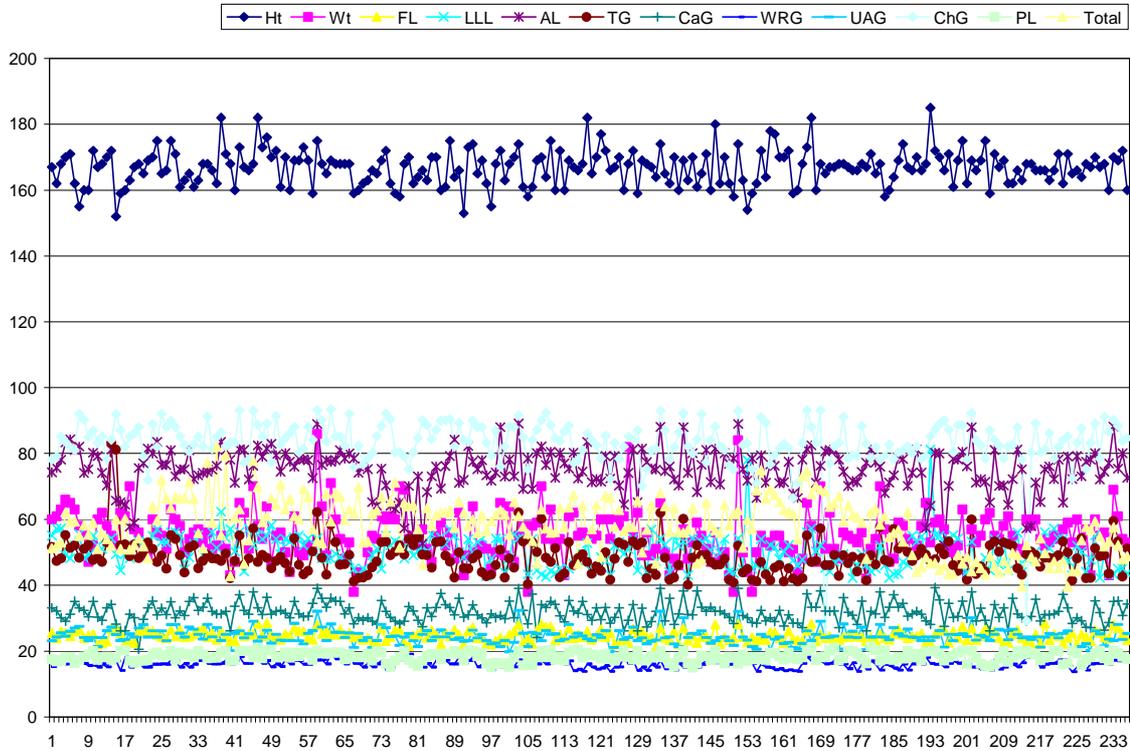


Figure No. - 1.  
Showing Inter-Corelation Among Selected Anthropometric Variables

**Testing of Hypothesis:**

It is hypothesised that there would be significant relationship of the Anthropometric Measurements, Physiological Variables and Physical Fitness with Performance of Collegiate Kho-Kho Players.

In the light of derived results, it was found that the hypothesi made by the researcher was partially correct. In beginning it was hypothesized that there might be significant relationship between the Anthropometric Measurements, Physiological Variables and Physical Fitness with Performance of Collegiate Kho-Kho Players. It was based on the previous experience.

**Conclusion:**

On the basis of finding and within the limitation of present study the following conclusion has been drawn:

From Tables-1 and 2 it was found that there is again little correlation between Anthropometric Variables and Total Performance in Kho-Kho.

### **Recommendation:**

The following recommendations are made on the basis of the results from the study which may be useful for the future research work:

1. The same study may be repeated with other Physiological and Physical Fitness and Anthropometric variables on the same subjects.
2. The same study may be repeated with other Physiological and Physical Fitness and Anthropometric variables on the female subjects.
3. The same study may be repeated with other Physiological and Physical Fitness and Anthropometric variables of other games.
4. The same study can be carried on other states and university.
5. The findings of the study may serve as a reference material for the future studies.

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