

## Position-Wise Discriminating Tendency Among Anthropometric Characteristics of Indian Youth Elite Basketball Players



### Physical Education

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### ABSTRACT

*In the current basketball scenario, the purpose of the study was to analyze the discriminating factors of anthropometrical variables on the performance of youth elite basketball players with special reference to their playing positions according to the Indian context. In this study, ninety nine basketball players were positively rated ranged 84 points to 1 point, in which ninety nine players with reference to their playing position were selected as subjects. Further these ninety nine youth Basketball players were identified as elite subjects, grouped on the top thirty three rankings from each position - Guard (GD = 33), Forward (FD = 33) and Center (CR = 33) assessed by the FIBA Live Stats Software. A series of anthropometric measurements included eight skinfold measurements - biceps, subscapular, triceps, supraspinale, abdominal, iliac crest, front thigh and medial calf; five girth measurements - arm girth relaxed, arm girth flexed, waist, gluteal and calf girth; three length measurements - arm span, arm length, leg length and two breadth measurements - humerus breadth and femur breadth (bicipicondylar) were selected as independent variables in this study. The performance of the selected subjects as the dependent variable was assessed through FIBA Live Stat software in terms of efficiency ratings. The Statistical techniques including descriptive statistics and discriminant analysis were applied. The result revealed that two length factors (arm length and leg length); six skinfold factors (triceps, scapula, iliac crest, abdominal, thigh and calf skinfold); three circumference factors (waist, gluteus and calf); - as totally 11 anthropometric factors have the discriminating tendency for guard, forward and center playing positions of Indian youth elite basketball players.*

### Introduction

Anthropometry refers to the measurement of living human individuals for the purposes of understanding human physical variation. In sports and games the performance is inevitable. Nowadays, the nature of sports and games has gone through tremendous radical changes in international arena. Identification of effective players is becoming a crucial, because day by day all the sports have become highly competitive (Anguera, 2009). Basketball is a complex sport in which two teams of twelve players compete for possession of ball and try scoring opportunities on a court measuring 28 x 15 meters. The aim of the game for each team is to defend a goal area while trying to score goals at the opposing end of the court. Each team consists of twelve players of which only five may take the court at any one time during play. The sport has evolved greatly since its inception over a couple of centuries ago. The 'structure' or 'style of play' has undergone rapid changes due to the rule changes since the introduction of the game. The modern game of basketball is played at very high speed that consists of activities of short duration but high intensity during the course of the game (Greene, et al, 1988). Further, the game according to the position on the court and their playing role varies in the offensive and defensive team tactics. Evaluating individual playing ability or performance within a team sport environment can present as a difficult task for team sport coaches. The changing nature of the game both on offensive and defensive system of play and advent of professionalism have led to greater anthropometrical demands on the players. Anthropometry provides scientific methods and observation to help in finding out talent in sports (Lorenzo, et al, 2010). The primary objective of the study was to identify the most important discriminating factors among anthropometrical characteristics of Indian youth elite basketball players with special reference to their playing positions towards performance.

### Methodology

Indian youth elite basketball players were identified as the total population as by means of participation in the 27<sup>th</sup> Indian National Youth Basketball Championship, organized by Basketball Federation of India, hosted by Care School of Engineering, Tiruchirappalli, Tamilnadu from 1st to 8th June, 2010. For selecting samples from the population, totally thirty five matches (level - I) in the tournament were used to assess the player's performance and they were ranked according to their efficiency rating made by the FIBA Live Stats software. The live court performances of the players were rated as both positively and negatively by the sum of their positive aspects as well as their errors committed during the play. In this study, one hundred and four basketball players were positively rated ranged 84 points to 1 point, in which ninety nine players with reference to their play-

ing position were selected as subjects in order to make the sample size into equal. Thus players positively rated were selected as the subjects for this study by adopting objective oriented purposive sampling technique. Further these ninety nine youth Basketball players were identified as elite subjects, grouped on the top thirty three rankings from each position - Guard (GD = 33), Forward (FD = 33) and Center (CR = 33) assessed by the FIBA Live Stats Software.

A series of anthropometric measurements included eight skinfold measurements - biceps, subscapular, triceps, supraspinale, abdominal, iliac crest, front thigh and medial calf; five girth measurements - arm girth relaxed, arm girth flexed, waist, gluteal and calf girth; three length measurements - arm span, arm length, leg length and two breadth measurements - humerus breadth and femur breadth (bicipicondylar) were selected as independent variables in this study. The performance of the selected subjects as the dependent variable was assessed through FIBA Live Stat software in terms of efficiency ratings.

**Table - I: Selection of Variables and its Unit of Measurements**

| Factors / S.No                       | Variables                                                                                                                                     | Instrument Used                                        | Unit of Measurement     |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-------------------------|
| 1<br>2                               | Standing height and Body weight                                                                                                               | Seca portable stadiometer and calibrated digital scale | Centimeter and Kilogram |
| 1<br>2<br>3<br>4<br>5<br>6<br>7<br>8 | Skinfold measurements<br>biceps,<br>subscapular,<br>triceps,<br>supraspinale,<br>abdominal,<br>iliac crest,<br>front thigh and<br>medial calf | Harpends Skinfold Caliper (Canada)                     | Millimeter              |
| 1<br>2<br>3<br>4<br>5                | Girth measurements<br>arm girth relaxed,<br>arm girth flexed,<br>waist,<br>gluteal and<br>calf girth                                          | Lufkins Anthropometric Tape (Canada)                   | Centimeter              |
| 1<br>2<br>3                          | Length measurements<br>arm span,<br>arm length and<br>leg length                                                                              | Lufkins Anthropometric Tape (Canada)                   | Centimeter              |
| 1<br>2                               | Breadth measurements<br>humerus breadth and<br>femur<br>breadth:bicipicondylar                                                                | Small Bone Caliper (Canada)                            | Centimeter              |

The Statistical techniques included descriptive statistics, and discriminant analyses were applied. Statistical Package for Social Sciences (SPSS-17) 17th version was used for data analysis. For all cases the level of significance was set at 0.05 level.

### Results and Discussions

Table – II presents the mean and standard deviation values of Indian youth elite basketball players with reference to their playing positions namely, Guard, Forward and Center. Since the unit of measurement of the selected parameters different and for analytical purpose, all the measured variables were converted to standard scores (z-scores).

**Table – II**  
**Position-wise Anthropometric Characteristics of Indian Youth Elite Basketball Players**

| S.No | Variables             | Guard<br>(N=33)    | Forward<br>(N=33) | Center<br>(N=33) |
|------|-----------------------|--------------------|-------------------|------------------|
|      |                       | Mean ( ± SD)       | Mean ( ± SD)      | Mean ( ± SD)     |
| 1    | Weight                | 57.82 (4.972)      | 63.27 (5.387)     | 70.03 (11.572)   |
| 2    | Height                | 177.94 (6.567)     | 181.70 (5.704)    | 192.82 (8.579)   |
| 3    | Arm Span              | 182.1330 (7.16965) | 187.97 (8.301)    | 199.94 (7.786)   |
| 4    | Arm Length            | 80.083 (5.8446)    | 86.06 (4.046)     | 92.67 (9.983)    |
| 5    | Leg Length            | 89.7276 (5.76849)  | 95.36 (4.999)     | 98.82 (4.565)    |
| 6    | Triceps Skinfold      | 8.115 (3.9891)     | 6.245 (2.8297)    | 6.27 (2.798)     |
| 7    | Subscapular Skinfold  | 7.918 (3.1401)     | 8.6524 (3.17609)  | 8.06 (3.132)     |
| 8    | Biceps Skinfold       | 7.958 (2.2379)     | 7.700 (3.0600)    | 7.45 (1.119)     |
| 9    | Iliac Crest Skinfold  | 5.997 (2.3296)     | 6.985 (3.4917)    | 8.761 (2.8014)   |
| 10   | Supraspinale Skinfold | 10.230 (4.2264)    | 10.633 (2.9480)   | 10.197 (2.9605)  |
| 11   | Abdominal Skinfold    | 11.08 (3.982)      | 6.767 (2.3287)    | 14.318 (2.9714)  |
| 12   | Front Thigh Skinfold  | 10.691 (3.4019)    | 11.367 (3.4367)   | 11.86 (3.562)    |
| 13   | Medial Calf Skinfold  | 7.579 (3.3816)     | 7.673 (2.1686)    | 8.19 (3.371)     |
| 14   | Arm Girth relaxed     | 16.00 (2.236)      | 20.06 (2.277)     | 22.64 (1.636)    |
| 15   | Arm Girth Tensed      | 18.18 (2.083)      | 22.94 (2.657)     | 22.97 (2.023)    |
| 16   | Waist                 | 69.3779 (4.41914)  | 75.5845 (5.44902) | 74.494 (6.6079)  |
| 17   | Gluteus               | 80.4491 (3.57990)  | 97.8585 (1.55709) | 96.673 (4.1299)  |
| 18   | Calf Girth            | 28.4161 (2.9540)   | 31.6315 (4.13131) | 33.879 (2.5550)  |
| 19   | Humerus Breadth       | 5.523 (.9651)      | 7.7727 (1.50483)  | 8.627 (1.3864)   |
| 20   | Femur Breadth         | 6.6339 (1.22668)   | 8.1030 (1.31966)  | 9.13 (1.368)     |

The study measures anthropometric characteristics of the three positions of the basketball players. Multiple discriminate analyses are used to analyze the specific characteristics that differentiate each positional player out of the 20 over all selected characteristics. Discriminate the positional characteristics being a categorical variable based on anthropometric characteristics with the objective of maximize the separation of coefficients between three groups was computed.

**Table – III**  
**Wilks's Lambda analysis of discriminating variables contributing to performance**

| Step | Statistic | Number of Variables | Lambda | df1 | df2 | df3     | Exact F   |        |      |      |
|------|-----------|---------------------|--------|-----|-----|---------|-----------|--------|------|------|
|      |           |                     |        |     |     |         | Statistic | df1    | df2  | Sig. |
| 1    | 1         | .142                | 1      | 2   | 96  | 290.031 | 2         | 96.00  | .000 |      |
| 2    | 2         | .034                | 2      | 2   | 96  | 209.550 | 4         | 190.00 | .000 |      |
| 3    | 3         | .003                | 3      | 2   | 96  | 510.217 | 6         | 188.00 | .000 |      |
| 4    | 4         | .002                | 4      | 2   | 96  | 518.943 | 8         | 186.00 | .000 |      |
| 5    | 5         | .001                | 5      | 2   | 96  | 486.764 | 10        | 184.00 | .000 |      |
| 6    | 6         | .001                | 6      | 2   | 96  | 511.743 | 12        | 182.00 | .000 |      |
| 7    | 7         | .001                | 7      | 2   | 96  | 495.466 | 14        | 180.00 | .000 |      |
| 8    | 8         | .001                | 8      | 2   | 96  | 455.057 | 16        | 178.00 | .000 |      |
| 9    | 9         | .001                | 9      | 2   | 96  | 425.751 | 18        | 176.00 | .000 |      |
| 10   | 10        | .000                | 10     | 2   | 96  | 399.641 | 20        | 174.00 | .000 |      |
| 11   | 11        | .000                | 11     | 2   | 96  | 403.113 | 22        | 172.00 | .000 |      |
| 12   | 12        | .000                | 12     | 2   | 96  | 383.644 | 24        | 170.00 | .000 |      |
| 13   | 13        | .000                | 13     | 2   | 96  | 368.686 | 26        | 168.00 | .000 |      |

**Eigen Value of Function = 63.343; Chi-square (df; 26) = 731.062, p<0.05**

**% of Variance explained by the Function = 55.2**

From the table – III, the wilks Lambda calculation showed that 11 steps were involved in filtering the discriminating variables and all the variables significant in contributing to the playing positions since all the F - statistics were significant at 0.01 level. The discriminating equation is highly significant in predicting the positions, since chi-square value = 731.062 at 26 df, p < 0.05 level. The eigen value of the function 63.343 and % of variance 55.2 % indicated that the variance in contribution to the position can be explained to the extent of 55.2 % by the discriminating variables.

**Table – IV**  
**Analysis of standardized canonical discriminant function coefficients**

| Steps | Variables            | Function | Steps | Variables      | Function |
|-------|----------------------|----------|-------|----------------|----------|
| 1     | Arm Length           | -1.797   | 7     | Thigh Skinfold | 1.748    |
| 2     | Leg Length           | 1.189    | 8     | Calf Skinfold  | 2.207    |
| 3     | Triceps Skinfold     | -.192    | 9     | Waist          | -1.053   |
| 4     | Scapula Skinfold     | 1.846    | 10    | Gluteus        | 2.666    |
| 5     | Iliac Crest Skinfold | -.173    | 11    | Calf           | -1.926   |
| 6     | Abdominal Skinfold   | -4.504   |       |                |          |

**Table – V**  
**Analysis of functions at group Centroids**

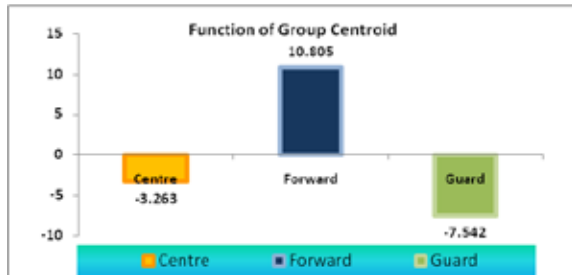
| Positions | Function |
|-----------|----------|
| Centre    | -3.263   |
| Forward   | 10.805   |
| Guard     | -7.542   |

**\*p < 0.05 Table F, df (2, 41) (0.05) = 3.21**

From the table – IV & V, the discriminate equation as

$Z = -1.797 (\text{Arm Length}) + 1.189 (\text{Leg Length}) - 0.192 (\text{Triceps SK}) + 1.846 (\text{Scapula SK}) - 0.173 (\text{Iliac Crest SK}) - 4.504 (\text{Abdominal SK}) + 1.748 (\text{Thigh SK}) + 2.207 (\text{Calf SK}) - 1.053 (\text{Waist}) + 2.666 (\text{Gluteus}) - 1.926 (\text{Calf})$

The group centroid value of the graph indicated that for the center position the z-score should fall between -3.263 and 10.805 and for guard position the z-score should fall between -7.542 and -3.263 and for forward position z score should be higher than 10.805.



**Fig - 1**  
**Functions of group centroid among basketball players**

### Conclusion

Two length factors (arm length and leg length); six skinfold factors (triceps, scapula, iliac crest, abdominal, thigh and calf skinfold); three circumference factors (waist, gluteus and calf); – as totally 11 anthropometric factors have the discriminating tendency for guard, forward and center playing positions of Indian youth elite basketball players.

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