ANTHROPOMETRY AND FUNCTIONAL PERFORMANCE OF ELITE INDIAN JUNIOR TENNIS PLAYERS

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ABSTRACT
To find out the correlation between body composition and functional performance of elite Indian junior tennis players. Tennis academies all over Delhi and National Capital Region 100 elite Indian junior tennis players. The anthropometric data (BMI, fat mass, height, weight, BMI, girth measurement, Waist-hip ratio, fat mass and muscle mass) of each athlete has measured and has been correlated with all the three functional performance tests. Pearson's correlation test was used to correlate the anthropometric data and functional performance test results. The study result showed there was a correlation exist between some of the anthropometric variables (e.g.: muscle mass, percentage of fat, Girth measurement,) with functional performance at the same time there was no correlation exist between some of the anthropometric variables (E.g.: BMI, Waist Hip ratio,) with functional performance.

Keywords: Anthropometry, Functional performance, Fat mass, Muscle mass, Junior tennis players.

INTRODUCTION
Tennis is the most popular racket sports in the world and is characterized by explosive activities interspersed with short interval of intermittence activity over a long period involving a great variety of abilities and movements [1]. It demands a complete physical conditioning program including exercises to develop flexibility, agility, cardio respiratory capacity, speed, strength, power and muscular endurance [2, 3].

The interest in anthropometric characteristic and body composition of the players of different sports has increased over last decades. It has been well described that there are specific physical characteristics in many sports such as anthropometric profile that indicate whether the player would be suitable to compete the highest level in specific sports [4-6].

Athletic performance is, to a large degree, dependent on the athlete's ability to sustain power (both anaerobic ally and aerobically) and to overcome resistance, or drag. Both of these factors are interrelated with the athlete's body composition. Coupled with the common perception of many athletes who compete in sports where appearance is a concern for the athlete and the common perception of these athletes (swimming, diving, gymnastics, and figure skating), attainment of an ideal body composition often becomes a central theme of training. Besides the aesthetic and performance reasons for wanting to achieve an optimal body composition, there may also be safety reasons.

During past two decades great changes have taken place in tennis with respect to technique and tactic, even more with respect to physical performance of the players. Most of the scientific literature has focus on physiological and biomechanical characteristic of the players. At present there is no data available regarding body composition and anthropometry of junior players of India and regarding their performance. Therefore the aim of this study was to find out how anthropometry & body composition of elite Indian junior players influence their functional performance.

METHODS
Subjects were recruited on the basis of voluntary
participation through informed consent. Subjects were recruited from different tennis academies all over Delhi and National Capital Region.

**Procedure**

The subjects from different tennis academies were being informed of the study. Subjects and their parents were informed about the nature, purpose, importance and possible risk of the study. Written parental or guardian consent were obtained before the players were permitted to participate. The research committee of the Singania University approved all the procedures. The subjects who match the criteria will be selected for the study. Anthropometric and body composition measurement will be taken for the entire subject.

**Instruction to the subject**

Subjects were refrained from strenuous exercise at least 48 hours prior to the testing and procedure and consume their normal pre training diet prior to the testing session. Subjects were asked to report any discomfort during the session. The subjects were asked for their full cooperation and to do the procedures to their best of the ability.

**Protocol**

The entire protocol consist of 2 phases

- **Pre-test measurement**
- **Protocol or intervention**

Pre test measurement included measurement of anthropometric data which consist of BMI, fat mass, height, weight, BMI, girth measurement, Waist- hip ratio, fat mass and muscle mass.

The following functional performance test were measured for each athletes after anthropometry.

A. Sergeant chalk jump test
B. 40 yard sprint test
C. T-test

One minute of rest period was allowed between all functional performance tests [7]. Three trials of functional performance test were performed with 30 seconds rest period between each trial [7]. The best score from each functional performance test were taken from each test and recorded.

**RESULTS**

A total number of 100 elite Indian junior tennis players participated in the study. Mean age, height and weight of the athletes were 15.34 ± 2.16, 170.54 ± 5.43, and 65.36 ± 3.41 respectively. The anthropometric data (BMI, waist to hip ratio, thigh circumference, fat mass, muscle mass) of each athlete has measured and has been correlated with all the three functional performance tests.

The result of the study shows as follows (Refer Table1)

**BMI and athletic performance**

The BMI of each athlete was calculated by measuring Height and Weight of the subjects. BMI = weight in Kg/Height² in meters The mean BMI of the subjects were 22.45± 2.26BMI values were correlated with the three functional performance tests. The result shows that there was no correlation exist between BMI and all the three functional performance tests.

**Waist – Hip ratio and performance**

The mean Waist – Hip ratio of 100 athletes was .88.The result shows that there was no correlation exist between Waist – Hip ratio and all the three functional performance test.

**Thigh circumference and performance**

The mean thigh circumference was 17.83± 2.45. The result showed that there is a positive correlation exist between thigh circumference and functional performance tests.

**Calf circumference and performance**

The mean calf circumference was 12.36± 2.36. The result of the study showed a positive correlation between calf circumference and functional performance tests.

**Muscle mass and performance**

The mean value of muscle mass was 37.32± 5.09. The result shows that there is positive correlation exist between muscle mass and functional performance of the athletes.

**Fat mass and functional performance**

The mean value of fat mass was 7.29± 2.38. The result shows that there is negative correlation existing between fat mass and functional performance.

**DISCUSSION**

The purpose of the study was to find out the correlation between body composition and functional performance of Indian junior tennis players. A total number of 100 elite junior tennis players from different parts of the country participated in the study. The anthropometric data’s like height, weight, BMI, girth measurement, Waist- hip ratio, fat mass and muscle mass of each athlete has been measured and which has been correlated with the scores of different functional performance test scores of the athletes.

The result of the study showed that

1. There was a correlation exist between some of the anthropometric variables (e.g.: muscle mass, percentage of fat, Girth measurement,) with functional performance.
Table 1. Correlation between anthropometric values and functional test values

<table>
<thead>
<tr>
<th>Tests</th>
<th>BMI</th>
<th>W-H Ratio</th>
<th>Thigh Circumference</th>
<th>Calf Circumference</th>
<th>Muscle Mass</th>
<th>Fat Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P value</td>
<td>R value</td>
<td>P value</td>
<td>R value</td>
<td>P value</td>
<td>R value</td>
</tr>
<tr>
<td>Sergeant chalk jump test</td>
<td>.931</td>
<td>-.009</td>
<td>.932 .009</td>
<td>.000 .996</td>
<td>.000 .994</td>
<td>.000 .989</td>
</tr>
<tr>
<td>40 yard sprint test</td>
<td>.710</td>
<td>.038</td>
<td>.868 -.017</td>
<td>.000 -.983</td>
<td>.000 -.983</td>
<td>.000 -.992</td>
</tr>
<tr>
<td>T test</td>
<td>.978</td>
<td>-.003</td>
<td>.859 .018</td>
<td>.000 -.994</td>
<td>.000 -.994</td>
<td>.000 -.987</td>
</tr>
</tbody>
</table>

2. There was no correlation exist between some of the anthropometric variables (E.g.: BMI, Waist Hip ratio,) with functional performance Effect of height, body mass, and BMI on functional performance: finding of the study showed that there is no correlation between height, BMI and functional performance.

BMI and athletic performance

The effect of body mass and BMI on performance have been investigated in some previous studies especially among the runners, but none of them investigated regarding tennis players.

The finding of the study is consistent with the previous study of Rehmani et al., [8] which investigated the supremacy of African sprinters. Another study conducted by B Knechtle et al., [9] there was no association detected between skin fold thickness and race performance, neither the front thigh or medial calf skin fold thickness was associated with performance. But at the same time the association of BMI with performance in Kenyan runners is known. Black runners tend to be smaller and lighter than white runners [10-12]. When Senegalese and Italian runners were compared, the African runners had a longer and lighter legs, it is thought that their lower BMI and smaller body size are important in the better performance of the African runners. A relationship between BMI and race performance has been found with Caucasian athletes. Marathon race time was positively correlated with BMI. One reason for different finding may be the differences in the fitness level and the differences in the training level of individual players. Absolute value of BMI seems to be of some importance in some of the studies like B Knechtle [13] which states that a higher and lower BMI negatively influence the performance.

BMI generally considered to be one of the best ways to determine if individual is at healthy weight. There are evidences suggest that BMI can provide acceptable proxy measures of body fatness in young people [14, 15]. But it is having some limitations also. As it is not a direct measurement of body fatness very muscular individuals may often fall into the overweight category when they are not over fat. Additionally BMI may place individuals who have lost the muscles into a healthy weight category.

Waist – Hip Ratio

The result of the study showed that Waist – Hip Ratio does not have any influence on performance. Waist – Hip Ratio can be considered as a health indicator than a performance indicator.

Body fat percentage and skeletal muscle mass

The result of the study indicated that there was an inverse correlation exists between body fat percentage and performance. Some of the previous studies have shown that the physical performance is negatively correlated with body fat and positively correlated with skeletal muscle mass [16, 17]. An excess subcutaneous adipose tissue means that greater muscular effort and therefore increased energy expenditure is required. In runners a high level of adipose tissue leads to a higher body weight and impairment of performance as more weight has to be moved, which does not contribute to the power development. In a recent study conducted by Arrese AL et al., [18], it has been noted that the loss of body fat is specific to the selected muscle group used during training and the race performance is enhanced with decreased skin fold thickness at lower limb. Body fat seems to have a special effect on African athlete’s especially African runners. It was noticed in a study conducted by Bosch AN et al., [19] in study conducted among African athletes. They have a lower skin fold thickness at legs and arms suggesting a smaller mass of subcutaneous adipose tissue. But in other studies effect of body fat on race performance is controversial. Hagan et al., [20] found a positive correlation between performance time and body fat in female athletes where as Christensen and Ruhling [21] found that percentage of body fat did not correlate with the performance. The study of Heltland et al., [22] demonstrated that regional and total body fat was inversely correlated with performance in treadmill test (-0.61 < r < -0.52, p < 0.0001). In runners decreased skin fold thickness in lower limb are measured after a longer training period, which may be particularly useful.
in predicting running performance [23]. In the study of Logos and Eston23 3 years of training has decreased the skin fold thickness and change in performance was related to the change in skin fold thickness of the triceps(r = -0.61, P = 0.001), front of the thigh ( r = 0.74, P < .601) and medial calf(r = -0.66, P < .001).

Our present study is also in agreement with the study of Slator GJ et al., which states that successful lightweight rowers possess more muscle mass and less fat than their less successful counterparts. Leaner athletes with greater total muscle mass were more successful [24].

Circumference of the limb

Circumference of the calf and mid thigh has been taken from the right side of the body and was correlated with the different functional performance tests and the result suggested that there was a correlation exists between circumference of the limb and functional performance of junior tennis players. In A recent study it has found a positive correlation with upper arm circumference and performance in a multistage ultra-endurance run. Our finding is in agreement with Mutsuura et al. [25] which found that thigh girth was best related to the performance over 800, 1500 and 5000 m. But at the same time another study conducted by B Knechtle et al found that no association of upper arm and thigh circumference with running performance with marathon runners. Knechtle et al. [26] conducted another study to find out the relationship between anthropometric measures and running performance among ultra endurance runners and a significant association was found between arm circumference and running speed and total running time( P < 0.05 , r² = 0.26). But in the same study he was failed to prove the association of circumference of thigh and calf with performance.

Anthropometric properties can be of two types. The first such as body height and length of the limb cannot be associated with the subjects whereas the second group of anthropometric properties like body weight, skin fold thickness ,limb circumference ,which may be altered by specific diet and training. There is no doubt that anthropometric properties can be associated with and exercise performance of human. The benefit of specific anthropometric properties may also depend up on type of sports and the discipline. There seems to be no ideal or unique anthropometric profile with respect to performance. Training parameters may be of more importance than anthropometric measures in the prediction of performance among players. However there is an upper limit in the training volume which there is no more improvement.

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REFERENCES