Limb circumference and performance in junior tennis players

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Abstract
Objective: To find out the correlation of limb circumference with functional performance of junior tennis players
Design: correlation design
Setting: Tennis academies all over Delhi and National Capital Region
Subjects: 100 junior tennis players
Measurement: The limb circumferences (thigh circumference and calf circumference) of each athlete have measured and have been correlated with all the three functional performance tests.
Result and conclusion: Pearson's correlation test was used to correlate the anthropometric data and functional performance test results. The study result showed that there was positive correlation exists between both thigh and calf circumference and the entire three functional performance tests.
Keywords: Limb circumference, functional performance, junior tennis players

1. Introduction
Tennis is the one of the most popular sports throughout the world and is played by millions of people. It is considered to be an ideal sport to improve physical activity levels in general population. Those who choose to play tennis appear to have a positive health benefits. Specifically lower fat percentage, more favorable lipid profile, enhanced aerobic fitness contributed to an overall improved risk profile for cardiovascular morbidity. Furthermore numerous studies have identified better bone health not only in tennis players with lifelong tennis participation history but also in those who take on the sport in mid adulthood1. It demands a complete physical conditioning program including exercises to develop flexibility, agility, cardio respiratory capacity, speed, strength, power and muscular endurance.2,3

Athletic performance is, to a large degree, dependent on the athlete's ability to sustain power (both anaerobically 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.
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.\textsuperscript{4,5,6}

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. There for the aim of this study was to find out how anthropometry &body composition of elite Indian junior players influence their functional performance

2. 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.

2.1 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 CMJ University approved all the procedures. The subjects who match the criteria were selected for the study. Anthropometric measurements were taken for the entire subject.

2.2 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 co operation and to do the procedures to their best of the ability.

2.3 Protocol: The entire protocol consist of 2 phases

a. Pre-test measurement
b. Protocol or intervention

Pre test measurement included girth measurement of thigh and calf measurement. A flexible meal tape was used for measurement.

Mid thigh: Measurement is taken on the right side of the body. The subject was standing erect with his weight evenly distributed on both feet and legs slightly parted. The circumference measure is taken at the level of the mid-point on the lateral surface of the thigh, midway between trochanterion and tibiale laterale (top of the tibia bone).

Calf: The subject was standing erect with his weight evenly distributed on both feet and legs slightly apart. The measurement was taken at the level of the largest circumference of the calf. The maximal girth was not always obvious, and the tape moved up and down to find the point of maximum circumference.

The following functional performance tests were measured for each athlete 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\textsuperscript{7}. Three trials of functional performance test were performed with 30 seconds rest period between each trial\textsuperscript{7}. The best score from each functional performance test were taken from each test and recorded.

3. Results

A total number of 100 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 limb circumferences (thigh circumference and calf circumference) of each athlete have measured and have been correlated with all the three functional performance tests.

The result of the study shows as follows

3.1 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
Table 1 Correlation of Thigh circumference and functional performance tests

| Tests                     | P value | R value |
|---------------------------|---------|---------|
| Sergeant chalk jump test  | .000    | .996    |
| 40 yard sprint test       | .000    | -.983   |
| T test                    | .000    | -.994   |

Significance level < 0.05

Graph 1 - Correlation of Thigh circumference and Sergeant Chalk jump test

Graph 2 - Correlation of Thigh circumference and 40 yard sprint test

Graph 3 - Correlation of Thigh circumference and T test
3.2 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.

Table 2 Correlation of Calf circumference and functional performance tests

| Tests                  | P value | R value |
|------------------------|---------|---------|
| Sergeant chalk jump test | .000    | .994    |
| 40 yard sprint test    | .000    | -.983   |
| T test                 | .000    | -.994   |

Significance level ≤0.05

Graph 4 - Correlation of Calf circumference and Sergeant Chalk jump test

Graph 5 - Correlation of Calf circumference and 40 yard sprint test

Graph 6 - Correlation of Calf circumference and T test
4. Discussion

The purpose of the study was to find out the correlation between limb circumference and functional performance of junior tennis players. A total number of 100 junior tennis players from different parts of the country participated in the study. The anthropometric data 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 there was positive correlation exists between both thigh and calf circumference and the entire three functional performance tests. 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 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 at al found that no association of upper arm and thigh circumference with running performance with marathon runners. Knechtle et al (2011) 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 sport 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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