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# Effect of body composition, anthropometric characteristics and lower body strength on the performance level of 110 m national hurdle athletes in Sri Lanka

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## Abstract

**Background:** Many scholars have been identified that there is a relationship between body composition, anthropometric characteristics, lower body strength, and performance in several sports. In Sri Lanka, there is no proper mechanism to select 110m hurdle athletes based on body composition and anthropometric characteristics. **Purpose:** The main purpose of this study was to identify the relationship between body compositions, anthropometric characteristics, and lower body strength, and the performance of 110 meters hurdles national-level athletes in Sri Lanka. **Methods:** Using the census sampling method twenty-eight national-level male athletes were selected as the sample. Body composition measures are measured as height, weight, overall fat, visceral fat, subcutaneous fat, BMI, total muscle, trunk fat, trunk muscle, leg fat, leg muscle, arm fat, arm muscle. Leg length, feet length, trunk length, arm length, thigh circumference, and calf circumference were used to evaluate the anthropometric characteristic, and standing long jump was evaluated by the lower body strength. To analyze the data SPSS statistical software was used with descriptive statistics and paired samples t-test was used to determine the differences. **Results:** Positive correlations were found between performance and visceral fat, trunk fat, leg fat, arm fat. There was a negative correlation between performance and body height, total muscle, trunk muscle, leg muscle, arm muscle, feet length, trunk length, lower body strength. There were no significant correlations between performance and training age, weight, overall fat, subcutaneous fat, BMI, leg length, arm length, thigh circumference, and calf circumference ($p > 0.05$). **Conclusion:** Lower body strength, leg muscle, trunk muscle, and arm muscle and trunk length significantly influence the performance of national-level 110 meters athletes in Sri Lanka. Further, it can also be concluded that athletes who developed well in the leg, arm, and trunk muscles have a higher performance. And also athletes who have minimum fat in the arm, leg, and trunk reached the highest level of performance. Therefore, it can be concluded that players with higher lower body strength tend to stay in top performance.

**Keywords:** Body composition, Anthropometric characteristic, Lower body strength.

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## INTRODUCTION

Body composition, anthropometric characteristic and lower body strength of a sportsman has a significant role in sports performance besides other factors like physiological and physical fitness, psychological aspects, skills, etc. Scholars found that the requirement of a specific physique for good performance in sprinting events had been supported their performance [1-4]. Most researchers had been attempted to relate performance level with anthropometric characteristics [3]. The relationship between the lower body strength and performance level during running had been established by different scholars. Lower body strength is an important factor in running events, because of the significant level of running during the event and training but the researchers have less focused on this area [5]. Furthermore, various studies showed that the sprinter's performance hangs on the capacity to generate power and to reach a high ratio between body mass and power. That the main biomechanical variable determining the difference in sprint running fulfillment is the mean force involve during the ground contact phase of each step divided by the weight of the whole body. Since muscle mass is a major determinant of maximal force and power results from the product of force and velocity [6]. Track and field games, especially in 110m hurdle events required appropriate body composition, anthropometric and leg strength to achieved the highest level of performance [5]. The current status of the 110m hurdle event in Sri Lanka is at a poor level compared to the other athletic events in Sri Lanka. Lack of anthropometric, body composition and lower body strength studies on Sri Lankan athletes could not establish the influence of anthropometric characteristics, body composition, and lower body strength on their performance level. Therefore, this study mainly focuses on

the effect of body composition,anthropometric characteristics, and lower body strength on the performance level of 110 m national hurdle athletes in Sri Lanka. To make proper implications for the management of an athlete.

## METHODOLOGY

### Subject

The study population was the top 28 athletes in the 110m hurdle event in the 2019 national trials. This was a census study; with the athletes who are in the top 28 ranks with electronic timing in 110 m hurdle event in the 2019 national trails. Athletes were in the 20-31 years range and all athletes undergo 2 training sessions a day. All athletes had a

1-16 years training age. All are actively participating at present, and there no detraining players. Players who represent the national squad train in the synthetic track layer although the other players are training in their usual ground.

### Procedure

Participants were tested in the same period at the starting of the competitive period. Data collection was done in 3 days and on the first day, the anthropometric characteristic of the players was obtained. This data was obtained before their warming-up period. On the second day, the body composition of all the participants was obtained and the data was gathered before the warming up session. On the third day, a standing long jump was measured for their lower body power, which was obtained after their warming up session. Players were familiar with the day 3 testing procedure, which were a regular part of their training routine. Electronic timing was used following IAAF rules and regulations to measure participants' performance. All these time data are obtained on the synthetic track layer. All participants were dressed in minimum clothes when receiving anthropometric characteristics and body composition (Shorts and light T-shirts).

### Data Gathering Techniques

### Anthropometric Characteristics:

Bodyweight measured using a digital scale, the subject stood straightly on the center of the weight scale, body weight equally distributed between both feet, hand keeps the side of the thigh. After the digital arm length measurement device was become to the constant value read and recorded the measurement.

Standing height was measured using a digital scale, the subject stood straight against the backboard barefoot. Bodyweight distributed equally to both feet on the platform. Heels together and slightly apart 60-degree angle. The head, shoulder blade, buttocks, and heel were contacted with the backboard. Then after the head part of the stationmaster pull to the top of the participant's head and compress the significant pressure to the hair

Leg length, feet length, truck length, arm length, thigh circumference, calf circumference were measured using steel tape.

### Body Composition

Body composition measured via Bioelectrical impedance. The researcher included the gender, age, and height of each participant on the scale. Then instructed to stand on this scale, advised to keep their chin-up, look forward and body relaxed. The athlete's body weight was then automatically calculated on this scale. Afterward, it is advised to keep the handle of the scale in place. Once all the data was calculated, the researcher instructed to participants to move away from the scale. Used this bioelectrical impedance to measure subcutaneous fat, total muscle mass, overall fat, visceral fat, body mass index (BMI), trunk fat, trunk muscles, leg fat, leg muscles, arm fat, and arm muscles.

### Standing Long Jump

Each participant underwent the three standing long jump attempts, the highest distance jump measured as a valid jump. Using steel tape get the measurement of horizontal distance from takeoff line to the mark made by the heels at landing.

### Statistical Analysis

Data were analyzed using descriptive statistics and presented as measures of mean and stranded deviation. Person correlation coefficient tests were used to distinguish the relationship between anthropometric characteristics and performance with the 5% level of significance. SPSS Statistic 22 software was used to conduct the Person correlation coefficient test.

## RESULTS AND DISCUSSION

Body composition, anthropometric characteristics, and lower body strength were measured to determine the performance level of 110 m national-level athletes in Sri Lanka. Table 1 illustrate the performance had a significant ($P<0.05$) correlation with body height, visceral fat, total muscle, trunk fat, trunk muscle, leg fat, leg muscle, arm fat, and arm muscle.

**Table 1:** Significant Correlation between Performance and Body Composition

| Variable | r | P | Correlation |
|---|---|---|---|
| Body Height | - 0.419 | 0.026 | Medium Negative |
| Visceral Fat | 0 .410 | 0.030 | Medium Positive |
| Total Muscle | - 0.566 | 0.002 | Strong Negative |
| Trunk Fat | 0 .570 | 0.002 | Strong Positive |
| Trunk Muscle | - 0.521 | 0.004 | Strong Negative |
| Leg Fat | 0 .515 | 0.005 | Strong Positive |
| Leg Muscle | -0.507 | 0.006 | Strong Negative |
| Arm Fat | 0.550 | 0.002 | Strong Positive |
| Arm Muscle | -0.397 | 0.036 | Medium Negative |

Source: Author 2020

Table 2 showed performance had a significant ($P<0.05$) correlation with feet length and trunk length.

**Table 2:** Significant Correlation between Performance and Anthropometric Characteristics

| Variable | r | p | Relation |
|---|---|---|---|
| Feet Length | - 0.423 | 0.025 | Medium Negative |
| Trunk Length | - 0.404 | 0.033 | Medium Negative |

Source: Author 2020

Table 3 showed performance had a significant ($P<0.05$) correlation with feet length and trunk length.

**Table 3:** Significant Correlation between Performance and Lower Body Strength

| Variable | r | p | Relation |
|---|---|---|---|
| Lower Body Strength | -0.867 | 0.000 | Strong Negative |

Source: Author 2020

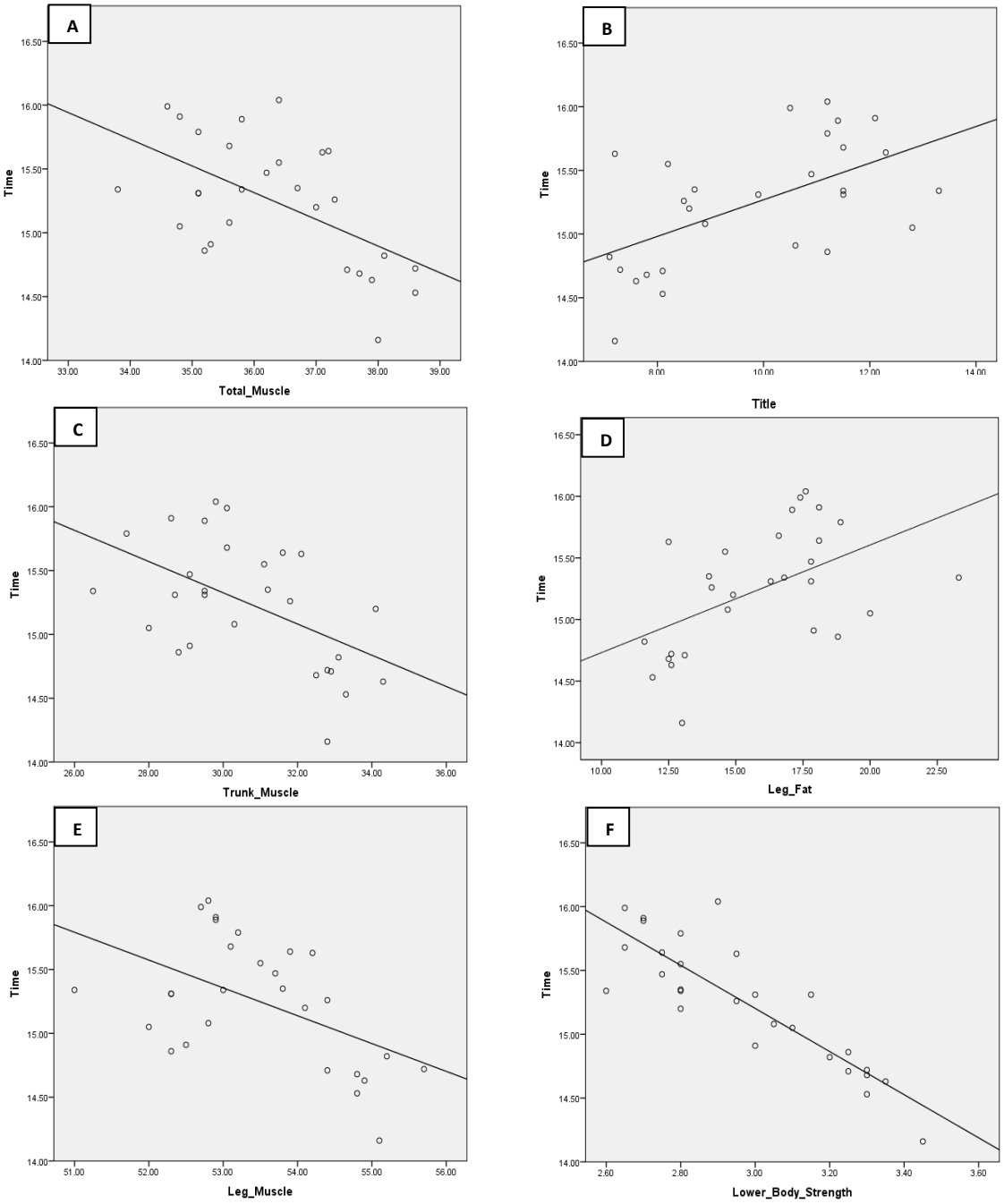


**Figure 1:** A, B, C, D, E, F- The strong correlation between performance and total muscle, trunk fat, trunk muscle, leg fat, leg muscle, and lower body strength

According to Figure A, there was a strong negative correlation between sprint time and total muscle, which is statically significant (r = - 0.566, n = 28, p = 0.002). The negative correlation indicates the fact that the time decreases with the increase of total muscle percentage. However, a decreased time indicates increased performance. Therefore, results show that the performance of athletes increased with the increase of total muscle percentage [6]. Figure B showed that there was a strong positive correlation between sprint time and trunk fat, which is statically significant (r = 0.570, n = 28, p = 0.002). According to the above result, there was high-performance athlete below to the 8% percentage. As a sprinter, a minimum body fat level is important for achieving the highest performance [2].

Figure C showed that there was a strong negative correlation between sprint time and trunk muscle, which is statically significant (r = - 0.521, n = 28, p = 0.004). The negative correlation indicates the fact that the time decreases with the increase of trunk muscle percentage. However, a decreased time indicates increased performance. Therefore, results show that the performance of athletes increased with the increase of trunk muscle percentage [6]. According to figure D, There was a strong positive correlation between sprint time and leg fat percentage, which is statically significant (r = 0.515, n = 28, p = 0.005). According to the above result, there was high-performance athlete between 11% – 13%.

According to figure 1E, The scatter plot diagram of Leg Muscle Vs. Performance is shown there was a strong negative correlation between sprint time and leg muscle, which is statically significant (r = - 0.507, n = 28, p = 0.006). The negative correlation indicates the fact that the time decreases with the increase of leg muscle. However, a decreased time indicates increased performance. Therefore, results show that the performance of athletes increased with the increase of leg muscle.

Figure F showed that there was a strong negative correlation between sprint time and lower body strength, which is statically significant (r = -0.867, n = 28, p = 0.000). The negative correlation indicates the fact that the time decreases with the increase of lower body strength. However, a decreased time indicates increased performance. Therefore, results show that the performance of athletes increased with the increase of lower body strength [7].

## CONCLUSION

It can be concluded that mainly lower body strength, leg muscle, trunk muscle, and arm muscle, and trunk length significantly influence the performance of national-level 110 meters athletes in Sri Lanka. Further, it can also be concluded that athletes who developed well in the leg, arm, and trunk muscles have high performance. And also an athlete who has minimum fat in the arm, leg, and trunk reached the highest level of performance. Therefore, it can be concluded players with higher lower body strength tend to stay in top performance.

All these athletes and their coaches were less concerned about hurdle technique and had better developed their sprinting skills. Furthermore, coaches gave less attention to the player's body composition and anthropometric characteristics to select which is the most suitable event for the athlete. And also most of these athletes moved to these events from another event (high jump to hurdle, a long jump to hurdle).

### Conflicts of interest

The author declares no conflict of interest.

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