Body composition, does it affect the physical performance of basketball players? A Pilot study conducted among General Sir John Kotelawala Defence University (KDU) Basketball team

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Abstract- Basketball is a common and fast sport played all over the world, with high levels of speed and frequent jumps. Sri Lanka is contesting for a higher ranking in the international basketball arena as a region. Body composition and physical fitness affects both individual and team performances. Therefore, the assessment of body composition and fitness level has become an emerging requirement in basketball players when designing their training sessions to improve performance. This study provides the baseline of their body composition and fitness level hence allowing them to reevaluate themselves for improvements after training sessions. Ten (10) male players of the KDU basketball team aged between 21 to 25 years were participated in this study. Data from anthropometric measurements and physical tests (VJ, SLJ) were analyzed. Results shows high body fat percentage of (Mean SD)16.31(5.83), average height of 181.35(5.79). Further, significant positive correlation between BMI and body fat (BF%) was identified and visceral fat levels and all other measured variables on body composition had significant relationships with both VJ and SLJ. In conclusion, this study suggests changing their training program focusing on improving muscle strength (anaerobic exercises) rather than focusing on aerobic exercise.

Index Terms- Basketball, Body Composition, Sri Lanka, Vertical jump, Standing Long Jump, Performance

I. INTRODUCTION

Basketball is one of the most popular and fast sports throughout the world with high levels of speed and constant jumps [1]. The findings of Hoffman et al. suggested that basketball is a sport where cardiovascular endurance, body composition, flexibility, muscle endurance and muscle power are optimally requires which are considered as the components of physical fitness[2].

Body composition and physical fitness plays a vital role in both individual and team performance [3]. The individual assessment of body composition and fitness parameters of players will allow the coaches to evaluate their physical fitness levels and make modifications to the training regimes based to improve performance. Hence coaches have increasingly rely on anthropometric and fitness parameters to tailor training programmes and evaluations [4]. In theory, basketball players are considered as physically fit, but no evaluation of physique might mislead those assumptions [5]. Further the body composition and fitness level expected of different sports vary [6]. A sport like basketball requires good agility, optimal level of muscle power and relatively low body fat level [6]. Therefore, the assessment of body composition and fitness level has become an emerging requirement in basketball players when designing their training sessions to improve performance.

In basketball, the ability to jump vertically and horizontally has a direct relationship with player's performance. The vertical jump (VJ) which is also known as Sargent jump [7]is an important predictor to compete during a basketball game [8]. Further it is an important measure in the assessment of muscle strength, especially in the lower limbs. Other than VJ the standing long jump (SLJ) is also a field test which is commonly used for assessment of lower body muscle strength [7].

Body weight of a basketball player is pivotal as it effects their vertical jump. Therefore, the excess levels of body fat will increase the body weight and act as a dead body mass [9] thus effecting the player negatively in his performance. Nunes et al reported that players with more lean muscle mass score more in performance parameters and outlines the negative correlation of fat percentage on performance during the game. Therefore, the evaluation of body composition, mainly the lean body mass and fat percentage will concrete the available data on performance [10].

As a country Sri Lanka is struggling to secure a higher level in Basketball in the international arena. Although basketball is not famous like cricket within Sri Lanka, it is still played to some extent in a competitive level mainly among schools and between institutions within the country. This could be due to various factors such as limited popularity of the gamey, lack of promotion of basketball tournaments in the country or it could be due to lack of physical fitness among basketball players. This lack of fitness

could be due to lack of evidence-based practice in training programmes, or it could be simply due to poor body composition of the players. Very limited literature is available when it comes to evidence-based practice among Sri Lankan basketball players and this pilot study aims to fill the gap in that knowledge through assessing the body composition parameters and muscular strength levels of university basketball players. We will be using the basketball players of General Sir John Kotelawala (KDU) as the first cohort to access the fitness levels and body compositions.

II. METHODOLOGY

Ten (10) male players of the KDU basketball team participated in the study. All participants were aged between 21 to 25 years. Each participant was informed of the research procedures (anthropometric and physical tests), benefits and the risks before getting the verbal and written consent. Demographic data was collected including the history of ankle injuries. One participant was unable to perform VJ and SLJ tests due to acute injury on the leg. An individual investigator was assigned to obtain each measurement to minimize the inter-observer errors. All the instruments were calibrated and pre-tested before the data collection. The ethical approval was granted by the ethical review committee of General Sir John Kothelawala Defence University.

Test Procedures.

Participants were instructed how to conduct the test including the benefits and risks involved. They were given a chance to ask questions prior to taking measurements. A stadiometer was used to measure the height of the participant to the nearest centimeter. Body weight (to the nearest 0.1kg), Body fat percentage, skeletal muscle mass, visceral fat level was determined using a Total body composition analyzer (bioelectrical impedance analyzer (Omron HBF-516B). Physical tests were performed after analyzing the body composition.

Vertical Test:

Participants were asked to jump vertically as high as possible using both arms and legs to assist in projecting the body upwards. The jumping height was determined by subtracting stand reach height from jumping reach height. The test was repeated twice, and the best score was taken to the nearest centimeter.

Standing long jump (SLJ):

The participants stood on non-slippery floor behind the starting line with feet together and arm movement was permitted to support the take of movement. The distance between the toes at start and the heels at the landing was measured. The test was repeated twice, and the best score was taken to the nearest centimeter.

Statistical Analysis

Data was analyzed using Statistical package for Social Sciences (SPSS) 23.0 version. The descriptive statistics were expressed as mean (SD), median, minimum, and maximum value for each variable. The distribution of data was verified by Kolmogorov-Simirnov test. Bivariate correlation was performed to investigate the relationship between body composition parameters with vertical jump and standing long jump and multiple regression analysis was done to find the association among body composition parameters. The level of significance was set at $p \leq 0.05$.

III. RESULTS

All the participants of the study were male basketball players (n=10) aged between 21 – 25 years of age. Except one participant all other were healthy according to BMI.

The anthropometric characteristics, body composition parameters, vertical and standing long jump data are shown in the table 01 bellow.

| Variable	n	Mean (SD)	Minimum	Maximum
Age (Years)	10	23.00(1.16)	21	25
Height (cm)	10	181.35(5.79)	173	193
Weight (cm)	10	71.81(9.41)	57.8	88.6
Body Mass Index (kgm^{-2})	10	21.75(1.86)	18	24.3
Body fat (%)	10	16.31(5.83)	5.1	23
Visceral fat level	10	3.70(1.64)	1	6
Skeletal muscle mass (%)	10	41.51(3.51)	37.1	48
Resting Metabolism rate	10	1645.20(115.01)	1484	1871
Vertical jump height (cm)	9	59.28(5.96)	51.48	70.76
Standing long jump distance (cm)	9	223.33(14.36)	210	255

Table 1: The anthropometric characteristics, body composition parameters, vertical and standing long

The correlation between the body composition parameters and Vertical and Standing long Jump are shown in the Table 2.

Parameter	Standing Long Jump		Vertical Jump	
	r	p	r	p
Height (cm)	0.551	0.034*	0.962	0.001**
Weight (cm)	-0.636	0.46*	-0.895	0.001**
Body Mass Index (kgm^{-2})	-0.712	0.031*	-0.544	0.13*
Body fat (%)	-0.768	0.016*	-0.583	0.29*
Visceral fat level	-0.496	0.175	-0.358	0.358
Skeletal muscle mass (%)	0.852	0.004*	0.75	0.02*
Resting Metabolism rate	-0.641	0.063*	-0.867	0.002**

Table 2: The Correlation between body composition parameters and Vertical and Standing Long Jump (p < 0.05 *, p < 0.001 **)

The graph 01 shows the linear relationship between the BMI and BF% of the Basketball players of the present study.
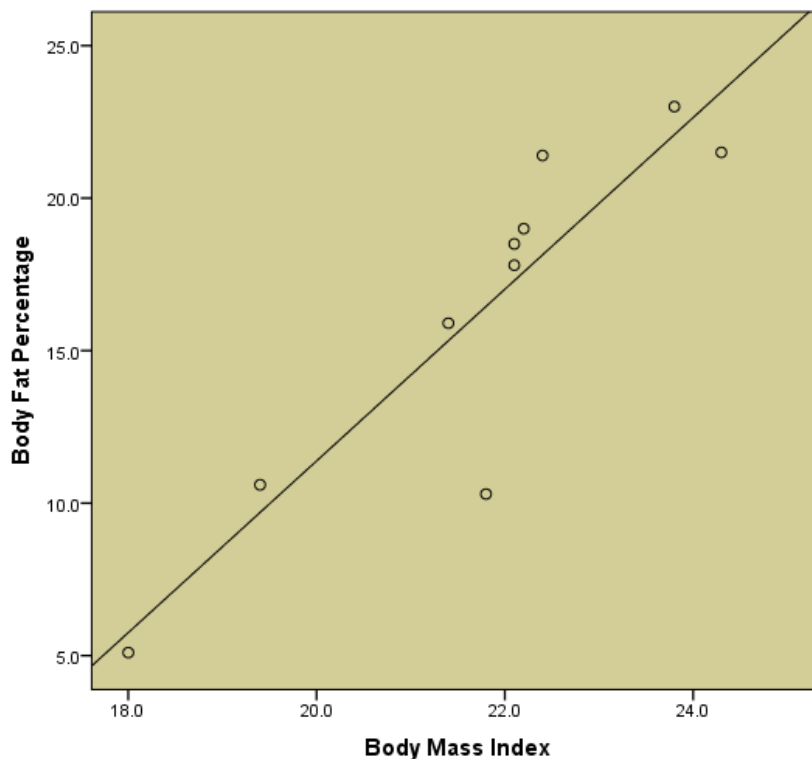
Graph 1: Relationship between Body Mass Index (BMI) and Body Fat Percentage (BF%)

IV. DISCUSSION

The main objective our study was to assess the body composition parameters and their influence on vertical and standing long jump distances as a foundation for formulating an assessment tool for the effectiveness of trainings and the performance of KDU basketball players. For this we examined the level of body composition variables among the players and the association of them with the VJ and SLJ distances.

A game of basketball goes for a duration of 40 minutes comprising 04 ten minutes quarters. Body fat is an essential source of energy in aerobic activities like football which is played for longer

duration [11]. But basketball is a sport which contains both aerobic activity (20% - 25%) and anaerobic activity (75% to 80%) [12]. The body fat percentage in our study is higher than that was reported (11.61 ± 5.48) in the study done by Ariyasinghe et l (2019) among 30 Sri Lankan national level basketball players [13]. The variations in the training sessions, dietary patters might be a reason for this. However, the reported body fat percentage levels in our study are lower compare to the values reported for the Sri Lankan population aged between 18-30 years (19.5 ±6.6) by Ranasinghe et. al. (2013) [14].

The average height of the basketball players was high comparatively to the height of the average male Sri Lankan aged between 18-39 (168.7cm ± 6.2, n=279) [14]. Body height is a characteristic feature in basketball where it provides an added advantage for the player during the competition [11]. Further the average height of the Sri Lankan Basketball players is lesser than the international levels which could mainly attributed to genetical and nutritional factors [13].

For a large extent the muscle mass provides data in muscle strength. Reed et al reports the relationship between muscle mass and the muscle strength in elderly people [15]. This study finds a significant correlation between skeletal muscle mass and vertical and standing long jumping indicating the strength in the muscles is directly especially in the lower limbs is important in performance to determine the association between relative muscle power and the body composition and concluded that lower fat percentage and greater muscle mass enhances the performance of vertical jump, making body composition an indirect predictor of performance.

The significant positive correlation between BMI and BF% in our study confirms the findings of Ranasinghe et al. 2013, which was done among 1114 Sri Lankan healthy adults and found a significant positive correlation between BMI and BF% in males (r =0.75, p < 0.01; SEE = 4.17) and in females (r = 0.82, p < 0.01; SEE = 3.54) [14]. Rush et al. found a significant relationship between BMI and BF% among different ethnicities of European, Maori, Pacific Islanders and Asian Indian adults [16]. Furthermore, a study done by S. Meeuwsen among UK adults (male) had further emphasized that this relationship between BMI and BF% can be observed when the BMI is less than 25 kgm^{-2}. Findings of above research further strengthen our findings as our study showed a BMI ranged between 18.0 – 24.3kgm^{-2} [17].

Corrina et al to assess the reliability of SLJ for track and field events. He reported the mean SLJ distance for 6 male track and field athletes from Utah Valley University as 2.65±0.11 meters. Standing long jump distance of our study KDU players achieved was less than the findings of Corrina et al. Hence improvements should be made on the SLI during the practices session to reach international standards [18].

Similar to the findings of our study Yıldırım, & Özdemir et al reported the presence of significant relationships among anthropometric measurements and vertical and standing long jump of 56 handball players [19]. They found a significant relationship between body fat percentage, height and weight and vertical jump and the significant relationship between body fat percentage and standing long jump. In our study we showed that visceral fat levels and all other measured variables on body composition had significant relationships with both vertical and standing long jump. This provides the evidence for the importance of assessing body composition parameters with this simple assessment tool for performance evaluation.

The findings of our study have important value for both basketball players and coaches alike for application in training regimes to enhance performance.
KDU basketball players now know their body fat percentage, vertical jump height and horizontal jump distance. This study provides the baseline of their body composition and fitness level hence allowing them to reevaluate themselves for improvements after monthly training sessions.

V. RECOMMENDATIONS

The body fat percentages of KDU basketball players are relatively high compared to international standards which may hinder the performance of KDU basketball team. Hence, we propose to change their training program focusing on improving muscle strength (anaerobic exercises) rather than focusing on aerobic exercise. Anaerobic exercises (mainly weight training) will improve the muscle mass in turn increasing the basal metabolic rate causing a reduction in body fat percentage and maintain them in the optimum reference range. Hence, we recommend a bespoke training program for KDU basketball team to improve their fitness levels and improve performance.

VI. LIMITATIONS

Few limitations were identified in our study. Due to COVID – 19 the training sessions of Sports in the university was limited which could lead to lower performance of players. Therefore, maintaining the performance and fitness level during pandemic situation might help them to come back to the game with better performance.

VII. CONCLUSIONS

In conclusion, the basketball players with a low body fat percentage, low BMI and higher muscle mass showed better performance in vertical and standing long jumps where the assessment of body composition and above filed tests suggested to be used as important parameters of performance in basketball where they can be used routinely.

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