BODY COMPOSITION AND CARDIORESPIRATORY FITNESS PROFILE OF JUNIOR BADMINTON PLAYERS OF MANIPUR

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ABSTRACTS
Assessment of body composition and cardiorespiratory fitness is an indispensable tool for the determination of the health status in the case of athletes. It has been extensively studied in badminton who plays a different level of competition worldwide. However, there are limited studies in the Indian context. Therefore, the present study focused on evaluating the body composition and cardiorespiratory fitness parameters for junior male Badminton players of Manipur. A total of 15 national-level junior players of Manipur were involved in the study. The Body composition (BMI and Fat%), was assessed using TANITA Body Composition Analyzer TBF-300A. And the selected parameters of cardiorespiratory fitness taken into account were maximal aerobic power and lung functions (Force vital capacity(FVC), forced expiratory volume in one second(FEV1), and peak expiratory flow rate(PEFR)). Maximal aerobic power(VO2max) was recorded using a Multistage fitness test and lung function was recorded by Spirotech (Clarity Medical Pvt. Ltd)- a computerized spirometer. Descriptive statistics (min, max, means, and standard deviations) were used for data analysis using IBM SPSS 20. The result of the study can help coaches in identifying and choosing new badminton players, and also help to design the training program to enhance badminton performance.

Keywords: Body Composition, Cardiorespiratory, Spirotech, Badminton, Junior

INTRODUCTION
Badminton is an extremely challenging sport and it consists of a series of rallies of demanding movements carried out using a unique movement pattern compared to other sports. The length of the rally is often short (for elite players, it is an average of around 6-8 seconds). Besides that, the players should be prepared for long rallies too. Rallies have a short rest time (typically 15 seconds) that allows for partial recovery from the previous rally. At the elite level, players often have to acquire to perform at their limit’s physical fitness. In addition, players must retain a high degree of concentration to meet their opponents’ tactical/mental demands. There is considerable potential stress in competitive play. Therefore, the players need to know the physiological demand of the game and how 'Badminton fitness' can be improved (The Badminton Association of England, 2002).

Body composition is a vital element of a player's fitness. In sports like badminton additional mass in ft form would be disadvantageous for the players in which the bodyweight is repeatedly lifted to counter gravity (Reilly and Stratton, 1995). The excess fat level of body fat percentage (% BF), which is averse to health was found to differentiate the players and varies from sport to sport in terms of performance excellence (Power and Howley, 2014). Analysis of body composition can characterize the percentage of different components (muscle and skeletal mass) of the individual's total body weight and provide accurate information about the entire body's functioning. Body composition is an important factor of an athlete that contributes to peak performance. Studies show that athletes who have a low-fat percentage desired are well accepted for optimum competitive performance (as cited in Dr. Sarjubala, et al., 2015).

VO2max (maximum uptake of oxygen) is the highest level of oxygen that the body needs when exhaustive exercise while breathing at sea level(Astrandcand Rodahl, 1986). VO2 max is one of the most widely used aerobic power and metabolism indicators (Howley et al., 1995) for measuring aerobic performance regularly, and it is considered the gold standard and the most important measuring factor in aerobic performance. Notably, lung functions can vary according to physical characteristics such as age, height, body weight, and altitude (SR Vedala et al., 2013). Regular practice athletes have a positive effect on the lungs through increasing pulmonary capacity also improves muscle strength, aerobic ability and reaction time, and joint flexibility. These exercises increase blood flow regularly and increase the supply of nutrients to those bodies (Pk Mehrotra et al., 1998; Shrikrishna, 2017).
MATERIALS AND METHODS
The present study was conducted on 15 male junior badminton players, who were participated in national-level badminton competitions. The purpose of the study and the testing procedure was explained to all the subjects and received written approval. Body composition was assessed by TANITA Body Composition Analyzer TBF-300A (Ramananda, 2016; Wan et al., 2019). The parameter of the body composition includes body mass index (BMI) and body fat percentage (BF %). The test was assessed in the morning before having breakfast and any physical activity. Participant height and age have a role in determining the body composition have taken. The participant was asked to step and stand straight without any movement on the weighing platform after all the data has been entered, and the flashing arrow appear. Enter the clothes weight as 0.01 and the body composition analyzer will automatically reduce the weight of the clothes. After completion, the score will be automatically displayed on the screen.

Maximal aerobic power was assessed by Multistage fitness test (MSFT) by Leger et al.,1988. It consists of a shuttle running between 20 meters parallel lines apart. The subjects start running with the signal emitted by a beep sound. The beep sound was quite slow at the beginning but it will increase gradually at each level. The test is stopped when the subjects failed to reach the end line with the beep sound for two consecutive ends. Subject completed shuttles are usually used for the test. The VO2max was calculated using the formula Y = 31.025 + 3.238X -3.248A + 0.1536AX(Leger et al., 1988). Where Y=VO2max(ml/kg/min), X = Maximal shuttle speed, A = Age(yr).

Lung function tests were recorded by Spirotech (Clarity Medical Pvt. Ltd)- a computerized spirometer. The parameters of lung function included in the study were forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and peak expiratory flow rate (PEFR). The participant was made familiar with the machine before the test. All the participant's height, weight, and age were collected as it is essential to determine their pulmonary functions test. The participant was instructed to inhale and exhale normally, and then after taking a forced inspiration, they were asked to expire forcibly into the nozzle of the machine. Three readings of all the tests were recorded and the best of the three was taken into account. (Shrikrishna,2017).

STATISTICAL ANALYSIS
Statistical Analysis was performed using the IBM SPSS program (Version 20). The descriptive statistics (mean, standard deviation, minimum and maximum) were computed to describe the body composition and pulmonary function test of Badminton players.

RESULT AND DISCUSSION
The studies were conducted on 15 Junior National badminton players of Manipur. The results were tabulated and statistically analyzed. The finding of the study is presented in table 1 and 2.

Table 1: Descriptive statistics of Body Composition of Junior Badminton Players of Manipur

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std. D</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI kg/m²</td>
<td>15.90</td>
<td>23.70</td>
<td>20.02</td>
<td>2.71</td>
</tr>
<tr>
<td>Fat %</td>
<td>11.50</td>
<td>19.60</td>
<td>15.98</td>
<td>2.60</td>
</tr>
</tbody>
</table>

Note: N=No. of the participant, Min=minimum, Max= maximum, BMI=Body mass index
According to Table 1, BMI in Junior National Badminton players of the study was 20.02±2.71kg/m², Fat % 15.98±2.60%. The BMI classification based on Bray (1979) most the subjects of this study were normal (BMI 20.0-25.0 kg/m²). But some of the subjects were classified as underweight. The obtained fat percentage of the study was more than that of the desirable ranges of an athlete (5 to 13%) (Michelle Matte, 2019). Body composition was known to be essential to excellence in the performance of athletes (Mathur & Salokun, 1985). The lower body fat percentage of the sportsmen has been found to have higher oxygen absorption (VO2max). In other words, the lower percentage of athletes with body fat seemed most efficient at using oxygen (Heck 1980), whereas excess body fat is shown to hinder physical performance (Wan et al.,1996). For gymnasts, figurines, wrestlers, runners, and other endurance athletes, a minimum level of fatness is particularly beneficial (Smith, 1984).

Table 2: Descriptive statistics of Cardiorespiratory fitness of Junior Badminton Players of Manipur

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std. D</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAP(VO2max) ml/kg/min</td>
<td>45.50</td>
<td>54</td>
<td>47.4</td>
<td>1.9</td>
</tr>
<tr>
<td>FVC litre</td>
<td>3.36</td>
<td>5.31</td>
<td>4</td>
<td>.47</td>
</tr>
<tr>
<td>FEV1 litre/sec</td>
<td>3.11</td>
<td>5.29</td>
<td>3.9</td>
<td>.53</td>
</tr>
<tr>
<td>PEFR litre/sec</td>
<td>6.95</td>
<td>10.82</td>
<td>8.60</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Note: MAP=maximal aerobic power, FVC=Force vital Capacity, FV1=Force expiratory volume in 1sec, PEFR=Peak Expiratory flow rate, N=15

According to table 2, the mean value of MAP(VO2max) of the present study is 47.4±1.9 ml/kg/min. According to the National Junior Program Badminton Australia (2008), the subjects of this study have an average VO2max (45.2 - 50.9 ml/kg/min). This number is determined by many factors like heredity, training, age, sex, and body composition (UC Davis Sports Medicine Department). Smaros and Guanello (1980); Monem (2018) described the higher VO2 max players perform the highest number of sprints and play decisive games more often than the lowest ones. The more the lungs capacity, the higher the VO2max scores, and can perform for a prolonged period. Therefore the determination of the VO2max is of special importance since it played a key role in professional sports and it is necessary for success in many sports.

The mean FVC, FEV1, and PEFR of Junior male National Badminton players in this study were 4 ± .47 L, 3.9 ± .53 l/s, and 8.60 ± 1.0 l/s respectively. Compared to the obtained mean value of FVC (4.03 ± 0.18 L), FEV1(3.23 ± 0.15 l/s), and PEFR (9.71 ± 0.38 l/s) from badminton in studies performed by Shrikrishna (2017) the value of the present study is slightly lower. The potential explanation might be obesity and abnormal waist circumference can be explained by inspiration restrictions. In many studies, obesity-associated FVC reduction has been observed and an improved impedance of the chest wall (Obaseki et al.,2017; Kurth and Hnizdo,2007; Thyagarajan,2008) is attributed to this reduction. Studies have also shown that a 1 cm waists increase FVC by 13 ml can be reduced low intensity of the training. Additionally, a lower heart pulse is required due to an increase in pulse volume. The increase in pulse volume helps O2 to be transferred to the muscles, which is required during maximum workouts. The increase in lung volume and capacity meanwhile increases Oxygen passage from the lungs into the blood. (Hagberg et al.,1985). Such an
increase may result from the positive effect of exercise and strengthening of breathing muscle on the dynamic lung capacity. Exercises lead to an increase in lungs functions (Makwana et al., 1988), while aerobic exercises lead to an increased level of anaerobic FVC values (Günay and Cicioglu, 2001)

CONCLUSION
In conclusion, this study shows BMI of Junior male badminton of Manipur have in normal ranges but Fat % was higher than those of the desired athlete ranges and possessed the average maximal aerobic power (VO2max). While FVC, FEV1, and PEFR are lower when compared to the other state or country badminton players. The data obtained from this study may be a possible indicator of detraction or negative adaptation to training. In this case, continuing training tolerance actions may be necessary to determine more detailed physiological changes to improve athletes' performance. The result of this study served as a good baseline and reference for coaches, trainers, athletes to improve the performance of Badminton players.

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INFORMED CONSENT
All the participants gave their written informed consent for inclusion before participation in the study.

CONFLICT OF INTEREST
The authors declare no conflicts of interest

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