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Body Morphology and Static Flexibility Status: A Study on Adult Bengalee Males Undergoing Training in Football

***Abstract*: Football, world's most popular sport, played in every nation at varying levels of competence, requires comprehensive skills including physical, psychological, technical and tactical abilities of the players that make them competent to win a match. In this backdrop, the present study has been conducted to assess the body morphology and static flexibility status of 39 adult Bengalee males (18-22 years) undergoing training in football for at least a period of 6 years and practicing it regularly at least a period of two hours every six days a week. It has been found that the individuals undergoing training in football have significantly (P<0.05) better body morphology, and have significantly (P<0.05) better static flexibility status, compared to their age and sex matched control group individuals.**

Keywords: Motor skill, obesity, health, body contact game, performance

Football, a most popular form of physical exercise is recognized as one of the important body contact team sports and it is played by at least 200 million people worldwide[1] according to 2005 Big FIFA count. Physiologically football has been characterized as a team sport that consists of a series of moderate to high intensity short-term, intermittent activities including jogging, kicking, acceleration, deceleration, jumping, pivoting that leads to a significant amount of metabolic heat production [2] and it basically depends on the aerobic endurance[3-4] energy system. Moreover, it is a kind of movement based game, needs ideal physical characteristics of the players for the continuous body movements[5] in different directions depending on the location of the ball along with a combination of technical and tactical expertise for preventing the team from the opposition's attack. Furthermore, football is a type of physical activity that requires enormous body flexibility with excessive fitness, a set of attributes that may be achieved through regular physical exercising for a particular duration of time period with specific intensity. In addition, mental and motivational predispositions[6] are also considered as the key factors in football to become successful in a match in different challenging situations. In this backdrop, a study has been undertaken to assess the effect of being trained in football on body morphology and static flexibility status of adult Bengalee males.

Methodology: Initially different centers in Hooghly, West Bengal, imparting training to male individuals on football were approached. The measurements were obtained in the morning hours from 39 randomly selected volunteering individuals of age range 18-22 years undergoing training in football for at least a period of 6 years and practicing it for about a period of two hours six days a week and with no chronic disease history (self-reported); they constituted the Football Practicing Group (FG). Initially basic information regarding their playing experience (year), daily practicing time (hour), playing position, educational qualification, socio-economic status and like were recorded. Stature (cm) (to the nearest 0.1cm) using anthropometric measurement set, body weight (kg) (to the nearest 0.1 kg) using an electronic weighing scale with individuals without shoes and in socially acceptable light weight exercising clothes, were measured and BMI ($kg.m^{-2}$) was calculated. Body fat (%) of the subjects was calculated from the skin fold measurements taken at abdominal, triceps, thigh and suprailliac[7] position. Anthropometric parameters, namely Waist Circumference-WC (cm), Hip Circumference-HC (cm), were measured, using a non-stretchable measuring tape and Waist to Hip ratio (WHR)[8] and Waist to Stature ratio (WStR)[9] were calculated. To assess fitness in terms of lower limb power, and agility of the study participants, vertical jump test [VJT][10] and Illinois Agility test (IAT) [11] were carried out respectively. To assess static flexibility in terms of hamstring flexibility of the study participants sit and reach test (SRT)[12] was carried out. Similar measurements were taken from 45 individuals of comparable age, socioeconomic

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and ethnic background but without having training in any form of exercise including football, constituting the control group (CG). On obtaining the measurements, data were subjected to statistical analyses and <0.05 was chosen as the level of significance (P).

Results and Discussions: The results obtained from the study conducted on 39 randomly selected adult Bengalee males, of age range 18-22 years constituting Football Practicing Group (FG) and 45 randomly selected males of comparable age and socio-economic-ethnic background constituting control group (CG), are presented below. It is to be noted that participating FG volunteers are being trained in football for at least a period of 6 years and practicing it daily for at least a period of two hours every six days a week.

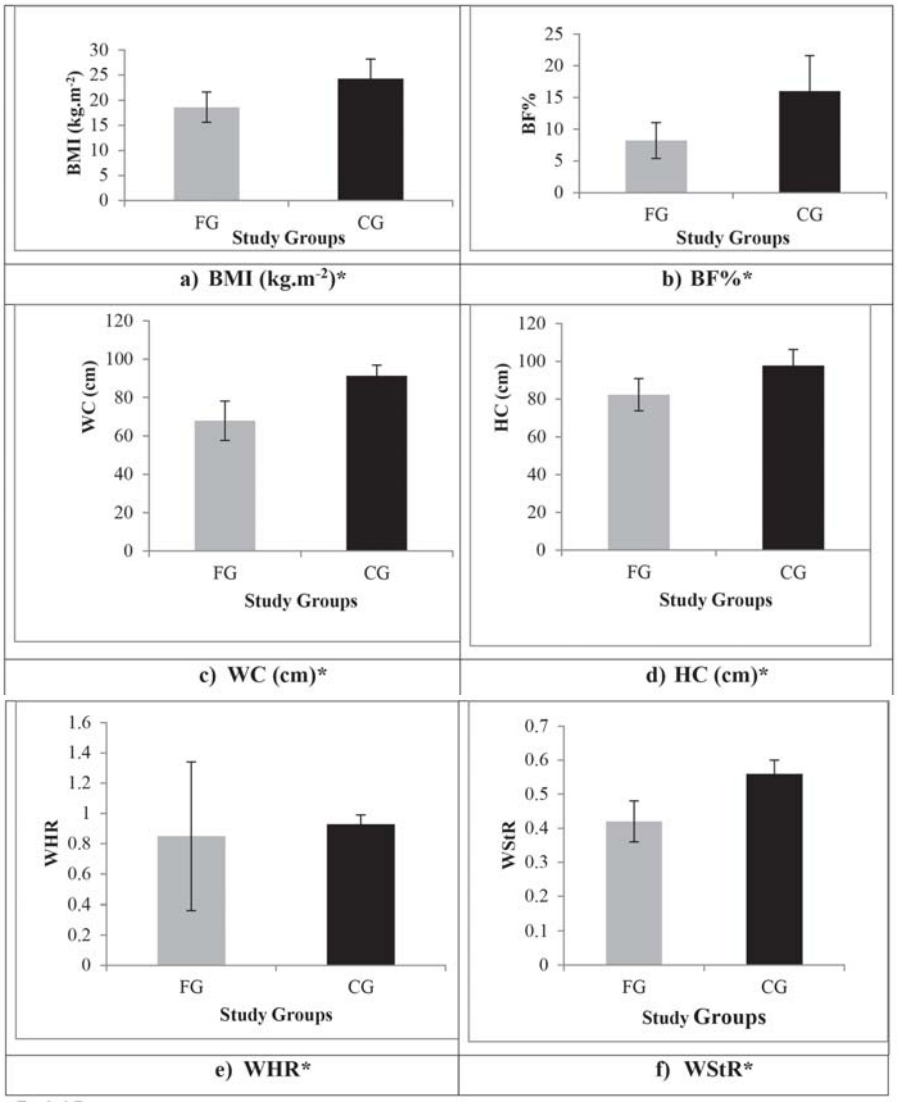
Body morphology status of FG and CG individuals assessed in terms of BMI, BF%, WC, HC, WHR and WStR are presented in Figure 1. It is found from the results that the BMI (Fig: 1a), BF% (Fig: 1b), WC (Fig: 1c), HC (Fig: 1d), WHR (Fig: 1e) and WStR (Fig:1f) of FG individuals are significantly (P<0.05) better compared to their CG counterparts.

Fitness status of the study participants has been estimated using Illinois Agility Test (IAT), Vertical Jump Test (VJT) and Sit and Reach Test (SRT). The results of the tests are presented in figure 2. It has been found that FG individuals have significantly (P<0.05) better fitness status in terms of VJT score (Fig: 2a), IAT score (Fig: 2b) and SRT score (Fig: 2c) compared to CG males.

The present work was conducted on the adult Bengalee males to study the effect of undergoing training in football on body morphological aspects in terms of body composition, body physique and static flexibility status.

It has been found from the results that, FG and CG individuals did not vary significantly (P<0.05) in terms of their age (FG 19.1 ± 1.23 and CG 19.5±0.70) and Systolic blood pressure (SBP) (mmHg) (FG 123.3±12.28 and CG 125.1±11.37) but they did vary significantly (P<0.05) in terms of their Body weight (kg) (FG 53.5 ±7.04 and CG 62.3±7.32) and Diastolic blood pressure (DBP) (mmHg) (FG 67.4±11.31 and CG 76.8±7.81). FG individuals have significantly (P<0.05) lower Body weight (kg) and DBP (mmHg) compared to their CG counterparts. The possible reason may be due to effect of being trained in an intermittent exercising for a longer period of time, has bought a significant positive changes in their body weight and diastolic blood pressure and reduces the chances of being overweight and followed by different non-communicable diseases[13].

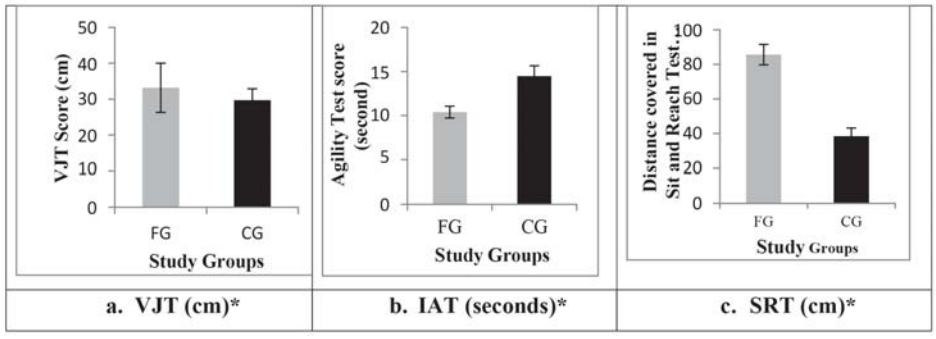
In the present work, to study body morphology status in terms of body composition of the study



*P<0.05

Fig. 1. Comparison between FG and CG individuals in terms of (a) BMI, (b) BF %, (c) WC, (d) HC, (e) WHR, and (f) WStR

participants, BMI ($kg.m^{-2}$) and body fat % (kg) were selected. BMI, representing an index of an individual's fatness, is widely used as a risk factor for the development of several metabolic disorders. In the present study, it has been found that the BMI ($kg.m^{-2}$) of the FG individuals is significantly ($P<0.05$) lower compared to the CG males (Fig:1a). The present finding is in agreement with our previous work carried out on adult female individuals receiving regular training in Indian classical dances[15-17]. In spite of the usefulness and popularity of BMI, it has several limitations. BMI is a relatively poor indicator of percent of body fat. Most importantly, the BMI also alone does not provide information about regional fat distribution. In the present study, for determining the overall body fat% of the study participants, skinfold measurement technique was used. It has been found from the result that the body fat % of the FG individuals is significantly ($P<0.05$) lower compared to the CG males (Fig: 1b). The result of the present finding is in consonance with our previous work carried out on sub division level trainee adolescent football players[18] and trainee Indian classical danseuses [19-23].



*P<0.05

Fig. 2. Comparison between FG and CG individuals in terms of (a)VJT, (b) IAT and (c) SRT.

In the present study, body morphology in terms of body physique status of the study participants has been assessed in terms of different anthropometric parameters including WC, HC, WHR and

WStR. According to World Health Organization (WHO) guidelines, WC, WHR, and WStR have been found to be superior to BMI [24-26] that reflect abdominal obesity. The recommended waist circumference cut-off points of 90cm for South Asian men has been proposed in the International Diabetes Federation (IDF) statement on type 2 diabetes prevention[27]. In the present study, it has been observed that the mean value of WC of CG individuals is significantly ($P<0.05$) higher compared to their FG counterparts (Fig: 1c). This finding is also in agreement with our previous work conducted on Bengalee male adult undergoing regular training in football[28] and cricket[29] and female individuals receiving regular training on Indian classical dances[30-32]. It has been proposed in studies that WC is a simple but more accurate predictor of different non communicable diseases including type 2 diabetes mellitus[33], cardiovascular diseases[34], hypertension, low HDL cholesterol, elevated triglycerides, and insulin resistance than BMI[35]. In fact, studies revealed that elevated CRP was related with high BMI and/or high WC for men that and it has a positive association with CVD[36]. Moreover, it has also been found in studies that WC is the best measure of adiposity to predict elevated BP in men[37]. However, the result of the present finding is may be due to dynamic body movements, continuous running with acceleration and deceleration, jumping leading to the changes in WC in FG individuals. Similar trend has also been observed in case of HC (Fig: 1d). This result is also in agreement with our previous study conducted on adolescent Bengalee male individuals undergoing regular training in football [38] and adult Bengalee females receiving training in recreational dances on a regular basis[39]. Studies indicated that WHR, may be the ideal measurement of adiposity because it takes body fat distribution into account by showing abdominal and peripheral adiposity[40]. WHR is an important indicator for defining central obesity and cardiovascular risk. The Asian population exhibit increased WHR and is likely to reflect increased visceral adipose tissue[41]. Visceral adiposity induces greater endocrine activity by modulating tissue concentrations of adipokines such as adiponectine and resistine, markers of insulin resistance, or by transforming growth factor á and interleukin 6, inflammatory mediators. It is also found that the risk of myocardial infarction was more strongly associated with WHR[42] than with WC. The present study has been planned to find out the comparison of fat deposition especially in the abdominal region as it exhibits much more significance in terms of developing non communicable diseases and therefore it has been measured for FG and CG males. It has been found from the results, that the FG individuals have significantly ($P<0.05$) lower value of WHR, (Fig: 1e) compared to their CG counterpart. The cut- off limit for WHR is 0.90 which is slightly exceeded in case of the CG individuals indicating a probability of inception of obesity and related metabolic diseases. It has also been reported that Waist-to-Stature Ratio (WStR) is also an improved predictor of abdominal

obesity, and is more strongly associated to CVD morbidity and mortality compared to other indicators. The mean value of WStR of the FG individuals is significantly ($P < 0.01$) lower (Fig: 1f) than their CG individuals preventing the FG individuals from the adult onset of obesity. The present finding is in agreement with our previous work conducted on adult Bengalee females receiving regular training in Indian classical dances[43-46]. The present findings, i.e. CG individuals are having higher WStR values, an important marker of overweight and obesity, may be due to leading sedentary lifestyle which is in agreement with our earlier reports on female individuals engaged in sedentary work [47-48].

In the present study fitness status of the study participants has been assessed using vertical jump test (VJT) (Fig: 2a), Illinois Agility Test (IAT) (Fig:2b) and Sit and Reach Test (SRT) (Fig:2c) respectively. It has been found that the VJT score (used for estimating the lower limb explosive power) and the IAT (used for estimating agility) score are significantly ($P<0.05$) better in FG individuals compared to their age and sex matched CG counterparts. As football is described as a team sports requiring enormous strength and power in the lower limbs and highly agile movement patterns, because the players have to cover for about 10-12 km distance in a 90 minutes of time period in any direction with an unpredictable changing gaming situation, this could be the reason for improving their leg explosive power and agility than their CG counterparts. The finding of the present study is in consonance with the previous studies which reported that football exercising program develops the coordination skills, explosive legs strength and power in shorter times[49].

In addition to body morphology status, flexibility in terms of static flexibility is an important aspect of sports personnel. Flexibility is defined as maximum range of motion in a joint or series of joints[50]. Nowadays different types of tests are used to assess static flexibility. Thus, angular tests that specifically measure hip flexion with the knee extended (straight leg raise test), or the range of knee extension with the hip flexed to 90 degrees (knee extension or popliteal angle test), have been widely used for measuring hamstring extensibility[51]. Unlike the angular tests, lineal tests have been used to measure static flexibility and Sit and Reach test (SRT) is one of them. It is a simple procedure and easy to administer which requires minimal training skills application[52] and is popularly used as lineal measures of hamstring flexibility[53]. It has been reported in previous studies that lack of hamstring muscles extensibility causes a decrease in pelvic mobility[54-55], severe spinal disorders including thoracic hyperkyphosis[56], disc herniation, spondylolysis [57], low back pain and changes in lumbo pelvic rhythm[58] that ultimately affects performance of an individual[59]. In the present study, static flexibility in terms of sit and reach test of the FG individuals, is significantly ($P<0.05$) better compared to their CG counterpart (Fig:2c). The result is in agreement with our previous work conducted on adult Bengalee males undergoing training in football[60] and adult Bengalee Kathak dancers[61]. From the result it is clear that the FG individuals are less prone to develop muscular strain, joint instability and spinal disorders compared to CG males.

Conclusion

From the findings of the present study it may be concluded that individuals undergoing training in football, for at least a period of 6 years and practicing it for about a period of two hours every six days a week had significantly better ($P<0.05$) body morphology and static flexibility status compared to their age and sex matched control group counterparts.

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