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Anthropometric traits, Body Composition and Physical Fitness Index: A Micro Level Study Among College Students of Haldia, Purba Medinipur, West Bengal

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KEYWORDS

Anthropometry, Body composition, BMI, Harvard Step Test, Footballers and Non-sports persons.

ABSTRACT

Anthropometric traits, body composition and physical fitness are considered as important indicators of health and generally executed in different sports to achieve the goal. In view, the objectives of the present study are to evaluate anthropometric characteristics, body composition components and physical fitness index (PFI) of the young college students, to assess nutritional status, and also to find out relationship between anthropometric traits, body composition and PFI of the participants of Haldia, Purba Medinipur, West Bengal. Present cross-sectional study was conducted among 42 college students including 18 College level footballers and 24 non-sports persons. Different anthropometric and body composition traits were measured following standard methods and instruments. Body Mass Index (BMI) was used to assess nutritional status of the study participants. PFI was measured by Harvard Step Test (HST). Descriptive statistics, t-statistics and correlation were used to analyze the data. BMI values indicate that the majority of the footballers were normal weight, while higher percentages of non-sports persons were underweight and overweight. Significantly lower mean values were observed among footballers in anthropometric traits like skinfold thicknesses; bi-iliac diameter; total fat and regional fat percentages than non-sports persons. However, PFI performance was 'poor' for both footballers and non-sports persons. PFI shows significant correlation with different anthropometric and body composition traits among non-sports persons, while sports persons show significant correlation between different anthropometric and body composition traits. The study shows the trend that footballers possess better health traits than non-sports persons but footballers have scope for improvement in PFI values.

Introduction

Biological anthropology is concerned with anthropometry, body composition and genetic background of the individuals associated with different sports activities. Knowledge of biological anthropology especially, nutritional anthropology, could be effectively utilized in sport activities to achieve the most favourable benefit in the desired direction. It appears that there exist some sort of relation between body composition, limb proportion, other anthropometric traits and sport activities (Jaiswal 2019).It is well reported that anthropometry is an essential, non-invasive and inexpensive tool to assess physique or nutritional status of individuals or populations (Baumgartner 1995; WHO 1995). Anthropometric and body composition characteristics are related to the genetic makeup, socio-economic status (Perissinotto *et al.* 2002), physical environment, lifestyle and health conditions of sports persons, which are regarded as essential components to get success in any sports events. Different anthropometric measurements such as height, weight, limb proportion, chest circumference, waist circumference (WC), hip circumference, and computed indices like body mass index (BMI), waist-to-hip ratio (WHR), body fat percentage, body muscle percentage, somatotype etc. are not only useful for the selection of sports person for a particular sport event but also essential for maintaining or

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upgrading performance in the specific sports events. BMI is good for the assessment of underweight or overweight/obesity, while WC and WHR are good indicators of abdominal fat distribution. Physical Fitness Index (PFI) is one of the important criteria to assess the cardio-respiratory efficiency of an individual (Das and Mahapatra 1993). Physical fitness is always prejudiced by anthropometric and body composition characteristics such as height, weight, BMI, fat percentage and muscle percentage. It is found that underweight and overweight/obesity has a negative impact on physical fitness parameters (Hasanbegovic *et al.* 2010; Tishukaj *et al.* 2017). Studies reported that changes in anthropometric and body composition traits during adolescence are important for sustainable physical fitness and positive health outcomes on later stage of life (Brooke *et al.* 2014; Ried-Larsen *et al.* 2015). Adolescence is a period when the growth and development of the body speed-up and also different health-related habits are formed (Patton and Viner 2007). Healthy habits during the adolescence period may lead to healthy lifestyles in adulthood and affects health both in adulthood as well as in the later phase of life (Bélanger *et al.* 2015). Saunders and colleagues (2016) reported that regular physical exercise have beneficial effects on health. At the same time, sedentary lifestyle may lead to several diseases like obesity, diabetes, and other cardio-vascular diseases (WHO 2002; Lavie *et al.* 2019). However, studies that focused health benefit of physical activity of non-sports as well as sport persons are still inadequate. Majority of the studies have focused either on few anthropometric traits or physical fitness of school students/ young adults or body composition of sports person. Studies that evaluate anthropometric traits, body composition and physical fitness of sports as well as non-sport youth are still scanty in the context of this particular area. In view of the above the objectives of the present study are:

To evaluate anthropometric characteristics, body composition components and physical fitness index (PFI) of the young college students;

To explore the nutritional status of the study participants, and

To find out relationship among anthropometric traits, body composition traits and PFI of the participants of Haldia, Purba Medinipur, West Bengal.

Materials and Methods

Study area and participants

The present cross-sectional study was conducted among the students of the Haldia Government College, Purba Medinipur, West Bengal. This paper is an outcome of a dissertation project on 'Sports and Nutritional Anthropology'. The project was supposed to be conducted among the individuals who involved in sports activities and another group of individuals who never participated in any competitive sports activities. In search of sports person, communication had been made with different sports club in Haldia. Unfortunately, due to busy schedule of the players, they could not participate in the data collection process. Due course, the author approached to a faculty of Physical Education Department of the College and managed to collect the data from the university level Football team of the college. No sampling procedure was adopted to select the participants. All the footballers were approached before collection of data, the aims and objectives of the study were explained to all the footballers as well as non-sports students. The individuals who voluntarily participated in the study were incorporated as study subjects after taking prior informed consent. A total of 42 young students participated in the study, of whom 18 male footballers and 24 non-sports participants including 13 males and 11 females. All the selected footballers have been playing football for at least 3 years and their control counterpart i.e. non-sports persons have never participated any competitive sports. The study was conducted in accordance with the ethical guidelines for human experimental research.

Data

Data types include socio-economic characteristics of the student participants like name, age, sex, class of education, and monthly household income. Anthropometric and body composition data have been collected from 24 young non-sports participants of both sexes and 18 male footballers. The anthropometric and body composition traits have been measured for the present purpose following standard methodology and instruments (Weiner and Lourie 1981). All skinfold thickness measurements were taken by Harpenden skinfold calliper and all circumference measurements were taken with a flexible, non-stretchable tape in close contact with the skin, but without indenting the soft tissue. Body Composition data were obtained by Omron Body Fat Monitor, which works on the principles of Bioelectrical Impedance to measure a person's relatively accurate body fat content in percentage. The methods Bioelectrical Impedance is considered to be one of the standard techniques as stated in many literatures (Chumlea and Baumgartner 1989; Kushner *et al.* 1990). Participants' resting heart rate was taken before physical fitness test and after the test again heart rate measured for three times following measurement protocol. The list of measured traits are given below –

Sl. No.	Anthropometric Traits	Sl. No.	Body Composition Traits
1.	Height (cm.)	1.	Body Mass Index
2.	Weight (kg.)	2.	Total Fat Percentage
3.	Waist circumference (cm.)	3.	Whole Body Fat
4.	Hip circumference (cm.)	4.	Visceral Fat Percentage
5.	Mid upper arm circumference (cm.)	5.	Muscle Whole Body
6.	Normal chest circumference (cm.)	6.	Arm Fat Percentage
7.	Inhale chest circumference (cm.)	7.	Arm Muscle Percentage
8.	Exhale chest circumference (cm.)	8.	Trunk Fat Percentage
9.	Calf circumference (cm.)	9.	Trunk Muscle Percentage
10.	Bi-acromial diameter (cm.)	10.	Leg Fat Percentage
11.	Bi-iliocristal diameter (cm.)	11.	Leg Muscle Percentage
12.	Bi-condylar humerus (cm.)		
13.	Bi-condylar femur (cm.)		Physiologic Traits
14.	Biceps skinfold thickness (mm.)	1.	Heart Rate (Bits/Min.)
15.	Triceps skinfold thickness (mm.)		
16.	Subscapular skinfold thickness (mm.)		
17.	Supra-iliac skinfold thickness (mm.)		

Nutritional status and classification of data

Body Mass Index (BMI) is considered to be the most useful population-level measure of nutritional status, and it is a simple index to classify underweight, normal weight, overweight and obesity in adults (WHO 1995). BMI is computed using the formula, **BMI = Weight (kg)/ Height (m^2)**

The World Health Organization's (2004) recommended universally accepted body mass index (BMI) cut-off values have been used for the screening and assessment of underweight and overweight status of the study participants (Table 1).

Table 1: Body mass index cut-off values for the assessment of nutritional status

BMI (kg/m2) categories	Cut-off values	Reference
Underweight	<18.50	WHO 2004
Normal weight	18.50 - 24.99	
Overweight	25.00 – 29.99	
Obese	≥ 30.00	

Physical Fitness Index

Physical Fitness Index (PFI) was measured by Harvard Step Test (HST). HST is a good measurement of the fitness of a person and it measures the ability of that person to recover after a strenuous exercise or physical fitness test by checking the recovery rate (Brouha 1943). The Index value is high when the heart rate returns to its normal rhythm in quick succession, that is why, it is called a kind of cardiovascular endurance test. The HST is a type of cardiac stress test for detecting and diagnosing cardiovascular disease.

The subject was asked to steps up and down on a platform (50.8 cm or 20 inches high) in a cycle of two seconds. A stopwatch and metronome used to ensure the right speed of 30 steps per minute for five minutes or until exhaustion. On completion of the test or exhaustion (cannot maintain the stepping rate for 15 seconds), the subject was instructed to sit down immediately, and the heartbeats counted for 1 to 1.5, 2 to 2.5, and 3 to 3.5 minutes. Therefore, the equation and rating categories of physical fitness index are as follows:

Physical Fitness Index = {({\displaystyle t_{e}}t_e) × 100} / {({\displaystyle t_{e}}h_b × 2}

Where, t_e is the test duration in seconds and h_b is sum of heart beats during the recovery periods.

Rating categories	Physical Fitness Index	Reference
Poor	< 54	Brouha 1943
Low average	54 – 67	
Average	68 – 82	
Good	83 – 96	
Excellent	≥ 97	

Statistical analysis

After collecting the data, transcription was done in computer for analysis of different anthropometric, body composition and physical fitness traits. Descriptive statistics were computed to describe anthropometric and body composition characteristics of the study participants. Independent sample t-statistics were used to compare mean differences in anthropometric and body composition traits between footballers and non-sports persons (males only). Pearson correlation coefficient was computed to find out relationship among different anthropometric, body composition measures and physical fitness index values. All statistical analyses were done using SPSS 16.0 (SPSS Inc., Chicago, IL, USA) and Excel 2010 software packages.

Results

Socio-demographic profile of the student participants

Out of total 42 participants, sports group represented by 18 male footballers and non-sports group represented by 13 male and 11 female students. All the participants' ages ranges between 18 years and 21 years and mean age is 19.12 $\pm$ 1.60 (Sd.) years. A higher percentage of participants belonged to the graduation 1st year classes (54.76%), followed by 2nd year classes (33.33%) and 3rd year classes (11.90%). Most participants' monthly household income is Rs.10000.00 – Rs.19999.00 (42.86%), followed by Rs.20000.00 & above (35.71%), below Rs.10000.00 (30.95%), and another 14.29% participants did not want to disclose their household's monthly income. (Table not presented)

Table 2: Mean comparison of Anthropometric traits between Footballers and Non-sports persons

Anthropometric characteristics	Footballers			Non-sports Persons			t value	Non-sports Persons		
	MALE			MALE				FEMALE		
	N	Mean	SD	N	Mean	SD		N	Mean	SD
Height (cm)	18	167.10	4.89	13	168.75	6.42	0.81	11	153.45	5.53
Weight (kg)	18	57.27	6.61	13	58.31	14.52	0.27	11	49.32	12.16
Circumferences (cm)										
Waist	18	69.77	4.91	13	74.90	13.57	1.48	11	72.02	11.17
Hip	18	85.11	3.96	13	88.01	10.99	1.05	11	87.64	8.35
Mid-Upper Arm	18	85.11	3.00	13	25.48	3.70	0.01	11	23.43	3.50
Normal Chest	18	84.74	5.16	13	84.88	7.98	0.06	11	70.60	6.52
Inhale Chest	18	88.73	5.44	13	88.65	7.42	0.03	11	72.58	6.73
Exhale Chest	18	83.20	4.55	13	83.41	8.04	0.09	11	68.72	6.39
Calf	18	32.58	2.04	13	32.44	3.80	0.14	11	31.56	4.27
Diameters (cm)										
Bi-acromial	18	37.42	1.75	13	37.36	1.43	0.09	11	33.39	2.16
Bi-Iliac	18	23.39	1.06	13	24.56	1.58	**24.85**	11	24.85	2.17
Biepicondylar Humerus	18	6.29	0.33	13	6.37	0.53	0.52	11	5.45	0.58
Biepicondylar Femur	18	8.49	0.58	13	8.78	0.60	1.36	11	8.06	0.62
Skinfold Thicknesses (mm)										
Biceps	18	3.46	1.30	13	5.63	3.44	**2.46***	11	6.10	3.20
Triceps	18	7.13	3.43	13	9.18	5.90	1.21	11	13.14	5.80
Sub-scapular	18	10.23	2.93	13	13.38	4.98	**2.21***	11	16.25	5.89
Supra-iliac	18	7.27	3.18	13	11.92	6.12	**2.76****	11	13.08	5.90

**$p \leq 0.05$; **$p \leq 0.01$*

Table 2 shows the mean comparison of anthropometric traits between footballers and non-sports persons. Independent sample t-test was performed to compare mean differences in the anthropometric traits between male footballers and male non-sports persons. Significantly lower mean values were observed in the traits like bi-iliac diameter, biceps skinfold thickness, sub-scapular skinfold thickness, and supra-iliac skinfold thickness among the footballers than the non-sports persons. The data on anthropometric traits of non-sports person females could not be compare due to paucity of data of the sports person females.

Table 3: Mean comparison of Body Composition components between Footballers and Non-sports persons

Body Composition components	**Footballers**			**Non-sports Persons**			**t value**	**Non-sports Persons**		
	MALE			MALE				FEMALE		
	N	**Mean**	**SD**	**N**	**Mean**	**SD**		**N**	**Mean**	**SD**
Body Mass Index	18	20.26	2.42	13	21.25	4.58	0.78	11	20.91	4.10
Total Fat Percentage	17	13.32	3.92	13	22.45	16.21	2.25*	11	28.45	3.91
Visceral Fat Percentage	16	3.97	1.94	12	5.29	4.09	1.14	11	2.91	2.65
Whole Body										
Fat	17	9.40	2.65	13	12.18	5.71	1.78	11	23.79	4.26
Muscle	18	37.15	2.33	13	35.25	3.24	1.91	11	25.27	3.51
Regional Fat Percentage										
Arm	17	15.54	3.68	13	19.96	6.45	2.38*	11	40.65	4.27
Trunk	16	8.19	2.48	12	11.55	4.77	2.42*	11	20.02	4.09
Leg	17	14.16	3.64	13	19.18	7.06	2.53*	11	35.96	4.80
Regional Muscle Percentage										
Arm	18	42.24	1.91	13	41.00	2.94	1.42	11	30.00	3.54
Trunk	17	31.55	2.34	13	28.18	5.26	2.36*	11	21.71	1.82
Leg	18	54.24	2.24	13	52.42	3.12	1.90	11	37.56	2.25

*$p \leq 0.05$

Table 3 shows the mean comparison of body composition components between footballers and non-sports persons. Here, independent sample t-test was computed to compare mean values of body composition components among the male footballers and non-sports persons. Significantly lower mean values were observed in the traits like total fat percentage and fat percentages of all regional areas like arm, trunk and leg of the footballers than the male non-sports persons. On the contrary, male footballers possessed significantly higher trunk muscle percentage than the male non-sports persons.

Table 4: Physical Fitness Index status of the participants in terms of Harvard Step Test (HST)

Physical Fitness Index Status	**Footballers**		**Non-sports Persons**			
	MALE (N=15)		MALE (N=13)		FEMALE (N=10)	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Before HST Heart Rate (Bits/Min.)	81.33	13.58	90.62	12.53	84.60	11.70
After HST Heart Rate (Bits/Min.)	128.93	19.78	149.38	27.69	136.20	26.34
After HST Heart Rate (Bits/Min.)	111.73	16.53	137.54	24.82	113.60	19.70
After HST Heart Rate (Bits/Min.)	101.73	15.56	123.23	21.79	108.40	17.93
Physical Fitness Index (HST) Score	44.89	7.87	31.41	11.34	29.90	10.66
	n	**%**	**n**	**%**	**n**	**%**
HST Step Up Time (300 Sec.) Completed	15	100	9	69.23	5	50.00
Physical Fitness Index (HST) Category Poor (HST Score < 54)	13	86.67	13	100	100	100
Low Average (HST Score 54-67)	02	13.33	-		-	
Average (HST Score 68-82)	-		-		-	
Good (HST Score 83-96)	-		-		-	
Excellent (HST Score >97)	-		-		-	

Table 4 reveals the physical fitness index status of the participants in terms of Harvard Step Test (HST). Mean Heart rates of the footballers were relatively lower than the non-sports persons in both cases i.e. before and after HST. Out of 24 non-sports persons, 9 participants (including 4 males and 5 females) were exhausted before completion of their stipulated 300 seconds HST step-up time, although all the footballers completed the said duration. It may be mentioned that three footballers and one female non-sport participants could not step-up the test due to their busy sports and academic schedule respectively. PFI performance was 'Poor' for both footballers and non-sports persons. Only two footballers' HST scores were categorised as "Low Average".

Table 5: Nutritional status of the student participants

Nutritional Status	**Footballers**		**Non-sports Persons**			
	MALE		MALE		FEMALE	
	No.	**%**	**No.**	**%**	**No.**	**%**
Underweight	4	22.22	5	38.46	3	27.27
Normal weight	13	72.22	5	38.46	6	54.55
Overweight	1	5.56	3	23.08	2	18.18
Obese	-		-		-	
Total	**18**	**100.00**	**13**	**100.00**	**11**	**100.00**

Table 5 shows the nutritional status in terms of body mass index categories of the study participants. Most footballers had 'normal' BMI values (72.77%), followed by 'underweight' (22.22%) and 'overweight' (5.56%) categories. Most male non-sports person belonged to 'normal weight' (38.46%) and 'underweight' (38.46%) categories, followed by 'overweight' (23.08%) category. Similarly, most female non-sports person showed 'normal weight' (54.55%), followed by 'underweight' (27.27%), and 'overweight' (18.18%). None of the participants belonged to 'obese' category.

Table 6a: Pearson correlation coefficient among anthropometric traits, body composition traits and Physical Fitness Index of the Footballers (males)

Pearson Correlation Matrix for Footballer Males											
Variables	Weight	Waist Cir.	Hip Cir.	Chest Cir.	Calf Cir.	MUAC	BMI	Total Fat	Body Muscle	Heart Rate	PFI
Height	0.461	0.294	0.434	0.165	0.363	0.207	-0.012	-0.179	0.259	-0.080	-0.101
Weight	1	**0.819**	**0.919*****	**0.849*****	**0.794*****	**0.827*****	**0.882*****	0.465	-0.335	-0.149	0.148
Waist Cir.		1	**0.696****	**0.733****	**0.557***	**0.575***	**0.762*****	**0.619****	-0.338	0.068	0.144
Hip Cir.			1	**0.816*****	**0.722****	**0.782*****	**0.807*****	0.285	-0.194	-0.212	0.057
Chest Cir.				1	**0.617****	**0.842*****	**0.866*****	**0.493***	-0.306	-0.123	0.183
Calf Cir.					1	**0.631****	**0.701****	0.239	-0.258	0.026	0.124
MUAC						1	**0.822*****	0.239	-0.194	0.052	-0.144
BMI							1	**0.612****	**-0.512***	-0.132	0.214
Total Fat								1	**-0.940*****	-0.147	0.341
Body Muscle									1	0.044	-0.418
Heart Rate										1	**-0.516***
PFI											1

Cir. = Circumference; MUAC = Mid Upper Arm Circumference; BMI = Body Mass Index;
p ≤ 0.05; **p ≤ 0.01; ***p ≤ 0.001

Table 6a shows the Pearson correlation coefficient among anthropometric traits, body composition traits and physical fitness index (PFI) of the footballers, which indicates that physical fitness index is significantly correlated only with the heart rate of the participants. None of the anthropometric and body composition traits were found to be significantly correlated with PFI of the footballers group.

Table 6b: Pearson correlation coefficient among anthropometric traits, body composition traits and Physical Fitness Index of the Non-sports person (males and females)

Pearson Correlation Matrix for Non-Sport Person Males											
Variables	Weight	Waist Cir.	Hip Cir.	Chest Cir.	Calf Cir.	MUAC	BMI	Total Fat	Body Muscle	Heart Rate	PFI
Height	0.457	0.306	0.136	0.088	0.215	0.235	0.130	-0.356	0.246	0.093	-0.235
Weight	1	0.919***	0.882***	0.846***	0.935***	0.865***	0.939***	0.006	-0.693**	0.349	-0.672*
Waist Cir.		1	0.891***	0.951***	0.921***	0.859***	0.914***	0.078	-0.813**	0.357	-0.878***
Hip Cir.			1	0.892***	0.947***	0.806**	0.927***	0.234	-0.859***	0.418	-0.697**
Chest Cir.				1	0.894***	0.848***	0.920***	0.076	-0.867***	0.351	-0.781**
Calf Cir.					1	0.859***	0.968***	0.012	-0.831***	0.272	-0.691**
MUAC						1	0.876***	0.106	-0.761**	0.094	-0.658*
BMI							1	0.091	-0.865***	0.335	-0.660*
Total Fat								1	-0.383	0.261	-0.279
Body Muscle									1	-0.283	0.722**
Heart Rate										1	-0.326
PFI											1
Pearson Correlation Matrix for Non-Sport Person Females											
Height	0.651*	0.529	0.579	0.617*	0.582	0.464	0.461	-0.264	0.242	-0.006	0.091
Weight	1	0.950***	0.952***	0.901***	0.970***	0.929***	0.972***	0.397	-0.065	0.262	0.011
Waist Cir.		1	0.929***	0.837**	0.932***	0.959***	0.948***	0.396	-0.104	0.311	0.000
Hip Cir.			1	0.803**	0.942***	0.915***	0.943***	0.429	-0.227	0.049	-0.028
Chest Cir.				1	0.945***	0.862**	0.852**	0.382	0.171	0.176	-0.115
Calf Cir.					1	0.950***	0.956***	0.424	-0.020	0.145	0.008
MUAC						1	0.947***	0.457	0.025	0.179	0.036
BMI							1	0.540	-0.161	0.294	0.031
Total Fat								1	-0.470	0.026	-0.417
Body Muscle									1	0.033	0.340
Heart Rate										1	0.205
PFI											1

Cir. = Circumference; MUAC = Mid Upper Arm Circumference; BMI = Body Mass Index;
$*p \leq 0.05$; $**p \leq 0.01$; $***p \leq 0.001$

Table 6b shows the Pearson correlation coefficient among anthropometric traits, body composition traits and physical fitness index (PFI) of the non-sports person males and females. This table reveals that in the case of non-sports person males, the physical fitness index had a negative significant correlation with different traits like weight, waist circumference, hip circumference, chest circumference (normal), calf circumference, mid upper arm circumference and body mass index. While PFI had a significant positive correlation with the whole body muscle mass of the non-sports person males. In case of non-sports person females, the physical fitness index had a significant correlation neither with anthropometric and body composition traits nor with heart rate of participants. It is also indicated that a significant correlation existed between different anthropometric and body composition traits of both non-sports person males and females.

Discussion

The present micro-level study was conducted among young college students of Haldia, Purba Medinipur to explore their anthropometric characteristics, body composition components and physical fitness index (PFI) and to find out the nature of the relationship among the anthropometric, body composition traits and the physical fitness of the participants. This cross-sectional study also attempted to compare the collected data between footballers and non-sports person groups. Due to the non-availability data from female footballers, the present study restricted its data comparison among the male groups only. The socio-economic background of the students showed that all participants were young adults, aged 18-21 years, most of them belonged to the graduation I and II year classes and the monthly household income of majority of the student participants was below Rs.20000.00.

The anthropometric data indicated that the footballers possessed significantly lower mean values in the traits like bi-iliac diameter, biceps skinfold thickness, sub-scapular skinfold thickness, and supra-iliac skinfold thickness than the non-sports persons. Similarly, body composition components like total fat and regional fat distribution in the body like arm, trunk and leg of the footballers showed significantly lower mean than the non-sports person males, which is supported by some other studies (Kubo *et al.* 2006; Qureshi and Khan 2019). On the contrary, the male footballers possessed a significantly higher trunk muscle percentage than the male non-sports persons. The data on anthropometric traits of non-sports person females could not be compared due to paucity of data of the sports person females.

The nutritional status in terms of body mass index categories of the study participants showed that an overwhelming majority of the footballers had 'normal' BMI values and this may be one of the reasons that sports persons were active with sports training and sport activity as stated by Saunders and colleagues (2016). However, their non-sports person counterpart showed a relatively high prevalence of 'overweight' as they spent sedentary lifestyle and consume highly caloric food, which may enhanced disease risk in a later stage of life (WHO 2002). In a research article, Ode and Colleagues (2007) reported that a BMI based classification of overweight/obesity is not always effective on population fatness, especially when it classifies fatness in young college level athletes and non-athletes. Although, none of the participants belonged to the 'obese' category and it is quite obvious as these particular age groups are physically active due to their daily journey to the campus.

Results of physical fitness index in terms of Harvard Step Test revealed that the said performance category was 'Poor' for both footballers and non-sports persons. All the footballers completed their stipulated 300 seconds HST step-up time but around 40% non-sports participants (both male and female) were exhausted before the completion of the said duration. The present study used the Harvard step height (i.e. 50.8 cm), and it may be one of the reasons behind the poor performance in the test. Several studies suggest modified step height especially for the female participants and for them lower step height should be used by ensuring valid test results (Das and Mahapatra 1993; Parmar *et al.* 2016). Although, there is a variation between individuals in bio-mechanical characteristics, but the participant's height and weight have shown to be a factor for poor performance in PFI, which is also corroborated by other study as well (Parmar *et al.* 2016).

Footballers show higher PFI score values than the participants who never participated in any competitive sports. It was a very tough task for non-sports persons to step-up a 50cm high platform because they are untrained and possess lower fitness than their footballer counterparts. On the contrary, footballers perform regular physical exercise and training to get success in the football field and their result was comparable with other studies (Chatterjee and Mitra 2001). Physical exercise helps to achieve maximum physical fitness through the development of muscle, cardio-respiratory strength and endurance of the sports person (Pansare 1986). However, the present study footballers' group may have scope to enhance PFI value. It may happen due to the fact that the majority of the footballers came from poor families, where they did not get adequate nutrition to meet the requirements of such a high intensity physical activity demanding game. Again, it also may happen if the footballers were amateur and not serious enough with the game. A study among Korean children and adolescents reported that their physical activity decreased and the rate of obesity increased (Oh *et al*. 2008) and this may happen due to the use of smart phone and internet addiction (Heo *et al*. 2014). The present study also observed a similar trend.

A significant correlation was observed between the physical fitness index and heart rates among the footballers when other anthropometric and body composition traits remained non-significant. While Pearson correlation between anthropometric and body composition traits and physical fitness index among the non-sports person males indicated that the physical fitness index had a negative significant correlation with weight, waist circumference, hip circumference, normal chest circumference, calf circumference, mid-upper arm circumference and body mass index. PFI had a significant positive correlation with the whole body muscle mass of the non-sports person males. In case of non-sports person females no significant correlation exited between the physical fitness index and anthropometric and body composition traits.

Studies show the physically active youth can manage to the stressful conditions easily and they show less neuromuscular tension than the inactive youth. Adequate physical activity helps to digest food which provides the necessary energy, vitamins and minerals for the growth and development of children, adolescent and youth. However, in recent decades we witnessed a decreased trend of physical activity and an increasing trend of consuming high fat processed food or spicy food. The present study participants are getting acquainted with the modern amenities that require less energy to perform tasks at a very fast rate and the young generation of the society more prone to the problem. They are neglecting habitual physical activities and sedentarily spend the day in social networking sites. Participants play cricket, football, and many other games not on the real field but on mobiles or computer screens. The present day education system has helped to improve the educational standards among students; unfortunately it left a very limited scope to be active in field or sports activities. The present study showed an indication of poor physical fitness even among sports person (footballers), and they aim to enhance physical fitness through proper training. Therefore, the time has come to consider physical fitness and exercise in the adolescent or young age group in order to plan a proper course curriculum.

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References

Baumgartner, R.N. (1995). "Body composition in elderly persons: a critical review of needs and methods". *Progress in Food and Nutrition Science*, 17:223-260.

Bélanger, M., Sabiston, C.M., Barnett, T.A., O'Loughlin, E., Ward, S., Contreras, G., O'Loughlin, J. (2015). "Number of years of participation in some, but not all, types of physical activity during adolescence predicts level of physical activity in adulthood: Results from a 13-year study". *International Journal of Behavioural Nutrition and Physical Activity*, 12:76. https://doi.org/10.1186/s12966-015-0237-x.

Brooke, H.L., Corder, K., Griffin, S.J., van Sluijs, E.M. (2014). "Physical activity maintenance in the transition to adolescence: a longitudinal study of the roles of sport and lifestyle activities in British youth". *PLoS ONE*, 9(2):e89028.

Brouha, L. (1943). "The step test: A simple method of measuring physical fitness for muscular work in young men". Research Quarterly. *American Association for Health, Physical Education and Recreation*, 14(1): 31-37. <DOI: 10.1080/10671188.1943.10621204>.

Chatterjee, S., Mitra, A. (2001). "The relation of physical fitness score with different morphological parameters and VO_2 Max on adult female Athletes and Non athletes". *Indian Journal of Physiology & Allied Sciences*, 55(1):7-11.

Chumlea, W.C., Baumgartner, R.N. (1989). "Status of anthropometry and body composition data in elderly subjects". *American Journal of Clinical Nutrition*, 50:1158-1166.

Das, S.K., Mahapatra, S. (1993). "Determination of physical fitness Index (PFI) with modified Harvard Step Test (HST) in young men and women". *Indian Journal of Physiology & Allied Sciences*, 47(2):73-76.

Hasanbegovic, S., Mesihovic-Dinarevic, S., Cuplov, M., Hadzimuratovic, A., Boskailo, H., Ilic, N., Njuhovic, A., Cengic, N., Bajramovic, E., Brkovic, S. (2010). "Epidemiology and aetiology of obesity in children and youth of Sarajevo Canton". *Bosnian Journal of Basic Medical Sciences*, 10(2):140–146.

Heo, J., Oh, J., Subramanian, S.V., Kim, Y., Kawachi, I. (2014). "Addictive internet use among Korean adolescents: a national survey". *PLoS ONE*, 9:e87-819.

Jaiswal, A. (2019). "Anthropology and Sports". *International Journal of Research in Sociology and Anthropology*, 5(3):1-2.

Kubo, J., Chishaki, T., Nakamura, N., Muramatsu, T., Yamamoto, Y., Ito, M., Saitou, H., Kukidome, T. (2006). "Differences in fat-free mass and muscle thicknesses at various sites according to performance level among judo athletes". *Journal of Strength and Conditioning Research*, 20(3):654-657.

Kushner, R.F., Kunigk, A., Alspaugh, M., Andronis, P.T., Leitch, C.A., Schoeller, D.A. (1990). "Validation of bioelectrical-impedance analysis as a measurement of change in body composition in obesity". *American Journal of Clinical Nutrition*, 52:219-223.

Lavie, C.J., Ozemek, C., Carbone, S., Katzmarzyk, P.T., Blair, S.N. (2019). "Sedentary Behavior, exercise, and cardiovascular health". *Circulation Research*, 124:799–815.

Ode, J.J., Pivarnik, J.M., Reeves, M.J., Knous, J.L. (2007). "Body mass index as a predictor of percent fat in college athletes and non-athletes". *Medicine and Science in Sports and Exercise*, 39:403-409.

Oh, K., Jang, M.J., Lee, N.Y., Moon, J.S., Lee, C.G., Yoo, M.H., Kim, Y.T. (2008). "Prevalence and trends in obesity among Korean children and adolescents in 1997 and 2005". *Korean Journal of Paediatrics*, 51:950-955.

Pansare, M.S. (1986). "Physiology of fitness". *Medical Journal of Western India*, 14:18-20.

Parmar, D.J., Ramavat, M., Vaishnav, R. (2016). "Influence of gender and height on physical fitness index in young adult Indian population". *Indian Journal of Basic and Applied Medical Research*, 6(1):83-87.

Patton, G.C., Viner, R. (2007). "Pubertal transitions in health". *Lancet*, 369:1130-1139.

Perissinotto, E., Pisent, C., Sergi, G., Grigoletto, F. (2002). "Anthropometric measurements in the elderly, age and gender differences". *British Journal of Nutrition*, 87(2):177-186.

Qureshi, A.A., Khan, M.A. (2019). "Comparative study of body mass index and fat percentage among sports and non-sports persons of Srinagar". *International Journal of Multidisciplinary Educational Research*, 8(1):216-225.

Ried-Larsen, M., Grontved, A., Kristensen, P.L., Froberg, K., Andersen, L.B. (2015). "Moderate and vigorous physical activity from adolescence to adulthood and subclinical atherosclerosis in adulthood: prospective observations from the European youth heart study". *British Journal of Sports Medicine*, 49(2):107–112.

Saunders, T.J., Gray, C.E., Poitras, V.J., Chaput, J.P., Janssen, I., Katzmarzyk, P.T., Olds, T., Connor Gorber S, Kho, M.E., Sampson, M., Tremblay, M.S., Carson, V. (2016). "Combinations of physical activity, sedentary behaviour and sleep: relationships with health indicators in school-aged children and youth". *Applied Physiology, Nutrition and Metabolism*, 41(6):S283-S293.

Tishukaj, F., Shalaj, I., Gjaka, M., Ademi, B., Ahmetxhekaj, R., Bachl, N., Tschan, H., Wessner, B. (2017). "Physical fitness and anthropometric characteristics among adolescents living in urban or rural areas of Kosovo". *BMC Public Health*,17:711. https://doi:10.1186/s12889-017-4727-4.

Weiner, J.S., and Lourie, J.A. (eds.) (1981). *Practical Human Biology.* London:Academic Press.

World Health Organization Expert Consultation. (2004). "Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies". *Lancet*, 363:157-163.

World Health Organization (WHO) (1995). Physical Status: The Use and Interpretation of Anthropometry. *WHO Technical Report Series* 854. Geneva: World Health Organization

World Health Organization (WHO). (2002). Physical inactivity a leading cause of disease and disability, warns WHO. Accessed on 02.12.2019 from https://www.who.int/mediacentre/news/releases/release23/en/. Geneva: World Health Organization.