



Effects of sporting activity on Body Mass Index and cardiovascular endurance among the students of the sporting school and general school: A pilot study from Bangladesh

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ABSTRACT

Aims: Childhood obesity is one of the leading causes of various musculoskeletal problems and health-related issues among school-going children. Regular sporting activity helps to maintain physical fitness. To compare the effects of physical activity on Body Mass Index (BMI) and cardiovascular endurance among the students of the sporting school and general school.

Method and Materials: This pilot study was conducted among the students of the sporting school and general school from a selected area of Bangladesh. A total of 20 participants (10 from sporting schools and 10 from general schools) both males and females took part in this study. Anthropometric measurement was taken after getting consent from the participants. The Havard Step Test was used to collect data. Descriptive statistics and an independent t-test were used to compare the data. The p value was set at <0.05 as the level of significance.

Findings: The mean age, height, weight, and BMI of the participants in the sporting group were 16.37±1.04 years, 117.72±12.01 cm, 64.25±25 kg, and 19.93±1.10 kg/m² and in the non-sporting group were 14.65±0.93 years, 105.22±14.42 cm, 61.23±2.19 kg, and 19.64±2.27 kg/m² respectively. There was no significant difference in BMI (p= 0.412) but cardiovascular endurance (p=0.026) showed a significant difference among sporting school and non-sporting school children.

Conclusion: Though females in sporting schools have a high level of cardiovascular endurance results of both groups are not as expected. The study strongly recommended that every school should arrange competitive games at least once a week for their students.

Keywords: Cross-sectional study, Cardiovascular Endurance, Havard Step Test, Body Mass Index, Physical Fitness Index (PFI).

Introduction

Childhood obesity is a serious public health concern and one of the major health issues during adulthood and causes various diseases like diabetes mellitus, heart disease, high cholesterol, and cardiovascular accidents [1]. The prevalence of childhood obesity among the aged 6-15 years in Bangladesh in both rural and urban areas is 3.5% where obesity is higher in urban school students (5.6%) as compared to rural schools (1.2%) students [2]. Physical inactivity and a sedentary lifestyle play a vital role in the development of childhood obesity. Physical exercise has been suggested as a powerful tool to prevent obesity. It has been said that every hour of moderate to vigorous exercise

reduces the 10% chance of developing obesity [3].

Physical exercise is an important tool for the prevention and treatment of childhood obesity [4]. The prevalence of obesity found in English medium school students in Dhaka was 24.1% where boys were more obese than girls [5]. A study reported that the magnitude of obesity was higher for those who did not participate in sports at school or outside school and was exposed to sedentary behavior [6]. Food habits among athletic adolescents are healthier than non-athletic adolescents and engaged in regular sporting activity significantly [7]. Cardiovascular fitness mainly depends on lifestyle and physical activity. Low

cardiovascular fitness level is associated with a higher mortality rate. Cardiovascular fitness reduces the mortality rate of various diseases like hypertension, diabetes, and obesity. A sedentary lifestyle and low cardiorespiratory fitness are associated with a high risk of all-cause of disease [8]. A study compares the cardiovascular fitness between adolescent athletes and non-athletes. The results of the study reported that athletes had significantly higher cardiovascular fitness than non-athletes [8]. A clinical trial among special education children investigate the effects of school-based sporting activities on aerobic performance and fat mass in the body and reported that aerobic performance improves significantly following a school-based sporting activity [9]. Sporting performance play important role in promoting physical activity^[10].

During covid-19 period the shutdown of the educational institute significantly impacted the physical activity of all individuals [11]. Non-sporting schools are more focused on promoting educational activities whereas sporting school focuses on both simultaneously. So there may significant differences in physical activity level and physical fitness. Thus our study aims to investigate the difference in BMI and cardiovascular endurance among sporting school and non-sporting school children in the post-covid phenomenon.

Method and Materials

This study was a pilot study in nature. This study was conducted using a validated questionnaire. The study was approved by the student project committee of Bangladesh Kria Sikka Protistan. This study strictly follows the research guideline laid by the declaration of Helsinki (Revised) 2013 and Bangladesh Medical Research Council guidelines 2014. Written consent was taken from the parents of the children

and the written ascent was taken from the participants before data collection.

The required sample size for a pilot study was estimated by using the rules of thumb. When estimating the sample size for the pilot trial JuliJuli suggests a minimum sample size of 12 subjects per group [12]. Hence we used 10 subjects for each group in our study. The selection criteria were both male and female, aged between 12 to 18 years, and willing to participate in this study. The exclusion criteria were any traumatic injury, an neurological, or cardiovascular problems. The nature and purpose of the study were explained by the researcher and informed consent was taken from the participants. The detailed description of the study was explained by the researcher before data collection. After that informed consent was taken from the participants. The required sample size was recruited by a using simple random sampling method. Data was collected from two schools (one sporting school and one non-sporting school). The instruments were used in this study were as: A structured questionnaire containing 1. Demographics with questions about Name, age, gender, height, and weight, 2. Harvard Step Test and 3. Body Mass Index (BMI).

Body Mass Index: It is widely used for defining anthropometric characteristics that represent an index of an individual's fitness. It is also a widely used tool as a risk factor for the development of severer health issues. The following formula was used to measure BMI [13]. $BMI = \text{weight} / \text{height}^2$, here, person's weight in kilogram and height in meters.

Harvard Step Test: Cardiovascular endurance was assessed by Harvard Step Test. The participants repetitively step onto and off a platform in a cycle of 2 seconds. Where 20 inches high platform was used for males and 18 inches high bench was used for females. The rate of 30 steps in one minute

for 5 minutes or until exhaustion must be sustained for males and 24 steps per minute for 3 minutes by females. Exhaustion is the point at which the subject cannot maintain the stepping rate for 15 seconds. The subject immediately sits down upon completion of the test, and the heartbeats are counted for 1 to 1.5, 2 to 2.5, and 3 to 3.5 minutes^[14]. The physical fitness index PFI is calculated by using the

$$\text{formula: } PFI = \frac{\text{Duration of exercise in second} \times 100}{2 \times \text{sum of pulse count in recovery}}$$

The collected data were analyzed by using SPSS 25.0 software for Windows. The normality of the data was measured by using the Kolmogorov-Smirnov test. As data followed normal distribution descriptive statistics were expressed as mean $\pm$ standard deviation. An Independent t-test was used to analyze within-group data. The significance level was set at 0.05 to minimize type 1 error.

Findings

Table 1 represents the anthropometric characteristics of the participants. There was no significant difference in weight, height, and BMI between sporting and non-sporting school children. A significant difference was observed in age and PFI among sporting and non-sporting school children.

Table 1) Anthropometrical parameters in Sporting & Non-sporting school student

Characteristics	Sporting School	Non-sporting school	p-value
Age	16.37 $\pm$ 1.045	14.65 $\pm$ 0.93	0.027
Weight	64.25 $\pm$ 2.40	61.23 $\pm$ 2.19	0.085
Height	117.72 $\pm$ 12.02	105.22 $\pm$ 14.42	0.208
BMI	19.93 $\pm$ 1.10	19.64 $\pm$ 2.27	0.412
PFI	64.86 $\pm$ 25.14	31.61 $\pm$ 19.07	0.026

Table 2 represents the cardiovascular endurance and BMI in the sporting school and non-sporting schools between males and females. A significant difference was obtained in cardiovascular endurance among males and females between sporting and non-sporting school children. Figures 1 and 2 represent the frequency distribution of cardiovascular endurance among male and female students in both group

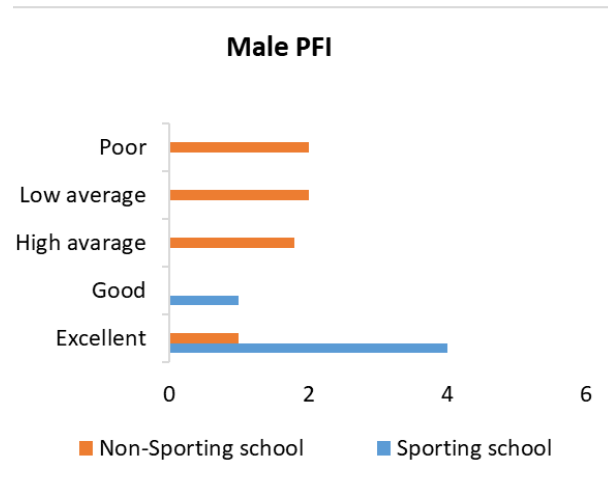


Fig. 1) Frequency distribution of Physical Fitness Index (PFI) in Sporting school and non-sporting school male students.

Excellent >90; Good 80-90; High Average 65-79; Low Average 55-64 and Poor <55.

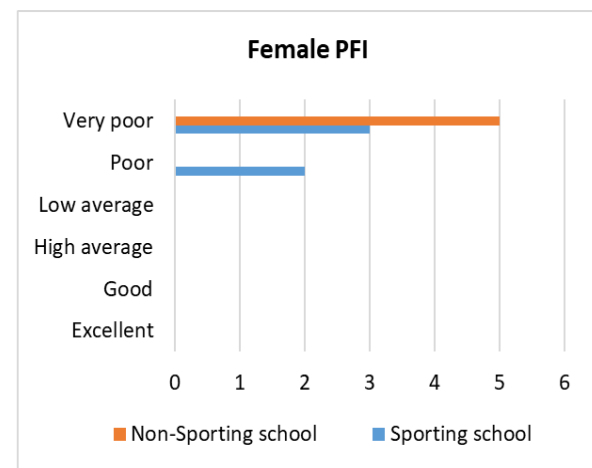


Fig. 2) Frequency distribution of Physical Fitness Index (PFI) in Sporting and non-sporting schools for female student. Excellent >72; Good 62-71; High average 51-61; Low average 41-50 and Poor 31-40; Very Poor <3

Table 2) Difference of PFI in gender between sporting & non-sporting school students

Characteristics	Sporting School	Non-sporting school	p-value
PFI of female	28.17 $\pm$ 3.35	7.39 $\pm$ 0.62	<0.001
PFI of Male	101.56 $\pm$ 15.69	55.82 $\pm$ 22.61	0.011

Discussion

In this present study, there was a significant difference in cardiovascular endurance among the students of the sporting schools and non-sporting schools. There was no significant difference in BMI reported in this present study among the groups.

Male students had significantly higher cardiovascular endurance in both sporting and non-sporting school students in this present study. A previous study reported cardiovascular fitness was significantly higher in the athletic population compared with the non-athletic population in the study [8]. Urban students had higher cardiovascular fitness as compared to rural students [15]. Physical function is significantly higher in academic course students as compared to professional course students [16]. Women generally reported lower physical activity levels than men. However there are various number of physiological difference between men and women including heart size, heart rate, lungs size, volume and pulmonary function, and body composition [17] that may be the reason of higher cardiovascular endurance among males in our study.

It is known that a regular, properly maintained nutrition, physical, and sports training protocol is strictly maintained in BKSP schools, while there was no such routine co-curricular activity in non-sporting schools. Studies have shown that children who engage in regular endurance training have better physical fitness than children who are more sedentary [16].

In our study, the physical fitness index of sporting school students is higher. About 90% of male students in the sporting school were in the excellent category, whereas 90% of non-sporting school male students

were in the low average or poor category. About 40% of female students in sporting schools reported the poor category and 60% in the very poor category whereas 100% of female students in non-sporting schools students fall very poor category. The poor physical fitness of the female student in both schools may be due to a lack of regular cardiovascular fitness, poor physical activity, improper nutritional status, family unwillingness in sports and physical activity, and a severe addiction to social media. Regular physical activity is essential for physical and mental health [18], and also physical activity helps to improve the motor cognition of individuals [19]. The benefits of physical activity to improve cardiovascular fitness is also well documented in the literature [20,21]. To have uniform physical fitness among school students, it is advisable to formulate a regular physical and sports training schedule, so that they can achieve better strength and endurance. A healthy BMI doesn't mean a person is fit, to get full fitness he/she should have cardiovascular fitness also.

Although there is some strength for this study such as random sampling techniques with structured questionnaire which help to reduce selection bias and increase the precision and validity of the data. Moreover, prefixed inclusion and exclusion criteria of the representative population may help increase the generalizability of the findings. Nevertheless, this study also has several limitations. The sample size was too small, and data were collected from a specific area of Bangladesh. As such the results of the study do not represent all the students of the country. Future studies can be done with a large sample size with multi centers

to increase the generalizability of the study. Conclusion: Students in non-sporting schools are focused more on academic education whereas students in sporting schools focus on academic as well as physical fitness. Though females in sporting schools have a high level of cardiovascular endurance results of both groups are not as expected. The study strongly recommended that every school should arrange competitive games at least once a week for their students.

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Authors' Contributions: AI: conceived and designed the experiments; performed the experiments; analyzed and interpreted the data; contributed reagents, materials, analysis tools, or data; wrote the paper. LN, ZF, SI, RU, HB, and SR: performed the experiments; contributed reagents, materials, analysis tools, or data; wrote the paper. All authors read and approved the final manuscript.

Conflict of Interest: There was no conflict of interest to declare.

Ethics Permission: Ethical clearances for this study were obtained from the institutional review board of Bangladesh Kria Sikka Protestant. The voluntary nature of the interview was explained to the participants. All the participants have provided written informed consent.

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