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Research Article

A Study to Assess the Fitness Level of Elementary School Students in Kamrup Metro, Assam

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A B S T R A C T

Introduction: The prevalence ofphysical inactivity, affecting both children and adults, stands out as a paramount public health challenge in the 21st century. Physical inactivity is one of the major risk factors for diseases linked to obesity and cardiovascular disease. Physical activity in children emerges as a catalyst not just for enhancing their physical well-being but also for bolstering self-esteem, nurturing social skills, and shaping behaviour which can contribute to the cultivation of a positive and enduring lifestyle throughout their lives.

Objective: To assess the fitness levels of elementary school students in Kamrup Metro, Assam, using the FitnessGram test

Methods: A cross-sectional study was conducted among 468 students aged 7–11 years. Four FitnessGram tests (1-mile walk test, sit-and-reach, trunk lift, and curl-up) were administered to assess aerobic capacity, muscular strength, flexibility, and endurance. Descriptive statistics were done using the SPSS statistical tool.

Results: The results showed that boys demonstrated a significantly higher average aerobic capacity (VO_2 max) than girls ($p < 0.05$). This superior performance by boys was consistently noted across other fitness measures, specifically the Sit-and-Reach, Curl-Up, and Trunk Lift assessments.

Conclusion: This research evaluated the physical fitness of elementary school children in Kamrup Metro, Assam, highlighting that boys exhibited significantly superior physical fitness as compared to girls in gender specific tests and contributions (significant at $p < 0.001$). Thus, the present study reveals the direct relationship of physical fitness (aerobic capacity, muscular strength and flexibility and endurance) among elementary school students using the FitnessGram test. As regular physical activity improves the physical fitness of an individual, adding various activities to the daily routine will not only help to improve fitness level but also to maintain a healthy lifestyle.

Keywords: Physical Fitness, FitnessGram, Physical Activity, Healthy Fitness Zone (HFZ)

Introduction

Physical inactivity, in both children and adults, is a major public health concern of the 21st century, especially in the last two–three years due to the COVID-19 lockdown.[1,2]

Physical activity (PA) plays an important role in children by improving their physical condition, self-esteem, social skills, and behaviour, and establishing a positive lifestyle for their future lifespan.[3,4]

Physical fitness (PF) is performing activities of the body effectively and efficiently. It encompasses a range of abilities, including muscle strength and endurance, motor skills, and cardiorespiratory endurance.[5]

The evaluation of PF is crucial for understanding the health status of children and adolescents. It includes cardiorespiratory fitness during exercise, muscular fitness, the ability to generate force, and motor fitness, which encompasses proficiency in daily physical activity. PF, particularly cardiovascular fitness, helps in maintaining a healthy BMI, reducing the risk of cardiovascular diseases, and overweight and obesity comorbidities in children as well as adolescents worldwide.[6–10]

It has been documented that, as compared to boys, girls are less physically active both during and outside the school day and in addition, this activity level decreases as they become adults.[11–15] Research findings indicate that females exhibit lower levels of daily moderate-to-vigorous physical activity as compared to men who participate in moderate to very intense sports. This indicates that even if they do play, they do so at a low to moderate level of intensity.[16,17]

According to the World Health Organization's guidelines of 2020 regarding PA and sedentary lifestyles and the latest physical activity guidelines for students, children need a minimum of one hour of daily moderate-to-vigorous exercise to stay healthy and fit.[18–20] In 2016, around 13% of the adult population in the world was obese. More than 1.9 billion adults over the age of 18 years were overweight, and more than 650 million were obese. In 2020, 39 million children under five were overweight or obese.[21]

FitnessGram is an educational tool that helps students understand their fitness levels and provides a framework for improvement. By employing FitnessGram, individuals can proactively determine their fitness zones, gaining valuable knowledge about potential links to future chronic illnesses. FitnessGram can provide valuable insights into students' fitness levels, which can be utilised to develop tailored physical activity programmes.[22]

There are many tests under the FitnessGram, but the health-related components of the FitnessGram test include the following: for cardiorespiratory fitness, 1-mile walk test, curl-up test, and trunk lift test, and for core muscle strength, sit-and-reach test (flexibility).[22,23]

In Assam, there is a lack of studies to know the correlation between PF and PA among varying age groups in school children. Thus, the study aims to assess the fitness level of elementary school students in Kamrup Metro in Assam.

Studies have found that insufficient PA and poor diet are widely known as the primary causes for an unhealthy body weight,[24] and the rising incidence of childhood obesity is contributing to an increase in chronic conditions such as type 2 DM, hypertension, and hypercholesterolaemia.[25] So, it is important to be fit from childhood to prevent such diseases in later stages of life.

However, very few studies have been done regarding the physical fitness of children representing the Indian population. Thus, this study was conducted to analyse the fitness levels between boys and girls using the FitnessGram test.

Methodology

A quantitative cross-sectional study was conducted for 6 months in the month of June on 2023 among 468 elementary students (aged 7–11 years) using cluster sampling. Before data collection, consent forms and permission were taken from the concerned authority and the parents/ guardians, respectively.

The inclusion criteria were

1. 7–11-year-old school-going students
2. Subjects who returned the parents'/ guardians' signed consent forms

The exclusion criteria were

1. If any injury or surgery happened within the past 3 months
2. If the subject had any kind of neurogenic, orthopaedic, or cardiovascular disease
3. If the student was an active participant in any sport

Materials used: (Figure 1)

1. Pen or pencil
2. Paper
3. Watch
4. Calculator
5. 3inch wide strip
6. Weight machine
7. 12-inch yardstick or ruler
8. Sliding indicator

At first, the subjects did warm-up exercises which included walking around for 5 to 6 minutes, gently shaking hands, and rubbing the hands together. Between each test, participants took approximately 3 minutes of rest.

Four tests were used for assessing the physical fitness of the subjects in this study, i.e.

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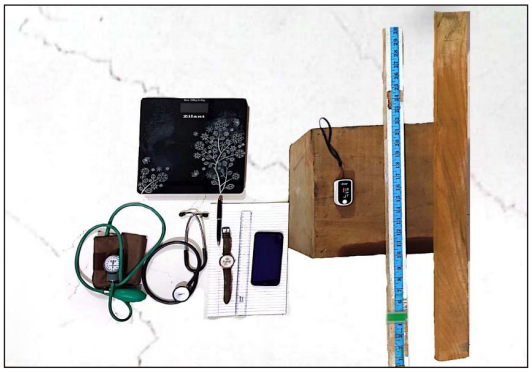

Figure 1.Materials Used

1-Mile Walk Test to Check VO_2 max: This test aimed to complete a 1-mile course in the shortest time possible. All participants commenced the race from a single starting line, maintaining a consistent walking pace throughout the entire distance. On receiving the signal, the subjects commenced running at their paces. After the walk, a 15-second heart rate count was taken. The duration of walking and the heart rate were recorded. (Figure 2)

VO_2 max = -0.3877 (Age) + 6.315 (Gender) - 0.0769 (Weight) - 3.2649 (Time) - 0.1565 (bpm)

Gender coding: 0: Female and 1: Male

Figure 2.The 1-Mile Walk Test

Curl-Up Test: The subjects were lying supine with arms straight, feet flat, and knees bent at a 140˚ angle. A 3-inch measuring strip was placed under their knees. They curled up, sliding fingers across the strip, and then returned to the starting position. The test continued until exhaustion or form breakdown. (Figure 3)

Sit-and-Reach Test: In this test, the subjects performed a seated reach test. Barefoot and with legs spread wide, they placed their feet against the front of a wooden box. They then leaned forward, pushing a sliding indicator as far as possible along a marked scale, holding the maximum reach for two seconds. The best of three attempts was recorded. (Figure 4)

Figure 3.Curl-Up Test

Figure 4.Sit-and-Reach Test

Trunk Lift Test: The subjects were positioned face down on a mat with pointed toes and hands tucked under their thighs. They were instructed to slowly and carefully raise the upper body 12” off the ground with the help of their back muscles. A yardstick was placed near their chin to measure the height. They were told to hold the position for measurement, but not to exceed 12”. (Figure 5)

Figure 5.Trunk Lift Test

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The subjects took deep breaths during the cool-down period by extending their arms to the side with the palms facing up and exhaled gently, pressing the palms down in front of the body just below the navel. They repeated this 5 to 6 times.

Ethical clearance for the study was granted by the College of Physiotherapy and Medical Sciences' Institutional Ethics Committee, in accordance with the rules for biomedical research involving humans. As the study was done in various schools so, the school's principal and the parents/ guardians of the students also were given the consent forms.

Table 1. Descriptive Summary of Girls

Age (Years)	N	Weight (kg)		VO_2 max	Sit-and-Reach	Curl-Up		Trunk Lift	
		Mean	Std Deviation	Mean	Mean	Minimum	Maximum	Minimum	Maximum
7	23	20.2691	1.22581	31.5830	4.91	4	6	4	6
8	59	19.1063	1.63093	32.7600	5.53	4	8	4	8
9	63	20.6830	2.40252	43.6763	6.71	6	10	5	10
10	61	23.4213	2.27927	52.9989	8.90	7	12	7	12
11	26	25.6892	2.36565	56.0754	9.15	9	12	8	12
Total	232	21.5220	3.01018	43.5420	7.08	4	12	4	12

Table 2.Descriptive Summary of Boys

Age (Years)	N	Weight (kg)		VO_2 max	Sit-and-Reach	Curl-Up		Trunk Lift	
		Mean	Std Deviation	Mean	Mean	Minimum	Maximum	Minimum	Maximum
7	30	18.7200	2.07967	33.0553	6.10	4	7	5	7
8	62	21.8976	3.18130	41.7006	6.63	4	9	5	9
9	52	25.6802	2.76989	54.2323	8.35	6	11	6	11
10	61	28.8033	2.61621	63.7836	10.21	7	15	8	12
11	31	29.0935	2.53955	69.6313	10.81	10	15	10	12
Total	236	25.0573	4.58640	52.7396	8.42	4	15	5	12

Table 3.Comparison of Descriptive Summary of Boys and Girls

Group	N	Weight (kg)		VO_2 max		Sit-and-Reach		Curl-Up		Trunk Lift	
		Mean	Std Deviation	Mean	Std Deviation	Mean	Std Deviation	Mean	Std Deviation	Mean	Std Deviation
Girls	232	21.5220	3.01018	43.5420	11.06239	7.08	1.999	7.66	2.206	7.5767	2.24996
Boys	236	25.0573	4.58640	52.7396	14.35850	8.42	2.298	8.78	2.962	8.5869	2.20488

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Results

Table 1 & 2 shows descriptive result of both girls and boys for weight of the subjects and all the tests i.e., VO_2 max, Sit & Reach test, Curl up test and Trunk Lift test. On comparing the results between both girls and boys (Table 3), we got to know that there was a significance difference in the mean of the dependent variable, especially aerobic capacity i.e., VO_2 max between both boys (43.542) and girls (52.7396) have significant difference ($p < 0.05$) with respect to sit-and-reach test ($\bar{x}\bar{x}_G = 7.08$, $\bar{x}\bar{x}_B = 8.42$), curl-up test ($\bar{x}\bar{x}_G = 7.66$, $\bar{x}\bar{x}_B = 8.78$) and trunk lift test ($\bar{x}\bar{x}_G = 7.57$, $\bar{x}\bar{x}_B = 8.58$).

Shapiro–Wilk test was used to confirm the normality (Table 4) of the distribution. Statistical significance was set at $p < 0.01$ and $p < 0.001$ for normality assessment. Therefore, when the p value was less than these values, the result turned out to be significant, indicating that these data did not meet the normality assumption, i.e., $p < 0.05$. Thus, we had to use a non-parametric test for the analysis.

Mann–Whitney U (Table 5) test was used due to the data's non-parametric distribution. The statistically significant result $p < 0.05$ allowed for the rejection of the null hypothesis in acceptance of the alternative hypothesis with 95% confidence level.

Table 4. Normality Test

Variables	Group	Shapiro–Wilk			
		Statistic	df	p Values	Remark
Weight	Girls	0.977	232	0.001	**
	Boys	0.970	236	0.000	***
VO_2 max	Girls	0.953	232	0.000	***
	Boys	0.959	236	0.000	***
Sit-and-reach	Girls	0.939	232	0.000	***
	Boys	0.946	236	0.000	***
Curl-up	Girls	0.957	232	0.000	***
	Boys	0.951	236	0.000	***
Trunk lift	Girls	0.951	232	0.000	***
	Boys	0.930	236	0.000	***

**Significant at $p < 0.01$, ***Significant at $p < 0.001$

Table 5.Mann–Whitney U Test Results

Variables	Mann–Whitney U	p Value	Remark
Weight	14799.000	0.000	***
VO_2 max	16731.000	0.000	***
Sit-and-reach	18574.500	0.000	***
Curl-up	21998.000	0.000	***
Trunk lift	20309.500	0.000	***

***Significant at $p < 0.001$

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Discussion

Physical activity is crucial for overall health. Regular PA helps in maintaining a healthy lifestyle by reducing chronic disease risk and improving both physical and mental well-being. Conversely, sedentary lifestyles can lead to posture problems, obesity, circulation issues, and increased mortality risk. Regular PA enhances blood circulation, strengthens bones and muscles, and improves stress tolerance.[26–28]

Researchers have uncovered a significant relationship between PA habits formed during childhood to adulthood. Young, physically active individuals are more inclined to sustain their active behaviours as they become adults. Moreover, recent research underscores the potential benefits of PA on children's cognitive functions and academic performance in the educational context. Thus, it is vital to promote adequate levels of PA among young individuals to bolster their current and future health.[26,27]

In this study, aerobic capacity was 52.74 ml/kg/min for boys and 43.54 ml/kg/min for girls, compared to previous research done; the values were below 42 mL/kg/min for boys and 35 mL/kg/min for girls.[30] Low aerobic capacity is linked to obesity risk. So, field-based fitness tests are practical, cost-effective, and suitable for large groups, making them crucial for addressing childhood obesity, a major public health issue.[31,32]

The values for sit-and-reach test results were 8.42 inches for boys and 7.08 inches for girls. However, this test is influenced by arm and leg length. Children with longer limbs may score better, even with less flexible hamstrings.[33] Also, the standard score for this test is 8 inches for both boys and girls, with no upper limit.[34] So, even though this study suggested that most of the students were in the healthy fitness zone (HFZ) group, assessing children's performance on a continuum poses difficulties, and to maintain it, they have to do regular physical activity.

The recommended performance range for the curl-up test in both boys and girls in the age group of 7 to 11 years is 4 to 28 and 4 to 29 repetitions, respectively.[22] In the current study, for girls, the range was 4 to 12 repetitions, and for boys, it was 4 to 15 repetitions. Though the results were within the HFZ range, it should be noted that since the results for both groups are closer to the lower limit of the range, so, to reduce the risk factors, they have to maintain or improve them.

In the age group of 7 to 11 years, a target score of 6 to 12 inches is considered ideal for the trunk lift test, irrespective of gender. This range indicates the desired level of trunk extensor strength and flexibility.[22] Here, the result for girls was 4 to 12 inches, and for boys, it was 5 to 12 inches. It means all children were in the HFZ. Thus, the study's findings indicated that most boys and girls exhibited satisfactory levels of abdominal, upper body, and back extensor. These findings offer an optimistic assessment of their overall physical fitness and health.[35]

While comparing the results of all 4 tests in both boys and girls, the overall findings of this study suggested that the 1-mile walk test showed a significant difference in the mean values as compared to the other three tests. This shows that the fitness levels differ significantly between boys and girls (significant at $p < 0.001$). Girls are less physically active than boys, possibly due to earlier maturation. Regular physical activity is crucial for improving fitness levels, both in school and at home.[36]

In the current educational environment, students are compelled to remain seated for the entirety of their classes, resulting in a minimum of five hours of sitting during the school day, often accompanied by sedentary behaviour.[37] Therefore, it is possible that the child is physically fit, but not active. A study by Chen et al. showed that for health-related physical fitness in class 5, students who had engaged in both school activities; physical activities and recess and other sports or dances had better physical fitness.[35] PA, PF, and overall health are interconnected. To maintain good health, children should focus on improving their fitness levels. Given the limitations of this study, longer-term research with daily activity logs is recommended to get better insight into the influencing factors of children's health.

Since this study used cluster sampling, the results may vary according to different types of schools. As the subjects were children, they might not have been able to maintain the pace for the walk test. The 1-mile walk test was an outdoor test for the students in this study; therefore, various weather conditions may have influenced the results. If the subjects were slightly heavyset, then it might have affected the results of the sit-and-reach test. This study did not specify if the subjects had any kind of hobby, like dance.

Conclusion

This study showed that boys demonstrated better physical fitness than girls. Therefore, it is suggested that incorporating playful activities can improve the PF of children, leading to better health outcomes. However, since the current study only focused on aerobic capacity, muscular strength, flexibility, and endurance, further research is recommended to assess the children's body composition and all five components of physical fitness to get a better assessment of the children.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process: SPSS tools for statistical analysis.

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Conflict of Interest: as the study was done during summer so the data might vary due to weather.

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