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Original Research Article

Development of Physical Fitness Percentile Norms for Primary School Boys of West Bengal

Babita Biswas[1], Nita Bandyopadhyay[2]*

[1]Scholar, Department of Physical Education, University of Kalyani, West Bengal, India
[2]Professor, Department of Physical Education, University of Kalyani, West Bengal, India

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***Corresponding author:** Nita Bandyopadhyay
Professor, Department of Physical Education, University of Kalyani, West Bengal, India

Abstract

Physical fitness in childhood is important for supporting healthy growth, development, and general well-being. Evaluating physical fitness gives important insights into children's growth, health, and ability to perform daily activities. Age-Specific physical fitness score allows each child to know their fitness status resulting in a fair and meaningful evaluation of physical fitness and these scores also assist in recognizing children who have low fitness and enable the progress of targeted interventions. However, there is a lack of age-specific percentile data for boys in India. The aim of the study was to develop Physical Fitness Percentile Norms for Primary Schools Boys of West Bengal. In this cross-sectional study, a total 435 boys of 6 – 10 years were selected primarily from three categories like less active, moderately active and vigorously active as participants from 20 primary schools from different districts in West Bengal. Physical fitness components included cardiorespiratory fitness, flexibility, speed, agility, strength, power which were evaluated through tests including the 20m shuttle run, sit-and-reach test, 50m dash, 10m×4 shuttle run, handgrip strength, and standing broad jump respectively. Age specific percentile scores were calculated for each test. Descriptive statistics were computed to summarize the data. The findings indicated an age-related impact on school boys between the ages of 6 and 10 years. The percentile scores for each component increased steadily as age increased. The study may conclude that the physical fitness components and the percentile norms may be applied for evaluation of physical fitness of primary school boys. Additionally, these norms may be useful for physical education teachers, coaches, and health professionals in monitoring growth, development, and fitness levels and at the same time planning of the appropriate exercise intervention. Further, the researchers in the field of physical education, sports science, exercise science, health management may use these physical fitness tests and their pertaining norms for research purposes.

Keywords: Physical fitness, percentiles score, children, physical fitness tests, fitness assessment.

INTRODUCTION

Physical Fitness in children refers to their ability to perform daily activities, play, and complete age-appropriate physical fitness tasks with energy and without excessive fatigue. It also involves having the necessary physical abilities to support healthy growth, proper development, and active participation in physical activities, which contribute to overall well-being (Ortega *et al.,* 2008; Janssen & LeBlanc, 2010). It includes health-related components such as cardiorespiratory fitness, muscular strength, flexibility, and body composition, along with skill-related components namely speed, agility, power, etc. Regular physical activity and good physical fitness play a crucial role in the healthy growth, development and well-being of children, as stated in a widely accepted definition of the World Health Organization (WHO, 2020). Physical fitness assessment is important in childhood as it is used to measure children's growth and physical development. It also gives an insight into the strengths and weaknesses of different types of fitness. This assessment can identify children who are at risk of poor health or low fitness. Additionally, they also offer basic data needed for designing appropriate physical education and fitness programmes. Physical fitness, therefore, remains an indispensable component of health and quality of life (Koley & Bandyopadhyay, 2024). Often, sedentary behaviour is a consequence of a physically inactive lifestyle, while frequent engagement in physical activity can have positive effects on fitness. It also enables coaches, teachers and health professionals to monitor

progress over time, evaluate the success of the interventions and encourage continued involvement in physical activities. Children are especially vulnerable to the effects of poor growth and development in their early years and these assessments are very important for healthy growth and development (Ortega *et al.,* 2008; Janssen & LeBlanc, 2010). Laboratory and field-based tests are typically used to evaluate physical fitness tests. However, field-based tests are generally less accurate than laboratory-based assessments, they are widely used because of their lower cost, and require less time to administer (Thomas & Palma, 2018).Physical fitness is generally categorized into health-related and skill-related. Health -related components required for maintaining good health and supporting normal daily activities. These components include cardiorespiratory fitness, flexibility, muscular strength, and body composition. Skill-related physical fitness refers to the abilities that improve performance in sports and physical activities. It includes speed, agility, power, balance ((Han & Lee, 2022). Physical fitness of the participants was evaluated by six widely used health-related and field-based tests for children. Particularly, these components of fitness tests were mostly taken from the established fitness test batteries, that may be assessed physical fitness abilities and overall physical development of the children. These tests were 20m shuttle run test for evaluating cardiorespiratory fitness, sit and reach test for the flexibility, 50m dash test for assessing speed, 10mx4 shuttle run for the evaluating of agility, handgrip strength for the assessing of strength, and standing broad jump for the evaluation of power.

Regular physical fitness monitoring underpins healthy growth and development and contribute to developing lifelong healthy habits that can extend into adulthood (ACSM's, 2022; the Cooper Institute's FitnessGram, 2017; Bandyopadhyay *et al.,* 2025). Age-Specific normative scores are important because physical fitness of children changes quickly as they grow and develop. Natural improvements in speed, endurance, flexibility, strength increase with age due to physical growth, neuromuscular changes, and biological maturation. Age-Specific percentile scores allow each child to be compared with peers of the same age and a fair and meaningful evaluation of all children's fitness can be made. These norms also assist in recognizing children who have low fitness levels and in developing appropriate intervention plans (Tomkinson, *et al.,* 2018, Monero et al. 2014, Kolimechkov, 2017). Since India has limited normative data for primary school boys compared to the population of other countries. In India, the primary stage of schooling comprises classes one to fifth standard and the children's age generally ranges between 6 to 10 years (NEP, 2020). So, keeping in mind this research gap, the aim of the present study was to develop of physical fitness percentile norms for primary school boys of West Bengal.

MATERIAL AND METHODS

Participants

In this cross-sectional study, total 435 boys' volunteers primarily from three categories of boys like less active, moderately active and vigorously active from 20 primary schools from different districts in the West Bengal were selected as the participants. The age of the participants ranged from 6 to 10 years of class one to fifth standard. The Mean and SD of age, height, and weight of the participants were 8.02±1.42 years, 127.1±9.77cm, and 26.5±6.52kg respectively.

Study Design

At the very outset a good number of schools of different districts in west Bengal were informed regarding the study objectivities and asked their willingness to depute students as subjects for the resent study. Children with medical issues or physical and mental disabilities were excluded. Total 20 primary schools responded and informed their willingness. Then with pre-informed date and time, the researchers visited the school and selected participants considering their admission register. Then the very next day started the procedure of sending the informed consent form to the presents. Like this way one by one all schools were covered. Upon obtaining the duly signed consent form parents, the medical test was conducted and a self-made physical activity questionnaire was filled through an interview. It was ensured that the participants from different activity levels like less active, moderately active and vigorously active were included in the sample. Subsequently, the data collection procedure was started. On the first day, data on speed, agility, strength were collected. The data on rest variables were collected on the second day. The same sequence was maintained in all schools. In a single day the data of maximum of 20 children could be collected. The total time for data collection ranged approximately seven months from January to July of 2024. The study was approved by the departmental Research Committee, Physical Education, University of Kalyani (Ref. No. KU/ph.D.-1094 of 2022 dated November.04, 2022).

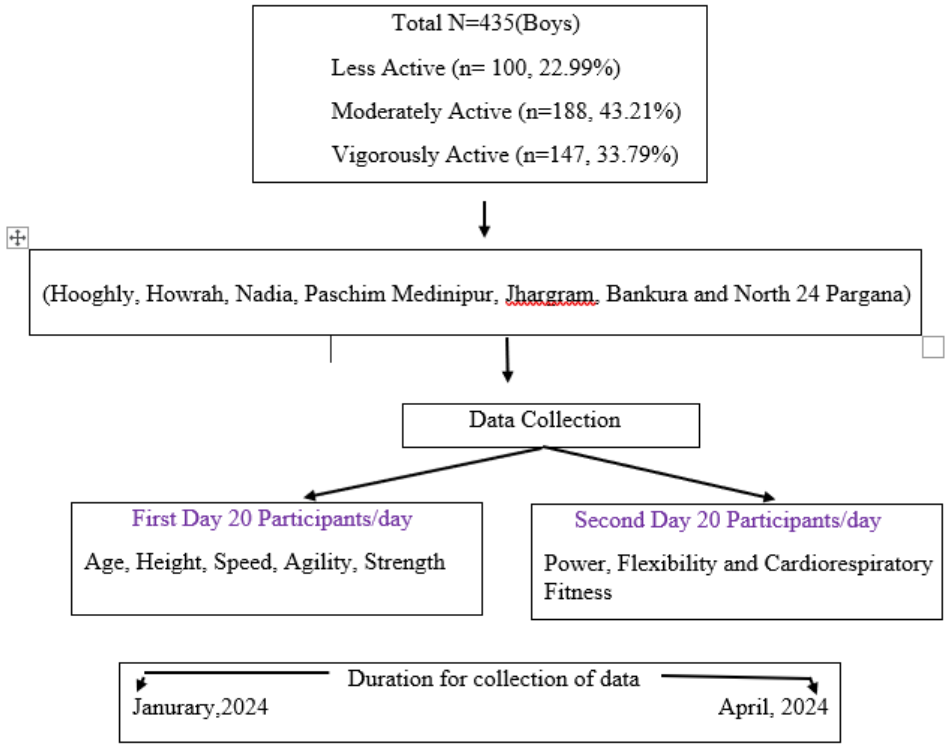

Figure 1: Flow chart of study design

Study variables and their assessment procedures

The literature of test battery for children was searched thoroughly and 12 physical fitness test batteries were found. Each battery was critically analysed and with consultation of 3 experts the following physical fitness components were incorporated for developing physical fitness norms for primary school boys of West Bengal aged 6 to 10 years which are presented in Table 1.

Table 1: Selection of variables and their measuring tests and sources

Sl. No.	Physical Fitness	Test items/Units	Resources
1	Cardiorespiratory fitness	20m shuttle run ($ml.kg^{-1}. min^{-1}$)	ALPHA Test Battery (2009), FITNESSGRAM,
2	Flexibility	Sit and Reach Test (cm)	EUROFIT Test Battery (1983); FITNESSGRAM, The Cooper Institution (1982); New Zealand Fitness Test Battery; The president's Council on Physical Fitness and Sports: President's Challenge (1986); Amateur Athletic union test Battery. Chrysler Foundation (1988).
3	Speed	50m. Dash (s)	AAHPERD, (1980); Physical Fitness and Athletic Ability Test (Japan,1964). CAHPER-FPT, 1980.
4	Agility	10m×4 Shuttle Run (s)	AAHPER, (1980); AAUTB,1988; ALPHHA,2009; CAHPER-FPT, 1980; INDARES, Roriz *et al.,* 2014; Golle, 2015; Thomas & Palma, 2018; Galvani *et al.,* 2024
5	Strength	Handgrip strength(kg)	Eurofit, 1983; Physical Fitness and Athletic Ability Test (Japan,1964); ALPHA Test Battery (2009),
6	Power	Standing broad Jump (m)	Eurofit, 1983; AAUTB,1988; FitnessGram,1982; AAHPER,1988; ALPHA,2009; NZFT, PCPF,1986; PFAAT,1964;

Six physical fitness components including cardiorespiratory fitness, speed, agility, flexibility, strength, power were measured by standardized procedures for the present study. The procedures were used to measure for physical fitness components described in detail below.

Cardiorespiratory Fitness: Cardiorespiratory fitness was assessed using the 20-m Shuttle Run Test (Beep Test). The test required participants to run continuously between two lines placed 20 m apart, synchronizing their pace with prerecorded audio signals. Participants stood behind the starting line and started running immediately after the audio signal Sounds (start the level no 1). Participants were required to reach the opposite line at the time of the first beep. If a participant reached the line before the beep, they waited until the

beep sounded before turning and continuing to the opposite line. Thereafter, participants continued running between the two lines in the same way, with the running speed increasing progressively at one-minute intervals (levels). Failure to reach the line before the beep resulted in a warning, and participants were required to regain the required pace within the next two beeps. The test was terminated after two consecutive failures to reach the line in time. The final score was recorded as the last level and shuttle completed successfully before the participant could no longer maintain the required pace.

Maximal oxygen uptake (VO_2 max) was estimated using the equation developed by Léger et al. (1988): VO_2 max = 31.025 + (3.238 × Speed) − (3.248 × Age) + (0.1536 × Speed × Age) where Speed ($km \cdot h^{-1}$) corresponds to the final running speed achieved during the test (8.5 + 0.5 × stage number), and Age is expressed in years (Eurofit, 1983; AAUTB, 1988; ALPHA-Fit, 2009; FitnessGram, 1982).

Flexibility:

The Sit & Reach test was used to assess the flexibility of the children. This test involves sitting on the floor with legs stretched out straight ahead. Shoes were removed. The soles of the feet were placed flat against the Sit and Reach box. Both knees were locked and pressed flat to the floor; the tester may assist by holding them. With the palms facing downwards, and the hands-on top of each other, the subject reaches forward. Each participant was given two trails, with the top score coming closest to an cm being recorded. (EUROFIT Test Battery (1983); FITNESSGRAM; (Johnson and Nelson, 1979)

Speed:

50m dash test was used to assess the speed performance of children. Participants were instructed to run as fast as possible towards the finish line and encourage to continue running hard through the finish line. The stater used the commands “On your mark”, “Set” and “Go” with starting signal. Time from starting line to the finish line was recorded to the nearest 0.1 seconds. Lower scores represent better performance. (AAPHERD, 1988; EUROFIT, 1983; PFAAT, 1964; Zhang *et al.,* 2021).

Agility:

10mx4 shuttle run test was used to measure agility of an individual participant. Two lines were marked 10 meters apart using marking tape or cones. Two blocks were kept on the lines facing away from the starting position. When the signal “go” was given, the participant ran toward the opposite line, picked up a block of wood, ran back and kept it on or beyond the line. They then turned immediately without delay and ran toward the opposite line, picked up the next block and ran back for the finish as soon as possible. The participants covered a total 40meters distance. The time was recorded to the nearest 0.1 seconds. A shorter completion time indicates better performance. (ALPHHA,2009; ACAHPER-FPT, 1980; AAUTB,1988; Roriz *et al.,* 2014; Golle, 2015; Thomas & Palma, 2018; Galvani *et al.,* 2024).

Strength:

Handgrip strength was used to evaluate the strength of the participants. The child was seated in a chair with back support, with their feet flat on the floor and their thighs at a right angle to their torso. The arm being tested should be at the side with the elbow bent at 90 degrees. The forearm should be in a neutral position (not pronated or supinator), and the wrist should be in a neutral position (not flexed or extended). The handle of the dynamometer was adjusted with the base resting metacarpal, while the hand rested in the middle of four fingers. The subjects were asked to squeeze the dynamometer with maximum effort. The subjects were encouraged consistently to ‘squeeze harder’. The subjects were given 3 attempts for each hand. The 3 trials were recorded and calculated the average of the three trials for each hand. The best score was taken for the measurement in kg (ALPHA 2009; PFAAT 1964; and Zhang *et al.,* 2021).

Power:

The standing broad jump test was used to measure lower body explosive power. Participants stood with both feet apart behind the take-off line and were instructed to jump as far as possible. Three trials were recorded, and the best of the three trials was taken in meter (Eurofit, 1983; AAUTB,1988; FitnessGram,1982; AAHPER,1988; ALPHA,2009; NZFT, PCPF,1986; PFAAT,1964).

Statistical Analysis

The collected data were analyzed using statistical software SPSS (version 32.0.0). Descriptive statistics, including mean, standard deviation, range were calculated for all physical fitness variables. Age specific Percentiles scores were calculated for each physical Physical fitness components.

RESULTS

Personal data

Age, Weight, Height, and BMI of the participants were considered as personal data. The Mean and SD of Age, Weight, Height, and BMI of all age groups of boys are presented in Table 2.

Table 2: Descriptive data of Mean and SD of Age, Weight, Height, and BMI for All Age Groups of Boys

Groups (Age)	Boys			
	Age(yrs)	Weight(kg)	Height(cm)	BMI (kg/m²)
6years	6.35±0.21	21.6±4.07	116±6.93	15.7±1.87
7years	7.31±0.19	23.0±3.77	120.5±5.86	15.8±1.81
8years	8.38±0.21	27.0±5.79	129.8±6.21	16.0±2.12
9years	9.38±0.24	28.5±6.08	131.6±6.40	16.5±2.51
10years	10.32±0.14	31.9±6.42	136.3±7.51	17.1±2.67

The Table 2. reveals the descriptive statistics that the mean age of 6 years, 7 years, 8 years, 9 years and 10 years boys has been found 6.35±0.21years, 7.31±0.19years, 8.38±0.21years, 9.38±0.24years, 10.32±0.14years respectively. The mean weight of 6 years, 7 years, 8 years, 9 years and 10 years boys has been found 21.6±4.07kg, 23.0±3.77kg, 27.0±5.79kg, 28.5±6.08kg, and 31.9±6.42kg respectively. The mean height of 6 years, 7 years, 8 years, 9 years and 10 years boys has been found 116±6.93cm, 120.5±5.86cm, 129.8±6.21cm, 131.6±6.40cm, 136.3±7.51cm respectively. The mean BMI of 6 years, 7 years, 8 years, 9 years and 10 years boys has been found 15.7±1.87kg/m², 15.8±1.81kg/m², 16.0±2.12kg/m², 16.5±2.51kg/m², 17.1±2.67kg/m² respectively.

Physical Fitness components and their descriptive statistics for 6 – 10 years boys.

In the present study, Cardiorespiratory fitness (20m shuttle run test), flexibility (sit & reach test), speed (50mt dash), Agility (10mx 4 shuttle run Test), Strength (handgrip strength), Power (standing broad jump) variables were selected to develop percentile norms for primary school boys aged 6 to 10 years. The mean, SD, range were calculated as descriptive statistics have been presented in table 3.

Table 3: Descriptive Statistics of Physical Fitness Variables for 6 – 10 years Boys

Variables	Age/N	Mean ± SD	Min	Max
Cardiorespiratory fitness (ml.kg^{-1}.min^{-1})	6 years	50.5±2.19	46.2	55.2
Flexibility (cm)	N=87	15.5±3.57	8	23
Speed (s)		12.8±1.57	10.4	17.8
Agility (s)		15.3±1.45	12.9	19.6
Strength (kg)		9.35±1.82	4.67	12.6
Power (m)		1.13±0.17	0.67	1.41
Cardiorespiratory fitness (ml.kg^{-1}.min^{-1})	7 years	49.8±2.49	45	57.9
Flexibility (cm)	N=84	19.6±4.25	10	26
Speed (s)		11.9±1.78	9.61	16.9
Agility (s)		14.8±1.38	12.5	18.9
Strength (kg)		10.5±1.69	6.70	14.9
Power (m)		1.25±0.18	.80	1.55
Cardiorespiratory fitness (ml.kg^{-1}.min^{-1})	8 years	48.6±2.48	44.5	54.0
Flexibility (cm)	N=86	20.4±4.40	12	28
Speed (s)		11.7±1.74	9.33	16.3
Agility (s)		14.4±1.54	12.0	18.2
Strength (kg)		12.5±2.08	7.93	18.1
Power (m)		1.31±0.17	.98	1.67
Cardiorespiratory fitness (ml.kg^{-}1.min^{-1})	9 years	47.9±2.97	42.5	57.2
Flexibility (cm)	N=89	22.0±3.68	15	30
Speed (s)		10.6±1.27	9.06	15.2
Agility (s)		13.6±1.32	11.9	17.2
Strength (kg)		13.8±2.35	9.97	21.5
Power (m)		1.37±0.19	1.00	1.81
Cardiorespiratory fitness (ml.kg^{-1}.min^{-1})	10 years	47.3±3.63	41.1	57.2
Flexibility (cm)	N=89	23.1±4.77	16	33
Speed (s)		10.5±1.28	8.94	14.3
Agility (s)		13.4±1.27	11.1	16.8
Strength (kg)		17.4±3.32	11.3	24.6
Power (m)		1.45±.22	1.05	1.98

Note: SD=Standard Deviation, cm=centimeter, s=seconds, kg=kilogram, m=meter, Min=Minimum, Max=Maximum

Table 3 shows that the results of all the tests increase across age. The mean value of cardiorespiratory fitness of 6 years boys is 50.5 ±2.19 ml.kg.min^{-1} and 10 years boys 47.3±3.63ml.kg.min^{-1}. The mean value of flexibility of 6 years boys =15.5 ± 3.57cm and 10 years boys = 23.1 ± 4.77cm. The mean value of speed of 6 years boys =12.8±1.57s, and 10 years boys 10.5±1.28s. The mean value of agility of 6 years, boys 15.3±1.45s, and 10 years boys 13.4±1.27s. The mean value of strength of 6 years boys =9.35 ± 1.82kg and 10 years boys ,17.4 ± 3.32kg. The mean value of power of 6years boys is 1.13±.17m and 10 years boys is 1.45±.22m.

Percentile norms for physical fitness components of 6 – 10 years boys.

The present study provided the percentile score of physical fitness components of West Bengal school boys aged 6 – 10 years. The physical fitness components included in the present study were cardiorespiratory fitness, flexibility, speed, agility, strength, power. The percentile scores for each component were computed separately and considered from 0th to 100th percentile. Percentile norms were developed on the basis of percentile scores, presented below as table format.

Table 5: Percentiles norms of cardiorespiratory fitness for 6 - 10 years Boys

Percentile	Boys					Percentile
	6 years	7years	8years	9years	10years	
100	55.2	57.2	54.2	57.2	57.2	100
95	54.2	53.6	52.4	52.9	53.3	95
90	53.1	52.8	52.2	51.3	52.6	90
80	52.8	51.7	51.4	50.3	50.3	80
75	52.5	51.4	51.2	50.3	50.3	75
70	51.1	50.6	49.7	49.6	49.7	70
60	51.0	50.5	49.1	48.4	48.0	60
50	50.5	49.3	48.4	47.3	48.0	50
40	49.9	49.3	47.5	46.2	45.7	40
30	49.2	48.9	46.8	45.7	45.7	30
25	48.9	48.6	46.8	45.7	45.7	25
20	48.6	47.1	46.7	45.7	45.3	20
10	47.9	47.0	45.2	44.6	42.5	10
5	46.6	45.3	44.8	43.4	41.2	5
0	46.2	45.0	44.5	42.6	41.1	0

Table 5 reveals the age-specific percentile scores of cardiorespiratory fitness at 0th -100th percentiles for aged 6 to 10 years boys. The cardiorespiratory fitness was measured by 20m shuttle run test (ml.kg^{-1}.min^{-1}). The 0th percentile scores of 6 years 7 years, 8 years, 9 years, and 10 years boys have been found 46.2 ml.kg^{-1}.min^{-1}, 45.0 ml.kg^{-1}.min^{-1}, 44.5 ml.kg^{-1}.min^{-1}, 42.6 ml.kg^{-1}.min^{-1}, and 41.1 ml.kg^{-1}.min^{-1} respectively. The 100th percentile scores of 6 years 7 years, 8 years, 9 years, and 10 years boys have been found 55.2 ml.kg^{-1}.min^{-1}, 57.2 ml.kg^{-1}.min^{-1}, 54.2 ml.kg.min^{-1}, 57.2 ml.kg^{-1}.min^{-1}, and 57.2 ml.kg^{-1}.min^{-1} respectively.

Table 6: Percentiles norms of flexibility for 6 - 10 years Boys

Percentile	Boys					Percentile
	6 years	7years	8years	9years	10years	
100	23.0	26.0	28.0	30.0	33.0	100
95	21.6	26.0	27.7	29.0	30.0	95
90	21.0	25.0	26.3	27.0	29.0	90
80	19.4	23.4	24.0	25.0	28.0	80
75	19.0	22.2	23.2	25.0	27.0	75
70	18.0	22.0	23.0	24.6	27.0	70
60	16.0	21.0	22.0	23.0	25.0	60
50	15.0	20.0	21.0	22.0	23.0	50
40	14.0	19.0	19.8	21.0	21.0	40
30	13.0	18.0	19.0	20.0	20.0	30
25	13.0	17.0	18.0	19.0	20.0	25
20	12.0	16.0	16.4	18.0	19.0	20
10	10.8	12.8	13.0	17.0	17.9	10
5	9.00	11.0	12.0	15.4	16.4	5
0	8.00	10.0	12.0	15.0	16.0	0

Table 6 shows the age-specific percentile score from 0th- 100th percentiles for aged 6 to 10 years boys. The flexibility was measured by sit-and-reach test (cm). The 0th percentile scores of 6 years 7 years, 8 years, 9 years, and 10 years boys have been found 8.00cm, 10.0cm, 12.0cm, 15.0cm, and 16.0cm respectively. The 100th percentile scores of 6 years 7 years, 8 years, 9 years, and 10 years boys have been found 23.0cm, 26.0cm, 28.0cm, 30.0cm, and 33.0cm respectively.

Table 7: Percentiles norms of speed for 6 - 10 years Boys

Percentile	Boys					Percentile
	6 years	7years	8years	9years	10years	
100	10.4	9.61	9.33	9.06	8.94	100
95	10.7	9.85	9.65	9.33	8.98	95
90	10.9	9.98	9.88	9.41	9.11	90
80	11.1	10.2	10.0	9.63	9.46	80
75	11.3	10.3	10.2	9.76	9.54	75
70	11.6	10.4	10.3	9.85	9.73	70
60	12.2	11.0	10.8	10.2	9.94	60
50	12.8	11.6	11.4	10.3	10.1	50
40	13.4	11.9	11.8	10.7	10.4	40
30	13.6	12.5	12.3	10.9	10.7	30
25	13.9	12.8	12.7	11.3	11.0	25
20	14.2	13.4	13.3	11.4	11.2	20
10	14.9	14.2	13.9	12.4	12.2	10
5	15.3	15.2	15.0	13.8	13.1	5
0	17.8	16.9	16.3	15.2	14.3	0

Table 7 reveals the age-specific percentile scores of speed at 0th to 100th percentiles for aged 6 to 10 years boys. The speed was measured by 50m dash (second). The 0th percentile scores of 6years 7 years, 8 years, 9 years, and 10 years boys have been found 17.8s, 16.9s,16.3s, 15.2s, and 14.3s respectively. The 100th percentile scores of 6 years 7 years, 8 years, 9 years, and 10 years boys have been found 10.4s, 9.61s, 9.33s, 9.06s, and 8.94s respectively. Lower times are indicating better performance.

Table 8: Percentiles norms of agility for 6 - 10 years Boys

Percentile	Boys					Percentile
	6 years	7years	8years	9years	10years	
100	12.9	12.5	12.0	11.8	11.0	100
95	13.0	13.1	12.3	11.9	11.3	95
90	13.5	13.3	12.6	12.1	12.0	90
80	13.9	13.6	13.1	12.2	12.4	80
75	14.2	13.8	13.2	12.5	12.4	75
70	14.3	14.0	13.5	12.9	12.6	70
60	14.6	14.3	13.7	13.0	12.8	60
50	15.4	14.5	14.1	13.3	13.1	50
40	15.7	14.8	14.6	13.7	13.4	40
30	16.1	15.6	15.1	14.0	13.9	30
25	16.3	15.7	15.5	14.6	14.2	25
20	16.4	15.9	15.8	14.8	14.4	20
10	17.3	16.5	16.5	15.9	15.0	10
5	18.0	17.6	17.2	16.4	15.8	5
0	19.6	18.9	18.3	17.2	16.8	0

Table 8 shows the age-specific percentile scores of agility at 0th- 100th percentiles for aged 6 to 10 years school boys. The agility was measured by 10mx4 shuttle run test (second). The 0th percentile scores of 6 years 7 years, 8 years, 9 years, and 10 years boys have been found 19.6s, 18.9s,18.3s, 17.2s, 16.8s respectively. The 100th percentile scores of 6 years 7 years, 8 years, 9 years, and 10 years boys have been found 12.9s, 12.5s, 12.0s, 11.8s, and 11.0s respectively. Shorter times are indicating better performance.

Table 9: Percentiles norms of strength for 6 - 10 years Boys

Percentile	Boys					Percentile
	6 years	7years	8years	9years	10years	
100	12.6	14.9	18.3	21.5	24.6	100
95	12.1	13.6	15.2	19.1	22.2	95
90	11.9	13.2	14.7	16.6	21.9	90
80	10.8	11.9	14.2	15.5	20.3	80
75	10.6	11.3	13.8	15.5	20.1	75
70	10.3	11.1	13.2	14.5	19.7	70
60	9.98	10.9	12.6	14.2	18.5	60
50	9.43	10.7	12.2	13.6	17.8	50
40	9.03	10.2	11.9	12.9	16.7	40
30	8.71	9.97	11.6	12.2	15.7	30
25	8.17	9.83	11.0	12.1	14.9	25
20	7.69	7.90	10.7	11.8	13.6	20
10	6.66	7.90	10.2	11.1	12.6	10
5	6.15	7.76	9.91	10.8	12.2	5
0	4.67	6.70	7.93	9.97	11.3	0

Table 9 shows the age-specific percentile scores of strength at 0^{th} – 100^{th} percentiles for aged 6 to 10 years school boys. The strength was measured by handgrip strength test (kilogram). The 0^{th} percentile scores of 6years 7 years, 8 years, 9 years, and 10 years boys have been found 4.67kg, 6.70kg, 7.93kg, 9.97kg, and 11.3kg respectively. The 100^{th} percentile scores of 6 years 7 years, 8 years, 9 years, and 10 years boys have been found 12.6kg, 14.9kg,18.3kg, 21.5kg, and 24.6kg. respectively.

Table 10: Percentiles norms of power for 6 - 10 years Boys

Percentile	Boys					Percentile
	6 years	7years	8years	9years	10years	
100	1.41	1.55	1.67	1.81	1.98	100
95	1.37	1.52	1.59	1.74	1.79	95
90	1.33	1.48	1.54	1.62	1.72	90
80	1.30	1.43	1.46	1.53	1.65	80
75	1.27	1.40	1.43	1.51	1.61	75
70	1.25	1.36	1.41	1.47	1.55	70
60	1.21	1.32	1.34	1.44	1.52	60
50	1.16	1.25	1.32	1.37	1.47	50
40	1.10	1.20	1.27	1.32	1.41	40
30	1.05	1.17	1.21	1.24	1.35	30
25	1.00	1.12	1.20	1.21	1.28	25
20	.95	1.08	1.15	1.19	1.22	20
10	.88	1.00	1.05	1.10	1.15	10
5	.82	.88	1.01	1.08	1.10	5
0	.67	.80	.98	1.00	1.05	0

Table 10 shows the age-specific percentile scores of power at 0^{th}–100^{th} percentiles for aged 6 to 10 years school boys. The power was measured by standing broad jump (meter). The 0^{th} percentile scores of 6years, 7 years, 8 years, 9 years, and 10 years boys have been found .67m, .80m, 1.00m, 1.05m, and 1.05m respectively. 100^{th} percentile scores of 6years, 7 years, 8 years, 9 years, and 10 years boys have been found 1.41m, 1.55m, 1.67m, 1.81m, and 1.98m respectively.

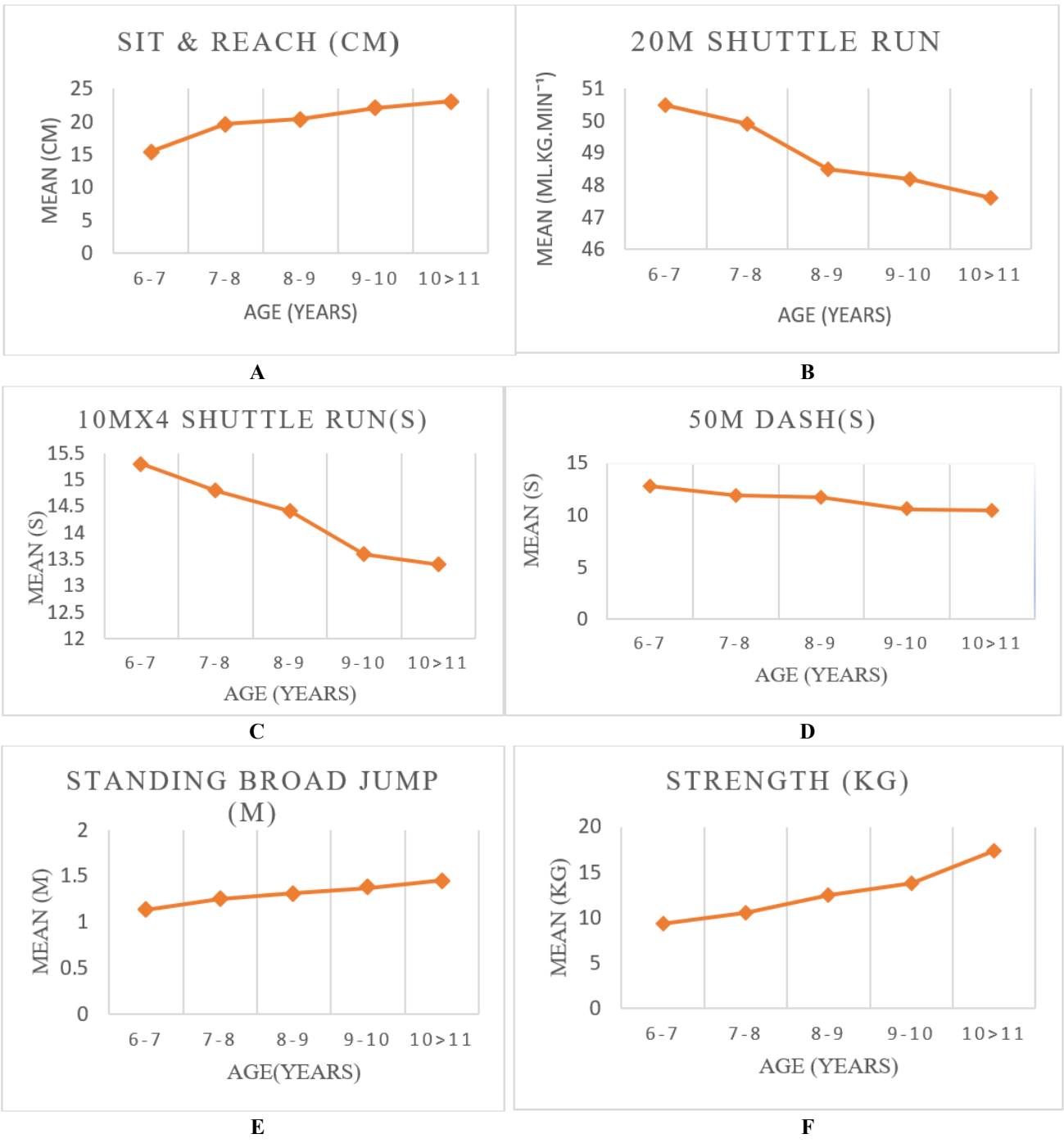

Figure 1: Mean values of performance by age 6 -10years boys 20m shuttle run (A), sit and reach (B), 50mdash (C), 10mX4 shuttle run (D), Strength(E), Standing broad jump (F)

DISCUSSION

The present study provides the percentile scores for assessing physical fitness test of West Bengal primary school boys aged 6 – 10 years. The physical fitness components included in the present study were cardiorespiratory fitness, flexibility, speed, agility, strength, power. The percentile scores for each component were considered from 0^{th} to 100^{th} percentile. Cardiorespiratory fitness is the capacity of the heart, lungs and blood vessels to distribute oxygen to the muscles during prolonged exercise, and the capacity of the muscles to utilize oxygen and create energy. It is usually measured by the maximal oxygen uptake (VO2max) directly or by a validated field-based test such as 20m shuttle run (American college of sports Medine, 2021). In the present study, VO_2 max was estimated using the formula of Leger *et al.,* (1988), calculated with maximum speed (S) and the child's age (A). The cardiorespiratory fitness percentile scores across all the age groups showed a positive trend with increasing percentile scores throughout the percentile range, from 0^{th} percentile to 100^{th} percentile, indicating that those

children in higher percentiles have higher cardiorespiratory fitness compared to those children in the lower percentiles. The lowest percentile VO2max scores ranged from 41.1 to 46.2 $ml.kg^{-1}.min^{-1}$ and the highest scores ranged between 53.3 to 57.2 $ml.kg^{-1}.min^{-1}$. The median (50th percentile) VO2maxscores showed a slight decline with increasing age, decreasing from 50.5 $ml.kg^{-1}.min^{-1}$ in 6years boys to 48.0 $ml.kg^{-1}.min^{-1}$ in 10 years boys. Thus, the percentile score serves as a reference chart. It is not comparing children of different ages, but it is comparing a child to other children of the same age. These results are same with previous research studies conducted by (Rowland, T.W. 2007; González et al.,2014; Kelimechkov *et al.,* 2019). The flexibility was measured by sit and reach test (cm). Flexibility is the ability of the joint or joints to move through the full range of motion; it is dependent upon the elasticity of the muscles and connective tissues surrounding the joint (ACMS, 2021; AAHPERD, 1980). In flexibility the 6-year boys showed the 0^{th} percentile score was 8.00 cm and subsequently 100^{th} percentile score was 23 cm. Similarly, in 7 years boys 0^{th} percentile score was 10.0cm and 100^{th} percentile score was 26.0cm and in 8 years boys 0^{th} percentile=12.0cm and 100^{th} percentile=28.0cm similarly, in 9 years boys 0^{th} percentile=15.0cm and 100^{th} percentile=30.0cm. Same as, in 10 years, boys 0^{th} percentile =16.0cm and 100^{th} percentile=33.0cm. One study also found that sit-and-reach performance increased significantly with age among boys reinforcing the developmental nature of flexibility (Ma *et al.,* 2022; Etayo *et al.,* 2014). When compared internationally in flexibility test performance, the present findings suggest that Indian boys demonstrate relatively lower flexibility levels than Chinese boys at the 50th percentile (P50) (Zhang *et al.,* 2021), but perform better than their Spanish and Portuguese counterparts (Roriz de Oliveira *et al.,* 2014). Speed is the ability to get the whole body or a particular body part from one place to another in the shortest time possible. The assessment of speed was made in 50m dash (seconds) which was shorter the better. In speed the 6 years boys showed the 0^{th} percentile score was 17.8s and subsequently 100^{th} percentile score was 10.4s. Similarly in 7 years boys 0^{th} percentile score was 16.9s and 100^{th} percentile score was 9.61s and in 8 years boys 0^{th} percentile=16.30s and 100^{th} percentile=9.33s similarly, in 9 years boys 0^{th} percentile=15.2s and 100^{th} percentile=9.06s. Same as, for 10 years boys 0^{th} percentile =14.3s and 100^{th} percentile=8.94s. The mean values of the 50 m dash, as illustrated in Figure 1, demonstrate a gradual decrease in running time across age groups, indicating enhanced speed performance as children grow older. This trend reflects normal physical development, including improvements in muscular strength, coordination, and neuromuscular efficiency, The results are consistent with earlier findings reported by (Roriz *et al.,* 2014; Ma *et al.,* 2022; Zhang *et al.,* 2021). Agility- changing direction or changing body position quickly and effectively without losing balance or control. It is associated with speed, balance, coordination and neuromuscular control to allow fast and accurate movement (Sheppard & Young, 2006; ACMS, 2021). The agility was assessed using 10mx4 shuttle run test (seconds) with shorter times indicating better performance In, agility the 6 years boys showed the 0^{th} percentile score was 19.6s and subsequently 100^{th} percentile score was 12.9s. Similarly, in 7 years boys 0^{th} percentile score was 18.9s and 100^{th} percentile score was 12.5s and in 8 years boys 0^{th} percentile=18.3s and 100^{th} percentile=12.0s. Similarly, in 9 years boys 0^{th} percentile=17.2s and 100^{th} percentile=11.8s. Same as, in 10 years boys 0^{th} percentile =16.8s and 100^{th} percentile=11.0s. Strength is the ability of a muscle or group of muscles to generate the maximum amount of force against a resistance during a single effort. Strength was measured using handgrip strength (kg). In, strength for 6 years boys, it was observed that the 0^{th} percentile score was 4.67kg and subsequently 100^{th} percentile score was 12.6kg. Similarly in 7 years boys, 0^{th} percentile score was 6.70kg and 100^{th} percentile score was 14.9kg and in 8 years boys, 0^{th} percentile=7.93kg and 100^{th} percentile=18.3kg. Similarly, in 9 years boys 0^{th} percentile=9.97kg and 100^{th} percentile=21.8kg Same as, in 10 years boys 0^{th} percentile =11.3kg and 100^{th} percentile=24.6kg. The data reveals that there was gradual increase in percentile score of all physical fitness variables with age among 6 – 10 years boys. These findings are in agreement with previous studies (Ma *et al.,* 2022; Galvani *et al.,* 2024; Zhang *et al.,* 2021). Power is the ability of the muscles to produce maximum force in a minimum amount of time; it is the combination of strength and speed and enables people to generate powerful actions (ACMS, 2021). The Power was measured using the standing broad jump (m). In, power, the 6 years boys showed the 0^{th} percentile score was .67m and subsequently 100^{th} percentile score was 1.41m. Similarly, for 7 years boys 0^{th} percentile score was .80m and 100^{th} percentile score was 1.55m and for 8 years boys 0^{th} percentile=.98m and 100^{th} percentile=1.67m. Similarly, for 9 years boys 0^{th} percentile=1.00m and 100^{th} percentile=1.81m. Same as, in 10 years boys 0^{th} percentile =1.05m and 100^{th} percentile=1.98m. One study reported similar age-related increases in physical fitness components, including muscular power, among Chinese children (Ma et al.,2022). The developmental trends observed in this study are consistent with established percentile norms (Kolimechkov *et al.,* 2019; Niessner *et al.,* 2020; Ma *et al.,* 2022; Galvani *et al.,* 2024) and the existing literature (Janssen & LeBlanc,2010), where physical fitness increases with age. Figure 1. showed the mean values of the different age groups of all the physical fitness tests, which are demonstrated a steady and consistent improvement in all the tests with increasing age among boys. Similar findings have been reported by the many other studies (Roriz de Oliveira *et al.,* (2014); Thomas and Palma (2018); Kelimechkov *et al.,* 2019; Galvani *et al.,* 2024).

CONCLUSION

The present study established physical fitness percentile norms for six physical fitness components of 6 – 10 years boys of West Bengal. Overall, the findings of the present study align well with existing literature and provide valuable normative data for assessing physical fitness among boys of aged 6 – 10 years. Based on findings the present study concludes that the physical fitness components which were measured by standard tests and the percentile scores were calculated may be applied for evaluation of fitness of primary school boys. Additionally, these norms may be useful for physical education teachers, coaches, and health professionals in monitoring growth, development, and fitness levels and planning the exercise intervention. Further, the researchers in the field of physical education, sports science, exercise science, health management may use these physical fitness tests and their pertaining norms for research purposes.

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