



RESEARCH ARTICLE

HEALTH-RELATED PHYSICAL FITNESS IN INDIAN SCHOOL CHILDREN

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ABSTRACT

The main aim of the study was to assess the health-related physical fitness in Indian school children. For this purpose, a cross sectional purposive sample of 437 male children into seven age groups i. e. 12 (N=63), 13(N=59), 14(N=63), 15(N=63), 16(N=63), 17(N=63) and 18(N=63) years belong to middle (N=215) and higher secondary (N=222) schools. The random sampling method was employed for the purpose of data collection from various schools running in the tribal region of Sarguja division in the state of Chhattisgarh. For estimated body fat percentage of an individual, two skin-fold sites i.e. triceps and sub-scapular were measured by standard Skin-fold Caliper of all the male subjects in millimeters. The measurements were made while the children were wearing light clothes and no shoes. Health-related physical fitness was assessed through the sit-and-reach test for flexibility, modified sit-ups test in one-minute for strength/muscular endurance and nine-minute running/walking test for cardio-respiratory endurance. The subjects were tested within one month of their birthdays. All the subjects were tested in AAHPER health related fitness test items i.e. 1.5 mile run, modified bent knee sit-ups for one minute, sit and reach test and triceps and sub scapular skin folds to collect the data on cardiovascular endurance, strength and endurance of abdominal muscles, flexibility of back and hamstring muscles and amount of fat. From this study, it was concluded that the health related fitness of boys of twelve to eighteen years of age of Sarguja division declined in all age groups on flexibility with advancement of age except fifteen years of age and inclined in all age groups on abdominal strength/muscular endurance and body composition with advancement of age. Which, possibly, may be attributed to the lack of physical activity after the age of fifteen years. They unproved in cardio-respiratory function at twelve to fourteen years of age and later on, they improved significantly up to the age of eighteen years with some fluctuations in time.

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INTRODUCTION

Majority of the population in India of rural region depends on agriculture for their livelihood. They carry out different type of physical activities in tribal region. Various tribal communities are in different stages of development in India, but they are still backward than urban communities. These tribals are aborigines of our country. They have been studied from different angles in their active life. Different type of physical activities in their daily life help them for their physical development. Saha. & Haldar (2012) noticed that healthy body is necessary for increasing the working capacity and maintaining health related physical fitness of an individual to perform his daily tasks strongly. Bandyopadhyay and

Bandyopadhyay (2007) investigated the better cardio-respiratory fitness among males than female college students. They also found the higher values of all the physical parameters of health related fitness in males. Physical fitness can be defined as the ability of an individual to perform everyday workout with sufficient capacity and ability in the condition of fatigue. (Council of Europe, 1983) The cardio-respiratory fitness is the very important components of health-related fitness which reflects the total capacity of the heart and respiratory systems to supply oxygen during assessment of physical fitness among Children and Adolescents (Ruiz *et al.*, 2006a). The higher levels of cardio-respiratory fitness in adolescence children is related with a healthy cardiovascular profile (Ruiz *et al.*, 2009). Physical fitness is a significant indicator of the health of children and adolescents. In recent years interest in the evaluation of form has increased in the public domain (Cvejic, Pejovic, Ostojic, 2013).

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Health-related physical fitness refers to cardio-respiratory fitness, muscular strength, speed-agility and body composition (Moliner-Urdiales *et al.*, 2010). The components of health-related fitness depend on constitutional/genetic differences (Bouchard, 1993a), they are affected by habitual physical activity and are related to health status (Bouchard, 1993). The performance in cardio-respiratory fitness, muscular strength, speed-agility and body composition (health-related physical fitness variables) was generally higher in older girls. Interventions to promote health-related physical fitness should not only consider gender and age of schoolchildren, but also selected socio-demographic and behavioral factors (Bazyar and Shabani, 2014) Saha, G.C and Haldar, S (2012). Showed the significant difference between rural and urban school going children in all the health related physical fitness components as well as the reaction ability. Rural school going children were found better than urban school going children. Deep, Singh and Kanchan (2012) showed that the static strength of rural children's was significantly higher than the urban school children. But there was no significant difference of speed, explosive strength, flexibility and cardiovascular endurance components between urban and rural primary school children. Taleja. (1986) resulted insignificant difference in the physical fitness between rural and urban high school students, and have no significant difference in physical fitness between rural and urban high school students

Interventions to promote health-related physical fitness should not only consider gender and age of schoolchildren, but also selected sociodemographic and behavioral factors, especially socioeconomic class and leisure activities (Guedes *et al.*, 2012). Dutt (2005) indicated the improper development of muscular strength endurance in boys which may be due to their habitual life style for an attractive physical appearance. Down fall of body fat percent was observed among boys in 8 to 13 years of age groups and Sharpe rise in body fat% was exhibited after the age of 14 years to 17 years of age. Worldwide health planners have been reported the importance of the contribution of health Education and physical Fitness in the development of total fitness among children.(Knuttggen, 1961; Campbell & Pohndof, 1961; Sloan, 1966; Hebbelinck and Borms, 1969; Ruskin, 1978 and J (Ishiko, 1978). Many researchers have been conducted studies on Health-related physical fitness which refers to cardio-respiratory fitness, muscular strength, speed-agility and body composition components of boys and girls in different age groups (Benhnke & Wilmore, 1974; Nelson and dorociak, 1982; Haywood, Clarke & Mayhew, 1986; AAHPER, 1987; Shephard, Berridge & Montelpare, 1990; Cureton & Warren, 1990 Muhammad, 1998; Kumar and Sathe, 1999).

## MATERIALS AND METHODS

### Participants

The study has been conducted on a cross sectional purposive sample of 437 male children into seven age groups i. e. 12 (N=63), 13(N=59), 14(N=63), 15(N=63), 16(N=63), 17(N=63) and 18(N=63) years belong to middle (N=215) and higher secondary (N=222) schools. The random sampling method was employed for the purpose of data collection from various

schools running in the tribal region of Sarguja division in the state of Chhattisgarh.

### Criterion Measure

For estimated body fat percentage of an individual, two skin-fold sites i.e. triceps and sub-scapular were measured by standard Skin-fold Caliper of all the male subjects in millimeters. The measurements were made while the children were wearing light clothes and no shoes. Health-related physical fitness was assessed through the sit-and-reach test for flexibility, modified sit-ups test in one-minute for strength/muscular endurance and nine-minute running/walking test for cardio-respiratory endurance.

### Instrumentation

The subjects were tested within one month of their birthdays. All the subjects were tested in AAHPER health related fitness test items i.e. 1.5 mile run, modified bent knee sit-ups for one minute, sit and reach test and triceps and sub scapular skin folds to collect the data on cardiovascular endurance, strength and endurance of abdominal muscles, flexibility of back and hamstring muscles and amount of fat.

### Test Protocol

#### Triceps skin-fold

The tester stood behind the participant and picked up the skin-fold about 1 cm above the midpoint mark over the triceps muscle (at the back of the upper arm), with the fold running downward along the midline of the back upper arm. The caliper jaws were applied at right angles to the neck of the fold just below the finger and thumb over the midpoint mark. While maintaining a grip on the skin-fold, the tester gently released the caliper handles and allowed the jaws to close on the fat fold for two seconds before taking the reading.

#### Sub-scapular skin-fold

The sub-scapular skin-fold is picked up on a diagonal, inclined inferior - laterally approximately 45° to the horizontal plane in the natural cleavage lines of the skin. The site is just inferior to the lower angle of the scapula. The caliper jaws were applied 1 cm inferior - lateral to the thumb and finger raising the fold

#### Sit and reach test

Purpose: The purpose of the sit and reach is to evaluate the flexibility (extensibility) of the low back and posterior thighs. Equipment: The testing apparatus of 12x12 inches made from ¾ inch plywood with a scale marked on the top of the box which extended an additional 9 inches (21 inches over all) towards the subject to be tested Procedure: The subject were asked to remove their shoes and place his feet against the testing box while sitting on floor with straight knees. The finger tips of the subject were on the edge of the top of box. The tester kept his hand on the knees of the subject to keep them straight not allowing any bending of the knees. The

subject was instructed to lean forward and was asked to slide his hand along the measuring scale as far as possible without bouncing and to hold the farthest position for at least one second. Scoring: Each subject was given three trials and the best lean forward was considered as score nearest to a cm, was recorded and 9 inches (23.81 cm) subtracted from the recorded reading to obtain the flexibility scores.

### Modified Sit-ups

Purpose: To measure the abdominal strength and endurance. Equipment: Stop watch, Mat Procedure: The maximum number of sit-ups achieved in 60 seconds was recorded. The subjects were instructed to keep their arms across the chest while curling up to a sitting position until their elbows touched their thighs. This test gave us insight into abdominal strength and endurance. One trial was given.

### 1.5 mile run/walk

Purpose: The purpose of the one-mile run is to measure maximal functional capacity and endurance of the cardio-respiratory system. Equipment: One and half mile run can be administered on a 400 meter or 200 meter or on any other flat, measured area. Test Description: Students are instructed to run one mile in the fastest possible pace. The students begin on signal, "ready, start" as they cross the finish line elapsed time should be announced to the participants. Walking is permitted, but the objective is to cover the distance in the shortest possible time. Scoring: The one-mile run is scored to the nearest of a second and the performance should be recorded on the individual score card.

**Table 1. Means and Standard Deviations of Health-Related Physical Fitness in School Children**

Age (Years)	Frequency (Subject)	Modified Sit-Ups (Numbers)	1.5 mile Run (Minute-Second)	Sit and Reach (cm.)	Body Composition
12	63	17.14 ±4.24	14.65 ±1.36	26.88 ±4.56	09.19 ±1.57
13	59	19.39 ±6.24	14.64 ±1.71	28.04 ±4.70	09.25 ±1.83
14	63	22.97 ±5.87	14.16 ±1.81	30.19 ±5.26	10.00 ±1.83
15	63	21.95 ±5.74	12.26 ±1.80	24.98 ±5.62	10.87 ±1.49
16	63	23.05 ±6.58	12.07 ±0.98	29.22 ±8.45	11.19 ±1.63
17	63	25.46 ±6.46	12.39 ±1.23	30.25 ±8.00	11.79 ±2.64
18	63	27.54 ±6.33	12.05 ±1.51	33.74 ±5.91	12.37 ±2.13

**Table 2. Analysis of Variance on Four Components of Health -related Physical Fitness of Male Children of Twelve to Eighteen Years of Age**

Fitness Components	Sources of Variance	df	Sum of Squares	Mean Square	F-Value
<b>Modified Sit-Ups</b>	Between Groups	6	4582.19	763.69	21.44*
	Within Groups	430	15314.70	35.62	
<b>Cardio-respiratory function</b>	Between Groups	6	569.66	94.94	41.38*
	Within Groups	430	984.38	2.29	
<b>Sit and Reach</b>	Between Groups	6	2996.38	499.39	12.63*
	Within Groups	430	17002.61	39.54	
<b>Body Composition</b>	Between Groups	6	407.91	67.98	18.57*
	Within Groups	430	1574.65	3.66	

\*Significant at .05 level

F.05 (6, 430)=2.12

**Table 3. Significance of Differences between Ordered Paired Means for Boys of Twelve to Eighteen Years of Age on Modified Sit-ups**

Age in Years								
12	13	14	15	16	17	18	MD	C.I.
17.14	19.39	-	-	-	-	-	2.25	3.86
17.14	-	22.97	-	-	-	-	5.83*	3.81
17.14	-	-	21.95	-	-	-	4.81*	3.81
17.14	-	-	-	23.05	-	-	5.91*	3.81
17.14	-	-	-	-	25.46	-	8.32*	3.81
17.14	-	-	-	-	-	27.54	10.40*	3.81
-	19.39	22.97	-	-	-	-	3.58	3.86
-	19.39	-	21.95	-	-	-	2.56	3.86
-	19.39	-	-	23.05	-	-	3.66	3.86
-	19.39	--	-	-	25.46	-	6.07*	3.86
-	19.39	-	-	-	-	27.54	8.15*	3.86
-	-	22.97	21.95	-	-	-	1.02	3.81
-	-	22.97	-	23.05	-	-	0.08	3.81
-	-	22.97	-	-	25.46	-	2.49	3.81
-	-	22.97	-	-	-	27.54	4.57*	3.81
-	-	-	21.95	23.05	-	-	1.10	3.81
-	-	-	21.95	-	25.46	-	3.51	3.81
-	-	-	21.95	-	-	27.54	5.59*	3.81
-	-	-	-	23.05	25.46	-	2.41	3.81
-	-	-	-	23.05	-	27.54	4.49*	3.81
-	-	-	-	-	25.46	27.54	2.08	3.81

\*Significant at .05 level

**Statistical Analysis**

To analyse the Health-related physical fitness parameters and anthropometric characteristics of male school children, means and standard deviations were computed. For the computation of collected data, SPSS software 16.0 was used.

**RESULTS**

To assess the health-related physical fitness on its four components and anthropometric characteristics of male school children ranging between twelve to eighteen years of age, means and standard deviations were computed. The data pertaining to this has been presented in table 1 and 2 and has been depicted in Figure 1 to 4.

The mean scores of male school children ranging between twelve to eighteen years of age on different components of health-related physical fitness have been depicted in Figure 1 to 4. From data presented in table 2, it can be observed that there were significant differences among the different age groups of male school children on different components of health related physical fitness i.e. cardio-respiratory function, modified sit-ups, sit and reach test and body composition, as the obtained F-values of 21.44, 41.38, 12.63 and 18.57 respectively were much higher than the require value of F.05 (6, 430)=2.12 As the F-ratio on four components of health related physical fitness was found to be significant, Scheffe’s Test of Post-hoc comparisons was applied to find out the significance of difference between ordered paired means of different age group and data pertaining to this, have been presented in table 4 to 8 and depicted in Figure 1 to 4

**Table 4. Significance of Differences between Ordered Paired Means for Boys of Twelve to Eighteen Years of Age on Cardio-respiratory Function**

Age in Years								
12	13	14	15	16	17	18	MD	C.I.
14.65	14.64	-	-	-	-	-	0.01	0.275
14.65	-	14.16	-	-	-	-	0.49	0.271
14.65	-	-	12.26	-	-	-	2.39*	0.271
14.65	-	-	-	12.07	-	-	2.58*	0.271
14.65	-	-	-	-	12.39	-	2.26*	0.271
14.65	-	-	-	-	-	12.05	2.60*	0.271
-	14.64	14.16	-	-	-	-	0.48	0.275
-	14.64	-	12.26	-	-	-	2.38*	0.275
-	14.64	-	-	12.07	-	-	2.57*	0.275
-	14.64	--	-	-	12.39	-	2.25*	0.275
-	14.64	-	-	-	-	12.05	2.59*	0.275
-	-	14.16	12.26	-	-	-	1.90	0.271
-	-	14.16	-	12.07	-	-	2.09*	0.271
-	-	14.16	-	-	12.39	-	1.77*	0.271
-	-	14.16	-	-	-	12.05	2.11*	0.271
-	-	-	12.26	12.07	-	-	0.19	0.271
-	-	-	12.26	-	12.39	-	0.13	0.271
-	-	-	12.26	-	-	12.05	0.21	0.271
-	-	-	-	12.07	12.39	-	0.32	0.271
-	-	-	-	12.07	-	12.05	0.02	0.271
-	-	-	-	-	12.39	12.05	0.34	0.271

\*Significant at .05 level

**Table 5. Significance of Differences between Ordered Paired Means for Boys of Twelve to Eighteen Years of Age on Sit and Reach**

Age in Years								
12	13	14	15	16	17	18	MD	C.I.
26.88	28.04	-	-	-	-	-	1.16	4.07
26.88	-	30.19	-	-	-	-	3.31	3.99
26.88	-	-	24.98	-	-	-	1.19	3.99
26.88	-	-	-	29.22	-	-	2.34	3.99
26.88	-	-	-	-	30.25	-	3.37	3.99
26.88	-	-	-	-	-	33.74	6.68*	3.99
-	28.04	30.19	-	-	-	-	2.15	4.07
-	28.04	-	24.98	-	-	-	3.06	4.07
-	28.04	-	-	29.22	-	-	1.18	4.07
-	28.04	--	-	-	30.25	-	2.21	4.07
-	28.04	-	-	-	-	33.74	5.70*	4.07
-	-	30.19	24.98	-	-	-	5.21*	3.99
-	-	30.19	-	29.22	-	-	0.97	3.99
-	-	30.19	-	-	30.25	-	0.06	3.99
-	-	30.19	-	-	-	33.74	3.55	3.99
-	-	-	24.98	29.22	-	-	4.24*	3.99
-	-	-	24.98	-	30.25	-	5.27*	3.99
-	-	-	24.98	-	-	33.74	8.76*	3.99
-	-	-	-	29.22	30.25	-	1.03	3.99
-	-	-	-	29.22	-	33.74	4.52*	3.99
-	-	-	-	-	30.25	33.74	3.49	3.99

\*Significant at .05 level

**Table 6. Significance of Differences between Ordered Paired Means for Boys of Twelve to Eighteen Years of Age on Body Composition**

Age in Years								
12	13	14	15	16	17	18	MD	C.I.
9.19	9.25	-	-	-	-	-	0.06	1.24
9.19	-	10.00	-	-	-	-	0.81	1.22
9.19	-	-	10.87	-	-	-	1.68*	1.22
9.19	-	-	-	11.19	-	-	2.00*	1.22
9.19	-	-	-	-	11.79	-	2.60*	1.22
9.19	-	-	-	-	-	12.37	3.18*	1.22
-	9.25	10.00	-	-	-	-	0.75	1.24
-	9.25	-	10.87	-	-	-	1.62*	1.24
-	9.25	-	-	11.19	-	-	1.94*	1.24
-	9.25	--	-	-	11.79	-	2.54*	1.24
-	9.25	-	-	-	-	12.37	3.12*	1.24
-	-	10.00	10.87	-	-	-	0.87	1.22
-	-	10.00	-	11.19	-	-	1.19	1.22
-	-	10.00	-	-	11.79	-	1.79*	1.22
-	-	10.00	-	-	-	12.37	3.73*	1.22
-	-	-	10.87	11.19	-	-	0.32	1.22
-	-	-	10.87	-	11.79	-	0.92	1.22
-	-	-	10.87	-	-	12.37	1.50	1.22
-	-	-	-	11.19	11.79	-	0.60	1.22
-	-	-	-	11.19	-	12.37	1.18	1.22
-	-	-	-	-	11.79	12.37	0.58	1.22

\*Significant at .05 level

The data in Table 3 clearly reveal that mean difference between twelve - thirteen; thirteen - fourteen followed by fifteen and sixteen; between fourteen - fifteen followed by sixteen and seventeen; between fifteen - sixteen followed by seventeen; sixteen and seventeen and between seventeen - eighteen were not found statistically significant, as the confidence intervals were higher than the mean differences. The data clearly indicate that abdominal strength improved with age, till the age of 18 years.

It is evident from Table 4 that the mean difference between twelve - thirteen followed by fourteen; between thirteen - fourteen; and among fifteen to eighteen years of age was not statistically significant, as the confidence intervals were higher than the mean difference. The results clearly indicated that male school children do not differ in cardiovascular endurance from twelve to fourteen years of age. It means, it unproved at 12 to 14 years of age and later on, it improved significantly up to the age of eighteen years with some fluctuations.

It is quite obvious from table 5 that mean difference between twelve - thirteen followed by fourteen, fifteen, sixteen and seventeen; between thirteen - fourteen followed by fifteen, sixteen and seventeen; between fourteen - sixteen followed by seventeen and eighteen; between sixteen - seventeen years of age were statistically insignificant, as the respective confidence intervals were higher than the mean differences. It is observed that the flexibility of hamstring and back muscle did not improved up to eighteen years of age.

It is quite obvious from table 6 that mean difference between twelve - thirteen followed by fifteen; between thirteen and fourteen; between fourteen - fifteen followed by sixteen; between fifteen - sixteen; between sixteen - seventeen; and between seventeen - eighteen years of age were statistically insignificant, as the respective confidence intervals were

higher than the mean differences. It indicate that the amount of accumulated fat increased with age, though the increase was insignificant through age.

## DISCUSSION

The present study investigated the health related physical fitness of male school children aged between 12 and 18 years, who regularly enrolled in the middle and higher secondary schools. The investigation was performed with a large sampling from selected tribal region of Sarguja in Chhattisgarh, The children of this region did not have a good socio-economic condition, which can affect the health of the children. The male school children in all analyzed age groups resulted significant differences. A declined tendency was observed among male school children in all age groups on flexibility except fifteen years of age. It clearly indicates that the flexibility of hamstring and back muscle did not improved up to eighteen years of age. The analysis of data using ANOVA, Scheffe's Test shows that variance exists among different age groups and male sex in health related physical fitness components. The low levels of flexibility are especially of concern for the associated risks to low back pain and higher incidence of postural problems, besides a possible explanation for the low school performance (Hoekstra *et al.*, 2008; Kwon, Bums and Janz, 2010). The children with low levels of flexibility in the school period reported more back pain in adulthood (Kwon, Bums & Janz, 2010). Similar data have been reported in research from other countries (Powell, *et al.*, 2009). In case of abdominal strength/muscular endurance, statistically significant differences were observed among male school children in all analyzed age groups. A inclined tendency was seen among male school children in all age groups on abdominal strength/muscular endurance. It indicate that abdominal strength /muscular endurance improved with age. The inadequate levels of abdominal strength/ endurance

may cause postural and articular problems, as well as musculoskeletal injuries (Plowman, 2005 and Plowman, *et al.*, 2006). The results of the ANOVA revealed the significant differences among male school children of tribal region in their cardio-respiratory function. This was supported by Sharma (2003), Singh (2005), and Derri *et al.* (2004). They unproved in cardio-respiratory function at twelve to fourteen years of age and later on, they improved significantly up to the age of eighteen years with some fluctuations in time. The results clearly indicated that male school children of twelve to thirteen years of age do not differ significantly in cardiovascular endurance. This is a fact that low aerobic fitness is associated with high levels of cholesterol and triglycerides (Williams, 2001, Myers, 2004) imbalanced blood pressure and insulin sensitivity (Moreira *et al.*, 2011) and higher obesity risk (Ortega *et al.*, 2008). This study was supported by Sharma (2003), Singh (2005), and Derri *et al.* (2004). Results of ANOVA also indicated the significant difference among the different age groups of male school children on body composition component of health related physical fitness. The amount of accumulated fat increased with age. All male children were found under normal fat category. The excess body fat is linked with the risk of chronic diseases like blood pressure, diabetes, hypertension etc. (Sourenson and Sonne, 1988; Mossberg, 1989). Fatty children become fat adults in their later part of life (Serdula *et al.*, 1993). Growth and body composition affects physical fitness in children (Pate *et al.*, 1989; Taylor & Baranowski, 1991; Malina, 1995; Pejic *et al.*, 2004). The fatness negatively affects health related physical fitness and performance related physical fitness (Malina, 1995)

### Conclusions

1. Male school children of twelve to eighteen years of age differed significantly on all components of health related physical fitness i.e. cardio-respiratory endurance, abdominal strength and endurance, flexibility of back and hamstring muscles and body composition,
2. Abdominal strength of male school children improved with advancement of age.
3. The male school children of twelve to thirteen years of age do not differ in cardiovascular endurance. It unproved at fourteen and fifteen years of age and later on, it did not improve significantly up to the age of eighteen years.
4. The flexibility of hamstring and back muscles improved up to eighteen years of age, but declined in age of fifteen years.
5. Male school children were found to have tendency to accumulate the fat increased with advancement of age.

### Suggestions

Thus, the authors emphasize the need for educational policies which consider the benefits of adequate levels of motor performance to health during the entire school life, promoting hence the development of these health indicators in school.

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