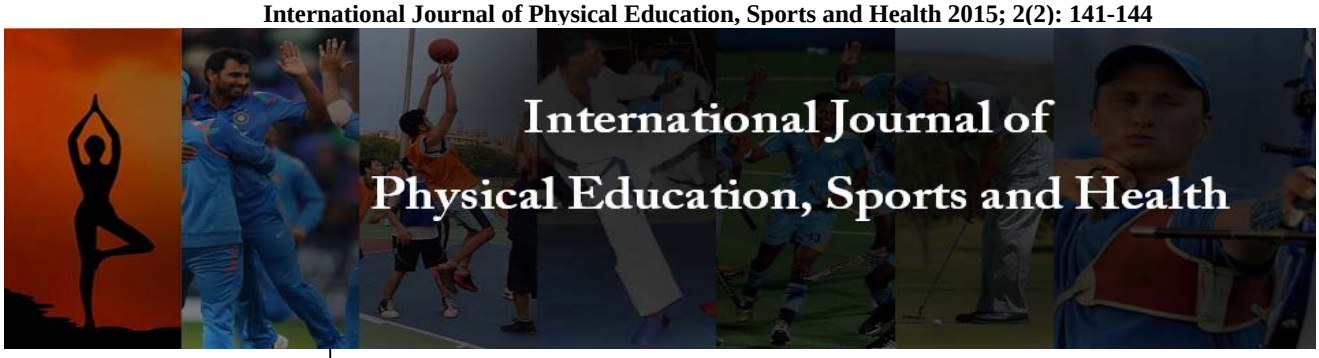

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Relationship of health related physical fitness variables to academic achievement of high school boys

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Abstract
The purpose of the present study is to find out the relationship of Health Related Physical Fitness Variables to Academic achievement of High School boys. To achieve the purpose of the study eight hundred sixty nine Male adolescent students, (N=869) in grades from 8th through 10th ranging in age between 13 to 15 years, from ten different recognized private schools of Mysore city, Were selected as subjects. Assessment of Health related fitness variables was made, that included, strength (grip And leg Strength) using a grip dynamometer and leg dynamometer; Cardio respiratory endurance (Harvard Step Test); Flexibility (sit and reach Test); Muscular endurance, (Sit-up Test); Body composition–BMI (Quetelet's Index). Academic achievement was considered as the academic performance of the subjects measured in terms of percentage of marks obtained in the examinations conducted by the schools, as given in the school records. Data of various measures obtained by the performance of subjects were analysed using product moment correlation and stepwise regression analysis. Analysis of data revealed that, Out of the seven variables only two variables, viz., cardio respiratory endurance and Flexibility were related to academic performance, whereas, the other variables did not correlate significantly with academic achievement. When the selected variables were regressed on academic achievement, only three variables viz., Flexibility, cardio respiratory endurance and body composition (BMI), emerged as major predictors of academic performance. Rest of the variables did not predict academic performance.

Keywords: Health Related Physical Fitness, Academic Achievement, High School Boys

Introduction
Background
The fitness levels of children and adolescence are in decline (Tomkinson, 2007). This is an alarming trend given that high levels of physical fitness in this age group are associated with improved physical and mental health both in the short -and long-term. (Malina, 1996) [13]. Recent studies have shown that children who display high levels of physical fitness, especially health-related fitness (Caspersen, 1985) [4], have a decreased risk of developing cardiovascular disease and other chronic illnesses (such as obesity, Type 2 diabetes mellitus, osteoporosis and some cancers (Murray, 2010) [14], are less likely to suffer from anxiety and depression. (Parfitt, 2009) [12], and more likely to perform better academically (Grissom, 2005) [8].With this background the researcher was interested in finding out the relationship Of Health Related Physical Fitness Variables to academic achievement of adolescent high school boys studying in standards 8th through 10th, ranging in age between 13-15 years

Physical Education is a field that advocates a holistic approach to human development. This approach emphasizes that the mind and body are one entity, and that anything that happens to one will affect the other. Physical educators therefore believe that the "whole child" comes to school to be educated and that this requires both physical and mental training. The relationship between physical activity and mental functioning is of particular interest in the school system because such a large portion of the school day is spent working in the cognitive domain, (Sibley and Etnier, 2003) [15].

Among the recognized objectives of physical education are the objectives of developing physical fitness, motor ability, and health status. Physical education program leads to improved physical fitness, motor ability and health which are vital to the education and academic achievement of every boy and girl (Bucher 1983) [2].

Good health generated by physical fitness is the logical and necessary starting point for the pursuit of excellence in any field. Physical vitality promotes mental vitality and this is essential to academic achievement. Physical fitness makes us work better, look better and feel better (Dutton, 1967) [6].

Educators, physicians and other health care professionals have long assumed that healthy children learn more effectively and efficiently than children who have health problems (Brown *et al.*, 2003).

Overall, a rapidly growing body of work suggests that time spent engaged in physical activity is related not only to a healthier body but also to a healthier mind (Hillman, *et al*., 2008) [10].

Although academic performance stems from a complex interaction between intellect and contextual variables, health is a vital moderating factor in a child's ability to learn. The idea that healthy children learn better is empirically supported and well accepted (Basch, 2010) [1], and multiple studies have confirmed that health benefits are associated with physical activity, including cardiovascular and muscular fitness, bone health, psychosocial outcomes, and cognitive and brain health (Strong, *et al*., 2005) [16].

Physical activity is considered a behavior focusing on the individual willingness to move part or his/her entire body, while physical fitness is defined as a biological characteristic aimed at the capacity to perform physical exertion. Therefore, if on one hand physical activity should be understood as a multidimensional constructor which includes type, intensity, duration and frequency of the body movement, on the other hand physical fitness comprises different components identified with more efficient practice of sports (sports performance related-physical fitness) and with some protection against the onset and development of chronic-degenerative disorders induced by debility in the energetic triggering and musculo-articular systems (H R P F Manual, 2013).

Physical fitness is a state of being that reflects a person's ability to perform specific exercises or functions and is related to present and future health outcomes. Historically, efforts to assess the physical fitness of youth focused on measures designed to evaluate the ability to carry out certain physical tasks or activities, often related to athletic performance. In more recent years, the focus has shifted to greater emphasis on evaluating health-related fitness (IOM, 2012) [11]. and assessing concurrent or future health status. Health- and performance-related fitness, while overlapping, are different constructs. Age- and sex-related changes in the components of both are strongly linked to the developmental changes in tissues and systems that occur during childhood and adolescence. Although genetic factors ultimately limit capacity, environmental and behavioral factors, including physical activity, interact with genes to determine the degree to which an individual's full capacity is achieved.

Cardiorespiratory endurance, muscular strength and endurance, flexibility, and body composition are components of health-related fitness historically assessed in school-based fitness assessment programs (IOM, 2012) [11]. These components of health-related fitness are considered important since they can be linked to the risk of cardio metabolic disease and musculoskeletal disability, chronic hypokinetic-related diseases. Cardiorespiratory (aerobic) endurance reflects the functioning of the pulmonary and cardiovascular systems to deliver oxygen and the ability of tissues (primarily skeletal muscle) to extract oxygen from the blood (IOM, 2012) [11]. Muscle strength is defined as the highest force generated during a single maximum voluntary contraction, whereas muscle endurance is the ability to perform repeated muscular contraction and force development over a period of time. (Malina, *et al.*, 2004) [13]. Flexibility has been operationally defined as "the intrinsic property of body tissues, including muscle and connective tissues, that determines the range of motion achievable without injury at a joint or group of joints" (IOM, 2012, 190) [11]. Body composition is the component of health-related fitness that relates to the relative amount of adipose tissue, muscle, bone, and other vital components (e.g., organs, connective tissues, fluid compartments) that make up body weight. (Going *et al*., 2012) [7].

Academic achievement is the indicator of the students' level of acquired knowledge or skill, which has been gained as a result of training or experience. "Academic achievement has been defined as the level of attainment of proficiency in academic work as evaluated by teacher or through standardized achievement tests" (caplin, 1965). It appears that there is a general consensus that the achievement of students in the courses, syllabus and subjects studied by them and as expressed in the form of grades, percentages or any other point scale can be broadly termed as the academic achievement or educational achievement. Academic achievement can be defined as excellence in all academic disciplines, in class as well as extracurricular activities.

Numerous cross-sectional and correlational studies demonstrate small-to-moderate positive or null associations between physical fitness (Grissom, 2005; Cottrell *et al*., 2007; Edwards *et al*., 2009; Eveland-Sayers *et al*., 2009; Cooper *et al*., 2010; Welk *et al.*, 2010; Wittberg *et al*., 2010; Zhu *et al*., 2010; Van Dusen *et al*., 2011) [8, 5, 18, 18], particularly aerobic fitness, and academic performance (Castelli *et al*., 2007; Chomitz *et al.*, 2008; Roberts *et al.*, 2010; Welk *et al*., 2010; Chih and Chen, 2011; London and Castrechini, 2011; Van Dusen *et al*., 2011) [3, 18]. Moreover, the findings may support a dose-response association, suggesting that the more components of physical fitness (e.g., cardiovascular endurance, strength, muscle endurance) considered acceptable for the specific age and gender that are present, the greater the likelihood of successful academic performance.

The literature does not indicate any clear linkage between PF and either academic achievement or intellectual performance. As early as 1969, Railo found no relationship between PF and either of these outcomes. More recently, Sibley and Etnier (2003) [15], concluded from a meta-regression analysis that the empirical literature did not support a link between cardiovascular PF and academic achievement.

METHODS: Subjects for the study were Eight Hundred Sixty Nine Adolescent Boys (N=869), ranging in age between 13 to 15 years, from ten different recognized private schools of Mysore city. The schools were recognized by the Karnataka State Board and considered as the best performing schools.

Procedure: Assessment of Health related fitness variables was made, that included, strength (grip And leg Strength) using a grip dynamometer and leg dynamometer; Cardio respiratory endurance (Harvard Step Test); Flexibility (sit And reach Test); Muscular endurance, (Sit-up Test); and Body composition – B M I (Quetelete's Index.)

For the purpose of the present study academic achievement is taken as the academic performance of the subject measured in terms of percentage of marks obtained by the subjects in the examinations conducted by the schools, as given in the school records.

Statistical Analysis of Data

Data of various measures obtained were statistically analysed. Statistical techniques used for data analyses were product moment Correlation and step-wise regression analyses.

Results of the Study

The figures obtained through statistical analyses of data are presented in Tables 1-3

Table 1: Results of Product Moment Correlation between Health Related Fitness variables and Academic Achievement

Variable 1	Variable 2	Correlation coefficient	Df	Significance	Interpretation
Muscular Strength (Left Hand grip strength)	Academic performance	.028	869	.407	Non-significant
Muscular Strength (Right Hand Grip Strength)	Academic performance	-.003	869	.937	Non-significant
Muscular Strength (Leg Strength)	Academic performance	.031	869	.356	Non-significant
Muscular endurance (Sit- up Test)	Academic performance	.025	869	.453	Non-significant
Cardio respiratory endurance (Harvard step test)	Academic performance	.137	869	.000	Significant
Flexibility (Sit and reach test)	Academic performance	.169	869	.000	Significant
Body Composition (BMI)	Academic performance	-.065	869	.056	Non-significant

When the Seven (07) health related fitness variables were correlated with academic performance, only 2 variables werefound to be significantly related to academic Achievement. The variables that correlated significantly and positively are Cardiovascular Endurance as mesured through Harvard step test (r=.137; p=.000), and Flexibility, as mesured through Sit and reach test (r=.169; p=.000). Other variables did not correlate significantly with academic Achievement. The values derived were, left grip strength (r=.028; p=.407), and Right girp strength (r=.003; p=.937), Leg Strength (r=.031; p=.356), Muscular Endurance (r=.025; p=.453) and BMI (r=-.065; p=.056). In other words only CVE and flexibility variables had linear relationship with academic performance, where we can infer that, as the scores incardio respiratory endurance and fiexibility tests increased, academic performance also increased linearly and significantly.

Table 2: Variables entered

Model	-+	Variables Removed	R	R Square	Adjusted R Square
1	Flexibility (Sit and reach test)	.	.169	.028	.027
2	Cardio respiratory endurance (Harvard step test)	.	.206	.042	.040
3	Body Composition (BMI)	.	.219	.048	.045

Stepwise (Criteria: Probability-of-F-to-enter <=.050, Probability-of-F-to-remove >=.100).

When 7 variables of health related fitness were regressed on academic performance, the major dependent variable, using step-wise multiple regression, the following results were obtained: Of the 7 variables entered into the equation, only 3 variables emerged as major predictors of academic performance of the students. The first and foremost variable to enter into the equation was flexibility, with squared R value of.028 and variance of 2.7; The second variable to enter into the equation along with flexibility was cardio vascular endurance with the squared R value of.042 and combined variance of 4.0; the last variable to enter into the equation was body composition (BMI) along with flexibility and cardio vascular endurance, with the squared R value of.048 and combined variance of 4.5%. In other words, these three variables predicted the academic performance to an extent of 4.5%. Rest of the variables did not enter into the equation and did not predict the extent of academic performance.

Table 3: Summary results depicting Unstandardized and Standardized beta Coefficients with t values

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	62.480	.672		93.018	.000
	Flexibility (Sit and reach test)	.661	.131	.169	5.049	.000
2	(Constant)	51.581	3.139		16.432	.000
	Flexibility (Sit and reach test)	.605	.131	.155	4.624	.000
	Cardio respiratory endurance (Harvard step test)CVE	.399	.112	.119	3.553	.000
3	(Constant)	59.395	4.722		12.580	.000
	Flexibility (Sit and reach test	.604	.131	.154	4.625	.000
	Cardio respiratory endurance (Harvard step test)	.416	.112	.124	3.699	.000
	Body Composition (BMI)	-.444	.201	-.073	-2.212	.027

The beta coefficients obtained for the first variable predicted, i.e. Flexbility at first step is.169; at second step is.155 and at 3rd step is.154. The beta value obtained for the second predicted variable, cardio vascular endurance at second step was.119 and at 3rd step was.124. The beta value obtained for BMI at 3rd step was.073. Further, all the t values obtained for the predicted variables and constants are found to be significant and varied from.027 to.000 levels.

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