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Relation between selected physical fitness components and reaction time among early adolescent pupil

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Abstract

Purpose: The aim of the study is to find out the relationship between selected physical fitness components with reaction time among early adolescent pupil.

Method: 51 students aged 12 – 14 years of Birbhum district, West Bengal, India have been tested on three physical fitness components namely; speed (50 Mt. Dash), agility (Semo agility test), explosive strength (standing broad jump) and reaction time (Nelson Hand Reaction Test). Pearson Product Moment Correlation Coefficient method has been used to find out the relationship.

Result: The result showed no significant relationship between all the three physical fitness components with reaction time with 'r' value of 0.053 (speed and reaction time), 0.029 (agility and reaction time) and -0.16 (explosive strength and reaction time).

Conclusion: The result may be due to lower level of physical fitness, socio economic status, physical activity, lifestyle etc. of the selected students.

Keywords: adolescent, pupil, reaction time, speed, agility, explosive strength

Introduction

Regular physical activities and exercises promote growth and development of the children. It is also an important aspect for health and fitness of different aged peoples. Physical activity decreases and prevents anxiety and depression and improves mental health and well-being of an individual. To make the physical activity programme more effective it should be based on developmental aspects of children's capacity (Kohl & Cook, 2013) [5].

Physical fitness, physical activities and physical exercises are different from each other (Castillo *et al.*, 2005 & Castillo *et al.*, 2006) [3, 4]. Physical fitness is the capacity to perform various physical activity efficiently where as physical activities increases energy expenditure through various body movement produced by muscle action (Ortega *et al.*, 2008) [32]. On the other hand physical exercises are those kinds of physical activities which are related to the development and maintenance of fitness and wellness (Kylasov & Gavrov, 2011) [22]. Exercise and physical activities controls weight, improves health conditions and fight against diseases, boosts energy, promotes better sleep and also provides enjoyment (Mayo Clinic, 2014) [26] and also improves the reaction ability (Roach *et al.*, 2014) [33].

In the areas like sports, academics, and other tasks of daily life reaction time (RT) is a significant component (Metin *et al.*, 2016; Sant'Ana *et al.*, 2016) [27, 35]. Reaction time is the time gap between the use of a stimulus and the appearance of suitable intentional response by a subject as quickly as possible (Teichner 1954) [39]. It is a measure of task of sensorimotor union (Shenvi and Balasubramanian, 1994) [38] and performance of an individual (Das *et al.*, 1997) [6]. It involves stimulus dispensation, supervisory, and response programming. Many factors such as physiological, psychological, pharmacological etc. have been shown to affect reaction times (Namita *et al.*, 2010 & O'Donovan *et al.*, 2006) [29, 31].

So there is a clear evident that moderate to vigorous level of physical activities and exercises improves both physical fitness as well as reaction time (Welford, 1980; Levitt & Gutin, 1971; Sjoberg, 1975; McMorris & Graydon, 2000; Tomporowski, 2003) [41, 24, 37, 25, 40]. There is a significant effect of physical fitness on simple reaction time was noted during exercise in the study of Brisswalter *et al.* (1997) [2]. There is link between physical fitness and improved cognitive performance as this boost in mental powers is associated with white matter integrity

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(Newman, 2019) [30]. The reaction time is depends on mental powers as it is related to proper brain functioning (Kosinski, 2005) [21].

On the basis of the available literatures and evidences the present researchers have hypothesized that there might be a strong relation between physical fitness and reaction time.

Purpose

The purpose of the present study was to explore the relationship between selected physical fitness components namely speed, agility and explosive strength with reaction time among early adolescent pupil.

Materials and Methods

51 school going students aged 11 to 13 have been randomly selected from different parts of Birbhum district, West Bengal, India.

For the purpose of the study as per the feasibility three physical fitness components namely speed, agility and explosive strength have been selected. The speed has been tested through 50 meter dash; agility through Semo agility test and explosive strength through standing broad jump. 50 meter dash has been recorded in nearest seconds; agility in nearest seconds and standing broad jump in nearest centimeter.

The reaction time has been tested through Nelson Hand Reaction test. The person tested stands or sits near the edge of a table, resting their elbow on the table so that their wrist extends over the side. The researcher holds the ruler vertically in the air between the subject's thumb and index finger, but not touching. Align the zero mark with the subject's fingers. When the subject indicated that they are ready the ruler has been released without warning. The subject caught the ruler as quickly as possible as soon as they see it is falling. The

distance has been recorded in meters. The test has been repeated for 20 times. The first five and the last five score have been discarded. The average of the remaining middle ten score has been taken as the subject's score as reaction time.

Table 1: Variables, Instruments, Test and Unit of Measurement

Components		Test	Scoring
Physical Fitness	Speed	50 Meter Dash	Seconds
	Agility	Semo Agility Test	Seconds
	Explosive Strength	Standing Broad Jump	Centimeter
	Reaction Time	Nelson Hand Reaction test	Centimeter

To find out and highlight the prominence and dominance of selected physical fitness components and reaction time of the early adolescent pupil descriptive statistics like mean, standard deviation etc. were used. To find out the association between physical fitness components and reaction time Product Moment Correlation coefficient method has been used. The level of Significance of the statistical result has been checked at 95% level of confidence. Proper interpretations of statistical values have been shown by graphical presentations of each parameter.

Result

Table 2: Descriptive Statistics of Physical Fitness Components and Reaction Time

Components	Mean	SD
Speed	8.49	0.58
Agility	15.14	0.644
Explosive Strength	170.57	9.613
Reaction Time	15.58	0.743

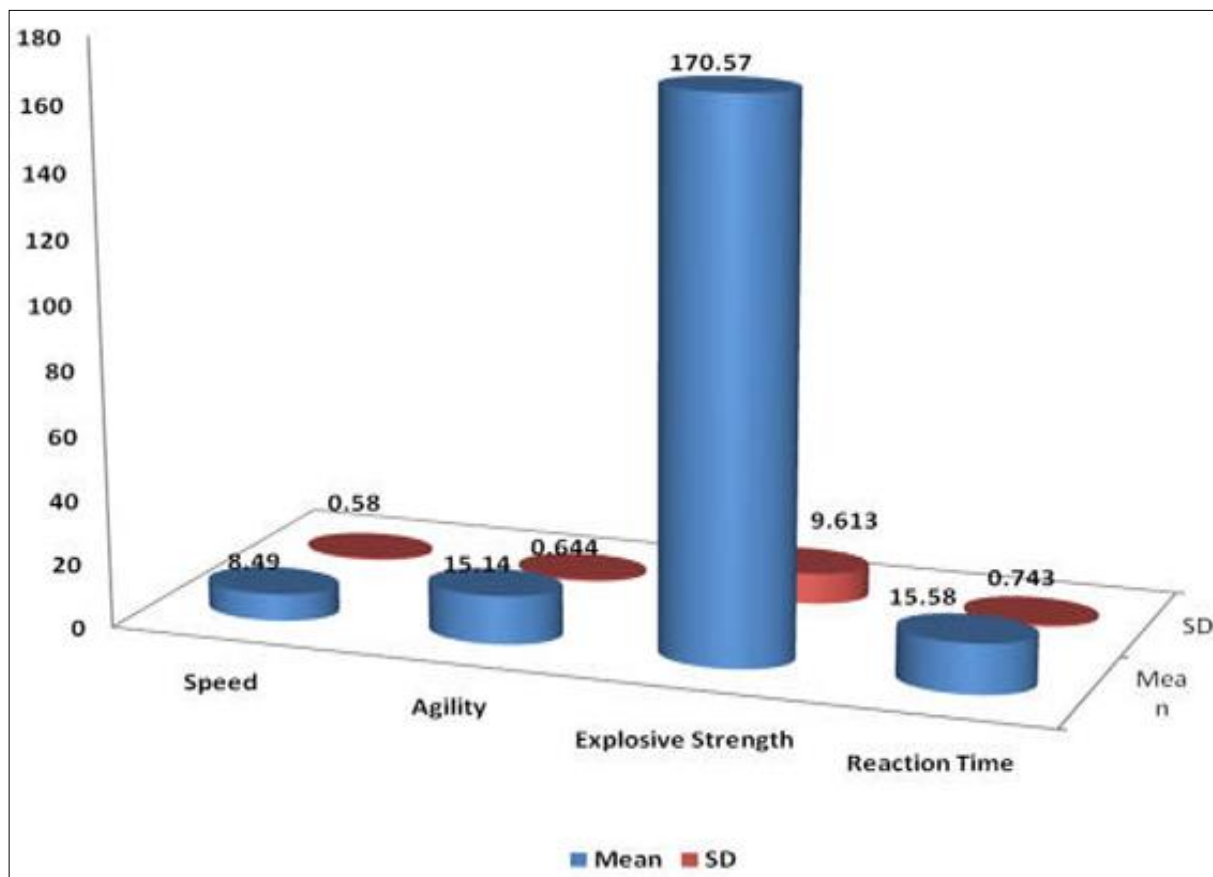


Fig 1: Descriptive Statistics of Physical Fitness Components and Reaction Time

Table – 2 and Figure – 1 is showing the result of descriptive statistics of the selected physical fitness variables and reaction time

Table 2: Correlation between Selected Physical Fitness Components and Reaction Time

Components	df (n-2)	r	Critical Value 0.05 Level
Speed	50-2 = 48	0.053*	0.273
Agility		0.029*	
Explosive Strength		-0.16*	

*Not Significant

Table – 2 is showing the result of correlation coefficient (r) between selected physical fitness components with reaction time. There is a positive correlation between speed and reaction time with r value of 0.053 which is not significant as the r value is less than the tab.o5 i.e. 0.273. There is a positive correlation between agility and reaction time with r value of 0.029 which is not significant as the r value is less than the tab.o5 i.e. 0.273. There is a negative correlation between explosive strength and reaction time with r value of -0.16 which is not significant as the r value is less than the tab.o5 i.e. 0.273.

Discussion

The statistical analysis clearly revealed that there is a very less relationship between physical fitness and reaction time. Though there is a positive relationship between speed and agility with reaction time but that relationship is statistically not significant. There is a negative relationship between explosive strength and reaction time. The present researchers have gone through various literatures and previous researches. On the basis of those and by their own understanding they would like to attribute some reasons behind such kind of result.

Alertness was primarily a reflection of speed of nerve conduction, rather than speed of muscle contraction. Reaction time and alertness have a positive relationship (Appelle & Oswald, 1974) ^[1] and alertness is mostly related to speed of nerve conduction, rather than speed of muscle contraction (Fontani *et al.*, 2005) ^[11]. Non significant relationship found in the present study between speed and reaction time may be due to that reason. The result of the present study is in accordance with the previous two studies of Henry and Trafton (1951) ^[15] and Henry (1952) ^[16] where they also found very low non significant relation between reaction time and speed.

Reaction time is related to cognitive function (Jakobsen *et al.*, 2011) ^[17] and the researches (Lennemann *et al.*, 2013) ^[23] showing that the proper physical training and agility training is very much potential for the development of cognitive performance. Furthermore socio economic status (Kodli, 2016) ^[19] also has effect on agility. The non significant relationship found between agility and reaction time. The result is in accordance with a previous research of Yildiz *et al.* (2020) ^[42]. The reasons may be the age (Rose *et al.*, 2002; Kiselev *et al.*, 2009; Esmaeilzadeh, 2014) ^[34, 18, 9], physical activities and lifestyle (Davranche *et al.*, 2006) ^[7] socio economic status (Henneberg *et al.*, 1988 & 2001) ^[13, 14] etc of the students which have not been taken into account for the present study.

The results of Esmaeilzadeh *et al.* (2018) ^[10] study indicated that the explosive strength, information processing speed and inhibitory control was significantly associated with each others. Reaction time test which is an example of information processing speed tasks are associated with health and cognitive ability (Jakobsen *et al.*, 2011; Deary *et al.*, 2011) ^[17].

^{8]}. Williams *et al.* (2020) ^[43] demonstrated that the adolescents who have higher physical fitness will have better and quicker response times, during information processing, inhibitory control and working memory tasks, than the low-fit adolescents. In the present study the non relationship between explosive strength and reaction time may be due to lower level of physical fitness level of the selected students.

Physical activities and exercises are helpful in the development of physical fitness (Mayo Clinic, 2014) ^[26] as well as reaction time (Roach *et al.*, 2014) ^[33]. So it was hypothesised by the present researcher that there would be positive relation between physical fitness and reaction time. But the result of the present study showed there is a non significant relationship between physical fitness and reaction time. It might be due to the level of physical activity of the selected pupil. Reaction time is related to cognitive function (Jakobsen *et al.*, 2011) ^[17]. Various previous researches and studies are suggesting that the active people have better cognitive function than the less active people (Sibley & Etnier, 2003; Gomez-Pinilla & Hillman, 2013) ^[36, 12]. Further it is also clear from the evidence that the active individuals are attentive toward the environment and they process the information very quickly (Gomez-Pinilla & Hillman, 2013) ^[12]. This is in accordance with the study of Moradi & Esmaeilzadeh (2015) ^[28] where they found negative relationship between reaction time and physical activity. Low socioeconomic status of the students showed slower neuromuscular reaction (Henneberg *et al.*, 1988 & 2001) ^[13, 14] which may be another reason behind the non significant relationship between physical fitness and reaction time.

Conclusion

On the basis of the result found in the present study it can be concluded that there is a non significant relationship between selected physical fitness components namely speed, agility, and explosive strength with reaction time may be due to lower level of physical fitness, socio economic status, physical activity, lifestyle etc.

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