PREVALENCE OF OBESITY AND CO-RELATIONSHIP OF SELECTED MOTOR QUALITY VARIABLES WITH BODY MASS INDEX AND FAT PERCENTAGE IN 5 TO 12 YEARS OLD SCHOOL GOING INDIAN BOYS

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ABSTRACT

This cross-sectional study was carried out in 1036 urban school going boys of 5 to 12 years of age from middle economic class Bengali families by race. For this study, different anthropometric and motor quality variables (including BMI, body fat%, hand reaction time, foot reaction time, speed of movement, agility, 30 meter sprint, standing long Jump test, vertical jump test) were measured in all selected boys. The result indicates the prevalence of being overweight and obese were 26.83% and 17.76% respectively of selected subject. BMI and motor quality values were significantly high in obese boys when compared with their non obese counterpart according to their chronological age. Product moment correlation coefficient analysis revealed that BMI and body fat percentage were significantly correlated (< 0.01) with the selected motor quality variable but BMI had not any significant correlation with speed of movement. BMI and body fat percentage were remarkably high in overweight and obese boys. Higher level of BMI and body fat percentage has a negative effect on motor performance skill. The information obtained from this study can therefore be used in the set of intervention programmes for school children in 5-12 years of age.

Keywords: BMI, Body fat%, Motor quality variable, Obesity, Overweight.

No. of Tables: 4 **No. of References: 54**

INTRODUCTION

The term obesity is defined as accumulation of excess fat in the body which has adverse effects on health. Different factors contributing to the development of childhood obesity are increased intake of high-calorie rich foods with little quantity of vitamins, micronutrients, mineral and less physical activity (Kaushik *et al.,* 2011). Video games, internet, television watching are the main underlying reasons of the physical inactivity for most children in developed and developing countries. The children in developing countries like India suffering from double form of malnutrition. Urban and semi-urban children's are afflicted with troubles of over-nutrition while rural and slam children suffer from under nutrition (Chatterjee, 2002). The several studies done in different parts of the India from 2007-2012 designate an increasing trend in the prevalence of overweight and obesity in children and adolescents (Sharma *et al.,* 2007; Kotian *et al.,* 2010; Khadilkar *et al.,* 2011; Chakraborty *et al.,* 2012).

Stature, body mass index, various skinfold thicknesses and other body dimensional measurements have internationally been established as perceptive indicators of growth and health status of children (Chatterjee and Mandal, 1993). The worldwide acceptable definition of obesity, BMI and stature are most easily assessable parameters for categorizing children as obese in age-gender-specific pattern (Cole *et al.,* 2002). Children with BMI ≥ 95th percentile are obese and those with BMI ≥ 85th percentile but < 95th percentile are defined overweight and are threat for obesity associated co-morbidities (Donohoue *et al.,* 2004).

Childhood obesity is related with a number of risk factors for the development of coronary heart disease and chronic problems such as hyperlipidemia, abnormal glucose tolerance, hypertension, orthopaedic problems, obstructive sleep apnoea, asthma, psychosocial problems, certain forms of cancer etc (Li *et al.,* 2004; Kuczmarski and Flegal, 2000). In addition to health problems, obesity is associated with poorer motor control, cognition and altered brain plasticity. Childhood obesity is also related to the reduced cognitive functions such as attention, executive function, mental rotation, reading achievement and mathematics (Davis and Cooper, 2011; Cserj´esi *et al.,* 2007; Jansen *et al.,* 2011; Lokken *et al.,* 2009; Lokken *et al.,* 2013). Obese children also have difficulty in postural coordination and increased dependency on vision to control locomotion which is quite automatic in normal weight children (D'Hondt *et al.,* 2011; D'Hondt *et al.,* 2008). Poorer posture and walking is associated with the excessive fat mass (Ponta *et al.,* 2014). Muscle quality ratio related with the adiposity that is associated with the peroneal nerve motor conduction velocity, memory performance and finger tapping speed (Moore *et al.,* 2014). Subcutaneous fatness can account for a significant variance of health-related and motor fitness (Malina *et al.,* 1995). The connection of childhood obesity to adulthood diseases is of major concern (Chatterjee *et al.,* 2006) since it is harder

to treat obesity in adults than in children (Park and Park, 2005). So, to prevent of adult diseases due to obesity will require the prevention and management of childhood obesity (WHO, 2000).

Above mentioned health risk associated conditions are possibly related with the physical health profile of overweight and obese children. These health risk factors are associated with overweight and obesity in children which resists physiological action. It is important to determine the basic nature of the relationship between the physical fitness in terms of motor quality development and overweight and obesity in Indian Bengali boys.Hence, the main aim of this study was to determine the rate of prevalence of obesity and its effect on selected motor quality variables and its co-relationship with body mass index and fat percentage.

Material and Method

Selection of Subjects and Experimental Design

This cross- sectional study was conducted in different urban private schools of West Bengal in India during the period of 2010 to 2012. In this present study, initially total 1450 boys having age group between 5-12 years were included from middle socioeconomic class Bengali families which were considered in accordance with the guidelines laid down by ICMR (Agarwal, 2008). Among 1450 boys, 267 boys do not agreed to participate for volunteered study. Hence, 1183 boys were investigated for the present study. On the basis of BMI-age-percentile values (de Onis *et al.*, 2007), the boys those belong to underweight (147) were also excluded. Finally, 1036 boys were selected and data obtained from them in connection with the study. The boys were divided according to their chronological age into four groups such as 5-6 years, 7-8 years, 9-10 years, 11-12 (but below 13 years) years and also categorised in three sub divisions according to their BMI - age- percentile value such as normal weight, overweight and obese boys.

The age of the each boys were determined from their date of birth as recorded in their school register. The boys were randomly sampled from their population from different private sector school of three different districts such as Paschim Medinipur, Bankura & Purba Medinipur from West Bengal. For this study, the parents of the participating boys and also head of the school were asked to give written approval for their boys to be involved in this research programme .This study was done after the receiving of clearance from Human Ethical Committee from Vidyasagar University, Midnapore, West Bengal.

Measurement of anthropometric parameters

Height

Body stature was measured by adopting standard procedure (Johnson and Nelson, 1974). Body height was measured by the calibrated anthropometric rod procedure from reliable company. The stood bare foot and erect with heels together and arms hanging naturally by the sides. The height was recorded to the nearest centimetre.

Body mass

Body mass was measured by adopting standard procedure (Johnson and Nelson, 1974). Body weight of the subject was taken by the calibrated electronic

portable weighing machine. The boys wearing vest and shorts stood at the centre of the weighing machine looking straight. The body weight was recorded to the nearest kilogram.

Body mass index (BMI)

BMI was calculated as the body weight in kilogram divided by height in square meters ($kg.m^{-2}$) .For the purpose of identification of overweight and obesity of the boys was considered by plotting BMI value on the WHO growth table to determined the corresponding BMI-for –age percentiles (de Onis *et al.,* 2007) and also following the proposed guidelines by T.J. Cole (Cole *et al.,* 2002).

Measurement of skinfold thickness

The skinfold thickness were measured at the right side on the triceps and sub-scapula with the boys standing in the proper erect posture according to the methods proposed by Johnson & Nelson (Jonson and Nelson, 1996) using Holtain skinfold callipers. For the computation of body fat% of boys were done using triceps and subscapular equation that is developed by Slaughter (Slaughter *et al.,* 1988).The equation is as follows:

Body fat % for boys = 783*(triceps + subscapular) -1.7

Measurement of motor performance variables

Determination of hand reaction time

The boys sited with his fore forearm and hand was resting comfortably on the table. The tips of the thumb and index finger were held in a ready to pinch position about 3 or 4 inches beyond the edges of the table. The upper edges of the thumb and index finger were in a horizontal position. Tester holds the stick timer close to the top, letting it hand between the boy's thumbs and index finger. The boys were directed to look at the concentration zone and were told to react by catching the stick when it is released. The boys were not allowed looking at the tester's hand and nor to move his hand up or down while attempting to catch the falling stick. The boys were allowed ten trials. Each drop was proceeded command of "ready". This procedure was followed by according methods proposed by Johnson & Nelson (Johnson and Nelson, 2007).

Determination foot reaction time

The boys were sited on a table which was about 1 inch from the wall. With his shoe off, the boys positions his foot so that the ball of the foot was held about 1 inch from the wall with the heel resting on the table about 2 inches from the edges. The tester holds the reaction timer next to the wall so that it hangs between the wall and the boy's foot with the base line opposite the end of the big toe. The boys look at the concentration zone and were told to react, when the timer was dropped, by pressing the stick against the wall with the ball of this foot. The boys were allowed ten trials (Johnson and Nelson, 2007).

Determination of speed of movement

The boys were sited at a table with his hands resting on the edges of the table. The palms were facing one another with the inside border of the little fingers along two lines which were marked on the edges of the cable 12 inches apart. The tester holds the timer near its top so that it hangs midway between the boy's palms. The base line was positioned so it is level

with the upper borders of the boy's hands. After the introductory command "ready" was given, the timer (ruler) was released and the boys clapping the hands together. The boys must be careful not to allow his hands to move up or down when he was clapping the hands together. Ten trials were given (Johnson and Nelson, 2007).

30 meter sprint

The boys were instructed to perform 30 meter sprint (flying start) and the reading were taken in seconds by stop watch. For the measurement, the time was performed twice. From there, faster time was selected for analysis (Svensson and Drust, 2005).

Agility (4 × 10 meter shuttle run)

This test helps to know about the integral evaluation of the speed, agility and coordination. The subject does four shuttle runs as fast as possible between 2 lines 10 meters apart. At each end the boys places or picks up an item (a wooden block) beside the line on the floor (España-Romero *et al.,* 2010).

Vertical jump test

This test helps to know about the muscular strength. The subject was asked to stand erect facing the wall. His dominant hand's fingertips are to a maximum height on the wall without lifting the heels so as to mark his maximum reach point. The fingertips were chalked. With the chalked hand side towards the wall, a vertical jump was to be performed by the subject to make another mark at the maximum height of the jump. The subject was not allowed to run or hop. The subject was given two trials and from there, the best one performance was considered (Johnson and Bahamonde, 1996).

Standing long jump

This test is also called the Broad Jump. It is very common test for the measurement of the explosive power of the legs. The subject was to be stands behind a line marked on the ground with feet slightly apart. A two foot take-off and landing is used, with swinging of the arms and bending of the knees to provide forward drive. The subject attempts to jump as far as possible, landing on both feet without falling backwards. Two trials were allowed, best one attempt was considered (Chung *et al.,* 2013).

Statistical Analysis

All the values of Anthropometric and Motor quality variable were expressed as Mean±SD (standard deviation). Analysis of variance (ANOVA) followed by Scheffe's multiple comparison test was performed to find out the mean difference of different Anthropometric and Motor quality variable of different categorised. In each cases significant level were chosen at 0.05 levels. Pearson product moment correlation coefficient (r) was used to examine the co-relationship of BMI and Fat percentage with the motor quality variable. Data analysis was executing using a statistical software package Origin 8.1 & Prism Graph pad 6.

Results

Prevalence of underweight, normal, overweight and obesity according to age groups (BMI Percentile)

In Table 1, it was showed that normal, overweight and obese boys were found 57.95%, 24.89%, 17.14% respectively in the

age group 5-6 years. On the other hand, 55.93 %, 27.58% and 16.47% boys were found as normal, overweight and obese respectively from the age group 7-8 years. Prevalence of normal, overweight and obesity were found 55.89%, 23.95% and 20.95% respectively in 9-10 years age group. In case of 11-12 years age group, 52.05%, 30.71% & 17.22% boys were found as normal, overweight and obese respectively.

Table 1. Prevalence of normal weight, overweight and obesity according to age groups (BMI Percentile).

Age (Years)	No. of Sample	Frequency & Percentage	Normal	Overweight	Obese
5-6	245	F	142	61	42
		%	57.95	24.89	17.14
7-8	261	F	146	72	43
		%	55.93	27.58	16.47
9-10	263	F	147	63	53
		%	55.89	23.95	20.95
11-12	267	F	139	82	46
		%	52.05	30.71	17.22
Total	1036	F	574	278	184
		%	55.40	26.83	17.76

Comparison of different anthropometric variables of normal, overweight and obese boys

Present study showed that there was no significant variation of height of same age group among normal, overweight and obese (Table 2). On the other hand, when we compared with mean value of body mass, BMI and skinfold thickness, it was found that triceps, subscapula of normal boys of similar age group were significantly ($p<0.05$) differences with the overweight and obese boys. It was also observed that mean values of above mentioned parameters of overweight boys differed significantly ($p<0.05$) from those of obese boys of similar age group. Obese boys were found to possesses significantly higher values ($p<0.05$) of body fat% and LBM when compared with their non-obese counterpart of identical age group.

Table 2. Comparison of different Anthropometric variables of Normal weight, Overweight and Obese boys

Age (yrs.)	Category	Height (cm)	Body Mass (Kg)	BMI (Kg/m^2)	Body Fat%
5-6 (N=245)	Normal(a) (n=146)	113.2 ± 4.14	19.00 ± 1.82	14.86 ± 0.54	12.24 ± 1.84
	Overweight(b) (n=61)	113.51±3.62	22.53±1.81	17.51±0.49	18.16 ± 2.57
	Obese(c) (n=42)	114.15±3.65	26.51±1.83	20.40±0.89	21.71 ± 3.60
F values		0.77	296.59	1534.50	304.05
Level of significance		ns	**(ab)(bc)(ac)	**(ab)(bc)(ac)	**(ab)(bc)(ac)

7-8 (N=261)	Normal(a) (n=146)	126.00±2.91	24.83±1.65	15.67 ± 0.71	13.40 ± 1.89
	Overweight(b) (n=72)	125.58±2.87	29.47±2.22	18.69 ± 0.71	20.09 ± 1.93
	Obese(c) (n=43)	125.87±2.77	33.97 ± 2.21	21.41 ± 0.70	24.57 ± 4.32
F values		0.49	403.59	1228.70	413.80
Level of significance		ns	**(ab)(bc)(ac)	**(ab)(bc)(ac)	**(ab)(bc)(ac)
9-10 (N=263)	Normal (n=147)	135.73±2.98	29.5 ± 2.38	16.18 ± 0.94	13.15 ± 2.36
	Overweight (n=63)	136.85±2.86	37.29 ± 2.51	19.86 ± 0.79	21.65 ± 1.79
	Obese (n=53)	136.51±2.98	44.04 ± 3.98	23.59 ± 1.10	26.46 ± 3.54
F values		3.65	541.36	1271.81	629.52
Level of significance		ns	**(ab)(bc)(ac)	**(ab)(bc)(ac)	**(ab)(bc)(ac)
11-12 (N=267)	Normal (n=139)	147.65±3.35	35.56±2.61	16.34 ± 0.84	14.13 ± 2.48
	Overweight (n=82)	147.39±3.23	47.63±3.40	21.94 ± 0.75	24.97 ± 2.09
	Obese (n=46)	147.47±3.12	53.88±4.22	24.78 ± 0.90	28.28 ± 4.21
F values		0.18	727.53	2314.42	655.62
Level of significance		ns	**(ab)(bc)(ac)	**(ab)(bc)(ac)	**(ab)(bc)(ac)

Values were expressed in terms of mean±SD, N; 1036, small 'n' indicates that number of samples in each category, one way ANOVA followed by Scheffe's multiple comparison test was performed among the group a, b and c for each parameter in each age group. (ab) indicates 'a' significantly differed from 'b' $p<0.05$, (bc) indicates 'b' significantly differed from 'c' $p<0.05$, (ac) indicates 'a' significantly differed from 'c' $p<0.05$; *indicates significantly differed of the values at the level of 0.05, **indicates significantly differed of the values at the level of 0.01, ns; not significant, BMI; body mass index

Comparison of different motor quality variables of normal, overweight and obese boys

In Table 3, Motor quality variables showed significant differences among normal, overweight and obese boys of similar age division. In case of 5-6 years age group, it was observed that obese boys had significantly ($p<0.05$) higher values of hand reaction time, foot reaction time, speed of movement, agility and 30 meter sprint than the normal weight and overweight boys. In case of vertical long jump test, there was a significant ($p<0.05$) variation observed between obese and overweight boys and as well obese and normal weight boys of 5-6 years age group. On the other hand, obese boys also exhibited significantly ($p<0.05$) higher values of hand reaction time, foot reaction time, speed of movement, agility and 30 meter sprint than the normal weight and overweight boys of 7-8 years age group. Alternatively, overweight boys also exhibited significantly ($p<0.05$) higher values of hand reaction time, foot reaction time, speed of movement, agility and 30 meter sprint than the normal weight boys of 7-8 years age group. The results obtained from the standing long jump, vertical jump test, hand reaction time, foot reaction time, speed of movement, agility and 30 meter sprint showed that significant differences ($p<0.05$) were found between the obese and overweight boys of 9-10 years age group. Alternatively, obese boys also exhibited significantly ($p<0.05$) higher values of hand reaction time, foot reaction time, speed of movement, agility and 30 meter sprint than normal weight boys of 9-10 years age group. In case of 11-12 years age group, the hand reaction time values showed that there was no significant difference between overweight and normal children.

Table 3. Comparison of different Motor quality variables among normal weight, overweight and obese boys

Age group (yrs.)	Category	HRT (sec)	FRT (sec)	SOM (sec)	Agility (sec)	30 meter Sprint(sec)	VJT (cm)	STLJ (cm)
5-6 (N=245)	Normal (a) (n=142)	0.279 ± 0.035	0.360 ± 0.013	0.812 ± 0.012	15.08 ± 0.670	7.76 ± 0.234	20.25 ± 3.53	97.3 ± 9.73
	Overweight (b) (n=61)	0.320 ± 0.049	0.394 ± 0.016	0.831 ± 0.009	16.60 ± 0.538	8.00 ± 0.248	16.09 ± 2.96	88.13 ± 11.30
	Obese (c) (n=42)	0.346 ± 0.048	0.408 ± 0.020	0.859 ± 0.027	18.41 ± 0.532	8.80 ± 0.352	12.79 ± 2.76	74.08 ± 6.78
F values		49.93	210.04	157.25	544.89	253.22	96.53	95.83
Level of significance		*(ab)(bc)(ca)	*(ab)(bc)(ca)	*(ab)(bc)(ca)	**(ab)(bc)(ca)	**(ab)(bc)(ca)	**(ab)(bc)(ca)	**(ab)(bc)(ca)
7-8 (N=261)	Normal (a) (n=146)	0.258 ± 0.034	0.334 ± 0.013	0.786 ± 0.020	14.10 ± 0.609	6.80 ± 0.300	26.23 ± 4.20	110.38 ± 12.07
	Overweight (b) (n=72)	0.299 ± 0.050	0.364 ± 0.022	0.814 ± 0.019	15.54 ± 0.615	7.25 ± 0.308	21.04 ± 3.71	103.52 ± 11.39
	Obese (c) (n=43)	0.319 ± 0.040	0.384 ± 0.024	0.839 ± 0.015	16.71 ± 0.565	8.20 ± 0.216	17.23 ± 3.02	93.64 ± 13.33
F values		48.60	148.59	142.25	361.07	393.46	105.25	33.39
Level of significance		*(ab)(bc)(ca)	*(ab)(bc)(ca)	*(ab)(bc)(ca)	**(ab)(bc)(ca)	**(ab)(bc)(ca)	**(ab)(bc)(ca)	**(ab)(bc)(ca)
9-10 (N=26)	Normal (a) (n=147)	0.235 ± 0.037	0.294 ± 0.019	0.734 ± 0.019	13.30 ± 0.558	6.32 ± 0.209	31.74 ± 5.07	123.69 ± 12.95
	Overweight (b) (n=63)	0.266 ± 0.046	0.329 ± 0.014	0.761 ± 0.014	14.73 ± 0.294	6.60 ± 0.240	24.85 ± 4.57	112.92 ± 11.69
	Obese(c) (n=53)	0.296 ± 0.039	0.346 ± 0.018	0.782 ± 0.018	15.80 ± 0.328	7.50 ± 0.306	20.76 ± 3.75	103.13 ± 11.76
F values		48.78	180.48	69.33	625.85	475.30	122.36	56.64
Level of significance		*(ab)(bc)(ca)	*(ab)(bc)(ca)	*(ab)(bc)(ca)	**(ab)(bc)(ca)	**(ab)(bc)(ca)	**(ab)(bc)(ca)	**(ab)(bc)(ca)
11-12 (N=267)	Normal (a) (n=139)	0.223 ± 0.041	0.273 ± 0.024	0.630 ± 0.028	12.63 ± 0.404	5.77 ± 0.336	35.71 ± 5.42	145.30 ± 19.75
	Overweight(b) (n=82)	0.244 ± 0.049	0.304 ± 0.020	0.664 ± 0.042	14.15 ± 0.461	6.20 ± 0.361	29.38 ± 4.01	130.27 ± 10.27
	Obese(c) (n=46)	0.269 ± 0.063	0.318 ± 0.030	0.684 ± 0.038	15.10 ± 0.240	7.42 ± 0.393	25.93 ± 4.27	119.11 ± 8.96
F values		16.34	77.12	50.26	791.06	373.49	88.93	55.61
Level of significance		*(ab)(bc)(ca)	*(ab)(bc)(ca)	*(ab)(bc)(ca)	**(ab)(bc)(ca)	**(ab)(bc)(ca)	**(ab)(bc)(ca)	**(ab)(bc)(ca)

Values were expressed in terms of mean±SD. N; 1036, small 'n' indicates that number of sample each category, one way ANOVA followed by Scheffe's multiple comparison test was performed among the group a, b and c. (ab) indicates 'a' significantly differed from 'b' $p<0.05$, (bc) indicates 'b' significantly differ from 'c' $p<0.05$, (ac) indicates 'a' significantly differ from 'c' $p<0.05$, *indicates significantly differed of the values at the level of 0.05, **indicates significantly differed of the values at the level of 0.01, ns; not significant, HRT; hand reaction time, FRT; foot reaction time, SOM; speed of movement, 30MS; 30 meter sprint, SLJT; standing long jump test, VJT; vertical jump test.

Analysis of correlation of fat % and BMI with different motor quality variables

The relationship of body fat% and BMI with different motor quality variables are shown in Table 4. BMI was found to have significant positive correlation with different motor quality variables such as hand reaction time (r = +0 .417; 95% CI 0.42, 0.52; P < 0.01), foot reaction time (r

= +0.411; 95% CI 0.35, 0.46; P < 0.01), agility (r = +0.364; 95% CI 0.31, 0.41; P < 0.01) but significantly negative correlation was found with the vertical jump test (r = - 0.166; 95% CI - 0.22, - 0.10; < 0.01). On the other hand, body fat% was found to have significant positive correlation with the selected motor quality variables like hand reaction time (r = 0.614; 95% CI 0.57, 0.65; P < 0.01), foot reaction time (r =0.510; 95% CI 0.46, 0.55; P< 0.01), speed of movement (r = 0.082; 95% CI – 0.21, 0.14; p = 0.082), agility (r = 0.413; 95% CI 0.36, 0.46; P< 0.01), 30 meter sprint (r = 0.276; 95% CI 0.21, 0.36; P< 0.01) and negatively correlated with the gross motor skill such as standing long jump test (r = - 0.162; 95% CI - 0.22, - 0.10; P< 0.01), vertical jump test (r = - 0.209; 95% CI - 0.26, -0.15; P< 0.01).

Table 4. Product moment correlation coefficient of BMI and Percentage of Body fat with different Motor quality variables (no. of cases 1036)

Variables	BMI (kg/m^2)			Body fat%		
	r values	95% CI	Significance (p)	r values	95% CI	Significance (p)
HRT (sec)	0.286	0.229, 0.341	< 0.01	0.396	0.342, 0.448	< 0.01
FRT (sec)	0.136	0.076, 0.195	< 0.01	0.247	0.188, 0.303	< 0.01
SOM (sec)	-0.055	-0.11,-0.00	ns	0.016	- 0.044, 0.07	ns
Agility (sec)	0.365	0.311, 0.416	< 0.01	0.398	0.340, 0.443	< 0.01
30 meter sprint (sec)	0.179	0.120, 0.238	< 0.01	0.218	0.160, 0.276	< 0.01
VJT (cm)	- 0.167	- 0.225, - 0.107	< 0.01	- 0.217	- 0.274, - 0.158	< 0.01
SLJT (cm)	- 0.091	- 0.129, - 0.008	<0.05	- 0.145	- 0.204, - 0.084	< 0.01

Two tailed of significance was used, ns; not significance, 95% CI; 95% Confidence intervals.

DISCUSSION

It is well established from different worldwide obesity related studies (Ortega and Ruiz, 2007; Bovet and Burdette, 2007) that overweight and obesity are global epidemic and threat in children and also in pubescent. From the present study, the prevalence of being overweight and obesity in the selected boys were (5-12 years of age) 26.83% and 17.76% respectively. On the other hand, 55.40% boys were normal weight out of 1036 selected sample. From the results, it has also been noted that the prevalence of overweight (30.71%) and obesity (17.92%) was high in 11-12 and 9-10 years of age group respectively. Similar trend of prevalence rate of overweight and obesity was also reported previously at Pune city in India. (Khadilkar and Khadilkar, 2004; Mahshid *et al.*, 2005).

In our study it has been shown that the obese boys were not able to run quickly as their non-obese counter part of identical age group, similar results were found from the study of Graf *et al.*, (2004) and Morano *et al.*, (2011). On the other hand, gross motor skill like jumping ability in the form of standing long jump, vertical long jump value of obese boys were very poor when compared with non-obese group in the same group in our study.

D'Hondt *et al.*, (2007) reported that children with high BMI and fat % affect the fine and gross motor skill performance under different postural constraints. Deposition of excess fat on the limb joint reduces the limb movement and

decreases reflex also. It was found that obesity influences the body geometry and increases the mass of different body segments (Mukherjee *et al.,* 2015). A report also revealed that children who were obese and overweight showed much more impairments in motor proficiency and were less physically active when compared with the non-obese counterpart (Numez-Gaunaurd *et al.,* 2013).

According to other studies showed that the overweight and obese children were significantly weaker from normal weight children in standing long-jump as well as in vertical jump performance as measurements of muscle strength (Tokmakidis *et al.,* 2006; Wearing *et al.,* 2007). Our study have also shown that the mean values of vertical jump and standing long jump were significant ($p<0.05$) higher in 11 to 12 years old boys in three body weight categorise because this age group represents the onset of adolescence. In the onset of puberty or during puberty, children obtain the capability to take higher advantages of elastic energy storage in the musculotendinous system while performing peak counter-movement jumps (Korff *et al.,* 2009).

A study also indicated that overweight and obese boys as well as girls in the 6-18 year old age group were found significantly weaker in abdominal muscle patience tests (Chen *et al.,* 2006). In addition, we also observed a significant ($p<0.01$) inverse relationship of BMI and fat % with fine motor skill like hand reaction time, foot reaction time and speed of movement. Similar results also found in few previously studies in children with different ages ranging from kindergarten to 10 years (Kambas *et al.,* 2012; Morrison *et al.,* 2012).

Although, few studies (Eckner *et al.,* 2006) has reported positive relationship between reaction time and obesity, but the results of present study demonstrated significantly ($p<0.01$) positive correlation between body fat % and motor performance skill that means higher body fat values in boys indicated lower motor performance skill in terms of reaction time.

The results of present study also demonstrated that motor quality (in terms of agility, 30 meter sprint) values were lower in obese children than in normal weight and overweight boys in all age group. Therefore, obese subjects are not enable rapidly change their body position and direction in precise manner. Generally, there are consistent inverse correlations among weight status and motor competence (Jones *et al.,* 2010; Barnett *et al.,* 2008).

The mean values of vertical jump and standing long jump were the lowest in overweight and obese boys when compared with healthy normal weight boys, the reason for poorer performances may be the difficulty faced during moving extra load generated from excess body fat during weight bearing task (Chen *et al.,* 2002; Malina *et al.,* 1995).

It is understandable from the results of the study that overweight and obesity do have a negative effect on the health promotional motor quality fitness variable of 5 to 12 years school children. The negative effect is the greatest in muscle power, speed, flexibility and fine motor skill of overweight and obese boys.

Conclusion

From this study it can be concluded that BMI and fat % are remarkably high due to higher level of body fat in overweight and obese boys. Higher level of BMI and body fat % has a negative effect on motor performance skill. The information obtained from this study can therefore be used in the set of intervention programmes for school children in 5-12 years of age. Furthermore, it provides confirmation for the essential of a strong establishment of motor quality development in relation to a physically active lifestyle for all boys. This study have been inadequate by its cross-sectional intend. Future studies required to employing a longitudinal design for completely recognize the composite relations of obesity and motor quality development in 5 to 12 years boys.

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