

The difference among various measurements, weight, height, body mass index waist to hip ratio, systolic blood pressure and diastolic blood pressure for the age groups seven to nine years is shown in (Table 4). Among the seven year old children the girls were found to have higher mean values for weight, height body mass index, waist- Hip ratio, than boys but the 't' values were found to be non-significant.

Table 4: Represents the difference in the various measurements among the different categories of BMI based on IOTF criteria. (8 years age group)

Measurement	Groups	Boys		F Value	Girls		F Value
		Mean ± SD			Mean ± SD		
Weight	1	17.25 ± 0.35		140.98	-		
	2	19.86 ± 0.84		(0.00)	20.25 ± 1.8	32.77	
	3	24.66 ± 0.41		***	24.22 ± 0.23	0.00	
	4	28.50 ± 0.70			28.75 ± 1.77	***	
Height	1	119.30 ± 0.98			-		
	2	120.11 ± 1.03		2.619	120 ± 1.12	3.27	
	3	121.23 ± 0.85		(0.06)	121.43 ± 0.67	*	
	4	120.65 ± 1.63			121.10 ± 1.27	(0.00)	
WHR	1	0.79 ± 0.04			-		
	2	0.85 ± 0.04		2.42	0.88 ± 0.33	26.79	
	3	0.85 ± 0.04		(0.086)	0.87 ± 0.09	(0.00)	
	4	0.85 ± 0.06			0.93 ± 0.06	***	
SBP	1	90.00 ± 0.00			-		
	2	98.21 ± 7.9		1.683	97.15 ± 4.96		
	3	99.33 ± 5.72		(0.192)	98.33 ± 12.54	0.87	
	4	107.00 ± 11.31			105.00 ± 4.24		
DBP	1	59.50 ± 7.1			-		
	2	57.83 ± 5.4		0.966	58.92 ± 18.04		
	3	59.67 ± 8.45		(0.421)	62.50 ± 10.40	.30	
	4	65.00 ± 7.07			67.50 ± 3.54		

** , P < 0.01, *** , P < 0.001

The mean values for systolic and diastolic blood pressure were however higher among boys as compared to girls, but 't' values were found to be non-significant. For the age group 8 years, weight, BMI, WHR, SBP and DBP were found to be higher among girls as compared to boys. The 't' values were found to be significant only for height, BMI, SBP. Similarly, for the age group nine years, measurements such as weight, BMI, WHR, SBP and DBP were found to have higher mean values for girls as compared to boys, but the 't' values were found to be statistically significant only for weight, BMI, WHR. Analysis of Variance was used to assess the differences in the various measurements for the different categories of Body mass index based on percentiles. Weight was found to have highest mean value in the obese categories. The 'F' value was statistically significant for all the three age group children among both boys and girls. Mean values of height were also found to be higher for overweight / obese children as compared to normal children. The 'F' value found to be significant for 8 years and 9, similarly WHR was also found to be higher among overweight and obese children in the age group 8 and 9 years.

Table 5: represents the difference in various measurements among the different categories of BMI based on IOTF Criteria. (9 years age group)

Measurement	Group	Males Mean ± SD	F Value	Girls Mean ± SD	F Value
Weight	1	19.10 ± 2.22		19.00 ± 1.4	
	2	24.11 ± 2.33	86.43	23.52 ± 4.34	105.03
	3	29.10 ± 3.48	(0.00)	28.44 ± 4.02	(0.00)
	4	36.50 ± 7.41	***	40.76 ± 5.56	***
Height	1	128.82 ± 6.85		127.15 ± 3.88	
	2	129.92 ± 5.04	3.34	128.46 ± 5.61	6.28
	3	131.28 ± 5.58	(0.02)	130.07 ± 6.63	(0.00)
	4	133.19 ± 5.62	**	133.44 ± 5.09	***
WHR	1	0.83 ± 0.03		0.83 ± 0.01	
	2	0.82 ± 0.13	0.52	0.85 ± 0.42	10.88
	3	0.84 ± 0.07	(0.66)	0.85 ± 0.35	(0.00)
	4	0.85 ± 0.03		0.91 ± 0.07	***
SBP	1	102.60 ± 9.20		94.50 ± 6.36	
	2	97.95 ± 7.10	26.53	103.02 ± 9.05	15.60
	3	103.02 ± 9.37	(0.00)	100.47 ± 7.33	(0.00)
	4	113.47 ± 10.74	***	114.64 ± 10.70	***
DBP	1	58.80 ± 5.21		59.00 ± 1.41	
	2	61.66 ± 7.08	21.72	64.00 ± 7.68	16.61
	3	65.00 ± 8.77	(0.00)	65.65 ± 9.26	(0.00)
	4	74.38 ± 8.91	***	75.90 ± 9.20	***

** , P < 0.01, *** , P < 0.001

F values were found to show significant differences but not for age group 7 years. Systolic blood pressure showed higher mean values for obese category children as compared to normal children. The 'F' values were found to be significant for the age group 7 and nine years. The mean values for diastolic blood pressure were also found to higher among overweight / obese category as compared to normal. The 'F' values were found to be statistically significant for 7 and 9 years age group. (Table 3, 4 & 5)

BMI showed statistically significant correlation with blood pressure both SBP and DBP among both boys and girls. WHR however showed significant correlation with SBP, only among girls. (Table 6).

Table 6: Correlation between Adiposity indices and blood pressure among Boys and Girls (7-9 years)

Adiposity index		SBP	DBP
WHR	Boys	0.03	0.04
	Girls	0.19*	0.09
BMI	Boys	0.48**	0.54**
	Girls	0.9**	0.39**

** , P < 0.01, *** , P < 0.001

As far as the Life style patterns are concerned, when the time spent, was considered in hours for various activities significant difference was observed between normal versus overweight children (both genders) for the number of hours for sleep, sedentary activities as well as energy expensive activities (Table 7).

Table 7: Represents the mean time spent in various activities by the children- (7 to 9 years).

Category of children		Time spent in hrs/ day (mean ± SD)		
		Sleep	Sedentary Activity	Energy Expensive Activity
Total children 404		8.95 ± 0.90	3.78 ± 0.89	1.61 ± 0.61
Normal wt children	251	8.95 ± 0.90	3.78 ± 0.89	1.61 ± 0.61
		8.89 ± 0.81	3.59 ± 0.85	1.70 ± 0.61
Overweight/children obese	153	9.34 ± 0.89	4.58 ± 0.89	1.60 ± 0.45
Normal weight Boys	139	8.90 ± 0.79	3.65 ± 0.98	1.64 ± 0.62
Overweight and obese Boys	92	9.21 ± 1.06	4.58 ± 0.98	1.32 ± 0.45
Normal weight Girls	102	8.89 ± 0.85	3.56 ± 0.89	1.51 ± 0.61
Overweight and obese Girls	61	9.49 ± 0.79	4.39 ± 0.85	1.10 ± 0.51

Underweight children are not included. (n = 10).

The values of ‘t’ were found to be statistically significant showing difference between normal and overweight boys for sedentary as well as energy expensive activities. For girls, however the difference was found to be statistically significant for all the three categories i.e. number of hours of sleep, sedentary and energy expensive activities (Table 8).

Table 8: represents the ‘t’ test for children for the time spent in various activities, by the children (7 to 9 years)

Category of children	Sleep	Sedentary Activity	Energy Expensive Activity
Normal vs overweight / obese children	3.29 *	7.19 *	4.95 *
Normal vs overweight / obese boys	1.89	5.72 *	4.15 *
Normal vs overweight / obese girls	3.21 *	4.45 *	3.34 *
Overweight / obese boys vs overweight / obese girls	1.90	0.51	1.14

*P<0.05

Overweight children belonged more to the families where both parents were overweight (Table 9).

Table 9: Shows the weight status of parents of children (7 to 9 years)

	Overweight / obese Both Parent Single		Normal (Both Parents)	Chi-square
Normal weight = 241	61 (25.3%)	92 (38.2%)	88 (36.5%)	5.97 (NS)
Overweight / obese = 163	63 (38.7%)	59 (3.61%)	41 (25.2%)	

NS = Non Significant

For overweight boys number of sleeping hours was more, they were more sedentary and did less of energy expensive activities as compared to normal boys. Same was true for girls also. Overweight children had more joint family system and business Background.

4. Discussion

Overweight / obesity among children is progressing towards epidemic levels. The health risks of excessive body fat are noted even with a relatively small increase in body weight, and not only with marked obesity (45). The World Health Organization has described obesity as one of today’s most neglected public health problems. Following the increase in adult obesity trends, the proportion of children and

adolescents who are overweight and obese has also been increasing (46).

Both systolic and diastolic blood pressures were found to have higher mean values among overweight and obese children in all the age groups (7-9) yrs for boys as well as girls. Irrespective of race, gender, or age, the risk of elevated blood pressure was significantly higher for children in upper compared with lower decile of BMI [50].

The overall prevalence of overweight and obesity in the private school children of 7-9 years was found to be 36.9% (overweight-20.5% and obesity-16.4%), in the present study. Studies among school children in different parts of the country have demonstrated increasing prevalence of overweight and obesity, with great disparity between rural and urban parts of country. The prevalence of overweight and obesity in a private school of Orissa, among children of age, 5-15 years was found to be 28.63% (overweight – 14.1% and obesity - 14.53%); (11).

The prevalence of overweight (including obese) in adolescents was to be 22% in better off schools in Chennai. In a Delhi school (9) with tuition fees more than Rs.2,500 per month, the prevalence of overweight was 31% of which 7.5% were frankly obese (10). Maximum prevalence i.e. 36.54% was found in 5-10 year age group and 22.3% in adolescence period (10-15 years). The highest prevalence of overweight and obesity was found within the 7 to 10 years old group (11, 12). Prevalence of overweight and obesity as 38.4% in boys and 34.8% in girls was reported in a private school in Orissa (11). Similar results, that is males showed a higher prevalence of obesity than females (P<0.0001) was reported in cluj-napoca school children (12). Higher prevalence in girls (8.82%) than boys (4.1), (P<0.001). in a study among affluent adolescent school girls, prevalence of overweight and obesity according to CDC BMI for age criteria was found to be 13.1% and 5.0% respectively (15).

The rate of overweight (20.5%) seen in the present study was higher but highest rate (28.5%) was reported among school going girls of Kolkata (27) when compared to the prevalence rate from different parts of India, and when compared to rates from USA and Great Britain (16.5% and 11.7%, respectively). A previous study (23) from Kolkata had shown that overweight and obesity among school girls were 17.63% and 5.1% respectively. The prevalence of overweight among the children from Punjab and Chennai, India, was 14.3% (22) and 15.8% (30), respectively. But Delhi children showed much lower rates (7.4%) of overweight (25). In a study (26) among school going

children of Wardha city, Central India, a higher prevalence (9.7%) was found among English medium schools compared to other schools (3.7%). Studies on urban Indian school children from selected regions report a high prevalence of obese and overweight children (37). In addition, studies on Indian school children have also demonstrated that the prevalence of hypertension in overweight children is significantly higher than that among normal children, (38-40). Elevated BP was seen in high percentages in children with overweight and obesity when compared with children who were neither overweight nor obese. Central obesity has been associated with the risk of cardiovascular and metabolic disease in children and anthropometric indices predictive of childhood central obesity include waist circumference (WC), waist-hip ratio (WHR) and waist-height ratio (WHtR), (28-32). Significant and positive correlation was found between BMI, WHR and blood pressure in the present study.

A higher percentage of children (38.7%), who belonged to overweight / obese category had both their parents to be overweight / obese, in the present study. When the number of hours spent in various activities was seen, statistically significant difference was observed between normal and overweight/obese children. This finding suggests that students in these school settings may be less involved in physical activities. All the variables such as height, weight, BMI, WHR, SBP and DBP had higher mean values among overweight and obese as compared to normal children. Overweight and Obesity was found significantly higher among children in 5-10 years age group ($P=0.001$), with family H/O obesity ($P=0.000$), watching TV, Computer more than 2 hours daily ($P = 0.002$), and consuming junk food regularly ($P=0.000$) overweight and obesity in adolescents in affluent school was significantly associated with TV watching > 2 hours, not playing outdoor games daily and frequently eating junk foods (16). The study among school children of 12-15 years reported higher prevalence obese children with physical activity of < 1 hour and watching TV, computer > 2 hours daily. Similarly a significant difference between obese and overweight children and the lean children with regard to the frequency of consumption of fast food was reported (19). Significant association between overweight and obesity with family history of obesity, lack of physical activity and snacking of high energy foods ($P<0.001$) was found among affluent children of devangre city, (13).

The present study was conducted only in two affluent schools of Delhi, therefore, the data could not be compared with non affluent schools of Delhi. The study is not representative of all school going children. Most importantly, it is a cross-sectional study and there can be temporal ambiguity. Hence causal claims cannot be made. To conclude, considering the burden of overweight and obesity among the school children, there is a need for periodic screening of overweight in schools which should be followed by counseling of parents of overweight children. Counseling of children on lifestyle modification should be emphasized. School health programmes with special focus on educating students and teachers regarding possible adverse effect of overweight and obesity should be conducted.

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