Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231-6345 (Online)
An Online International Journal Available at http://www.cibtech.org/jls.htm
2012 Vol. 2 (1) January- March, pp. 139-144/Mogra and Kaur
Research Article

ASSOCIATION OF BODY FAT AND BLOOD PRESSURE AMONG SCHOOL CHILDREN (9-12 YEARS)

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ABSTRACT
Nutritional anthropometry of 270 school children was assessed and their blood pressure was determined. It was found that 21.48percent children were underweight, 34.07 normal, 14.45percent overweight and 30percent obese. Weight, height, abdominal circumference, hip circumference were higher in obese and overweight subjects than the normal. About 30, 36.6 and 41.1 percent children in the age group of 9-10, 10-11 and 11-12 years were hypertensive with blood pressure ranging from 110-160mmHg systolic and 70-90 mm Hg diastolic. Normal children were having normal blood pressure. Pearson's correlation coefficient among body fat and blood pressure showed a positive correlation. Faulty diet, inactive life style, playing of indoor and computer / video games, more of studying, sitting and sleeping hours, lack of exercise were some of the reasons for increased problem of overweight and obesity among children which in turn increased blood pressure among children.

Key Words: school children, obesity, overweight, blood pressure

INTRODUCTION
School going children, our future citizen forms an important segment of Indian population. They contribute to vital human potential and impact strength to the national economy and development. Nutrition in childhood is the basis for survival and good health in adulthood. The nature of physical growth and development of children depends upon the genetic endowments, nutritional status, psychological environment and surrounding conditions (Balgir, 2005). Now a day, there is change in life style, activity pattern and food habits of the children due to the impact of mass media, urbanization and many other factors. Today's children lead sedentary life style, play indoor games like video and computer, consume fast foods and preserved snack items. This has led to the development of many health problems like overweight, obesity and hypertension. These diseases have significant negative effect on emotional and social development of child. It has been shown to track the child to obesity and risk of adult mortality (Kapil, 2005). The present study is an attempt to find out the prevalence of obesity and high blood pressure among school children.

METHODS
Study was carried out in three private schools of Udaipur. A total of 270 school children with equal representation of boys and girls were selected randomly. Information on their general background, activity pattern was gathered through a structured Performa. Anthropometric measurements like height, weight, waist hip ratio, abdominal girth and skinfold thickness were measured. Body fat distribution was assessed by calculating conicity index (Veldez et al, 1993), sum of three and six skin folds, TE ratio, relative fat pattern (Hasstedt et al 1989) and body fat was calculated by using following equations:
Percent of fat (males): 0.735(tricep + calf) + 1.0 (Hansen, 1993)
Percent of fat (females): 0.610(tricep + calf) + 5.1 (Jenson, 1993)
Blood pressure was measured by using sphagmomanometer and compared with Ghai (2002).

RESULTS
General information of the subjects revealed that 92.22percent children were Hindu, 43.3 percent were vegetarian and belonged to families having income more than Rs 25000/- pm.

Table 1: Anthropometric measurement of children

Parameters	Age (years)					
	9-10		10-11		11-12	
	Boys	Girls	Boys	Girls	Boys	Girls
Body weight (kg)	31.69±7.36	29.42±4.96	32.36±5.27	33.18±5.45	35.58±7.51	37.42±8.76
Height (cm)	132.43±9.22	131.21±7.02	133.76±7.76	133.51±5.85	139.09±12.97	141.69±7.65
Abdominal circumference (cm)	63.33±9.15	62.48±8.02	66.14±6.93	67.67±7.50	63.78±8.32	62.44±8.52
Hip circumference (cm)	72.85±9.14	73.67±7.33	75.17±6.11	75.51±8.02	76.19±7.10	76.14±10.09
Biceps (mm)	9.96±3.45	9.84±1.66	9.64±2.54	10.24±2.56	11.53±2.00	12.38±3.09
Triceps (mm)	10.42±4.23	10.32±2.33	9.60±2.46	9.87±2.01	11.02±1.96	12.22±2.73
Supralliac (mm)	10.31±3.84	9.73±2.92	9.27±3.24	9.96±3.12	11.29±2.40	11.82±2.29
Subscapular (mm)	9.76±2.99	9.27±3.26	9.38±3.52	9.53±2.98	10.82±2.41	11.27±1.80
Calf (mm)	13.42±4.32	11.67±3.22	12.36±2.66	11.16±2.26	11.22±2.39	12.07±3.09
Waist circumference (cm)	64.33±10.27	63.27±6.99	65.78±10.93	66.86±8.48	65.86±7.27	65.73±8.27

n=270, *All the values are Mean ± SE*

Table 2: Blood pressure of children

Blood pressure	Age (years)		
	9-10	10-11	11-12
Systolic mmHg			
<100	5.55	3.34	5.56
100-110 (normal)	64.45	60.00	53.33
110-160	30	36.66	41.11
Diastolic mmHg			
50-60	5.56	10.00	12.22
60-70	75.56	50.00	43.33
70-90	21.00	40.00	44.44

n=270

Anthropometric measurement:
Anthropometric measurements like weight, height, abdominal circumference, waist circumference, skinfold thickness and weight status of the children have been presented in Table1.

Table 3a: Body fat pattern of school children (9-10years)

Parameters	Underweight (n=19)		Normal (n=33)		Overweight (n=4)		Obese (n=34)	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
WHR	0.83±0.72	0.82±0.59	0.85±0.20	0.85±0.06	0.85±0.01	0.85±0.104	0.92±0.041	0.88±0.06
CI	0.007±0.03	0.006±0.004	0.009±0.026	0.008±0.01	0.32±0.03	0.004±0.004	0.009±0.07	0.005±0.02
TSF3	60.2±7.52	59.0±7.78	65.33±0.04	60.84±3.82	60.41±0.18	60.00±9.75	67.48±7.73	71.65±7.52
TSF6	62.977.74	61.86±7.77	74.60±10.63	63.68±3.79	64.51±1.87	64.11±1.45	92.53±8.74	75.40±7.53
TE Ratio	20.88±2.4	23.64±4.20	25.54±6.82	21.29±2±.56	15.54±6.98	15.46±4.02	19.45±2.99	19.45±2.98
RFPI	0.51±0.01	0.46±0.05	0.52±0.01	0.49±0.08	0.49±0.35	0.49±0.03	0.45±0.6	0.77±0.05

n=90, All the values are Mean ± SE

Table 3b: Body fat pattern of school children (10-11years)

Parameters	Underweight (n=19)		Normal (n=33)		Overweight (n=4)		Obese (n=34)	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
WHR	0.71±0.23	0.78±0.06	0.80±0.07	0.83±0.45	0.89±0.04	0.87±0.04	0.88±0.05	0.85±0.10
CI	0.003±0.02	0.002±0.001	0.003±0.002	0.005±0.02	0.006±0.01	0.006±0.001	0.005±0.004	0.005±0.07
TSF3	61.06±6.28	70.52±4.18	66.75±3.85	69.56±7.16	68.02±6.02	68.98±8.79	74.87±7.78	74.85±5.54
TSF6	63.91±6.15	65.66±4.07	69.70±3.72	72.65±7.38	72.08±6.18	71.69±8.62	78.13±7.77	78.11±5.64
TE Ratio	38.09±4.16	22.15±5.26	22.99±5.89	21.46±4.01	18.20±3.08	26.64±4.82	28.59±4.20	20.33±3.18
RFPI	0.50±0.04	0.4±0.07	0.47±0.04	0.5±0.03	0.047±0.05	0.50±0.03	0.49±0.05	0.40±0.052

n=90, All the values are Mean ± SE

Weight

Mean body weight of 9-10 years boys and girls was 32 kg 30 kg respectively. Among 10-11 years age group weight of boys and girls was 32.36 and 33.18 kg while it was 36 and 38 kg in the 11-12 years boys and girls respectively.

Height

Mean height of 9-10 years boys and girls was 133 cm and 105cm. Height of both 10-11 years boys and girls was133cm while 11 – 12 years children were having mean height of 139 and 142 cm. These results indicated that the mean weight of children was nearer or at par with NCHS values.

Table 3c: Body fat pattern of school children (11-12years)

Parameters	Underweight (n=19)		Normal (n=33)		Overweight (n=4)		Obese (n=34)	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
WHR	0.85±0.10	0.84±0.45	0.87±0.104	0.85±0.43	0.86±6.02	0.87±0.41	0.85±0.99	0.83±0.42
CI	0.002±0.001	0.003±0.01	0.005±0.01	0.006±0.03	0.003±0.01	0.004±0.01	0.005±0.01	0.004±0.001
TSF3	59.0±7.78	53.73±0.01	64.07±4.15	64.22±6.15	63.07±5.15	70.08±4.12	81.65±11.12	73.21±7.62
TSF6	59.9±2.78	58.0±7.78	67.30±3.85	67.82±6.85	70.47±5.38	65.94±4.27	77.83±1.85	70.27±7.94
TE Ratio	19.45±2.99	16.90±6.98	21.38±5.26	21.65±4.26	19.16±3.99	18.44±2.96	24.14±6.36	19.87±4.11
RFPI	0.40±0.052	0.40±0.042	0.41±0.04	0.43±0.26	0.42±0.07	0.4±0.5	0.45±0.05	0.46±0.45

n=90, All the values are Mean ± SE

Abdominal circumference

Boys were having abdominal circumference of 63.33, 66.14 and 68.78 cm in the age of 9-10, 10–11 and 11-12years respectively while it was 64.48, 67.67 and 69.44cm respectively. Girls were having slightly higher values for abdominal circumference than boys. This may be due to the fact that this is a pre adolescent age where child prepare themselves for adolescence period (Golan et al, 1998).

Waist circumference

Mean waist circumference of 9-10, 10-11 and 11-12 years boys was 64.33, 65.78 and 65.86cm while it was 63.27, 66.86 and 65.72 cm in girls. Significant difference between mean circumferences of these children was not found.

Hip circumference

It was 72.85, 75.17 and 75.51cm in the case of 9-10, 10-11 and 11-12years old boys while it was 73.67, 75.51 and 76.14cm in girls. Results showed that there was increase in hip circumference with increase in age of boys and girls.

Skinfold thickness

Bicep, tricep, subscapula and supralliac are the best sites suggested to determine the amount of subcutaneous fat. A significant increase or decrease in the skinfold measurement reflects a shift in the individual energy stores (Rao and Raghvan, 1996). It was found that value for skinfolds at bicep, tricep, suprailliac, subscapular and calf were higher in girls than boys at the age of 10-11 and 11-12years of age. Boys tend to be heavier than girls.

Weight status

Out of all the subjects studied, 21.48percent were underweight, 34.07 percent normal, 21.11percent overweight and 30 percent obese as per NCHS (1987) standards. No significant difference was found in the weight status of boys and girls. It was observed that with increase in age there was decrease in the number of obese children but increase in the prevalence of overweight. Sidhu et al (2002) reported 23percent obesity in Punjabi school children while Khadikar and Khadikar (2004) reported 5.7percent obesity and 19.9 percent overweight among school children (9-16years age). Choudhary and Kishore (2004) reported 30percent obesity among school children.

Body fat pattern

Table 3a, 3b and 3c revealed that WHR, TE ratio, TSF3 and TSF6 were higher in overweight and obese children compared with normal weight children of age group 9-10 and 10-11 years. Further girls with normal weight status had higher values for WHR, CI, TSF3, TSF6 and TE ratio in the age group of 9-10

and 10-11years than boys. Ahuja et al 2004 reported that WHR of overweight children was significantly higher than the normal weight. Further, overweight boys had a significant higher abdominal circumference than girls.

Blood pressure

Subjects with normal body weight had normal systolic (100-110mm Hg) and diastolic (60-70 mmHg) blood pressure while obese and overweight children were having higher blood pressure ranging from 60-90mmHg (diastolic) and 100-160mmHg (systolic) respectively. According to Ahuja et al (2004) overweight and obese children have higher blood pressure than normal children. Anand and Tondon (1996) reported that 11.9percent boys and 11.4 percent girls of school age were having high blood pressure.

Body fat

Percent body fat of the normal children ranged from 14.01 to 18.32. Girls had higher amount of fat in the body than boys. Similarly overweight (15.93 – 21.83) and obese (19.99-25.22) children had higher fat in their bodies. Similar results were reported by Moreno et al (1998). According to Shear et al (1987) body fat pattern does not affect blood pressure significantly.

Pearson‘s correlation coefficient among body fat and blood pressure showed a positive correlation. It was observed that with increase in body fat there is increase in blood pressure. Faulty diet, inactive life style, playing of indoor and computer / video games, more of studying, sitting and sleeping hours, lack of exercise were some of the reasons for increased problem of overweight and obesity among children which in turn increased blood pressure among children.

Conclusions

The school age is more crucial age as it is the age of growth and development. Increase in the prevalence ob obesity and overweight is one of the leading cause of high blood pressure among children. Children should be advised to lead active life, indulge more in physical activities rather than sitting or playing indoor games to be fit and prevent risk of degenerative diseases in future.

ACKNOWLADGEMENTS

Authors are grateful to Dean, College of Home Science and Head Department of Foods and Nutrition, College of Home Science, MPUAT, Udaipur for providing all the facilities to conduct the research.

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