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Corresponding Author

S. Abdul Khaleef,
Department of Pediatrics, GMC,
Kadapa, India

Author Designation

¹⁻³Assistant Professor of Pediatrics

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Prevalence of Obesity and Hypertension Among Apparently Healthy School Children Aged 5-15 Years

¹S. Abdul Khaleef, ²M. Rajasekhar and ³Satna Soumya
¹⁻³Department of Pediatrics, GMC, Kadapa, India

ABSTRACT

Obesity is a product of imbalance between energy intake and energy output. Several factors such as overeating, psycho social factors, physical inactivity and genetic predisposition trigger this energy imbalance. The comorbidities of obesity include hypertension, coronary heart disease, stroke and certain types of cancers, NIDDM, gallbladder disease, dyslipidemia, osteoarthritis, gout and pulmonary diseases including sleep apnea. Aim of this study is to evaluate the prevalence of obesity and hypertension among apparently healthy school aged children of Kadapa. This was a Cross Sectional study done in one year period in 1900 students. Out of 1900 children, 65.26% were males and 34.73% were females, 17.5% were aged 12 years. Prevalence of obesity was 3.89% and overweight was 5.21%. Prevalence of hypertension was 1.36% and pre hypertension was 1.26%. 2.09% boys were obese and 1.5% was hypertensive. 7.27% girls were obese and 1.06% was hypertensive. Prevalence of obesity was more in girls than in boys and the observation is statistically significant. Prevalence of hypertension was slightly higher in boys but the observation was statistically insignificant. Anthropometric variables like height, weight and body mass index showed positive correlation with systolic as well as diastolic blood pressure. Obese children are at a higher risk of "childhood onset of adult diseases".

INTRODUCTION

Malnutrition, in every form, presents significant threat to human health. The world today faces a double burden of malnutrition which includes both under nutrition and obesity, especially in developing countries. **Obesity** is a form of development driven malnutrition that is emerging among all ages. WHO designated obesity as a “global epidemic” in view of increasing incidence of obesity and its complications^[1]. The International Obesity Task Force (IOTF), World Health Organization (WHO) estimate of the global prevalence of overweight (including obesity) among children aged 5-17 years is 10% with an unequal distribution ranging from 30% in America to <2% in sub Saharan Africa. Overweight and obesity has been recently on the rise^[2]. Obesity in children and adolescents is gradually becoming a major public health problem in India. Childhood obesity is a single marker of the child at risk for development of various non-communicable diseases later in life. The comorbidities of obesity include hypertension, coronary heart disease, stroke and certain types of cancers, NIDDM, gallbladder disease, dyslipidemia, osteoarthritis, gout and pulmonary diseases including sleep apnea. Invariably obesity is a product of imbalance between energy intake and energy output. Several factors such as overeating, psychosocial factors, physical inactivity and genetic predisposition trigger this energy imbalance^[3]. WHO has also emphasized the urgent need of understanding the prevalence trends and influencing factors of childhood obesity^[4]. Results of such studies are helpful in development of interventional strategies to halt the emerging epidemic of childhood obesity. Success of adult obesity prevention is firmly based on prevention of childhood obesity. **Hypertension** Children with upper percentile of blood pressure levels are more likely to become adult hypertensive. If the trend towards adult hypertension can be recognized in childhood, it may be possible to alter life style and prevent systemic hypertension as well as related complications^[5]. As per Nelson text book of pediatrics, to increase early detection of hypertension, accurate blood pressure measurements should be part of the routine annual physical examination of all children, three years or older^[6]. The prevalence of hypertension in children is reported to be 1-3%^[7]. Elevated blood pressure in children and adolescents may be an early expression of essential hypertension in adulthood^[8].

Aim of the Study: Was to estimate the Prevalence of Obesity and Hypertension and correlation between Obesity and Hypertension among apparently healthy school children aged 5-15 years of Kadapa.

MATERIALS AND METHODS

This was a Cross Sectional study done in one year period in 1900 apparently healthy school children aged

5-15 years of Kadapa. Children below 5 years and above 15 years, Children with chronic illness, long term medications, congenital anomalies, Children diagnosed to be obese and hypertensive secondary to other cause were excluded.

Study Methods: Initially questionnaires were issued to the students. After the questionnaire was filled up, students were asked to come to the investigator with their questionnaires in hand and then their weight and height were measured and BP was recorded one by one and was noted in their respective questionnaires with the help of teachers. After collection of data from all the four schools, the questionnaires were used for analysis.

Statistical Analysis: Data analysis was done using MS Excel software, Epi Info 7 version software and also SPSS 17 version software.

RESULTS AND DISCUSSIONS

Table 1: Age and Sex Wise Distribution of the Study Sample

Age (years)	Total	Male	Female
5	133 (7%)	70 (5.7%)	63 (9.6%)
6	119 (6.3%)	70 (5.7%)	49 (7.5%)
7	109 (5.7%)	66 (5.3%)	43 (6.5%)
8	104 (5.4%)	60 (4.9%)	44 (6.6%)
9	149 (7.8%)	89 (7.1%)	60 (9%)
10	99 (5.2%)	62 (5%)	37 (5.6%)
11	121 (6.4%)	76 (6.1%)	45 (6.9%)
12	332 (17.5%)	243 (19.6%)	89 (13.4%)
13	285 (15%)	196 (15.8%)	89 (13.4%)
14	159 (8.4%)	109 (8.8%)	50 (7.6%)
15	290 (15.3%)	199 (16%)	91 (13.9%)
Total	1900 (100%)	1240 (100%)	660 (100%)

Table 2: Distribution of BMI and Blood Pressure in the Study Population

	Group	Number
BMI	Normal	1727 (90.89%)
	Overweight	99 (5.21%)
	obese	74 (3.89%)
BP	Normal	1850 (97.3%)
	Pre hypertension	24 (1.26%)
	Hypertension	26 (1.36%)

Developing countries are undergoing nutritional transition due to increased economic development and market globalization leading to rapid changes in lifestyle and dietary habits^[9]. In India, approximately 19% (190 million) of the growing population comprises school-aged children of whom 30% (48 million) currently reside in urban India. A significant and increasing number of these children belong to middle and high socio-economic groups^[10]. As a consequence of the socio-economic and demographic transitions that are affecting developing countries such as India, the nutritional status of the children in middle and high-income groups could be affected by the changes in dietary habits and lifestyle, leading to an increase in the prevalence of overweight and obesity.

Age and Gender Wise Distribution of Study Population: The present study was carried out among 1900 apparently healthy school children aged 5-15

Table 3: Age Wise Distribution of BMI and Blood Pressure in the Study Population

Age (yrs)	Weight			BP		
	Normal	Overweight	Obese	Normal	Pre HTN	HTN
5	124 (93.23%)	5 (3.75%)	4 (3%)	133 (100%)	0 (0%)	0 (0%)
6	109 (91.6%)	7 (5.8%)	3 (2.5%)	119 (100%)	0 (0%)	0 (0%)
7	98 (90%)	5 (4.5%)	6 (5.5%)	108 (99.08%)	0 (0%)	1 (0.91%)
8	94 (90.3%)	6 (5.7%)	4 (3.8%)	101 (97.11%)	1 (0.96%)	2 (1.92%)
9	143 (95.9%)	4 (2.6%)	2 (1.3%)	147 (98.65%)	1 (0.67%)	1 (0.67%)
10	96 (96.9%)	2 (2.02%)	1 (1.01%)	96 (96.96%)	0 (0%)	3 (3.03%)
11	115 (95%)	4 (3.2%)	2 (1.6%)	117 (96.69%)	2 (1.65%)	2 (1.65%)
12	300 (90.3%)	15 (4.5%)	17 (5.1%)	325 (97.89%)	3 (0.9%)	4 (1.2%)
13	254 (89.1%)	18 (6.3%)	13 (4.5%)	272 (95.43%)	8 (2.8%)	5 (1.7%)
14	135 (84.9%)	14 (8.8%)	10 (6.2%)	151 (94.96%)	5 (3.1%)	3 (1.88%)
15	259 (89.3%)	19 (6.5%)	12 (4.1%)	281 (96.89%)	4 (1.37%)	5 (1.72%)

Table 4: Gender Wise Distribution of BMI and Blood Pressure in the Study Population

Gender	BMI			Blood Pressure		
	Normal	Overweight	Obese	Normal	Pre HTN	HTN
Male	1176 (94.8%)	38 (3.01%)	26 (2.09%)	1206 (97.2%)	15 (1.2%)	19 (1.5%)
Female	551 (83.4%)	61 (9.2%)	48 (7.27%)	644 (97.5%)	9 (1.36%)	7 (1.06%)
Total	1727 (90.89%)	99 (5.2%)	74 (3.89%)	1850 (97.3%)	24 (1.26%)	26 (1.36%)

Table 5: Distribution of Blood Pressure and Body Mass Index in Children

	Overweight	Obese	Total
Normal	76 (76.7%)	49 (66.2%)	125 (72.2%)
Pre Hypertension	14 (14.1%)	8 (10.8%)	22 (12.7%)
Hypertension	9 (9%)	17 (22.9%)	26 (15.02%)
Total	99 (100%)	74 (100%)	173 (100%)

Table 6: Age and Gender Wise Distribution of BP Patterns Among Obese Children

Age	Normal	Pre Hypertension	Hypertension	Total
5-10 years	17 (85%)	1 (5%)	2 (10%)	20 (100%)
11-15 years	32 (59.2%)	7 (12.9%)	15 (27.7%)	54 (100%)
Gender				
Male	8 (30.7%)	5 (19.2%)	13 (50%)	26 (100%)
Female	41 (85.4%)	3 (6.2%)	4 (8.3%)	48 (100%)

Table 7: Sex Wise Prevalence of Obesity and Hypertension in the Study Population

Sex	BMI			Blood Pressure		
	Non-obese	Obese	Total	Non HTN	Hypertensive	Total
Male	1214 (97.9%)	26 (2.09%)	1240 (100%)	1221 (98.46%)	19 (1.53%)	1240 (100%)
Female	612 (92.7%)	48 (7.27%)	660 (100%)	653 (98.93%)	7 (1.06%)	660 (100%)
Total	1826 (96.1%)	74 (3.89%)	1900 (100%)	1874 (98.63%)	26 (1.36%)	1900 (100%)
	p-value <0.0001 and chi square=30.83			p-value=0.39 and chi square=0.71		

Table 8: Distribution of Pre Hypertension and Hypertension in Overweight and Obese Children

	Pre-hypertension	Hypertension	Total
Overweight	14 (63.63%)	9 (34.61%)	23
Obese	8 (36.36%)	17 (65.38%)	25
Total	22 (100%)	26 (100%)	48
	p-value=0.04 and chi square=4.02		

Table 9: Age and Gender Wise Distribution of BP Patterns Among Obese Children

Age	Non-hypertensive	Hypertensive	Total
5-10 years	18 (90%)	2 (10%)	20 (100%)
11-15 years	39 (72.2%)	15 (27.7%)	54 (100%)
Total	57 (77.02%)	17 (22.9%)	74 (100%)
	Fisher's exact test and 2 tailed p-value=0.13		
Gender			
Male	13 (49.99%)	13 (50%)	26 (100%)
Female	44 (91.66%)	4 (8.33%)	48 (100%)
Total	57 (77.02%)	17 (22.9%)	74 (100%)
	p-value <0.0001 and chi square=22.98		

years. The proportion of males is 65.26% (1240) and that of females is 34.73% (660). Most of the study subjects were aged 12 years followed by 15 and 13 years.

Prevalence of Obesity: Using BMI as criteria and based on CDC growth charts developed by NCHS, prevalence of obesity (BMI for age and sex above 95th percentile) was evaluated. Out of the study population of 1900 (100%), 74 (3.89%) apparently healthy school children

are obese. Studies conducted in different parts of India on school children have come out with prevalence ranging from 0.35 % (Deoke^[11]) to 6% (Sharma^[12]). The prevalence of obesity in the present study (3.89%) correlates with the study done by Premnath^[13] (3.4%) which was conducted among 43,152 school children aged 5-16 years at Mysore.

Prevalence of Overweight: Using BMI as criteria and based on CDC growth charts developed by NCHS,

prevalence of overweight (BMI for age and sex between 85th and 95th percentile) was evaluated. Out of 1900 (100%) study population, 99 (5.21%) apparently healthy school children are overweight. Studies conducted in different parts of India on school children have come out with prevalence ranging from 5.43% (Chakroborty^[14]) to 22% (Sharma^[12]). The prevalence of overweight in the present study (5.21%) correlates with the study done by Chakroborty^[14] (5.43%) which was conducted among 979 school children aged 5-18 years.

Prevalence of Hypertension: The National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents published the Fourth Report on the Diagnosis, Evaluation and Treatment of High Blood Pressure in Children and Adolescents. According to these recommendations prevalence of hypertension (average systolic or diastolic BP is \geq 95th percentile for age, sex and height) was evaluated. Out of 1900 study population, 26 (1.36%) apparently healthy school children are hypertensive. Studies have come out with prevalence of hypertension ranging from 0.41% (Gupta A.K and Ahmad^[15]) to 1.8% (Aggarwal^[16]). The prevalence of hypertension in the present study (1.36%) correlates with the study done by Verma^[17] (1.1%) which was conducted among 2560 apparently healthy school children aged 5-15 years.

Gender Wise Prevalence of Obesity: In the present study out of 1240 (100%) boys, 2.09% (26) were obese whereas out of 660 (100%) girls, 7.27% (48) were obese. Girls were found to be more obese than boys and the difference is statistically significant. Studies done by Mudur^[18] in three major Indian cities reported higher prevalence of obesity among girls than boys. Also study by Sonya Jagadesan^[19] (IOTF criteria) showed higher prevalence of obesity among girls than boys. This could be due to the fact that during puberty, females have tendency to accumulate more fat and male adolescents have larger amount of lean mass compared to females. Contrarily a few studies have come out with lower prevalence of obesity among girls when compared to boys (Kapil^[20] and Shiji K Jacob^[21]).

Gender Wise Prevalence of Hypertension: In the present study out of 1240 (100%) boys, 1.53% (19) are hypertensive and among 660 (100%) girls, 1.06% (7) are hypertensive. The percentage of hypertensive boys are slightly higher than girls but the difference is statistically insignificant. Similar finding were reported in other studies conducted by Anjana^[22] and Chada^[23].

Age Group Wise Prevalence of Hypertension Among Obese Children: Out of 74 (100%) obese children, 72.9% (54) belonged to 11-15 years age group whereas only 27.02% (20) belonged to 5-10 years age group.

Out of 54 (100%) obese children of 11-15 years age group, 27.7% (15) are hypertensive. Out of 20 (100%) obese children of 5-10 years age group, 10% (2) are hypertensive. Similar findings were reported by one other study conducted by Chada^[7]. These findings strongly favour the argument that anthropometric variables like height, weight and body mass index show positive correlation with systolic as well as diastolic blood pressure. Hence, obese children of 11-15 years age group who were taller and heavier showed higher prevalence of hypertension than those of 5-10 years age group.

Prevalence of Obesity Among Hypertensive Children: The present study shows that among hypertensive children 65.3% are obese. Similar findings were reported in many other studies. Percentage of asymptomatic hypertensive children found to be obese. Close relevance was found in the study conducted by Gupta^[15]. Hypertension in obese children may occur due to: Increased cardiac output, Increased blood volume, Excessive sodium intake, Increased steroid production, Alteration in receptors for various press or substances.

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