Obesity, obesity related hypertension, their association with adipocytokines among 12-16 years school students

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Abstract

Obesity, obesity related hypertension is increasing at higher rates among adolescents these days. An increase in leptin level and a decrease in adiponectin level were observed in obese individuals with hypertension. Our study aimed to know the association of obesity with hypertension and the levels of adipocytokines. The study was carried out among school children aged 12-16years, 60 students (30 cases & 30 controls). Anthropometric data, Blood pressure (BP) were measured. 30 Students with increased waist circumference to height ratio and elevated BP were selected. Biochemical parameters were investigated in these students and compared with age & gender matched controls. A significant relationship was observed between obesity and waist circumference to height ratio ($p<0.0002$). SBP showed more significance than DBP with obesity. Extremely significant relationship was found in serum leptin ($p<0.0001$), serum adiponectin ($p<0.0001$), lipid profiles. Our study observed a relation between obesity, hypertension & levels of adipocytokines among adolescents. Further studies in more number of people, in both the genders and programmes for increasing awareness among obese children helps to prevent future morbidity and mortality.

Keywords: Adiponectin, Adolescents, Hypertension, Leptin, Obesity, Waist Circumference to Height Ratio.

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Introduction

Overweight and obesity are emerging as epidemic without regional, economic barriers both in developed and developing countries, also seen in school going children.[1] European Society of Hypertension strongly remarked that excess weight is the most important condition related to paediatric hypertension. The negative metabolic effects of obesity on BP begin early during childhood and track through adolescence into adulthood.[2] It is now established that high BP is not only detectable even in school going children but also is surprisingly common, and is increasing in prevalence but relatively little attention is being paid to the problem of hypertension in this age group.[3] Moreover a correlation between adipocytokines and hypertension in teenage, leading to coronary diseases in their adulthood has been suggested in various studies.

Childhood obesity is a risk factor for chronic diseases-insulin resistance, type 2 diabetes, hypertension, cardiovascular diseases.[4] The use of anthropometric data of BMI, Waist circumference (WC), Waist Circumference to Height Ratio (WctHtR) for determining obesity in children was shown to be simple, sensitive, specific.[5]

Adipose tissue is an active endocrine organ with different secretion products. Adipocytokines are altered in obese states and lead to metabolic and cardiovascular complications. Among all the adipocytokines, leptin and adiponectin are more connected with the pathophysiology of complications. In children, the association among leptin levels, obesity and cardiovascular risk was analysed in previous studies and was showed that, together with BMI and WC, also adipocytokines are associated with cardiovascular risk.[6] Subjects with hypertension showed negative correlation between adiponectin values and hypertension. Leptin levels are more in hypertensive people than in normotensive people.[7]

Keeping in view, all the above points screening school going children can definitely help in avoiding future morbidity. There is no literature showing that similar study was carried out in Guntur town.

Materials and Methods

Conducting such research may add immense value as review of literature showed that study of hypertension in school students was not conducted previously in the town of Guntur.

There is a study which has estimated the risk factors for non-communicable diseases in school

children in Guntur.[8] But BP measurement and biochemical investigations were notdone. Present study can thus become useful to the society as it is screening hypertension at an early age.

Subjects: Study Population

The present study is a cross sectional, community based, case control, non-interventional study. The study is intended at measuring anthropometric data, blood pressure (BP), and biochemical measurements including leptin, adiponectin, low density lipoproteins, high density lipoproteins, triglycerides, serum creatinine, and random blood sugar in 12 to 16 years aged school going students. The sample size was 30 students identified with increased waist circumference/Height ratio (WCHtR). Biochemical parameters in these subjects were compared with age and gender matched 30 controls. School students from a residential school in Guntur were selected. Students suffering from secondary hypertension and the students whose parents have not signed the consent form were excluded from the study.

Prior approval from Institutional Ethics committee was obtained before commencing the study. Informed consent was obtained from all the subjects, their parents involved in the study.

Anthropometric Data and Blood Pressure Measurement

Weight, height, Waist circumference, WCHtR was calculated in all the students. Weight (in kilograms) was measured with electronic weighing scale placed on a horizontal flat surface. Subjects were asked to wear light clothing, and weight was recorded to nearest 0.5kg.

Height (in centimeters) was measured using stadio meter. The individual were asked to stand upright without shoes with his or her back against the vertical blackboard, heels together, eyes directed forwards.

BMI was calculated using the formula weight (kg)/ height (m^2).

Waist circumference (WC) was measured using a non-stretchable measuring tape. WC was measured at the smallest horizontal girth between the coastal margins and iliac crest at the end of expiration.[9]

BP was measured in them after they lie for 5 minutes in supine position with a sphygmomanometer with appropriate cuff size. Two readings were taken 5 minutes apart and their mean was taken as the blood pressure.

Blood Sample Collection and Biochemical Determination

30 subjects with increase in waist circumference to height ratio (WCHtR) were selected.These subjects were made to lie in the supine position for 5 to 10 minutes before venipuncture and 5 ml venous blood was collected in plain bottle and allowed to clot to separate serum. The following methodology was applied to the samples to obtain the required parameters. Serum was separated within one hour after sample collection. Care was taken to avoid haemolysis. Serum from all 60 subjects was analyzed for the following parameters: serum leptin, serum adiponectin, low density lipoproteins, high density lipoproteins, triglycerides, serum creatinine, and random blood sugar. Serum leptin and adiponectin were analysed by ELISA method. All the other parameters were analysed by Biosystems kits on Biosystems fully automated analyser.

Statistical Analysis

After obtaining results, statistical analysis was done with appropriate statistical tools. Mean, standard deviation, for the biochemical results was seen. P value was calculated. Mean and S.D were calculated using an online standard deviation calculator. P value was calculated with the help of Graph pad software.

The potential benefit of the study is, screening of young people for obesity and hypertension can be done. This helps in identification of at risk children and future morbidity in them can be prevented. Confidentiality was maintained throughout the study.

Observations and Results

The study population consisted of 60 students (30 controls, 30 cases). An assessment on obesity in adolescents based on BMI values (Fig. 1) showed that most of the students in case population were under categories of normal weight, obese whereas students in the control group mostly were in categories of underweight, normal weight.

Table 1 shows the anthropometric data in individuals. Results showed statistical significance. There was an extremely significant relationship between obesity and the anthropometric data i.e. BMI, WC, WCHtR since their p values are 0.0001, 0.0001, 0.0002 respectively. SBP ($p<0.0004$) had more significance with obesity when compared with DBP ($p<0.0227$).

When the biochemical parameters (table 2) were considered an extremely significant relationship between serum leptin (p<0.0001), serum adiponectin (p<0.0001), LDL (p<0.0001), HDL (p<0.0001) with obesity and its related hypertension was observed. Triglycerides and RBS were also statistically related to obesity and associated hypertension. Serum creatinine shows no statistical significance with obesity.

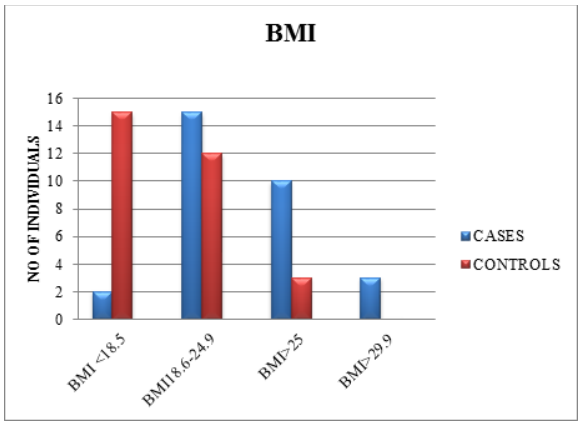

Fig 1

Table 1

S.No.	Parameter	Mean±S.D	P Value	Significance
1	**BMI**		0.0001	Extremely significant
	CASE	24.531±4.372		
	CONTROL	20.019±3.515		
2	**WAIST CIRCUMFERENCE**		0.0001	Extremely significant
	CASE	0.879±0.06189		
	CONTROL	0.6957±0.0693		
3	**WC/HT RATIO**		0.0001	Extremely significant
	CASE	0.54060±0.041007		
	CONTROL	0.434028±0.048537		
4	**SBP**		0.0004	Extremely significant
	CASE	123.3±10.67756		
	CONTROL	114.533±7.23847		
5	**DBP**		0.0227	Significant
	CASE	79.46666±8.152568		
	CONTROL	74.9333±6.78199		

Table 2

S. No	Biochemical Parameter	Mean±S.D	P Value	Significance
1	**Serum Leptin**		0.0001	Extremely significant
	Case	10.58±5.25805785		
	Control	5.41666±2.4133369		
2	**Serum Adiponectin**		0.0001	Extremely significant
	Case	3.51±2.48961		
	Control	7.09±1.4995056		
3	**LDL**		0.0001	Extremely significant
	Case	111.5±22.701587		
	Control	89.133±12.59374		
4	**HDL**		0.0001	Extremely significant
	Case	31.13333±2.224213		
	Control	34.2±3.252585		

5	**Triglycerides**		0.0016	Very significant
	Case	104.1±21.43209		
	Control	89.3±11.80049		
6	**Serum Creatinine**		0.4607	Not significant
	Case	86.53333±9.7758793		
	Control	84.76666±8.6130		
7	**RBS**		0.0031	Very significant
	Case	0.773333±0.1837039		
	Control	0.63333±0.1667816		

Discussion

Obesity has become a global issue because in 77% of the countries examined, at least 10% of youth were overweight and in 20% of the countries at least 3% were obese.[10] Abdominal obesity, that represents both subcutaneous and visceral fat accumulation, has been linked to increased cardio metabolic risks in adolescents.[11] Waist circumference which is a measure of abdominal or visceral obesity is an important and useful indicator of obesity related disorders as it is independent of muscle mass.[12] A strong determinant of elevated blood pressure in adolescents is visceral obesity. Several longitudinal and cross sectional studies also show an association between increased body weight and elevated blood pressure. A threefold higher prevalence of hypertension is seen in obese children than in non-obese children.[13] An infiltration of macrophages occurs in adipose tissue among obese individuals. These infiltrated macrophage subtypes shift from M2 to M1 subtype, which leads to increased levels of proinflammatory cytokines such as TNF-α, IL-6, and ROS. TNF-α induces the expression of an adipoctokine leptin which in turn acts on macrophages and increases the production of proinflammatory cytokines.[14,15] In contrast to this adiponectin levels are reduced which is normally a protective adipocytokine.

Obesity as an epidemic is very rapidly progressing in our country also. Waist circumference (WC) and waist circumference /height ratio (WCHtR) are sensitive and specific in adolescents. Increased WCHtR is an important factor for determination of blood pressure. The cut off limit of 0.5 WCHtR as suggested by PE Mishra et. al[16] was considered. Most of the students with increased WCHtR also presented with elevated BP levels. Studies conducted by Amit Vasant et al[17] Jasmine S Sundar et al,[18] also showed similar results regarding BP. An elevation in SBP when compared with DBP was shown in some studies vidula sri et al.[12]

Elevated leptin levels in obesity were observed, this study also showed a decrease in adiponectin levels in individuals with increased WCHtR. Similar results were seen in study of Ranjana Sinha et al.[19] An increase in the levels of TG'S, LDL, and random blood sugar were observed in individuals with increased WCHtR and BP.Qiang Lu et al[20] also observed that an increase in WCHtR is associated with altered glucose and lipid metabolisms.

Conclusion

WC and WCHtR are better predictors to determine obesity. Hypertension in adolescent age group is being observed at a higher rate these days. But awareness regarding this is very low. Proper screening of obese children at this age, counselling parents as well as children may prevent future morbidity. Therefore effective interventions & preventive strategy at local & national level, targeting the children & adolescents can improve this condition. An increase in leptin and decrease in adiponectin levels were seen in obese individuals. But further studies are recommended to clarify the effect of adipokines on obesity and hypertension. Some limitations of the present study include that all readings were taken on the same day and there was no follow-up to confirm hypertension, both the genders were not included.

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Conflict of Interest: No conflicts of interest.

Compliance of ethical standards: This article does not contain any studies with animals performed by any of the authors. The study involved human participants and it was in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent was obtained from all individual participants included in the study.

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