

Assessment of Blood Pressure in School Going Overweight Adolescents

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ABSTRACT

Background: According to the various studies done previously, hypertension may starts since adolescence. Therefore early detection is always good to check its progression.

Methods: A case-control observational study based on school-going adolescents of both sexes between the age group of 10 to 16 years was done among 30 control and 30 overweight children. Their blood pressure, pulse pressure and anthropometric measurement were done according to the standard protocols. Unpaired student t-test was applied to compare the various parameters.

Results: We were found that the significant difference between antropometric and blood parameters values of normal and control subjects with p-value 0.001.

Conclusion: Outcome of our study suggested that most of the overweight students were hypertensive's and might be at a risk of getting obsessed and will prone to future risk of cardiac disorders.

Key-words: BMI measurement, Hypertensive adolescent, Obese adolescent, Overweight, Overweight adolescent

INTRODUCTION

Hypertension is a worldwide problem rising at alarming rate. Incidences of hypertension among children and adolescents are rapidly growing and have often been ignored by the family members and physicians. If left unchecked the condition remains in adulthood with worse manifestation. High blood pressure (hypertension) is an unfavorable health parameter which has disastrous impact on health. Blood pressure (BP) is the pressure created by circulating blood on blood vessels walls and it is expressed as systolic pressure over diastolic pressure, measured in millimeters of mercury (mmHg), above the surrounding atmospheric pressure^[1]. Normal Adult's systolic blood pressure (SBP) was nearly 120 millimeters

of mercury and diastolic was 80 millimeters of mercury^[1]. Blood pressure is measured using an instrument known as mercury-tube sphygmomanometer^[1]. In a number of cases obesity and overweight used to be the causative factors lie in the etiology of hypertension. Overweight is described by increased BMI while obesity is described by excessive body fat^[2]. The growing obesity is a major source of unsustainable health, causes morbidity and mortality because of susceptibility of individual of getting hypertension, type 2 diabetes mellitus and few types of cancers and cardiovascular diseases^[3]. Obesity affects seriously, many system of the body including cardiovascular system. Various Indicators for occurrence of hypertension are obesity, abdominal obesity and weight gain. The extra bulk of the body due to obesity requires sufficient supply of oxygen and nutrients in order to live, which requires the blood vessels to circulate more blood to obesity tissue site. This increases the workload of the heart as it pumps more blood through additional blood vessels. More circulating blood means more pressure on artery walls. Higher

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pressure on the arterial walls increases the blood pressure. Extra weight can raise heart rate and reduces body's ability to transport the blood through vessels ^[4]. A number of studies have been done in this global concern. A research done in the city Varanasi by Singh *et al.* ^[5] as per census 2011, which is a community, based cross-sectional study among 640 people aged between 25 to 64 years. According to Body Mass Index (BMI) values, study subjects either overweight or obese are more than one-third. With regard to abdominal obesity as measured by waist circumference, 40% subjects are at risk of developing hypertension. Men exhibited higher prevalence of hypertension and pre-hypertension than female. From the above background we therefore wish to assess the blood pressure in school going overweight adolescents by body mass index, waist-hip ratio, mean arterial pressure, pulse pressure.

MATERIALS AND METHODS

A case control observational study was conducted in 2017 for a period of 3 months from May to July, based on school-going adolescents of both sexes between age group of 10 to 16 years who were selected randomly. The study population was 60 students including 30 overweighted and 30 normals. Permission was obtained from the school principal and medical teacher to conduct the study. Informed consent was taken from every subject in the mother tongue (Hindi). Data collection was done by school visits with a pre-tested questionnaire. Before conducting the study, ethical clearance was taken from college ethical committee. Children suffering from any chronic cardiovascular, renal, musculoskeletal, endocrinal disease, obesity due to heredity, metabolic disorders, on any medicinal intake, were excluded from the study.

Blood pressure measurement- In this study, the blood pressure was regarded as systolic and diastolic pressure. Firstly the subjects were asked to rest for 5-10 minutes if they might engage in any physical activity then pressure was measured by sphygmomanometer. Systolic BP and Diastolic BP were measured by the auscultatory methods ^[6]. Pulse pressure was checked manually by using a normal wrist watch.

Anthropometric measurements- Weight was measured by weighing machine with a minimum amount of clothes wore. Measurement of height was done with stadiometer by making the subject standing straight.

Waist Circumference measurement was performed at the midpoint between the lower portion of the last rib and the upper edge of the iliac crest. It was done by elastic tape by having the subject in normal posture neither more inhaling nor exhaling. Hip Circumference measurement was done by elastic tape by having the subject in normal posture neither more inhaling nor exhaling ^[7].

Weight status with respect to BMI as per WHO criteria ^[8] is given in Table 1.

Table 1: Weight status in relation to BMI

S. No.	BMI	Weight status
1	Below 18.5	Underweight
2	18.5 - 24.9	Normal
3	25 - 29.9	Overweight
4	30 - 34.9	Obese Class I
5	35.9 - 39.9	Obese Class II
6	40 and above	Obese Class III

Statistical Analysis- An unpaired student's t-test was applied to analyze the case and control data using statistical software IBM SPSS version 23.0 (Chicago IL, USA). A P-value <0.05 was considered statistically significant.

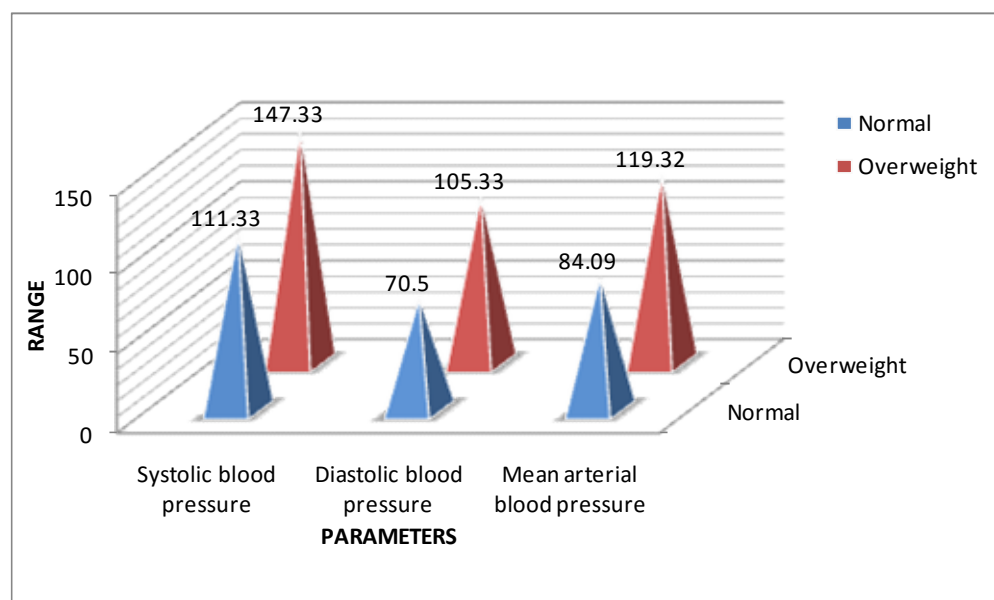
RESULTS

The study group consisted of 60 subjects including 30 overweighted and 30 normal male and female students, aged between 10 to 16 years. Their anthropometric characteristics and blood pressure were analyzed and compared. All the parameters including BMI, waist/hip ratio, systolic blood pressure, diastolic blood pressure, mean arterial blood pressure were significantly raised in study group as compared to control (with p values 0.001). The comparative values of all aforesaid parameters are given in Table 2. From Fig. 1 & Fig. 4 clearly shows, the differences of these parameters of normal and control group through graphical representation.

Table 2: Comparison of anthropometric parameters and blood pressure of study subjects and control

Variables	Group	N	Mean \pm SD	t-test value	p value
Body Mass Index	Normal	30	21.22 \pm 2.03	13.19	0.001*
	Overweight	30	27.18 \pm 1.40		
Waist/Hip Ratio	Normal	30	0.84 \pm 0.06	3.53	0.001*
	Overweight	30	0.89 \pm 0.04		
Systolic Blood Pressure	Normal	30	111.33 \pm 10.08	15.43	0.001*
	Overweight	30	147.33 \pm 7.84		
Diastolic Blood Pressure	Normal	30	70.50 \pm 6.06	17.71	0.001*
	Overweight	30	105.33 \pm 8.89		
Mean Arterial Pressure	Normal	30	84.09 \pm 6.47	19.2	0.001*
	Overweight	30	119.32 \pm 7.62		
Pulse Pressure	Normal	30	89.50 \pm 8.01	5.92	0.001*
	Overweight	30	100.60 \pm 6.40		

Unpair t-test, *Significant

**Fig. 1:** Comparison of blood pressure and mean arterial blood pressure of normal and overweight children

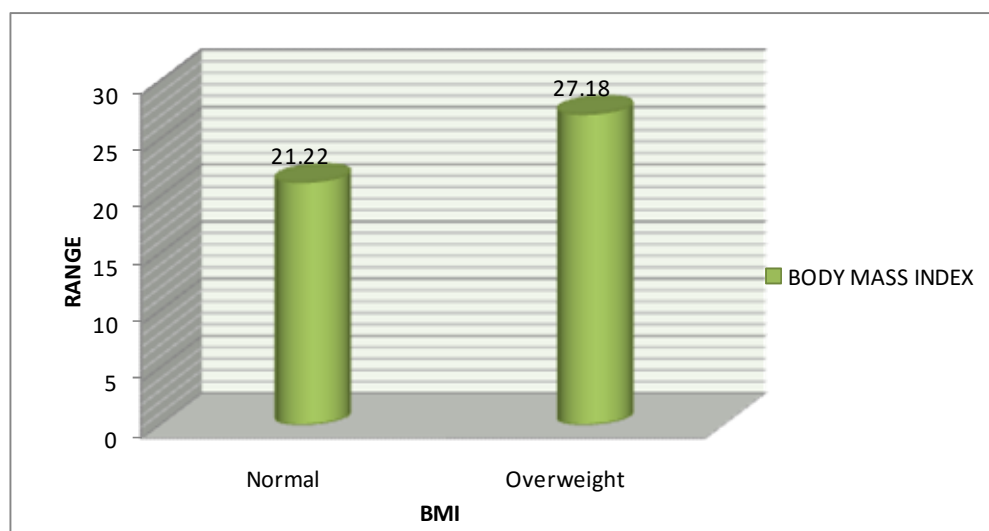


Fig. 2: BMI comparison of normal and overweight children

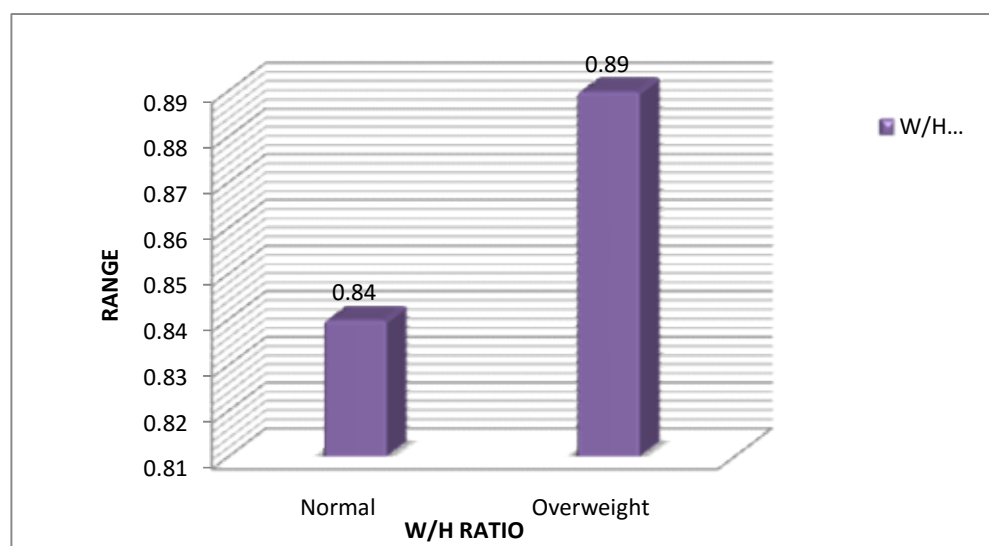


Fig. 3: Comparison of Waist/Hip ratio of normal and overweight children

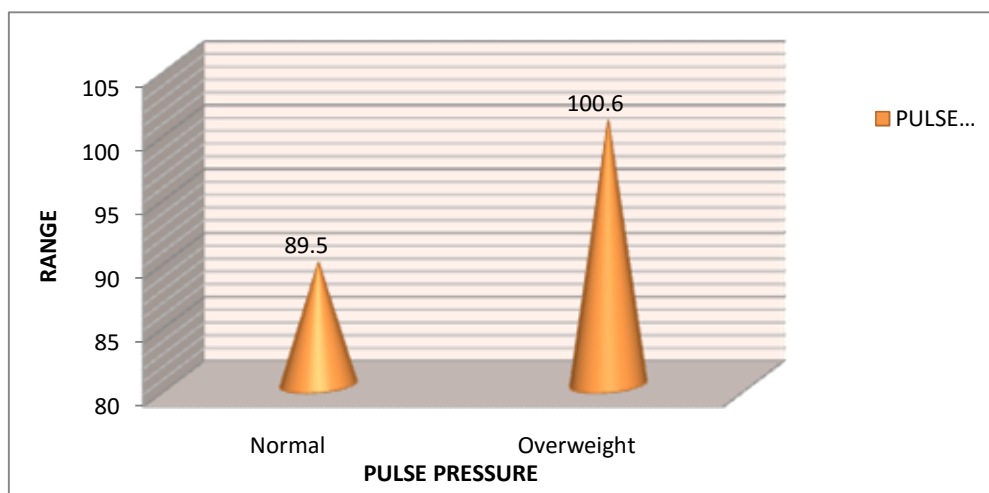


Fig. 4: Comparison of pulse pressure of normal and overweight children

DISCUSSION

Hypertension is not a disease of sudden onset in adults but a gradual phenomenon which happens in a genetically susceptible individual due to the interaction of multiple causative factors over a period of time since a younger age. Primary prevention in hypertension starts from the school age group by searching high-risk individuals and initiating non-pharmaco-therapeutic interventions at the earliest and reducing the incidence of hypertension in the community. The present study showed the prevalence of high blood pressure among overweight school children. In our study, 10-16 years age group was involved. Overweight students had been found to have more mean arterial pressure and more waist/hip ratio as compared to control. Overweight adolescents mostly were not having a proper and regular sleep pattern, neither they used to eat nutritious food and nor doing regular and proper exercise to stay fit. In our study, we found a significant change in all the above said parameters i.e. BMI, W/H ratio, MAP, PP among study subjects as compared to control (with P-value 0.001). Results of the study were found compatible with various studies done earlier^[8-11] in this direction.

According to the literature survey the age, BMI, salt intake and family history of hypertension were key predictors of high blood pressure among the 10-16 years aged adolescents^[12]. The higher calorie intake was documented among the hypertensive students^[13]. Dietary management including reduced salt intake, low fat diet, intake of healthy food and increased fruit consumption are important primary preventions as well as in preventing the future incidence of hypertension in the susceptible school children.

A study was conducted in Lithuania by Dulskiene *et al.*^[14] from November 2010 to April 2012. This cross-sectional study included 7,638 subjects aged between 12 to 15 years old. Studies on pre-hypertension and hypertension among various age groups and different sample sizes of children and adolescents showed that the prevalence rates vary widely. They concluded the high prevalence of high blood pressure and overweight, obesity, and abdominal obesity were significantly associated with pre-hypertension and hypertension among Lithuanian school children. Another study was conducted in Jinan, China by Shu-Kang Wang *et al.*^[15] in the year 2011-2012. An obesity task force in China generated standard criteria for overweight and obese people based on Body

Mass Index (BMI) and Waist Circumference (WC) values appropriate for Chinese people^[15]. A total of 1,870 people (P=0.494) were examined under this cross-sectional study from the blocks randomly selected from among 6 communities of Jinan, China. They concluded that the relationship between hypertension and general obesity was stronger than the relationship between hypertension and either overweight or central obesity in both genders. One more study done in the year 2012 in Kasturba Medical College, Manipal University, Karnataka, was conducted by Rao *et al.*^[16] in which a cross-sectional community based survey among 1,239 people aged ≥ 30 years was designed to estimate the prevalence and the sociodemographic correlates of hypertension. The study showed that a significant number of individuals were in pre-hypertension category. Among the study subjects, 16% had diabetes and a higher prevalence was noted among males as compared to females. Another study was done in the year 2016 at General Outpatient Clinic of the Federal Medical Centre, Owerri, Nigeria by Onuoha *et al.*^[17]. They found positive correlation between central obesity and blood pressure. One more study done in Department of Community Medicine, Pt. Jawahar Lal Nehru Memorial Medical College, Raipur, Chhattisgarh, India by Panda *et al.*^[18] in the year 2017 and it was concluded that there is a rising burden of hypertension among study population and waist hip ratio was strongly associated with hypertension. From the various studies conducted in the direction^[19-23] results seem to be compatible with the outcome of our study, though smaller sample size and lack of gender wise data, have been the major limitations of our study.

CONCLUSIONS

The increasing trend of raised blood pressure among adolescents points towards a change in lifestyle that has been implicated in the causation of the increasing prevalence of hypertension. This trend calls for a modification of lifestyle from birth to adulthood. Adopting a healthy diet, lower salt intake, and partaking in physical activity would help to maintain normal BP values in both children and adolescents.

In our study, the systolic and diastolic blood pressures are strongly associated with BMI. Avoidance of fast food intake, increase in routine physical activity like vigorous walking, dancing, swimming shall prove to be panacea to check the future risk of developing hypertension and

thereby preventing the individual from any risk of cardiac diseases. In future, however many large size studies with separate assessment of male and female variations are needed to be done in order to more clear the concept.

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