ORIGINAL RESEARCH

To study the asymptomatic hypertension among adolescent school going children

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ABSTRACT

Background: BP normally varies with age, sex and time of day. It increases with increasing age, is higher in males and demonstrates higher levels in the morning.It also varies with ethnicity.BP also demonstrates tracking which is maintenance of ranking with those of peers throughout life, implying that those that rank at higher ranges of normal are more likely to progress into hypertensive levels in later life. **Aim:** This study was done to evaluate asymptomatic hypertension among adolescent school going children. **Methods:** The present study was conducted at Dept. of PEDIATRICS, SHRI KRISHNA MEDICAL COLLEGE AND HOSPITAL, Muzaffarpur, Bihar, after obtaining clearance from institutional ethical committee, Informed consent was taken from the parents before including into the study. This is a prospective study, to evaluate blood pressure profile of apparently healthy high school going adolescent. **Study duration:** September 2021 to February 2023. **Results:** In the present study, the study group had 10% children of 13, 14, 15 and 16 years, 9% children of 6, 8, 9 and 12 years and 8% children of 7, 10 and 11 years. 54% children were female while male children constituted 46% of the study group. **Conclusions:** The mean values of systolic and diagnostic blood Pressure in overweight and obese group is significantly higher with p value <0.001. For a given age, blood pressure levels were higher in taller and obese children.Children with family history of hypertension and those belonging to higher socio economic status (class I) had increased systolic and diastolic blood pressure. Higher body weight may be used as a predictor of high blood pressure. Overweight and obesity in children should be considered as pre disease state which may lead to development of hypertension and related cardiovascularcomplications in later life.

Keywords: hypertension, adolescent

INTRODUCTION

Blood pressure measurement in childhood and adolescence is an important clinical examination as is the recording of body temperature, pulse rate and respiratory rate. Blood pressure raises with increasing age. Both systolic and diastolic blood pressure show a positive correlation with height and weight in both sexes. The underlying process of growth and maturation is closely linked to the BP in children and adolescents.

Blood pressure (BP), also referred to as arterial BP, is the pressure exerted by circulating blood upon the walls of blood vessels.[1] BP is a reflection of haemodynamic variables such as cardiac output and peripheral vascular resistance as well as adequacy of tissue perfusion.

BP normally varies with age, sex and time of day. It increases with increasing age, is higher in males and demonstrates higher levels in the morning.[2] It also varies with ethnicity.[2] BP also demonstrates tracking which is maintenance of ranking with those of peers throughout life, implying that those that rank at higher ranges of normal are more likely to progress into hypertensive levels in latter life.[3]

Blood pressure measurement in childhood and adolescence is an important clinical examination as is the recording of body temperature, pulse rate and respiratory rate. Blood pressure raises with increasing age. Both systolic and diastolic blood pressure show a positive correlation with height and weight in both sexes. The underlying process of growth and maturation is closely linked to the BP in children and adolescents.

Even after so much of improvements in the diagnostic techniques, it is often difficult to determine the arterial blood pressure with accuracy in infants and young children. The difficulty encountered is both in the technique and in the interpretation of the reading itself. Although the prevalence of clinical hypertension is of a far lesser magnitude in children than adults, there is

ample evidence to support the concept that the roots of essential hypertension extend back into childhood.[4]
The original orientation of physicians with regard to BP in children and adolescents was towards identification and treatment of secondary forms of hypertension, such as renal parenchymal disease and renal artery stenosis. It is now understood that hypertension detected in some children may be a sign of an underlying disease, whereas in other cases the elevated BP may represent the early onset of essential hypertension.[5]
A document from the National Heart Lung and Blood Institute of the United States of America (USA), called the Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents (Fourth Report) defines hypertension (HTN) as average systolic blood pressure (SBP) and/or diastolic blood pressure (DBP) that is ≥95th percentile for age, sex, and height obtained on ≥3 occasions.[6]
Hypertension could be primary or secondary.[3] Primary (essential) HTN is the term used when there is no identifiable cause while secondary HTN is used when the cause is identified.[3] These causes could be from the renal, cardiovascular, endocrine or nervous systems as well from drugs e.g. oral contraceptives, corticosteroids and cocaine.[3] It could also be due to residence at high altitudes.Risk factors for primary HTN include heredity, diet, stress, and obesity.
Primary HTN is now identifiable in children,and is more common in adolescents while secondary HTN is more common in younger children.[3] The prevalence of HTN increases with age, ranging from less than one per cent in infants and younger children through 15 per cent in young adults to 60 per cent in individuals older than 65 years.[3]
Primary prevention of one of the leading health problems like hypertension and ischemic heart disease in adults necessitates a scientific evaluation of the predictors in children and adolescents. Blood pressure studies in these younger age groups provide important epidemiological information which may help in controlling or modifying the risk factors thereby decreasing the mortality and morbidity in the future.[7]
Hence this study was done to evaluate asymptomatic hypertension among adolescent school going children.

AIM OF THE STUDY

To Identify Prevalence of

a) Asymptomatic hypertension.
b) Obesity
c) Overweight among school children between 10 - 17 years.

Association of risk factors like age, sex, obesity, overweight, socio economic status, physical activity, hours of watching television, oil consumed, family history of hypertension, family Ho. Diabetes mellitus, to hypertension among these children.

METHODOLOGY

The present study was conducted at Dept. of PEDIATRICS, SHRI KRISHNA MEDICAL COLLEGE AND HOSPITAL, Muzaffarpur, Bihar, after obtaining clearance from institutional ethical committee, Informed consent was taken from the parents before including into the study. This is a prospective study, to evaluate blood pressure profile of apparently healthy high school going adolescent.

STUDY DURATION

September 2021 to February 2023.

INCLUSION CRITERIA

- Apparently healthy high school adolescents, in the age group of 13–18 years without any known comorbidities or congenital abnormalities.

EXCLUSION CRITERIA

- Adolescents with any serious chronic illness like congenital heart disease, renal disease, liver disease, hypothyroidism.
- Adolescents with congenital anomalies.
- Adolescents below 13 and above 18 years of age.

MEASUREMENT OF BLOOD PRESSURE

- Before recording BP, the procedure was explained to children and sufficient time were given to allay anxiety and fears. BP were measured in sitting position using mercury manometer with a set of different sized cuffs as per the recommendations. The cuff bladder was wide enough to cover at least 2/3rd of arm and long enough to encircle arm completely. Auscultatory method were used and the first and fifth Korotkoff's sounds were taken as indicative of the SBP and DBP, respectively. BP were recorded three times with 2 min interval between each measurement. Average of three BP readings were taken.
- Detailed history and physical examination of all systems (respiratory system, cardiovascular system, gastro-intestinal system, nervous system) were done to exclude the systemic disorders like congenital heart disease, renal disorders, and liver diseases.

RESULTS

Data was entered into Microsoft Excel spreadsheet and was checked for any discrepancies. Summarized data was presented using Tables and Graphs. The data was analysed by SPSS (21.0 version). Data was normally distributed therefore, bivariate analyses were performed using the parametric tests i.e Independent t test and Paired t test. For inter group comparison, Chi square test was used for categorical variables. Level of statistical significance was set at p-value less than 0.05.

Table 1: Mean age of the study group was found to be 16.69 ± 0.46
Table 1: Mean age of study subjects

	N	Minimum	Maximum	Mean	Std. Deviation
AGE in Yrs	202	13.0	18.0	16.693	.4624

Table 2 & Figure 2: Study population comprised of 109 (54%) females and 93 males (46%)
Table 2: Gender wise distribution

		Frequency	Percent
	F	109	54.0
	M	93	46.0
	Total	202	100.0

Figure 1: Gender wise distribution

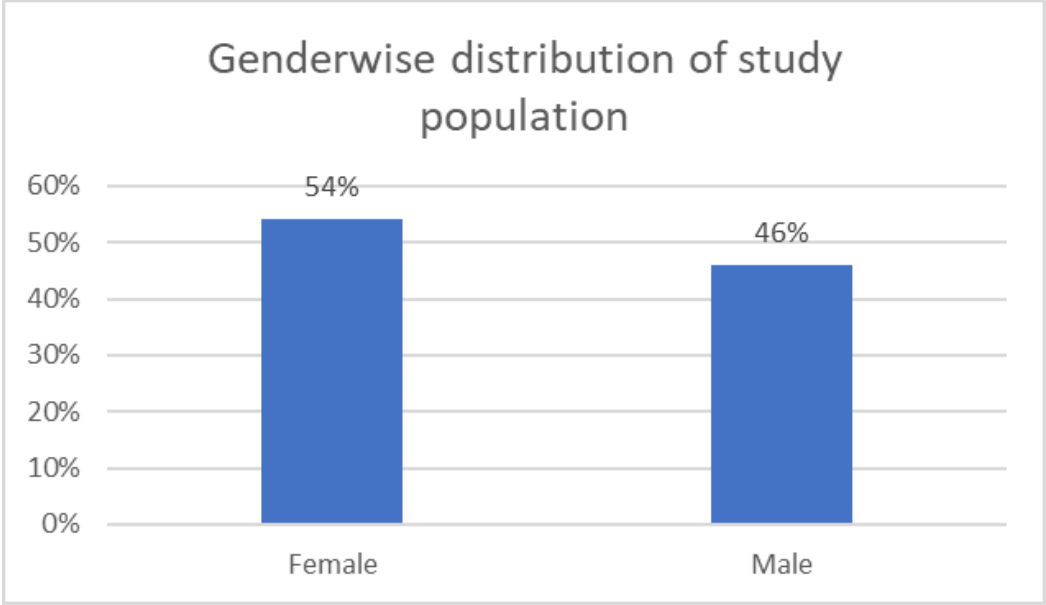

Table 3 & Figure 3: A total of 7 (3.5%) subjects had HTN among the study population
Table 3: Prevalence of HTN

		Frequency	Percent
	Absent	195	96.5
	Present	7	3.5
	Total	202	100.0

Figure 2: Prevalence of HTN

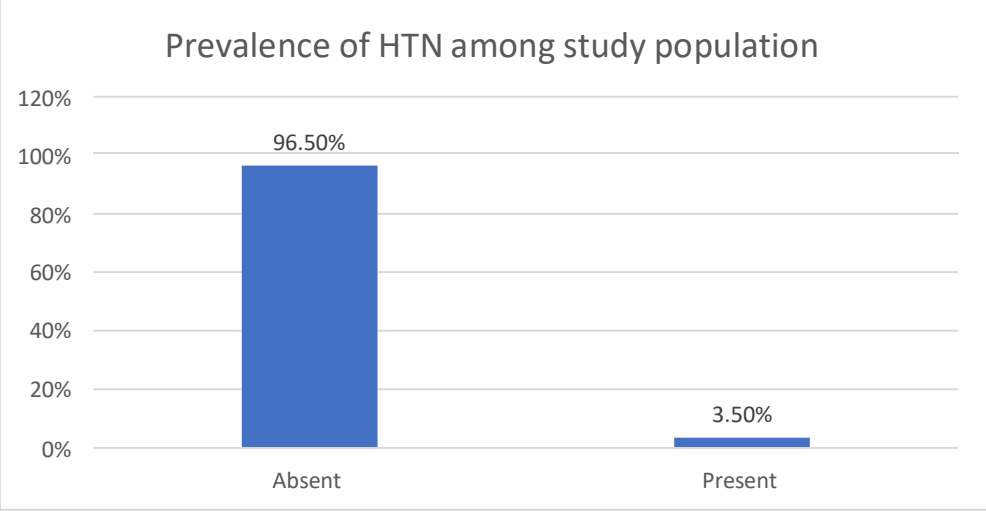

Table 4: Mean weight of the study population was found to 49.42 ± 6.21 Kg
Table 4: Mean weight of the study population

	N	Minimum	Maximum	Mean	Std. Deviation
Weight in kg	202	30.0	72.0	49.422	6.2130

Table 5: Mean height of the study population was found to be 1.60 ± 0.077
Table 5: Mean height of the study population

	N	Minimum	Maximum	Mean	Std. Deviation
Height in meter	202	1.33	1.77	1.6027	.07734

Table 6 & Figure 3: Among the study population, 20 subjects had a family history of HTN
Table 6: Distribution of study population based on family history of HTN

		Frequency	Percent
	Absent	182	90.1
	Present	20	9.9
	Total	202	100.0

Figure 3: Distribution of study population based on family history of HTN

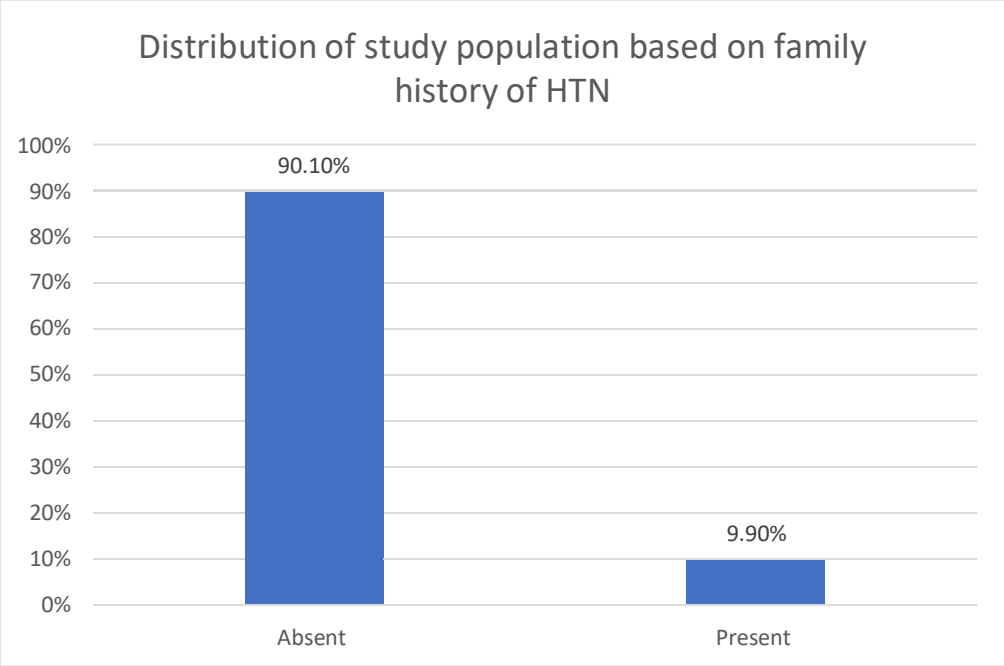

Table 7 & Figure 4: Among the study population, 142 subjects were from Class I SES group, 42 from Class II group and 18 from class III group.
Table7: Distribution of study population acc to SES

		Frequency	Percent
	Class I	142	70.3
	Class II	42	20.8
	Class III	18	8.9
	Total	202	100.0

Figure 4: Distribution of study population acc to SES

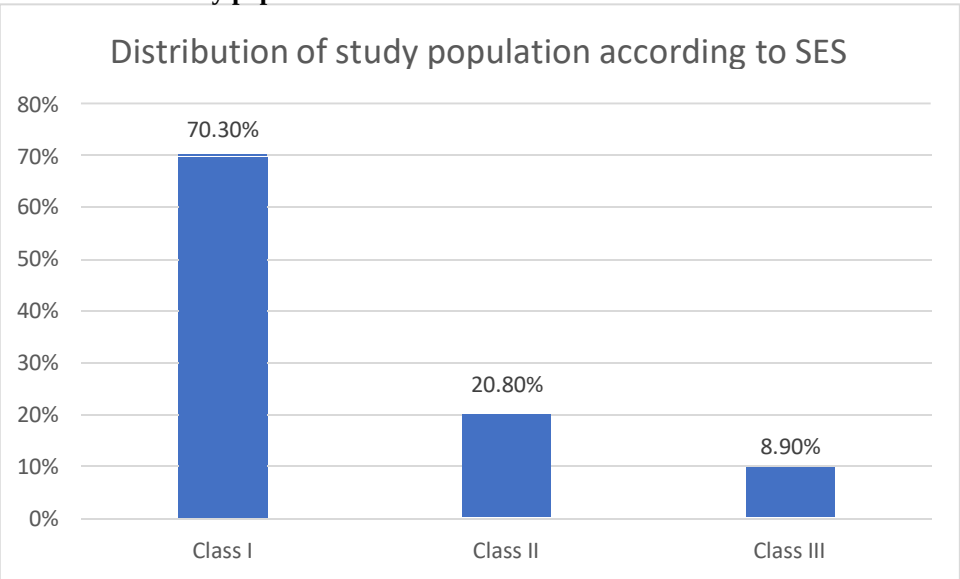

Table 8 & figure 5: Among the study population, 142 subjects were vegetarian and 60 subjects were Non vegetarian.

Table 8: Distribution based on diet

		Frequency	Percent
	Non vegetarian	60	29.7
	Vegetarian	142	70.3
	Total	202	100.0

Figure 8: Distribution based on diet

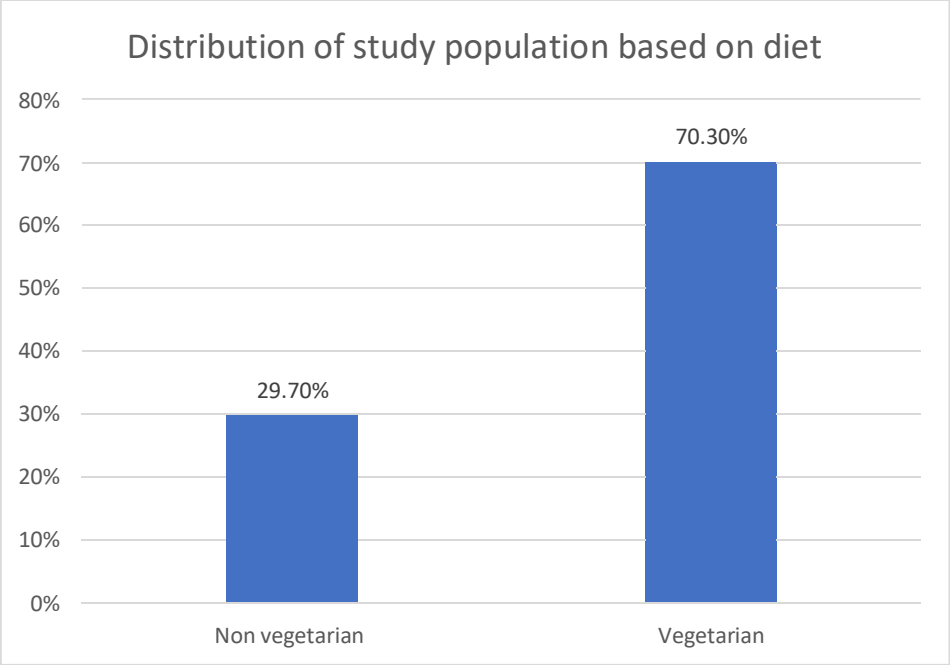

Table 9 & figure 6: Among the study population, mean SBP was found to 116.30 ± 6.74 and mean DBP was found to be 75.40 ± 7.16

Table 9: Mean SBP and DBP

	N	Minimum	Maximum	Mean	Std. Deviation
SBP	202	106.00	150.00	116.3070	6.74780
DBP	202	66.00	110.00	75.4095	7.16018

Figure 6: Mean SBP and DBP

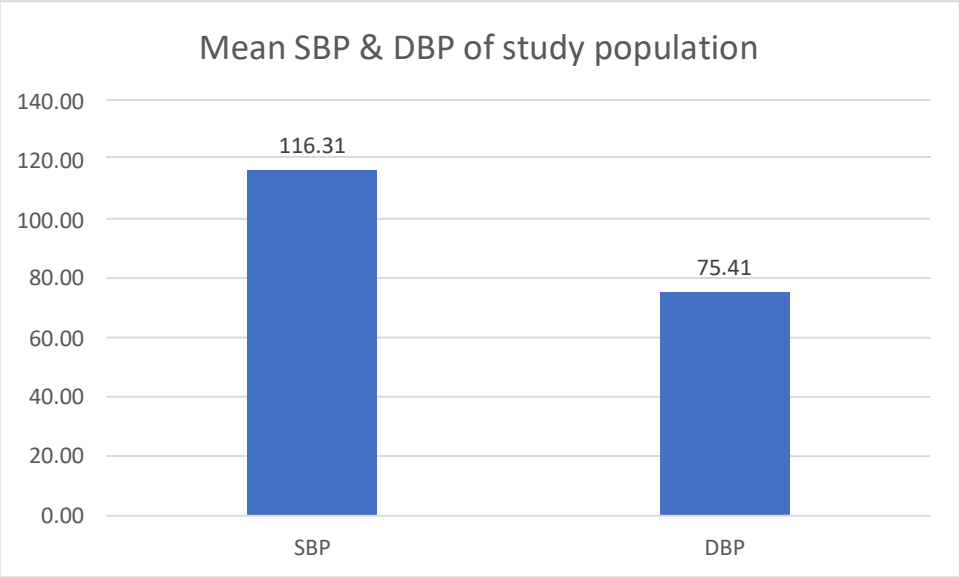

Table 10: Gender wise comparison among study population was done for mean SBP and DBP. It was observed to significant for both SBP and DBP i.e there was significant difference among in mean SBP & DBP of males and females.

Table 10: Comparison of mean SBP and DBP among males and females

	SEX	N	Mean	Std. Deviation	Std. Error Mean	P VALUE
SBP	Male	93	117.6345	6.74268	.69918	0.009*
	Female	109	115.1743	6.57273	.62955	
DBP	Male	93	77.0399	7.07320	.73346	0.003*
	Female	109	74.0183	6.96816	.66743	

Table 11: When SBP and DBP were correlated with weight, height and BMI, a significant correlation was observed between SBP and height, DBP with weight and height

Table 11: Correlation of SBP and DBP with weight, height and BMI

		Weight	Height	BMI
SBP	Pearson Correlation	.109	.172*	-.040
	Sig. (2-tailed)	.122	.014	.571
	N	202	202	202
DBP	Pearson Correlation	.156*	.189**	.013
	Sig. (2-tailed)	.026	.007	.858
	N	202	202	202

DISCUSSION

HT is a major health problem in developed and developing countries associated with high mortality and morbidity affecting approximately one billion individuals worldwide. Since sign and symptoms generally do not appear during childhood and adolescence so it goes undetected during this period. Prevalence of HT increases with age and in adolescence as well. It is multifactorial disease, influenced by genetic, racial, geographic, cultural and dietary patterns.[8]

The BP varies with age, sex, weight, height, Body Mass Index (BMI), social economic status, family history of HT and dietary habits. It is very difficult to record reliable BP in children below six years by conventional methods; hence the ideal age would be 6–16 years, i.e., school children.[9]

In the present study, the study group had 10% children of 13, 14, 15 and 16 years, 9% children of 6, 8, 9 and 12 years and 8% children of 7, 10 and 11 years. 54% children were female while male children constituted 46% of the study group.

Madhusudhan K et al[10] in an observational study reported according to weight, students were arranged into 6 groups with a difference of 10 kg between each group, independent of age and height. It is observed that with increase of weight, there is a linear increase of mean systolic and diastolic blood pressures in both boys and girls. It is observed that as the height of the group increased, there is a linear increase of mean systolic and diastolic blood pressures of the group with a steep rise in >170 cm height group. BMI of subjects, students were categorized into four groups (those with BMI < 5th percentile, between 5th and <85 percentile, 85th and <95 percentile and those ≥ 95

percentile). The mean SBP and DBP of the overweight group (BMI 85th to 95th percentile) and obese group (BMI ≥95th percentile) was higher than other BMI groups.

In our study, 10% children had a family history of hypertension while 90% children had no family history of hypertension. 70% children were from upper class, 20% children were from middle class and 9% lower class . Majority of the children 70.3% in our study were vegetarian and 29.7% were non vegetarian. Prevalence of overweight was 7.5% in males compared to 4.8% in females with overall prevalence of 6%. Prevalence of obesity was 2.4% in males compared to 0.7% in females with overall prevalence of 1.5%.

Taksande et al[11]., in their study in Wardha district, found prevalence of HT in children to be 5.75%. Various studies[12,13] reported prevalence of HT in children between 0.46% to 11.7%. The reason for low prevalence of HT in some studies may be because of use of means and standard deviation for HT assessment rather than using the more acceptable criterion of 95TH percentile of BP-values. Chadha SL et al[14]., in their study reported, prevalence of HT in school children was 11.7%. Similarly, Anjana et al.[15], reported prevalence of HT among boys and girls, as 8.33% and 6.52%, respectively. Both the above studies were conducted in urban schools, where dietary habits and lack of physical activity could have contributed to a higher incidence.

In the present study, the SBP and DBP showed a positive correlation with age, height and BMI which is consistent with the previously reported studies on BP in children.[16-19] In the present study, both SBP and DBP show a significant correlation with increase in age, height and BMI but not with weight. Voors et al.[20], reported that BP was correlated more closely to height and body mass than age.

The positive correlation of both systolic and diastolic blood pressure with height in the present study confirms the presence of primary HT among children and suggests that such children are at risk of developing HT at latter stages. The finding recommend that these children should be considered for high risk for developing CVD and type 2 diabetes and must be screened for a close follow up for modification of risk factors.

Healthy dietary patterns developed in childhood are important for prevention of Cardio-Vascular Diseases (CVD) in adulthood. The evidences regarding the effectiveness of long term dietary intervention for the reduction of risk factors for CVD in children is limited, but the available data suggest that changes in specific dietary macronutrients (e.g., dietary fat and carbohydrates) and micronutrients (e.g., sodium and calcium) have an impact on the risk of Cardio-vascular diseases. Unhealthy dietary practices such as junk food and cold drink consumption, less vegetable and fruit intake was found in many school going students in present study. These habits should be prohibited from early age.

Hypertension was significantly associated with higher B.M.I. Similarly cross sectional studies done by Prasad et al and Shaziya et al among adolescent school children reported a highly significant ($p<0.001$) correlation between BMI and hypertension.[21,22]

CONCLUSION

Hypertension is not an uncommon problem in children; its morbidity should be prevented by identifying children in pre hypertension stage and adopting life style modification.Therefore blood pressure measurement should be made mandatory in school health programs and in routine clinical practice. High BMI should be taken as risk factor for hypertension and it should also be taken into consideration for labeling a particular child as hypertensive based on blood pressure nomograms. There was no significant difference of blood pressure (systolic as well as diastolic) between males and females.With increase of age, weight and height there was a linear increase of mean systolic and diastolic blood pressure. The mean values of systolic and diagnostic blood Pressure in overweight and obese group is significantly higher with p value <0.001. For a given age, blood pressure levels were higher in taller and obese children.Children with family history of hypertension and those belonging to higher socio economic status (class I) had increased systolic and diastolic blood pressure. Higher body weight may be used as a predictor of high blood pressure. Overweight and obesity in children should be considered as pre disease state which may lead to development of hypertension and related cardiovascular complications in later life.

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