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Original Research Article

The study of blood pressure profile among school going adolescents in urban Agra

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ABSTRACT

Background: Hypertension once considered a problem of adults only in the high income countries, now dramatically is on the rise in low and middle income countries. An established predictor of adult hypertension and organ damage is childhood hypertension. Thus for the control, effective treatment and prevention of its complications, early diagnosis of hypertension in adolescents in an important strategy. The objective was to study the blood pressure profile and its socio-demographic determinants among school going adolescents in urban Agra.
Methods: A cross-sectional survey was done among 534 adolescent in age group of 13-18 years studying in various government and private schools in urban Agra. Socio demographic details, anthropometric measurements and family history of hypertension were obtained. Also the dietary habits, physical activity, mode of transport to school were included in the present study. Blood pressure was measured at 0 and 30 minutes and average of two readings was taken as the final reading of that individual.
Results: It was found that 49.82% of the study subjects had above normal blood pressure and among them 21.16% were hypertensive and 28.66% had pre-hypertension. Higher blood pressure showed a statistically significant ($p<0.05$) association with gender, age, dietary habits, physical activity, body mass index, and parental history of hypertension.
Conclusions: Hypertension among the adolescent age group was very high. Prevalence of high blood pressure significantly associated with age, gender, family history of hypertension, physical activity, type of school and dietary habits.

Keywords: Prevalence, Hypertension, School, Adolescents

INTRODUCTION

Cardiovascular diseases (CVD) have been declared as ‘the world’s number one killer’ by World health organization in their global heart initiative report 2016.[1]

Globally it accounts for approximately 17 million deaths a year, nearly one third of the total reported deaths world wide.[2] Of these, complications of hypertension account for more than half of the deaths (9.4 million) worldwide every year.[3] Hypertension is now a common disease associated with high morbidity and mortality and is recently described as a "silent killer" by World Health Organization. About one billion of adult world population was hypertensive in the year 2000 and this is expected to increase to two billion by 2025.[4]

Hypertension once considered a problem of adults only in the high income countries, now dramatically is on the rise in low and middle income countries.[5] Childhood hypertension is an established predictor of adult hypertension and organ damage, and it is underestimated problem in developing countries like India.[6] An increasing number of healthy children and adolescents across the world are being diagnosed with HTN.[6]

Early diagnosis of hypertension is an important strategy in its control, effective treatment and prevention of complications. Thus this study was planned with the objective to find the blood pressure profile and its biosocial correlates among school going adolescents of urban Agra.

METHODS

The present community based cross sectional study was planned in urban schools of Agra city. A list of schools was obtained from the government website, then a separate list of Government and Private schools was made to ensure participation of both type of schools.[7] The schools were randomly selected and children of the selected school fulfilling the inclusion criteria were included in the present study. Attempts were made to ensure proportionate participation of both male and female subjects (Figure 1).

The purpose and procedure of the study was discussed in detail with the Principal of the selected school and permission was obtained. Students from 9th to 12th class were included in the study.

Inclusion criteria

Inclusion criteria were all students from 9th to 12th class in the school; students who gave consent for the study conducted on them.

Exclusion criteria

Exclusion criteria were students not consenting; students absent on the day to examination; parents not consenting.

Study was done from during April 2018 to October 2018.

Sample size calculation

For this, the study by Saaduddin has been used as reference.[8] The study revealed that the cumulative prevalence of hypertension and pre-hypertension in school children in Central India (Aurangabad) was found to be 19.4. Thus Sample size calculated was 426. Adding a figure of 20% for incomplete/incorrectly filled forms the total number came out to be 511.

As all the students from each selected section were taken the final sample size came out to be 534.

Sampling technique

Stratified random sampling was used in the present study.

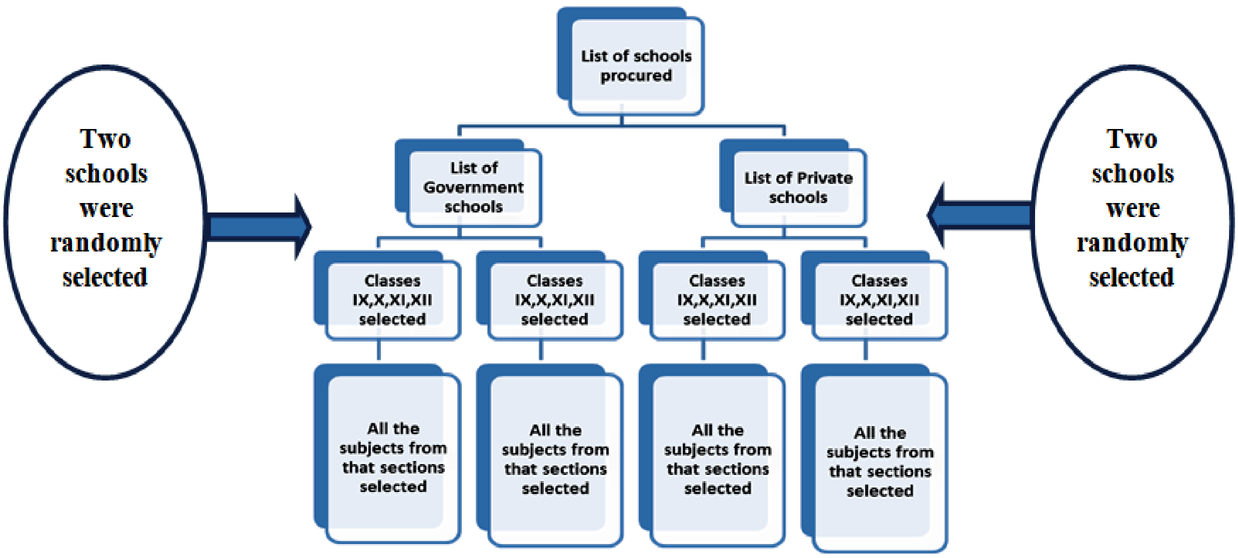

Figure 1: Flow chart depicting sample selection process.

Blood pressure measurement was measurements were recorded according to recommended guidelines.[9] For each subject, two recordings were taken at an interval of 30 min and the average of two readings was taken as the final reading. Adolescents with average systolic blood pressure (SBP) or diastolic blood pressure (DBP) levels greater than or equal to 90 percentile, but less than the 95 percentile, were classified as pre-hypertensive. The children were considered to be hypertensive if their SBP or DBP or both were equal to or more than the 95 percentile for age, sex and height according to “The fourth report on the diagnosis, evaluation and treatment of high blood pressure in children and adolescents”.[9]

Socioeconomic status of the family was calculated according to the Modified Kuppuswamy Socio-economic classification.

The semi-structured, self administered questionnaire included details such as personal details (age, sex, Standard of study, school type), family details (Type of family, family history of hypertension among parent), mode of transport of school, sedentary life style questions and physical activities questionnaire (International physical activity questionnaire, IPAQ).[10]

Dietary pattern questions included frequency of meals, breakfast, intake of vegetables, fruits, sugary drinks and junk food (according to GSHS criteria 2013).[11]

Adding extra salt to food and eating while watching television or studying were also included in the study. Anthropometric measurements such as height and weight were also recorded.

Body mass index also called as the quetelet's index is the ratio of weight (kg)/height (m^2). For subjects of adolescent age group, the percentiles of BMI were calculated to assess the prevalence of overweight (≥85th percentile but <95th percentile) and obesity (≥97th percentile) in the study population (WHO).[12]

Statistical analysis was done using Epi info software**.** The results were reported as a proportion with 95% confidence interval. Appropriate statistical tests were applied. The p value less than 0.05 was considered statistically significant.

RESULTS

A total 534 school children (13-18 years) from four different schools, two each from Government and private sector were included in this study.

The age of the study subjects varied from 13 to 18 years. Maximum study subjects (42%) belonged to 15 to 16 years of age group followed by 13 to 14 years (36%) and 17 to 18 years of age group (22%). 300 (56.2%) subjects were male and 234 (43.8%) were female. 53.9% subjects studies in government school and 46.1% subjects studied in private school (Table 1).

Blood pressure distribution among school students shows that half of the subjects (50.18%) had normal blood pressure. While 28.65% of the subjects were pre-hypertensive and 21.6% were hypertensive (Table 2).

Table 1: General profile of study subjects.

Variables	Category	Total N (%)	Normal N (%)	Prehypertension N (%)	Hypertension N (%)	P value
Age group (in years)	13 to 14	194 (36.3)	91 (46.9)	55 (28.4)	48 (24.7)	χ^2=29.99 d.f. 4 p<0.001
	15 to 16	224 (41.9)	138 (61.6)	58 (25.9)	28 (12.5)	
	17 to 18	116 (21.7)	39 (33.6)	40 (34.5)	37 (31.9)	
Sex	Male	300 (56.2)	119 (39.7)	111 (37.0)	70 (23.3)	χ^2=33.27 d.f. 2 p<0.001
	Female	234 (43.8)	149 (63.7)	42 (17.9)	43 (18.4)	
Class	IX	202 (37.8)	101 (50.0)	62 (30.7)	39 (19.3)	χ2=44.44 d.f. 6 p=0.001
	X	168 (31.5)	89 (53.0)	42 (25.0)	37 (22.0)	
	XI	58 (10.9)	46 (79.3)	12 (20.7)	0 (0.0)	
	XII	106 (19.9)	32 (30.2)	37 (34.9)	37 (34.9)	
School type	Private	246 (46.1)	56 (22.8)	106 (43.1)	84 (34.1)	χ2=137.8 d.f. 2 p=0.001
	Government	288 (53.9)	212 (73.6)	47 (16.3)	29 (10.1)	
Socio-economic class	Upper	16	1 (6.3)	5 (31.3)	10 (62.5)	χ2=123.39 d.f. 6 p=0.003
	Upper middle	244	69 (28.3)	100 (41.00)	75 (30.7)	
	Lower middle	82	64 (78.0)	8 (9.8)	10 (12.2)	
	Lower	192	134 (69.8)	40 (20.8)	18 (9.4)	
	Total	534	268 (50.18)	153 (28.66)	113 (21.16)	

Table 2: Distribution of blood pressure among study subjects according to their dietary habits.

Variable	Category	No.	Normal N (%)	Pre-hypertension N (%)	Hypertension N (%)	P value
Meals Per day	3 or more meals per day	280	103 (36.8)	101 (36.1)	76 (27.1)	χ2=42.33 d.f. 2 p=0.000
	less than 3 meals per day	254	165 (65)	52 (20.5%)	37 (14.6)	
Breakfast Daily	Yes	324	162 (50.0)	91 (28.1)	71 (21.9)	χ2=0.318 d.f. 2 p=0.853
	No	210	106 (50.5)	62 (29.5)	42 (20.0)	
Fruits intake per week	Less than 3 days per week	427	203 (47.5)	129 (30.2)	95 (22.2)	χ2=5.972 d.f. 2 p=0.04
	3 or more days per week	107	65 (60.7)	24 (22.4)	18 (16.8)	
Vegetables intake per week	Less than 3 days per week	355	149 (42.0)	127 (35.8)	79 (22.3)	χ2=33.593 d.f. 2 p=0.000
	3 or more days per week	179	119 (66.5)	26 (14.5)	34 (19.0)	

Continued.

Variable	Category	No.	Normal N (%)	Pre-hypertension N (%)	Hypertension N (%)	P value
Sugary drinks intake per week	Less than 3 days per week	474	251 (53.0)	125 (26.4)	98 (20.7)	χ2=14.56 d.f. 2 p=0.001
	3 or more days per week	60	17 (28.3)	28 (46.7)	15 (25.0)	
Junk food intake per week	Less than 3 days per week	416	232 (55.8)	110 (26.4)	74 (17.8)	χ2=25.014 d.f. 2 p=0.000
	3 or more days per week	118	36 (30.5)	43 (36.4)	39 (33.1)	
Total		534	268 (50.18)	153 (28.66)	113 (21.16)	

Table 3: Association between blood pressure with physical activity

Variable	Category	No.	Normal N (%)	Pre-hypertension N (%)	Hypertension N (%)	P value
Physical activity	Low	127	61 (48.0)	43 (33.9)	23 (18.1)	χ^2=12.25 d.f. 4 p=0.016
	Moderately	158	65 (41.1)	51 (32.3)	42 (26.6)	
	Highly	249	142 (57.0)	59 (23.7)	48 (19.3)	
Eating while studying/ watching T.V.	Yes	335	142 (42.4)	113 (33.7)	80 (23.9)	χ2=22.133 d.f. 2 p=0.000
	No	199	126 (63.3)	40 (20.1)	33 (16.6)	
Mode of transport to school	Manual	332	218 (65.7)	69 (20.8)	45 (13.6)	χ2=84.846 d.f. 2 p=0.002
	Automobile	202	50 (24.8)	84 (41.6)	68 (33.7)	
Total		534	268 (50.18)	153 (28.66)	113 (21.16)	

Table 4: Basal Metabolic Index (B.M.I.) and blood pressure distribution among the study subjects.

Variable	Category	Number N (%)	Normal N (%)	Pre-hypertension N (%)	Hypertension N (%)	P value
<5th Percentile	Underweight	76 (14.2)	59 (77.6)	17 (22.4)	0 (0.0)	χ2=84.67 d.f. 4 p=0.000
5th to <85th Percentile	Normal	334 (62.5)	181 (54.2)	93 (27.8)	60 (18.0)	
≥85th Percentile	Overweight/ Obese	124 (23.3)	28 (22.6)	43 (34.7)	53 (42.7)	

Table 5: Association between sex, socio-economic class and B.M.I. with blood pressure among study subjects.

Variable	Odds ratio	C.I. (lower)	C.I. (upper)	P value
Sex (males v/s females)	2.666	1.874	3.794	0.000
SES* (Class IV-V v/s Class I-III)	7.071	4.832	10.349	0.001
BMI (≥85th Percentile v/s <85th Percentile)	4.840	3.042	7.702	0.001
Type of school (Private v/s Private school)	9.464	6.364	14.074	0.001
Fruits less than 3 days per week	1.708	1.109	2.630	0.015
Eating extra salt with meals	1.766	1.189	2.624	0.005
Vegetables less than 3 days per week	2.742	1.884	3.990	0.000
Sugary drink three or more days per week	2.847	1.579	5.135	0.000
Junk food three or more days per week	2.872	1.855	4.446	0.000
Three or more meals per day	3.186	2.236	4.540	0.000
Saturated oil used for cooking at home	3.499	2.312	5.293	0.000
Father having hypertension (Yes vs No)	3.211	1.703	6.056	0.000
Mother having hypertension (Yes vs No)	2.559	1.199	5.462	0.012
Physically less active	1.675	1.188	2.360	0.003

The hypertension was significantly associated with age ($p<0.001$), male sex ($p<0.001$), class of study ($p<0.001$), studying in private school ($p<0.001$) (Table 1, 2).

Maximum number of the study subjects belong to Upper Middle class (45.69%) and Upper lower class (35.95%). While very few study subjects belonged to upper (2.9%) and lower (0.4%) socio economic class. This was found to be statistically significant ($p<0.001$) (Table 1).

Hypertension was more prevalent among the subjects taking three or more meals per day (27.1%), taking fruits for less than three days per week (22.2%) and taking vegetables for less than three days per week (22.3%). Prevalence of hypertension was more seen with the subjects taking sugary drinks more than three days per week (20.7%) and taking extra salt with meals (26.5%) and taking junk food for three or more days per week (33.1%). The hypertension showed a significant association with the above mentioned dietary habits. Insignificant association of blood pressure was seen with frequency of eating breakfast. (Table 2)

In the present study prevalence of hypertension increased significantly with decrease in physical activity ($p<0.05$). Eating while watching T.V. or studying ($p<0.001$) and going to school via automobile ($p<0.05$) was significantly associated with increased prevalence of hypertension, 23.9% and 33.7% respectively (Table 3).

Majority of the subjects (62.5%) were having normal B.M.I. (WHO criteria for B.M.I. for gender, age and height for adolescents).[12] It was found that more than one fifth (23.3%) of the subjects were either overweight (16.9%) or obese (6.4%) (Table 4).

There were significantly higher odds of having hypertension ($p<0.05$) among subjects studying in private school (OR=9.464), higher socioeconomic status (OR=7.071), high B.M.I. (OR=4.840), eating three or meals per day (OR=3.186), eating vegetables for less than three days per week (OR=2.742), drinking sugary beverages more than three days per week (OR=2.847), eating junk food for three or more days per week (OR=2.872), male subjects (OR=2.666), taking extra salt with meals or fruits (OR=1.766), consumption of fruits less than three days per week (OR=1.708) and less physically active (OR=1.675) (Table 5).

DISCUSSION

In the present study the blood pressure profile of the school going adolescents of urban Agra was observed. The overall prevalence of hypertension was found to be 21.2%. Similar prevalence of hypertension was reported in studies conducted by Sharma et al, Sundar et al and Das et al (20.0%, 21.5% and 19.7% respectively).[13-15]

The prevalence of pre-hypertension was found to be 28.65%. Similarly Nagar et al reported 30.2% prevalence of pre-hypertension among School Going Adolescents in Surendranagar City, Gujrat.[16] Higher prevalence of pre-hypertension has been reported by Kini et al from Mangalore and by Banker Chirag et al from Ahmedabad (i.e. 42.6% and 100.0% respectively).[17,18]

In coherence with the present study Sabapathy et al did not find any linear relation of blood pressure with age of the study subjects.[19]

In the studies conducted by Sundar et al and Katta et al male subjects had significantly higher blood pressure as compared to female subjects and this goes along with the present study.[14,20] Subjects studying in private school had significantly higher prevalence of hypertension and as compared to those studying in government schools and similar observations were reported by Nagar et al and Sabapathy et al.[16,19]

Similar findings were reported by Satyanarayana et al and Kaur et al where the blood pressure was found to increase with rising socio-economic status as in the present study.[21,22]

Similar to the findings of the present study, Katta et al and Satyanarayana et al also reported that elevated blood pressure was significantly higher among subjects with positive family history of hypertension.[20,21]

The present study reported significant association of hypertension with increased frequency of meals per day, less intake of fruits and vegetables, more intake of sugary drinks and intake of extra salt with meals and consumption of junk food. Similar findings were observed in the studies done by Satyanarayana et al and Prasad et al.[21,23]

Similarly studies done by Kini et al, Prasad et al, Naha et al and Hu et al found that higher prevalence of hypertension was associated with decreased physical activity.[17,23-25]

In the present study subjects who ate while watching television or studying were found to have significantly higher blood pressure as also reported in study conducted by Prasad et al, Naha et al and Hu etal.[23-25]

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.[23,26]

Limitations of the study

The confounding variables whether known or not known are inevitable in any analytical study. The acknowledgement of such factors must be proficient. The food habits were assessed based on frequency of consumption and responses were from the child's memory, which can be subject to recall bias. Similarly physical activity was recorded as told by the children, no observation was done.

CONCLUSION

In the present study statistically significant association is observed between prevalence of high blood pressure with age, gender, academic standard and type of school. Prevalence of higher blood pressure was found to be significantly high among subjects belonging to higher socio-economic class, taking less vegetables and fruits and more number of meals per day, sugary drinks, junk fast food and extra salt in their diet. Other risk factors significantly related directly or indirectly to high blood pressure are physical inactivity, eating while watching T.V. or studying, mode of transport to school, family history of hypertension and high BMI of the study subjects. Findings of this study recommend on creating awareness among school students particularly in adolescent age group regarding hypertension and its complications and educate them about the modifiable risk factors of hypertension and how to lower risk of developing high blood pressure. Their parents should also be educated about increasing prevalence of adolescent hypertension and how to prevent it. School authorities should organize screening programs in school particularly for hypertension.

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