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PRE-HYPERTENSION AND HYPERTENSION AND ITS DETERMINANTS AMONG SCHOOL ADOLESCENTS OF RURAL AREA OF INDORE- A CROSS SECTIONAL STUDY

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ABSRACT

Background: Objectives of the study were to evaluate the prevalence of hypertension (HBP) and pre-hypertension (PHT) among the apparently healthy school children and to estimate the association of different risk factors with the HBP.

Methods: A cross sectional study was conducted during the period from August-December 2014.

Results: The prevalence of hypertension was detected to be 5.25% and pre-hypertension was 17.4%.Overall the mean systolic blood pressure and mean diastolic blood pressure were 113 ± 12.44 mm of Hg and 72.96 ± 8.95 mm of Hg respectively which was found to be similar in both sexes. The risk of high blood pressure significantly increased with age ($p< 0.0001$) Proportion of hypertension was higher among 71 (36.8%) adolescents, who were physically inactive as compared to 41 (13.6%) physically active adolescents which was found to be highly significant.[OR= 0.26 (0.17-0.4) $p < 0.0000001$].The major risk factors was additional salt intake ($p < 0.00013$) & papad/pickle intake($p < 0.0080$)OR = 0.59 (0.38-0.90) found to be significant.

Conclusion: In our rural population, the evaluation of blood pressure in children and adolescents is not a routine measure. Physical inactivity is reflecting increasing trend, along with changing dietary habits which is a major risk factor for hypertension.

K**ey words:** Hypertension, Prevalence, Determinants, Rural community

INTRODUCTION

With globalization bringing more lifestyle modifications, adolescents are exposed to multiple risk factors including obesity and also family history of hypertension.[1]

One of the key risk factors for cardiovascular disease is hypertension or raised blood pressure. Hypertension is also a major risk factor for stroke, aneurysms of the arteries (e.g. aortic aneurysm), peripheral arterial disease and is a cause of chronic kidney disease. Even moderate elevation of arterial blood pressure is associated with a shortened life expectancy.[2]

Hypertension is a silent, invisible killer that rarely causes symptoms. Hypertension rarely causes symptoms in the early stages and many people go undiagnosed. Addressing behavioural risk factors, e.g. unhealthy diet, harmful use of alcohol and physical inactivity, can prevent hypertension .[2]In 2008, worldwide, approximately 40% of

adults aged 25 and above had been diagnosed with hypertension; the number of people with the condition rose from 600 million in 1980 to 1 billion in 2008.[3]

Evidences across the globe have documented prevalence of childhood hypertension 1-2% in the developed countries and 5-10% in the developing countries.[4] The prevalence of hypertension in various Indian studies ranges from 0.96% to 11.4%, respectively.[5]

In adolescents, it has been proposed that hypertension and pre-hypertension are diagnosed and classified using the same criteria as in adults.[6] In 2004 the National High Blood Pressure Education Program recommended that children aged 3 years and older have blood pressure measurement at least once at every health care visit.[6]The National Heart, Lung, Blood Institute's and American Academy of Pediatrics made a similar recommendation.[7] In Indian, setting few efforts has been done to obtain local reference data for any observed BP values. [8,9]

Objectives of the study to evaluate the prevalence of hypertension (HBP) and pre-hypertension among the apparently healthy school children and to estimate the association of different risk factors with the HBP.

METHOD

This cross sectional study was carried out at the Rural Health Centre service area of Index Medical College, Hospital & Research Centre, Indore which is the Rural field practice area of Department of Community Medicine. The data was collected between August-December 2014. Seven schools from field practice area of index medical college was selected as study area. Students from 10-19 yr group were selected by systematic random sampling method from each class. After getting permission from school authority the study was conducted. Every second student was interviewed by semi structured pretested formula and detailed information regarding age, sex, education, type of family, personal habits like physical activity, tobacco, alcohol consumption, dietary habits ,salt intake was collected. Physical activity frequency was defined on basis of doing outdoor activity like helping parents in farming, playing in ground. Stress among adolescents was measured on basis of subjective phenomenon like fear of exam, peer pressure, death of parents etc. Junk food was defined as food that is high in calories and low in nutritional content. It includes food items like potato chips, samosa, cold drinks, kachori, etc. Frequency of intake of junk foods was defined as more than/less than two times in a week. Additional salt intake was defined as having more than one pinch in diet. Then their height, weight, general examination was conducted. Systemic examination was also done to exclude cardiovascular, renal and other diseases which could affect blood pressure.

In adolescents, it has been proposed that hypertension and pre-hypertension are diagnosed and classified using the same criteria as in adults. So hypertension was defined according to VIIth report of Joint National Committee (Indian scenario) 2003 for detection, evaluation and treatment of high blood pressure ,as systolic blood pressure more than or equal to 140 mm of Hg or diastolic more than or equal to 90 mm of Hg.[10] Pre-hypertension was defined as systolic blood pressure more than or equal to 120 mm of Hg or diastolic more than or equal to 80 mm of Hg and isolated systolic hypertension was defined as systolic blood pressure ≥ 140 mm of Hg with diastolic < 90 mm of Hg.Blood pressure was measured by mercury Sphygmomanometer. After giving rest for 5-10 minutes blood pressure was recorded in sitting position with his back supported, feet on the floor and right arm supported with cubital fossa at heart level. Two readings five minutes apart were taken by same person by same instrument. Average of two BP readings was noted.

All the data was entered into Microsoft Excel and analyzed using SPSS (version 20) computer software. Analysis was done by using Comparing Means by ANOVA test, Pearson's Correlation Coefficient, T-Test. Significance level is considered at $p < 0.05$ level.

RESULTS

Overall, the mean SBP and DBP were 113.2 mm of Hg (SD ± 12.44) and 72.96 mm of Hg (SD ± 8.95) respectively. Mean SBP among male participants was 114.7 (SD ± 12.7) and the mean DBP was 73.4 (SD ± 9.4).Females had mean SBP & DBP of 112.2 (SD ± 12.2) and 72.6 (SD ± 8.7) mm of Hg respectively. The difference of mean blood pressure among genders was not significant. The mean blood pressure increased significantly with age (r= 0.098 for SBP and 0.04 for DBP)as explained in Table 1.

Table 2 reveals -Out of 495 adolescents, the overall prevalence of hypertension was detected 26 (5.25 %) hypertensive and 86 (17.4%) pre -hypertensive

adolescents. Most of the hypertensives 9 (13.3 %) were from the age group between >16-19 yrs followed by 15 (5.4 %) from >13-16 yr. The risk of high blood pressure significantly increased with age ($p < 0.0001$). Among 197 males, 10 were hypertensive (5.1 %) & 38 were pre-hypertensive (19.3%).Among 298 females, 16 (prevalence of 5.4%) were hypertensive and 48 were pre-hypertensive (16.1%)There was no sex predilection for hypertension among both male & female adolescents. This was found to be statistically insignificant.

Association between hypertension and covariates: For study purpose we have combined hypertensive adolescents with pre-hypertensive; as group of hypertensive adolescents was too small to compare with normo-tensive. Nuclear family shown higher proportion of hypertensive as compared to Non-nuclear families. But this relationship was statically not significant. [OR = 1.09 (0.71-1.68)] Majority of hypertensive were belonged from socioeconomic Class III & Class IV based on Modified Prasad scale 2013 and association was found to be insignificant with hypertension as shown in table 3

Table 1: Age & Sex wise distribution of blood pressure among adolescents

	Males			Females			Overall		
Age (Yr)	No	Mean SBP (SD)	Mean DBP (SD)	No	Mean SBP (SD)	Mean DBP (SD)	No	Mean SBP (SD)	Mean DBP (SD)
>10-11	09	114.2 (9.6)	74 (11.8)	09	107.1 (11.9)	68 (11)	18	110.7 (11.1)	71 (11.5)
>11-12	16	110 (11.7)	70.1 (9.9)	25	110.9 (10.5)	72.5 (7.6)	41	110.7 (10.6)	71.6 (8.6)
>12-13	21	107.4 (13.3)	71.5 (9.5)	45	107.9 (14.3)	69 (8.1)	66	107.7 (13.9)	69.8 (8.6)
>13-14	44	113.3 (11.5)	72.6 (8.6)	85	111.7 (11.8)	74.1 (9.2)	129	112.3 (11.7)	73.6 (8.9)
>14-15	42	113.3 (12.9)	73.7 (9.1)	72	115.9 (9.6)	74.7 (6.9)	114	114.9 (10.9)	74.2 (7.7)
>15-16	26	122.1 (9.8)	76.2 (8.1)	33	113.7 (12.7)	72.7 (9.5)	59	117.4 (12.4)	72.2 (8.9)
>16-17	23	113.9 (8.7)	72.3 (5.7)	18	112.9 (13.4)	72.4 (7.8)	41	113.5 (10.8)	72.5 (6.6)
>17-18	06	116.3 (12.3)	79 (12.8)	08	108.7 (16.4)	63.7 (10.6)	14	112 (14.8)	70.3 (13.6)
>18-19	10	130.6 (15.6)	78.4 (15.6)	03	123.3 (15.3)	76.7 (5.7)	13	128.9 (15.2)	78 (13.7)
Total	197	114.7 (12.7)	73.4 (9.4)	298	112.2 (12.2)	72.6 (8.7)	495	113.2 (12.4)	72.9 (8.9)

Correlation coefficient : r = 0.098* (sbp) & 0.044*(dbp)
* Significant at 0.05 level
SBP = systolic blood pressure
DBP = diastolic blood pressure

Table 2: Distribution of adolescents as per blood pressure status

Category	Normotensive n= 383(%)	Pre-hypertensive n=86 (%)	Hypertensive n= 26(%)	Total N= 495 (%)	p -value
Distribution of blood pressure as per sex					
Male	149 (75.7)	38(19.3)	10(5.1)	197(100)	**<0.0001***
Female	234 (78.5)	48 (16.1)	16 (5.4)	298 (100)	
Distribution of blood pressure as per age					
10-13yr	104 (83.2)	19 (15.2)	02 (1.6)	125 (100)	**0.45**
>13-16 yr	232 (76.6)	55 (18)	15 (5.4)	302 (100)	
>16-19 yr	47 (69.1)	12 (17.6)	09 (13.3)	68 (100)	

*Significant at 0.05 level of confidence

Proportion of hypertension was compared according to different variables. Overall mean BMI of adolescents was 16.68(range of 10.27-27.04 ± SD 8.15). In this study, most of the adolescents 413 (83%), were underweight. Very few adolescents were obese 2(0.8%) so were excluded from analysis. Association between BMI & hypertension, was found to be statistically insignificant.[OR = 0.96 (0.54-1.6) p >0.44].Proportion of hypertension was higher among 71 (36.8%) adolescents, who were physically inactive (physical activity < 30 min/day) as compared to 41 (13.6%) physically active adolescents (physical activity > 30 min./day) which was found to be highly significant.[OR= 0.26 (0.17-0.4) p < 0.0000001].Positive family history of hypertension, stress , type of diet (vegetarian /Non-vegetarian),Junk food intake did not make any statistical difference in occurrence of hypertension. Significantly, hypertension was more frequently observed among 38 (36.5%) adolescents who were having additional salt intake (> one pinch) in their diet [OR= 0.4 (0.25-0.65)

p < 0.00013].Similarly, additional salt intake in the form of papad/pickle more than twice a week was having significant relation with hypertension [OR = 0.59 (0.38-0.90) p < 0.0080]. In our study, we found that smoking and alcohol consumption were virtually absent.

Table 3: Association of different study variables with hypertension

Variables	Hypertensive (n=112) (%)	Normotensive (n=383) (%)	Total (n=495)	p-value	OR with 95% C.I.
Type of family					
Nuclear	68 (23.3)	224 (76.7)	292	0.33	1.09 (0.71-1.68)
Non-nuclear	44 (21.7)	159 (78.3)	203		
Socioeconomic status#					
Class I (PCI ≥5156)	01 (6.6)	14(93.4)	15	0.43	
Class II (PCI 2578-5155)	06 (17.2)	29(82.8)	35		
Class III (1547-2577)	23 (22.4)	80(77.6)	103		
Class IV (PCI 773-1546)	55 (25.4)	162(74.6)	217		
Class V(PCI <773)	27 (21.6)	98(78.4)	125		
BMI					
Underweight	93 (22.5)	320 (77.5)	413	0.44	0.96 (0.54-1.6)
Normal	17 (24.3)	53 (75.7)	70		
Physical activity					
< 30 min./day	71(36.8)	122 (63.2)	193	<0.0000001*	0.26 (0.17-0.41)
> 30 min./day	41 (13.6)	261 (86.4)	302		
Family h/o					
Yes	103 (22.8)	348 (77.2)	451	0.71	1.15 (0.53-2.47)
No	09 (20.5)	35 (79.2)	44		
Stress					
Yes	45 (23.7)	145 (76.3)	190	0.65	1.102
No	67 (21.9)	238 (78.1)	305		
Type of diet					
Vegetarian	74 (22.9)	248 (77.1)	322	0.79	1.06(0.68-1.65)
Non-vegetarian	38 (22)	135 (78)	173		
Junk food frequency					
< twice /wk	53 (23.8)	169(76.2)	222	0.27	1.13 (0.74-1.73)
≥ twice/wk	59 (21.6)	214 (78.4)	273		
Additional Salt intake					
> One pinch	38 (36.5)	66 (63.5)	104	0.00013*	0.4 (0.25-0.65)
< one pinch	74 (18.9)	317 (81.1)	391		
Papad/pickle intake					
< twice /wk	56 (18.9)	240 (81.1)	296	0.0080*	0.59 (0.38-0.90)
≥ twice /wk	56 (28.1)	143 (71.9)	199		

*Significant at 0.05 level of confidence # Modified Prasad Socioeconomic Scale 2013

DISCUSSION

Hypertension is important cause of morbidity and mortality among adults & elderly population and is a risk factor for many diseases. Early identification of hypertension and pre-hypertension translates into early interventions and possibly prevention of later morbidity and mortality.[6]

In this study, the overall prevalence of hypertension among adolescents was 26 (5.25 %) and pre-hypertension was 86(17.4%).In a study by D Narayanappa Et al which was also a school based study conducted in Mysore, shown prevalence of HT 2 % and pre-HT 2.8 %.[11]While in a study by Patil Et al prevalence of HT was found to be 3%.[12] In a similar different international studies by Bertrand Fikahem Et al at Congo,the prevalence of HT was 10.1% and pre-hypertension was 20.7%,study by Christine stewart Et al among Nepali rural adolescents 11-13%,study conducted by Xiaofan Guo Et al at North-east China found overall prevalence of hypertension 20.2 %. [13,14,15]Among all these study shown similar prevalence's for Hypertension as compared to Indian rural adolescents.

In this study, prevalence of HT among male found to be 5.1% & female 5.4 % which was statistically insignificant(p >0.45). Similarly, Savitha et al. showed no such sex predilection for hypertension among males and females.[16] Mean Systolic & diastolic blood pressure was almost similar among both male & female adolescents. Overall mean Systolic Blood pressure and mean Diastolic

Blood pressure among both the sexes were 113.2 mm of Hg (SD ± 12.44) and 72.96 mm of Hg (SD ± 8.95) respectively which was found to be similar in study by M.B. Soudarssanane,Et al.[17] Mean SBP among male participants was 114.7 (SD ± 12.7) and the mean DBP was 73.4 (SD ± 9.4).Females had mean SBP & DBP of 112.2 (SD ± 12.2) and 72.6 (SD ± 8.7) mm of Hg respectively. The difference of mean blood pressure among genders was not significant. A trend of increase in mean values of SBP and DBP with age in the present sample has been observed in both sexes. Similar findings were found in study done in Shimla by Mahajan A Et al the Mean SBP (111.60 mmHg ± 11.43) and DBP (72.88mmHg ± 7.41) were higher in males in comparison to females in whom mean SBP and DBP were 109.91 ± 12.04mmHg and 71.84 ± 7.37mmHg, respectively.[24]

In most of the cross-sectional studies in various populations of the world, an increase of SBP and DBP with age has been reported.[14, 18,19] In this study,the mean blood pressure increased significantly with age (r= 0.098 for SBP and 0.04 for DBP).This spurt in BP is attributed to certain biological and psychological factors in puberty. [20, 21]

In this study, mean BMI of adolescents was 16.68(range of 10.27-27.04 ± SD 8.15) & 93 (18.8%) adolescents were underweight, 01 (0.2%) were overweight and 01 (0.2%) were obese respectively among hypertensive's which was found to be statistically insignificant (p value > 0.9).This was in contrast to other studies, which shown majority rural adolescents were in undernourished status and overall BMI was found to be below normal.[22,23] Proportion of hypertension was higher among 71 (36.8%) adolescents, who were physically inactive (physical activity < 30 min/day) as compared to 41 (13.6%) physically active adolescents (physical activity > 30 min./day) which was found to be highly significant.[OR= 0.26 (0.17-0.4) p < 0.0000001]. This reflects the changing scenario of cardiovascular diseases co-morbid factors increasing incidence in current era due to changing lifestyle, dietary pattern and decreased physical activity.

Positive family history of hypertension, stress (subjective), type of diet (vegetarian /Non-vegetarian),Junk food intake (samosa,kachori,shev,etc) did not make any statistical difference in occurrence of hypertension. Significantly, hypertension was more frequently observed among 38 (36.5%) adolescents who were having additional salt intake (> one pinch) in their diet [OR= 0.4 (0.25-0.65) p < 0.00013]. In a similar study carried out in Bihar among 5-19 yr adolescents by Kumar Amritanshu et al, hypertension was significantly associated with family history of hypertension (p<0.001), type of diet (p<0.001) and additional salt intake (p=0.008). [25] Similarly, additional salt intake in the form of papad/pickle more than twice a week was having significant relation with hypertension [OR = 0.59 (0.38-0.90) p < 0.0080]. In our study, we found that smoking and alcohol consumption were virtually absent. It would be logical to advise families with physically inactive children to change their lifestyle with respect to diet, exercise and reduced salt intake to get their children accustomed to lifestyle that are favorable for maintenance of normal BP.

CONCLUSION

In our study, the prevalence of hypertension was high among adolescent who were physically inactive and using additional salt in their diet.Physical inactivity,dietary change in the form of additional salt intake is increasing gradually among rural adolescent. As hypertension is major public health concern,it would be logical to advise families with physically inactive children to change their lifestyle with respect to diet, exercise and reduced salt intake to get their children accustomed to lifestyle that are favorable for maintenance of normal BP.

LIMITATION OF STUDY

Adolescents of urban area should have been compared with their rural counterparts but due to distance and time constraints it has not been done. Only school adolescents covered in our study, instead other adolescents who are dropout from schools should also have been involved for better results.

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