Original Research Article

Prevalence of hypertension and its risk factors among urban school children of Belagavi- a cross sectional study

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ABSTRACT

Background: Primary hypertension is becoming common among apparently healthy children. Measures for early diagnosis of pre hypertension and hypertension along with its risk factors during childhood could benefit from earlier intervention and follow-up.

Methods: This cross sectional study was conducted among 270 urban school students of Belagavi of class 10th in 2016 by using a structured questionnaire followed by anthropometry and blood pressure measurement.

Results: About 39% of children had family history of hypertension and 27% had family history of chronic diseases. Majority had inadequate consumption of vegetables (84.07%) and fruits (83.70%). The overall physical activity among the students was inadequate (78.15%) and about 46.30% of them got easily angered, stressed or irritated. The waist circumference of 14.07% students was falling in obese category. About 11.48% of them were overweight and 7.04% were obese according to their body mass index. Among the students, 71.85% had normal blood pressure and 18.15% had pre-hypertension. Hypertension was detected among 10.00% of students of which 5.56% belonged to stage I and 4.44% belonged to stage II hypertension. Statistical association between the blood pressures of school children showed significance with family history of chronic diseases (p=0.025), body mass index and waist circumference (p<0.001).

Conclusions: One tenth of the children had hypertension and one fifth of the children had pre-hypertension. The children who were obese had increased blood pressure than those with normal weight. Health promotion at early phase of life can help in the prevention of hypertension.

Keywords: Adolescent hypertension, Non-communicable disease, Obesity, Pre-hypertension, School children

INTRODUCTION

According to World Health Organization (WHO) Hypertension has affected 1.28 billion adults of the world living in low and middle income countries.[1] There is evidence that 14% of adolescents with pre hypertension developed elevated blood pressure within 2 years.[2] The reason for this changing trend could be the unhealthy life style adopted by children which includes increased sedentary entertainment, physical inactivity, stress and unhealthy food habits like increased consumption of fast foods, high fat, high salt and low fibre diets.

The asymptomatic nature of hypertension in early phases of its onset during adolescence usually goes undiagnosed because of lack of routine measurement of BP among children and this increases the chances of developing complications during adulthood.[3,4] Blood pressure profile among Indian school children for hypertension are limited with only a few studies showing different patterns of normal BP.[5] Measures for early diagnosis of pre hypertension and hypertension along with its risk factors during childhood could benefit from earlier intervention and follow-up.[4] This can be done by strengthening of health services in the form of regular screening and health education for lifestyle modification at an early phase of

life so as to prevent hypertension in adulthood. Therefore, an attempt has been made to determine the prevalence of hypertension among urban school children and to study the risk factors associated with it.

METHODS

This cross-sectional study was conducted among the high school children of 10th standard selected from three urban schools (Gajananrao Bhatkande English Medium High School, VG Model English medium high school and Mahila Vidyalaya English medium high school) of Belagavi, North Karnataka over a period of five months from June to October 2016. Sample size of 270 was obtained using the formula $4pq/d^2$ [p = prevalence, q=100-p, d=5%] where prevalence of hypertension among adolescents was considered to be 21.5% from a study.[6] Three schools were selected randomly from each zone (north, middle and south) of the Belagavi city by using simple random technique. Institutional ethical committee approval was obtained. Permission was obtained from the respective school authorities and written informed consent was taken from the students and their parents.

All the students of 10th standard who were present on the day of data collection and willing to participate were included in the study. Those students/parents who were not consenting to participate were excluded from the study.

Data was collected from the students after explaining the study in detail by self-administered, Predesigned, semi-structured questionnaire which included Socio-demographic details and their risk profile. The students were then briefed about the whole procedure and their Blood pressure measurement and anthropometry were obtained. The results were compiled and compared using SPSS software version 22. Various relevant statistical tests of significance like chi square test, Fisher's exact test, Mann Whitney U test etc. were used. The following variables were considered:

Vegetable consumption was graded as adequate and inadequate such that adequate consumption includes a minimum of 2 and ½ cups vegetables for girls and 3 cups vegetables for boys on daily basis. Here, 1 cup of raw or cooked vegetables or vegetable juice, or 2 cups of raw leafy greens can be considered as 1 cup from the vegetable group.[7]

Fruits consumption was graded as adequate and inadequate such that adequate consumption includes a minimum of 1 and ½ cups of fruits for girls and 2 cups of fruits for boys on daily basis. Here, 1 cup of fruit or 100% fruit juice, or ½ cup of dried fruit can be considered as 1 cup from the fruit group.[7]

Salt consumption was graded as normal and excessive such that if the child is consuming more than or equal to 5 gram of salt per day is considered excess. 1 teaspoon=5 gram.[8]

Physical activity was also graded as adequate and inadequate such that children and young people aged 5-17 years old performing at least 60 minutes of moderate to vigorous intensity of physical activity daily or Vigorous-intensity activities for at least 3 times per week was considered adequate.[9]

Anthropometry

Weight and height of children wearing light clothes and no footwear was checked. Weight was recorded in kilograms using a calibrated digital weighing machine nearest of 0.1 kg and height was recorded in centimeters to the nearest of 0.1cm using a Stadiometer with the student standing upright barefoot on ground with heels, buttocks touching wall and head in Frankfurt plane. Body mass index was calculated as weight (kg) divided by the square of height (m^2). The BMI was classified according to IAP charts as overweight and obese for particular age and sex.[10] Waist circumference was measured using an inelastic measuring tape in centimeters at the level of umbilicus and classified as normal and obese.[11]

Table 1: Anthropometry.

Anthropometry	Boys		Girls	
	15 years	16 years	15 years	16 years
BMI (kg/m²)				
Overweight	21.4	22.0	22.2	22.6
Obese	24.8	25.4	26.4	26.6
Waist circumference				
Central obesity	≥86.1 cm	≥88.6 cm	≥83.9 cm	≥84.7 cm

Blood pressure measurement

The blood pressure was measured using Omron HEM-7113 electronic blood pressure monitor which was

standardized against a mercury sphygmomanometer. A cuff of appropriate arm size was tied midway between the olecranon and acromion process of the right hand placed on table and the BP was measured in sitting position, after

a five minutes rest. The systolic blood pressure and diastolic blood pressure was recorded three times at an interval of 10 minutes each. The average of these reading was considered and interpreted according to the BP charts that takes into account age, gender and height of the child.[12]

The blood pressure was classified accordingly into the specific category (normo-tension, pre-hypertension, hypertension-stage 1 and 2) as per recommendations of fourth report by task force on diagnosis, evaluation and treatment of high blood pressure in children and adolescents.[12]

Systolic or diastolic BP equal to/more than 95th percentile is defined as hypertension in children.

Stage 1 hypertension refers to BP from 95th percentile to the 99th percentile plus 5 mmHg.

Stage 2 hypertension refers to values above stage 1 hypertension.

Pre-hypertension is defined as systolic or diastolic BP that are equal to/more than 90th percentile but less than 95th percentile. Also, if the blood pressure is more than/equal to 120/80 mmHg irrespective of the percentile, it is considered as pre-hypertension.

RESULTS

This study was done among 270 children of standard 10th of 3 different urban schools to assess the prevalence of hypertension and its risk factors. Majority 148 (54.81%) were males and 122 (45.19%) were females. About 136 (50.37%) students were 16 years old and 134 (49.63%) were 15 years old. About 95 (35.19%) students belonged to class II of modified BG Prasad classification, followed by 92 (34.07%) class III (Table 2).

Among the 270 students only 32 (11.85%) had got their blood pressure checked in the past. All of which was normal. Of these 12 (4.44%) checked it within 1 year and it had been more than a year for the remaining 20 (7.41%) students. However almost 238 (88.15%) children had never got it checked. Family history of hypertension was present among 105 (38.89%) children of which 3 (1.11%) and 53 (19.63%) of them had both parents and single parent hypertensives [mother 2 (8.52%) and father 30 (11.11%)]. Family history of chronic non-communicable diseases (obesity, diabetes, heart problem, renal problem, stroke or paralysis, etc.) was present among 72 (26.77%) students, of which 46 (17.04%) included their parents [31 (11.48%) father, 13 (4.81%) mother and 2 (0.74%) both parents]. None of the students had any personal history of hypertension or chronic diseases. About 22 (8.15%) children considered themselves as being overweight or obese.

Table 2: Distribution of students according to their socio-demographic factors.

Variables	Number	Percentage
School		
School 1	090	33.33
School 2	114	42.22
School 3	066	24.44
Age:		
15 years	134	49.63
16 years	136	50.37
Sex		
Male	148	54.81
Female	122	45.19
Religion		
Hindu	249	92.22
Jain	015	05.55
Muslim	006	02.22
Type of family		
Nuclear	190	70.37
Joint	080	29.63
Socio-economic status		
Class 1	049	18.15
Class 2	095	35.19
Class 3	092	34.07
Class 4	030	11.11
Class 5	004	01.48

Most students i.e. 169 (62.59%) consumed mixed diet and 101 (37.41%) were vegetarian. Majority of students had inadequate consumption of vegetables 227 (84.07%) and fruits 226 (83.70%). Half of the students 132 (48.89%) in our study consumed vegetables about 4-5 days/week; however frequency of consuming fruits was less. About 80 (29.63%) children in our study regularly added extra salt of which 15(5.56%) were consuming in excess and 121 (44.81%) of them ate junk food regularly. Everyday consumption of caffeinated beverages was present among 64 (23.7%) students and 113 (41.85%) students regularly added visible fats to their diet. Also, physical activity was inadequate amongst 211 (78.15%) students. The physical activity was significantly more adequate among boys 40 (27.03%) as compared to girls 19(15.57%) (χ^2=5.137, p=0.023). The leisure time of majority 132 (48.9%) children was spent doing sedentary activity like watching TV, playing video and computer games for 30 to 60 minutes almost every day. Moderate activities like household activities, walking, cycling was done by most 110 (40.7%) students for 30 to 60 minutes and vigorous physical activities like strenuous sports, gym was indulged by only a few 28 (10.4%) students for around 60 to 90 minutes most of the week. About 13 (4.81%) students have consumed alcohol, of which 4 (01.48%) took 1 drink/month, 3 (1.11%) took 1 drink/year and 6 (2.22) drank occasionally. One student gave the history of smoking cigarette occasionally. About 67 (24.81%) children experienced heavy burden of studying and 42 (15.56%) worried about not coping up with academics or

competitions. While 28 (10.37%) students experienced sleep abnormalities like insomnia etc. about 125 (46.30%) got easily angered, stressed or irritated for petty things (Tables 3, 4 and 5).

Table 3: Distribution of students according to their dietary practices.

Dietary variables	None	Daily	1-2 times/week	3 times/week	4-5 times/week
Vegetables consumption	0 (0%)	88 (32.6%)	14 (5.19%)	36 (13.33%)	132 (48.9%)
Fruits consumption	16 (05.9%)	20 (7.41%)	86 (31.9%)	68 (25.2%)	80 (29.6%)
Salted food consumption	11 (4.1%)	59 (21.9%)	101 (37.4%)	77 (28.5%)	22 (8.2%)
Caffeinated drinks consumption	13 (4.8%)	64 (23.7%)	131 (48.5%)	44 (16.3%)	18 (6.7%)
fast food/junk consumption	0 (0)	0 (0)	149 (55.2%)	84 (31.1%)	37 (13.7%)

Table 4: Distribution of students according to their physical activity.

Physical Activity	Duration of activity	Total N (%)	<30 minutes N (%)	30 minutes N (%)	1 hour N (%)	>1 hour N (%)
Sedentary		132 (48.9)	013 (04.8)	052 (19.3)	048 (17.8)	019 (07.0)
	Occasionally	019 (07.0)	004 (01.5)	006 (02.2)	006 (02.2)	003 (01.1)
	2-3days/week	038 (14.1)	004 (01.5)	017 (06.3)	013 (04.8)	004 (01.5)
	Everyday	075 (27.8)	005 (01.9)	029 (10.7)	029 (10.7)	012 (04.4)
Moderate		110 (40.7)	010 (03.7)	041 (15.2)	046 (17.0)	013 (04.8)
	Occasionally	017 (06.3)	002 (00.7)	009 (03.3)	006 (02.2)	000 (00.0)
	2-3days/week	032 (11.9)	004 (01.5)	011 (04.1)	016 (05.9)	001 (00.4)
	Everyday	061 (22.6)	004 (01.5)	021 (07.8)	024 (08.8)	012 (04.4)
Vigorous		028 (10.4)	000 (00.0)	008 (03.0)	011 (04.1)	009 (03.3)
	Occasionally	009 (03.3)	000 (00.0)	006 (02.2)	002 (00.7)	001 (00.4)
	2-3days/week	007 (02.6)	000 (00.0)	000 (00.0)	004 (01.5)	003 (01.1)
	Everyday	012 (04.4)	000 (00.0)	002 (00.7)	005 (01.9)	005 (01.9)

Table 5: Gender wise distribution of students according to their adequacy of dietary practices and physical activity.

Variables	Male 148	Female 122	Total 270	Percentage	Statistical analysis
Vegetable consumption					χ^2=0.228 p=0.63 not significant
Adequate	025 (16.89%)	018 (14.75%)	043	15.93	
Inadequate	123 (83.11%)	104 (85.25%)	227	84.07	
Fruit consumption					χ^2=0.492 p=0.483 not significant
Adequate	022 (14.86%)	022 (18.03%)	044	16.30	
Inadequate	126 (85.14%)	100 (81.97%)	226	83.70	
Salt intake					χ^2=0.014 p=0.906 not significant
Excess	008 (05.40%)	007 (05.74%)	015	05.56	
Normal	140 (94.59%)	115 (94.26%)	255	94.44	
Physical activity					χ^2=5.137 p=0.023 Significant
Adequate	040 (27.03%)	019 (15.57%)	059	21.85	
Inadequate	108 (72.97%)	103 (84.43%)	211	78.15	

Based on waist circumference, central obesity was present among 38 (14.07%) students of which 16 (5.92%) were boys and 22 (8.14%) were girls. Body mass index showed that 31 (11.48%) students were overweight of which 13 (4.81%) were boys and 18 (6.67%) were girls. About 19 (7.04%) students were obese of which 7 (2.59%) were boys and 12 (4.44%) were girls. However, the difference was not statistically significant. Among the students, 194 (71.85%) had normal blood pressure of which 102 (37.78%) were males and 92 (34.07%) were

females and 49 (18.15%) had pre-hypertension of which 33 (12.22%) were males and 16 (05.93%) were females. Hypertension was detected among 27 (10.00%) students of which 15 (5.56%) belonged to stage I and 12 (4.44%) belonged to stage II hypertension. Isolated systolic and diastolic hypertension was present among 13 (4.81%) and 5 (1.86%) students respectively. Both systolic and diastolic high blood pressure was seen among 9 (3.33%) students. Among the hypertensives 13 (04.81%) were males and 14 (05.19%) were females. The average

systolic blood pressure was 113.22±13.15 mmHg and diastolic blood pressure was 67.25±10.1 mmHg (Table 6 and 7).

Table 6: Distribution of students according to their blood pressure values.

Blood Pressure Variables	Number	Percentage
Normal Blood Pressure	194	71.85
High Blood Pressure	076	28.15
Pre-hypertension	049	18.15
Hypertension	027	10.00
Stage 1	015	05.56
Stage 2	012	04.44
Isolated systolic hypertension	013	04.81
Isolated diastolic hypertension	005	01.86
Both	009	03.33

Table 7: Distribution of students according to the various stages of blood pressure (N=270).

Systolic \ Diastolic	Normal N (%)	Pre-hypertension N (%)	Stage 1 N (%)	Stage 2 N (%)	Total N (%)
Normal	194 (71.85)	004 (01.48)	003 (01.11)	000 (00.00)	201 (74.44)
Pre-hypertension	038 (14.07)	007 (02.59)	002 (00.74)	000 (00.00)	047 (17.41)
Stage 1	006 (02.22)	002 (00.74)	002 (00.74)	000 (00.00)	010 (03.70)
Stage 2	004 (01.48)	001 (00.37)	005 (01.85)	002 (00.74)	012 (04.44)
Total	242 (89.63)	014 (05.19)	012 (04.44)	002 (00.74)	270 (100)

DISCUSSION

The present study was conducted among the 270 students of Belagavi to know the prevalence of hypertension and its risk factors among urban school children. Majority of students had inadequate consumption of vegetables (84.07%) and fruits (83.70%) similar to the study done by Ekta and Tulika et al at Assam where consumption of fruits and vegetables was 64.3% and 44.3% respectively.[13] Consumption of salted food was present among 21.85% students and that of junk food among 44.81%. A study done at Delhi by Grace et al revealed that daily consumption of fruits and vegetables was 42% and 76% respectively. High salt containing foods were consumed by 21.6% of the school children on most days of the week. Fried foods and fast foods were consumed at least once a week by 65.7% and 49.2% of them respectively which co-related with our study.[5] In this study most of them 103 (38.15%) took bicycles to school and 71 (26.30%) went by walk. About 53 (19.63%) took auto rickshaw and 35 (12.96%) went by bus or 8 (2.96%) other vehicles. It differed from study done by grace et.al at Delhi which found that 46.2% of the school children walked to school and one percent of them used bicycle as the mode of transport between school and home.[5] The physical activity was inadequate amongst 78.15% students. The results were similar to the studies done by Grace et al where only 43.8% were physical and study done in Assam where only 41.1% were moderately active.[13] About 4.81% students had consumed alcohol in the past and only one student had smoked previously which was lower than the study at Banaras (7.3% consumed alcohol, 8.5% smoked) and Assam (6.3% consumed alcohol) (Tables 3-5).[14, 13]

Based on waist circumference, central obesity was present among 14.07% students of which 5.92% were boys and 8.14% were girls. A study conducted at Assam similarly showed that 16.1% of students had increased waist circumference of which 6.7% were boys and 9.4% were girls. Unlike our study the gender difference of Assam study was significant.[13] Body mass index showed that 11.48% students were overweight of which 4.81% were boys and 6.67% were girls. About 7.04% students were obese of which 2.59% were boys and 4.44% were girls. The prevalence of overweight and obesity was higher among girls than boys which may be due to the predominantly sedentary lifestyle of girls as compared to boys in our study. Other Indian studies like those done at Chennai, Banaras and Ghaziabad revealed consistent results of students being overweight (11.5%, 21.9% and 16.27%) and obese (3.75%,1.21% and 8.89%).[6,14,15] A Study done at Assam showed similar distribution where in 11.7% girls and 6.8% boys were overweight and 4.7% boys and 6.4% girls were obese.[13]

Only 11.85% children in our study had got their blood pressure checked in the past which was lower than the study at Poland where 88.4% students had checked blood pressure in past.[16] This reveals the lack of routine measurement of BP among pediatric age group and hence stresses on its importance. The overall mean systolic blood pressure in our study was 113.22±13.15 and mean diastolic blood pressure was 67.25±10.1. This was

comparable with studies done at central Delhi (SBP was 108.38±9.56 mmHg and DBP was 72.38±7.12 mmHg), Wardha (SBP was 97.2±15.8 mmHg and DBP was 62.1±11.9 mmHg) and Jaipur (SBP was 109.2 mmHg and DBP was 72.4 mmHg).[4,17,18] The overall prevalence of pre-hypertension in our study was 18.15% which was similar to studies done at Kerala (24.5%), but higher than that by Grace et al (12.4%).[19,5] Males (12.22%) were more pre-hypertensive than females (5.93%) resembling the study done in Kerala (males-30.5%, females-20.3%) and unlike that of Assam (males-11.0%, females-13.4%) (Table 6).[19, 13]

The mean systolic blood pressure among boys and girls was 114.58±12.98 mmHg and 111.57±13.21 mmHg respectively. However, the difference was not significant (p=0.061). The mean diastolic blood pressure among boys and girls was 65.52±9.89 and 69.35±10.03 respectively. And there was significant difference (Mann Whitney U test =7254, p=0.005) such that the mean diastolic pressure among girls was higher than that of boys. Similar findings were seen in a study conducted at Jaipur where mean SBP was 108.8 mm Hg among boys and 109.7 mm Hg among girls. Also mean DBP was 72.6 mm Hg among boys and 72.0 mm Hg among girls. The difference was significant (p=0.01).[18] Another study at Wardha showed significant difference wherein Mean SBP level was 97.4±15.3 mmHg among boys and 96.9±16.3 mmHg among girls. However, the mean diastolic pressure was 61.4±11.7 mmHg among boys and 62.8±12.2 mmHg among girls which was same as our study.[17]

Among the children, hypertension was detected in 10.00% of students which was higher than studies done at Kerala (0.6%), Warada (3.0%), Kathmandu (4.40%) and Delhi (7%), but lower than that conducted at Chennai (21.5%) and Assam (21.2%).[4,6,13,17,19,20] About 5.56% students in our study had stage I and 4.44% of them had stage II hypertension. Study by Grace et al also revealed that 6.8% had stage I hypertension and 1.4% had stage II hypertension.[5] Isolated systolic and diastolic hypertension was present among 4.81% and 1.86% students respectively. Both systolic and diastolic high blood pressure was seen among 3.33% students. A similar study done at Chennai reported that both the systolic and diastolic BP was observed in 5.25% whereas 16.25% had isolated systolic HTN. No students had isolated diastolic hypertension. Delhi study also revealed that, of the 7% hypertensive students 1.6% were found to have systolic hypertension and 5.4% had diastolic hypertension (Tables 6 and 7).[6,4]

Amongst the hypertensive, 4.81% were males and 5.19% were females. Similarly, the higher proportion of hypertension among females (3.2%, 24.1%) as compared to males (2.8%, 18.1%) was seen among studies done at Wardha and Assam respectively.[13,17] But study at Chennai and kerala showed contradiction wherein hypertension was more prevalent among males (16.75%,0.98%) than females (4.75 %,0.34%). Unlike our study this gender difference was found to be significant among other studies. [6,19]

Significant statistical association was found between the blood pressures and family history of chronic diseases (p=0.025), such that children with positive history had significantly higher blood pressure (34.1%) than those with negative history (25.8%). No such correlation was seen among the other studies however study done at Chennai showed significance with positive family history of hypertension.[6]

There was highly significant association between Body mass index of the children and blood pressure (Fisher's exact test =22.489, p<0.001). Those who were obese (57.9%) and overweight (51.7%) had high blood pressures as compared to those who had normal BMI (22.3%). On associating the waist circumference with blood pressure there was high significance (Chi-square test =14.8, p<0.001), such that children with central obesity (52.6%) had comparatively higher blood pressure than those who had normal waist circumference (24.2%). Significant positive correlation of blood pressure with BMI and waist circumference was also seen among studies done at Chennai, Kerala, Kathmandu and Wardha.[6,17,19,20]

This study had a small sample size limited to students belonging to 10th grade. The food habits were assessed based on frequency of consumption and responses were from the child's memory, subject to recall bias. Physical activity was recorded as told by the children, no observation was done. There was no provision for follow up of those detected with hypertension. Hence these areas are open for further research.

CONCLUSION

One tenth of the children in our study were detected with hypertension and one fifth of the children with pre-hypertension. The children who were obese had increased blood pressure than those with normal weight. With respect to risk, we found one tenth of the students were obese. About two fifth students had a family history of hypertension and one third of them had family history of chronic diseases. Most of the students were not consuming protective foods like fruits and vegetables adequately. Also their physical activity was inadequate. Hence we conclude that there is a need for Intervention programs among the high risk and hypertensive students to further evaluate and treat the hypertension through regular follow ups. We also encourage the establishment of healthy food facilities, sports complex for improvement of physical activity and practice of yoga, meditation etc. Health visits to school and community health camps should be organized to routinely screen for high blood pressures in the pediatric population.

REFERENCES

1. World Health Organization. Global Health Observatory (GHO) data. Available from: http://www.who.int/gho/ncd/risk_factors/blood_pressure_text/en/. Accessed on 23 February 2023.
2. Falkner B. Hypertension in children and adolescents: epidemiology and natural history. Pediatr Nephrol. 2010:25(1):1219-24.
3. Rahman AM, Afroze A, Islam MN. Prevalence and Risk Factors of Hypertension among School Going Children of Dhaka City. Bangladesh J Child Health. 2005:29(3):82-7.
4. Anand T, Ingle GK, Meena GS, Kishore J, Kumar R. Hypertension and its correlates among school adolescents in Delhi. Int J Prev Med. 2014:5(1):65-70.
5. George GM, Sharma KK, Ramakrishnan S, Kumar S, Gupta. A study of cardiovascular risk factors and its knowledge among school children of Delhi. Indian Heart J. 2014:66(3):263-71.
6. Sundar JS, Adaikalam JMS, Parameswari S, Valarmarthi S, Kalpana S, Shantharam D. Prevalence and determinants of hypertension among urban school children in the age group of 13-17 years in, Chennai, Tamil Nadu. Epidemiol. 2013:3(3):130.
7. Dietary Recommendations for Healthy Children. Available from: www.heart.org/HEARTORG/HealthyLiving/Dietary-Recommendations-for-Healthy-Children_UCM_303886Article.jsp#mainContent. Accessed on 20 October 2016.
8. WHO. Salt reduction. Available from: www.who.int/mediacentre/factsheets//fs393/en/. Accessed on 8 June 2023.
9. WHO Global recommendations on physical activity for health. Available from: www.who.int/dietphysicalactivity/factsheet_recommendations/en/. Accessed on 8 June 2023.
10. Khadilkar V, Yadav S, Agrawal KK, Tamboli S, Banerjee M, Cherian A, et al. Revised IAP growth charts for height, weight and body mass index for 5- to 18-year-old Indian children. Indian Pediatr. 2015;52:47-55.
11. Khadilkar V, Yadav S, Agrawal KK, Tamboli S, Banerjee M, Cherian A, et al. Revised IAP growth charts for height, weight and body mass index for 5- to 18-year-old Indian children. Indian Pediatr. 2015;52:47-55.
12. National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents. Pediatrics. 2004;114(2):555-76.
13. Ekta G, Tulika MG. Risk factor distribution for cardiovascular diseases among high school boys and girls of urban Dibrugarh, Assam. J Fam Med Prim Care. 2016:5(1):108-13.
14. Avadhesh K, Manushi S, Shamshad A, Ratan S. Prevalence of hypertension and awareness of its predictors among fresh undergraduate medical students of Banaras Hindu University. Stand Glob J Med Med Sci. 2014:1(3):46-50.
15. Gupta GK, Agrawal D, Singh RK, Arya RK. Prevalence, risk factors and socio demographic co-relates of adolescent hypertension in District Ghaziabad. Indian J Community Health. 2013:25(3):293-8.
16. Grad I, Mastalerz-Migas A, Kiliś-Pstrusińska K. Factors associated with knowledge of hypertension among adolescents: implications for preventive education programs in primary care. BMC Public Health. 2015:15(1):463.
17. Rao R, Patil S, Garg BS. Prevalence of hypertension and variation in blood pressure among school children in rural area of Wardha. Indian J Public Health. 2014:58(2):78-83.
18. Swarnkar M, Baig VN, Bhardwaj AK, Rathore M, Kasyap A. A study of blood pressure profile in school going adolescents of district Jaipur. Nat J Community Med. 2012:3(2):242-6.
19. Madhavikutty Amma GD, Vasudevan B, Akshayakumar S. Prevalence and determinants of prehypertension and hypertension among adolescents: a school based study in a rural area of Kerala, India. Int J Res Med Sci. 2015:3(1):58-64.
20. Raju K, Srijana S. Prevalence of essential hypertension in school going early and mid-adolescent children of Kathmandu valley. J Univ Coll Med Sci. 2013:1(2):24-9.

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