Original Research Article

A Cross-Sectional Study on The Risk Factors for Hypertension Among School Going Adolescents In Urban Berhampur, Odisha.

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ABSTRACT:

Background: Hypertension in childhood is associated with an increased risk of cardiovascular mobility and mortality.Many risks factors affect hypertension in children and adolescents.

Aims/objectives: The objectives are to find outprevalence of hypertension among school going adolescents and to determine the association of risk factors with hypertension in those detected cases.

Methodology:A community based cross sectional study was conducted from July to December 2016 on school going adolescents (13 to 19 years) in urban Berhampur, Odisha. Total 646 samples were selected from 2 schools by simple random sampling.Information was collected about various risk factors. Data were analysed in SPSS.

Results:

Total 120 (18.6%) adolescents were detected with hypertension.Hypertension was significantly more in male and in overweight/obese adolescents. Family history of obesity was significantly associated with hypertension. Adolescents with improper sleep habits were significantly higher chance of hypertension. Performance stress and work stress were significantly high in adolescents withhypertension.

Conclusion: The prevalence of hypertension in school going in study area was relatively high which reflects changing scenario of cardiovascular diseases. The study results urge for screening of adolescents in the locality so that early intervention can be applied to halt the progression of hypertension and its complication.

Key words: Adolescent, obesity, junk food, cardiovascular diseases, physical inactivity

Introduction:

Hypertension in childhood is associated with an increased risk of essential hypertension (HTN) in adulthood which subsequently increases the risk of cardiovascular mobility and mortality.Youth with higher BP levels in childhood are also more likely to have persistent HTN as adults. Due to tracking of blood pressure (BP), adolescents with elevated BP progressed to hypertension at a rate 7% per year.[1]In addition young patients with HTN are likely to experience accelerated vascular aging. Hypertension in children is also commonly associated with other risk factors for cardiovascular diseases such as hyperlipidaemia and diabetes mellitus.It is an independent predisposing factor for heart failure, coronary artery disease, stroke, renal disease and peripheral artery disease. Hypertension can be categorized as primary or essential hypertension (PH) when there is no identifiable cause and secondary hypertension (SH) when there is an underlying cause for hypertension. Primary hypertension now the most common cause of hypertension in adolescents and young adults. According to centres for disease control and prevention (CDC) study, an estimated 1.3 million youth ages 12 to 19 have high blood pressure with 1 in 25 youthhave hypertension and 1 in 10 has elevated blood pressureglobally.[2]India has the largest adolescent population in the world with 253 million population and every fifth person in between 10-19 years.[3]Over the past two decades, studies have shown that prevalence of essential hypertension increased in children and adolescents.[4]Many risks factors affect the occurrence of hypertension in children and adolescents like age, sex, family history of hypertension, genetic factors, stress, obesity, behavioural risk factors like tobacco use, alcoholism, physical inactivity, unhealthy diet and manymore.

Habits adopted during adolescents are likely to persist in adult life.It is important to detect and manage harmful behaviours related to NCDs in children and adolescents as investing in adolescent health ensures triple dividends in terms of health during adolescence, health during later adulthood (by preventing risk factors fornon-communicable diseases) as well as health of the future generation (by ensuring health of the offspring of women who themselves remained healthy).[5]Hence early detection of hypertension and its risk factors in adolescents can prevent future burden and complications of hypertension. To the best of our knowledge, there is not a single study on risk factors for hypertension in adolescents in Odisha till date. Hence this study was undertaken with objectives of to find out the prevalence of hypertension among school going adolescents and to determine the association of risk factors with hypertension in those detectedcases.

Methodology:

Study design, study population and study period

A community based cross sectional study was conducted from July 2016 to December 2016 on school going adolescent boys and girls aged between 13 to 19 years in urban Berhampur, Odisha. WHO defines 'adolescents' as individuals in age group 10-19 years.However we excluded 10 years to 12 years individuals as they may not provide accurate information about the risk factors due to their small age. Adolescentswho were not willing to participate, mentally disabled, severely ill, with chronic disease, on stimulant drugs were excluded. IEC approval was taken prior to study which followed ethical standards for observational study. Prior required permission was taken fromappropriate school authority and a written, valid and informed consent was taken from all participants.

Sample size and sampling technique

With an estimated prevalence of hypertension (in school going adolescents in an urban area)[6]as 12, with 95% confidence interval, relative error of 20% and non-response rate as 5%, sample size was calculated to be 655 using formula Z^2pq/l^2. Blood pressure was not constant and fluctuated in 4 students (despite 3 visits) and 5 were unable to tell detail about risk factors. Hence excluding those 9 adolescents, finally 646 adolescents were included. Samples were carefully chosen from schools which have classes from standard 6[th]to 12[th]to get adolescents of 13 years to 19 years. There were 10 schools of these types in urban Berhampur.We took 20% of these schools (2 schools named St. Xavier's and DAV school) by simple random sampling to select sample. From each school 323 adolescents were selected as total students of two schools were nearly equal. For equal distribution of populationequal students from each class (65 from class 10th, 11[th]and 12th; 64 from class 8[th]and 9th) were decided to be taken. First of all, list of all class wise students was obtained and thensamples were selected by simple random sampling from thelist.

Data collection and variables

A pre designed, pre-tested, semi-structured questionnaire was used to collect data. Participants were met in school campus in their leisure period and interviewed one to one usingquestionnaire. Information was collected about age, sex, class, family history of hypertension and family history of obesity. Weight(using an analog scale in kilograms) and Height(using height chart calibrated in centimetres) were obtained by prescribed standardized methods.[7]Body mass index (BMI) was calculated and participants were classifiedaccording to BMI for age scores as per WHO chart (separately for boys and girls). The BMI percentile between 5th percentile to less than 85th percentile was taken as normal, 85th to less than 95th percentile was taken as overweight and equal to or above95th percentile was taken as obese.According to standard guidelines blood pressure was measured by the same investigator with mercury sphygmomanometer in both arms and the average of readings was considered as recommended by American Heart Association.[8]Average of three readings with 5 minutes intervals was recorded. Participants with BP levels at 120/80 mm Hg or above or average systolic blood pressure (SBP) or diastolic blood pressure (DBP) levels greater than equal to 90th percentile, but less than the 95th percentile, were classified as pre-hypertensive. Adolescents were considered to be hypertensive if their SBP or DBP or both were equal to or more than the 95th percentile for age, sex and height.[9]The BP was repeated in another session in adolescents those found to be pre-hypertensive or hypertensive in one session and if results were found to be consistent, that was taken as final. The second part was for assessing risk factors for hypertension in participants. The method of assessment of differentrisk factors was depicted in table number 1. This was constructed using STEPS questionnaire prepared by WHO for assessing risk factors for non-communicable diseases.[7]**(Table1)**

Table 1: Method of assessment of different risk factors for participants

Risk factors	Method of assessment
Improper Sleeping habits	less than 8 hours per day/interrupted sleeping was considered as risk factor
Unhealthy Diet habit	-Junk food more than 5 times a week was a risk factor. Junk food areaerated drinks, fried chips, processed packed food, fried items, Chinese fast food -Extra salt added in food and salads, soya sauce, processed food high in salt like Chinese food, chips, beverages are unhealthy diet.
Physical activity	-Insufficient physical activitydefined as < 2.5 hours of moderate-intense activity. -Moderate or Intense activity are outdoorsports/cricket/volleyball /swimming/tennis/cycling/jogging/dancing/yoga/aerobics/running -sedentary behaviour were sitting at home/with friends/travelling in car/bus/watching TV/internet, playing cards
Performance stress	-Current level of percentage in class and expected level of performance in exams were assessed. Performance stress was said to be present when the difference was greater than 30%.
Work stress	When more than 3 factors present in an individual work stress was said to be present. The factors were less than 3 hours spent per week in outdoor activity, less than 2 hours spent per day for TV/phone, less than 2 hours spent per day in indoor games, music, novel and more than 4 hours spent per day in tuitions/studying excluding school.
Mental stress	Financial/relationship disturbance/future apprehension about carrier/body image/loss of parent/sibling/close relatives/friendswere asked for mental stress
Smoking	Any Smoking habit
Alcohol intake	Alcohol habit
Family history of obesity	Either of parents or both were obese (BMI ≥ 30)- if a participantscouldn'tsay,she/hewastoldtoaskparentswhichwas again asked in another visit
Family history of hypertension	Either of parents or both having history of hypertension (if a participant couldn't say, she/he was told to ask parents which was again asked in another visit)

Statistical analysis

All the data were analysed in SPSS (version 16.0). Descriptive analysis was denoted in mean with standard deviation and proportions. Chi square test was performed to find out association between variables. P value less than 0.05 was taken as statisticalsignificant.

Results:

The baseline characteristics of participants were described in table number 2. Majority (19.8%) of the participants were 17 years old followed by 15 years (18.6%). Most of them were male (57.6%). Out of 646, 39% had family history of hypertension and 24.1% had family history of obesity. 28.9% were either overweight or obese. Total 120 (18.6%) adolescents were detected with hypertension in our study. The mean SBP and DBP in this study are 121 mm Hg and 77 mm Hg respectively.**(Table 2)**

Table 2: Baseline characteristics of study participants (N=646)

Characteristics	Value
Age in years	
13	30 (4.6)
14	106(16.4)
15	120(18.6)
16	119(18.4)
17	128(19.8)
18	102(15.8)
19	41 (6.4)
Sex (n,%)	
Male	372(57.6%)
Female	274(42.4%)
Categories of blood pressure	
Normal BP	327(50.6%)
Pre-hypertension	199 (30.8%)
Hypertension	120 (18.6%)
Isolated systolic hypertension	30(25%)
Isolated diastolic hypertension	36(30%)
Both systolic and diastolic HTN	54(45%)
BMI (body mass index)	
Normal weight	459(71.1%)
Overweight/obesity	187(28.9%)
Family history of hypertension	
Present	252(39%)
Absent	394(61%)
Family history of obesity	
Present	156(24.1%)
Absent	490(75.9%)

Majority (90.7%) had improper sleeping habit followed by physical inactivity (72.9%). 15.2% was having junk food more than 5 per weeks and 26% had added salt in their diet. Different risk factors found in the participants were illustrated in figure number 1. **(Figure1)**

Fig 1: Risk factors found in the participants (N=646)
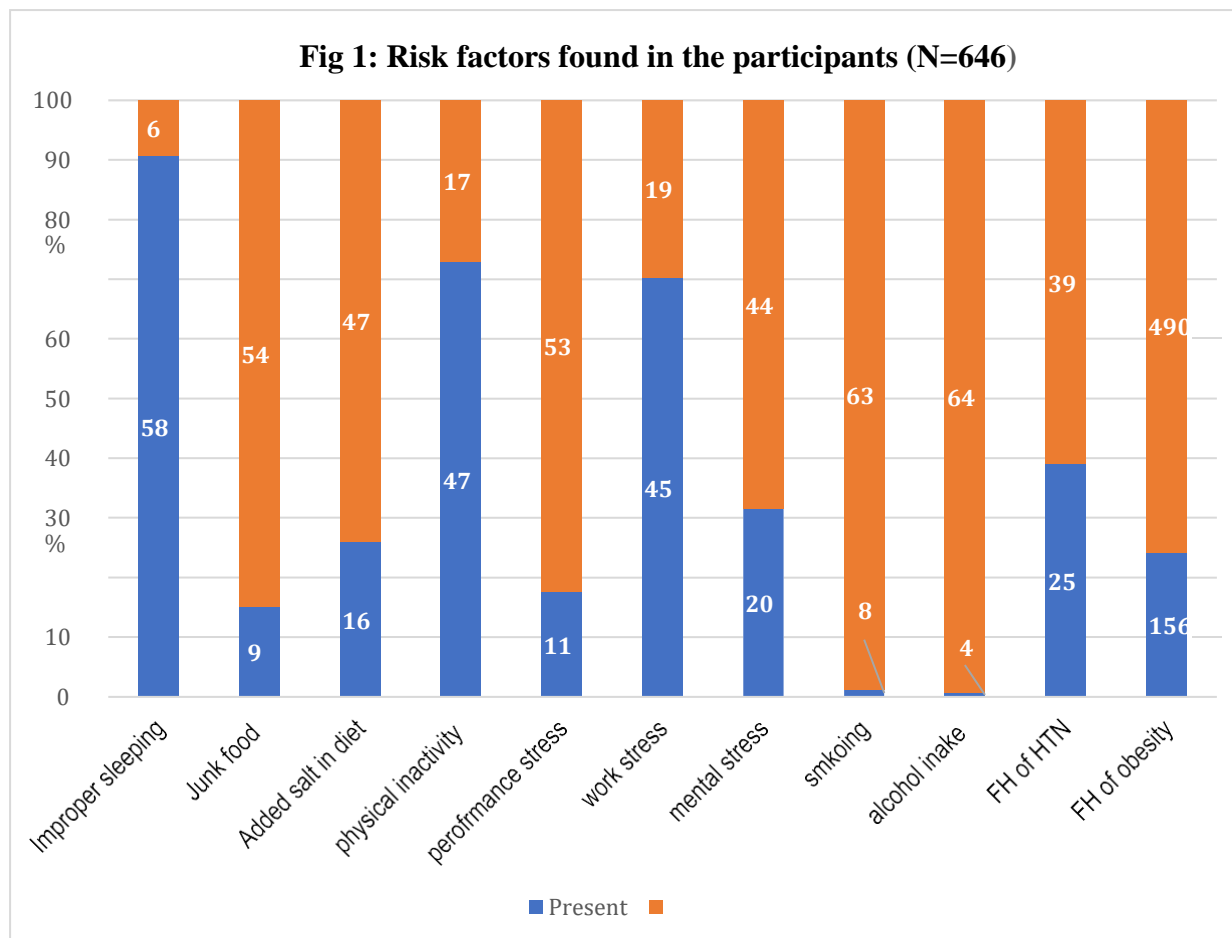
Association of various risk factors with hypertension in adolescents was depicted in table number 3. Age of participants was not significantly associated with hypertension. Hypertension was significantly more in male (p< 0.001) and in overweight/obese adolescents (P<0.001). Family history of obesity was significantly associated with hypertension but family history was not significantly associated with it. Smoking and alcohol were not significantly associated with hypertension. Adolescents with improper sleep habits were significantly higher chance of hypertension than those without. However, junk food consumption and added salt in diet were not significantly high in participants with hypertension. Performance stress (p= 0.0007) and work stress (p=0.032) were significantly high in adolescents with hypertension. However physical inactivity and mental stress were not significantly associated with hypertension. **(Table3)**

Table 3: Association of hypertension with different risk factors in study participants (N=646)

Parameters (n, %)	Total (646)	Hypertension present(120)	Hypertension absent (526)	Chi square	P value
Age					
13	30	05 (16.6)	25 (83.3)		
14	106	21 (19.8)	85 (80.2)		
15	120	23 (19.2)	97 (80.8)	1.928	0.749

16	119	19(15.9)	100 (84.1)		
17	128	29(22.7)	99(77.3)		
18	102	18(17.6)	84(82.4)		
19	41	05(12.2)	36(87.8)		
Gender					
Male	372	90(24.2)	282(75.8)	18.29	<0.001
Female	274	30(10.9)	244(89.1)		
BMI					
Within normal limit	459	60(13.1)	399(86.9)	31.75	<0.001
Overweight/ obesity	187	60(32.1)	127(67.9)		
Family history of HTN					
Yes	252	52(20.6)	200(79.4)	1.16	0.281
No	394	68(17.3)	326(82.7)		
Family History of Obesity					
Yes	156	32(20.5)	124(79.5)	4.55	0.033
No	490	88(17.9)	402(82.1)		
Smoking					
Yes	08	02 (25)	06 (75)	0.221	0.638
No	638	118 (18.5)	520 (81.5)		
Alcohol intake					
Yes	04	01 (25)	03 (75)	0.11	0.740
No	642	119 (18.5)	523 (81.5)		
Improper sleeping habits					
Yes	586	118 (20.1)	468 (79.9)	10.2	0.001
No	60	2 (3.3)	58 (96.7)		
Junk food consumption					
Yes	98	20 (20.4)	78 (79.6)	0.256	0.613
No	548	100 (18.2)	448 (81.8)		
Added salt in diet					
Yes	168	36(21.4)	132(78.6)	1.22	0.269
No	478	84(17.6)	394(82.4)		
Performance stress					
Yes	114	34(29.8)	80 (70.2)	11.58	0.0007
No	532	86(16.2)	446 (83.8)		
Work stress					
Yes	454	94(20.7)	360(79.3)	4.57	0.032
No	192	26(13.5)	166(86.5)		
Physical inactivity					
Yes	471	85(18)	386(82)	0.322	0.570
No	175	35(20)	140(80)		
Mental stress					
Yes	204	39 (19.1)	165 (80.8)	0.058	0.809

No	442	81 (18.3)	361 (81.7)		

Discussion:

Hypertension is a major risk factor for cardiovascular and cerebrovascular diseases. Hypertension is fast emerging as a major health problem amongst all school adolescents, particularly in urban areas and early diagnose of essential hypertension is an important strategy in its control.In the present study most of adolescents were male. The most common risk factor was improper sleep (90.7%) followed by physical inactivity (72.9%) and work stress (70.3%). Khan et al. in their study reported the most common risk factor was intake of junk food (90.5%) and 31.7% had added salt in their diet while 6.9% had history of tobacco.[10]In contrast in our study, only 15.2% had junk foodand 28.9% were either overweight or obese. Khan et al. reported 10.4% and 5.7% were overweight and obese respectively.[10]Shah et al. also reported 9.25% and 5.5% were overweight and obeserespectively.[11]

In this study, 18.6% of the students were found to be hypertensive with predominant form as both systolic and diastolic hypertension. More proportion of adolescents (30%) had isolated diastolic blood pressure than those (25%) having isolated systolic blood pressure. Tony et al. found 21.4% prevalence of hypertension among school adolescent in Kerala and pre-dominant form among children was systolic hypertension.[12]Sundar et al. observed 21.5% had hypertension and among them 76% isolated systolic and 24% combined hypertension which is contrast to our findings.[13]Similarly, Singh et al. found 78% had systolic hypertension and 22% combined hypertension.[14]Soudarssanane et al. found lower prevalence of 8.5%[15]; Khan et al.too found a prevalence of 9.8% among boys[10]; Buch et al. found it to be 6.48%.[16]Sharma et al. reported prevalence of hypertension was 7.1% in urban adolescents[17]and Gupta et al. found only 5.3% of adolescent had hypertension.[18]Anand et al. found much lower prevalence of 1.6 %had systolic hypertension while 5.4% were found to have diastolic hypertension.[19]The mean SBP and DBP in this study were 121 mm Hg and 77 mm Hg respectively. Other studies have found it to be much lesser, 109 and 69 mm Hg by Khan et al.[10]; 108 and 72 mm Hg by Anand et al.[19]; 113.6 and 74.3 mm Hg by Soudarssanane et al. in Puducherry[15]and 116 and 69 mm Hg by Singh et al.[14]The high prevalence in this study may be due to genetic inheritance, dietary habits, life style factors and variations in the region. The individual risk factors for diastolic hypertension are obesity and family history of hypertension and obesity, while those for systolic hypertension are male sex, obesity, extra salt and recent smoking experience.

In this study 19 years adolescents had highest proportion (22.4%) of hypertension followed by 17 years old individuals. However, the association of age with hypertension was not significant. Soudarssanane et al. found mean blood pressure increased significantly with age.[15]Male gender (24.2%) was seen to suffer from hypertension more than female (10.9) whichwashighlysignificantinourstudy.(Chisquare=18.29,p<0.001)Thismaybelikely

due to the estrogen protective effect in premenopausal females. Sundar et al. also found a highly significant higher prevalence among boys.[13]Vedasathy et al.[20]and Soudarssanane et al.[15]found no significant association between gender and hypertension. Adolescents having overweight or obesity had significantly (p <0.001) more chance of hypertension than those with normal BMI in this study. Vedavathy et al.[20]and Sharma et al.[17]also found a statistical significance between overweight/obesity and hypertension. Soudarssanane et al. observed that a clear-cut rise in the prevalence of hypertension only with increasing weight.[15]Buch et al. in their study observed significant prevalence of hypertension in obese children and 1/3rd of obese children was hypertensive.[16]Gupta et al.in Ghaziabad found hypertension was significantly more in obese individuals.[18]Obesity in children is associated with increased incidence of hypertension, diabetes, coronary artery disease, osteoarthritis and mortality. Obesity in children increases chance of hypertension may be due to increased cardiac output, excessive sodium intake, increased steroid production and alteration in the reception for various pressuresubstance.

In the study, more proportion of adolescents having family history of hypertension and obesity had hypertension than those who had not. The association of obesity with hypertension in adolescents was significant. But interestingly the association of hypertension with family history of hypertension was not significant which is contrast to many studies.[10,13,15,17]Soudarssanane et al. in their study found persons with positive history of parental hypertension showed significant elevation in both SBP and DBP.[15]High prevalence of hypertension among children of hypertensive parents was found by Sundar et al.[13]and Sharma et al.[17]in their study. Vedavathy et al. in Bangalore reported that family history of hypertension was significantly associated with hypertension in children.[20]However, Buch et al.[16]and Singh et al.[14]found no significant association between family history of hypertension and hypertension in children. Familial tendency for developing high blood pressure due to genetic influence leads to higher chance of hypertension in children with hypertensive parents. The non-significant findings in this study may be influenced by the samplesize.

Another significant risk factor for hypertension was found in our study was improper sleeping. Adolescents having improper sleeping habits had more tendency for hypertension than those who had not. This is due to stress factors and hormones released due to sleep disturbances which cause hypertension. However, Vedasathy et al. found no significant association with sleep disturbances. Performance stress and work stress had a significant association with hypertension in adolescents.[20]Singh et al. found association of stress with hypertension.[14]Sundar et al. reported no significant relationship between hypertension and academic performance.[13]Gupta et al. found no significant association between stress and hypertension.[18]

In the present study, though more proportion of adolescents were detected with hypertension who have added salt in diet and junk food more than 5 days per week the association was not significant. Similar non-significant findings were reported by Sundar, et al.[13],Vedasathy et

al.[20]and Khan et al.[10]However, Soudarssanane et al. found higher salt intake as an independent predictor of hypertension but in their study only mean DBP was significantly associated with the amount of salt intake.[15]

In the present study though, majority had physical inactivity the association of it with hypertension was not significant. This association was non-significant, probably physical exercise alters blood pressure levels only in long term practice.The number of students who admitted of taking alcohol and smoking cigarettes was low. The association of hypertension with smoking and alcohol intake was not significant. Soudarssanane, et al. also reported that unlike the findings reported in adults, there was no effect of physical exercise, stress, type of food intake, smoking and alcohol consumption on blood pressure among adolescents.[15]Gupta et al. in their study, found adolescent hypertension was significantly associated with smokers.[18]However, he observed that drinking habits and physical inactivity had no significant association with hypertension.Vedasathy et al. found no significant association between hypertension with physical activity.[20]Even the percentage of alcohol consumption was higher in the study by Singh et al., the association was not significant.[14]As established the smoking and alcohol intake have role in development of hypertension in long term. There are many influencing factors like dose, frequency and duration of alcohol intake and smoking those affect onset of hypertension.Hence, we may found non-significant association between smoking, alcohol and hypertension.

In the study those who were detected with hypertension were informed along with their parents and teachers. They were advised about importance of hypertension and its risk factors. They were counselled about life style modification and instructed to consult with doctors for their hypertension management and followup.
Limitation

In the study, socioeconomic status was not assessed as most of the students couldn't talk about income. Psychological stress couldn't be analysed as proper assessment was difficult to be performed. Early menarche exhibits elevated blood pressure and glucose intolerance compared with later maturing girls, independent of body composition. But out of 120 hypertensive students, only 30 were female and thus could not constitute a statistically significant sample to provide information for this study. A study with a larger sample including only girl adolescents could possibly provide a conclusion regarding this risk factor.

Conclusion:

The prevalence of hypertension in school going adolescents aged 13 years to 19 years in the study area was relatively higher than that in other areas of India. High level of hypertension among school going adolescent in this urban area reflects changing scenario of cardiovascular diseases. Overweight, obesity, family history of obesity, improper sleeping habits, performance and work stress are some of the risk factors those are found to be significantly associated with hypertension in the study population. Though physical activity was found not be significantly associated with hypertension, high proportion of study population had

physical inactivity which was alarming. The study results urge for screening of adolescents in the locality so that early intervention can be applied to halt the progression of hypertension and its complication.

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