Lifestyle Determinants of Hypertension among Government School Adolescents: A Cross-sectional Study

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Abstract

Background: High blood pressure in adolescents is a growing concern around the world, and is caused by various lifestyle factors like an unhealthy diet, high in sodium and fats, lack of sleep, and physical inactivity. Unchecked hypertension during adolescence can lead to stroke, cardiovascular and kidney disease later in life. This study investigated any possible correlation between lifestyle variables and adolescent hypertension.

Materials and Method: A cross-sectional analytic study was conducted with 600 school-going adolescents after obtaining permission from Ethical Committee, school administration, and parents. Data was collected for the student's sociodemographic profile, personal/family history, lifestyle habits, BMI, and systolic/diastolic blood pressure. Qualitative data were presented as percentages or proportions; quantitative data was denoted by mean and standard deviation. 'p-value' less than 0.05 was considered significant.

Results: Most of the adolescents (68%) were found to be underweight. Sleep duration had a negative correlation with blood pressure, which showed a statistically significant difference. Other lifestyle variables didn't show any significant relationship with hypertension.

Conclusion: 2/3rd of government school students studied were underweight, with a ratio of 1.2 normotensives for every hypertensive individual. Sleep duration exhibited a negative correlation with blood pressure, showing the importance of sleep.

Keywords: Adolescent, Electronic Device, Exercise, Hypertension, Lifestyle, Sleep

Introduction

Globally, hypertension is a major public health problem and a leading modifiable risk factor for cardiovascular disease (CVD) and death[1,2]. Hypertension could have its origin in childhood and go unnoticed unless specifically diagnosed during this childhood period. Adolescent hypertension is becoming more common, and its incidence is rising internationally. The prevalence of hypertension

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among Indian adolescents ranged from 2% to 20.5% among studies, with a pooled estimate of 7.6%.[3]

Multifactorial lifestyle factors can contribute to the development of adolescent hypertension. A diet high in sodium, unhealthy fats, and added sugars (mainly fructose) have been linked to the etiology of hypertension[4]. Lack of physical activity or a sedentary lifestyle is also a major cause of weight gain and an increase in blood pressure. Chronic stress & anxiety, and poor or irregular sleep can raise blood pressure and increase the risk of developing hypertension. Behavioral risk factors like addiction to smoking and excessive alcohol consumption and depression were significantly associated, with and contributed to the development of hypertension in school-going adolescents[5,6,7].

Hypertension in adolescents often remains asymptomatic, without regular blood pressure monitoring. There is strong evidence that pediatric hypertension tracks into adulthood and is associated with premature cardiovascular, stroke, and/or kidney diseases[8,9,10,11,12]. The prevention and control of hypertension among school-going adolescents have not received due attention in many developing countries, although it is one of the most modifiable risk factors for cardiovascular diseases[13]. There have been few studies on the effect of adolescent lifestyle on hypertension, despite the fact that it might give essential input into the design of policies and initiatives targeted at preventing and controlling adults' hypertension. Therefore, it is important to identify hypertension in adolescents at earlier stages for effective management. The objective of the present study was to determine the association of lifestyle factors with hypertension among school-going adolescents.

Material and Methods

A community-based, cross-sectional, analytic type of observational study was conducted on 600 healthy age-matched school-going adolescents with in the 10-19 years of age group. The present study was conducted after taking approval from the Institutional Ethical Committee and school administration and consent from parents/ guardians. Students suffering from any acute or chronic disease, secondary hypertension, taking any medications, or not willing to participate were excluded from the study.

A pre-designed working proforma was asked to be filled out by each participant that has information regarding demographic details (name, age, gender, residence), family history of chronic diseases, and details of their lifestyle like physical inactivity, sleeping hours, food habits,exercise, time spent on electronic devices. The anthropometric measurement was recorded to calculate the body mass index (BMI) for each participant. The blood pressure was measured on the left arm by using a standard mercury sphygmomanometer, after giving five minutes of rest to participants in a sitting posture and taking all the necessary precautions[14]. Three measurements of systolic blood pressure (SBP) and diastolic blood pressure (DBP) were taken at intervals of five minutes and the average was calculated. This measured average blood pressure was converted into percentile and adolescents were classified intonormotensive, pre-hypertensive, and hypertensive categories using the below percentile chart (Table-1). The percentile charts based on gender, age, and height were provided by the National High Blood Pressure Educational Programme (NHBPEP): the fourth report was used for the classification of blood pressure[15].

Table 1: Percentile Chart

Classification of Hypertension in Children and Adolescents	
Normal	<90th
Prehypertension	90th to <95th or if BP exceeds 120/80 mmHg even if below 90th percentile up to <95th percentile
Stage 1 hypertension	95th percentile to the 99th percentile plus 5 mmHg
Stage 2 hypertension	>99th percentile plus 5 mmHg

In the present study, the adolescents were further divided into 2 groups normotensive and hypertensive. The hypertensive group included both prehypertensive and hypertensive stages 1 and 2 for the lifestyle determinants.

Statistics: All the collected data was entered and compiled into an Excel sheet and statistical analyses were performed using a statistical software primer (version 6). The qualitative data was expressed in the form of percentages and proportions; the chi-square test was used to infer the significance of proportion. The regression analysis was performed for the correlation coefficient. A 'p-value' less than 0.05 is considered as significant.

Results

In the present study, most of the adolescents belong to the age group 13-15 years (53.5%) and 68% of adolescents were underweight. Whereas the other characteristics of adolescents were nearly similar. Out of 600 adolescents, 210 (1/3rd) had a family history of hypertension (Table 2).

Table 2: Sociodemographic and family history of the adolescent population

Variables	Number (N=600)	Percentage (%)
Age group		
10-12 years	165	27.5
13-15 years	321	53.5
16-18 years	114	19
Gender		
Boys	286	47.7
Girls	314	52.3
Residence		
Urban	300	50
Rural	300	50
BMI		
Underweight	407	67.8
Normal weight	170	28.3
Overweight	18	3
Obese	5	0.8
Family History		
Hypertension		
Yes	210	35
No	390	65
Heart Diseases		
Yes	28	4.7
No	507	95.3
Diabetes		
Yes	93	15.5
No	507	84.5
Obesity		
Yes	101	16.8
No	499	83.2

Normotensive and hypertensive subjects showed no significant difference in food habits with respect to fruit intake, fast food intake, and the type of food (Table-3).

Table 3: Association of blood pressure with food habits among adolescents (N=600)

Food Habits	Normotensive	Hypertensive	Total	Pearson chi-square
Fruit Intake				
Daily	76	64	140	X^2=0.950
Weekly	76	74	150	p=0.622
Occasionally	172	138	310	
Total	324	276	600	
Fast food Intake				
Daily	32	24	56	X^2=0.589
Weekly	78	73	151	p=0.745
Occasionally	214	179	393	
Total	324	276	600	
Type of food				
Vegetarian	217	175	392	X^2=0.838
Non-vegetarians	107	101	208	p=0.203
Total	324	276	600	

N= Number of subjects

The sleep duration had a significant (p=0.008) difference in normotensive and hypertensive subjects, while the exercise variable did not influence blood pressure among adolescents (Table 4).

Table 4: Association of blood pressure with the duration of sleep and exercise among adolescents

Variables	Normotensive	Hypertensive	Total number of subjects	Pearson chi-square
Sleep duration				
Normal sleep	222	176	398	X^2=9.786
Short sleep	79	92	171	***p*=0.008**
Long sleep	23	8	31	
Total	324	276	600	
Exercise				
Regular	227	187	414	X^2=0.371
Irregular	97	89	186	p=0.542
Total	324	276	600	

The normotensive adolescents (70%) were more regular in exercise than hypertensive (68%) adolescents with a nonsignificant difference (p=0.542) (Table 4, Figure 1).

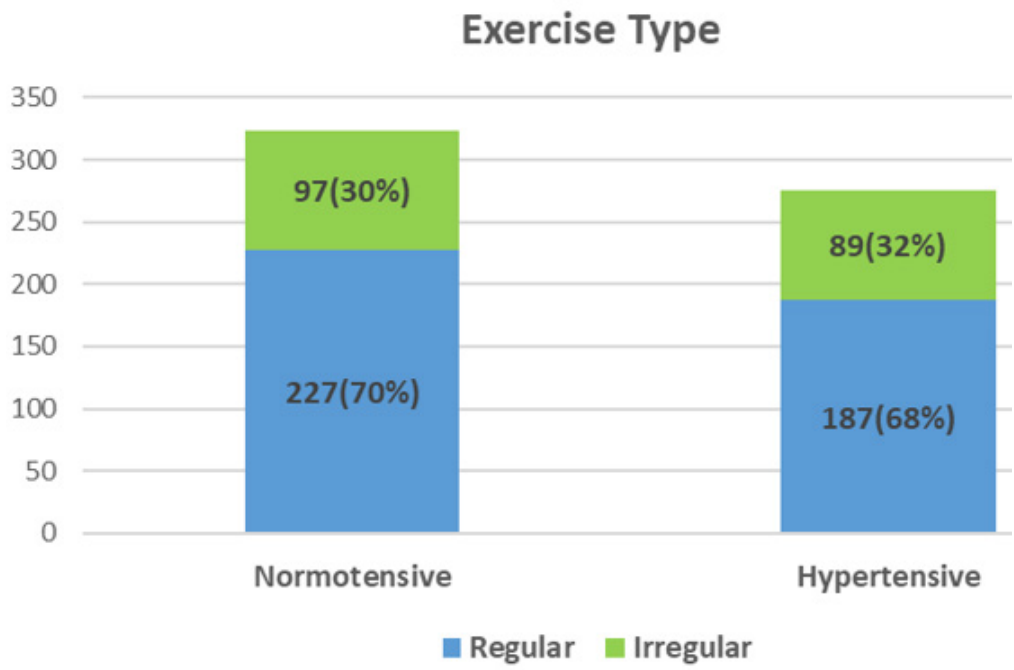
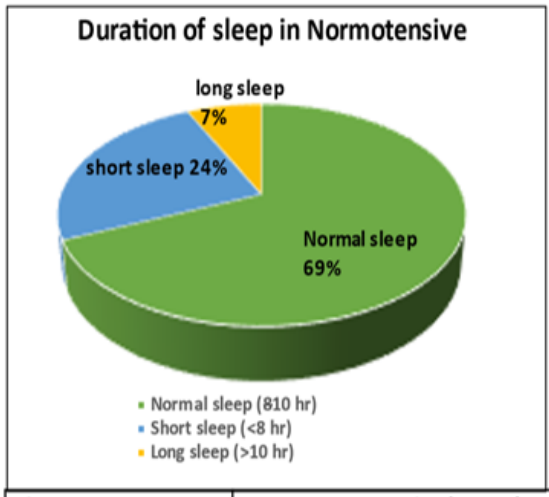
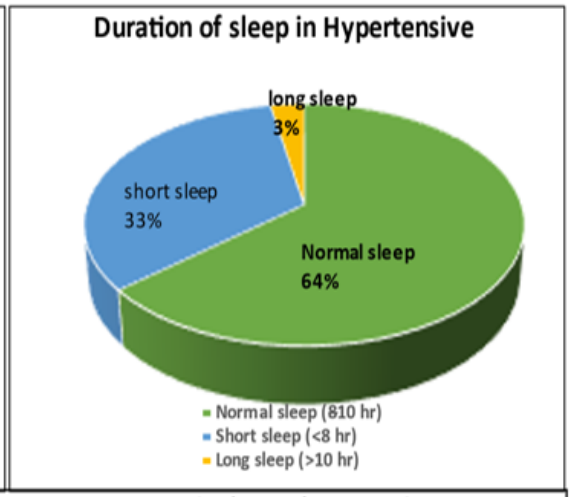


Figure 1: Proportions of exercise regularity among normotensive and hypertensive adolescents

The normotensive adolescents were having more normal sleep than the hypertensives with a significant difference (p=0.046) (Figure 2).





Sleep groups	Normotensive (N=324) Means (SD)	Hypertensive (N= 276) Means (SD)	p-value
Normal sleep	8.72 (0.79)	8.57 (0.67)	0.046
Short sleep	6.53 (0.63)	6.53 (0.57)	1.000
Long sleep	11.79 (0.93)	11.37 (0.69)	0.253

Figure 2: Distribution of sleep duration among the normotensive and hypertensive adolescents

A negative correlation was found between blood pressure (SBP, DBP) and sleep duration with significant differences (p=0.008, p=0.016), respectively. Time on electronic devices had a positive correlation (non-significant) with the blood pressure of adolescents (Table 5).

Table 5: Regression analysis of blood pressure with sleep duration and time on electronic devices

Independent variable (I)	Dependent variables (D)	Constant (A)	Unstandardized Coefficient (B)	Standardized coefficient (Beta)	Significance	R^2	Regression Line D=A+(B x I)
Sleep duration	SBP	122.641	-0.633	-0.087	0.033	0.008	SBP=122.641+ (-0.633 (Sleep hrs))
	DBP	77.04	-0.655	-0.125	0.002	0.016	DBP=77.042+ (-0.655 (Sleep hrs))
Time on electronic devices	SBP	117.03	0.228	0.027	0.501	0.001	SBP=117.037+ (0.228 (Elect hrs))
	DBP	71.50	0.078	0.013	0.749	<0.001	DBP=71.502+ (0.078 x time on Elect device))

Correlation value = Beta, D = Dependent variable, A = Constant, B = Unstandardized Coefficient, I= Independent variable

Discussion

Most of the adolescents (54%) belong to the age group 13-15 years and 2/3rd (68%) of adolescents were underweight. Out of 600 adolescents, only 1/3rd (35%) had a family history of hypertension. In the present study, only sleep duration was significantly associated with hypertension, whereas other lifestyle factors like exercise regularity, food habits, and time on electronic devices didn't influence hypertension.

In several previous studies[16,17,18,19,20] childhood obesity has been considered a major contributing factor to the increasing prevalence of hypertension in adolescents, whereas, in the present study, 68% of participants were underweight. Recently review articles publishedby Fikriana R et.al[21] and Ubaidillah et al.[22] collected 55 and 20 relevant

articles respectively to determine the risk factors for hypertension in adolescents, also suggested that most of the risk factors for hypertension in adolescents are related to obesity. However, these literature reviews included most of the lifestyle factors but the factor "sleep duration" was not considered. Whereas the present study reported a negative correlation was found between blood pressure and sleep duration with significant differences.

The National Sleep Foundation recommends <8 hours as insufficient, 8 to <9 hours as borderline, and ≥9 hours as optimal sleep for adolescents[23] In the present study, the normotensive adolescents exhibited a higher occurrence of normal sleep duration in comparison to their hypertensive counterparts, with a statistically significant difference (p=0. 046). Compared with other studies, the association of sleep duration with hypertension was like that of Javahri and associates[24] who reported that adolescents with low sleep efficiency, on average had a 4.0 ± 1.2 mmHg higher systolic BP compared to other children. Moreover, the study by Santos et.al [25] conducted in Brazil reported that sleep duration was significantly associated with blood pressure, and each increase of one hour in sleep was associated with blood pressure reduction in both sexes combined (p< 0.0001).Our findings are consistent with the findings of a Chinese cross-sectional study conducted on 4902 children and adolescents age 5 to 18 years and Kucieni[23] done on almost similar age groups(12- 15 years) of adolescents. It is suggested by these findings that the duration of sleep may have an impact on hypertension.

Possible explanation: Various potential mechanisms have been suggested in existing literature for the relationship between short sleep duration and blood pressure increase. One of them is elevated cortisol levels which can contribute to central and peripheral disturbances. People who get little sleep have higher levels of cortisol in their saliva compared to those who get a normal or long duration of sleep[24,25]. Another investigation implied that limited sleep time could elevate blood pressure by intensifying sympathetic nervous system activity, or by distorting circadian tempo and autonomic response[26].

Limitations: In this study, we were unable to gather information about the socioeconomic status of adolescents' parents. The participants were unable to give correct information regarding their total hours of exercise. Therefore, we gathered information on exercise on the basis of being regular or irregular. The various lifestyle factors like food habits, sleep duration, exercise type, etc depend on participants' memory, so there may be a recall bias.

Conclusion

In the present study, 2/3rd of adolescents were underweight. The ratio of normotensive versus hypertensive was 1.2:1 for the adolescents of the government schools of Jaipur district and only the 1/3rd adolescent had a family history of hypertension. Among the life style factors, only sleep duration was significantly associated with the tendency of hypertension. Sleep duration had a negative relationship with blood pressure, indicating an increase in sleeping hours reduces blood pressure. The exercise regularity and the time on the electronic device did not show any significant difference on hypertension.

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