

Original Research Article

A study of hypertension and obesity in school-going children age 10-16 years

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ABSTRACT

Background: The rising prevalence of hypertension and obesity among the current generation of children has become a significant public health concern. This alarming trend highlights the urgent need to study the occurrence of these conditions in school-going children aged 10 to 16 years. Accurate estimates of the prevalence of pediatric hypertension and obesity, particularly in the post-COVID era, are essential for designing effective prevention and treatment strategies. The study aims to determine the occurrence of hypertension and obesity in school going children and the risk factors associated with it.

Methods: In this cross-sectional study included 402 school going children of Kalaburagi city of age group 10 -16 years. After selecting the school, informed consent from school Principal and Parents of children was obtained. A predesigned, pre tested questionnaire proforma was administered to each child to collect data (intake of fatty food, dietary pattern, duration of screen time, duration of sleep, hours of physical activity). Parameters of height, weight and blood pressure were measured and recorded. Ethical approval was obtained.

Results: The prevalence of hypertension was 2.5% and pre-hypertension was 2.5%. Prevalence of obesity was 1.7%, over weight was 5.2%. Significant association was found between obesity and mixed type of diet (p value=0.016). It was found that obesity was significantly associated with increased risk of hypertension (p value= 0.000). Significant association was found between hypertension and increased screen time (p value=0.001). It was observed that there is a statistically significant association between female gender and overweight (p=0.027).

Conclusions: The prevalence of hypertension in obese children was high. Hypertension was positively associated with increased screen time. Prevalence and early detection of childhood obesity and high BP should be strengthened to prevent the risk of cardiovascular diseases.

Keywords: Blood pressure, Hypertension, Obesity

INTRODUCTION

Globally, the prevalence of adolescent obesity and high blood pressure has dramatically increased during the last 20 years. Health disorders such as dyslipidemia, hyperglycemia and metabolic abnormalities are frequently associated with these conditions. This rise has been significantly influenced by rapid shifts in disease patterns, dietary habits and society.¹ The early identification of cardiovascular risk factors, such as

hypertension and obesity, is a significant public health priority, as it may potentially prevent the serious consequences of cardiovascular diseases in adulthood.²

Prior research has indicated a various incidence of hypertension in children, ranging from less than 1% to 16.2% and a prevalence of obesity between 12% and 19%. This variation may be attributed to the differing age groups chosen for the studies and the distinct criteria employed for identifying hypertension and obesity.³

The global prevalence of Mean Body Mass Index (BMI), overweight and obesity is rising due to changes in diets and sedentary lifestyles.⁴ India is going through an epidemiologic and nutritional transformation, with a growing frequency of noncommunicable diseases (NCDs).⁵

Childhood obesity is often closely linked to unhealthy lifestyle habits. These include skipping breakfast, low consumption of fruits and vegetables, excessive intake of added sugars and saturated fats, insufficient physical activity, prolonged screen time, reduced sleep duration and poor sleep quality.⁶

Associated factors for variation in blood pressure and obesity in children and adolescents

The early identification of cardiovascular risk factors, such as hypertension and obesity, is a significant public health priority, as it may potentially prevent the serious consequences of cardiovascular diseases in adulthood.

Sedentary lifestyle

Many children are sedentary most of their waking hours, with much of this time spent diverted by screens and disengaged from human interaction. Screen time, generally operationalized as television viewing time, has consistently been associated with a range of adverse outcomes, including adiposity in children.⁷

In the 2003 to 2004 NHANES (National Health and Nutrition Examination Survey), it was estimated that children and adolescents were sedentary for ~7 hours daily; in the 2009 Canadian Health Measures Survey, the average sedentary time was 8.6 hours daily.⁸

Television viewing and total recreational screen time in adolescence, along with increases in these behaviors, were associated with unfavorable levels of several cardiovascular risk factors in young adulthood, including adiposity, triglycerides and metabolic syndrome.⁹ One of the study confirms the significant relationship between sedentary activity and the risk of hypertension and obesity. High levels of sedentary activity increase the risk of hypertension significantly.¹⁰

Physical activity

Regular physical activity reduces the risk factors of many diseases such as high blood pressure, diabetes and obesity. On the other hand, inactivity may cause obesity and a low level of cardiovascular fitness and increases the risk of high blood pressure. This situation also may lead to the development of chronic diseases such as high blood pressure and diabetes during adulthood.¹¹

In the systematic study of Janssen and Leblanc, where the relationship between physical activity and health of school-age children and adolescents were examined, it

was found that physical activity contributed significantly to health and that physical activity should be continued at least moderately to maintain health benefits and that vigorous activities provided more benefits.¹¹

The World Health Organization (WHO) recommends MVPA (Moderate to Vigorous Physical Activity) for children and adolescents aged 5-17 years for at least 60 min per day.¹²

Screen time

According to Common Sense Media, the average daily time spent using recreational screen-based media among 13- to 18-year-olds was 6 hours 40 minutes, of which only 2.5 hours were spent watching television content. Although access differs by income, 7 in 10 adolescents own a smartphone and use it an average of 4.5 hours daily, excluding talking and texting.¹³

In the NHANES (National Health and Nutrition Examination Survey) participants who exceeded 2 hours daily of recreational screen time were 1.8 times more likely to be adolescents with overweight or obesity.¹⁴

It is notable that in a 2-year longitudinal study of 9064 children, television watching was positively associated with weight gain.¹⁵

The relationship between screen media exposure and obesity has been widely studied. Many epidemiologic studies have revealed associations between screen time and obesity. For example, in 1 longitudinal cohort study of a nationally representative sample of US 10- to 15-year-olds, there was a strong dose-response relationship between the number of hours per day children viewed television and the prevalence of overweight and as much as 60% of the 4-year incidence of overweight was estimated to be attributable to excess television viewing.¹⁶

Sleep duration

The American Academy of Sleep Medicine recommends that the duration of sleep must be at least 9 hours for children and 8 hours for adolescents; those who sleep fewer than the recommended hours were classified as having insufficient sleep duration.¹⁷ Subjects exposed to experimental sleep restriction tend to consume more calories which may precipitate obesity-related hypertension. Cross-sectional data indicate short sleep duration (6–8 hours per night) is associated with elevated risk for impaired fasting glucose (6%), central obesity (12%) and hypertension (8%).¹⁸

Junk food

Indian Academy of Pediatrics Guidelines on the Fast and Junk Foods, Sugar Sweetened Beverages, Fruit Juices and Energy Drinks

The guidelines suggest a new acronym 'JUNCS' foods, to cover a wide variety of concepts related to unhealthy foods (Junk foods, Ultra-processed foods, nutritionally inappropriate foods, Caffeinated/colored/carbonated foods/beverages and Sugar-sweetened beverages). It concludes that consumption of these foods and beverages is associated with higher free sugar and energy intake, and is associated with higher body mass index (and possibly with adverse cardiometabolic consequences) in children and adolescents.¹⁹

It recommends avoiding consumption of the JUNCS by all children and adolescents as far as possible and limit their consumption to not more than one serving per week. It recommends intake of regional and seasonal whole fruits over fruit juices/drinks to infants and young children (age<2 years), whereas for children aged 2-5 years and >5-18 years, their intake should be limited to 125 mL/day and 250 mL/day, respectively.

It recommends that caffeinated energy drinks should not be consumed by children and adolescents. The Group supports recommendations of ban on sale of JUNCS foods in school canteens and in near vicinity and suggests efforts to ensure availability and affordability of healthy snacks and foods.¹⁹

To study the occurrence of hypertension in school-going children. To study the occurrence of obesity in school-going children. To study the risk factors associated with obesity and hypertension in school-going children.

METHODS

Study design

A school based cross-sectional study conducted at Mahadevappa Rampure Medical College, Kalaburagi on 402 school going children of Kalaburagi city of age group 10-16 years. Consent was taking from school principal and parents. The study was approved by the Institutional Ethics Committee of Mahadevappa Rampure Medical College, Kalaburagi.

Study place

The present study was conducted in two private schools in Kalaburagi city Chandrakant Patil English medium school (CBSE) S.B Patil Nagar, University Road, Kalaburagi 585102. International Public School old SBH, Sadar Mohella, Kalaburagi 585104.

Study duration

The study period was of 18 months i.e from 1 August 22 to 31 January 2024

Sample size

402, Using the formula, $n = Z^2 PQ/d^2$ where n=sample size, Z=confidence interval, P=Prevalence, Q=1-P, d=error rate.

Inclusion criteria

All school-going children belonging to the age group of 10 to 16 years.

Exclusion criteria

Known chronic illness, Drugs known to cause hypertension, Syndromic obesity.

Data collection

After selecting the school, informed consent from school principal and parents of children was obtained. A predesigned, pre tested questionnaire proforma was administered to each child to collect data (intake of fatty food, dietary pattern, duration of screen time, duration of sleep, hours of physical activity). All proformas were filled by respective parents. Parameters of height, weight and blood pressure was measured and recorded. After three BP readings a child was labelled as hypertensive.

Statistical analysis

Statistical data was analysed by using IBM SPSS 20.0 version software. For qualitative data analysis chi square test and fisher exact test were applied. For quantitative analysis apply student 't' test and ANOVA test was applied for statistical significance. If P value is <0.05 than the study was considered to be significant.

RESULTS

This study included 402 school going children. Among the study population, about 47.8% were female and 52.2% were males. 94% children were in the age group of 12-16 years.

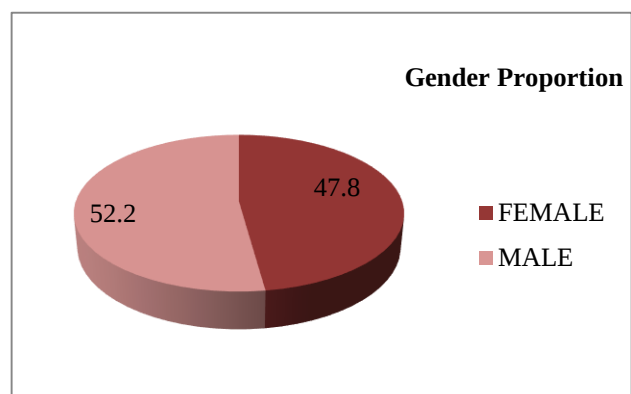


Figure 1: Sex wise distribution.

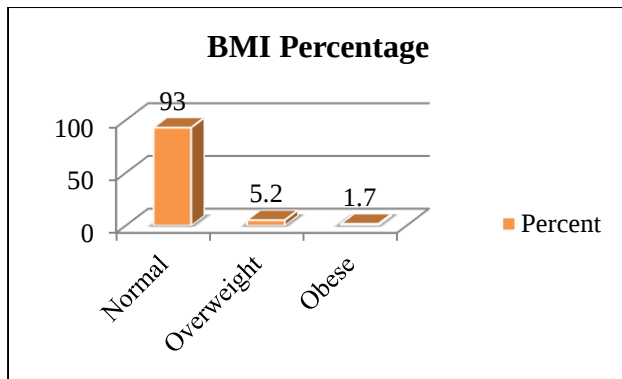


Figure 2: Distribution of BMI.

Table 1: Age wise distribution.

Age	Frequency	%
11	4	1.0
12	87	21.6
13	79	19.7
14	151	37.6
15	60	14.9
16	19	4.7
17	2	5
Total	402	100.0

Table 2: Association between gender and BMI.

Sex	BMI			Total
	Normal	Overweight	Obese	
Female	173	16	3	192
	90.1%	8.3%	1.6%	100.0%
Male	201	5	4	210
	95.7%	2.4%	1.9%	100.0%
Total	374	21	7	402
	93.0%	5.2%	1.7%	100.0%

*chi-square statistic=7.210, p-value=0.027 (significant association).

Table 3: Diet and BMI.

Diet	BMI			Total
	Normal	Overweight	Obese	
Mixed	300	12	7	319
	94.0%	3.8%	2.2%	100.0%
Veg	74	9	0	83
	89.2%	10.8%	0.0%	100.0%
Total	374	21	7	402
	93.0%	5.2%	1.7%	100.0%

*chi-square statistic=8.313, p-value=0.016 (significant association).

Table 4: Screen time and BP.

Screen time	BP			Total
	Hypertension	No hypertension	Pre hypertension	
< 45	2	139	10	151
	1.3%	92.1%	6.6%	100.0%
45 -90	5	167	0	172
	2.9%	97.1%	0.0%	100.0%
> 90	3	76	0	79
	3.8%	96.2%	0.0%	100.0%
Total	10	382	10	402
	2.5%	95.0%	2.5%	100.0%

*chi-square statistic=18.339, p value=0.001 (significant association).

1.7% of children were obese, 5.2% of children were overweight. 93% had normal BMI. 2.5% of children had hypertension, 2.5% of children had pre hypertension. 95% children had normal BP. It was observed that there is a statistically significant association between female gender and overweight with a p value Of 0.027.

A statistically significant association was observed between mixed type of diet and obesity (p value= 0.016). Among the study population there was a statistically significant association between increased screen time and hypertension with a p value=0.001. A statistically significant association was observed between obesity and hypertension (p value=0.000).

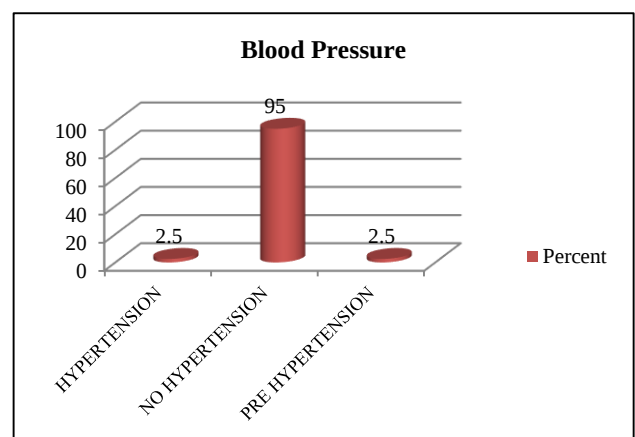


Figure 3: Distribution of BP.

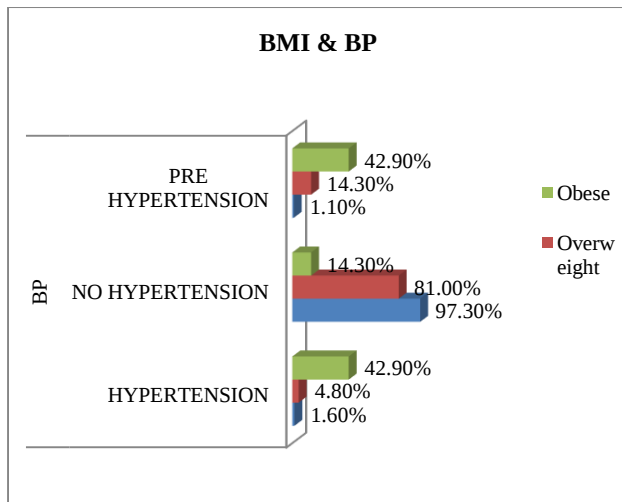


Figure 4: Association between BMI and BP.

DISCUSSION

This cross-sectional study demonstrates the prevalence of hypertension and obesity in school going children age 10-16 years. Various factors like type of diet, junk food consumption, screen time, sleep duration and duration of physical activity were recorded and its association with obesity and hypertension was studied. In our study out of 402 children, 210 were male (52.2%) and 192 were female 47.8%. when compared to males (2.4%) female had a high prevalence of overweight (8.3%). Males had high prevalence of obesity (1.9%) as compared to females (1.6%) this finding is similar to study by Angela Spinelli et al and Carolina Muller Ferrer et al, where the prevalence of obesity was higher in males as compared to females.^{20,21}

The male to female ratio in our study was found to be 1.09:1, with a slight male preponderance. In our study 1.7% of children were obese, 5.2% of children were overweight. In a study by Bishav Mohan et al, (2019) in North India prevalence of obesity was 11%. Study by Aggarwal T et al, (2008) Ludhiana prevalence of obesity was 3.4% and overweight prevalence was 12.7%.^{1,23} In the present study the prevalence of hypertension (95th percentile for age, sex and height was cut-off point) was found to be 2.5%, pre hypertension 2.5%. Prevalence of hypertension in school children in different studies. Nirav buh et al, 6.48% (6-18 years), Sarala sabapathy et al, 2.7% (6-16 years). Vedavathy S et al, (11-19 years) 3.6%.²⁴⁻²⁶

In our study out of 402 children 7 had obesity. Out of these 3 cases had hypertension. Findings of our study are compared with the study conducted by Bishav Mohan et al, which shows participants who were overweight and obese were at higher risk of hypertension.¹ It was found in our study that there is a significant association between mixed type of diet and obesity. In a study by Ouzna Redjala et al, there was an association of pre hypertension and hypertension with the time spent watching television,

internet and electronic devices.²² Similar association was also found in our study. Out of 10 children with hypertension three children (3.8%) had a screen time of >90 mins.

CONCLUSION

Our study highlights important links between childhood hypertension, overweight and obesity and underscores the need for proactive measures in prevention and early detection. The rise in screen time and the reduction in physical activity during and after the COVID-19 pandemic are critical factors that need to be addressed. Many children experienced significant lifestyle changes, such as more sedentary behavior and increased screen time, which could contribute to higher rates of obesity and hypertension. Understanding these effects is crucial for developing targeted interventions.

Research indicates that excessive screen time and reduced physical activity are strongly correlated with weight gain and hypertension. Strategies to counteract these effects might include promoting regular physical activity and encouraging breaks from screen use. Alongside physical activity, dietary habits play a significant role in childhood obesity and hypertension. Interventions that focus on healthier eating habits can complement efforts to increase physical activity. Educating families, schools and healthcare providers about the risks associated with sedentary behavior and poor diet is essential. Public health campaigns and school programs can help raise awareness and promote healthier lifestyles.

Understanding and addressing these factors can help mitigate the long-term risks of cardiovascular diseases in adults. Implementing comprehensive strategies that incorporate physical activity, dietary changes and mental health support is essential for tackling these issues effectively.

Study Results cannot be generalised because of the study population restricted to one geographical location.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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