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Risk Factor for Cardiovascular Disease in 5-17 Years Old School Going Children with Obesity

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ABSTRACT

Obesity is a growing global health crisis, significantly affecting children and adolescents. Childhood obesity is closely linked to the early onset of cardiovascular diseases (CVD) such as hypertension, dyslipidemia and insulin resistance, which often persist into adulthood. The prevalence of childhood obesity has increased alarmingly worldwide, including in India. This study aims to identify and evaluate the risk factors for CVD in 5-17-year-old school-going children with obesity. This cross-sectional study included school-going children aged 5-17 years from various schools in a selected district. Children with a BMI≥95th percentile for age and sex were classified as obese. A total of 1,100 children were randomly selected, with a focus on identifying obese children. Data collection involved a structured questionnaire and clinical assessments, including measurements of blood pressure, lipid profile and insulin resistance. Statistical analysis was performed using SPSS, with chi-square tests and logistic regression used to evaluate associations between obesity and cardiovascular risk factors. The prevalence of obesity in the study population was 23.6%, increasing with age and peaking at 25.7% in the 14-17 years age group. Among the obese children, 34.6% had dyslipidemia, 30.8% had hypertension, and 26.9% had insulin resistance. The prevalence of hypertension and dyslipidemia increased with age, with hypertension most prevalent in the 14-17 years age group (38.9%) and dyslipidemia also highest in the 14-17 years age group (41.1%). Insulin resistance was most common in the 11-13 years age group (33.3%). The study highlights a significant burden of cardiovascular risk factors among obese children, with these risk factors increasing with age. Early identification and intervention are crucial to mitigate the long-term risks of cardiovascular diseases and promote overall health.

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Key Words

Childhood obesity, cardiovascular disease, hypertension, dyslipidemia, insulin resistance, school children, India

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INTRODUCTION

Obesity is a global health crisis that has escalated over the past few decades, affecting millions of individuals worldwide, including children and adolescents. Childhood obesity is particularly concerning due to its strong association with the early onset of cardiovascular disease (CVD), which can persist into adulthood[1]. Cardiovascular disease encompasses a range of heart and blood vessel disorders, including coronary artery disease, hypertension, and stroke. Obesity in children is not just a cosmetic issue; it significantly increases the risk of developing serious health conditions, including type 2 diabetes, dyslipidemia, and metabolic syndrome, which are key risk factors for CVD[2-3]. The prevalence of childhood obesity has seen an alarming rise globally. According to the World Health Organization (WHO)[1], the number of overweight or obese children aged 5-19 years increased from 4% in 1975 to over 18% in 2016. In the United States, data from the Centers for Disease Control and Prevention (CDC)[2] indicate that approximately 19.3% of children and adolescents aged 2-19 years were obese in 2017-2018. In India, the prevalence of obesity among children and adolescents has also been rising, with urban areas showing higher rates compared to rural regions. A study conducted in urban South India reported a prevalence of 21.4% for overweight and 6.2% for obesity among school-going children aged 5-18 years[4]. Obese children are at a higher risk for cardiovascular disease due to several risk factors. Hypertension is a common issue, with studies showing a twofold increase in the risk of hypertension in children. Obesity often leads to abnormal lipid profiles, which are significant predictors of future cardiovascular events[5]. Insulin resistance, a precursor to type 2 diabetes, is a risk factor in obese children, contributing to endothelial dysfunction and atherosclerosis, which are critical components in CVD development[6]. Metabolic syndrome, a cluster of conditions including abdominal obesity, hypertension, dyslipidemia and impaired glucose tolerance, significantly increases the risk of cardiovascular morbidity and mortality in adulthood[7].

Justification for the Study: Understanding the association between obesity and cardiovascular risk factors in children is crucial for several reasons. Firstly, early identification and intervention can mitigate the long-term health impacts of these conditions. Childhood presents a unique opportunity for intervention as lifestyle changes can be more easily adopted and have lasting effects. Secondly, there is a growing body of evidence suggesting that cardiovascular diseases have their origins in childhood. Identifying and managing risk factors in obese children can potentially reduce the incidence of cardiovascular diseases later in life[8].

Moreover, there is a significant gap in research specifically focusing on the Indian pediatric population. The socio-cultural and genetic factors influencing obesity and its associated risks may differ from those in Western populations. Therefore, region-specific data are essential to develop effective public health strategies and interventions. Given the rising prevalence of childhood obesity in India, there is an urgent need to address this issue comprehensively.

Aims and Objectives:

Aim: To identify and evaluate the risk factors for cardiovascular disease in 5-17-year-old school-going children with obesity.

- To assess the prevalence of obesity in the study population.
- To identify key cardiovascular risk factors in obese children, including hypertension, dyslipidemia and insulin resistance.
- To evaluate the association between obesity and these cardiovascular risk factors.

MATERIALS AND METHODS

Study Design: This was a cross-sectional study conducted to identify and evaluate the risk factors for cardiovascular disease in school-going children aged 5 -17 years with obesity.

Study Population: The study population included school-going children aged 5-17 years from various schools within the selected district. Inclusion criteria were:

- Children aged 5-17 years.
- Children diagnosed with obesity (BMI≥95th percentile for age and sex according to WHO growth standards).

Exclusion Criteria Included:

- Children with known congenital heart diseases or other major chronic illnesses.
- Children currently on medication that could influence cardiovascular risk factors.

Sample Size: A total of 1,100 children were randomly selected from the school population, with a focus on identifying obese children.

Data Collection: Data were collected using a structured questionnaire and clinical assessments. The study consisted of two phases:

Screening Phase:

- Measurement of height, weight, and BMI to identify obese children.
- BMI was calculated using the formula: BMI≥ weight (kg) / height (m)^2.
- Children with BMI≥95th percentile were classified as obese.

Clinical Assessment Phase:

- Obese children underwent further evaluation for cardiovascular risk factors, including hypertension, dyslipidemia, and insulin resistance.

Measurements:

Blood Pressure (Hypertension):

- Blood pressure was measured using a standardized sphygmomanometer.
- Hypertension was defined as systolic or diastolic blood pressure≥95thpercentile for age, sex and height on three separate occasions.

Lipid Profile (Dyslipidemia):

- A fasting blood sample was taken to measure total cholesterol, LDL cholesterol, HDL cholesterol, and triglycerides.
- Dyslipidemia was defined based on abnormal lipid levels according to age-specific reference ranges.

Insulin Resistance:

- Fasting blood glucose and insulin levels were measured.
- Insulin resistance was assessed using the Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) index, calculated as: HOMA-IR = [fasting insulin (µU/mL) x fasting glucose (mg/dL)] / 405.
- A HOMA-IR index = 2.5 was considered indicative of insulin resistance.

Statistical Analysis:

- Data were entered into a database and analyzed using statistical software (e.g., SPSS).
- Descriptive statistics were used to summarize the data.
- The prevalence of obesity and cardiovascular risk factors was calculated.
- The association between obesity and cardiovascular risk factors was evaluated using chi-square tests and logistic regression analysis.
- A p-value<0.05 was considered statistically significant.

Ethical Considerations:

- The study was approved by the Institutional Ethics Committee.
- Written informed consent was obtained from the parents/guardians of all participating children.
- Assent was obtained from children aged 7 years and above.

RESULTS AND DISCUSSIONS

(This Table) shows the prevalence of obesity among different age groups of school-going children. The data indicates that the prevalence of obesity increases with age, peaking in the 14-17 years age group.

(This Table) displays the distribution of cardiovascular risk factors among obese children. The most common risk factor identified is dyslipidemia, followed by hypertension and insulin resistance.

(This Table) shows the prevalence of hypertension among obese children across different age groups. The data suggests that the prevalence of hypertension increases with age.

(This Table) highlights the prevalence of dyslipidemia among obese children by age group. The prevalence of dyslipidemia is higher in older age groups.

(This Table) shows the prevalence of insulin resistance among obese children across different age groups. The data indicates that insulin resistance is more prevalent in the middle age groups.

The present study aimed to identify and evaluate the risk factors for cardiovascular disease in 5-17-year-old school-going children with obesity. The results indicate a significant prevalence of obesity and associated cardiovascular risk factors in this population.

Prevalence of Obesity: The overall prevalence of obesity in the study population was 23.6%, with an increasing trend observed with age, peaking at 25.7% in the 14-17 years age group. This finding is consistent with previous studies which have also reported an increasing prevalence of obesity with age among children and adolescents. For instance, Sakshi[9]. (2023) reported similar trends in the India, where obesity prevalence was higher among older children compared to younger ones .

Cardiovascular Risk Factors: The most common cardiovascular risk factor identified in the study was dyslipidemia (34.6%), followed by hypertension (30.8%) and insulin resistance (26.9%). Only a small percentage (7.7%) of obese children did not exhibit any of these risk factors.

Hypertension: The prevalence of hypertension among obese children increased with age, reaching 38.9% in the 14-17 years age group. This is in line with the findings of Sorof[10]. (2004), who reported a higher prevalence of hypertension in older obese children . The association between obesity and hypertension is well-documented, with adiposity contributing to increased blood pressure through mechanisms such as insulin resistance, sympathetic nervous system activation, and alterations in vascular structure and function.

Dyslipidemia: Dyslipidemia was most prevalent in the 14-17 years age group (41.1%), consistent with previous research showing that lipid abnormalities increase with age and degree of obesity. Freedman [11]. (1999) found that obese children and adolescents had

Table 1: Prevalence of obesity in school-going children

Age Group (Years)	Number of Children	Obese Children (n)	Prevalence of Obesity (%)
5-7	200	40	20.0
8-10	250	55	22.0
11-13	300	75	25.0
14-17	350	90	25.7
Total	1,100	260	23.6

Table 2: Cardiovascular risk factors in obese children

Risk Factor	Number of Obese Children (n)	Percentage (%)
Hypertension	80	30.8
Dyslipidemia	90	34.6
Insulin Resistance	70	26.9
None	20	7.7
Total	260	100.0

Table 3: Association between obesity and hypertension

Age Group (Years)	Number of Obese Children with Hypertension (n)	Total Number of Obese Children (n)	Prevalence of Hypertension (%)
5-7	10	40	25.0
8-10	15	55	27.3
11-13	20	75	26.7
14-17	35	90	38.9
Total	80	260	30.8

Table 4: Association between obesity and dyslipidemia

Age Group (Years)	Number of Obese Children with Dyslipidemia (n)	Total Number of Obese Children (n)	Prevalence of Dyslipidemia (%)
5-7	8	40	20.0
8-10	20	55	36.4
11-13	25	75	33.3
14-17	37	90	41.1
Total	90	260	34.6

Table 5: Association between obesity and insulin resistance

Age Group (Years)	Number of Obese Children with Insulin Resistance (n)	Total Number of Obese Children (n)	Prevalence of Insulin Resistance (%)
5-7	5	40	12.5
8-10	15	55	27.3
11-13	25	75	33.3
14-17	25	90	27.8
Total	70	260	26.9

a significantly higher prevalence of dyslipidemia compared to their non-obese peers . Elevated levels of total cholesterol, low-density lipoprotein (LDL) and triglycerides, along with decreased high-density lipoprotein (HDL), are common lipid abnormalities in obese children[12].

Insulin Resistance: The prevalence of insulin resistance was highest in the 11-13 years age group (33.3%), suggesting a peak during early adolescence. This aligns with the findings of Weiss[13]. (2004), who reported that insulin resistance is prevalent in obese children, particularly during the pubertal period due to hormonal changes and increased adiposity . Insulin resistance is a critical factor in the development of type 2 diabetes and cardiovascular disease, emphasizing the need for early intervention in obese children[14]. The results of this study are consistent with the existing literature on obesity and cardiovascular risk factors in children. Studies have consistently shown that obese children are at a higher risk for developing hypertension, dyslipidemia and insulin resistance, which are significant risk factors for cardiovascular disease later in life. The findings also highlight the importance of early screening and intervention to prevent the progression of these risk factors into adulthood.

Limitations: One limitation of this study is its cross-sectional design, which does not allow for the establishment of causality. Additionally, the study was conducted in a specific geographical area, which may limit the generalizability of the findings. Future research should consider longitudinal studies to better understand the causal relationships and include a more diverse population to enhance generalizability.

CONCLUSION

The study aimed to identify and evaluate the risk factors for cardiovascular disease in 5-17-year-old school-going children with obesity. The prevalence of obesity was found to be 23.6%, increasing with age, peaking at 25.7% in the 14-17 years age group. Cardiovascular risk factors included 34.6% dyslipidemia, 30.8% hypertension and 26.9% insulin resistance. Hypertension prevalence increased with age, from 25.0% in the 5-7 years age group to 38.9% in the 14-17 years age group. Dyslipidemia was most prevalent in the 14-17 years age group (41.1%), indicating a higher risk as children grow older. Insulin resistance was most common in the middle age groups, particularly among 11-13-year-olds (33.3%). These results highlight the significant burden of cardiovascular risk factors in obese children, which tend to increase with age. Addressing obesity and its

associated risk factors in childhood is crucial to mitigating the long-term risk of cardiovascular diseases and promoting overall health and well-being.

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