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Association of Cardiometabolic Diseases in Adolescents with Level of Obesity and Lifestyle Pattern at Metropolitan City; Findings from Southern India

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Abstract

The crisis of obesity is observed among adolescents in metropolitan cities in India. It is associated with a range of cardiometabolic diseases, such as hypertension, prediabetes, Asthma, hypercholesterolemia, hyperlipidaemia, and reproductive abnormalities. The objective of this study was to analyse the cardiometabolic risk factors and weight status of adolescents in association with their lifestyle patterns. A cross-sectional study was conducted among adolescent patients who received treatment for cardiometabolic disease in a tertiary care hospital. They were selected based on inclusion and exclusion criteria. 83 adolescent patients with obesity were identified and interviewed. General information, lifestyle patterns and details of the cardiometabolic risk factors were collected through a questionnaire. ANOVA was calculated using SPSS Version 23, and the statistically significant level was <0.05. There was an association between age group, family income, physical activity, screen time, junk food consumption, balanced diet and sleeping hours in obesity-level adolescent patients. The mean values of cardiometabolic diseases were worse in obesity III and II than in obesity I. The status of blood pressure (SBP and DBP), fasting PG, total cholesterol, HDL, LDL, and triglyceride strongly correlated with adolescent patients' level of obesity. Lifestyle modifications are essential among adolescents to prevent comorbidities that have developed from cardiometabolic risk factors.

Keywords: *Adolescents, Cardiometabolic Diseases, India, Lifestyle Pattern, Obesity.*

Introduction

Adolescent obesity is associated with a range of cardiometabolic diseases and is also identified as a primary risk factor for hypertension, prediabetes, insulin resistance, asthma, hypercholesterolemia, hyperlipidemia, and reproductive abnormalities. Many review articles stated that adolescence is strongly associated with cardiometabolic diseases and mortality in adulthood [1]. In addition, they are at higher risk of psychosocial comorbidities such as stigmatization, negative stereotyping, teasing, and bullying [2]. World Health Organization revealed that 390 million children and adolescents aged 5-19 were overweight in 2022. The prevalence of obesity has risen drastically from 8% to 20% in 1990 - 2022 and 19% of girls and 21% of boys were overweight in 2022 [3].

Cardiometabolic risk indicators, including blood pressure and blood lipids, were linked to healthy eating habits [4]. Furthermore, several

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studies looked into how physical exercise affected cardiometabolic risk. It has been discovered that there are inverse relationships between triglycerides and body composition and an active lifestyle. The findings about sedentary behaviours such as watching television or playing video games are less clear-cut since some research found no correlations between a sedentary lifestyle and cardiometabolic risk, while other studies found inverse relationships [5]. A recent meta-analysis confirmed a comprehensive study that found short sleep duration was inversely related to cardiometabolic risk indicators. It has been demonstrated that an unfavourable body composition during adolescence is positively correlated with a subsequent risk of coronary heart disease[6]. The focus of this study was to analyse the cardiometabolic risk factors and weight status of adolescents in association with their lifestyle patterns (Figure. 1).

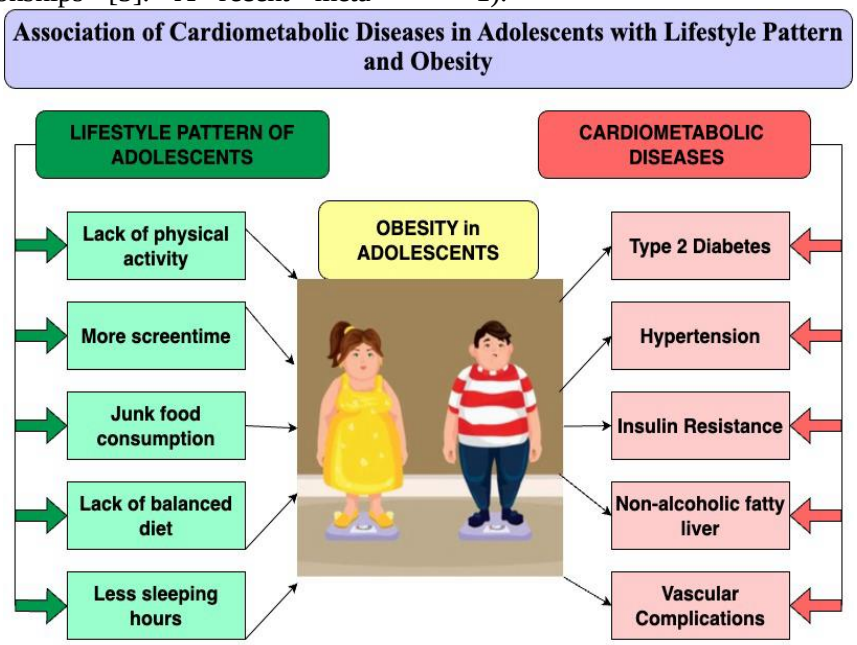

Figure 1. Association of Cardiometabolic Diseases in Adolescents with Lifestyle Patterns and Level of Obesity

Materials and Methods

Study Design and Population

A cross-sectional study was conducted in a tertiary care hospital in Chennai. The study involved the review of medical records of all adolescent patients who received cardiometabolic disease treatment at the outpatient unit. The data was collected from Jan 2024 to July 2024. The participants consisted of adolescents with obesity, along with cardiometabolic disease, and were selected using purposive sampling.

Inclusion Criteria

Adolescents aged 10 to 19 years, affected by cardiometabolic disease (Diabetes, Hypertension, obesity, Insulin resistance and non-alcoholic fatty liver disease), willing to participate, the ability to share their experience with obesity and the ability to understand English or Tamil were included in the study.

Exclusion Criteria

Patients above 19 years, with severe illness, unable to understand English or Tamil, and not providing consent to participate were excluded from this study. A total of 83 adolescent patients affected by cardiometabolic disease with obesity were identified and interviewed. Among them, male adolescents were 51 and female adolescents were 32.

Study Instrument

Data collection was continued in a comprehensive health service centre using

individual, face-to-face and structured interviews. A purposive sampling method was used based on inclusion criteria. The interviews were done by setting appointments, and the locations of the interviews were chosen according to the opinions of the participants. Interviews with each adolescent patient lasted for 35 to 45 minutes.

Body Mass Index

Standard body height and weight measures were used to derive a Body Mass Index (BMI). Body weight and height were measured with a weighing scale and meter rod, respectively. BMI, which is the ratio of weight in kilogram to height in centimetres, was used to assess body weight status. BMI categories were used to diagnose weight status. According to the National Institute of Health, adults were classified based on their BMI as normal weight (BMI 25 kg/m2), overweight (BMI >25 to 30 kg/m2), Obesity I (BMI >30 to 35 kg/m2), Obesity II (BMI >35 to 40 kg/m2), and Obesity III (BMI >40 kg/m2).

Closed Type Questionnaire

The survey was divided into three sections. The first section was about socio-demographic data, the second section asked about their lifestyle behavioural pattern, and the last section was about the clustered cardiometabolic risk factors of adolescent patients. Agreed adolescents were given a questionnaire. All interviews were conducted in a private room and immediately transcribed by one of the researchers manually.

Ethical Considerations

Ethical principles related to the confidentiality of the patient's information and having the right to withdraw from the study at any time were also considered without any consequences.

Statistical Analysis

The association of cardiometabolic diseases in adolescents with lifestyle patterns and levels of obesity was analysed by statistical method. Data were collected based on the conventional content analysis approach, the data management was done and ANOVA was calculated using SPSS software version 23.0. Results were expressed in frequencies, and percentages and the significant level (p-value) was <0.05.

Results

Socio-demographic Characteristics of Adolescent Patients

Table 1 reveals that the majority of adolescent patients were in the age group of 17 to 19 years (late adolescence). The majority of adolescents were male (51). 48.3% of patients had a family income of Rs 50,000 to 1 lac. There was an association between age group and family income with the weight status of adolescent patients.

Table 1. Socio-demographic Variables of Adolescent Patients in Association with their Weight Status

Variables	**Obesity I**	**Obesity II**	**Obesity III**	**p-value**
	N (%)	**N (%)**	**N (%)**	
Age Group				
Early adolescents*	14(16.9)	6(7.2)	0(0.0)	0.04
Middle adolescents*	19(22.9)	9(10.8)	1(1.2)	
Late adolescents*	23(27.7)	9(10.8)	2(2.5)	
Gender				
Male	36(43.4)	13(15.6)	2(2.5)	0.381
Female	20(24.1)	11(13.2)	1(1.2)	
Family Income (monthly)				

<50,000	7(8.4)	3(3.6)	0(0.0)	0.002
50,000-1 L	28(33.7)	12(14.6)	0(0.0)	
>1L	21(25.3)	9(10.8)	3(3.6)	
Note: Table 1 -*Early adolescents -10 to 13 years, *Middle adolescents -14 to 16 years, *Late adolescents -17 to 19 years, *Obesity I -BMI >30-35 kg/m2), *Obesity II - BMI >35-40 kg/m2, *Obesity III - BMI >40 kg/m2.				

Lifestyle Behavior Pattern of Adolescent Patients

Table 2 portrays 73(88%) adolescents involved in low physical activities. The majority of adolescents (57.8%) had 1-3 hours of screen time per day. 59 adolescents (71.1%) frequently add junk food. Out of 83 adolescents, 57 did not have a balanced diet. The majority of adolescents (37) slept 4 to 6 hours per day. There was an association between physical activity, screen time, junk food, balanced diet and duration of sleep with the weight status of adolescent patients.

Cardiometabolic Risk Factors of Adolescent Patients

Table 3 shows the clustered cardiometabolic risk factors of adolescent patients with their weight status. The mean values of cardiometabolic risk factors were worse in obesity III and II than in obesity I. The status of blood pressure (SBP and DBP), fasting PG, total cholesterol, HDL, LDL, and triglyceride strongly correlated with adolescent patients' weight status since the p-value was <0.001.

Table 2. Lifestyle Pattern of Adolescent Patients in Association with Their Weight Status

Variables	**Obesity I**	**Obesity II**	**Obesity III**	**p-value**
	N (%)	**N (%)**	**N (%)**	
Physical Activity				
Low	49(59.0)	21(25.4)	3(3.6)	<0.000
Medium	7(8.4)	3(3.6)	0(0.0)	
Sufficient	0(0.0)	0(0.0)	0(0.0)	
Screen Time				
< 1 Hour	4(4.8)	0(0.0)	0(0.0)	<0.000
1-3 Hours	33(39.7)	14(16.9)	1(1.2)	
>3 Hours	19(22.9)	10(12.0)	2(2.5)	
Junk Food				
Daily	4(4.8)	7(8.4)	0(0.0)	<0.000
Frequently	45(54.3)	11(13.3)	3(3.6)	
Rarely	7(8.4)	6(7.2)	0(0.0)	
No	0(0.0)	0(0.0)	0(0.0)	
Balanced Diet				
Yes	17(20.5)	8(9.6)	1(1.2)	<0.000
No	39(47.0)	16(19.2)	2(2.5)	
Duration of Sleep				
< 4 hours	14(16.8)	5(6.0)	0(0.0)	<0.000
4 to 6 hours	27(32.6)	10(12.0)	0(0.0)	
> 6 hours	15(18.1)	9(10.9)	3(3.6)	
Note: p-value is statistically significant at <0.05				

Table 3. Correlation of Cardiometabolic Risk Factors of Adolescent Patients with Weight Status

Cardio Metabolic Risk Factors	**Obesity-I**	**Obesity-II**	**Obesity-III**	**p-value**
	Mean ± SD	**Mean ± SD**	**Mean ± SD**	
BMI (kg/m2)	33.3 ± 2.1	37.5 ± 2.7	42.0 ± 1.5	<0.001
SBP (mmHg)	115.3 ± 1.4	120.7 ± 3.0	124.0 ± 4.2	<0.001
DBP (mmHg)	71.0 ± 0.8	73.1 ± 1.5	80.0 ± 3.7	<0.001
FPG (mg/dL)	97.3 ± 6.0	103.9 ± 5.0	121.7 ± 8.9	<0.001
TC (mg/dL)	171.6 ± 1.6	173.2 ±3.5	175.6 ±2.4	<0.001
HDL (mg/dL)	47 ± 0.1	46 ±1.7	45 ±2.4	<0.001
LDL (mg/dL)	103 ± 1.8	105 ± 2.3	108 ±2.7	<0.001
TG (mg/dL)	104.1 ± 0.3	107.6 ±3.1	109.1 ±2.2	<0.001

Note: BMI – Body Mass Index, SBP – Systolic Blood pressure, DBP – Diastolic Blood pressure, FPG – Fasting plasma glucose, TC - Total Cholesterol, LDL- Low-density Lipoprotein cholesterol, HDL- High-density Lipoprotein cholesterol, TG-Triglyceride.

Discussion

The current study highlights the association of cardiometabolic risk factors with lifestyle patterns and the weight status of adolescent patients. Lifestyle behaviours are multidimensional and include elements of physical activity, screen time, and junk food, which are particularly analysed in this study. All these elements play a vital role in the development of obesity among adolescents. Some studies have only focused on the role of dietary patterns [7]. A study conducted among young Australian women stated that Individual risks associated with obesity included lower education, stressful life events, and less vigorous physical activity [8]. Obstructive sleep apnea is a risk factor among patients with cardiovascular disorders [9]. Among Chinese children and adolescents, a study conducted and portrayed that the high prevalence of weight misperception was closely related to unhealthy weight patterns and unhealthy dietary or exercise patterns [10].

According to the current study, obese individuals had a greater prevalence of the majority of cardiometabolic risk factors. Adolescents who are severely obese have substantial metabolic and cardiovascular morbidity. There may be a connection between early hardship and obesity, according to another research [11]. According to a recent meta-analysis, adolescent overweight measurements and childhood adversity were positively correlated in a pooled estimate of examined longitudinal studies. Adversity throughout adolescence has also been linked to a higher chance of developing type 2 diabetes as an adult. Teenagers' CMR is greatly impacted by screen time [12].

High screen time has been linked to higher levels of obesity, BMI, waist circumference, TG, LDL-C, and blood pressure and lower levels of HDL-C, according to studies. Studies conducted in Brazil in 2017 and Iran in 2016 demonstrated the connection between high ST and higher CMR, particularly in teenagers who are overweight or obese [13]. Teenagers who watched Television for more than four hours a day also had a markedly increased risk of CMR, according to a 2011 US study [14]. Our study's cross-sectional approach, which might offer important insights into relationships between many factors and CMR at a certain period, is one of its limitations. It cannot, however, prove causation or forecast future occurrences.

Conclusion

Well-designed studies about weight status and cardiometabolic risks in adolescents are needed in the future. Practicing yoga is essential to prevent comorbidities that have developed from cardiometabolic risk factors. The risk of cardiometabolic diseases is significantly higher among the overweight/obese. The nutritional status of the adolescents was significantly associated with elevated blood pressure and increased risk for cardio-metabolic diseases. There is a need for more interest and intervention by stakeholders in the cardio-metabolic health of adolescents in India.

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Conflict of Interest

The authors declared no conflict of interest.

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