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A Case Control Study on Risk Factors of Obesity Among Adolescents

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ABSTRACT

Background: Adolescence is the transition period from childhood to adulthood and adolescent obesity can lead to systemic complications affecting the quality of life in later stages. This study aimed to assess the risk factors of obesity among school children of adolescent age.

Methods: This Case control study included 110 obese and 110 non-obese adolescents between 10 and 17 years of age. Children with Body Mass Index (BMI) >+2 SD of WHO growth reference median for their age and sex were included as cases. Children with BMI between -2SD and +1SD were included as controls. Data was collected using a structured questionnaire and analyzed with SPSS software.

Results: The risk factors which showed a statistically significant association with adolescent obesity were less educated father and mother, being a single child in the family, adolescents from nuclear type of family, having an obese parent, increased waist hip ratio and lack of exclusive breastfeeding during infancy.

Conclusion: Educating children and parents on the importance of preventing obesity and harmful effects of adolescent obesity is the need of the hour. This can be done through intensive health education campaigns in community and schools, and regular reinforcement on primary preventive measures.

Keywords: Adolescents, obesity, risk factors, urban, school children

INTRODUCTION

In the year 2016, nearly 650 million people were found to be obese and majority of the world's population live in countries where the mortality due to obesity and overweight is more when compared to mortality due to underweight.[1] Once obesity was considered a public health problem only in high-income countries; But now it is on the rise in both low- and middle-income countries like India, China and Nepal, especially in urban areas.[2,3] The prevalence of obesity is increasing in children and around 340 million children were either overweight or obese in the year 2016.[4]

In the present era, it is quite common to find co-existence of under-nutrition and obesity within a community and even within a household.[4] Children living in low- and middle-income countries are more susceptible to poor antenatal nutrition, and inadequate infant and young child nutrition. With changes in lifestyle patterns, children are exposed to foods with abnormally high calories, high fat and salt content. This in synergy with low physical activity, result in sharp rise in childhood obesity.[5,6] Apart from dietary factors and physical inactivity, various socio demographic factors, previous history of gestational diabetes, birth weight, postnatal feeding practices might play a role in occurrence of obesity.

Many researchers have examined the various causes of obesity in children and adolescents.[7] Very few studies have been done in India especially in Tamilnadu,

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using Case Control study design to evaluate the various factors associated with development of obesity in the adolescent age group. School children are the prime target to assess the determinants for obesity and hence forth to plan preventive measures. So, we intended to do this study among adolescent school children to identify the determinants for emerging problem of obesity. Although many studies have addressed the factors that lead to obesity in adults, research on the risk factors associated with adolescent obesity is very limited.

The prevalence of obesity among adolescents has increased six to seven fold in the past 16 years.[8] With interventions, we can prevent development of obesity in adolescent age and thereby prevent obesity and its associated complications in adulthood.[7] Hence it is worthwhile doing this study on risk factors of obesity in adolescent school children.

MATERIALS & METHODS

This was a case control study conducted among school students aged 10-17 years studying in Chrompet, a residential area of Chennai. The study was conducted between September 2019 and February 2020.

Sample size: Sample size was calculated using StatCalc software. The proportion of exposure among cases and controls in a reference study was 59% and 40% respectively.[9] The sample size for this study was 110 cases and controls, with ratio of cases to controls as 1:1.

Inclusion and Exclusion criteria: Students with BMI >+2 SD of WHO growth reference median were taken as cases. Students with BMI between -2SD and +1SD were selected as controls. Students who had a BMI between +1SD and +2SD (overweight children) and those with a BMI <-2SD (underweight children) were excluded from the study.

Sampling method: From the list of Higher Secondary Schools in the study area, two schools were selected using simple random sampling. After obtaining permission from school authorities, cases were included in the study based on the inclusion criteria.[10] Controls were recruited using group matching. Based on the proportion of cases included in the study in each age group (10-12, 13-15 and 16-17 years), similar proportion of controls were recruited in each group.

Study Tool & Data collection process: The study was approved by the Institutional Ethics Committee, Sree Balaji Medical College and Hospital. Informed Consent was obtained from the parent and written/oral assent from the children depending on the age of the child. Data were collected on socio demographic characteristics, parents' education, occupation and income, parents' weight and height, sibling's weight and height, birth weight of the child and history of maternal gestational diabetes. Investigators collected the data through home visits after getting prior permission from the parents. Data regarding birth weight of child, antenatal and postnatal events were based on information given by the parents as records were not available to verify.

Standard procedures of anthropometry were followed to measure weight, height, waist circumference and hip circumference. Body weight was recorded using SECA electronic scale placed on an even floor, accurate to the nearest 0.1kg. Height was measured to the nearest 0.1 cm with a portable stadiometer. Waist circumference and hip circumference were measured using a flexible tape accurate to the nearest 0.1 cm. Waist circumference was measured at the end of normal expiration, in the midpoint between the highest point of iliac crest and the lower point of costal margin in the mid axillary line. Hip circumference was measured at the largest circumference over the gluteal region.

Statistical analysis:

Data was entered in Microsoft excel and analyzed using SPSS software, version 22. Categorical variables such as socio-demographic characteristics, antenatal and postnatal factors were assessed for their association with adolescent obesity. For quantitative data, *t*-test was done to assess significant differences between the mean values of cases and controls.

RESULTS

The socio-demographic characteristics of the cases and controls are shown in Table 1. Gestational diabetes was reported by the parents in 3.6% of cases and 1.8% of controls. Increased birth weight was noted among 17.3% of cases and 10.9% of controls. About 35.5% of cases and 65.5% of controls were exclusively breast fed during their infancy.

Comparison of Anthropometry among cases and controls

The mean weight among the cases and controls were 64.4 kgs (range: 36.5-84.1kgs) and 46.95 kgs (range: 28.0-65.6 kgs) respectively. The mean height was 152.4 cm (range: 122-171 cm) among cases and 149.84 cm (range: 121.8-169 cm) among controls. The mean BMI for the cases was 27.42 kg/m^2 (range: 24.44-31.29 kg/m^2) and the mean BMI for the controls was 20.56 kg/m^2 (range: 18.48 - 23.17 kg/m^2).

The mean waist circumference was 80.82cm (range:70.5-96.0 cm) for the cases and 70.89 cm (range:60.8-79 cm) for the controls. The mean hip circumference was 98.53 cm (range: 82.0-112.6 cm) for the cases and 87.81 cm (range: 75.3-98.2 cm) for the controls. Waist hip ratio ranged from 0.7 to 0.96 for the cases and 0.68 to 0.93 for the controls.

The differences in the means of weight, BMI, waist circumference and hip circumference of cases and controls were statistically significant (Table 2). Increased waist hip ratio was noted in 31.8% of cases and 8.2% of controls.

Table 1: Socio demographic characteristics of Study participants

Characteristic	Obese (n=110) (%)	Non-obese (n=110) (%)
Age		
10-12	30 (27.3)	30 (27.3)
13-15	58 (52.7)	58 (52.7)
16-17	22 (20.0)	22 (20.0)
Gender		
Male	49 (44.5)	53 (48.2)
Female	61 (55.5)	57 (51.8)
Father's Education		
Professional	25 (22.8)	32 (29.1)
Graduate degree	56 (50.9)	66 (60.0)
Diploma/intermediate	24 (21.8)	12 (10.9)
High school	5 (4.5)	-
Mother's Education		
Professional	-	16 (14.5)
Graduate degree	65 (59.1)	66 (60.0)
Diploma/intermediate	11 (10.0)	22 (20.0)
High school	34 (30.9)	6 (5.5)
Socio-economic class		
Upper	11 (10.0)	18 (16.4)
Upper middle	60 (54.5)	77 (70.0)
Lower middle	33 (30.0)	15 (13.6)
Upper lower	6 (5.5)	-
No. of siblings		
Nil	38 (34.5)	5 (4.5)
Having Sibling	72 (65.5)	105 (95.5)
Type of family		
Nuclear	93 (84.5)	81 (73.6)
Joint	17 (15.5)	29 (26.4)

Table 2: Anthropometric measurements of study participants

Characteristic	Obese (n=110) Mean ± SD	Non-obese (n=110) Mean ± SD	p-value
Weight (kg)	64.4 ± 11.89	46.95 ± 10.78	<0.0001*
Height (cm)	152.4±11.1	149.84±13.42	0.12
BMI (kg/m^2)	27.42 ± 1.68	20.56 ± 1.53	<0.0001*
WC (cm)	80.82 ± 5.81	70.89 ± 5.07	<0.0001*
HC (cm)	98.53 ± 7.58	87.81 ± 6.46	<0.0001*

WC=Waist circumference; HC=Hip circumference
*Statistically significant at 95% CI

Association between Socio-demographic factors and adolescent obesity

The association of socio-demographic factors with development of adolescent obesity was analysed among the cases and controls (Table 3). The risk factors which showed a statistically significant association with adolescent obesity were less educated father and mother, being a single child in the family and adolescents from nuclear type of family.

Other factors associated with adolescent obesity

Other factors and their association with adolescent obesity are presented in Table 4. Increased waist hip ratio had a statistically significant association with obesity among adolescents. Among antenatal and postnatal factors, children who were not exclusive breastfed during infancy were found to have higher odds of developing adolescent obesity. History of gestational maternal diabetes and increased birth weight of the child didn't show significant association with adolescent obesity.

DISCUSSION

This Case-control study was done to assess the risk factors associated with adolescent obesity.

In the present study, adolescent obesity was found to be associated with low education of parents. In the study done by Giugliano et al, lower educational status of mother was identified as a risk factor for adolescent obesity.[11] Similar result was reported by Mozaffari et al in a study on obesity and related risk factors among adolescent school children in Iran.[12] In the Case control study by Bhuiyan et al, mother's education level was assessed for its association with adolescent obesity but it was not statistically significant.[9] This could be due the fact that less educated parents may have limited knowledge on healthy food choices.

In our study, being a single child in the family was found to be associated with adolescent obesity. Similarly, a study done by Min J et al in China reported that being a single child in the family was a significant risk factor associated with adolescent obesity compared to a child with one or more sibling.[13] Haugaard et al also noted similar finding in a study done in Denmark.[14] This could be due to over protective parents not allowing their only child to spend more time outdoors resulting in limited physical activity, increased screen viewing time and excess energy intake.

In the present study, nuclear type of family was found to be associated with adolescent obesity. Likewise, Piryani et al in their study from Nepal reported that adolescents from nuclear family had increased odds of developing obesity but the association was not statistically significant.[15] Ahmad et al in a study among school going adolescents in North India found that children living in nuclear family had increased chances of developing obesity compared to children from joint family.[16] This could be due the fact that employed parents may not have adequate time to pay attention on nutrition and dietary intake of their children due to their busy schedule. In nuclear families, parents can also afford to spend more on fast foods.

We also found that having an obese parent was found to be a risk factor for adolescent obesity. Similar results were reported by Menezes et al in a Brazilian study.[17] The association between parental obesity and adolescent obesity could be due to multiple factors.

Genetic factors are known as one of the risk factors for development of obesity in adolescents. However, genetic susceptibility has to be coupled with behavioural and environmental factors in order to bring a change in body weight.[18] Apart from this, adolescents will follow their parents' dietary habits, physical activity pattern and sedentary behaviour. If adolescents need to be trained in healthy lifestyle practices, the change should start from their parents.

Table 3: Socio-demographic factors associated with obesity in adolescent school children

Factor	Obese (n=110) (%)	Non-obese (n=110) (%)	Odds Ratio (95% CI)	p value
Gender				
Male	49 (44.5)	53 (48.2)	0.86 (0.51-1.47)	0.68
Female	61 (55.5)	57 (51.8)		
Education of Father				
Less than graduate degree	29 (26.4)	12 (10.9)	2.92 (1.41-6.26)	0.005*
Graduate and above	81 (73.6)	98 (89.1)		
Education of Mother				
Less than graduate degree	45 (40.9)	28 (25.4)	2.02 (1.14-3.62)	0.02*
Graduate and above	65 (59.1)	82 (74.6)		
Socio economic class				
Upper middle and below	99 (90)	92 (83.6)	1.76 (0.79-4.04)	0.23
Upper class	11 (10)	18 (16.4)		
Single child				
Yes	38 (34.5)	5 (4.5)	11.08 (4.16-29.51)	<0.0001*
No	72 (65.5)	105 (95.5)		
Type of family				
Nuclear	93 (84.5)	81 (73.6)	1.95 (1.03-3.82)	0.047*
Joint	17 (15.5)	29 (26.4)		

*Statistically significant at 95% CI

Table 4: Other factors and their association with adolescent obesity

Factor	Obese (n=110) (%)	Non-obese (n=110) (%)	Odds Ratio (95% CI)	p value
Obese parent				
Yes	34 (30.9)	16 (14.5)	2.62 (1.3-5.1)	0.003*
No	76 (69.1)	94 (85.5)		
Obese sibling				
Yes	15 (13.6)	11 (10)	1.42 (0.62-3.25)	0.4
No	95 (86.4)	99 (90)		
Waist Hip ratio				
Increased	35 (31.8)	9 (8.2)	5.24 (2.37-11.55)	<0.001*
Normal	75 (68.2)	101 (91.8)		
History of Gestational Diabetes in mother				
Yes	4 (3.6)	2 (1.8)	2.04 (0.37-11.36)	0.41
No	106 (96.4)	108 (98.2)		
Increased birth weight				
Yes	19 (17.3)	12 (10.9)	1.7 (0.78-3.71)	0.17
No	91 (82.7)	98 (89.1)		
Exclusive breast feeding				
No	71 (64.5)	38 (34.5)	3.43 (1.98-6.02)	<0.001*
Yes	39 (35.5)	72 (65.4)		

*Statistically significant at 95% CI

In this study, cases had significantly abnormal waist hip ratio when compared to controls (OR: 5.24, p value <0.001). Taylor et al in a study done in New Zealand among children aged 3-19 years reported that waist circumference and waist hip ratio can serve as a simple and effective measure to identify truncal adiposity in children and adolescents.[19] In a study by Mohammad Beigi et al, increased waist hip ratio was seen more among obese adolescents compared to non-obese adolescents (OR: 1.46, p value <0.05).[20] A high waist hip ratio could serve as an indicator to identify at-risk adolescents who might later on develop impaired glucose tolerance, diabetes, hypertension, and cardio vascular diseases.[21]

In the present study, lack of exclusive breastfeeding during infancy was found to be a risk factor for adolescent obesity. WHO recommends exclusive breast feeding for infant until six months of age, which should be followed by step by step introduction of complementary foods.[22] In a prospective cohort study by Yin J et al, the authors reported that breast feeding was associated with a decrease in fat mass of adolescents by 14% (p value: 0.01). This study was done for a period of 16 years following up 415 pregnant women and their children.[23] A systematic review on breast feeding and childhood obesity by Arenz et al, included nine studies with a cumulative total of 69000 participants and the meta-analysis showed that breastfeeding significantly reduced the risk of obesity in childhood and adolescence.[24] The advantages of exclusive breast feeding for the mother and the baby are well established, but still the babies who are exclusively breastfed for six months is low in India (54.9%) and Tamilnadu (48.3%).[25,26]

LIMITATIONS OF THE STUDY

The main limitation of this Case control study is recall bias, especially on recalling events in antenatal and

postnatal period. Laboratory investigations were not done due to logistic constraints. To establish temporal relationship and causality, longitudinal studies are preferred over case control studies.

CONCLUSION AND RECOMMENDATIONS

This Case control study assessed the determinants of obesity among school children of adolescent age group. The factors which were found to be associated with adolescent obesity were nuclear type of family, single child in the family, less education level, obese parent, increased waist hip ratio, irregular menstrual cycles and absence of exclusive breast feeding in infancy. Though there is a National Adolescent Health Programme in India, adolescent obesity is not identified as a public health problem. The prevalence of obesity among children has increased to a great extent and India will soon face the consequences of the rising burden of adolescent obesity.

The primary objective of Preventive Medicine is to intercept the cause and thereby the natural progression of disease. What is required in the present era for addressing adolescent obesity is "primordial prevention" and "primary prevention". Our efforts should be directed at the population level to encourage the adolescents in adopting healthy lifestyle habits and avoiding harmful lifestyle practices. The main modes of interventions are to be aimed at the individual, family and community level. Health education programmes should target adolescents, parents, school teachers, health care providers, general public and community leaders.

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