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Prevalence of obesity and overweight amongst adolescents in rural and urban areas of Rajasthan India

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Abstract
Background: Overweight and obesity is a global problem affecting millions of adolescents in developed as well as developing world. This is not only associated with predisposition to chronic systemic illnesses like diabetes and hypertension but psychosocial problems like poor body image and detrimental consequences for self-esteem in adolescents. The greater concern is that the risks of obesity during adolescence will persist into adulthood. With economic development in developing world the problem of overweight and obesity seems to be taking a global proportion. The worldwide prevalence of adolescence obesity and overweight is growing at a worrisome pace. India and other countries undergoing economic transition is predisposed for even a higher incidence of adolescents having over-weight and obesity which will predispose them to insulin resistance, metabolic syndrome, type 2 diabetes mellitus and hypertension with their consequences. Acquiring these medical problems in adolescence means there will be greater chances of developing chronic kidney disease, ischemic heart disease and end organ damage. Therefore it is of utmost importance to understand and check the rising menace of obesity and overweight amongst adolescents. In this context, we conducted a study to estimate the prevalence of overweight and obesity in rural and urban adolescent students of Rajasthan India.
Aims and Objectives: (1) To find out the prevalence of obesity and overweight amongst adolescent children in urban and rural area in Rajasthan (2) To find out the factors contributing to overweight/obesity.
Materials and Methods: A cross-sectional study was conducted in two high schools one in urban private and one in rural population in Rajasthan Bikaner, India. A total of 220 adolescents in the age group of 16-19 years were selected using stratified random sampling. Weight and height of each student was measured using standard measures and body mass index (BMI) was calculated. A semi-structured questionnaire was used to evaluate risk factors like family history of obesity, intake of high calorie and junk foods, physical inactivity and use of computers and televisions. Results: 220 adolescents were included in this study. Out of this 32 (12 boys, 20 girls) children were found to be either overweight or obese. Mean age was 17.6 years. Mean weight was found to be 52.3 kg. A statistically significant higher prevalence of overweight and obesity was found among subjects having family history of obesity, intake of high calorie foods, physical inactivity and television or computer viewing for more than 3 hours a day.
Conclusion: This study shows that the prevalence of overweight and obesity is an emerging problem of adolescent in this study area which shows comparable trends with other parts of the country. Passive school transport, high caloric and junk food, excessive use of computers and television were found to be independent predictors for being overweight and obesity.

Keywords: adolescents, overweight and obesity, low self-esteem, body mass index

1. Introduction
Childhood obesity has become a huge problem acquiring proportion of an emerging pandemic [1]. Once considered a problem of developed world childhood obesity since past few years is fast becoming a problem of developing nations including India [2]. The drift towards an urbanized population, industrialization and improved socioeconomic conditions in India has led to an increase in overweight and obese children. Based upon BMI the children is divided into Underweight (BMI<18.5) Normal (BMI= 18.5-24.9) Overweight or pre-obese (BMI 25.0-29.9) and Obese (BMI= 30 or more).
Although rare in the past, obesity is now one of the most widespread medical problems affecting children and adolescents in the country [3]. Obesity has a profound effect on a child's life. It increases the child's risk of numerous health problems, and it also can create emotional and social problems [4]. Obese children are also more likely to be obese as adults, increasing their risk of serious health problems such as heart disease, stroke, type-2 diabetes, and infertility and skin disorders [5]. The prevalence of diabetes, coronary artery diseases and other life style disorders is increasing alarmingly in India, and is affecting much younger populations than in the West. A large pool of young Indians demonstrates 'prediabetics' (*i.e.*, insulin resistance and or glucose intolerance). Gestational diabetes is common in mothers [6]. The association of these problems with high BMIs and importantly central obesity is now well accepted. In transitional economies such as in India obesity and

malnutrition often coexist ('double burden of disease') causing confusion in health messages [7]. Epidemiological studies have shown a progressive increase in the incidence of hypertension, diabetes mellitus, and coronary artery disease, sleep apnea syndrome, and certain cancers in obese [8]. The important causes of obesity in children includes Genetic factors, Dietary habits, Physical inactivity and recently use of gadgets by children [9]. The principles of therapy are generally same as in prevention and include reduced calorie intake, increased activity levels, decreased sedentary behavior, family involvement and Behavioral changes [10].

Early detection of childhood obesity is important as it provides an opportunity to take corrective measures and prevent complications. Since, the data on prevalence of obesity from Rajasthan is limited, we, therefore, planned this study with the objective to assess the prevalence of obesity among adolescents in school children in Rajasthan, India and identify its associated risk factors. A few studies have been conducted in India on overweight and obesity among children mostly in metropolitan cities. The present study was undertaken to study the magnitude of overweight/obesity and its correlates among children in Rajasthan India, so this study was done with this in view.

2. Materials and Methods

The study was carried out among the students of 2 leading high schools in Rajasthan (India). The students belonged to classes 11th -12th and in the age group of 16 to 18 years. A predesigned, pretested Semi structured questionnaire was administered to each pupil information on socio demographic profile, on risk factors of non-communicable diseases. Dietary practices were assessed by putting questions on dietary preference, fast-food intake, fruit consumption; Physical activity was ascertained by asking for daily physical activity (running, fast walking, biking, and dancing) for at least 30 minutes/day during the past 7 days and during a typical week. Any involvement in sports at school or in the community and the time spent at home in sitting activities like watching T.V and video game was also asked. Any single trial of smoking or alcohol was asked for and if yes then the frequency in the last 30 days for smoking and 6 months for alcohol. History of passive and parental smoking was also ascertained. Family history of hypertension and obesity in parents or grandparents was noted. Stress felt in any which way by the students (subjective) was also inquired.

Subsequently anthropometric measurements and blood pressure were taken. A general physical examination of all the children was performed. At the end, health education session was conducted by including all adolescents. Age was confirmed from school records.

The prevalence of childhood obesity was compared between urban and rural areas and expressed in percentage (%). Student - test was used to find out the significance between urban and rural areas with respect to childhood obesity. Overweight and obesity was defined using International Obesity Task Force (IOTF) criteria and children were divided into different categories on the basis of BMI into Starvation (< 15), Underweight (15 – 18.5) Normal (18.5 – 25) Overweight (25 – 30) Obese (30 – 40) Morbidly Obese (>40).

The data was collected and studied with the help of excelsheets and sophisticated statistical softwares.

3. Results

In the present study, a total of the 220 children were included. Out of these 220 children 108 were boys and 112 were girls with a M: F ratio being 1: 1.03.

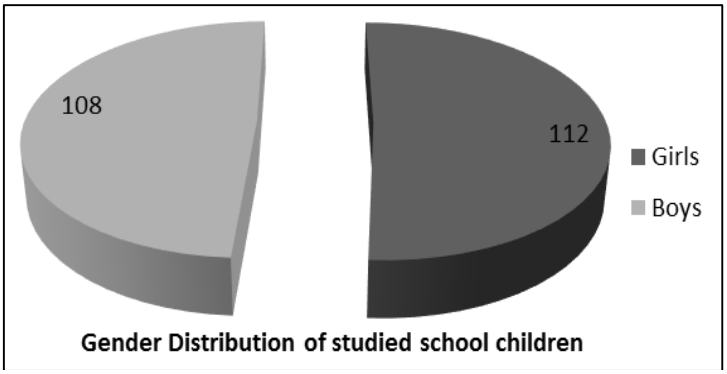

Fig 1: Gender distribution of the studied cases.

The studied adolescents were found to be obese with a prevalence of obesity in 4.54 %, and overweight in 10 %. Total prevalence of obesity and overweight was found to be 14.5 %. Prevalence in girls was 9.09 % while in boys it was found to be 5.45 % (Table 1)

Table 1: Prevalence of obesity in plus two children total and sex

Prevalence	Number (N = 220)	%
Obesity	10	4.54
Overweight	22	10
Obesity + Overweight	32	14.54
Obesity + Overweight - Girls	20	9.09
Obesity + Overweight - Boys	12	5.45%

The mean age of study subject was 17.6 years, out of 220 (108boys, 112 girls) studied children 49.09% were boys and 50.90 % were girls. Out of this 32 (12 boys, 20 girls) were found to be either overweight or obese.

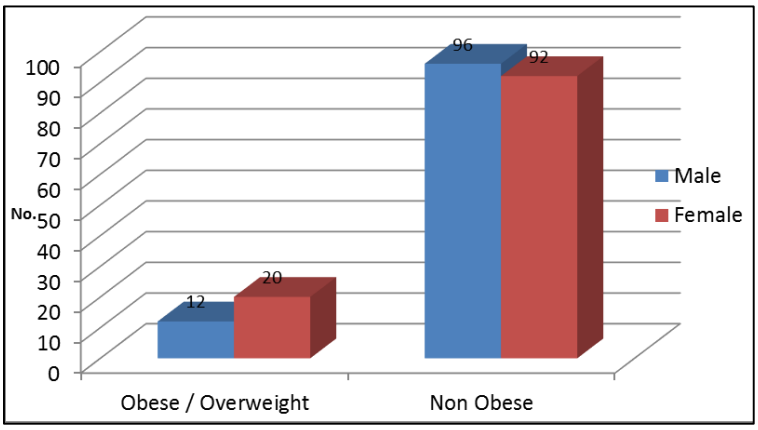

Fig 2: Gender distribution and prevalence of obesity.

The age wise distribution of obesity and overweight is given in tabulated form below (Table 2).

Table 2: Prevalence of overweight and obese children in different age groups

Variables	Number (N = 220)	Obese / Overweight (N = 32)	Non-Obese (N = 188)	P value
Age (Yrs)				
16	70	10	0	0.07
17	60	9	51	0.05
18	50	8	42	0.06
19	32	5	27	0.10
Sex				
Male	108	12	96	0.12
Female	112	20	92	0.20

The distribution of studied children on the basis of BMI revealed that out of 220 children studied 56.36 % children had normal weight. Prevalence of obesity and overweight was found to be 14.54 %. This study significantly show that 30% of studied children were underweight. And prevalence of overweight was found to be more in urban population (10.45 %) than in whereas in rural population (4.09 %).

Table 3: Distribution of the cases on the basis of BMI.

BMI	Number (N = 220)		Rural (100/220)		Urban (120/220)	
	No.	%	No.	%	No.	%
<18.5	66	30	40	18.18	26	11.81
18.5 - 24.9	122	55.36	55	25	67	30.45
>24.9	32	14.54	9	4.09	23	10.45

The distribution of obese or overweight adolescents on the basis of whether they belong to urban/ rural or government/ private schools showed significant difference. The prevalence of obesity /overweight in Government school in rural area was found to be 4.09 % whereas urban population in non-government private school prevalence this prevalence was 10.45 %.

Table 4: Distribution of the studied cases on the basis of Gender and obesity.

Prevalence	Government / Rural		Non-Government / Urban	
	No. (100/220)	%	No. (120/220)	%
Obese / Overweight	9	4.09	23	10.45
Girls	5	2.27	15	6.81
Boys	4	1.36	8	3.63

The study of demographic and socioeconomic characteristic showed that 54.54 % participant lived in urban area while 45.45 % lived in rural area, more children were living in nuclear family (55%) than in joint family (45%).

Table 5: Demographic characteristic of the studied cases.

Prevalence	Number (N = 220)	%
Residence		
Rural	100	45.45
Urban	120	54.45
Type of school		
Government	100	45.45
Non-Government	120	54.54
Religion		
Hindu	188	85.45
Other	32	14.5
Type of Family		
Nuclear	121	55
Joint	99	45

Parental educational status revealed that more than half 119 (54.9%) of the fathers were graduate and above and 61 (27.73%) plus two and high school education whereas 25 (11.36%) primary education 15 (6.82%) of the fathers had no formal education. On the other hand around one third 89 (40.45%) of the mothers graduate and above, 57 (19.09%) high school, and plus two 36 (16.36%), primary School and 38(17.27%) no formal education respectively. Almost half 140 (63.6.2%) of the participants were from upper or upper middle socio economic index category 33.6 % belongs to upper lower and lower Socio-economic by Kuppuswamy scale. The major occupation of the fathers were professional 92 (41.6%) and semiprofessional 84 (38.3%) respectively.

Table 6: Socioeconomicstatus of the the studied cases.

Variables	<18.5		18.5 - 24.9		>24.9	
	No.	%	No.	%	No.	%
Socioeconomic Status (Kuppuswamy scale)						
Upper	6	2.73	50	22.72	20	9.09
Upper middle	12	5.54	35	15.90	10	4.54
Upper lower	26	11.81	30	13.63	10	4.54
Lower	20	9.09	17	7.72	2	0.90
Mother's education						
Graduate & Above	27	12.27	40	18.18	12	5.54
High school plus	20	9.09	27	12.27	10	4.54
Middle & Primary	10	4.54	18	8.18	8	3.63
No formal education	20	9.09	16	7.27	2	0.90
Father's education						
Graduate & Above	19	8.63	40	18.18	60	27.27
High school plus	17	7.72	20	9.09	25	11.36
Middle & Primary	12	5.54	8	3.63	5	2.27
No formal education	8	3.63	5	2.27	2	0.90

Among the risk factors evaluated, family history of obesity was present in one third of obese or overweight children while in non-obese. Children 15.9 % had family history of obesity. only 31 % of obese children claim to do regular exercise, rest all either rarely or occasionally were doing physical exercise whereas in non-obese its 78.19% doing regular exercise Computer use or television watching, Intake of high calorie and Fast/junk food was statidtically significantly associated with occurrence of being overweight and obese. Very large proportion 197 (89.5%) of adolescents never consumed alcohol, while among few took it occasionally.

Table 7: Factors associated with the risk of obesity/ overweight.

Variables		Obese(N = 32)	Non Obese(N = 188)	P value
Substance Abuse Alcohol / Tobacco / Pan Chewing	Occasionally / Rarely	7	16	1.3
	Regularly	3	5	1.7
Physical Exercise	Occasionally / Rarely	21	39	1.5
	Regularly	10	147	0.6
Non vegetarian food	Occasionally / Rarely	9	79	0.4
	Regularly	18	14	0.79
Fast Food	Occasionally / Rarely	20	141	0.1
	Regularly	10	39	0.6
Watching TV (>3 hrs)	Occasionally / Rarely	10	101	0.3
	Regularly	22	78	0.2

The study of prevalence of parental history of Hypertension, Diabetes, Heart Disease and parental obesity with obesity/overweight showed that a positive family history of obesity in either of the parent was a significant risk factor and was existent in 75 % of obese children and 21.27 % of non-obese children. It shows that there is a significant increase in the risk of obesity through genetic mechanisms or by shared family characteristics in the environment such as food preferences.

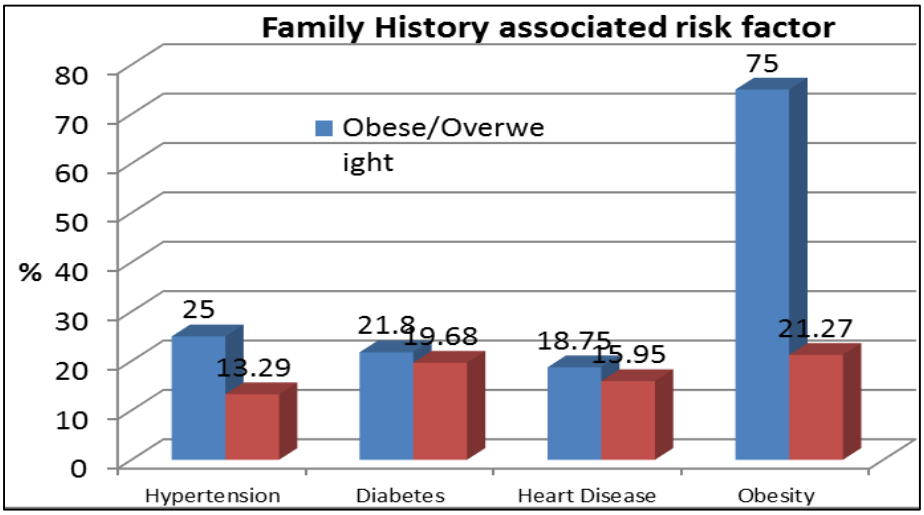

Fig 3: Family history of the risk factors

The analysis of various medical problems associated with being overweight or obese revealed that the most common problem associated with obesity or being overweight was change in appetite. While being overweight/obese was associated with a significantly reduced risk of anemia. On the other hand in non-obese school children anemia appeared to be a major health problem as almost 31.81 % children had anemia in this group. This highlights the co-existingproblem of undernutrition.

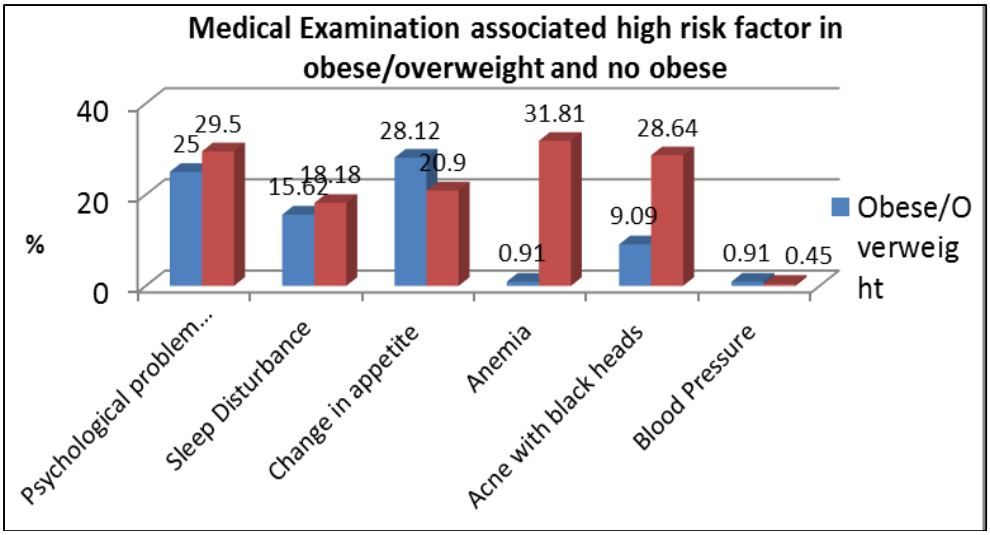

Fig 4: Clinical Findings in the studied cases.

The analysis of reproductive health of girls in this study showed that menstrual irregularities were more common in non-obese individuals than their non-obese peer. The other menstrual irregularities line excessive menstrual flow, dysmenorrhea or burning sensation during micturition were all more commonly seen in non-obese individuals.

Table 8: Reproductive health in the studied girls.

Prevalence	Obese/Overweight		Non Obese	
	No. (50/112)	%	No. (62/112)	%
Menstrual periods				
Normal	45	20.45	50	22.73
Irregular	5	2.72	12	5.45
Menstrual Flow				
Normal	46	20.91	47	21.36
Excess	4	1.82	5	2.72
Dysmenorrhea				
Present	12	5.45	16	2.72
Absent	38	17.27	46	20.91
Burning sensation during urination				
Present	4	1.82	6	2.72
Absent	46	20.91	56	25.45

4. Discussion

In our study, the prevalence of obesity was 4.09%. overweight 10.45 % and total obesity and overweight 14.45 %, This was similar to observations made by Aggarwal *et al* and Khadilkar *et al* who reported the prevalence of 3.4% and 5.7%, respectively [11,12]. Other authors like Sharma *et al* and Kapil *et al* have reported a prevalence of 6% and 7.4% in their respective studies from Delhi [13, 14]. The differences in reported prevalence of obesity among different studies could be due to regional differences, different age range of children studied and non-uniformity in the criteria to define socio-economic status. In our study prevalence in girls was 9.01% and in boys it was 5.56 % similar results were reported in the index study, the prevalence of obesity in girls (9.3%) was more as compared to boys (5.7%) though the difference was found to be statistically non-significant. Also similar result were reported by Kumar *et al* who found a prevalence of 4.42% in boys and 8.82% in girls in affluent schools of Davangere [15]. The study also suggest that undernutrition rates remain high both in urban and rural children. It is predominantly felt in rural school children, in some case the total body fat is much below the prescribed limit. This shows children in rural areas are under-nourished and prone to deficiency disorders [16].

Among the risk factors studied, family history of obesity, intake of high calorie/junk foods, lack of physical activity and number of hours of television viewing per day were found to be significantly associated with obesity [17]. Parental obesity may increase the risk of obesity through genetic mechanisms or by shared family characteristics in the environment such as food preferences. A positive family history of obesity in either of the parent was found to be a significant risk factor and was existent in 75.7% of obese children and 21 % of non-obese children. Our observation was supported by Reilly *et al* who in their respective studies reported a similar association [18]. In index study, intake of high energy and fast foods was present in 92.6%of obese children as compared to 52.2% of non-obese. Similar results were reported by Laxmaiah *et al* who also found increased intake of high energy foods to be a significant risk factor among obese children [19]. Another risk factor found significant in obese children was lack of physical activity. We observed that 77.8% of obese children were physically inactive as compared to 65% of non-obese ones which are similar to the observations made by Bodhare *et al* Physical inactivity not only has an important role in the development of overweight and obesity but also in the development of chronic diseases such as diabetes and hypertension in later life. Television and computer watching is a major reason for physical inactivity among children and in our study 64.2% of obese children watched television or used computers for more than 3 hours a day as compared to 34% among non-obese which are similar to the observations of Bodhare *et al* [20].

5. Conclusion

Low levels of physical activity, consuming high calorie/junk food, increased television watching are significant risk factors in causation of childhood obesity in children and suggests an urgent need to educate urban community on aspects of healthy food habits and desired lifestyle to prevent it. Co-existing problem of undernutrition (anemia in 30% non-obese group) also needs be addresses in a systematic manner.

6. Conflict Of Interest: None

7. References

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