Research Article

Prevalence of childhood obesity and associated risk factors: a cross sectional study in schools of Jaipur

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Abstract

Purpose: To determine the Prevalence of obesity in school children aged 6 to 15 years in co-educational schools of Jaipur and Evaluation of risk factors associated with obesity. **Materials and Methods:** The present study was conducted on 1250 school children of either sex aged 6 to 15 years in four schools of Jaipur. The height and weight of each child was measured and BMI was calculated. Children with BMI more than 95th percentile for that age and sex were considered as obese and from this prevalence of obesity was calculated. Various risk factors causing obesity were also evaluated. **Results:** The prevalence of obesity was found to be 7.6%. Overall prevalence among girls and boys was 9.34% and 5.69% respectively. The prevalence of obesity among those with positive family history, obesogenic diets, high socio-economic status, who did not exercise, was found to be 22.85%, 12.09%, 11.82%, 8.19% respectively. **Conclusion:** The sex, socio-economic status and physical activity have a bearing effect on obesity while family history and dietary habits have no effect. Obesity is an emerging health problem in school-age children belonging to affluent families in Jaipur.

Keywords: obesity, risk factors.

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INTRODUCTION

Obesity is defined as excess of body fat. The abnormal growth of adipose tissue may be due to an enlargement of fat cell size (hypertrophic obesity) or an increase in fat cell number (hyperplastic obesity) or both (Gupte, 2007). The Center for Disease Control and prevention (CDC) defined overweight in children as : at or above 95th percentile of Body Mass Index (BMI) for age and sex and at risk for overweight as between 85th to 95th percentile of BMI for age and sex(CDC, 2009). Age group of 5-7 years which is the start of schooling and these children are also abnormal in their eating habits and hence, few go into overweight and obesity. The World Health Organization (WHO) defines obesity as a 'global epidemic'. It is now estimated that there are more than 100 million obese individuals worldwide. A study conducted by the Nutrition Foundation of India among the urban upper middle class population in New Delhi showed that 32.2% of males and 50% of females were obese (Gopalan C, 1998). The pace of developmental transition in third world countries which has been particularly marked in recent times has led to the 'double burden' of under nutrition and obesity in developing countries. It is therefore imperative that the rising incidence of obesity is controlled before it emerges as the single most important public health problem in India (Sharma *et al*, 2006). BMI centile lines rise from 6 years onwards and continue through adolescence (Frederiks *et al*, 2000). Third vulnerable age group is adolescence, it contributes >20% of total growth in stature and up to 40-50% of body weight as somatic growth (Agarwal *et al*, 2001). So, overweight and obesity are marginally higher in the pubertal age group that is 13 to 15 years of age perhaps because of increased adipose tissue and overall body weight in children during this period (Laxmaiah *et al*, 2007). With this background, this study was undertaken to explore the scenario among the school-age children and its association with the determinants.

MATERIALS AND METHODS

The study was conducted in 1250 students in the age group 6-15 years in the following schools of Jaipur.

1. Saint soldier Public School, Jaipur.

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2. Mahaveer Public School, Jaipur.
3. Kendriya Vidyalaya, Jaipur.
4. Mahaveer Digamber Jain School, Jaipur.

Procedure

1. Prior permission was obtained from the Principals of the above mentioned schools.
2. The purpose and procedure of the study was explained to the students and they were requested to participate in the study. Foreign students and children with pathological obesity (Cushing's syndrome, hypothyroidism, children taking steroids, Prader Willi syndrome, Alstrom syndrome, Bardet-Biedl, Lawrence-Moon-Biedl, Beckwith-Wiedemann, Turner syndrome) were excluded from the study.
3. 25 students were taken from each age group by stratified random sampling i.e. every 5th student was taken till 25 students were completed.
4. Written informed consent of parents was taken and 25 students in each age group whose parents consented to let their child be a study subject were measured for their height and weight. Height was measured with the help of a stadiometer to the nearest one millimeter with the student standing straight with head held in Frankfurt horizontal plane. Weight was measured to the nearest 0.1kg using an electronic weighing machine without shoes.
5. BMI was calculated using the formula:
$$\text{BMI} = \frac{\text{Weight in Kilograms}}{(\text{Height in meters})^2}$$
6. These children were supplied with a Performa inquiring about the education and occupational status of parents, their monthly income, history of obesity in family, their eating habits, their hobbies, type of exercise they do and hours of television viewing etc.
7. Child's BMI was plotted on BMI for age percentile charts given by 2000 CDC. BMI for age between 85th to 95th percentiles was taken as overweight and more than 95th percentile was taken as obese.
8. From this overall prevalence of obesity was calculated.
9. The association of the above mentioned risk factors with obesity was also studied and presented in forms of percentage and bar diagrams.

RESULTS

The present study was conducted on 1250 school children of either sex aged 6 to 15 years in four schools of Jaipur. The height and weight of each child was measured and BMI was calculated. Children with BMI more than 95th percentile for that age and sex were considered as obese and from this prevalence of obesity was calculated. Various risk factors causing obesity were also evaluated. The observations obtained are described in the following tables.

Table 1: Sex wise prevalence of obesity

Sex	Total number of children (%)	Number of obese (%)	χ^2	p value
Male	597 (47.76)	34 (5.69)	5.9	0.015 Significant
Female	653 (52.24)	61 (9.34)		
Total	**1250 (100)**	**95 (7.6)**		

Statistical Analysis

In our study, out of 1250 students, 653 (52.24%) were female and 597 (47.76%) were male. Out of 597 males, 34 (5.69%) were found to be obese while out of 653 females, 61 (9.34%) were found to be obese Prevalence of obesity was higher in females as compared to males. The statistical analysis was found to be significant.

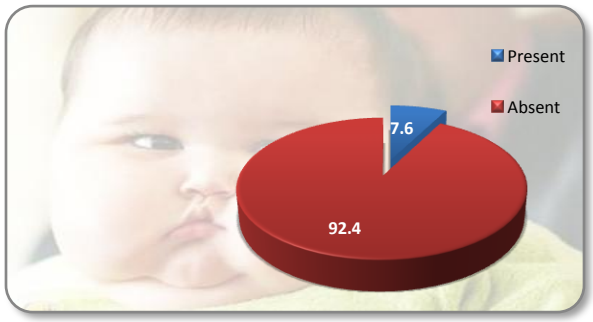

Figure 1: Pie Chart Showing Prevalence of Obesity

Table 2: Age wise prevalence of obesity

Group	Age group (in years)	Total number of children (%)	Number of obese (%)
I	6-9	412 (32.96)	27(6.55)
II	9-12	418 (33.44)	29 (6.93)
III	12-15	420 (33.6)	39 (9.28)
Total		**1250 (100)**	**95 (7.6)**

Statistical analysis

Group	x^2	p value	Significance
I - II	0.05	0.825	NS
II-III	1.55	0.213	NS
I-III	2.1	0.145	NS

Among 412 (32.96%) students, 27 (6.55%) were found to be obese in the age group of 6 to 9 years, while in 9 to 12 years age group 29 students (6.93%) were obese among 418 students (33.44%). In 12 to 15 year age group, 39 students (9.28%) were obese among 420 (33.6%) students. The statistical analysis was not found to be significant.

Table 3: Positive family history

Age group (in years)						
Tota no. of childrens						
No. of children with positive family history						
Gender	M	F	M	F	M	F
	52	51	45	38	51	78
No. of obese in them	7	14	10	9	14	18
(%)	18.46	27.45	22.22	23.68	25	23.07
X2	4.56	1.23	3.65	0.34	6.32	1.36
P value	0.196	0.453	0.1612	0.8437	0.243	0.439
Significance	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Various risk factors associated with obesity were studied among them, family history of obesity was found to be present in 315 (25.2%) students out of whom 72 (22.85%) students were obese. In 6 to 9 years age group, 103(25%) students had positive family history out of whom 21 (20.38%) were obese. In 9 to 12 years age group, 83 (19.85%) students had positive family history out of whom 19 (22.89%) were obese. In 12 to 15 years age group, 129 (30.7%) students had positive family history out of whom 32 (24.8%) were obese. The statistical analysis was not found to be significant.

Table 4: Diet

Age group (in years)	6-9		9-12			12-15
Tota no. of childrens	412		418			420
No. of children with Diet						
Gender	**M**	**F**	**M**	**F**	**M**	**F**
	98	81	133	106	152	116
No. of obese in them	9	14	9	16	13	22
(%)	9.18	17.28	6.67	15.09	8.55	18.96
X2	0.63	0.63	0.57	0.68	0.51	0.59
P value	0.662	0.713	0.723	0.629	0.7749	0.7445
Significance	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Among 1250 students, faulty dietary habits were found to be present in 686 (54.88%) students out of whom 83 (12.09%) were obese. In 6 to 9 years age group, 179 (43.99%) students had obesogenic diets out of whom 23 (12.84%) were obese in 9 to 12 years age group, 239 (57.17%) students had obesogenic diets out of whom 25 (10.46%) were obese. In 12 to 15 years age group, 268 (63.8%) students had obesogenic diets out of whom 35 (13.05%) were obese. The statistical analysis was not found to be significant.

Table 5: Socio economic status

Age group (in years)	6-9		9-12			12-15
Tota no. of childrens	412		418			420
No. of children with highsocio economic status	206		199			229
Gender	**M**	**F**	**M**	**F**	**M**	**F**
	112	94	117	85	117	119

No. of obese in them	9	13	10	14	13	16
(%)	8.03	13.82	8.54	16.47	11.11	13.44
X2	0.84	2.13	0.79	0.94	0.63	1.85
P value	0.613	0.136	0.692	0.523	0.7298	0.3965
Significance	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Out of 1250 students, 634 (50.72%) were from high socio-economic status out of whom 75 (11.82%) were obese. In 6 to 9 years age group, 206 (50%) students were from high socioeconomic status. Out of whom 22 (10.67%) were obese. In 9 to 12 years age group, 199 (97.6%) students were from high socioeconomic status out of whom 24 (12.06%) were obese. In 12 to 15 years age group, 229 (54.52%) students were from high socioeconomic status out of whom 29 (12.66%) were obese. The statistical analysis was not found to be significant.

Table 6: Television viewing

Age group (in years)	6-9		9-12			12-15
Tota no. of childrens	412		418			420
No. of children viewing television for 3 hrs. or more	212		239			372
Gender	**M**	**F**	**M**	**F**	**M**	**F**
	123	89	107	132	153	119
No. of obese in them	8	4	11	7	12	17
(%)	6.5	4.49	10.28	5.3	7.84	14.28
X2	1.49	3.61	1.52	7.29	1.12	8.91
P value	0.4631	0.1632	0.3214	0.039	0.5712	0.0116
Significance	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Out of 1250 students, 823 (65.84%) students viewed television for 3 hours or more out of whom 61 (7.41%) were obese. In 6 to 9 years age group, 212 (51.45%) children viewed television for 3 hours or more out of whom 14 (6.6%) were obese. In 9 to 12 years age group, 239 (57.17%) children viewed television for 3 hours or more out of whom 18 (7.53%) were obese. In 12 to 15 years age group, 372 (88.57%) children viewed television for 3 hours or more out of whom 29 (7.79%) were obese. The statistical analysis was not found to be significant.

Table 7: Exercise wise

Age group (in years)	6-9		9-12		12-15	
Tota no. of childrens	412		418		420	
No. of children who don't exercise	330		231		208	
Gender	**M**	**F**	**M**	**F**	**M**	**F**
	167	163	98	133	110	98
No. of obese in them	4	7	8	14	12	18
(%)	2.39	3.57	8.16	8.33	10.9	12.58
X2	5.79	9.41	3.53	2.52	9.61	22.29
P value	0.197	0.002	0.079	0.112	0.0082	<0.001
Significance	**NS**	**HS**	**NS**	**NS**	**S**	**HS**

Out of 1250 students, 769 (61.52%) did not do any exercise out of whom 63 (8.19%) were obese. In 6 to 9 years age group, 330 (80.09%) students did not do any exercise out of whom 11 (3.33%) were obese. In 9 to 12 years age group, 231 (55.26%) students did not do any exercise out of whom 22 (9.52%) were obese. In 12 to 15 years age group, 208 (49.52%) students did not do any exercise out of whom 30 (14.42%) were obese. The statistical analysis was found to be highly significant.

DISCUSSION

Paediatric obesity is a complex and growing global health problem. Earlier it was considered a problem of affluent countries but today the problem has started appearing even in developing countries. There has been an increase in the percentage of overweight and obese children in affluent urban families of India in the past decade. Evaluation of obesity in children is important as it provides us an opportunity to identify the problem early with its risk factors so as to prevent disease progression into adulthood. As childhood obesity is associated with several risk factors for later coronary artery disease and

other chronic diseases including dyslipidemia, hyperinsulinemia and hypertension, it should be controlled at an early age. In view of this, the present study was carried out. The prevalence of obesity in school children aged 6 to 15 years in co-educational schools of Jaipur and the factors responsible for obesity were evaluated. The prevalence of obesity was found to be 7.6% as shown in the Table 1. The obesity was 5.69% in males while it was 9.34% in females. The obesity was 6.55%, 6.93% and 9.28% in the age group of 6 to 9 years, 9 to 12 year and 12 to 15 years respectively as shown in Table 2. Kapil *et al* (2002)[1] done the study on the prevalence of obesity amongst the affluent adolescent school children in Delhi. The prevalence of obesity was observed in 7.5% of the cases. The prevalence of obesity was 8% in boys while it was 6% in girls. The prevalence of obesity was maximum in the age group of 11 years in boys and in the age group of 10 years in girls. The prevalence of obesity, age wise distribution of obesity and sex wise presence of obesity are consistent with our study. However, different groups have been taken in study in reference. It was 10 to 16 years in reference group while it was 6 to 15 years in our group. Subramanyam *et al* (2003)[2] observed the prevalence of overweight and obesity in affluent adolescent girls in 1981 and 1998. As per the observations, the prevalence of obesity was 6%. The age group was 10 to 15 years. The maximum obesity was observed age of 12 to 14 years. Their observations are coinciding with our observations with the difference that they have taken children of 10 to 15 years that also, females. Sharma *et al* (2005)[3] studied the growth pattern and prevalence of obesity in affluent school children of Delhi. The prevalence of obesity was 6%. The prevalence of obesity was maximum in both the sexes in the same age group i.e. 13.1% in boys and 8.82% in girls in the age group of 6-8 years. However the prevalence of obesity was alike our study in the subsequent age groups in both the sexes. The difference in the values may be attributed to the two yardsticks compared by the author National Center for Health Statistics and Indian National Nutrition Monitoring Bureau. Marwaha *et al* (2006)[4] studied the growth parameters and prevalence of overweight and obesity amongst school children in Delhi and found the prevalence of obesity 5.59% in boys and 5.0% in girls. In the subsequent age groups, the pattern of obesity was identical to our study in both the sexes. Khadilkar *et al* (2007)[5] found the prevalence of obesity 5.7% in their study titled prevalence of obesity in affluent school boys in Pune. The age group chosen was 10 to 15 years and males were the only the inclusion criteria. The findings were consistent with our study both in terms of sex and age. Kumar *et al* (2007)[6] done a work on prevalence of obesity and its influencing factors among affluent school children of Davangere City. The overall prevalence of obesity turned out to be 5.74%. It was more in girls i.e. 8.2% than boys i.e. 4.42%. The age group chosen was 10 to 15 years. It was found that age and sex wise distribution of obesity was similar to that of our study. The prevalence of overweight and obesity amongst school children in Delhi was observed by Kaur *et al* (2008)[7]. The age group was 5 to 18 years. The prevalence of obesity was 9.3% in high income group. It was also high in both the sexes and at all the ages. The findings are coinciding with our observations. It can be concluded that the prevalence of obesity amongst the school going children of the affluent population was high. It was also higher in females. However variability in obesity in different age groups was observed. The factors responsible for causing obesity were also evaluated as follows:

Family History

The family history of obesity was found to be present in 25.2% of cases among whom 22.85% were obese as shown in Table 3. The family history of obesity was found to be present in 24.79% of males out of whom 20.94% were obese. It was found in 25.57% of females among whom 24.55% were obese. Kumar *et al* (2007)[6] studied the prevalence of obesity and its influencing factors among affluent school children of Davangere City and found that family history of obesity was present in 44.8% children among whom 68.37% were obese. However, sex wise distribution of the risk factor was not studied. The results of their study are not consistent with our study, The difference could be due to difference in obesogenic diets which was found to be taken in 71.26% of children in their study as compared to 54.88% of children in our study. It can also be accounted for by genetic variability. Reilly *et al* (2005)[8] studied the early life risk factors for obesity in childhood and observed that prevalence of obesity was 23.6% when only mother was obese, 16.2% when only father was obese and 43.8% when both the parents were obese. The results of the above study are consistent with our study as far as maternal family history is concerned. However, in our study no distinction was made between maternal and paternal obesity.

Dietary Habits

In our study, obesogenic dietary habits were found to be present in 54.88% cases out of whom 12.09% were obese as shown in Table 4. They were found in 64.15% males out of whom 8.09% were obese and 46.4% females out of whom 17.16% were obese. Kumar *et al* (2007)[6] studied the prevalence of obesity and influencing factors among affluent school children of Davangere City and found that faulty dietary habits were present in 71.26% children among whom 43.01% were obese. The results of their

study are not consistent with our study. This could be attributed to difference in the age group of sample size. Kumar *et al* study included children between 10 to 15 years (adolescent period). However, the present study included children from 6 to 15 years. The percentage of children (adolescents) consuming obesogenic diet in their study was higher as compared to our study which contributed to higher prevalence of obesity in these children.

Socioeconomic Status

In our study, 50.72% cases were from high socioeconomic status out of whom 11.82% were obese as shown in Table 5. 56.28% males were from high socioeconomic status out of whom 9.52% were obese. Among females, 56.63% were from high socioeconomic status among whom 14.42% were obese. Marwaha *et al* (2006)[4] studied the growth parameters and prevalence of overweight and obesity in school children from Delhi and found that prevalence of obesity was 5.59% in girls from upper socioeconomic status while it was 0.42% in boys and 0.28% in girls from low socioeconomic status. The results of this study are not consistent with our study. Kaur *et al* (2008)[7] studied the prevalence of overweight and obesity amongst school children in Delhi and found that prevalence of obesity was higher among children from high income group i.e. 6.8% as compared to middle and low income group i.e. 0.6% and 0.1% respectively. The prevalence of obesity was 6.5% among males and 7.1% among females of high income group. The results of their study are not coinciding with our study. The prevalence of obesity in the above mentioned studies both boys and girls is lower as compared to our study. This could be attributed to the difference in the criteria selected for defining high socio-economic status. In our study, the criteria for high socioeconomic status was monthly income more than Rs. 20,000 whereas in the above mentioned studies, criteria for high socioeconomic status was a child studying in a private school in Delhi.

Television Viewing

In our study, television viewing for 3 hours or more was found in 65.84% cases out of whom 7.41% were obese as shown in Table 6. Among males, it was found in 64.15% among whom 6.78% were obese while among females, it was found in 52.06% among whom 10.29% were obese. Laxmaiah *et al* (2007)[9] studied the factors affecting prevalence of overweight among 12 to 17 years old adolescents in Hyderabad and found that the prevalence of obesity was 10.4% among adolescents who watched television for 3 hours or more per day. The results of this study are consistent with our study.

Exercise

In our study, lack of exercise was found in 61.52% cases out of whom 8.19% were obese as shown in Table 7. Among males, physical inactivity was found in 62.81% out of whom 6.4% were obese while among females, it was found in 60.33% out of whom 7.69% were obese.

Kumar *et al* (2007)[6] studied the prevalence of obesity and its influencing factors among affluent school children of Davangere City and found that physical inactivity was present in 42.91% of children out of whom 49.1% were obese. The results of this study are not consistent with our study. It can be due to the reason that criteria for physical inactivity in this study have not been defined whereas criteria for physical inactivity in our study was taken to be physical activity of less than two days per week.

CONCLUSION

The prevalence of obesity was 7.6%. The sex, socio-economic status and physical activity have a bearing effect on obesity while family history and dietary habits have no effect.

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