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Original Article

A study of socio – demographic co-relates of overweight in children in an urban school

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Abstract

Introduction: Generally individuals with Body Mass Index (BMI) exceeding the age-gender-specific 95th percentile are considered overweight and those with BMI between the 85th and 95th percentiles are at risk of overweight.

Material and Methods: The present research was a cross sectional descriptive study undertaken to determine the socio – demographic co-relates of overweight amongst school children in the age group of 5 to 10 years in an urban school. All the 1207 children aged 5 to 10 years enrolled in the school during the study period were studied. The study consisted of anthropometric measurements and an interviewer administered questionnaire.

Results: Out of the total of 1207 children examined, 57.9% were male while 42.1% were female. Based on BMI criteria, overall, 16.5%, 49.6%, 18.4% and 15.5% of the children were <5th, ≥5th – <85th, ≥85th - <95th and ≥95th percentile, respectively. Amongst the socio-demographic factors, mother's working status was not found to have any significant effect on the weight status of the children as was family size, total number of children in the family and diet preference. However, more children who belonged to the better socio-economic strata were found to be overweight.

Discussion: Results from the present study were found to be comparable to those of other studies conducted in similar set-ups.

Conclusion: The study revealed that overall prevalence of overweight was 15.5%, with 18.4% being at risk of overweight. Introduction of healthy lifestyle is essential for prevention of overweight/ obesity in these age groups.

1. Introduction

Although the definition of overweight and obesity varies, depending on the source of the definition, generally individuals whose Body Mass Index (BMI) exceeds the age-gender-specific 95th percentile are considered overweight, while those with BMI between the 85th and 95th percentiles are at risk of overweight [1]. Overweight and obesity are abnormal or excessive fat accumulation that may impair health [2] or simply a state of excess adipose tissue [3,4]. Globally, even in developing countries, relatively affluent and urbanized communities are showing a rapidly increasing prevalence of overweight and obesity among children and young adults [5,6,7]. Although, compared to adult population, research in case of childhood overweight is limited, but it has been established that the rising incidence of overweight and obesity among children parallels that among adults [8,9]. Childhood overweight and obesity has become the most prevalent pediatric nutritional problem in many countries [4,10-14]. Recent surveys found that 36% of 9-year-olds in mainland Italy and Sicily were overweight or obese, while in Greece the prevalence was 26% in boys and 19% in girls aged 6–17 years [10-13]. In India, the overall prevalence of overweight/ obesity in urban children has shown an increase from 16% in 2002 to about 24% in 2006-2007; 16.75 % and 5.59 % in boys and 19.01 % and 5.03 % in girls, respectively, in different studies [12-14]. Also, a phenomenon of "tracking" has been observed, i.e., blood pressure, blood lipid levels, and obesity in childhood "track" into adulthood [1,15-16]. It was against the above backdrop of the importance of overweight among school children that the present research was taken up with the aim to study some of the socio – demographic co-relates with respect to overweight amongst school children in the age group of 5 to 10 years in an urban school.

2. Material and Methods

The present research was a cross sectional descriptive study undertaken to determine the socio – demographic co-relates of overweight amongst school children in the age group of 5 to 10 years in an urban school. Children in the age group of 5 to 10 years in the school were selected for the study. The study population came from an urban setting in general. There was a mixture of various types of family backgrounds, ethnic, religious and occupational sub-groups from the community. The reference (target) population which was kept in mind for generalizing the study results was defined as "the children of urban families studying in a government school in an urban area". A pilot study was done on 25 subjects to pretest and refine the questionnaire, and the data collection technique. The subjects of the pilot study were not included in the main survey. Preliminary data from the pilot study indicated that prevalence of overweight among the children aged 5 to 10 years would be about 15%. All the 1207 children aged 5 to 10 years enrolled in the school during the study period were studied. Since the study was to be undertaken on the children aged 5 to 10 years, all those who were above and below these completed years of age were excluded from the list. Before start of the study, informed consent was taken, the relevant administrative authorities of the school were informed of the scope of the study, with a view to solicit their co-operation. The time and place of examining the subjects were decided in consultation with them to facilitate the smooth conduct of the study. Keeping in conformance with the dictum of no "survey without service", after the data collection was completed, all the students and teachers were given detailed health education as regards the prevention and control of overweight and obesity as well as other lifestyle diseases. The instruments used in the present study were broadly of two type i.e. physical instruments and the questionnaire. The physical instruments

included a portable digital weighing machine and a portable anthropometric rod. All these instruments were initially standardized. In addition, the weighing machine was regularly standardized against the standard equipment throughout the period of data collection. The questionnaire was pre-tested and validated during the pilot study. The questionnaire was used to record the data regarding various socio-demographic variables and values of the anthropometric measurements. The interview was conducted using the 'personal interview technique'.

The study variables included age of the child, educational status of the child, educational status of the parents and anthropometric measurements. The age was recorded to the nearest completed year (6 months and above being rounded off to the next year and less than six months to the previous year). Record of the educational status of the child was restricted to the class in which the child was studying at the time of data collection. Educational status of the parents was recorded as the highest education standard passed. Subsequently it was grouped into classes of no formal education, educated upto 5th standard, educated upto 10th standard, educated upto 12th standard, graduate and post – graduate. The anthropometric measurements recorded during the conduct of the study included weight, height and the Body Mass Index (BMI). The recording of all the anthropometric measurements was done with the full uniform on, less the belt, and shoes and was conducted on the guidelines issued by the World Health Organisation [17]. The body weight was measured to the nearest half kilogram using a portable weighing machine, which was standardized periodically during the study. Height was recorded with the subject standing against a portable anthropometric rod that was positioned against the wall and was recorded to the nearest 0.1 cm. Thereafter, the BMI was calculated as follows:

$$BMI = \text{Weight (in Kgs)} / \text{Height}^2 \text{ (in meters)}$$

Using the above equation, BMI was calculated until the second decimal value.

Data thus collected was compiled and analysed the using appropriate and relevant statistical tests, keeping in view the aims and objectives of the study.

3. Results

Commensurate with the main objective of the study, the results were compiled and general description of the subjects according to certain socio-demographic variables was presented. It was seen that out of the total of 1207 children examined, 57.9% were male while 42.1% were female. The percentage of male children who had completed 5, 6, 7, 8, 9, 10 years of age was found to be 62.9%, 62.4%, 48.8%, 56.8%, 59.8%, and 61.4%, respectively. In case of the female children, this percentage was 37.1%, 37.6%, 51.2%, 43.2%, 40.2% and 38.6% for 5, 6, 7, 8, 9 and 10 completed years of age respectively.

The distribution of BMI percentiles according to total number of children is as shown in table-1.

Table 1: Distribution of BMI Percentiles According to Total Number of Children

Total number of children	BMI Percentiles				Total
	<5th	≥5th – <85th	≥85th - <95th	≥95th	
1	33 (21.9)	68 (45)	25 (16.6)	25 (16.6)	**151 (100)**
2	147 (15.4)	471 (49.2)	184 (19.2)	155 (16.2)	**957 (100)**
3	18 (19.4)	55 (59.1)	13 (14)	7 (7.5)	**93 (100)**
4	1 (20)	4 (80)	0	0	**5 (100)**
5	0	1 (100)	0	0	**1 (100)**
Total	**199 (16.5)**	**599 (49.6)**	**222 (18.4)**	**187(15.5)**	**1207 (100)**

$\chi^2 = 15.7348$; df = 12; p = 0.2037

From the table it is clear that more number of children had BMI ≥95th percentile among age group 7 years, followed by 8 years, 6 years, 10 years, 9 years and 5 years. Also, the statistical analysis showed that BMI percentile categories were homogeneous with respect to age ($p<0.05$).

Table 2: Distribution of BMI Percentiles According to Father's Education

Father's Education	BMI Percentiles				Total
	<5th	≥5th – <85th	≥85th - <95th	≥95th	
10th Std	44 (18.3)	103 (42.9)	47 (19.6)	46 (19.2)	**240 (100)**
12th Std	59 (13.1)	217 (48.3)	93 (20.7)	80 (17.8)	**449 (100)**
Graduate	64 (17.8)	190 (52.9)	60 (16.7)	45 (12.5)	**359 (100)**
PG	32 (20.1)	89 (56)	22 (13.8)	16 (10.1)	**159 (100)**
Total	**199 (16.5)**	**599 (49.6)**	**222 (18.4)**	**187(15.5)**	**1207 (100)**

$\chi^2 = 22.1765$; df = 9 ; p = 0.0083

The distribution of BMI percentiles according to father's education (table-2) shows that a total of 240, 449, 359 and 159 children had their fathers educated up to 10th Std, 12th Std, graduate level and post-graduate level respectively. 56% of the children had BMI between ≥5th – <85th percentile when the father's education was up to post-graduate level, compared to 42.9%, 48.3%, and 52.9%, when the same had been up to 10th Std, 12th Std, and graduation, respectively. It is evident that as the education of the fathers has increased, the BMI of the respective children shifted towards higher percentile. On statistical analysis it was found that BMI percentile categories as shown in the table were homogeneous with respect to father's education ($p<0.05$).

The distribution of BMI percentiles according to mother's education is as shown in table-3.

Table 3: Distribution of BMI Percentiles According to Mother's Education

Mother's Education	BMI Percentiles				Total
	<5th	≥5th –<85th	≥85th - <95th	≥95th	
No formal education	0	3 (100)	0	0	**3 (100)**
5th Std	19 (39.6)	21(43.8)	4 (8.3)	4 (8.3)	**48 (100)**
10th Std	64 (22.1)	142 (49.1)	44 (15.2)	39 (13.5)	**289 (100)**
12th Std	36 (9)	197 (49.3)	85 (21.3)	82 (20.5)	**400 (100)**
Graduate	51 (15.4)	163 (49.1)	68 (20.5)	50 (15.1)	**332 (100)**
PG	29 (21.6)	72 (53.7)	21 (15.7)	12 (9.0)	**134 (100)**
Total	**199 (16.5)**	**598 (49.6)**	**222 (18.4)**	**187 (15.5)**	**1206 (100)**

$\chi^2 = 60.8510$; df = 15; p = 0.0000

Note: One child with mother no more (omitted from analysis).

The percentage of children with BMI between ≥5th – <85th percentiles was found to increase with the increase in the mother's educational qualification, from 43.8%, 49.1%, 49.3%, 49.1% and 53.7% for mother's education up to 5th Std, 10th Std, 12th Std, Graduate level and PG level, respectively. The percentage of children with BMI between ≥85th – <95th percentiles has been found to increase with the increase in their mother's education from 8.3%, 15.2%, 21.3% for mother's education up to 5th Std, 10th Std and 12th Std, respectively, and there after decrease to 20.5% and 15.7% with education up to Graduate level and PG level, respectively. Similarly, the percentage of children with BMI ≥95th percentile has also been found to increase with the increase in their mother's education from 8.3%, 13.5% and 20.5% for mother's education up to 5th Std, 10th Std and 12th Std, respectively, and there after decrease to 15.1% and 9.0% with education up to Graduate level and PG level, respectively. Statistical analysis showed that the BMI percentile categories as shown in the table were homogeneous with respect to mother's education ($p<0.05$).

The distribution of BMI percentiles according to mother's working status is as shown in table-4 below.

Table 4: Distribution of BMI Percentiles According to Mother's Working Status

Mother's Working Status	BMI Percentiles				Total
	<5th	≥5th – <85th	≥85th - <95th	≥95th	
Yes	26 (24.5)	49 (46.2)	20 (18.9)	11 (10.4)	**106 (100)**
No	173 (15.7)	549 (49.9)	202 (18.4)	176 (16)	**1100 (100)**
Total	**199 (16.5)**	**598 (49.6)**	**228 (18.4)**	**187 (15.5)**	**1206 (100)**

$\chi^2 = 6.7875$; df = 3; p = 0.0790; Note: One child with mother no more (omitted from analysis).

24.5% of children of working mothers were found to be having BMI <5th percentile while in case of house wives, this figure was 15.7%. On statistical analysis it was found that BMI percentile categories as shown in the table were not homogeneous with respect to mother's working status ($p>0.05$).

The distribution of BMI percentiles according to family size is as shown in table-5 below.

Table5: Distribution of BMI Percentiles According to Family Size

Family Size	BMI Percentiles				Total
	<5th	≥5th – <85th	≥85th - <95th	≥95th	
2	0	1 (100)	0	0	**1 (100)**
3	27 (21.6)	53 (42.4)	24 (19.2)	21 (16.8)	**125 (100)**
4	139 (15.1)	454 (49.3)	175 (19)	152 (16.5)	**920 (100)**
5	27 (20.1)	76 (56.7)	21 (15.7)	10 (7.5)	**134 (100)**
6	5 (20.8)	13 (54.2)	2 (8.3)	4 (16.7)	**24 (100)**
7	1 (50.0)	1 (50.0)	0	0	**2 (100)**
8	0	1 (100.0)	0	0	**1 (100)**
Total	**199 (16.5)**	**599 (49.6)**	**222 (18.4)**	**187(15.5)**	**1207 (100)**

$\chi^2 = 19.7313$; df = 18; p = 0.3482

It was seen that there were a total of 125, 920, 134, 24, and 2 children who had a family of 3, 4, 5, 6 and 7 members respectively. Minimum family size observed was 2 and the maximum was of 8 members. Statistical analysis showed that BMI percentile categories as shown in the table were not homogeneous with respect to family size ($p>0.05$).

Distribution of BMI percentiles according to total number of children is as shown in table-6.

Table 6: Distribution of BMI Percentiles According to Total Number of Children

Total number of children	BMI Percentiles				Total
	<5th	≥5th – <85th	≥85th - <95th	≥95th	
1	33 (21.9)	68 (45)	25 (16.6)	25 (16.6)	**151 (100)**
2	147 (15.4)	471 (49.2)	184 (19.2)	155 (16.2)	**957 (100)**
3	18 (19.4)	55 (59.1)	13 (14)	7 (7.5)	**93 (100)**
4	1 (20)	4 (80)	0	0	**5 (100)**
5	0	1 (100)	0	0	**1 (100)**
Total	**199 (16.5)**	**599 (49.6)**	**222 (18.4)**	**187(15.5)**	**1207 (100)**

$\chi^2 = 15.7348$; df = 12; p = 0.2037

It was seen that out of the total, 151 children had no sibling, 957 had 1, 93 had 2, 5 had 3 and 1 had 4 siblings. The only child who had 4 siblings was found to have a BMI ≥5th – <85th percentile. Statistical analysis showed that BMI percentile categories as shown in the table were not homogeneous with respect to total number of children ($p>0.05$).

Distribution of BMI percentiles according to diet is as shown in table-7 below.

Table 7: Distribution of BMI Percentiles According to Diet

Diet	BMI Percentiles				Total
	<5th	≥5th –<85th	≥85th - <95th	≥95th	
Veg	62 (19.7)	152 (48.3)	51 (16.2)	50 (15.9)	**315 (100)**
Non-veg	137 (15.4)	447 (50.1)	171 (19.2)	137 (15.4)	**892 (100)**
Total	**199 (16.5)**	**599 (49.6)**	**222 (18.4)**	**187(15.5)**	**1207 (100)**

$\chi^2 = 3.9653$; df = 3; p = 0.2652; Note: None of the children belonged to a family that was ovo – vegetarian.

It was seen that a total of 315 children were vegetarian while 892 were non-vegetarian. Out of those who had a BMI <5th percentile 19.7% were vegetarian and 15.4% were non- vegetarian. Statistical analysis showed that BMI percentile categories as shown in the table were not homogeneous with respect to diet ($p>0.05$).

Distribution of BMI percentiles according to religion is as shown in table-8 below.

Table 8: Distribution of BMI Percentiles According to Religion

Religion	BMI Percentiles				Total
	<5th	≥5th – <85th	≥85th - <95th	≥95th	
Hindu	181 (16)	557 (49.1)	213 (18.8)	183 (16.1)	**1134 (100)**
Muslim	6 (31.6)	9 (47.4)	4 (21.1)	0	**19 (100)**
Sikh	4 (18.2)	15 (68.2)	2 (9.1)	1 (4.5)	**22 (100)**
Christian	5 (18.5)	18 (66.7)	2 (7.4)	2 (7.4)	**27 (100)**
Others	3 (60)	0	1 (20)	1 (20)	**5 (100)**
Total	**199 (16.5)**	**599 (49.6)**	**222 (18.4)**	**187 (15.5)**	**1207 (100)**

χ^2 = 23.4638; df = 12; p = 0.0240

It was seen that 1134 of the total children examined, belonged to Hindu families, 19 were Muslim, 22 were Sikh, 27 were Christian and 5 belonged to other religions (Buddhist and Parsis). Statistical analysis showed that BMI percentile categories as shown in the table were homogeneous with respect to religion (p<0.05).

Distribution of BMI percentiles according to per capita income per month is as shown in table-9.

Table 9: Distribution of BMI Percentiles According to Per Capita Income Per Month

Per capita income per month (Rupees)	BMI Percentiles				Total
	<5th	≥5th – <85th	≥85th - <95th	≥95th	
<1000	9 (30)	15 (50)	5 (16.7)	1 (3.3)	**30 (100)**
1000-1999	79 (13.4)	272 (46.1)	125 (21.2)	114 (19.3)	**590 (100)**
2000-2999	51 (19.5)	145 (55.6)	38 (14.6)	27 (10.3)	**261 (100)**
3000-3999	14 (17.9)	38 (48.7)	12 (15.4)	14 (17.9)	**78 (100)**
≥4000	46 (18.5)	129 (52)	42 (16.9)	31 (12.5)	**248 (100)**
Total	**199 (16.5)**	**599 (49.6)**	**222 (18.4)**	**187(15.5)**	**1207 (100)**

χ^2 = 32.5528; df = 12; p = 0.0011

Out of the total of 1207 children examined, 30 families had a per capita income <1000 rupees per month, whereas, 590, 261 and 78 families had a per capita income between 1000-1999 rupees, 2000-2999 rupees and 3000-3999 rupees per month respectively. 248 families had a per capita income of ≥4000 rupees per month. Statistical analysis showed that BMI percentile categories as shown in the table were homogeneous with respect to per capita income per month (p<0.05).

Distribution of mean BMI, median BMI and Standard Deviation (SD) according to age and sex of the child is as shown in table-10.

Table 10: Distribution of Mean BMI, Median BMI and Standard Deviation According to Age and Sex of the Child

Age (completed years)	Boys				Girls			
	No.	Mean	Median	SD	No.	Mean	Median	SD
5	61	14.6631	14.5748	1.3046	36	16.3994	14.0629	13.1036
6	123	14.6593	14.4925	1.5020	74	14.5959	14.4064	1.5261
7	124	15.2434	14.3113	6.9272	130	14.7624	14.3117	1.7725
8	126	14.6704	14.3286	1.7228	96	14.7377	14.2431	1.1210
9	122	15.8783	15.2356	2.5365	82	15.3361	15.1684	2.3381
10	143	15.7292	15.1367	2.3590	90	15.5852	14.6807	2.7963

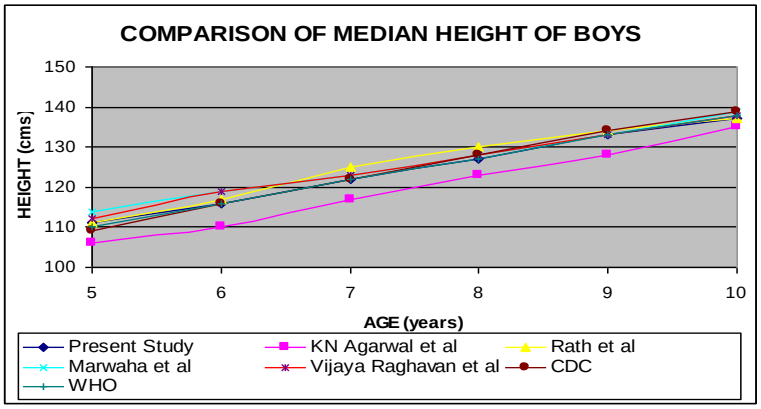
It was seen that the mean BMI of the girls was more than that of the boys at the age of 5 years and 8 years whereas it was otherwise at all the other ages. However, the median BMI of the boys was more than that of the girls at all ages except at the age of 7 years when it was almost equal.

4. Discussion

In the present study, the sex ratio was 727 females per 1000 males. Based on BMI criteria as defined, overall, 16.5%, 49.6%, 18.4% and 15.5% of the children were <5th, ≥5th – <85th, ≥85th - <95th and ≥95th percentile, respectively. Results of the anthropometric data from the present study were found to be comparable to those of other studies conducted in similar set-ups.

The comparison of median height of boys is as shown in fig–1 below.

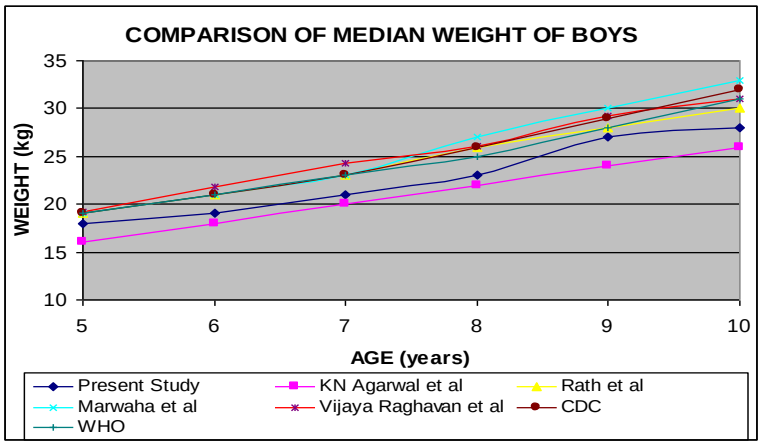
Figure 1: Comparison of Median Height of Boys



On comparing with other studies, it was observed that the median height of the boys in the present study is lower than CDC [18] and WHO [19] standards except at the age of 5 years. It is higher at all ages than that observed by KN Agarwal et al [20], whereas, it is lower than that observed in other studies [21,22], except at age 9. On the whole, it was observed that the median height of the boys in the present study is comparable to the other studies.

The comparison of median weight of boys is as shown in fig–2 below.

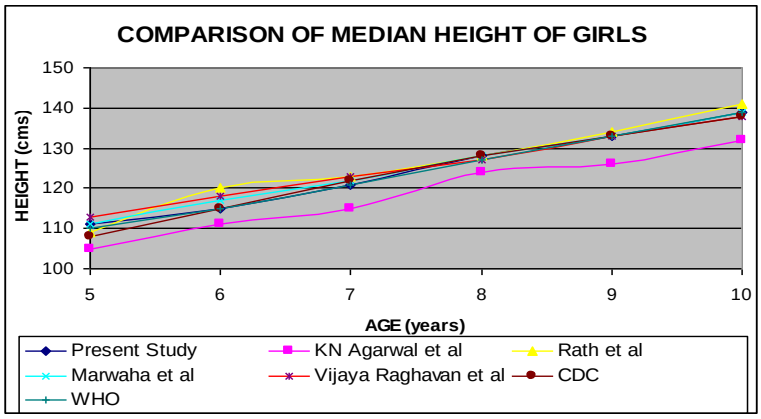
Figure 2: Comparison of Median Weight of Boys



On comparing with other studies, it was observed that the median weight of the boys in the present study is higher at all ages than that observed by KN Agarwal et al [20] whereas it is lower at all ages than the median weight observed in others [18,19,21-23].

The comparison of median height of girls is as shown in fig–3 below.

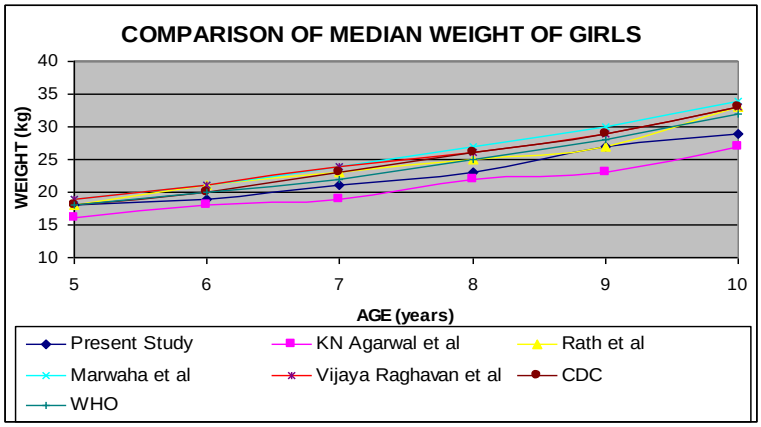
Figure 3: Comparison of Median Height of Girls



On comparing with other studies, it was observed that the median height of the girls in the present study is higher at all ages than that observed by Agarwal et al [20] whereas it is lower at all ages than that observed by Marwaha et al [21]. It is lower than that observed by Raghavan et al [22], at all ages except at the age of 8 and 10 years. On the whole, it was observed that the median height of the girls in the present study is comparable to the other studies.

The comparison of median weight of girls is as shown in fig–4 below.

Figure 4: Comparison of Median Weight of Girls



On comparing with other studies, it was observed that the median weight of the girls in the present study is higher at all ages than that observed by KN Agarwal et al [20] whereas it is lower at all ages than the median weight observed in the other studies.

Amongst the socio-demographic factors, mother's working status was not found to have any significant effect on the weight status of the children. Similarly, the family size and the total number of children in the family were also not found to have any significant effect on the weight status of the children. Diet preference, whether vegetarian or non- vegetarian, was not found to have any bearing on the overweight status of the children. However, more children who belonged to the better socio-economic strata were found to be overweight. These findings were similar to those found in other studies like one in which a significant association was found between the age, religion, a higher socio-economic status and the abdominal obesity. No significant association was noted between the educational status, occupation, type of family and the abdominal obesity [24,25]. Yet another study, conducted in North India to evaluate the body mass index (BMI) and factors related to BMI in 12-15 years old adolescents attending school showed that the prevalence of underweight, normal weight, overweight, and obesity were 13.6, 58.4, 22.7, and 5.3%, respectively. The prevalence of both overweight and obesity was higher among males than that among females. Those with a high SES, vegetarians, and those aged 15 years were highly likely to be obese and the important factors related with BMI were age, gender, socioeconomic score, mean daily diet score, and the type of school [26]. Another study conducted with a view to identify the occurrence of obesity and its related factors among adolescents of selected urban and rural schools showed a significant difference in the occurrence of obesity among urban and rural children respectively i.e., 31 (5.2%) and 13 (2.2%). A significant association was found between obesity and variables like type of family, family history of obesity and family income[27].

5. Conclusion

The study revealed that the overall prevalence of overweight was 15.5%, with 18.4% being at risk of overweight. Among the boys, the proportion of overweight and at risk of overweight was 15.6% and 15.7% respectively, while among the girls the same proportion was 15.4% and 22% respectively. Obesity is the most common metabolic disorder known and is increasing as modern civilization is developing. It is a major health problem not only in the economically developed but also in the developing countries. The WHO has declared a global epidemic of obesity. India too is affected by this epidemic of obesity. Not only are the adults affected, but even the children are, especially because of the interplay of many socio-demographic factors. Therefore, introduction of healthy lifestyle is essential for the prevention of overweight/ obesity in these age groups.

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