

## Original Research Article

**Study of risk factors of obesity and overweight among high school children****Karmakonda Anil Kumar<sup>1</sup>, M. Pavani Varma<sup>2</sup>, Karna Jahnvi<sup>3</sup>, M. Anil Kumar<sup>4</sup>**<sup>1</sup>*Associate Professor, Department of Community Medicine, Dr. V.R.K. Women's Medical College, Rangareddy, Telangana, India*<sup>2</sup>*Associate Professor, Department of Community Medicine, Apollo Institute of Medical Sciences and Research, Hyderabad, Telangana, India*<sup>3</sup>*Associate Professor, Department of Community Medicine, Santhiram Medical College and General Hospital, Nandyal, Andhra Pradesh, India*<sup>4</sup>*Associate Professor, Department of Community Medicine, Chalmeda Anand Rao Institute of Medical Sciences, Bommakal, Karimnagar, Telangana, India*

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**Abstract**

**Background:** Overweight and obesity now rank as the fifth leading risk for mortality worldwide. Although the health consequences of obesity are mostly manifested during adulthood, the factors underlying the disease condition commonly originate during childhood. Overweight and obese children are more likely to grow to become overweight and obese adults with higher chances of developing non-communicable diseases like diabetes and CVDs. **Aim of the study:** To study risk factors of obesity and overweight among high school children. **Materials and methods:** Cross-sectional descriptive study was done for duration of 06 months i.e., from August 2019 to January 2020 in the urban field practice area of Dr.V.R.K. Women's Medical College, Rangareddy, Telangana, India. **Results:** In the present study 48% were males (120/250) and females occupied 52% (130/250). Male : female ratio was 2:1. Mean Age  $\pm$  S.D. of males was  $8.82 \pm 0.51$  and Mean Age  $\pm$  S.D. of females was  $8.97 \pm 0.54$ . 84% were over-weight and 16% were obese. **Conclusion:** The prevalence of obesity in comparison to overweight, varied significantly among gender (male=4.8% female=11.2%), education and occupation of mother, type of family and frequency of junk food consumption, number of siblings, dietary habits, cold drink consumption and number of hours of watching TV were significantly associated with obesity ( $P < 0.05$ ).

**Keywords:** obesity and overweight.

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**Introduction**

Overweight and obesity now rank as the fifth leading risk for mortality worldwide [1]. Although the health consequences of obesity are mostly manifested during adult life, the factors underlying the disease condition commonly originate during childhood [2]. Overweight and obese children are more likely to grow to become overweight and obese adults with higher chances of developing non-communicable diseases like diabetes and CVDs.

Overweight and obese are the terms used to describe body weight in excess of what is considered healthy for a particular height [3].

According to the World Health Organization (WHO), for children aged 5-19 years, overweight is defined as a Body Mass Index (BMI)-for-age greater than one standard deviation, and obese as a BMI-for-age greater than two standard deviations above the WHO growth reference median [3].

Many risk factors contribute to overweight and obesity, they include

genetic, biological, social and environmental factors, which affect weight gain through the mediators of energy intake and energy expenditure[4]

**Aim of the study**

To study risk factors of obesity and overweight among high school children.

**Materials and Methods**

Study was done after getting institutional ethical permission. Written informed consent was taken from all the parents of the children included in the study. Written informed consent as also taken from the school Principal.

**Type of study**

Cross-sectional descriptive study .

**Place of Study**

Urban field practice area(Langerhouse, Hyderabad) of Dr.V.R.K. Women's Medical College, Rangareddy, Telangana, India.

**Duration of study**

06 months i.e., from August 2019 to January 2020.

**Study population**

The study population was school children aged 5 to 10 years The respondents were parents of the child (either mother or father). The study was conducted in Government and Private schools located in urban field practice area (Langerhouse, Hyderabad ) of DR.V.R.K. Women's Medical College.

**Sample Size**

250

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Sample size has been estimated to be based on the formula with reference (5)

$$n = \frac{Z^2 P (1-P)}{d^2}$$

Where n is the sample size, Z is the level of confidence of 95% (1.96), P is expected prevalence 0.05 (as per similar previous studies), and d is precision 0.04. Level of confidence aimed for is 95%.

#### Inclusion criteria

Parents of school children willing to participate in the study.

Child Age 5 to 10 years.

Child staying at home with their parents.

#### Exclusion criteria

Parents of school children not willing to participate in the study.

Child Age less than 5 years or more than 10 years.

Children with amputated body parts.

Child with any acute or chronic health condition were excluded from the study as these conditions could affect their body weight.

Those staying in a hostel away from their parents were also excluded as the questionnaire had to be filled out by a parent.

#### Methodology

After getting permission from the institutional ethical committee and school authority, self-administered questionnaires were distributed to a total of 250 children, with instructions about the questionnaire by the principal investigator and respective class teacher. A separate request letter to the parents, prepared by the school, along with an informed consent paper, was attached to the questionnaire and distributed among the parents through the eligible children. Then, questionnaires filled by parents were collected at the school after two days, and the weight and height measurements of each child were taken using a digital weighing machine and standard measuring tape respectively. Study variables: the following characteristics were measured:

Demographic characteristics including age, sex, birth weight (categorized as low birth weight: < 2.5 kg; normal weight: 2.5–4.0 kg; and large weight for gestational age: > 4.0 kg), family type (nuclear, joint).

Socioeconomic status was included such as education level of both father and mother (below high school: < 10th grade; high school: 10–12 grade; and university level: higher education), occupation of both father and mother (unskilled worker, skilled worker, clerical/shop-owner/farmer and profession) and monthly income of the family in NRs (< 10,000, 10,000–25,000, 25, 001–50,000 and > 50,000). All variables were self-reported by a parent of the child.

Occupation status of both father and mother.

Physical activity: assessed using the Physical Activity Questionnaire for Children (PAQ-C) [6].

Diet history : It contains questions on a list of foods and drinks organized by food categories and the respondents (parents) were asked to report how frequently their children usually consumed each of the foods listed. Respondents reported the consumption of fatty meat products, red meat, fried potato products, salty snack foods, confectionery, ice cream and beverages including sugar-sweetened drinks. Item specific sub-scores were calculated which were specified as 0 for never or rarely, 1 for 1–2 times per week, 2 for 3–4 times per week and 3 for more than 5 times per week according to SPANS junk index questionnaire.

#### Anthropometric measurements

Weight (kg) and height (cm) were measured, and body mass index (BMI) was calculated as weight in kilograms divided by height in metres squared (kg/m<sup>2</sup>) for each adolescent. Corpulence was classified from the WHO reference curves (2007) for children aged 5–19 years. The anthropometric calculation (Body Mass Index-for-age-sex) was conducted using WHO Anthro plus software V.1.0.4 [7]. “Overweight” was defined as having a BMI-for-age between the 85th and 95th percentiles, and “Obesity” was defined as having the BMI-for-age at or above the 95th percentile [8].

Weight was measured without shoes and with minimal clothing using an Omron Model HBF-400 Scale and recorded to the nearest 0.1 pounds.

Height was measured without shoes using a standard tape measure with participants standing against the wall and recorded to the nearest 0.1 cm.

#### Statistical analysis

Statistical analysis was performed using SPSS version 21. Data was collected in Excel sheet.

Tables and graphs were prepared. The prevalence of childhood overweight/obesity was calculated. Chi square test and logistic regression were carried out to find the association of variables. Bivariate and multivariate binary logistic regression analyses were conducted to determine the association between dependent and independent variables.

The dependent variable of the study was overweight/obesity which was based on the Body Mass Index (BMI) for the age-sex of the children.

Independent variables were socio-demographic factors of children, socio-economic characteristics of respondents, dietary behaviours, physical activity, and sedentary behaviours of the children.

#### Results and Observation

Total of 250 school children from 2 Government and 2 private schools were analysed. Out of 250 respondent parents, 55% were fathers and 45% were mothers

Table 1: Age and Gender demographic data

S.No	Age (years)	Male	Female	No of patients
1	8 -8.5	40 (16%)	30 (12%)	70 (28%)
2	8.6 -9.0	50 (20%)	50 (20%)	100 (40%)
3	9.1-10	30 (12%)	50 (20%)	80 (32%)
Mean Age ± SD	8.9 ± 0.53	8.82 ± 0.51	8.97 ± 0.54	
	Total	120 (48%)	130 (52%)	250 (100%)

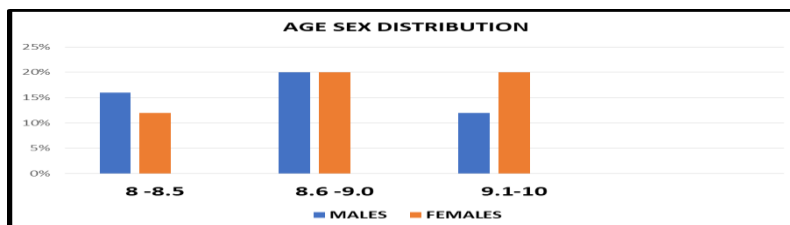


Fig 1: Bar diagram showing age sex distribution

In the present study age distribution ranged from 8-10 years. Majority of the children were between age 8.6-9.0 ( 100/250) constituting 40 %, next common age group was among 9.1-10 years (80/250) occupying 32%, least noted among 8-8.5 years (70/250) i.e., 28% . The Mean Age  $\pm$  SD was  $8.9 \pm 0.53$ . Females occupied 52% ( 130/250) and 48% were males (120/250) .Male : Female ratio was 1:2. Mean Age  $\pm$  SD of males is  $8.82 \pm 0.51$  and Mean Age  $\pm$  SD of females is  $8.97 \pm 0.54$ . Majority of the fathers were farmers 48% ( 120/250), 28% ( 70/250) were laborers and 12% each ( 30/250 ) were teachers and unemployed . Majority of the mothers were farmers (40% ( 100/250), 16% ( 40/250) were laborers, 8% ( 20/250 ) were teachers and 36% ( 90/250) were house wives . Majority of the mothers were illiterate constituting 60% ( 150/250), 28% (70/250) studied upto 10<sup>th</sup> and 12% ( 30/250) studied upto graduation. 52% (130/250) were living in a nuclear family and 48% ( 120/250) in a joint family. 56% (140/250) had siblings up to 2 and

44% (110/250) had siblings more than 2. 56% (140/250) were non vegetarians and 44% (110/250) were vegetarians. 60% (150/250) were having history of junk food , 8% (20/250) showed no habit of eating junk and 32%(80/250) had habit of eating junk food regularly. 52% (130/250) watch TV >2 hrs /day and 48%(120/250) had <2 hrs /day. 80% ( 200/250) had fruit consumption < 4times a week and 20% ( 50/250) had > 4times a week. 64% (160/250) had cool drinks consumption > 250ml/week and 36% ( 90/250) consumption < 250ml/week. In our study 84% were over-weight and 16% were obese. Risk factors associated with overweight and obesity. Having at least one overweight parent and spending >4 hours each day on sedentary activities such as watching television and/or computer games were risk factors for overweight or obesity. Physical activity at home for  $\geq 30$  minutes each day was noted in only 40% (100/250) in the form of dancing, playing .Lack of physical activity 60% ( 150 /250) .

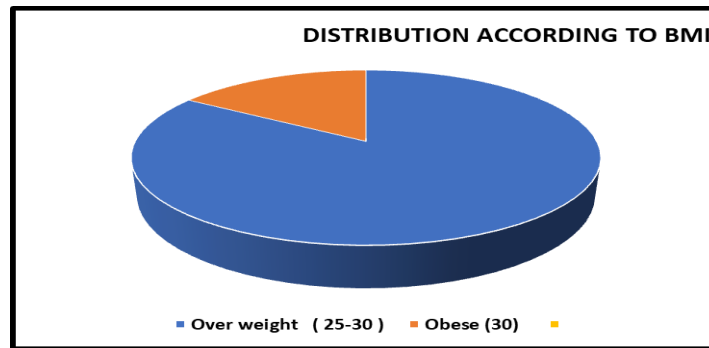


Fig 2: Pie diagram showing distribution according to BMI

Table 2: Anthropometric measurements and BMI categories by gender

Outcome measures	Males		Females		Total		P value
	Mean	$\pm$ SD	Mean	$\pm$ SD	Mean	$\pm$ SD	
Age	8.82	0.51	8.97	0.54	8.9	0.53	0.0206 *
Weight	126.38	5.14	127.5	5.89	126.96	5.55	0.1099 ns
Height	48.81	6.82	46.12	7.99	45.01	7.53	0.0152 *
BMI	27.27	2.62	28.18	3.22	27.75	2.98	0.0157*
<b>BMI category</b>	<b>N</b>	<b>%</b>	<b>N</b>	<b>%</b>	<b>N</b>	<b>%</b>	<b>P value</b>
Overweight	108	43.2	102	40.8	210	84	0.0154 *
Obese	12	4.8	28	11.2	40	16	

Student t Test & Chi Square Tests (Fisher's exact test). \* significant; ns (not significant)

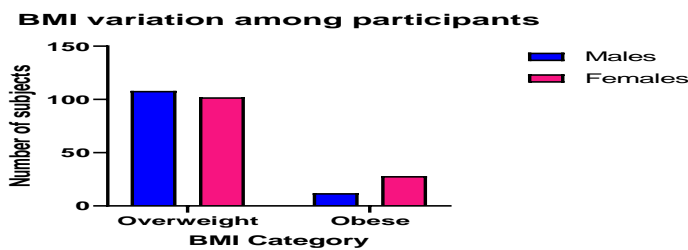


Table 3: Bivariate analysis of independent variables with elevated BMI

Outcome measures	Overweight		Obese		P value
	N	%	N	%	
<b>Gender</b>					0.0129 *
Male	108	43.2	12	4.8	
Female	102	40.8	28	11.2	
<b>Type of family</b>					0.0105 *
Joint	87	34.8	8	3.2	
Nuclear	123	49.2	32	12.8	
<b>Mothers Education</b>					0.0138 *

Degree	20	8	10	4	
Upto10th	58	23.2	12	4.8	
Illiterate	132	52.8	18	7.2	
<b>Fathers Occupation</b>					
Farmer	99	39.6	20	8	0.8905 ns
Labourer	61	24.4	10	4	
Teacher	20	8	10	4	
Unemployed	30	12	00	0	
<b>Mothers Occupation</b>					
Farmer	92	36.8	8	3.2	<0.0001****
Labourer	30	12	10	4	
Teacher	10	4	10	4	
Housewife	78	31.2	12	4.8	
<b>Number of Siblings</b>					
≤ 3	181	72.4	25	10	0.0003***
>3	29	11.6	15	6	
<b>Dietary Habits</b>					
Vegetarian	77	30.8	32	12.8	<0.0001****
Non vegetarian	133	53.2	08	3.2	
<b>Fruit consumption</b>					
< 4 times/week	170	68	30	12	0.3884 ns
>4 times/week	40	16	10	4	
<b>Cool Drinks consumption</b>					
<250 ml/week	30	12	00	00	0.0108*
>250 ml/week	180	72	40	16	
<b>Junk Food Frequency</b>					
None	20	8	00	00	0.0042**
Occasionally	117	46.8	33	13.2	
Regularly	73	29.2	07	2.8	
<b>Watching TV</b>					
<2 Hrs/day	87	34.8	33	13.2	<0.0001****
>2 Hrs/day	123	49.2	07	2.8	

Values are presented as number and percentage (%). Chi-square ( $\chi^2$ ) test was used for bivariate statistical analyses. \*Statistically significant ( $p < 0.05$ ).

Table 4. shows bivariate analyses of independent variables with elevated BMI. The prevalence of obesity in comparison to overweight, varied significantly among gender (male=4.8% female=11.2%), education and occupation of mother, type of family

and frequency of junk food consumption, number of siblings, dietary habits, cold drink consumption and number of hours of watching TV were significantly associated with Obesity ( $P < 0.05$ ). However, Fathers occupation and fruit consumption were not significantly associated with elevated BMI in obesity, thus were not included in the multivariate analysis.

**Table 4: Multivariate logistic regression analysis assessing the relationship between different independent variables and elevated BMI**

Variables (N=250)	Adjusted OR (95% CI)	P value
<b>Gender</b>		
Male	1	0.014*
Female	1.114 (1.019 - 1.218)	
<b>Type of family</b>		
Joint	0.849 (0.773 – 0.931)	0.001*
Nuclear	1	
<b>Mothers Education</b>		
Degree	1.064 ( 0.947 – 1.196)	0.298 ns
Upto10th	0.930 (0.836 – 1.035)	0.182 ns
Illiterate	1	
<b>Mothers Occupation</b>		
Farmer	1.007 (0.908-1.116)	0.900 ns
Labourer	1.042 (0.917-1.184)	0.529 ns
Teacher	1.219 (1.064-1.397)	0.004*
Housewife	1	
<b>Number of Siblings</b>		
1	1	
2	1.018 (0.852-1.216)	0.844*
3	1.305 (1.148-1.484)	<0.001*
4	1.263 (1.071-1.490)	0.006*
5	1.351 (1.113-1.641)	0.002*
6	1.418 (1.174-1.713)	<0.001*

<b>Dietary Habits</b> Vegetarian Non vegetarian	1 0.860 (0.786-0.941)	0.001*
<b>Cool Drinks consumption</b> <250 ml/week >250 ml/week	1 2.589 (1.286-5.214)	0.008*
<b>Junk Food Frequency</b> None Occasionally Regularly	1 2.518 (1.114-5.976) 2.388 (1.030-5.538)	0.027* 0.043*
<b>Watching TV</b> <2 Hrs/day >2 Hrs/day	1 0.854 (0.779-0.937)	0.001*

Multiple Logistic Regression was used for multivariate statistical analyses. OR: Odds Ratio, CI: Confidence Interval, 1 = Reference Category. \*Statistically significant ( $p < 0.05$ ) ns = not significant.

Multivariate analysis: Table 5 shows the multivariate logistic regression analysis results examining the associations of elevated BMI in obesity adjusted for variables such as types of family, gender, education of father, education of mother, occupation of father, occupation of mother and frequency of consumption of junk foods, number of siblings, watching TV, cool drinks consumption, dietary habits. Adjusted odds ratio (AOR) and corresponding 95% confidence intervals (CI) are presented.

Mothers with Teachers occupations increased the risk of elevated BMI relative to farmers, labourers and housewife mothers (for Teachers, AOR 1.219 CI: 1.064-1.397,  $p = 0.04$ ). Female gender is at increased risk of developing obesity than males (for Females, AOR: 1.114 CI: 1.019 - 1.218  $p = 0.014$ ). When compared to nuclear family the risk of obesity is more in joint family (for Joint family, AOR: 0.849, CI: 0.773 - 0.931,  $P = 0.001$ ). More number of siblings students were at risk relative to 1 sibling for obesity (for siblings from 2 to 6  $P$  value is significant for all number of siblings from 2 to 6). Non vegetarians are at increased risk relative to vegetarians (for Non Vegetarians AOR: 0.860 CI: 0.786-0.941,  $p = 0.01$ ). Those who consumed cold drinks of >250 ml/week were at greater risk of obesity than who had <250ml/week (for >250ml/week AOR: 2.589 CI: 1.286-5.214,  $p = 0.008$ ). Relative to those who did not had junk food all others who had it either occasionally or regularly were at increased risk of elevated BMI or obesity (for Occasionally AOR: 2.518 CI: 1.114-5.976  $p = 0.027$ , for Regularly AOR: 2.388 CI: 1.030-5.538,  $p = 0.043$ ). Those who watched TV >2hrs/day were at increased risk compared to those with lesser hours of TV (for >2hr/day of TV AOR: 0.854 CI: 0.779-0.937,  $P = 0.001$ ). Education of mother, farmer and laborer occupation of mother did not show significant relationships in the logistic regression analysis.

### Discussion

In the present study 250 children were studying in two Government and 2 private schools and Out of 250 respondent parents, 55% were fathers and 45% were mothers. In Ashmita et al[9] study Out of 575 respondent parents, 55% were fathers and 45% were mothers. In Sujan et al [5] study out of 1185 participants, 36.4% were from unaided/private schools, followed by 35.7% from aided schools, and 27.9% from government schools.

In our study the mean age of the children was  $8.9 \pm 0.53$ . In Ashmita et al[9] study the mean age and SD of the children was  $9.0 \pm 1.0$  years. In Mejbah Uddin Bhuiyan et al[10] study the mean age of study respondents was 13.1 years (SD: 1.2).

In the present study 48% were males and females occupied 52%. Male : female ratio was 2:1, In Ashmita et al[9] study 57% were males and 43% were females. In Sujan et al [5] study There was an almost equal distribution among males and females, 49.8% and 50.2%, respectively. In Zelalem Alamrew AZ et al[11] study 254

(58.9%) were females. In Mejbah Uddin Bhuiyan et al[10] study 107 (54%) were males and 91 (46%) females.

In the present study majority of the fathers of the children were farmers (48%), 28% were laborer, 12% each were teachers and unemployed. Majority of the mothers were farmers (40%), 16% were laborer, 8% were teachers and 36% were housewives. In Ashmita et al[9] study more than half of the respondent-fathers were professionals. About 52% of the fathers had attained university-level education. Among the respondent mothers, 57% were either unskilled workers or housewives while 28.5% were professionals. In Sujan et al[5] study most of the parents had attained primary and secondary education (fathers -64.8%; mothers- 67.3%). Regarding the occupation of parents, 40.8% of the fathers had unskilled work and more than two-thirds (67.2%) of the mothers were housewives.

In the study majority of the mothers were illiterate constituting 60%, 12% upto degree, 28% studied upto 10<sup>th</sup>. Education of mother, farmer and laborer occupation of mother did not show significant relationships in the logistic regression analysis. In Sujan et al[5] study most of the parents had attained primary and secondary education (fathers-64.8% and mothers- 67.3%).

In the study 52% watch TV >2 hrs /day and 48% had <2 hrs /day. Those who watched TV >2hrs/day were at increased risk compared to those with lesser hours of TV (for >2hr/day of TV AOR: 0.854 CI: 0.779-0.937,  $P = 0.001$ ). In a study conducted by Mohamed El Kabbou et al[12] time spent using a computer was, however, statistically significantly related to the prevalence of overweight and obesity, the prevalence being higher in adolescents who spent more than 4 h/day using a computer than in those who spent < 1 h/day (or a few times a week) ( $P = 0.003$ ). In a study done by Ashmita et al[9] more than half of the children were engaged in small screen recreation (SSR) that includes watching television/DVDs, playing computer games and using cell phones, iPads, etc. for less than an hour a day during weekdays. Almost 33% watched TV for more than 3 hours on the weekend. In Suneel priyani et al[13] study students who spent more than 2 hrs per day watching television were 8.86 times more likely to be overweight than students who spent less than 2 h per day watching television (AOR 8.86, 95% CI 3.90 to 20.11).

In the study non vegetarians are at increased risk relative to vegetarians (AOR: 0.860 CI: 0.786-0.941,  $p = 0.01$ ). 60% were having history of junk food, 8% showed no habit of eating junk and 32% had habit of eating junk food regularly. In Sujan et al [5] study Most participants (91.5%) were non-vegetarian/mixed in their dietary habits. More than three-fourths (77.4%) of the participants consumed junk food occasionally and 15.6% consumed junk food.

In the study 80% had fruit consumption < 4times a week and 20% had > 4times a week. 64% had cool drinks consumption > 250ml/week and 36% consumption < 250ml/week. Those who consumed cold drinks of >250 ml/week were at greater risk of obesity than who had <250ml/week (for >250ml/week AOR: 2.589 CI: 1.286-5.214,  $p = 0.008$ ). In a study done by Zelalem Alamrew AZ et al (11) (27.4%) Out of the respondents who were reported to eat

fruits, 166 (44.3%) reported to eat fruits one time per day, 144 (38.4%) reported to eat fruits two times per day, and the remaining 119 (27.8%) reported to eat fruits more than three times per day. In Mohamed El Kabbaoui et al [12] study a statistically significant relation was seen between the prevalence of overweight and the frequency of consumption of soda and soft drinks ( $P = 0.03$ ). In Suneel priyani et al [13]. Students who consumed fruit four times or less a week were 3.13 times more likely to be overweight than students who consumed fruit more than four times a week (AOR 3.13, 95% CI 1.39 to 7.01).

In the present study Physical activity at home for  $\geq 30$  minutes each day was noted in only 40% cases. Lack of physical activity in 60%. In Ashmita et al<sup>(9)</sup> dancing, walking for exercise, and bicycling were the most frequently performed activities. On average, at least 50.1% of the male children and 43.6% of female children performed any one form of physical activity at least once a week.

In the present study 84% were over-weight and 16% were obese. bivariate analyses of independent variables with elevated BMI. The prevalence of obesity in comparison to overweight, varied significantly among gender (male=4.8% female=11.2%). In Sujjan et al<sup>(5)</sup> study the prevalence of overweight and obese status was found to be 11.0% and 7.1% among males and 10.6% and 5.4% among females, respectively. The overall prevalence of overweight and obese children was found to be 10.8% and 6.2%, respectively. In Mohamed El Kabbaoui et al [12] study the prevalence of underweight was 3.05%, that of overweight was 7.69%, and that of obesity was 3.41%. The prevalence of overweight and obesity was higher among adolescents who went to school in motor vehicles than among those who walked to school ( $P = 0.001$ ). In Suneel priyani et al [13] The prevalence of overweight was 12.2% (95% CI 8.9 to 15.5). The mean age, weight, height and BMI of the participants were 16.98 years (range 16.88–17.08), 52.5 kg (range 51.5–53.5), 159.9 cm (range 159.0–160.8) and 20.5 kg/m<sup>2</sup> (range 20.2–20.8) respectively. Bivariate analysis showed that six factors were independently associated with overweight in adolescents.

#### Conclusion

The prevalence of obesity in comparison to overweight, varied significantly among gender (male=4.8% female=11.2%), education and occupation of mother, type of family and frequency of junk food consumption, number of siblings, dietary habits, cold drink consumption and number of hours of watching TV were significantly associated with Obesity ( $P < 0.05$ ).

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