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ORIGINAL RESEARCH

Prevalence and Determinants of Obesity in School Going Children: A Cross Sectional Study

Hitesh Tanwar[1], Arif Husain[2], Vedika A. Bhat[3]

[1]PG Resident, [2]Associate Professor, [3]Associate Professor, Department of Pediatrics, Rohilkhand Medial College and Hospital Bareilly, UP, India

Corresponding Author
Hitesh Tanwar
PG Resident, Department of Pediatrics, Rohilkhand Medial College and Hospital Bareilly, UP, India
Email: hiteshtanwar007@yahoo.com

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ABSTRACT

Background: According to the WHO, obesity is a "global epidemic". Obesity is a significant public health issue due to the possibility of difficulties in childhood and the rise in morbidity and mortality throughout adulthood. **Objective:** to evaluate the prevalence &determinants of obesity using Body mass index, waist circumference & waist height ratio of school going children aged 6 to 18 years. **Methods:** This Cross-sectional study was done among Children of 6-18 yrs age group in private or government schools of Bareilly, UP. Duration of Study was from 1st August 2023 – 31st July 2024. **Result:** we found not a statistically significant association between family members or number of siblingsin the study population, the accompanying condition of living with obesity, and BMI, waist circumference, and waist hip ratio in obese people.We found statistically significant association between snacking and BMI (p-value = 0.005) in obese people by chi square approach. Eating and screen time were strongly statistically associated with waist circumference (p-value = 0.001) and waist hip ratio (p-value = 0.001). Low extracurricular activities showed a substantial statistically significant association with waist circumference (p-value = 0.001), waist hip ratio (p-value = 0.001), and BMI (p-value = 0.001). Waist circumference (p-value = 0.002) and waist hip ratio (p-value = 0.002) showed statistically significant association with the time of morning awakening. **Conclusion:** Our study's total obesity prevalence falls within the precise same range as other research. Obesity may go undiagnosed if BMI is the sole metric used to measure it. Increased incidence of the obesity is affected by age, gender, parent's education and occupation, screen time, meals taken during that time, more indoor activities and late morning awakening

Keywords: Prevalence, Determinants, Obesity, School Going Children.

INTRODUCTION

According to the World Health Organization (WHO), obesity is a "global epidemic" that affects over 22 million children, with every one in ten being overweight.[1]

Most youngsters grow into adulthood with established diet and activity patterns. The prevalent trends presented by students today are the changes in diet and lifestyle brought on by the popularity of fast food, soft drinks, sedentary behavior, lack of exercise, increased television viewing, and computer use, which are the causes of overweight and obesity.[2] Parental obesity and the child's home food environment are significant determinants. Other significant determinants in emerging nations include a variety of beliefs that have been passed down through the centuries. Generous pocket money, the accessibility of domestic help, as well as driving to school might all contribute to the higher frequency of obesity at high-SES private schools. As a result, obesity and overweight are seen in a growing number of children and adolescents. The body mass index (BMI) or Quetelet's[4]Index, is an effective substitute for a more precise measurement of body fat, is used by health care providers to define obesity or increased adiposity. BMI is equal to weight in kg/height in meters.[3]

For any Asian Indian adults, the World Health Organisation (WHO) and IOTF have proposed lower BMI cut-offs of 23 & 25 kg/m2 for overweight & obesity, respectively[4] but they do not apply to children & adolescents. The several classifications or cut-values used to categorise childhood and teenage obesity and overweight have not been widely agreed

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upon several years. Due to this, it is hard to evaluate and contrast national or international prevalence rates.[5]Typically, age & gender-specific body mass index normogramshave been used to describe overweight & obesity in children & adolescents.

BMI percentiles are used to describe obesity & overweight in children. Children >2 years old who have a BMI 95th percentile for their age and sex are considered obese, while those who have a BMI between the 85th and 95th percentiles for their age and sex are considered to be overweight.[7]However, a drawback of BMI is that it cannot distinguish between lean body mass & body fat, nor pinpoint where the fat is located, therefore individuals with "central obesity" may have normal BMIs.

As a further indicator of the distribution of body fat, the waist circumference and waist-height ratio were proposed.[6] The ratio gives an indication of both subcutaneous & intra-abdominal adipose tissue, and it can be quantified more precisely than skinfolds.In recent years, the waist circumference waist-to-height ratio has been advocated as an alternate measurement technique for identifying childhood abdominal obesity.Few research, meanwhile, have looked critically at these variables as indicators of childhood adiposity. In this context, obesity of school going children is estimated using BMI, waist circumference and waist-to-height ratio.

As a result, childhood obesity issevere illness that impacts kids and teenagers. It happens when kids are significantly heavier and taller than average for their age. It is especially concerning because children who gain excess weight develop health conditions like diabetes, hypertension, psychiatric disorders, and high cholesterol that were previously only seen in adults. Additionally, it may result in melancholy and low self-esteem.[7] Improving the family's eating & exercise habits are good strategies to lower childhood obesity. Therefore, treating and avoiding childhood obesity will safeguard their health both now & in the future.[8]

Approximately 10% of school-age children aged 5 to 17 are thought to be overweight or obese (Childhood Obesity-the Global Picture 2006). In last decades, childhood obesity has become more common, and the numbers are concerning. A person's lifestyle and socioeconomic standing can have an impact upon prevalence and aetiology of childhood obesity. The majority of reports on childhood obesity come from research done in India's major cities.[9]

Moreover, there is paucity of data regarding prevalence of childhood obesity and overweight in this part of Uttar Pradesh. Hence our study aims to evaluate the prevalence &determinants of obesity and also use the various newer indices in early detection of obesity among school going children especially taking into consideration the increase in screentime amongst the children as observed during the Covid pandemic.

MATERIAL AND METHODS

This Cross-sectional study was done among Children of 6-18 yrs age group in private or government schools of Bareilly, UP. Duration of Studywas from 1st August 2023 – 31st July 2024.

Sample Size: A minimum sample of 396 was required.[10]

$$N=4pq/l^2$$

p = prevalence of childhood obesity (45%) q = 100 – p

l = Absolute error (5%) $N = 4pq/l^2$

= (4 x 45 x 55) / 25 = 396

Sampling Technique

Multistage sampling technique was used for all the study units until the required sample size was attained.

Inclusion Criteria

- All the children satisfying the following criteria were included in the study.
- Children of 6 to 18 years age with informed consent.

Exclusion Criteria

- Children with age < 6 years or > 18 years.
- Children with ascites/ organomegaly/ abdominal lump/ anasarca.
- Children with chronic illnesses.

Study Equipment

Following equipment was used for our study purposes.

- Non-stretchable measuring tape- to measure waist circumference in centimeters.
- Height scale/ Stadiometer- for measuring the height of all the children, measured in terms of centimeters.
- Digital weighing scale- for measuring the weight of children in kilograms.

Study Tool

Pre-tested, pre-designed proforma was utilised to collect data.

Methodology

After taking clearance from Institutional Ethics committee, Rohilkhand Medical College and Hospital, Bareilly, the study was carried out. Selection of study participants was done via multi stage sampling that was applied in urban and rural areas of Bareilly. 10% of 70 wards in urban areas i.e. 7 wards and 10% of 15 blocks in rural area i.e. 2 were selected by lottery method. In each of the selected ward of urban area all the schools were listed down. 10% schools among each of the ward were selected that came out about 1 school per each ward i.e. total 7 schools were selected. In rural blocks, 10% of schools from each block was selected randomly that came out as 1 school from each block were selected randomly for

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the study. Single school were selected via lottery method. Selection of grades, sections and adolescents were again randomly selected till the estimated sample size was achieved. School Children after taking permission from school authorities and consent of parents/ guardian who meet inclusion criteria were included and examined for the study. Detailed history regarding age, gender, living habits, food habits, screentime, demographic details, socioeconomic status and any illnesses that they presented with was taken and recorded. Complete clinical examination was also done to exclude any chronic illness and complications of obesity and any pointers to endocrine and pathological obesity (if present). Following measurements were taken and recorded for the study purpose:

1. Bodyweight in kg.
2. Height in meters
3. Waist circumference in cm.
4. Waist hip ratio and waist height ratio
5. BMI calculated.

After collecting all the data and entering into the master chart, the BMI was measured for all the children using the body weight and the height with the following formula:

$$BMI = (\text{Body weight in kgs}) / (\text{Height in m})^2$$

If the children were obese / overweight, then appropriate counselling and follow up was done if required.

Measurement protocol

The Protocol can be summarized as outlined below:

- After taking multiple consecutive natural breaths, measure your waist circumference at a level level with the floor, halfway between the top of the iliac crest and the lower edge of the last perceptible rib along the mid-axillary line.
- Wrap the subject tightly with stretch-resistant tape to take both measurements During the measurement, make sure the person is standing straight, with their arms relaxed at the side, their feet equally spaced, and their body weight distributed evenly.

Statistical Analysis

Data was filled in predesigned proforma. The data was entered in MS Excel spread sheet and analyzed using statistical package for social science (SPSS) version 23.0 software and appropriate statistical test were applied and results were tabulated as percentages. Results was displayed in form of table and figures. A p-value <0.05 was considered significant.

RESULTS

In our study, maximum males belonged to 13 years age whereas maximum females belonged to 11 years age.

Table 1: Prevalence of Obesity in the study Population

Prevalence of Obesity in the study Population		
OBESE		
Variables	YES	NO
BMI	20	376
WC	85	311
W/H Ratio	61	335

In our study, obesity was found in 20 subjects of BMI, 85 subjects of waist circumference and 61 subjects of waist: hip ratio measured individuals

In our study, maximum study participants (41.9%) belonged to 7th grade whereas minimum study participants (0.3%) belonged to 6th grade.

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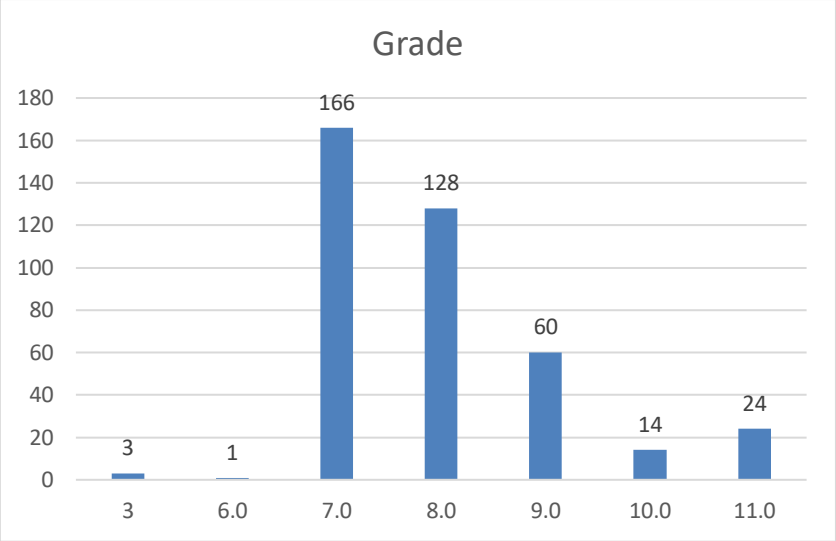

Figure1: Grade Wise distribution

Table 2: Association of Father's education with Obese in study Population

Association of Father's education with Obese in study population				
OBESE				
FATHER'S EDN	**Total**	BMI	WC*	W/H Ratio*
ILLITERATE	2	0	0	0
PRIMARY SCHOOL	9	0	2	2
MIDDLE SCHOOL	3	0	1	0
HIGH SCHOOL	48	0	1	0
POST HIGH SCHOOL	62	6	20	14
DEGREE	69	6	22	18
POSTGRADUATE	101	3	22	12
PROFESSIONAL	102	5	17	15
p-value		0.260	0.003	0.007
*** → Significant at <0.05 level**				

In our study, there was strong statistical association of father's education with obesity; waist circumference (p-value = 0.003) and waist hip ratio (p-value = 0.007) by applying chi square method in obese individuals.

Table 3: Association of Father's Profession with Obese in study Population

Association of Father's Profession with Obese in study population				
OBESE				
FATHER'S PROFF	**Total**	BMI	WC*	W/H Ratio*
UN EMPLOYED	17	0	1	0
UN SKILLED	51	2	7	8
SEMI SKILLED	9	1	5	3
SKILLED	172	6	28	19
SHOP AND AGRICULTURE	103	9	35	23
SEMI PROFESSIONAL	8	0	0	0
PROFESSIONAL	36	2	9	8
p-value		0.427	0.001	0.026
*** --> Significant at <0.05 level**				

In our study, there was strong statistical association of father's profession with obesity; waist circumference (p-value = 0.001) and waist hip ratio (p-value = 0.026) by applying chi square method in obese individuals.
In our study, there was strong statistical association of mother's education with obesity; waist hip ratio (p-value = 0.022) by applying chi square method in obese individuals.
In our study, there was strong statistical association of mother's profession with obesity; BMI (p-value = 0.001), waist circumference (p-value = 0.001) and waist hip ratio (p-value = 0.005) by applying chi square method in obese individuals.

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Table 4: Association of Family Income with Obese in study population

Association of Family Income with Obese in study population				
OBESE				
Family Income	**Total**	**BMI**	**WC**	**W/H Ratio**
< Rs.1600	6	0	0	0
Rs.1600 - 4809	76	5	16	11
Rs.4810 - 8009	133	3	26	18
Rs. 8010 - 12019	57	1	7	6
Rs.12020 - 16019	32	2	10	9
Rs.16020 - 32049	39	2	11	7
>Rs.32050	53	7	15	10
p-value		0.072	0.167	0.303
* --> Significant at <0.05	level			

In our study, there was statistical association of family income with obesity; BMI (p-value = 0.007) by applying chi square method in obese individuals.
In our study, there was no statistical association of accompany of Living with Obese in study population with obesity; BMI, waist circumference and waist hip ratio by applying chi square method in obese individuals.
In our study, there was no statistical association of number of siblings with obesity; BMI, waist circumference and waist hip ratio by applying chi square method in obese individuals.
In our study, there was no statistical association of number of family members with obesity; BMI, waist circumference and waist hip ratio by applying chi square method in obese individuals.

Table 5: Association of Snacks eaten every day with Obese in study population

Association of Snacks eaten every day with Obese in study population				
OBESE				
Snacks type	**Total**	BMI	WC	W/H Ratio
Healthy	82	2	10	9
Un Healthy	314	18	75	52

p-value of association of Snacks Eaten Everyday with BMI = 0.005; WC = 0.22, W/H Ratio = 0.212
In our study, there was statistical association of snacks with obesity; BMI (p-value = 0.005) by applying chi square method in obese individuals.

Table 6: Association of No. of meals taken while watching TV with Obese in study population

Association of No. of meals taken while watching TV with Obese in study population				
OBESE				
No. of Meals	**Total**	BMI	WC*	W/H Ratio*
0	74	0	1	0
1	203	8	49	35
2	77	7	22	16
3	42	5	13	10
p-value		0.11	0.001	0.001
*** --> Significant at <0.05 level**				

In our study, there was strong statistical association of eating with screen time with obesity; waist circumference (p-value = 0.001) and waist hip ratio (p-value = 0.001) by applying chi square method in obese individuals.

Table 7: Association of Extra Curricular activities with Obese in study population

Association of Extra Curricular activities with Obese in study population				
OBESE				
Extra-Curricular				
Activities	**Total**	BMI*	WC*	W/H Ratio*
Indoor	140	60	126	44
Outdoor	256	25	31	17
p-value		0.001	0.001	0.001
*** --> Significant at <0.05 level**				

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In our study, there was strong statistical association of extracurricular activites with obesity; BMI (p-value = 0.001), waist circumference (p-value = 0.001) and waist hip ratio (p-value = 0.001) by applying chi square method in obese individuals.

Table 8: Association of Morning waking up time Intervals with Obese in study population

Association of Morning waking up time Intervals with Obese in study population				
OBESE				
Time	**Total**	BMI	WC*	W/H Ratio*
4AM -4.59AM	29	1	3	4
5AM -5.59AM	21	1	3	2
6AM - 6.59AM	51	5	9	6
7AM - 7.59AM	96	9	25	18
8AM - 8.59AM	187	8	44	41
p-value		0.184	0.002	0.002
*** --> Significant at <0.05 level**				

In our study, there was strong statistical association of morning waking up time with obesity; waist circumference (p-value = 0.002) and waist hip ratio (p-value = 0.002) by applying chi square method in obese individuals.

In our study, there wasstatistical association of late night sleeping time with obesity; waist circumference (p-value = 0.003)and waist hip ratio (p-value = 0.005)by applying chi square method in obese individuals.

In our study, there was statistical association of socioeconomic status with obesity; BMI (p-value = 0.014) by applying chi square method in obese individuals.

DISCUSSION

In our study, obesity was prevalent in 20 subjects of BMI, 85 subjects of waist circumference and 61 subjects of waist: hip ratio measured individuals

There were total 262 males and 134 females in our study. In our study, maximum males belonged to 13 years age and minimum belonged to 8 years age whereas maximum females belonged to 11 years age and minimum belonged to 6 as well as 10 years age. There is strong association of age with gender in our study with p-value of 0.001 by chi square formula.

In this study, maximum study participants (41.9%) belonged to 7th class whereas minimum study participants (0.3%) belonged to 6thclass.Similar findings were observed by **Wanghi G *et al.*, 2020**[11], they found that older students were more likely to be overweight or obese than younger students, and older girls were more likely to be overweight or obese than older boys. Compared to younger males, younger girls had a higher percentage of body fat (p<0.001). Regarding older children, there are notable gender differences in all of the variables; girls had a BMI that was greater than boys (p<0.001), boys are a greater probability to report eating a lot of fruits and vegetables than girls, and boys are more inclined to report being physically active than girls.**ViswambharanJK*et al.*, 2020**[12] found no association of obesity with age (p-value = 0.92) or gender (p-value = 0.94). Prevalence of obesity and overweight was 8.2% among boys and 7.3% among girls.

Globally, the incidence of teenage obesity increased by 4.9% for girls and 6.9% for boys between 1975 & 2016.[13] Approximately three hundred million children & adolescents aged of 5 - 19 suffer from overweight and obesity, according to current research.[14]

In our study,a high statistical association between father's education and waist circumference (p-value = 0.003) and waist hip ratio (p-value = 0.007)is present in obese people.The waist circumference (p-value = 0.001) and WHR (p-value = 0.026) showed a substantial statistical association with the father's occupation. The mother's educational attainment and the waist-to-hip ratio showed a substantial statistical association (p-value = 0.022). BMI (p-value = 0.001), waist circumference (p-value = 0.001), and WHR (p-value = 0.005) were all statistically associated with the mother's occupation. Similarly, **Kang H.-T.*et al.*, 2006** concluded that low education levels of parents and non-parental carers contribute to childhood obesity.[15] Similarly, **Martorell R *et al.*, 2000** reported increased risk of overweight among children of mothers with higher education.[16]**ViswambharanJK*et al.*, 2020** found that the risk of obesity/overweight was higher among adolescents whose Parents had schooling for more than 7 yrs. There was direct association of paternal education with obesity (p-value = 0.006).[12]

In our study,we found a statistically significant association between obesity & family income with BMI (p-value = 0.007) as well as socioeconomic position among obese people, as measured by BMI (p-value = 0.014). **Kang H.-T.*et al.*, 2006** concluded that Low socioeconomic position contribute to childhood obesity.[15] Furthermore, **Ebbeling CB *et al.*, 2002** found that there is an intriguing contradiction in the link between SES & weight. Urban affluent people in developing nations continue to be at danger because of their greater inclination towards the western way of life, whereas urban poor people in developed nations seem vulnerable because of their bad nutrition & lack of physical exercise.[17]**Nair GLR *et al.*, 2021** concluded that prevalence of overweight / obesity is

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found to be significantly associated with higher socioeconomic status (p<0.0001) and mode of conveyance to school using motor vehicles (p<0.0001).[18]

In our study, by applying the chi square approach, we found not a statistically significant linkagewith family members or number of siblingsin the study population, the accompanying condition of living with obesity, and BMI, waist circumference, and waist hip ratio in obese people.In contrast, **Muhihi*et al.*, 2013** observed in their study that Children from homes with fewer children had a considerably higher mean BMI (p=0.019), however there was no association of number of adults living in the family with obesity.[19]**Kilinc A *et al.*, 2019**found that Children's WC/BMI levels are significantly impacted by the obese status of their parents (p<0.05). When it came to diagnosing obesity & abdominal obesity, the WHtR proved a good predictor (p<0.0001).[20] **Nair GLR *et al.*, 2021**concluded that prevalence of overweight / obesity is found to be significantly associated with family history of overweight (p<0.0001).[18]

In our study, we found statistically significant association between snacking and BMI (p-value = 0.005) in obese people. Eating and screen time were strongly statistically associated with waist circumference (p-value = 0.001) and waist hip ratio (p-value = 0.001). **Lakshman R*et al.*, 2006**discovered that the diet that kids eat on a daily basis is a risk factor that is frequently linked to juvenile obesity occurrences.[21]For improved health and nutritional status, parents should help their kids make the right decisions at the right times and with the right amounts of food. In contrast **ViswambharanJK*et al.*, 2020,**noted that risk of obesity/overweight was 1.28 times higher among those who watched television which was not statistically significant.[12]

In our study, extracurricular activities showed a substantial statistically significant association with waist circumference (p-value = 0.001), waist hip ratio (p-value = 0.001), and BMI (p-value = 0.001). Similarly, **Teferi DY *et al.*, 2018** found association of physical activity with obesity and overweight in their study (p-value was less than 0.05).[22]

In our study, a statistical significant association was there with waist circumference (p-value = 0.002) and waist hip ratio (p-value = 0.002) during morning awakening. Sleeping late at night did statistically linked with BMI, waist circumference, or waist-hip ratio. Physical activity levels in children affect their chances of obesity. **Laurson K.R.*et al.*, 2014** recommended that limiting screen time along with leading a sedentary lifestyle should be supplemented with encouraging physical exercise, since it is insufficient on its own.[23]**KilincA *et al.*, 2019**found that sleep durations and BMI/WC values had an inverse association (p<0.05).[20] **Kang H.-T.*et al.*, 2006** concluded that short sleep duration contribute to childhood obesity.[15]

CONCLUSION

In our nation, obesity is turning turning into an important public health issue. Our study's total obesity prevalence falls within the precise same range as other research. Obesity may go undiagnosed if BMI is the sole metric used to measure it. Increased incidence of the obesity is affected by age, gender, parent's education and occupation, screen time, meals taken during that time, more indoor activities and late morning awakening.

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