

Dietary Patterns and Association with Overweight and Obesity among Adolescents of Rewa City, Madhya Pradesh

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ABSTRACT

Introduction: Prevalence of overweight/obesity has been increasing around the world. Obesity among adolescents is associated with both immediate and long-term health complications. Unhealthy dietary habits are the major modifiable risk factors which promote weight gain. Dietary patterns analysis may provide insight about effect of diet on overweight/obesity.

Aim: To assess the association of overweight and obesity with dietary patterns among adolescents of Rewa city, MP (Madhya Pradesh).

Materials and Methods: A cross-sectional community-based study was conducted among 744 adolescents of 10-19 year age group of Rewa city, MP from January 2018 to December 2018 with multistage random sampling procedure. Information was collected for socio-demographic variables and pattern of dietary habits and standardised anthropometric measurement were taken following STEPS manual. Data was collected through house-to-house visits. Data was interpreted using descriptive statistics with SPSS version 20.00 software. Chi-square test was used to find out the association of dietary with overweight

and obesity. The p-value of less than 0.05 was considered as statistically significant.

Results: In the present study prevalence of over-weight and obesity showed positive association with increased frequency of consumption of carbonated soft drinks ($p=0.006$), energy dense food intake ($p=0.009$), non-vegetarian food ($p=0.04$), less consumption of fruits and vegetables ($p=0.005$ and 0.02 , respectively). In summation, the dietary behaviour showed a significant association with overweight or obesity. The study participants who had a poor dietary pattern showed a greater prevalence of overweight and obesity.

Conclusion: The present findings suggest that increased intake of carbonated soft drinks, junk food (like pizza, samosa), sweets/candies/chewing gums/chocolates, potato chips/popcorns/packed food are highly significant in increasing the prevalence of overweight and obesity. So healthy dietary pattern and limited intake of unhealthy dietary pattern should be followed and before this widely neglected problem acquires gigantic proportions, more research and timely intervention are much needed.

Keywords: Community based, Prevalence, Subject

INTRODUCTION

Around 5.87 million deaths, which account for 60% of all deaths in India are caused due to Non-Communicable Diseases (NCDs) [1]. In South-East Asia Region (SEAR), India shares more than two-third of the total deaths due to NCDs [1]. Obesity is creating an enormous socio-economic and public health burden and can be viewed as the first wave of a defined cluster of NCDs called New World Syndrome [2]. As a complex multi-factorial disease, prevalence of overweight and obesity has been increasing around the world [3].

Adolescent obesity is associated with complications, which may be immediate or long-term health complications [4]. Metabolic abnormalities including increased blood cholesterol, TAG and glucose levels, insulin resistance and hypertension are the immediate complications of overweight and obesity [5,6]. As for the long-term health risks, studies have consistently demonstrated that, compared with obesity in early childhood, obesity in adolescence is a stronger predictor of adult obesity [7]. The likelihood that obesity in adolescence would persist into adulthood has increased to 80% [8]. Previous studies have suggested poor dietary pattern as a risk factor for adolescent obesity [9,10]. To assess joint effects of multiple dietary components to obesity, dietary pattern analysis was proposed as an approach [11]. Unhealthy dietary habits are the major modifiable risk factors which promote weight gain, so the dietary pattern analysis may provide insight about effect of diet on overweight and obesity [12].

For the last 20 to 30 years, dietary patterns and lifestyles have changed dramatically in India [13]. Obesity is a modifiable risk

factor for development of metabolic abnormalities in later life, so preventing this epidemic becomes an important step in having better future generations [14]. Eating habits acquired during the early childhood years may serve as an indicator for similar future habits through adulthood showed by tracking of obesity. Traditional methods of examining single foods or nutrients was not sufficient approach to analyse outcomes, so to overcome that limitation, analysis of multiple dietary components has been proposed as a more reliable approach for the assessment of overweight and obesity [15,16].

Primarily the present community based study was carried out to find out the prevalence of overweight and obesity among adolescents with dietary pattern as one of its associated factor. The authors want to declare that this study was a part of the thesis work titled, "study to assess the prevalence of overweight and obesity with its determinants among adolescents of Rewa city, Madhya Pradesh"; a part of which has been published titled "study to assess the association between sleep duration and prevalence of overweight/obesity" [17]. The current study aimed to assess the association of overweight and obesity with dietary patterns among adolescents.

MATERIALS AND METHODS

A cross-sectional community-based study was conducted in Rewa city among 744 adolescents aged 10-19 years from January 2018 to December 2018 after approval of Institutional Ethics Committee (vide number 21/SS/MC/18).

After obtaining permission from the ethics committee, a pilot

study was conducted. Fifty adolescents between 10-19 years were randomly selected from a ward on a particular week they were excluded from the final sampling. The study objectives were explained to them and consent taken as per protocol. Subjects were assured of the maintenance of their privacy and then the semi-structured questionnaire was filled by principal investigator himself. After pilot study, the data was collected, analysed to check response rate.

The sample size for the study was determined by taking combined prevalence of overweight and obesity as 19.3% by a systematic review conducted by Ranjani H et al., [18]. By keeping specified relative precision 15% at 95% confidence interval. Sample size was estimated according to formula $n = Z^2_{1-\alpha/2} p(1-p)/d^2$ where $p=19.3\%$, $d=15\%$ of prevalence. Thus, sample size estimated was 744.

Stratified random sampling procedure was adopted for the selection of study subjects. Ward list was obtained from Municipal Corporation and then these wards were divided into urban, peri-urban and slum areas. Then randomly three wards were selected from each area, so nine wards were selected randomly. House listing from each selected ward was carried out. A team went to the centre of the ward and then proceeded in all the directions. To complete sample size in each ward, house-to-house survey was undertaken till 83/82 subjects of 10 to 19 years age group were selected from each ward.

Inclusion criteria: A total of 744 subjects who gave informed consent were included in the study.

Exclusion criteria: Subjects not able to participate due to severe illness, subjects with bony deformities, subjects who were on long term medication and those were absent on the day of visit were excluded. Study subjects were assured of confidentiality and anonymity.

Then data was collected by using final questionnaire which contained detailed questions regarding general socio-demographic variables which included gender, age, socio-demographic status, type of family, education status etc. and dietary habits, which consisted of type of diet whether vegetarian/mixed, daily servings of vegetables and fruits, one standard serving=80 grams. In the present cross-sectional study, one-time assessment of nutritional status through survey questions on dietary behaviour based on the modified Global Student-Based School Health Survey (GSHS)-expanded questionnaire [19] was done which recommended 400 grams of vegetables and fruits per day, or five servings of 80 grams each.

Information on soft drink and pizza, samosa and similar junk food, sweets/candies/chewing gums/chocolates, potato chips/popcorns/packed food consumption was obtained using a Food Frequency Questionnaire (FFQ) [20] and response categories including never, less than once per week, once per week, 2-4 days, 5-6 days per week, daily and more than once a day. Then study subjects were called to a separate room to take their anthropometric measurements which included height measurement, weight measurement and BMI, by using standard procedure, as directed by World Health Organization (WHO) STEPS manual [21].

For classification of overweight and obesity among the included subjects, Centres for Disease Control and Prevention (CDC) growth chart were applied to identify the age and gender specific cut-off [20]. Children with BMI value between 85th to 95th percentile for a specific age and sex were considered as overweight. Similarly children with a BMI value above 95th percentile defined as obese, while <5th percentile were considered "Underweight" for a specific age and sex [22]. Overweight and obesity both were considered as risk factors for future complication, so both were taken in a single category.

STATISTICAL ANALYSIS

Statistical Analysis was done and data was represented using descriptive statistics and analysed with Statistical Package for the

Social Sciences (SPSS) version 20.00 software. Chi-square test was used to find out the association with overweight and obesity. The p-value of less than 0.05 was considered as statistically significant.

RESULTS

[Table/Fig-1] shows the socio-demographic characteristics of the study subjects. The study population comprised of 51.7% males and 48.3% females. Majority of study subjects (57.8%) were from the age group of 15-17 years. The mean age of the study participants

S. No.	Variables	N (%)
1.	Gender	
	Males	385 (51.7)
	Females	359 (48.3)
2.	Age	
	10-14	192 (25.8)
	15-17	430 (57.8)
	18-19	122 (16.4)
3.	Education status	
	Illiterate	0 (00.0)
	Up to 5 th	19 (02.5)
	Up to 12 th	563 (75.6)
	Graduate and above	162 (21.8)
4.	Socio economic class (Modified BG Prasad scale 2019 [23])	
	Upper (I)	134 (18.0)
	Upper Middle (II)	210 (28.2)
	Middle (III)	266 (35.8)
	Lower middle (IV)	90 (12.1)
	Lower (V)	44 (5.9)
5.	Type of family	
	Nuclear	516 (69.3)
	Joint	228 (30.7)
6.	Father's education	Total (%)
	Illiterate	32 (4.30)
	Up to 5 th	144 (19.4)
	Up to 12 th	338 (45.4)
	Graduate and above	230 (30.9)
7.	Mother's education	Total (%)
	Illiterate	68 (9.1)
	Up to 5 th	276 (37.2)
	Up to 12 th	298 (40.0)
	Graduate and above	102 (13.7)
	Total	744

[Table/Fig-1]: Distribution of study subjects according to socio-demographic characteristics.

was 15±3.5 years. All study subjects were literate. Almost two third of study subjects 516 (69.3%) belonged to nuclear family. Amongst the parents, 4.3% fathers had no formal education, while 9.1% mothers had no formal education.

Dietary habits of subjects are depicted in [Table/Fig-2]. More than half (53.3%) of study subjects were vegetarian. More than one third of study subjects (35.2%) did not eat vegetables every day. The frequency of fruit intake showed slightly worse results. About 41.7% subjects did not eat fruits every day and only 25.3% ate fruits twice or more times daily. A total of 19.8% subjects consumed pizza, samosas, other junk food ≥4 times/week, 53.1% eat sweets/candies/chewing gums/chocolates ≥1 times per week and 38.6% subjects eat Potato chips/popcorns/packed food ≥1 times per week.

[Table/Fig-3] Depicted Association of overweight and obesity with

1.	Type of diet	Total (%)
	Vegetarian	397 (53.3)
	Mixed	347 (46.7)
2.	Frequency of eating non-vegetarian diet (per week)	
	5-6	8 (1.1)
	2-4	92 (12.4)
	≤1	247 (33.1)
3.	Frequency of vegetable intake (servings)	
	>2 time daily	196 (26.3)
	Once daily	286 (38.5)
	Not everyday	262 (35.2)
4.	Frequency of fruits intake (servings)	
	>2 time daily	188 (25.3)
	Once daily	246 (33.0)
	Not everyday	310 (41.7)
5.	Frequency of carbonated soft drink intake	
	>/=2 time daily	113 (15.2)
	Once daily	187 (25.1)
	Not everyday	323 (43.4)
	Don't drink	121 (16.3)
6.	Frequency of pizza, samosa and similar junk food intake	
	>/=4 time/week	148 (19.8)
	2-3 time/week	218 (29.3)
	Once/week	246 (33.2)
	Don't eat	132 (17.7)
7.	Sweets/Candies/Chewing Gums/Chocolates	
	≥1 times per week	395 (53.1)
	<1 times per week	349 (46.9)
8.	Potato chips/Popcorns/Packed food	
	≥1 times per week	287 (38.6)
	<1 times per week	457 (61.4)
	Total	744 (100)

[Table/Fig-2]: Distribution of study subjects according to dietary pattern.

Type of diet	Under-weight/ Normal (%)	Over-weight/ Obese (%)	Total	χ ²	p-value
Vegetarian	317 (79.8)	80 (20.2)	397	1.5367	0.22 (NS)
Mixed	264 (76.1)	83 (23.9)	347		
Total (%)	581 (78.1)	163 (21.9)	744		
Frequency of eating Non-vegetarian diet (per week)					
≤1	191 (77.3)	56 (22.7)	247	6.4625	0.04 (*p)
2-4	68 (73.9)	24 (26.1)	92		
5-6	5 (62.5)	3 (37.5)	8		
Total	264	83	347		

[Table/Fig-3]: Association of overweight and obesity with dietary habits. *p<0.05 statistically significant **p<0.001 statistically highly significant NS=Not significant

dietary habits. Among 347 mixed diet subjects, 23.9% were obese/overweight. The proportion of subjects who consumed a more non-vegetarian diet was more obese than who consumed non-vegetarian food less frequently (≤1 or 2-4 times/week).

[Table/Fig-4] showed the association of overweight and obesity with fruit and vegetable intake. In the present study, the prevalence of overweight or obesity was significantly higher at 27.5% among those who did not consume vegetables daily, compared to only 18.4% in those who consumed vegetables >2 times daily. Similarly, the prevalence of overweight or obesity was significantly higher at 27.1% among those who did not consume fruits daily, compared to 14.9% in those who consumed fruits twice or more daily.

	Under-weight/ Normal (%)	Over-weight/ Obese (%)	Total	χ ²	p-value
Frequency of vegetable intake (servings)					
Not everyday	190 (72.5)	72 (27.5)	262	7.3904	0.02*
Once daily	231 (80.8)	55 (19.2)	286		
>2 time daily	160 (81.6)	36 (18.4)	196		
Frequency of fruits intake (servings)					
Not everyday	226 (72.9)	84 (27.1)	310	10.4838	0.005*
Once daily	195 (79.3)	51 (20.7)	246		
>2 time daily	160 (85.1)	28 (14.9)	188		
Total (%)	581 (78.2)	163 (21.9)	744		

[Table/Fig-4]: Association of overweight and obesity with fruit and vegetable intake. *p<0.05 statistically significant **p<0.001 statistically highly significant NS=Not significant

[Table/Fig-5] depicted association of overweight and obesity with energy dense food intake. In the present study those with a higher frequency of carbonated soft drink intake showed a significantly higher prevalence of overweight or obesity i.e., 29.2% in those who consumed soft drinks twice or more times daily. A significantly higher prevalence of overweight or obesity was also found in those with higher frequency of high energy food and junk food intake: 29.7% in those who consumed pizza, samosas and other junk food ≥4 times/week. Higher (25.8%) prevalence of overweight and obesity was observed among those who eat sweet/candies/chewing gums/chocolates ≥1 times per week and among those who eat potato chips/popcorns/packed food ≥1 times per week, 26.5% were obese and overweight.

	Under-weight/ Normal (%)	Over-weight/ Obese (%)	Total	χ ²	p-value
Frequency of carbonated soft drink intake					
>/=2 time daily	80 (70.8)	33 (29.2)	113	12.4296	0.006*
Once daily	142 (75.9)	45 (24.1)	187		
Not every day in a week	271 (83.9)	52 (16.1)	323		
Don't drink every week	88 (72.7)	33 (27.3)	121		
Frequency of pizza, samosa and similar junk food intake					
>/=4 time/week	104 (70.3)	44 (29.7)	148	11.514	0.009*
2-3 time/week	165 (75.7)	53 (24.3)	218		
Once/week	199 (80.9)	47 (19.1)	246		
Don't eat every week	113 (85.6)	19 (14.4)	132		
Sweets/candies/chewing gums/chocolates					
≥1 times per week	293 (74.2)	102 (25.8)	395	7.5407	0.006*
<1 times per week	288 (82.5)	61 (17.5)	349		
Potato chips/popcorns/packed food					
≥1 times per week	211 (73.5)	76 (26.5)	287	5.7092	0.016*
<1 times per week	370 (81.0)	87 (19.0)	457		
Total (%)	581 (78.2)	163 (21.9)	744		

[Table/Fig-5]: Association of overweight and obesity with energy dense food intake. *p<0.05 statistically significant **p<0.001 statistically highly significant NS=Not significant

DISCUSSION

Unhealthy dietary pattern may itself propagate future health complications. To the best of author's knowledge, this was the first investigation from Rewa city to report the association of major dietary patterns with obesity and overweight in adolescents. It is not a new area of research to identify the association between major dietary patterns and obese and overweight. However, to know about the different dietary patterns that exist in different parts of the world and to know the extent of these patterns related to the obesity epidemic is always interesting. In the present study, it was found that an inverse relationship exists between a healthy dietary pattern and risk of being overweight and obese.

In the study, significantly higher prevalence of overweight and

obesity were reported among subjects taking mixed diet and the trend increased with increasing frequency of non-vegetarian food, which was similar to the studies done by Ramachandran Y, in Kerala, Biso SK and Mohanty MD, in Berhampur [24,25], Odisha, Jain A et al., [20]. All the mentioned studies had similar findings as obtained by the present study and shows that non-vegetarian diet preference is also a significant predictor of the overweight and obesity. This may be due to the fact that animal food products contain much more fat than plant-based items. Therefore, consumption of such items frequently leads to weight gain with increased BMI [24].

Similarly, more than one third of the subjects did not eat fruits and vegetables every day and lower frequencies of vegetables and fruit intake show significant association with overweight and obesity in the study. Jain A et al., Faizi N et al., Ghosh A et al., also found significant association between less consumption of vegetable and fruits with occurrence of overweight/obesity [20,26,27]. Study conducted by Shukla NK et al., also found higher prevalence among subjects who didn't consume fruits daily, compared to those who consume fruits daily [28].

Prevalence of over-weight and obesity was positively associated with increased frequency of consumption of carbonated soft drinks and energy dense food intake in the study. Jain A et al., also found Children who took, carbonated soft drink and junk food more frequently were more obese and overweight as compared to those who took carbonated soft drink and junk food in low frequency [20]. Goyal RK et al., in a study conducted in 2011 in the city of Surat [29], Gujarat also showed that those participants who drank soft drinks daily and whose consumption of carbonated drinks exceeded more than three times a week were at a greater risk of obesity [8]. Similar associations have been reported by Goyal J and Julka S, Gupta N et al., Kochar IS et al., and Kumar S et al., that Junk food, salty snacks and carbonated soft drinks are highly significant in increasing the prevalence of overweight/obesity [30-33].

Goyal J and Julka S, Watharkar A et al., also found findings similar to the present study, that sweetened beverages increased prevalence of overweight and obesity [30,34]. Keerthan Kumar M et al., also found higher prevalence of overweight and obesity if sweet, chocolate, pastries were consumed more than four times a week as compared to those who didn't consume these regularly [35]. So the diet with high fat, high sugar, low fibre high calorie content, resulted in increase of prevalence of overweight as well as of obesity.

Limitation(s)

Future prospective studies are required to confirm these findings. In depth interview for behavioural changes could be done.

CONCLUSION(S)

The present findings suggest that a dietary pattern characterised by high consumption of fruits and vegetables is associated with lower risk of overweight/obesity, while increased intake of carbonated soft drinks, junk food (like pizza, samosa), sweets/candies/chewing gums/chocolates, potato chips/popcorns/packed food is associated with increased risk of these conditions. These findings further confirmed the importance of dietary patterns among adolescents in developing obesity. Interventions aimed at discouraging the adoption of unhealthy dietary patterns, such as consumption of pizza etc., should be developed. Findings of this study could be used to promote the development of effective interventions and policies aimed at changing dietary habits, by providing further insight into diet-obesity associations among adolescents.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: May 20, 2020
- Manual Googling: Jun 15, 2020
- iThenticate Software: Jul 31, 2020 (16%)

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- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. No (No patient images were used)

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