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Potential Factors Related to BMI Among School Going Adolescents of Madurai District, Tamil Nadu, India

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ABSTRACT

This study aims to recognize essential aspects (related to lifestyle, eating and sedentary behaviours) of overweight and obesity among school-going adolescents of Madurai District, Tamil Nadu. Data were elicited on the physical activity patterns, sedentary practices at home, sleep duration and lifestyle behaviours such as habits of snacking, skipping breakfast, eating in front of television and frequency of eating out. Among 7660 subjects, 514 samples were found to be overweight and obese and analyzed with the suitable statistical tools such as percentage analysis, chi-square test to check the level of significance. 74.4 per cent of obese adolescents were found to have the habit of consuming snacks. The prevalence of Overweight 95 (18.48%) and obese 315 (61.28%) was more significant in Nuclear families. However, there was no statistically significant association between family type and BMI (χ^2 = 2.575, p > .05). No statistical association was found between the BMI and snacking and eating patterns of school-going adolescents. Majority of 364 children expenditure towards snacks are less than Rs.25.

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INTRODUCTION

Globally, obesity had nearly tripled ever since 1975. In 2016, Over 650 million adults were obese, including more than 1.9 billion overweight adults. Of these over 650 million were obese. Around 340 million school-going children and adolescents of 5-19 years were neither overweight nor obese in 2016. The prevalence of overweight and obesity among school-going children and adolescents belonging to 5-19 years age group has risen intensely from just 4% in 1975 to over 18% in 2016. The upsurge has arisen similarly among both the genders: in 2016, 18% of girls and 19% of boys were overweight (WHO, 2018). Once, overweight and obesity were believed as a problem of high-income countries but, now it is increasing in low income and middle-income countries, particularly in urban areas.

The vital cause of obesity is an energy imbalance between calories consumed and depleted. Changes in dietary and physical activity patterns are often the outcome of environmental and societal changes globally. Numerous trends in eating patterns have concurred with the increase in obesity rate, including large portion sizes, rise in the intake of food prepared outside the home and increases in the contribution of snacks to total energy intake. But, the impact of obesity in children and adolescents is not yet well understood. In precise, there is a lack of consensus regarding the factors related to BMI to enlighten the development of recommendations and

Table 1: Socio-demographic characteristics of the students and their comparison with Body Mass Index

Variables	Body Mass Index			
	Overweight (%)	Obesity (%)	Total (%)	p-value
Religious Status				χ^2= 2.779*
Hindu	105 (20.42%)	343 (66.73%)	448 (87.15%)	df=2
Christian	4 (0.77%)	14 (2.72%)	18 (3.49%)	= .24
Muslim	18 (3.50%)	30 (5.86%)	48 (9.3%)	
Family Type				χ^2= 2.575
Nuclear	95 (18.48%)	315 (61.28%)	410 (79.78%)	df=1
Joint	32 (6.22%)	72 (14 %)	104 (20.22%)	= .10
Socioeconomic Status				
Lower	93 (18.09%)	297 (57.78%)	390 (75.87%)	χ^2= 2.109
Upper Lower	32 (6.22%)	78 (15.17%)	110 (21.4%)	df=1
Lower Middle	2 (0.38%)	12 (2.33%)	14 (2.72%)	= .34

Table 2: Eating patterns of children based on their age and different school sectors

Adolescent St	Government School				Private School				Total
	Family meals	Eating alone	watch-ing TV	read-ing	Family meals	Eating alone	watch-ing TV	read-ing	
Early (13-14 Yrs)	44	6	58	12	70	17	68	6	281
Middle (15-16 Yrs)	28	12	20	0	10	8	18	0	96
Later (17-18 Yrs)	42	10	60	2	4	9	10	0	137
Total (%)	114 (22.17)	28 (5.44)	138 (26.84)	14 (2.72)	84 (16.34)	34 (6.61)	96 (18.67)	6 (1.16)	514 (100)

interventions (Larson and Story, 2013).

This study aimed to 1) observe eating habits, patterns of snacking behaviour (including Pocket money spent on snacks, preference of snacks, frequency of consumption and reason for snacking); and 2) evaluate the association between snacking behaviours, physical activity levels and BMI.

MATERIALS AND METHODS

A cross-sectional study was conducted in Government and Private Schools of Madurai District, Tamil Nadu, which comprised questionnaire framing, quantitative data collection and interpretation. School-going adolescents aged 13-18 years from the Government and private schools of Madurai District, Tamil Nadu were selected irrespective of their religious status, gender and residential area. Later, random sampling methods were utilized on each stratum to obtain the final study sample size (N=514).

Eligibility criteria included the following: 1) aged 13–18 years; 2) non-smokers; 3) fluent in either English or Local Language - Tamil; 4) not under medications that affect appetite or body weight; 5) not presently on a weight loss program.

The close-ended questionnaire was framed to capture students' information concerning meal pattern, living arrangement and food choices. The socio-demographic details of the students (Salma and Ramakrishnan, 2017) and anthropometric measurements such as height and weight were measured using a stadiometer and a digital weighing scale, respectively. Based on these measurements, (Kuczmarski *et al.*, 2000) BMI-for-age child growth charts (Normal weight = $\geq 5^{th}$ to <85th Percentile, Overweight = $\geq 85^{th}$ to <95th Percentile and Obese = $\geq 95^{th}$ Percentile) used to determine adolescent's BMI for age percentile. The choice and frequency of consumption of snacks, reason for snack-

Table 3: Snacking pattern and BMI Comparison of adolescents

Questions	Answer Levels	Over Weight	Obese	Total (%)	P-Value
Q1: How often do you eat snacks apart from regular meals?	Once a day	35	113	148 (23.3)	X^2=16.52 df=10 = .86
	Twice a day	31	58	89 (14)	
	Weekly once	14	37	51 (8.0)	
	Frequently	14	49	63 (9.9)	
	Rare	33	130	163 (25.7)	
	Yes	51	191	125 (24.3)	X^2=8.10 df=2 = .01*
Q2: Do you often replace snacks formeals.	No	74	198	389 (75.7)	
Q3: on what basis you select the snack	Tasty	65	212	277 (53.89)	
	Used it	30	59	89 (17.31)	X^2=14.78 df=5 = .01*
	Attractive	16	37	53 (10.3)	
	Peer pressure	6	40	46 (8.9)	
	Advertisement	12	37	51 (9.9)	
Q4: What kind of snack youprefer for nibbling?	Junk/fast food	18	24	42 (8.17)	X^2=19.20 df=12 = .08
	Bakery foods	23	77	100 (19.45)	
	Fried foods	14	62	76 (14.78)	
	Sweets	10	38	48 (9.33)	
	Artificial Beverages	2	2	4 (0.77)	
	Fresh fruits & vegetables	6	12	18 (3.50)	
Q5: when do you feel to eat snacks	Happy	47	111	158 (30.73)	X^2=12.44 df=8 = .13
	Unhappy/ Bored	2	18	20 (3.86)	
	Normal	34	125	159 (30.93)	
	Watching TV/Studying	43	124	167 (32.49)	
	Others	1	9	10 (1.94)	
Q6: How much money do you spend on snacks?	>25	76	214	290 (56.42)	X^2=13.95 df=11 = .23
	26 to 50	7	34	41 (7.97)	
	51 to 75	19	45	64 (12.45)	
	76 to 100	13	43	56 (10.89)	
	< 100	12	51	63 (12.25)	

*1% level of significance

Table 4: Relationship of Physical Activity, Body Mass Index and preference on Purchasing Snacks

Activity	BMI	Preference on purchasing Snacks					Total	P Value*
		Costly & Tasty	Used It	Attractive in appearance & Hygienic	Suggested by friends	Influenced by Advertisement & Cheaper		
Indoor Games	Overweight	6	6	0	0	0	12	.062
	Obese	28	12	4	4	2	50	
Outdoor Games	Overweight	24	10	4	0	2	40	.032*
	Obese	92	14	4	16	8	134	
Both	Overweight	43	6	8	2	8	67	.000**
	Obese	107	14	12	6	10	149	
No PA	Overweight	6	2	0	0	0	8	.334
	Obese	38	2	10	2	2	54	
Total	Overweight	79	24	12	2	10	127	
	Obese	265	42	40	28	22	387	
	Total	348	68	52	30	32	514	

*5 % level of Significance *1 % level of Significance

ing and pocket money spent on snacks were also elucidated. Additionally, physical activity patterns, sedentary practices at home (time spent in front of the television, playing computer games, studying and writing home works) and time spent in playing games in both school and home were noted. Data analysis was done using SPSS latest version.

RESULTS AND DISCUSSION

Demographic characteristics of respondents

Table 1 represents the Socio-demographic Information of the school going students and their Body Mass Index. Majority of the adolescents belonged to the religion Hindu (87 %) and nuclear families with 80 % including obese with high percentage. Seventy-six percentage of adolescents' belonged to lower socio-economic while twenty-one percentage were classified in upper-lower socio-economic status. These findings were statistically not significant with the BMI of the adolescents. Our study results were contradictory to fewer studies conducted in India (Ramachandra, 2002; Goyal *et al.*, 2010), because of the diversity in the study population. More of our study population belonged to the lower socio-economic status than the higher or middle income. Hence, there was data insufficiency in comparison with the higher or middle socio-economic status group.

Eating Habits of School going children basing on their age

Of the total studied population, the children study-ing in government schools were 298. Out of 298 respondents, 26.8 per cent of the students ate their breakfast and dinner by watching television, 22.1 per cent of them had their meals with their family, and 5.44 per cent of them have their meals alone. On the other hand, similar to the government school, the majority of private school students too, ate by watching TV, and 16.3 per cent of them had their meals with family. 6.61 per cent of private school students ate alone, which is higher per cent than the government school students (Table 2).

Table 3 represents the response of school-going adolescents to questions related to snacking pattern and their comparison with Body Mass Index. Obese students (BMI $\geq 95^{th}$ Percentile) were found to eat snacks regularly (75.2 %) compared to overweight students (24.8%), and it was not statistically significant (p=.86). Even though the school-going children preferred to nibble snacks, they did not skip the meals for snacks which is also statistically proven (p=.01). Majority of the children preferred to purchase the delicious snacks (53.89%), and this is also not significant with the Body Mass Index of the children (p=.01).

Eating bakery and fried foods was found more frequently among obese students (27.04%) compared to overweight students (7.19%), but it was not statistically significant. Most of the obese students were found to nibble snacks while watching TV, in general, and whenever happy (70.03%), and this was also not statistically significant with the BMI of the children. 56 per cent of adolescents spend less

amount to purchase snacks.

The common perception of snacking is that snack foods are harmful as it is high in fat and sugar and not appropriate for healthy eating (Astrup *et al.*, 2006). Adolescents habitually choose more salty and crunchy snacks than the other healthier substitutes available since they prefer tasty foods over nutritious foods. Adolescents tend to snack more when they skip their regular meal patterns, and the frequent or regular intake of snacks increases their energy and non-balanced nutrient intakes leading to overweight and obesity (Nicklas *et al.*, 2003).

Table 4 represents the relationship of physical activity performed, Body Mass Index and preference on purchasing the snacks by the school-going children. Majority of the children preferred purchasing tasty snacks than nutritious and hygienic snacks. Children who fall under obese category found to nibble snacks more than overweight children. More students were found to play outdoor games than indoor games. Significantly few children showed no interest in physical activity. Association between Body Mass Index and Physical activity has no significance (p-value .062, .032) whereas preference on purchasing snacks and Physical Activity showed significance (p-value .000) statistically at 1% level of significance.

CONCLUSIONS

The present investigation was conducted on school-going adolescent children (13-18 years) from Madurai District, Tamil Nadu state, India. Preventing overweight and obesity among school-going adolescents is a public health privacy improving adolescents knowledge to take balanced nutrition; to eat breakfast and meals regularly; to avoid frequent snacks and fatty food consumption; to stop eating before fullness and to do regular physical exercise may endorse maintaining healthy body weight among students and decrease the prevalence of overweight and obesity.

Author Contribution

We declare that all of the authors mentioned in the article have contributed equal efforts in this research and also for the submission of the article.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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