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The Effects of Overeating, Socioeconomic Status and Modern Practices: A Structural Equation Modelling Approach to Obesity in Teenage Girls

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Abstract

This study investigates the effects and the relationship between the factors that cause childhood obesity. Several practices such as increased consumption of sweetened drinks, fast foods, eating while watching television (TV), skipping breakfast, reduced family meal times and lower consumption of healthy foods accelerate the rate of childhood obesity. Media plays a major role in the lives of millennials. Recent studies have established that there is an increase in obesity rates in low socioeconomic groups which indicates that it is an important factor to be considered while developing the model. Structural equation modelling (SEM) is a quantitative model approach which brings out the relationships between various factors. Exploratory factor analysis is used to examine the SEM model. The latent variables are over eating, socio economic status and modern practices. The observed variables are family income, educational qualification of parents, physical activities, stress, BMI, food practices, consumption of junk food, consumption of vegetables and media availability. The sample consists of school and college students (n=250) in Vellore-Tamil Nadu between the ages 13-18. The data collection was conducted through Questionnaires. SPSS (Statistics & Amos) software is used for SEM modelling. The proposed model is found to be an acceptable fit.

Key words:Childhood Obesity, Structural equation modelling, Exploratory factor analysis, Multi variate statistical analysis

AMS classification:

1. Introduction

Obesity is a pathology that has a multifactor etiology. Genetics and environment interact and play various roles in different socioeconomic realities, establishing a disease with high prevalence in industrialized countries and in developing countries where a process of westernization is occurring. In the case of a child at risk of becoming overweight (including dietary, physical aspects, and sedentary behavior), the main characteristics can be explained by the influence of family and school environment as well as a larger social environment [30]. According to CDC, Childhood obesity is a serious problem in the United States putting children and adolescents at risk for poor health. Obesity prevalence among children and adolescents is still too high. For children and adolescents aged 2-19 years:

- The prevalence of obesity was 18.5 percentage and affected about 13.7 million children and adolescents.
- Obesity prevalence was 13.9 percentage among 2- to 5-year-olds, 18.4 percentage among 6- to 11-year-olds, and 20.6percentage among 12- to 19-year-olds. Childhood obesity is also more common among certain populations.

India has the second highest number of obese children in the world, with 14.4 million reported cases, according to a new study published in The New England Journal of Medicine.

Low L. C. (2010) and Harish Ranjani et.al (2016) studied the obesity prevalence among children and its effects. Obesity is prevalent among all age groups. Childhood obesity mostly often leads to obesity in adulthood. Childhood obesity causes hypertension, non-alcoholic liver disease, insulin resistance, dyslipidaemia, pulmonary disorders and psychological problems. Sanjay Kalra et al. (2012), Seema Gulati et al. (2014) and Ranjit M Anjana et al. (2014) analysed the obesity epidemic in India and the underlying causes leading to the rapid increase in obesity. According to the National Family Health Survey (NFHS), the obesity among married women is increasing and a large percentage of people in India are inactive and very few engage in recreational physical activity.

Eric A. Finkelstein et al and Claire Wang et al (2007) forecasted the obesity conditions. The study estimates a 33 percentage increase in obesity prevalence and a 130 percentage increase in severe obesity prevalence over the next 2 decades. If these forecasts prove accurate, this will further hinder efforts for healthcare cost containment. As the baby boom generation approaches retirement age, the continuing obesity epidemic signals a likely expansion in the population with obesity-related comorbidities.

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Works have been carried out in the structural equation modelling of obesity by Diane T. Finegood et al(2010), Rita Orji et al (2012) . The Foresight obesity system map takes into account the complexity of and interrelationships between the variables and determinants of obesity and suggests possible intervention points. Development of the Foresight map helps in understanding the complexity of the obesity. Complex problems such as obesity demand appropriate tools in identification of core problem.

Muskaan Gumani et al., W. Douglas Evans et al. (2010), W. Douglas Evans et al.(2005), Janet D. Latner et al (2007) examined the consequences of recent practices that lead the way to obesity. Modern practices like increased consumption of sweetened drinks, fast foods, eating while watching television (TV), skipping breakfast, reduced family meal times eating together, and lower consumption of healthy foods have all been associated with increased rates of childhood obesity. Media has a major role in the lives of millenials. The constant exposure to media encourages children to many unhealthy habits such as smoking and consumption of junk foods. Researchers have established that there is an association between heavy television viewing and frequent snacking of sugary beverages and frequent visits to fast-food chains. Heavy television viewing is also negatively associated with the consumption of fruits and vegetables. Availability of fast foods at a high rate near and in colleges and schools also should be noted. Media exposure is significantly associated with obesity stigma.

Several authors have worked on SEM models including various factors, Binge Eating and Exercise Behavior after Surgery for Severe Obesity by Junilla K. Larsen et al(2006), Associations among overeating, overweight, and attention deficit/ hyperactivity disorder by Caroline Davis et al. (2006), the relations between sensitivity to reward and overeating were analysed and confirmed by Caroline Davis et al (2007). Various researches have been conducted regarding childhood obesity. The role of family environment in childhood obesity by Hui Huang et al. (2017), the role of maternal feeding strategies and child food intake by Katja Kröller and Petra Warschburger (2009), the relation between body weight and depression among children by M Chaiton et al (2017) and Alina Dragan and Noori Akhtar-Danesh (2007).

2. Materials and Methods

Socioeconomic Status

The latent variable socioeconomic status consists of three indicators namely age of the parents, Work experience of parents and Educational qualification of parents. The

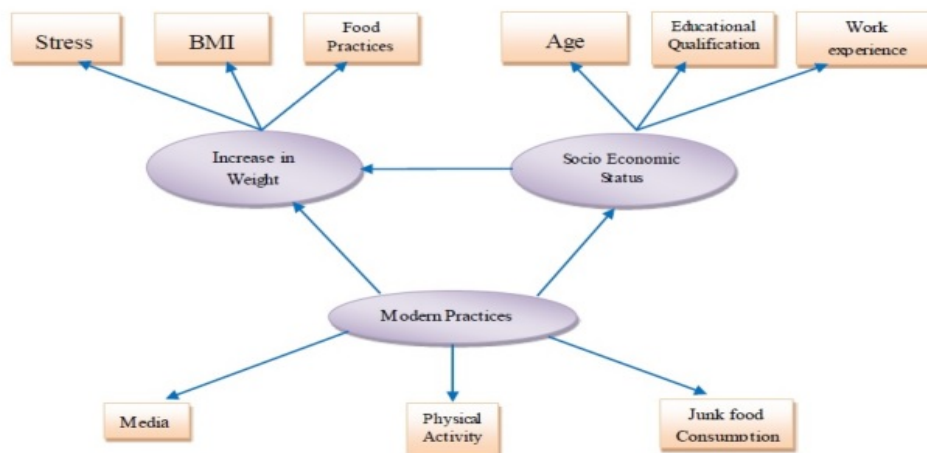[1]*priyankavictor2@gmail.com,[2]preethivictor2@gmail.com

Figure 1: Research Framework

parents age were classified into four groups: 30 years or younger, 30-40 years, 40-50 years, above 50 years. The education qualification of the parents were categorised into four groups: Less than high school, high school, Diploma or Bachelor degree, Masters degree or Ph.D.

Modern practices

The indicators of modern practices are consumption of junk food, physical activity and media availability. We measured the child's fast food intake based on Kröller and Warschburger study. Parents indicated on a six-point scale ("never", "rarely", "sometimes", "usually", "always" and "several times a day") how often their children eat junk foods. Physical activity was divided into five categories: None, 1-2 times per week, 3-4 times per week, 5-6 times per week, Everyday. We use a five pointer scale for Media availability from less than one hour per day to more than four hours per day.

Over eating

Height, weight and food consumption are the observed variables of over eating. Weight of the child is divided into 7 categories: 5-10 kg, 10-20 kg, 20-30 kg, 30-40 kg, 40-50 kg, 50-60 kg and ¿60 kg. The height of the child is divided into four categories: ¡50 cms, 50-100 cms, 100-150 cms and ¿150 cms. We measured the child's food intake based on Kröller and Warschburger study. Parents indicated on a six-point scale ("never", "rarely", "sometimes", "usually", "always" and "several times a day")

how often their children eat food.

Sampling

In the present study, we have considered two groups. The first group consists of teenage girls aged from 13 to 15, the second group consists of teenage girls aged from 16-18. We distributed 250 questionaires to random household with teenage girls in Vellore, Tamil Nadu and asked them to fill out the questionnaires. The regions that we covered Katpadi, Bagayam, Adukamparai, Gudiyatham and Thiruvalam. The questionnaire is given in the appendix. The first group consisted of 125 girls from the above mentioned areas who participated and responded to the questions in the questionnaire. The second group consisted of 125 girls from 16- 18 years who also participated actively. The data was collected from each person personally and the doubts were cleared in case of any. There was no incomplete questionnaires.

3. Results

Structural Model

Structural model of childhood obesity was constructed using the SPSS Amos software. The model shows relationship between junk food consumption and food practices and also with BMI, Health and education, education and physical activity. The dataset obtained from the questionnaire of teenage girls aged from 13 to 15 and teenage girls aged from 16-18 is incorporated in the SEM model and the confirmatory factor analysis is carried out. Few paths were incorporated to the formulated model to improve the model fit. The SEM model for group 1 and 2 is found to be having a good fit. We obtained a non-significant chi-square $\chi^2 = 33.327$, df= 20 and $p = 0.031$ for group 1 and chi-square $\chi^2 = 44.890$, df=20 and $p = 0.001$ for group 2 indicating a good absolute or overall model fit.

Study Reliability and Validity

Fornell and Larcker[31] defined questionnaire validity and reliability based on the following terms and conditions:

1. Validity: Cronbach's alpha of every latent variable must be equal to or higher than 0.7
2. Reliability:
   - The average variance extracted (AVE) for every latent variable must be equal to or higher than 0.50
   - The factor loading of every indicator must be higher than 0.70 in the
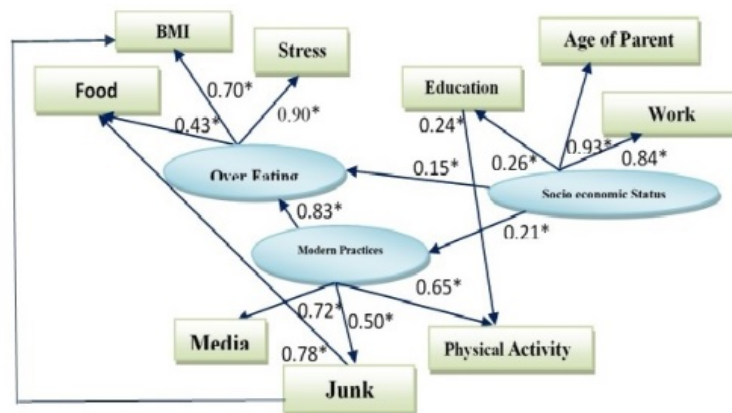

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Figure 2: SEM Obesity model for group 1($^*-p < 0.01$).
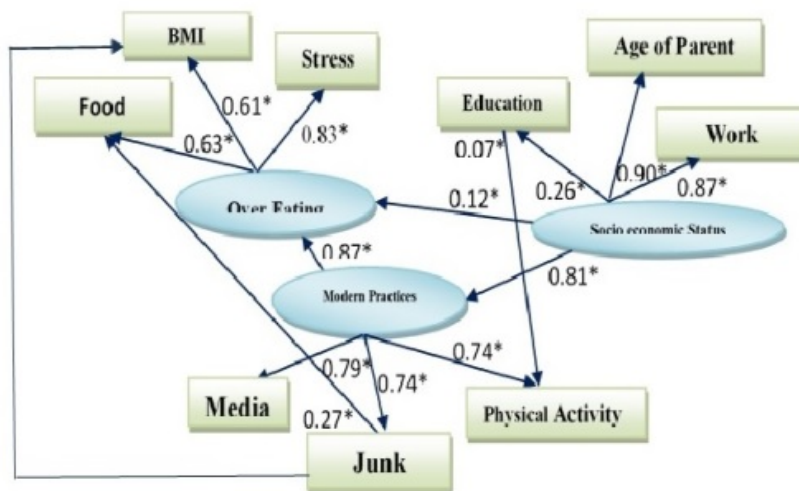
Figure 3: SEM Obesity model for group 2($^*-p < 0.01$).

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construct

Table 1 shows the outputs from the AVE and Cronbach's alpha analysis. There are three groups of indicators namely modern practices, socio economic status and over eating. Table 1 illustrates that all research group variables have acceptable Cronbach's alpha and AVE values.

Construct	AVE for group 1	AVE for group 2	Cronbach's Alpha for group 1	Cronbach's Alpha for group 2
Modern Practices	0.689	0.651	0.729	0.884
Socio Economic Status	0.765	0.855	0.804	0.790
Over eating	0.60	0.788	0.776	0.803

Table 1: AVE and Cronbach's Alpha for group 1 and 2.

The fit of the SEM model for groups 1 and 2 are checked. The Root mean square residual(RMR), Goodness of fit index(GFI), Adjusted Goodness of fit index(AGFI), Comparative fit index(CFI) and Root mean square error of Approximation(RMSEA) of the model are found to be within acceptable ranges. The model fit implies that the model is plausible.

Measure	Cut-off for good fit	Model fit for group 1	Model fit for group 2
RMR	$\prec 0.08$	0.065	0.074
GFI	≥ 0.95	0.95	0.951
AGFI	≥ 0.90	0.982	0.909
CFI	$\geq .90$	0.977	0.930
RMSEA	$\prec 0.08$	0.073	0.080

Table 2: Model fit for SEM obesity model

Bivariate correlation coefficients among all measured variables of Group 1 and 2 are given below:

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	Junk Food	Stress	Education of Parents	Physical Activity	Food	BMI	Media	Work Experience of Parents	Age of Parents
Junk Food	1.000								
Stress	.721	1.000							
Education of Parents	.578	.636	1.000						
Physical Activity	.593	.663	.610	1.000					
Food	.679	.712	.574	.605	1.000				
BMI	.592	.583	.630	.487	.617	1.000			
Media	.546	.617	.616	.658	.623	.552	1.000		
Work Experience of Parents	.470	.583	.711	.542	.535	.593	.556	1.000	
Age of Parents	.441	.571	.716	.630	.617	.559	.612	.782	1.000

	Junk Food	Stress	Education of Parents	Physical Activity	Food	BMI	Media	Work Experience of Parents	Age of Parents
Junk Food	1.000								
Stress	.614	1.000							
Education of Parents	.574	.621	1.000						
Physical Activity	.503	.524	.524	1.000					
Food	.577	.573	.479	.532	1.000				
BMI	.592	.583	.630	.487	.617	1.000			
Media	.414	.404	.334	.302	.641	.552	1.000		
Work Experience of Parents	.439	.591	.522	.490	.609	.479	.556	1.000	
Age of Parents	.419	.482	.449	.667	.524	.531	.788	.782	1.000

4. Discussion

In both the groups, modern practices has significant impact over eating. But group $2(\beta = 0.87)$ has a higher impact of modern practices on over eating compared to group $1(\beta = 0.83)$.The impact of socio economic status on modern practices is higher in group $2(\beta = 0.81)$ compared to group $1(\beta = 0.21)$. Therefore, it is observed that there is a high chance of socio economic status of parent leading to over eating in teenage girls aged between 16-18. The present research shows a direct relation between socio economic status of parents and over eating.

5. Appendix

The questionnaire distributed to the children for the analysis of obesity SEM model is as follows:

S.No	Question	Answer								
1	How many hours do you spend on social media (T.V, Mobile, Tablet) per day?	Never		rarely		Sometimes		Usually	Always	Several times a day	
		1	2	3	4	5	6	7	8	9	10
2	How frequent do you have fruits, vegetables or whole grain products?	Never		rarely		Sometimes		Usually	Always	Several times a day	
		1	2	3	4	5	6	7	8	9	10
3	How frequent does your child have sweets, chips, soft drink or fast food?	Never		rarely		Sometimes		Usually	Always	Several times a day	
		1	2	3	4	5	6	7	8	9	10
4	The average number of times per week you do physical activities	None		1-2 times per week		2-4 times per week		5-6 times per week		Every day	
		1		2	3	4	5	6	7	8	9	10
5	To which age group does your parents belong?	40-45		45-50		50-55		55-60		60-65	
		1		2		3		4		5	
6	What is the educational qualification of your parents?	Less than High School		High School		Bachelor's or Master's Degree		Ph. D degree	
		1		2		3		4		5	
7	What is the year of work experience of your parents(cumulative)?	Below 10 years		10-15 years		15-20 years		20-25 years		25-30 years	
		1		2		3		4		5	
8	Do you have any health problems?	Yes					No				
		1					2				
9	If yes, how much does your food intake increase from normal amount?	No change		A little			Average	High		Very High	
		1		2	3	4	5	6	7	8	9	10
10	How much do you eat when you are tired or stressed?	No change		A little			Average	High		Very High	
		1		2	3	4	5	6	7	8	9	10

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