

Prevalence of Obesity among High School Children in Chennai Using Discriminant Analysis

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Abstract: Obesity is a leading preventable cause of death worldwide with increasing rates in children and adults. It is a condition where a person has accumulated so much body fat that might have a negative effect on their health. Obesity increases the likelihood of various diseases particularly type 2 diabetes, breathing difficulties during sleep, certain types of cancer and osteoarthritis. Childhood obesity is a condition where excess body fat negatively affects a child's health or well being. As methods to determine body fat directly are difficult, the diagnosis of obesity is often based on B.M.I. The term overweight rather than obese is often used in children as it is less stigmatizing. Childhood obesity may not be a wide spread phenomenon as yet but the rapidly increasing numbers do provide us cause to be concerned about it The objective of the study is to discriminate the factors that influence the childhood obesity.

Keywords: Body Mass Index, Childhood obesity, Chi-square test, Discriminant analysis,

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I. Introduction

Obesity is a medical condition in which excess body fat is accumulated in the body to the extent that it may have an adverse effect on health, leading to reduced life expectancy and increased health problems. Obesity has reached epidemic proportions globally. More than one billion adults are overweight and at least 300 million of them are clinically obese. Significantly obesity is increasing rapidly in developing countries undergoing rapid nutrition and lifestyle transition and it often exists with under nutrition. The rising prevalence of obesity in developing countries is largely due to rapid urbanization and mechanization which has led to reduction in the energy expenditure along with an increase in energy intake due to increasing purchasing power and availability of high fat and energy dense fast foods.. Researches show that kids have lesser obesity and associated health problems in comparison to adults. . The very common ones accounting for childhood obesity are genetic factors, inadequate or total absence of physical activities like exercise, unhealthy eating habits and so on. In few cases, obesity in kids could be a consequence of a medical condition. The problem of obesity in childhood can also be associated with certain family habits like their eating and activity patterns. Genetic factors can hike up the possibility of a child getting overweight. Two factors that play a vital role in deciding a kid's weight is his/her eating or activity patterns. Due to the popularity of the video games and television, many children nowadays in the urban regions spend a lot of time remaining inactive. Changes in environmental and societal factors are likely the main explanation for doubling of severe childhood obesity over the last thirty years. Obesity is encouraged by such obesogenic environmental conditions that promote overeating and inactivity is either already present or emerging in most populations. The present study has been undertaken among the schools in Chennai and a total of 200 students from standard VI to X, aged between 11-16 years had been enrolled in the study. Obesity was assessed by BMI for age. Body mass index (BMI) was calculated as body weight in kilograms/height in meter square.

$$\text{BMI}=\text{WEIGHT (in kg's)}/\text{HEIGHT}^2 \text{ (in meters)}$$

It is a descriptive study and this study aimed to identify the risk factors to discriminate obesity classes among high school children.

CLASSIFICATION OF BMI UNDER WEIGHT

The children were classified into four major categories are

- ◆ Underweight
- ◆ Normal
- ◆ Overweight and
- ◆ Obese

CLASSIFICATION	BMI RATIO
Underweight	<18.5
Normal	18.5 – 24.9
Overweight	25 – 29.9
Obese	>30

OBJECTIVES

- To determine the prevalence of obesity in school children.
- To identify the factors influencing childhood obesity.
- To find whether the reasoning association between BMI and various factors which influence the obesity
- To discriminate the children with obese and non-obese.

II. Materials and Methods

The mode of the data collection used in the present survey is through direct interaction with the customer by using questionnaire. The elements in the process of sampling are

- ◆ Selection of the sample
- ◆ Collection of information
- ◆ Drawing of inference

A total of 200 students from standard VI to X, aged between 11-16 years had been enrolled in the study.

Data Collection

The permission was obtained from the school administration to conduct the study. For data Collection, pre-designed and pre-tested questionnaire was used. The questionnaire consists of the information about socio-demographic factors (Age, sex, occupation, parent’s education and income) and family history of obesity.

A. Height:

Height of the sample was recorded thrice for accurate measurements. Height was recorded in centimeters to the nearest of 0.1cm with a standard tape.

B. Weight:

Weight of the sample was recorded in kilograms with the help of a weighing machine.

C. Body Mass Index:

The body mass index of the sample was calculated on the basis of the height and weight .

DISCRIMINANT ANALYSIS:

Table 1 Summary of Canonical Discriminant Functions

Eigen values				
Function	Eigen value	% of Variance	Cumulative %	Canonical Correlation
1	.542 ^a	100.0	100.0	.593

a. First1 canonical discriminant functions were used in the analysis.

Wilks' Lambda

Step	Number of Variables	Lambda	df1	df2	df3	Exact F			
						Statistic	df1	df2	Sig.
1	1	.760	1	1	137	43.373	1	137.000	.000
2	2	.702	2	1	137	28.882	2	136.000	.000
3	3	.668	3	1	137	22.363	3	135.000	.000
4	4	.649	4	1	137	18.141	4	134.000	.000

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	Df	Sig.
1	.649	58.423	4	.000

The statistical significant of discriminate function’s is done by Wilk’s lambda. Since p value is less than 0.05, it indicates that the two groups are highly significant.

Table 2

Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
Transport used by the students to school	.953	6.745	1	137	.010**
Type of snacks consumed by the students in a day	.874	19.788	1	137	.000**

Snacks taken by the students in between the food	.874	19.687	1	137	.000**
Frequency of eating habits by the students in a day	.967	4.652	1	137	.033*
Frequency of students skipping the food	.991	1.262	1	137	.263
Frequency of having soft drinks per week by the students	.760	43.373	1	137	.000**
Frequency of taking fast-food per week by the students	.983	2.364	1	137	.126
students like to do exercise daily	.878	19.088	1	137	.000**
Students feel their studies are stressful	.937	9.235	1	137	.003**
Physical activity offered by the school to the students	.855	10.44	1	137	.002**
Family member whose having obesity	.995	.697	1	137	.405
Frequency of spending time in play activities/sports during the week by the students	.929	10.449	1	137	.002**

a. Cannot be computed because this variable is a constant.

* denote significant at 5% level.

** denote significant at 1% level.

Table 3 Box's Test of Equality of Covariance Matrices

Log Determinants		
Obesity	Rank	Log Determinant
Normal weight	4	-.652
Obese	4	-4.265
Pooled within-groups	4	-1.637

The ranks and natural logarithms of determinants printed are those of the group covariance matrices.

Test Results

Box's M		78.202
F	Approx.	7.567
	df1	10
	df2	76068.483
	Sig.	.000

Tests null hypothesis of equal population covariance matrices.

The covariance matrices of the discriminate variable differ significantly.

Table 4

Variables Entered / Removed^{a,b,c,d}

Step	Entered	Wilks' Lambda							
		Statistic	df1	df2	df3	Exact F			
						Statistic	df1	df2	Sig.
1	Frequency of having soft drinks per week by the students	.760	1	1	137.000	43.373	1	137.000	.000
2	Type of snacks consumed by the students in a day	.702	2	1	137.000	28.882	2	136.000	.000
3	Snacks taken by the students in between the food	.668	3	1	137.000	22.363	3	135.000	.000
4	students like to do exercise daily	.649	4	1	137.000	18.141	4	134.000	.000

At each step, the variable that minimizes the overall Wilks' Lambda is entered.

a. Maximum number of steps is 24.

b. Minimum partial F to enter is 3.84.

c. Maximum partial F to remove is 2.71.

d. F level, tolerance, or VIN insufficient for further computation.

Wilks' Lambda

Step	Number of Variables	Lambda	df1	df2	df3	Exact F			
						Statistic	df1	df2	Sig.
1	1	.760	1	1	137	43.373	1	137.000	.000
2	2	.702	2	1	137	28.882	2	136.000	.000
3	3	.668	3	1	137	22.363	3	135.000	.000
4	4	.649	4	1	137	18.141	4	134.000	.000

It is shows that the entire four explanatory variables are significant

Table 5
Standardized Canonical Discriminant Function Coefficients

	Function
	1
Type of snacks consumed by the students in a day	.353
Snacks taken by the students in between the food	-.373
Frequency of having soft drinks per week by the students	.617
students like to do exercise daily	.304

Structure Matrix

	Function
	1
Frequency of having soft drinks per week by the students	.765
Type of snacks consumed by the students in a day	.516
Snacks taken by the students in between the food	-.515
students like to do exercise daily	.507
Students feel their studies are stressful ^a	-.341
Frequency of eating habits by the students in a day ^a	.191
Transport used by the students to school ^a	.187
Frequency of spending time in play activities/sports during the week by the students ^a	-.161
Family member who is having obesity ^a	.114

Both the standardized discriminate coefficient function and structure matrix is consistent

Table 6
Canonical Discriminant Function Coefficients

	Function
	1
Type of snacks consumed by the students in a day	.253
Snacks taken by the students in between the food	-1.001
Frequency of having soft drinks per week by the students	.701
students like to do exercise daily	.290
(Constant)	-2.053

Un standardized coefficients

The discriminate function is,

$$Y = -2.053 + .253(\text{type of snack consumed}) + -1.001(\text{snack taken in between the meal}) + 0.701(\text{frequency of having soft drink}) + 0.290(\text{students like to do exercise}).$$

If the entire explanatory variable is known to predict, the discriminant function will give the score to classify them as obese and normal weight.

Table 7
Classification Results^a

		Predicted Group Membership		Total
		normal weight	Obese	
Original	Count	normal weight	21	138
		Obese	49	62
	%	normal weight	15.2	100.0
		Obese	79.0	100.0

a. 83.0% of original grouped cases correctly classified.

From the above table it is found that 85% of normal weight students are classified correctly and 79% of obesity students are classified correctly.

Findings of the study

- 54% of the respondents are boys and 46% of the respondents are girls.
- 38.5% of the respondents are underweight., 30.5% of the respondents are normal ,19.5% of the respondents are overweight and 11.5% of the respondents are obese.
- 32.5% of the respondents go to school by walking and 28.5% of the respondents use school transport.
- 74% of the respondents have snacks in between the meals.
- 81% of the students skip breakfast and food to school.
- 54.5% of the students take fast food once in the week.
- 38% of the students watch TV, play video games more than 2hrs in a day.
- 79% of the student’s family members have obesity
- 55% students strongly agree that to take baked foods ,salty, snacks or chips frequently.
- 32.5% strongly agree that they feel their studies are stressful and they have don’t have time to go to play daily.

Chi-square test

BMI Categories * Transport used by the students to school

H₀: There is no association between BMI and Transport used by the students to school.

H₁: There is association between BMI and Transport used by the students to school.

Table 8

Crosstab

		Transport used by the students to school					Total
		Bicycle	Walking	Own transport	Private transport	school transport	
BMI Categories	under weight	16	32	9	1	10	68
	Normal	9	19	10	2	21	61
	over weight	1	10	13	6	19	39
	obese	1	3	5	6	7	22
Total		27	64	37	14	57	200

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	44.420 ^a	12	.000
Likelihood Ratio	45.441	12	.000
Linear-by-Linear Association	10.140	1	.001
N of Valid Cases	199		

a. 5 cells (25.0%) have expected count less than 5. The minimum expected count is 1.55.

BMI Categories * Snacks taken by the students in between the meal

H₀: There is no association between BMI and Snacks taken by the students in between the meal.

H₁: There is association between BMI and Snacks taken by the students in between the meal.

Table 9

Crosstab

		Snacks taken by the students in between the meal		Total
		Yes	No	
BMI Categories	under weight	46	31	77
	Normal	42	19	61
	over weight	37	2	39
	Obese	22	0	22
Total		147	52	199

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	25.454 ^a	3	.000
Likelihood Ratio	33.364	3	.000
Linear-by-Linear Association	23.631	1	.000
N of Valid Cases	199		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.75.

BMI Categories * Frequency of spending time in outdoor play activities/sports during the week by the students

H₀: There is no association between BMI and Frequency of spending time in outdoor play activities/sports during the week by the students.

H₁: There is association between BMI and Frequency of spending time in outdoor play activities/sports during the week by the students.

Table 10
Crosstab

		Frequency of spending time in play activities/sports during the week by the students				Total
		Never	1-2times	3-4times	>5 times	
BMI Categories	under weight	5	33	21	18	77
	Normal	11	21	15	14	61
	over weight	10	15	11	3	39
	obese	8	10	2	2	22
Total		34	79	49	37	199

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20.074 ^a	9	.017
Likelihood Ratio	21.780	9	.010
Linear-by-Linear Association	13.572	1	.000
N of Valid Cases	199		

a. 2 cells (12.5%) have expected count less than 5. The minimum expected count is 3.76.

BMI Categories * obesity among family member of the students

H₀: There is no association between BMI and Obesity among family member of the students.

H₁: There is association between BMI and Obesity among family member of the students.

Table 11
Crosstab

		obesity among family member of the students		Total
		Yes	No	
BMI Categories	under weight	50	27	77
	Normal	47	14	61
	over weight	38	1	39
	Obese	22	0	22
Total		157	42	199

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.073 ^a	3	.000
Likelihood Ratio	30.321	3	.000
Linear-by-Linear Association	21.796	1	.000
N of Valid Cases	199		

a. 1 cells (12.5%) have expected count less than 5. The minimum expected count is 4.64.

From the above Tables 8,9,10 and 11, since chi-square value is significant, there is association between BMI categories and transport used by the students, Snacks taken by the students in between the meal, Frequency of spending time in outdoor play activities/sports during the week by the student and obesity among family members.

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