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Causes and Implications of Obesity in Urban School Going Children

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***Abstract*—**Obesity is an abnormal physical condition where an increased and undesirable fat accumulates in the human body. Obesity is an international phenomenon. In the present study, 12 schools were randomly selected from each district considering the areas i.e. Elite Private Schools in the private sector, Government schools in urban areas and Government schools in rural areas. Interviews were conducted with male students studying in grade 5 to grade 9 in each school. The sample size was 600 students; 300 from Faisalabad district and 300 from Rawalpindi district in Pakistan. A well-structured and pre-tested questionnaire was used for data collection. The calibrated scales were used to attain the heights and weights of the respondents. Obesity of school-going children depends on family types, family size, family history, junk food consumption, mother's education, weekly time spent in walking, and sports facility at school levels. Academic performance, physical health and psychological health of school going children are affected with obesity. Concrete steps and policies could minimize the incidence of obesity in children in Pakistan.

***Keywords*—**BMI, cardiovascular disease, fast food, morbidity and overweight.

I. Introduction

OBESITY has emerged as a real nutritional issue in South Asia and the Western world. Obesity is linked with morbidity and decreased life expectancy, which leads to the development of numerous other health symptoms like hypertension, hyperlipidemia and type II diabetes. All these health problems can be treated by reducing obesity. Obesity is inherited and also develops from eating patterns and sedentary life styles. It can be treated by applying changes in behaviors and attitudes, change in life styles, and regular physical activities. Obesity is the accumulation of undesirable fat in the tender body; this could be an alarm of future health problems. Overweight is an increase in body weight in comparison of age and height. Body Mass Index (BMI) is used as the scales for the achievement of acceptable and desirable weight bench marks throughout the world. BMI is derived when a person's weight in pounds is divided by the square of their height in inches and multiplied by a factor of 703 [1].

With regard to children, a delayed bedtime was associated with less sleep duration and this was resulting in a form of overweight and obesity in the children. Moreover, this was also making them dull and sluggish in routine life [2].

Ecological and genetic factors hugely affect the expression of obesity throughout the lives of people and each factor to the phenotype variance is yet to be explored by the researchers. Data on factors and determinants of obesity, other than the family history, needs to be searched out relating to cardio vascular diseases. Such data will allow people to better understand the importance of primary prevention which begins early in life including physical activities and dietary habits. It will also help policy makers to present ways for modification of health-related activities and policies addressing end users, providers, educational institutions, and communities [3].

Obesity is an outcome that has many attributes to it apart from physical activity, namely socioeconomic status, poverty, education, sedentary life style and neighborhood safety [4].

While studying the causes of obesity in children and adults, cultural, social, religious, and economic factors cannot be overruled with regard to food consumption. These factors become an obstacle in the interventional programs. It is imperative to deeply study these factors at middle school level that students come across individually and collectively to combat obesity [5].

Fruit and vegetable preferences were the significant predictors of the food groups' consumption, and they concluded that interventions that alter children's food preferences may be more effective than other strategies persuaded to date. However, to do this, we need information about the factors that influence children's food preferences [6], [15].

There is a positive linkage between the local food atmosphere and epidemic of childhood obesity at the local, regional and national level and this was also found to be positive after adjustment of individual and family factors [7].

Children who develop healthy food habits in their early life are quite likely to maintain these habits at their adulthood and will have very reduced chances of coming across chronic diseases like cardiovascular diseases, certain types of cancers, diabetes and osteoporosis [8].

Around 75% children between age 6-11 years have not developed the habit to intake a minimum of three times of vegetables or two servings of fruit in a day, and are not choosing healthy alternatives such as a veggie burger instead of a hamburger, carrot sticks instead of chips or a piece of fruit in place of juice. He further suggests that by taking a balanced and healthy diet, children and families can improve their physical and mental health. If families can improve their life style and eating patterns, it will be taken as a major step

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towards the eradication of the childhood obesity epidemic; however, this needs a consistent approach at parent's end [9].

The obesity rate in all age groups was higher in the USA than other countries. The underlying reasons for this increase is changing life styles, industrialization, sedentary behaviors, ecological conditions, people's cognitive perception, frequent junk food intakes, and lack of physical activities in all groups [10].

Fat increases in the body of people, especially in children, if they regularly have an intake of high-calorie carbonated drinks. Increase of fat in the body is not good, as it leads to obesity and ear-related diseases, which creates issues in hearing later on [11].

Children are overweight with regard to their ages and heights because they regularly consume saturated drinks and eat fried meats when they are out with their elders and parents [11].

Children take heavy meals that do not digest timely. Children think that soft drinks and junk-food items make their muscles stronger and better without taking into consideration it will take them towards eating disorder. They watch powder milk ads on TV and start taking it regularly considering it is healthier without realizing that these powders harm their health [11].

This study focused on exploring the factors associated with the obesity of children. The main objectives are:

- To explore socio-economic characteristics of the respondents,
- To explore the main factors and their association with respondents' obesity,
- To depict the reasons of obesity among school going children, and
- To suggest measures to overcome obesity among children.

II. Methodology

A cross-sectional research method was adopted to explore the objectives of the study. The study was conducted in two districts of Punjab, namely Faisalabad and Rawalpindi [14]. A total of 12 schools were selected randomly from each district considering the area i.e. Elite Private, Public and Rural Schools; that constituted a total of 24 schools for the study. Respondents were male students from grade 5 to grade 8 in each school. Total sample size was 600 respondents - 300 from Faisalabad district and 300 from Rawalpindi district. A sample of 25 respondents was carefully and randomly selected from each school to make a total sample size of 600 for the study. The data were collected through a well-structured (including open- and close-ended questions) pre-tested interviewing schedule. In addition, the height and weight of each student was measured using calibrated scales. Body Mass Index (BMI = weight (kg)/ height^2 (m^2) was calculated for each student. The obtained data for the study was analyzed by using descriptive statistics such as frequency distribution, mean and standard deviation for summarizing purpose; and inferential statistics such as Chi-square, Lambda Statistics and Pearson's Correlation were applied to find the association between independent and dependent variables. Multivariate analysis was used to find out the relative significance of independent variables in explaining and predicting dependent variable.

A. Body Mass Index (BMI)

Following are the two formulas for measuring obesity:

$$BMI = \frac{\text{Weight (kg)}}{\text{Height (m)2}} \text{ or } \frac{\text{Weight in Pounds} * 703}{(\text{Height in inches}) * (\text{Height in inches})}$$

Example: A 14 year old boy weighing 210 lbs and 65 inches tall would have a BMI of 34.94

$$(\text{BMI} = \{210/ (65)*(65)\}*703 = 34.94).$$

In adults (both for men and women), a BMI score greater than 30 represents obesity for all ages. For children, as they still have to grow, there is no global standard for determining childhood obesity. It is accepted to use age and sex specific BMI, or BMI-for-age, as a guide (Centers for Disease Control and Prevention, 2009) [1].

III. Results and Discussion

A. Univariate Analysis

TABLE I
Percentage Distribution of the Respondents According to Their School Class

Grade	Frequency	Percentage
5th	95	15.8
6th	126	21.0
7th	132	22.0
8th	209	34.8
9th	38	6.3
Total	**600**	**100.0**

Mean = 6.94, Std. Dev. = 1.20

The data presented in Table I reveals the distribution of respondents according to their grade at school. It was studies that 95 students (15.8%) were in 5th grade, 126 children respondents (21%) were in 6th grade, 132 respondents (22%) were studying in 7th grade, 209 respondents (34.8%) were in 8th grade and only 38 respondents (6.3%) were in 9th grade. Table data also indicates the mean grade 6.94 and standard deviation 1.20.

The weight of respondents was of great importance in the current study in order to determine the level of obesity among children. The current study was done on the level obesity of school going children. Table II indicates that respondents whose weight was in the category of up to 40 kg were 110 or 18.3%, while those in the range of 41-50 kg were 143 or 23.8 %. Respondents with weight in the range of 51-60 kg were the vast majority at 239 or 39.8%, while 108 respondents were recorded in the last category, with weight of more than 60 kg, representing 18% of the sample population. Mean weight came as 51.70 kg, which is an indicator of the average weight of the respondents included in the sample population and there could be variation of 11.33 kg as per as the standard deviation

calculated in this table. Results show that respondents who were obese had weight in the range of 51-60 kg with 39.8% of the sample population their strength was 239.

TABLE II
DISTRIBUTION OF THE RESPONDENTS ACCORDING TO THEIR WEIGHT

Weight (kg)	Frequency	Percentage
Up to 40	110	18.3
41-50	143	23.8
51-60	239	39.8
More than 60	108	18.0
Total	600	100.0

Mean = 51.70, Std. Dev. = 11.33

TABLE III
DISTRIBUTION OF THE RESPONDENTS ACCORDING TO THE ITEMS GENERALLY TAKEN IN BREAKFAST

Items Generally taken breakfast	Frequency	Percentage
Oil Loaf, Egg and Tea	300	50.0
Oven Bread, Egg, Tea and Lassi	78	13.0
Bread, Jam, Meat Patty and Tea	28	4.7
Oil Loaf and Tea	106	17.7
Bread and Curry	88	14.7
Total	600	100.0

Data presented in this table is more about the eating habits of the respondents with regard to daily breakfasts. Breakfast is a very crucial meal amongst all meals of the day as one needs the instant energy after a gap of many hours in order to work actively throughout the day. Heavy foods eaten at breakfast also have a negative effect on health. The data shown in the above table reveal that a very vast majority of 300 respondents used to take Oil Bread, egg and tea in the breakfast and they were 50%. Among the respondents, 78 (13%) consume oven bread, egg with tea or lassi at breakfast, while 28 respondents (4.7%) say they ate bread with jam or a meat patty with tea. 17.7% respondents were taking Oil Bread and tea in their breakfasts, 14.7% were taking bread and curry. Data indicates that 50.0% respondents were taking Oil Bread, egg and tea and 17.7% Oil Bread with tea, respectively.

TABLE IV
DISTRIBUTION OF THE RESPONDENTS ACCORDING TO THE JUNK/ FAST FOOD CONSUMPTION BY THEIR FAMILY N=600

Junk/ fast food consumption by Respondents' family	Frequency	Percentage
Daily	90	15.0
Alternate Day	156	26.0
Weekly	154	59.0
Never/ occasionally	200	100.0

Data reveals the junk foods habits of the respondents' families. From the total sample population of 600 respondents, 90 (15%) respondents indicated that their families used to consume junk food on a daily basis, while 156 (26%) respondents said they consumed junk food on alternate days with their families. A vast majority of 354 (59%) respondents confirmed that their families consume junk food on a weekly basis. Junk foods are full of fats, sugar and high levels of carbohydrates that are instrumental in the phenomena of obesity. Obesity becomes a leading factor in many chronic diseases like diabetes, high blood pressure, heart diseases and asthma at later levels of age.

TABLE V
DISTRIBUTION OF THE RESPONDENTS ACCORDING TO THEIR BMI

BMI	Frequency	Percentage
Normal (Less than 25)	233	38.8
Over weight (25.1 to 30)	99	16.5
Obese (More than 30)	268	44.7
Total	600	100.0
	Mean = 29.60, Std. Dev. = 10.16	

The data predicts that 38.8% of respondents' BMI was in normal range of ≤ 25; 16.5% have a BMI range ≥ 25, and ≥ 30. It further revealed that 44.7% children were obese as their BMI was ≥ 30; [12] BMI score greater than 30 is obesity for all age groups. In the study of [13], prevalence of obesity in adolescents in Pakistan was quite significant and it travels through the childhood period to adolescents and up to adulthood, and it might reach at some alarming figures in future if preventive measures are not taken by the policy makers. He related his research with some other study depicting prevalence of obesity in adolescents with a BMI greater than 25 was at 18% in Pakistan was similar with figures prevailing in the Western world [13].

TABLE VI
DISTRIBUTION OF RESPONDENTS BY TYPE OF JUNK FOOD CONSUMED

Junk Food consumed	Frequency	Percentage
Burger	227	37.8
Pizza	118	19.7
Noodles	68	11.3
Fried vegetable rolls (Pakoras)	76	12.7
Fried patties (Samosas)	69	11.5
Not consuming	42	7.07
Total	600	100.0

Table VI indicates that a large majority 227 (37.8%) of respondents consumed fast food in the form of burgers, while 118 (19.7%) respondents' families preferred to eat pizza, and 68 (11.3%) consumed fast food noodles,12.7% used to take fried vegetable rolls (pakoras). Fried patties (Samosas) were consumed by 11.5% and 7.07% were not consuming junk food items either. Burgers were the major junk food item, with 37.8% of respondents consuming them quite often.

B. Bivariate Analysis

Table IV explores the relationships of various independent variables with a dependent variable. Income was highly significant at the 1% level of significance. Values of chi-square is 16.72**, Gamma test 0.199**, and Pearson's Correlation Coefficient 0.135** show a highly positive relationship between family income and obesity in children.

The level of education of the respondent's mother was also found to be highly significant at the 1% of level of significance. The negative value of Gamma and Pearson's Correlation indicates the inverse relationship between mother's education and child obesity; the higher the education

level of the mother, the lower the incidence of obesity in the children and vice versa.

TABLE VII
THE VALUES OF CHI-SQUARE, GAMMA AND PEARSON'S CORRELATION COEFFICIENT OF DIFFERENT INDEPENDENT VARIABLES WITH DEPENDENT VARIABLE (OBESITY) FOR URBAN AREAS

Variables	Chi-square value	Gamma	Pearson correlation coefficients Value
Income	16.72**	0.199**	0.135**
Mother's education	56.39**	-0.479**	-0.367**
Family type	15.10**	0.343**	0.185**
Age	19.78**	0.043	-0.002
Family size	10.18*	0.205**	0.133**
Mode of travel	7.74*	-0.242**	-0.139**
Waist measurement	4.27NS	0.151 NS	0.114
School distance	24.67**	-0.367**	-0.244**
Sports facility in school	18.25**	-0.362**	-0.210**
Exercise habits	45.33**	-0.128*	-0.092
Eating patterns	7.61NS	0.166*	-0.118*
TV & Internet use	35.58**	0.374**	0.268**
Junk food consumption	110.2**	0.817**	0.498**
Mutton and beef intake	20.60**	0.453**	0.218**
Time spent on sport activity (weekly)	106.2**	-0.115*	-0.074
Time spent on walk (weekly)	16.70**	-0.259**	-0.177**
Family history	10.88**	0.239**	-0.142**

Dependent Variable: BMI, ** Significant at the 0.01 level, * Significant at the 0.05 level, NS = Non-significant

Family type was also found significant at the 1% level of significance, meaning high obesity in school-going children in nuclear family structure and less in joint family structure. The values of chi-square, Gamma Test and Pearson's Correlation Coefficient came to 15.10**, 0.343** and 0.185**, respectively, indicating that the relationship between family type and child obesity highly positive.

Family size was explored highly significant on 1% level of significant; indicating bigger the family size higher will be the children obesity and vise-versa.

Mode of traveling was also highly significant at the 1% level of significance as per the values of chi-square, Gamma test and Pearson's Correlation Coefficient presented in the table. Children going to school on foot were less obese as compared to those students who were driven to school in cars or by school bus. Similarly, children who rode their bikes to school were found to be of normal weight in comparison with those coming on public transports. This shows the highly inverse association between modes of traveling and child obesity as per the negative values of the Gamma test and Pearson's Correlation Coefficient.

School distance from home was found as highly significant at 1% level of significance; negative signs of Gamma and Pearson's Correlation indicate that there was an inverse relationship between school distance from home and obesity of the children. In case of sports facilities in schools, exercise habits of the respondents and eating pattern; all were significant at 1% of level of significance. Inversed relationships were observed among sports facilities at school, exercise habits and eating habits of the respondents. Better sports facilities at school had an inverse effect on child obesity – more sports facilities meant less BMI, while less playing facilities in school was resulting high obesity in children.

Similarly, more exercise habits resulted in lower levels of BMIs in children respondents and vice versa. Eating quality food resulted in lower levels of obesity and eating low quality foods showed negative impact on respondents' BMI.

Eating patterns, watching TV, Internet use, junk food and foods like mutton/ beef were also positively associated with obesity in the children and also had a positive relationship in effecting the response variable. Children with abnormal eating patterns were also found to be more obese. Children watching more TV and using the Internet for hours also had high BMIs. Children frequently eating junk foods and mutton/ beef had high levels of the obesity.

Weekly time spent in sports, weekly time spent in walking, and family history had a strong inverse relationship with BIM. All three independent variables were significant at 1% level of significance. Negative signs of Gamma and Pearson's Correlation Coefficient indicate the more time spent in sports will reduce the children obesity and lower down the BMI scores and vice versa. Similarly, more hours spent walking in a week by the children respondents was responsible for reducing obesity and vice versa, if walking hours less in a week. Family history is a very strong factor in exploring the BMI levels in the children. Medical science has proved that people carry certain heredity trends or diseases which are transferred to children through genes. In the study, this relationship was explored that was highly significant at 1% level of significance with an inverse relationship. Chi-square, Gamma test and Pearson's Coefficient values came as 10.88**, 0.239** and -0.142**

C. Multivariate Analysis

In this model, un-standardized coefficients like B values and standard errors, standardized coefficients like Beta values, t values and significance levels at 1% of the level of

significance of all independent variables are shown. Most important variables which have the highest importance in explaining the obesity of the children in urban areas are, Mother's education, family history, TV watching and Internet use, Junk food, weekly time spent in sports, playing facility at school and school distance. Beta values of Mother's education, family history, TV watching and Internet use, Junk food, weekly time spent in sports, playing facility at school and school distance were -0.451, -0.194, 0.217, 0.169, -0.182, -0.221 and -0.088, which indicate that all these socio-economic and demographic, physical, eating related and psychological related variables had greater significance in affecting the obesity of the children in urban areas.

TABLE VIII
RESULTS OF REGRESSION ANALYSIS: UN-STANDARDIZED, STANDARDIZED REGRESSION COEFFICIENT, AND LEVEL OF SIGNIFICANCE OF THE INDEPENDENT VARIABLES FOR URBAN AREAS N=400

Variables	Un-standardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
Monthly income	3.086E-6	0.000	0.031	0.463	0.644
Father's education level	-0.135	0.190	-0.055	-0.712	0.478
Mother's education level	-4.710	0.782	-0.451	-6.023	0.000
Age of respondent	-0.126	0.258	-0.029	-0.488	0.626
Family type	1.846	1.218	0.085	1.515	0.132
Family size	-2.004	1.062	-0.121	-1.887	0.061
Waist scores of respondents	0.779	0.556	0.076	1.403	0.162
School distance	-1.173	0.722	-0.088	-1.624	0.106
Sports facility at school	-5.899	1.765	-0.221	-3.342	0.001
Mode of travelling	-0.686	1.438	-0.031	-0.477	0.634
Weekly time spent in sports	-1.618	0.749	-0.182	-20.161	0.032
Weekly time spent in walking	-0.496	0.841	-0.041	-0.589	0.556
Sport exercise hours	0.674	0.808	0.073	0.835	0.405
TV & Internet	2.809	0.742	0.217	30.783	0.000
Eating pattern	0.355	0.972	0.023	0.365	0.715
Junk food	4.024	1.344	0.169	20.993	0.003
Mutton and beef taken	-1.306	1.860	-0.050	-0.702	0.483
Family history	-4.215	1.275	-0.194	-30.307	0.001

Dependent Variable: BMI

IV. IMPLICATIONS OF OBESITY IN SCHOOL GOING CHILDREN

A. Urban Areas

TABLE IX
IMPLICATIONS OF OBESITY (URBAN AREAS) PEARSON CORRELATION VALUES OF BMI WITH ACADEMIC, PHYSICAL AND PSYCHOLOGICAL IMPLICATIONS N=400

Variables	Pearson correlation coefficient values
Academic	-0.273**
Physical	-0.153*
Psychological	0.180*

Dependent variable: BMI

This analysis reveals that obesity has linkages with children's academic performance, physical health and psychological health. The Pearson's Correlation Coefficient values of academic, physical and psychological variables in overall model are -0.273**, -0.153* and 0.180* which depicts a a high inverse relationship between academic performance & obesity and physical health & obesity at a 1% level of significance. Higher obesity will result in low academic performance and vice versa. High levels of obesity result in the disturbed physical health of the children and vice versa. With regard to psychological health, the relationship is positive and significant at 1% level of significance; high obesity means more psychological issues, while less obesity will mean fewer psychological issues in children in the urban areas.

The summary of all models, combined, rural and urban reveals that obesity affects the academic performance and psychological health of children in all models; whereas it affects physical health in urban areas, it does not have an impact on the physical health of children in rural areas.

V. IMPLICATIONS OF OBESITY IN SCHOOL GOING CHILDREN

A. Academic Consequences

TABLE X
RESULTS OF REGRESSION ANALYSIS: UN-STANDARDIZED, STANDARDIZED REGRESSION COEFFICIENT, AND LEVEL OF SIGNIFICANCE OF THE ACADEMIC CONSEQUENCES FOR URBAN AREAS

	Un-standardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
Academic	0.543	0.136	0.273	3.987	0.000

Independent Variable: BMI, R^2 = 0.074 F-value = 15.896**

VI. IMPLICATIONS OF OBESITY IN SCHOOL GOING CHILDREN

A. Physical Consequences

TABLE XI
RESULTS OF REGRESSION ANALYSIS: UN-STANDARDIZED, STANDARDIZED REGRESSION COEFFICIENT, AND LEVEL OF SIGNIFICANCE OF THE PHYSICAL CONSEQUENCES FOR URBAN AREAS

Model	Un-standardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
Physical	-0.762	0.349	-0.153	-2.182	0.030

Independent Variable: BMI, R^2 = 0.019 F-value = 4.759**

VII. IMPLICATIONS OF OBESITY IN SCHOOL GOING CHILDREN

A. Psychological Consequences

TABLE XII
RESULTS OF REGRESSION ANALYSIS: UN-STANDARDIZED, STANDARDIZED REGRESSION COEFFICIENT, AND LEVEL OF SIGNIFICANCE OF THE PSYCHOLOGICAL CONSEQUENCES FOR URBAN AREAS

	Un-standardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
Psychological	0.291	0.113	0.180	2.581	0.011

Independent Variable: BMI, R^2 = 0.28 F-value = 6.660**

VIII. CONCLUSION

It was found that junk food and cold drinks, inappropriate playing facilities in school, playing on the Internet, watching TV and playing video games, school distance, mode of traveling, Mother's education, less physical activity and walking, as well as family history and family income, were all

factors affecting obesity in children in urban areas. It was also explored that obesity had social and psychological effects on children in urban areas. In urban schools, obese children tended to give low performance in academics due to laziness. Their physical health was also being affected; they felt fatigued and were less prone towards playing, walking and doing exercise. Obese children in urban schools also tended not to be active mentally, were used to being isolated, and ignored by fellow students and teachers, to hearing sarcastic comments from society, had a lack of confidence, and were less interactive with guests and friends, as well as were more shy and so on.

IX. Recommendations

In light of the findings of the present study, the following are recommendations are presented for future policy makers:

- Government should start a National Childhood Obesity Prevention Program and cascade it in all provinces, divisions, districts, tehsils and union councils. A separate dedicated management team should run this program and all reports should be shared with all stakeholders and general public.
- Schools and other educational institutions should come forward and start intervention programs and invite experts and consultants to teach children about healthy eating habits and physical activities.
- Media's role could be very pivotal for prevention of childhood obesity. Studies have shown that children adapt the things and habits which they see in the media. Thus, media should send social messages through advertisements which show the problems of obesity and chronic diseases it carries in the future lives of children. Media Can play a vital role in changing the food preferences of the children by arranging certain talk shows, panel discussion and general advertisements stating the repercussions of certain foods on their health. Media should periodically organize shows in which doctors and experts could tell the public about healthy life styles and eating habits.
- Maintaining strong physical education (PE) programs in schools that engage students in moderate to vigorous physical activity for at least 50% of PE class time.
- Awareness campaigns with regard to a balanced diet, increasing the literacy level, better socioeconomic conditions and enhanced physical activity on the part of people will help in bringing down the obesity epidemic among children in Pakistan.

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