

CHILDHOOD OBESITY AND ASSOCIATED FACTORS – AN ANALYSIS OF CNNS DATA IN INDIA

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Abstract

This study focusses on the “wealth effect of obesity” in Indian children aged 5-9 years in light of the growing epidemic of obesity amongst South-Asian countries. As India’s economy is growing, we are unfortunately moving towards unhealthy diet and lifestyle behavior. Also, the children of educated Indian mothers tend to be on the higher side of body mass index (BMI), as compared to those of less or uneducated mothers, as evident from the results of the study.

Keeping in mind the rate at which literacy and the percentage of Indians moving towards the higher quintiles is increasing, this issue is an alarming one for our country. As childhood obesity is associated with detrimental effects in adolescent and adult life, there is an urgent need to address this issue through interventional strategies like the use of the educational system (school-centered interventions), health promotion for better eating habits and family education, increased physical activity and community education, infrastructure to support a favorable built environment, and improved supervision of management programs to foster future planning.

5- 9 years of age is the time when children are young and can develop good habits that can last through their teenage as well as adulthood. Also, at this age as the dependency on the mother is more compared to the forthcoming years, interventions that involve parental involvement along with children can be an effective strategy, especially while viewing the scene through the lens of the fact that education of the mother has a significant effect on the BMI status of the child.

Introduction

Background:

The composite index of anthropometric failure (CIAF) has been studied using CNNS data, and the overall prevalence was found to be 48.2% among children under the age of five, with 6.0% of children having all three types of anthropometric failures (height-for-age, height-for-weight, and weight-for-age, calculated using the World Health Organization Multicenter Growth Reference Study). Children from the weakest socioeconomic groups and those living in urban areas had higher risks of developing CIAF, showing a direct correlation between the former and their socioeconomic situation. Children with high parity and underweight moms were more likely to have CIAF, but children exposed to mass media had a lower risk of developing the condition. (1)

Further evidence of the menace of obesity and overweight in South Asian nations comes from large regional and nationally representative data sets. Female gender, middle age, living in an urban area, having more education, and having a higher socioeconomic level were socioeconomic characteristics linked to greater obesity.

Greater attention is required due to the swift spread of the epidemic of obesity in nations of South Asia and the mounting body of research showing that people belonging to the Indian subcontinent have a higher peril of non-communicable diseases, such as diabetes mellitus type 2, stroke and coronary heart disease than people from Europe. To prevent such a health threat, later on, research on the problem's prevalence in children and the characteristics of its temporality will aid in its early treatment.

The prevalence figures in India are more complicated because several research has produced contradictory results. One study, for instance, found that men and women, respectively, had moderate obesity rates of 9.3% and 12.6%. In contrast, another study found that in the southern regions, overweight and obesity rates were 46.1% and 50.2%, respectively. In addition, a study conducted in six distinct regions of India revealed that obesity levels varied depending on whether a person lived in the country or the city, with slums having intermediate levels of obesity. Similar trends for abdominal obesity have been found. The complexity of India's difficulties with excess and inadequate nutrition was underlined in a review.

In addition to the variations in obesity prevalence according to subethnicity, region, religion, caste, and women's marital status, studies have demonstrated a relationship between the obesity epidemic and low birth weight, smoking, and tuberculosis in Indian babies.

If environmental factors have a substantial role in growing body weight, one should anticipate a lower prevalence of obesity in rural areas where people lead a traditional lifestyle. India is one country where this urban-rural divide has been noted. Studies, however, also imply that as rural areas grow more urbanized, the prevalence of obesity may rise there as well. As a result, a study examining the relationship between socioeconomic determinants and BMI is crucial in a nation like India where obesity is on the rise and the situation is dynamic. In order to develop long-term solutions, socioeconomic restrictions must be taken into consideration.

Food supply and accessibility have improved recently, which has coincided with an improvement in the standard of living in many nations. Technical and agricultural advancements have reduced undernourishment, but the increasing accessibility of foods high in energy may result in weight gain and eventually obesity. This change has happened quickly, especially in urban India, compared to many wealthy nations where the diet is high in carbs, where it has happened more gradually.

(2)

On the other hand, shedding light on undernutrition, research findings revealed that, according to the WHO categorization of severity malnutrition, UW and ST prevalence among children aged 1 to 12 belonging to the lowest socio-economic group was very high (30%). Studies on UW showed that the level was quite high and that it is utilized as a composite biomarker to represent both acute and chronic undernutrition. These rates surpass the UNICEF-reported rate of 47% for the general Indian population. Results from ST similarly showed that these kids had a very high degree of chronic undernourishment brought on by years of food insecurity. These results suggested that these kids had widespread, extremely poor nutritional experiences. (15)

According to a study on NFHS (2015–16), there is a negative correlation between the district's economic growth and child underweight and stunting. In India's least developed districts, it was revealed that there were more stunted and underweight children. According to the decomposition method, open defecation has a favorable impact on the disparity in stunting and underweight.

Inequality in undernutrition is also hastened by the mother's height, level of education, and access to clean water in a district. (16)

Chronic childhood malnutrition in India has been on the decline, but there are still concerns about how it disproportionately affects the poor. More so in the states where chronic malnutrition among children appears to indicate a lower prevalence, special attention on the socio-economic gradient of long-term nutritional status among children is necessary. (17)

The findings show that access to food and clean WASH procedures are crucial for improving children's nutritional results. Results indicate that illness bouts degrade children's nutritional health. The findings demonstrate that a child's nutritional status is significantly influenced by his or her mother's diet. Male children were found to have higher wasting rates, while younger children had much lower rates of stunting and were underweight. Additionally, the investigation revealed some regional variations in underweight, stunting, and wasting. The investigation also attempted to answer the query of whether being underweight, wasting, and stunting have any common determinants. It was discovered that various indicators, including food security, bathroom use, mothers' BMI status, and child age group, were frequently associated with being underweight and stunting. Stunting, being underweight, or any other factor did not predict wastage. (18)

Stunting rates decreased steadily between 1992 and 2005, according to studies on trends in childhood undernutrition, but the fall in underweight was higher between 1992 and 1998 than between 1998 and 2005. During a period of significant economic growth, social differences in children undernutrition in India either grew or remained the same. (20)

Review of Literature

The review of literature has been done through articles published covering topics on malnutrition of both kinds among Indian children, focusing on the age group of 5-9 years.

Previously published literature on CNNS data has also been reviewed along with international articles published on the ill effects of childhood obesity on adolescent and adult health and lifestyle.

The determinants of obesity from the literature review include :

Sex

Age (8)

Education

Occupation (9)

Sedentary lifestyle

Calorie-dense foods of low nutritional value (10): Sugary beverages, snack foods

Portion size

Activity level

Environmental factors (tv, media)

Socio-cultural factors: using food as a reward in our society

Family factors: food preferences of family members, family mealtimes, family habits, whether they are sedentary or physically active, single-parent status

Psychological factors: Depression and anxiety (11)

Socioeconomic status (12)

Urbanization and residence in metropolitan cities

School meal programs (13)

The determinants of these that are available from the CNNS data set include sex, place of residence, wealth index, religion, caste, mother's education, region, frequency of watching television and food habits and have been taken into account for the analysis.

Justification/Rationale for the study

An important public health issue in India is the high prevalence of pre-diabetes and diabetes among adolescents as they age, which highlights the importance of studying the BMI status and its trends in the population of children aged 5 to 9 years. Designing efficient strategies that are essential to

combating these disorders in children and adolescents will be made easier with knowledge of the predisposing factors causing these conditions. (4)

There have been international studies that demonstrate the alarming rates of obesity among Italian children through a cross-sectional study of kids between the ages of 6 and 8 to determine whether there is any correlation (if any) between certain socioeconomic and environmental factors and overweight/obesity. It was discovered that being overweight was positively correlated with being a man, as well as ethnicity, tobacco consumption, educational attainment, and occupation. This study demonstrated the necessity for the government to develop adequate obesity prevention programs, which should include educational measures regarding lifestyle for parents from the earliest stages of their child's life. The geographical area also played a role. (5)

The frequency of being underweight, on the other hand, has long been a problem in India and is among the highest in the world; it is about twice as high as in Sub-Saharan Africa, and the rate of improvement is slower than one might anticipate given India's economic progress. The inhabitants of the slums are a significant contributor to this issue. (19)

Though there have been studies that show a strong association between maternal and child undernutrition confirming the intergenerational linkage between the two, ours is the first to trace the linkage between the socioeconomic status of the family and the malnutrition of the child. (3)

While everyone may gain from economic prosperity, it appears that the wealth gap between the rich and the poor families has widened. Through an evidence-based strategy developed by studies tying socioeconomic determinants to undernutrition, it is critically necessary to address the high prevalence of undernutrition (even among socially advantaged groups) and the enduring social inequities. (20)

Why 5-9 years?

Food neophobia, or the dread of trying new foods, is the name given to a syndrome when a child's cognitive development enables the formation of a "concept" of food, food neophobia begins to manifest. The young toddler learns that unfamiliar meals can be either safe or harmful. The neophobic phase peaks between the ages of 2 and 5 years, perhaps as early as 2 or 3, and it then

gradually declines throughout childhood. As a result of exposure, peer pressure, and social/imitation learning, a child's preferences will alter throughout their entire childhood. Therefore, between the ages of 5 and 9 is the best period to intervene in a child's life to alter and establish eating preferences, as the “fear of trying new foods” accelerates its decline. (22)

Children who experience imbalances of just 100 kJ per day, or 2% of their entire daily energy flux, may later become obese. The capacity to eat more or less of a particular food depending on one's overall calorie intake and previous preloads is known as compensation ability. According to data from children aged 5 to 12, a child's capacity for compensating is influenced by their weight status, with heavier children being less capable of compensating than their leaner counterparts. (22)

Objectives

- To find the state-wise prevalence of obesity among Indian children aged 5-9 years.
- To find the association between the obesity of children and the socio-economic status of their families.

Methodology

Data:

The data from the Comprehensive National Nutrition Survey are used in this study (CNNS, 2016–18). For ages 0 to 19 years of children and adolescents, CNNS offers comprehensive information on nutritive status, anthropometric measurements, consumption of food, and levels of micronutrients. The study was the biggest micronutrient study ever conducted. The Ministry of Health and Family Welfare (MohFW), Government of India, oversaw the CNNS; UNICEF provided technical support, Over Field Coordination Training, and Population Council handled data analysis. The study used a sampling design targeted at multiple levels to gather information from 30 Indian states. Preschoolers (0–4 years), school-going children (5–9 years), and teenagers (10–19 years) were the three target groups whose data was collected. A total of 122,100 children and adolescents from the 2035 main sampling units made up the projected national-level sample size. The intended sample size for a home survey, anthropometric measurements, and biological samples was 20,350 people from each of the three age groups or 40,700 people in total. The overall response rate for one-on-one interviews was 95%; however, the response rates for the collection

of biological samples were only 63-64% across the three age groups. Access to a thorough explanation of household screening, the interviews, collection of data, tools utilised, and data treatment is available in the CNNS (2016–18) report. (21)

Problem statement:

The growing problem of obesity in children aged 5-9 years in India. India is undergoing an epidemiological transition from communicable diseases to non-communicable diseases. In the years to come, NCDs will become an epidemic. Obesity is one of the main causes of NCDs. Obese children usually grow into obese adults and thus it is important to explore obesity in children aged 5-9 years, which has never been explored earlier.

The definitions of overweight and obesity include abnormal or excessive fat accumulation that could harm one's health. Body mass index (BMI) is a straightforward measure of weight in relation to height that is frequently used to categorize adult overweight and obesity. It is determined by dividing the individual's weight in kilograms by the square of his or her height in meters (kg/m²). (1)

Overweight and obesity are defined as follows for children aged between 5–19 years:

- overweight is BMI-for-age greater than 1 standard deviation above the WHO Growth Reference median; and
 - obesity is greater than 2 standard deviations above the WHO Growth Reference median.
- (1)

Study setting :

In order to better understand the scope of micronutrient deficiencies, as well as the correlates and risk factors related to them, the Comprehensive National Nutrition Survey (CNNS) profiles children and adolescents (ages 0–19) in India. Researchers are gathering biomarkers and information on anemia and other micronutrient deficiencies in addition to looking at nutritional status, which is determined by anthropometric data such as height and weight. The study encompasses the understudied group of kids and teenagers between the ages of 5 and 14. It is a joint initiative between the Ministry of Health and Family Welfare and the United Nations

Children's Fund (UNICEF) (MoHFW). The survey is being carried out across 30 Indian states. (14)

Sample size:

36,798 (available data on 5-9 years children from CNNS Survey)

Outcome variables:

In this study, BMI is taken as the outcome variable for measuring malnutrition. BMI is used as a measuring pivot, ($<-3SD$ from normal) was taken as a very low BMI, ($<-2SD$) as a low BMI, ($>+1SD$) as a high BMI, and ($>+2SD$) as a very high BMI.

In children and adolescents, BMI is a crucial predictor of overweight and obesity. BMI is an effective indication of overweight and obesity when measures are performed carefully and compared with appropriate growth charts and suggested cutoffs. This indicator is sufficient for the majority of clinical, screening, and monitoring applications. (46) As a result, BMI has established itself as the standard measure of overweight and obesity. (47)

Predictor variables:

The socio-economic factors considered for performing the logistic regression include: Sex (Male, female), location (Urban, Rural), wealth index (Poorest, Poor, Middle, Rich and Richest), religion (Hindu, Muslim, Christian, Sikh and Others), caste (General, SC, ST, OBC and Others), mother's education (no education, < 5 years completed, 5–8 years completed, 9–11 years completed, ≥ 12 years completed), region (North, Central, East, West, South, North-East), hours of watching television, and food habits.

Statistical Analysis

The population was distributed in the five weight parameters to the BMI i.e. very low, low, healthy, high, and very high according to the socio-economic categories to see which category's subsets have more difference among the quintiles and which subset is the richest. (Table 1)

The food profiling was done to study the dietary habits of children in the five different wealth quintiles. (Table 2)

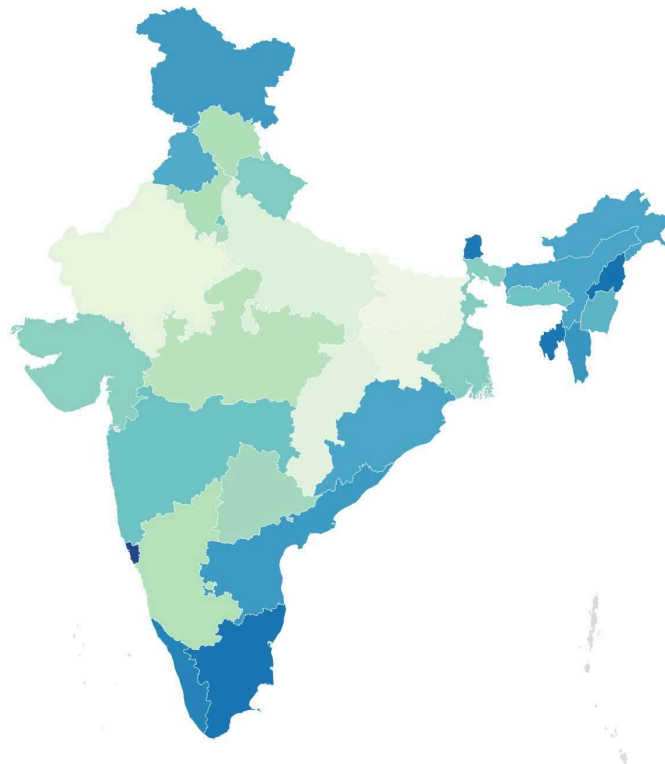
The association between obesity and socioeconomic variables was assessed using logistic regression to assess the odds of obesity in different background characteristics, i.e., the different socio-economic factors (Table 3). Two models of logistic regression were used (Model 1 and Model 2). Model 1 gives the crude association while Model 2 gives the adjusted association and hence is more reliable. According to the four socio-economic factors (region, religion, mother's education and place of residence), the population was distributed among the five wealth quintiles to check which subsect has more % of wealthy people. (Tables 4,5,6 and 7) Then, five different logistic regressions were performed for the five different wealth quintiles for the BMI and the socioeconomic factors to assess the correlates of obesity in the different wealth quintiles. (Table 8-12)

Results

Figure 1: shows the state-wise prevalence of obesity.

[State-wise prevalence of obesity(5-9 years)]

0.17 5.91



From the map, it is evident that the union territory of Goa (5.91) was at the top, followed by the north-eastern state of Nagaland (4.61). Tamil Nadu came next (4.52) followed by Tripura (4.46) and Sikkim(4.4). According to earlier research, some states, including Andhra Pradesh and Tamil Nadu, have a statistically higher risk of overweight/obesity than other states, such as Madhya Pradesh, Bihar, and Rajasthan, among urban males. (24) According to a survey conducted in the metropolitan districts of Udupi, South India, 10.8 percent and 6.2%, respectively, of schoolchildren are overweight or obese.(23)

Table 1: Distribution of the target population according to the socio-economic variables into the weight parameters (according to BMI)

	n (%)	VERY 3SD)	LOW	(<- LOW SD)	(<-2 HEALTHY	HIGH +1SD)	(> VERY +2SD)	HIGH	(> the weighted prevalence of obesity (%)	Chi- square P-value
Sex										
Male	19,253 (52.3)	6.55		26.22	69.49	4.29	1.88		1.88	0.00
Female	17,545 (47.7)	4.44		20.76	75.94	3.30	0.92		0.92	
Place of Residence										
Rural	20,184 (54.9)	5.51		24.49	72.88	2.63	0.94		0.94	0.00
Urban	16,614 (45.1)	5.46		20.39	72.09	7.52	2.89		2.89	
Wealth Index										
Poorest	2778 (7.5)	5.04			98.88	1.12	0.44		0.44	0.00
Poor	4296 (11.7)	6.81		24.48	73.77	1.75	0.79		0.79	
Middle	6821 (18.5)	5.77		26.87	70.17	2.96	0.84		0.84	
Rich	9772 (26.6)	5.51		25.18	70.31	4.51	1.49		1.49	
Richest	13131 (35.7)	4.34		22.70	68.54	8.76	3.49		3.49	
Religion										
Hindu	25326 (68.8)	5.55		23.61	72.82	3.57	1.33		1.33	0.00
Muslim	4868 (13.2)	5.53		24.44	71.89	3.67	1.17		1.17	
Christian	4591 (12.5)	5.57		20.74	71.56	7.70	2.78		2.78	
Sikh	701 (1.9)	2.34		13.33	78.76	7.91	3.94		3.94	
Other	1312 (3.6)	4.51		19.04	72.25	8.71	3.99		3.99	

Caste								
SC	6824 (20.1)	5.79	24.59	72.30	3.11	1.10	1.1	
ST	7376 (21.7)	6.08	25.48	71.46	3.06	1.33	1.33	
OBC	11567 (34.1)	5.19	23.27	73.12	3.61	1.33	1.33	0.00
Others	8171 (24.1)	5.01	19.97	74.17	5.86	2.24	2.24	
Mothers Education								
No education	9603 (26.2)	5.65	25.17	73.16	1.67	0.74	0.74	
< 5 years completed	2864 (7.8)	5.63	25.53	71.28	3.19	0.72	0.72	
5-7 years completed	5799 (15.8)	6.00	24.40	72.03	3.57	1.09	1.09	
8-9 years completed	6273 (17.1)	5.85	23.42	72.28	4.30	1.66	1.66	0.00
10-11 years completed	4762 (13.0)	4.02	19.77	74.12	6.11	2.21	2.21	
≥ 12 years	7371 (20.1)	5.00	18.33	71.90	9.77	3.73	3.73	
Region								
North	8380 (22.8)	4.19	19.85	76.22	3.93	1.28	1.28	
Central	4281 (11.6)	5.75	25.16	73.22	1.62	0.63	0.63	
East	5299 (14.4)	5.34	24.04	73.54	2.42	0.91	0.91	
West	4040 (11.0)	5.35	23.34	70.29	6.37	2.08	2.08	0.00
South	5761 (15.7)	6.38	23.07	69.65	7.28	2.95	2.95	
North-East	9037 (24.5)	6.20	21.43	70.37	8.20	3.13	3.13	
Frequency of watching television								
almost everyday	24390 (66.3)	5.20	22.32	71.85	5.83	2.07	2.07	
at least once a week	3258 (8.8)	5.09	22.83	73.63	3.54	1.59	1.59	0
less than once a week	1584 (4.3)	6.53	27.93	69.62	2.45	1.04	1.04	
not at all	7566 (20.6)	5.86	24.67	73.93	1.40	0.56	0.56	
Oil consumption								
Never	3096 (8.4)	6.96	23.35	71.46	5.19	3.09	3.09	
Occasionally	12062 (32.8)	5.75	24.08	72.13	3.79	2.04	2.04	0
3 to 5 day	1858 (5.0)	6.59	24.43	70.72	4.85	1.85	1.85	

frequently	19782 (53.8)	5.11	23.19	73.24	3.57	1.63	1.63	
Fruits								
Never	942 (2.6)	4.69	21.36	76.07	2.57	1.14	1.14	
Occasionally	24666 (67.0))	5.70	24.42	72.65	2.93	1.07	1.07	0
3 to 5 day	5169 (14.0)	5.01	20.07	72.79	7.14	2.75	2.75	
frequently	6021 (16.4)	4.62	20.21	72.02	7.77	2.78	2.78	
Veg/Non-Veg								
Non-Veg	30,725 (83.5)	5.74	24.10	71.93	3.97	1.47	1.47	0.001
Veg	6073(16.5)	4.65	21.44	75.34	3.22	1.19	1.19	

It was found that within the subjects – the place of residence, Region, Religion, wealth index, frequency of watching tv and Mother's Education a wide difference in Body Mass Index existed.

While 2.63% of the rural population was overweight, the urban population touched 7.52%. The numbers with a healthier BMI vary from 98.88% to 68.54% from the poorest to the richest., while the overweight and obese numbers demonstrate an increase from 1.12% to 8.76% and 0.44% to 3.49% in the range respectively from the poorest to the richest. Of the children belonging to the Hindu and Muslim communities, 3.57% and 3.67% are overweight, while of the children belonging to the Christian and Muslim communities, 7.70% and 7.91% have obesity. Among the children of mothers with no education, 0.74% were overweight and 3.73% were obese, with the children of mothers having attained an education of more than 12 years, 1.67% are overweight and 9.77% are obese. The Central region has the lowest prevalence of overweight and obese population (1.62% and 0.63%), while the Northeast region shows the maximum prevalence (8.20% and 3.12%). The South Indian children have lesser healthy BMIs (69.65%) than the North Indian children (76.22%). The frequency of watching television shows the difference in the range of the overweight segment from 1.40% (not at all watching) to 5.83% (for those watching television almost daily). The children eating fruits daily have a prevalence of 7.77% of overweight ones

while those never eating fruits have a prevalence of 2.57%. Contrasting the conventional locus of thought, 72.20% of the children eating fruits daily have a healthy BMI, which is less as compared to 76.07% which is for children who rarely ate fruits.

Studies have indicated that the mean hours of television viewing reported in evaluations were strongly associated with BMI and the prevalence of overweight in children of all ages up to 5 years, indicating that time spent watching television is a significant predictor of BMI and overweight in children. (29)

International studies have also included younger, preschool-aged children in their analysis of the relationship between watching TV and the likelihood of being overweight. Even more strongly indicative of a child's higher risk of obesity is a TV in their bedroom. (30)

Children from socioeconomically better-off households have greater access to eating fruits than those from socioeconomically low households, according to literature findings that children who lived in low poverty neighborhoods ate more fruit and vegetable servings per day than children who lived in high poverty neighborhoods. (31)

Table-2: Food profiling for different wealth quintiles

Wealth Index for India	Number of days in a week does child consume: Cereals				Total
	never	occasionally	3 to 5 da	frequently	
Poorest	0.68	5.36	1.30	92.66	100.00
Poor	0.95	6.94	2.42	89.69	100.00
Middle	1.57	9.66	4.41	84.36	100.00
Rich	2.19	12.13	6.46	79.23	100.00
Richest	1.96	11.57	6.33	80.14	100.00
Total	1.74	10.35	5.17	82.74	100.00

Wealth Index for India	Number of days in a week does child consume: Milk or milk products				Total
	never	occasionally	3 to 5 da	frequently	
Poorest	11.81	62.02	3.17	23.00	100.00
Poor	11.80	52.72	4.28	31.19	100.00
Middle	9.85	44.41	5.79	39.95	100.00
Rich	6.10	31.45	7.23	55.22	100.00
Richest	3.36	17.88	6.13	72.63	100.00
Total	6.91	33.80	5.92	53.36	100.00

Wealth Index for India	Number of days in a week does child consume: Pulses or beans				Total
	never	occasionally	3 to 5 da	frequently	
Poorest	1.40	52.52	26.49	19.58	100.00
Poor	1.33	48.37	28.00	22.30	100.00
Middle	1.95	45.48	28.22	24.35	100.00
Rich	2.17	42.06	28.50	27.27	100.00
Richest	1.29	39.39	30.93	28.38	100.00
Total	1.66	43.27	29.11	25.97	100.00

Wealth Index for India	Number of days in a week does child consume: Green leafy vegetables				Total
	never	occasionally	3 to 5 da	frequently	
Poorest	1.58	54.61	23.79	20.01	100.00
Poor	1.42	50.98	26.28	21.32	100.00
Middle	2.52	48.09	27.69	21.70	100.00
Rich	3.88	46.47	27.45	22.21	100.00
Richest	4.38	45.08	27.38	23.17	100.00
Total	3.35	47.41	27.06	22.19	100.00

Wealth Index for India	Number of days in a week does child consume: Roots and tubers				Total
	never	occasionally	3 to 5 da	frequently	
Poorest	2.12	44.24	19.58	34.05	100.00
Poor	3.45	47.95	20.11	28.49	100.00
Middle	4.03	52.65	18.84	24.48	100.00
Rich	4.29	54.76	19.58	21.38	100.00
Richest	3.90	53.67	23.81	18.63	100.00
Total	3.84	52.39	21.01	22.76	100.00

Wealth Index for India	Number of days in a week does child consume: Other vegetables				Total
	never	occasionally	3 to 5 da	frequently	
Poorest	1.98	58.24	23.07	16.70	100.00
Poor	1.98	52.12	26.19	19.72	100.00
Middle	2.80	50.87	26.54	19.79	100.00
Rich	3.28	49.79	26.68	20.25	100.00
Richest	2.64	48.54	26.53	22.29	100.00
Total	2.71	50.45	26.27	20.56	100.00

Wealth Index for India	Number of days in a week does child consume: Fruits				Total
	never	occasionally	3 to 5 da	frequently	
Poorest	5.29	87.62	3.56	3.53	100.00
Poor	4.63	85.64	5.63	4.10	100.00
Middle	3.89	81.37	9.37	5.38	100.00
Rich	2.03	70.53	15.35	12.10	100.00
Richest	1.01	46.54	20.48	31.97	100.00
Total	2.56	67.03	14.05	16.36	100.00

Wealth Index for India	Number of days in a week does child consume: Eggs				Total
	never	occasionally	3 to 5 da	frequently	
Poorest	18.50	75.99	4.82	0.68	100.00
Poor	15.67	76.40	6.66	1.28	100.00
Middle	15.01	71.92	10.06	3.01	100.00
Rich	17.14	63.32	13.59	5.95	100.00
Richest	24.29	50.45	16.03	9.23	100.00
Total	19.23	62.81	12.33	5.63	100.00

Wealth Index for India	Number of days in a week does child consume: Fish				Total
	never	occasionally	3 to 5 da	frequently	
Poorest	19.94	75.52	3.31	1.22	100.00
Poor	20.51	72.21	5.68	1.61	100.00
Middle	22.56	67.29	7.64	2.51	100.00
Rich	27.04	61.42	8.26	3.28	100.00
Richest	36.18	49.30	8.92	5.60	100.00
Total	28.17	60.51	7.70	3.61	100.00

Wealth Index for India	Number of days in a week does child consume: Chicken or muton				Total
	never	occasionally	3 to 5 da	frequently	
Poorest	18.29	79.70	1.69	0.32	100.00
Poor	17.27	79.19	2.96	0.58	100.00
Middle	16.63	78.46	4.12	0.79	100.00
Rich	20.28	71.21	6.93	1.58	100.00
Richest	29.26	61.42	7.26	2.06	100.00
Total	22.31	70.63	5.67	1.39	100.00

Wealth Index for India	Number of days in a week does child consume: Nuts and oils				
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	never	occasionally	3 to 5 da	frequently	Total
Poorest	19.62	75.52	1.51	3.35	100.00
Poor	19.81	74.88	2.09	3.21	100.00
Middle	18.21	74.26	3.28	4.25	100.00
Rich	16.76	72.55	4.95	5.73	100.00
Richest	12.54	68.81	6.79	11.85	100.00
Total	16.10	72.03	4.71	7.17	100.00

Wealth Index for India Number of days in a week does child consume: Fats and oils

	never	occasionally	3 to 5 da	frequently	Total
Poorest	7.78	39.81	3.35	49.06	100.00
Poor	9.33	38.18	4.28	48.21	100.00
Middle	9.84	36.50	5.50	48.16	100.00
Rich	9.37	32.47	5.77	52.38	100.00
Richest	6.79	27.82	4.89	60.50	100.00
Total	8.41	32.78	5.05	53.76	100.00

Wealth Index for India Number of days in a week does child consume: Sugar and jaggery

	never	occasionally	3 to 5 da	frequently	Total
Poorest	2.63	39.74	6.37	51.26	100.00
Poor	2.68	30.98	6.61	59.73	100.00
Middle	2.23	24.85	6.39	66.53	100.00
Rich	2.60	18.80	5.57	73.04	100.00
Richest	1.86	12.78	4.06	81.30	100.00
Total	2.28	20.78	5.36	71.58	100.00

Wealth Index for India Number of days in a week does child consume: Fried foods

	never	occasionally	3 to 5 da	frequently	Total
Poorest	6.30	88.37	3.17	2.16	100.00
Poor	7.84	85.82	3.70	2.63	100.00
Middle	7.21	83.36	6.05	3.37	100.00
Rich	5.32	82.62	7.45	4.60	100.00
Richest	3.43	82.23	9.57	4.76	100.00
Total	5.37	83.43	7.19	4.02	100.00

Wealth Index for India	Number of days in a week does child consume: Junk food				Total
	never	occasionally	3 to 5 da	frequently	
Poorest	34.95	63.32	1.15	0.58	100.00
Poor	32.22	65.25	1.79	0.74	100.00
Middle	26.39	68.52	3.42	1.67	100.00
Rich	21.19	70.84	5.73	2.24	100.00
Richest	15.22	75.81	6.25	2.72	100.00
Total	22.35	70.96	4.68	2.01	100.00

Wealth Index for India	Number of days in a week does child consume: Sweets				Total
	never	occasionally	3 to 5 da	frequently	
Poorest	10.40	87.08	1.33	1.19	100.00
Poor	11.45	85.13	1.86	1.56	100.00
Middle	9.57	84.24	3.78	2.40	100.00
Rich	7.10	84.26	5.15	3.49	100.00
Richest	4.52	84.24	6.58	4.66	100.00
Total	7.40	84.56	4.73	3.31	100.00

Wealth Index for India	Number of days in a week does child consume: Aerated drinks				Total
	never	occasionally	3 to 5 da	frequently	
Poorest	24.26	74.95	0.50	0.29	100.00
Poor	21.55	77.44	0.65	0.35	100.00
Middle	19.18	78.46	1.39	0.97	100.00
Rich	15.37	80.11	2.93	1.60	100.00
Richest	12.54	81.00	4.06	2.40	100.00
Total	16.46	79.42	2.60	1.52	100.00

It can be seen that the majority of the children in the poorest quintile consumed milk occasionally (62.02%) while majority of the children in the richest quintile consumed milk frequently (72.63%). Children of the poorest quintile that consumed roots and tubers frequently were 34.05% while only 18.63% of the richest quintile consume these frequently. Occasional consumption of fruits was seen among majority of the children of the poorest quintile (87.62%) while almost its half number (46.54%) of the richest children consume fruits occasionally. The frequent consumption of fruits was at 31.97% for the richest quintile children while for the poorest quintile children it was just 3.53%. The egg consumption was occasional for 75.99% of the children of the poorest quintile while for the richest quintile it was 50.45%. A small percentage (4.82%) of the poorest quintile

children consumed eggs three to five days while 16.03% of the richest quintile children consumed the same. The occasional fish consumption differed from 75.52% amongst the poorest to 49.30% amongst the richest. Frequent sugar or jaggery consumption was found amongst 81.30% children of the richest quintile families while for the poorest quintile family's children it was 51.26%. Children of the poorest quintile that never ate junk food were 34.95% while it the number was just 15.22% for the richest quintile children.

Table – 3: Socio-economic factors affecting obesity in India

	Model-1		Model-2	
	Odds Ratio	95% CI	Adj. Odds Ratio	95% CI
Sex				
Male	1.00	-	1.00	-
Female	0.55***	0.48 - 0.63	0.54***	0.47 - 0.62
Place of Residence				
Rural	1.00	-	1.00	-
Urban	2.39***	2.02 - 2.82	1.45***	1.22 - 1.71
Wealth Index				
Poorest	1.00	-	1.00	-
Poor	1.92*	1.08 - 3.39	1.59ns	0.89 - 2.83
Middle	2.41***	1.40 - 4.14	1.73ns	0.99 - 3.03
Rich	3.38***	1.98 - 5.78	2.07*	1.17 - 3.66
Richest	7.78***	4.62 - 13.12	3.94***	2.21 - 7.00
Religion				
Hindu	1.00	-	1.00	-
Muslim	0.79*	0.62 - 0.99	0.84ns	0.67 - 1.06
Christian	1.46***	1.18 - 1.78	1.07ns	0.83 - 1.39
Sikh	1.41ns	0.92 - 2.16	1.57*	1.01 - 2.42
Other	1.03ns	0.72 - 1.47	0.73ns	0.50 - 1.07
Caste				
General	1.00	-	1.00	-
SC	0.45***	0.36 - 0.55	0.60***	0.48 - 0.75
ST	0.68***	0.55 - 0.84	0.76ns	0.58 - 1.01
OBC	0.60***	0.50 - 0.71	0.70***	0.59 - 0.83
Mothers Education				
No education	1.00	-	1.00	-
< 5 years completed	1.60***	1.15 - 2.23	1.13ns	0.82 - 1.57
5-7 years completed	1.44**	1.11 - 1.87	0.99ns	0.77 - 1.30
8-9 years completed	1.99***	1.56 - 2.52	1.16ns	0.90 - 1.48
10-11 years completed	3.04***	2.40 - 3.86	1.46***	1.14 - 1.88
≥ 12 years	4.45***	3.57 - 5.54	1.87***	1.47 - 2.39
Region				
North	1.00	-	1.00	-
Central	0.33***	0.21 - 0.52	0.67**	0.36 - 0.88
East	1.22ns	0.91 - 1.63	1.81***	1.33 - 2.46
West	1.42*	1.09 - 1.86	1.45**	1.11 - 1.91
South	1.49***	1.18 - 1.89	1.35*	1.05 - 1.73
North-East	1.68***	1.34 - 2.10	2.15***	1.62 - 2.86
Frequency of watching television				

almost everyday	1.00	-	1.00	-
at least once a week	0.75*	0.59 - 0.95	1.03ns	0.80 - 1.31
less than once a week	0.76ns	0.54 - 1.08	1.35ns	0.96 - 1.91
not at all	0.34***	0.26 - 0.44	0.82ns	0.63 - 1.06
Oil consumption				
Never	1.00	-	1.00	-
Occasionally	0.87ns	0.70 - 1.09	0.89ns	0.72 - 1.12
3 to 5 day	0.93ns	0.66 - 1.30	0.76ns	0.54 - 1.07
frequently	0.66***	0.53 - 0.83	0.68**	0.54 - 0.85
Fruits				
Never	1.00	-	1.00	-
Occasionally	0.65ns	0.43 - 0.98	0.64*	0.42 - 0.98
3 to 5 day	1.20ns	0.78 - 1.85	0.79ns	0.50 - 1.23
frequently	1.34ns	0.88 - 2.06	0.78ns	0.50 - 1.22
Veg/Non-Veg				
Non-Veg	1.00	-	1.00	-
Veg	0.75**	0.62 - 0.90	0.88ns	0.71 - 1.07

From this analysis, it can be seen that components of sex, place of residence, wealth index, religion (Sikh), caste, region and mother's education show increased odds of high BMI in children aged 5-9. While females have shown decreased odds, the urban population has increased odds.

The odds of high BMI also increase towards higher wealth quintiles and decreases for the SC and OBC population. The Northeast region shows higher odds as well, followed by the east, west and south. Children of mothers with 10 years and more education and those belonging to the Sikh faith show increased odds for high BMI.

Boys were more likely to be overweight and obese generally in earlier research than girls were. It was also discovered that considerably more boys than girls were overweight in a study of 1000 teenagers from Punjab. This is probably because boys in Indian families receive preferential care. (32)

According to previous studies, urban Indian kids between the ages of 8 and 18 had a significant prevalence of overweight, obesity, and abdominal obesity compared to rural children, and children from high socioeconomic status backgrounds who live in urban areas are more likely to develop obesity. (34)

In developing countries, youngsters from wealthy families who attend private schools are much more likely to be overweight and obese than children from lower socioeconomic backgrounds.

When compared to nonmetropolitan cities in India and other emerging nations, metropolitan cities have very different lifestyles, vocational compositions, food patterns, and outlooks. Metropolitan cities are valuable targets for the majority of global fast-food corporations due to urban youth's interest Western-style eateries and their willingness to pay for these services. A research study done on 859 students from a nearby rural area and 2467 students from a North Indian metropolitan area, discovered that the prevalence of overweight (BMI = 25–30 kg/m²) was much greater in the urban area (11.6% in the urban area vs. 4.7% in the rural area). (25)

High caste has been linked to a higher BMI and a higher likelihood of obesity, according to the literature. A decreased risk of obesity was shown to be associated with low caste, including SC, ST, and other backward castes (OBC), while a higher frequency of overweight and obesity was found to be associated with higher caste persons. (33)

According to a study, children in non-parental care whose moms had a college diploma or above would have a 1.4%-1.8% higher risk of obesity at the same ages. But it was also found that spending a year in a non-parental childcare setting reduced the incidence of obesity among kids whose moms had fewer than 12 years of schooling by 1.4% to 1.9% from the ages of 2 to 18. (26)

Table 4: Region-wise distribution of respondents and Wealth Index

Regions of India	Wealth Index for India					
	Poorest	Poor	Middle	Rich	Richest	Total
North	2.71	5.82	12.86	24.95	53.65	100.00
Central	21.98	19.67	19.79	19.01	19.55	100.00
East	18.98	21.04	21.40	20.55	18.02	100.00
West	2.18	5.69	13.44	30.69	48.00	100.00
South	2.01	6.96	15.99	28.75	46.29	100.00
North-East	4.43	13.50	25.43	31.89	24.75	100.00
Total	7.55	11.67	18.54	26.56	35.68	100.00

According to the region, the North region has a major population that falls under the last two wealth quintiles, followed by the West region.

Table 5: Religion-wise distribution of respondents and Wealth Index

Religion of the mother	Wealth Index for India					
	Poorest	Poor	Middle	Rich	Richest	Total
Hindu	8.81	11.58	17.59	25.93	36.09	100.00
Muslim	5.55	12.55	20.25	27.83	33.81	100.00
Christian	3.33	13.07	24.29	28.34	30.97	100.00

Sikh	0.00	0.57	6.99	18.69	73.75	100.00
Others	9.45	11.28	16.54	31.78	30.95	100.00
Total	7.55	11.67	18.54	26.56	35.68	100.00

According to religion, the Sikh religion has the majority of its population that falls under the last two wealth quintiles.

The Indian National Demographic and Health Survey indicates that 59.6% of Sikhs belong to the wealthy class. In India's Punjab State, there is a concentration of Sikhs. The Punjab region, which is squeezed between three rivers, is particularly fertile. The Sikh community is extremely rich in part because of the strong soil and high agricultural production. Roughly 80 lakh Sikhs are living outside of India, mostly in Canada. The assets of the Sikh religion are also increased by these NRIs (Non-Resident Indians). (27)

Table 6: Mother's Education-wise distribution of respondents and Wealth Index

What is the highest education completed by the mother?	Poorest	Poor	Middle	Rich	Richest	Total
No education	21.91	23.99	25.26	20.36	8.48	100.00
< 5 years completed	7.86	19.55	29.22	29.47	13.90	100.00
5-7 years completed	4.54	13.24	24.59	34.70	22.93	100.00
8-9 years completed	2.02	7.11	20.79	36.06	34.02	100.00
10-11 years completed	0.69	2.81	10.84	30.34	55.31	100.00
>12 years	0.31	0.96	3.72	16.65	78.36	100.00
Total	7.57	11.68	18.50	26.57	35.68	100.00

According to the mother's education, the education of more than 12 years segment has the majority of the population that falls under the last two wealth quintiles., followed by the 10-11 years of education completed.

A study that used data from the India Demographic and Health Surveys to investigate if educated Indians had wealthier lives (IND-DHS). The use of IND-DHS data in regression analysis. Indian education serves as the explanation. The Indian wealth index is the outcome. Our research, which is limited to India, adds to the body of knowledge about the relationship between wealth and education in India. Indians with greater education are wealthier than Indians with less education, the study finds. (28)

Table 7: Residence-wise distribution of respondents and Wealth Index

Type of area	Wealth Index for India					
	Poorest	Poor	Middle	Rich	Richest	Total
rural	12.39	18.53	24.62	24.43	20.03	100.00
urban	1.67	3.35	11.15	29.14	54.70	100.00
Total	7.55	11.67	18.54	26.56	35.68	100.00

According to the place of residence, the urban area of residence has the majority of its population that falls under the last two wealth quintiles.

According to detailed study findings, rural families' consumption growth rate has outpaced that of the urban area. In light of the current discrepancy in the levels between them, this is not very implausible. The findings demonstrate that the high marginal rate of savings is still the only thing determining the level of debt in urban families' total rate of household savings despite a nearly doubling of rural income. The greater marginal propensity to consume has completely consumed it. Thus, the rural household saving rate persisted at the low level of just over 2% while urban savings rose to 25% in the last few years. (35)

Table 8: Poorest quintile on wealth Index, socio-economic factors and BMI

overweight	Odds Ratio	Std. Err.	z	P> z	[95% Conf. Interval]	
Sex:						
male(B)						
female	0.6660767	0.2217052	-1.22	0.222	0.3468964	1.278935
Area:						
Rural(B)						

urban	2.509057	1.253718	1.84	0.066	0.9422906	6.680918
Region: North(B)						
Central	0.7583869	0.4860654	-0.43	0.666	0.2159428	2.66344
East	0.2291136	0.1976432	-1.71	0.088	0.0422443	1.242607
West	1.203241	1.216338	0.18	0.855	0.1659149	8.72609
South	3.998877	3.421119	1.62	0.105	0.747684	21.3874
North-East	6.071291	4.559601	2.40	0.016	1.393221	26.45709
Religion: Hindu(B)						
Muslim	8.44305	4.972262	3.62	0.000	2.662022	26.77855
Christian	1.682074	0.9253537	0.95	0.345	0.5722377	4.944402
Sikh						
Others	0.7807147	0.688525	-0.28	0.779	0.138613	4.397246
Caste General(B)						
scheduled caste	0.5545554	0.4787798	-0.68	0.495	0.1021065	3.011872
scheduled tribe	2.912996	2.064582	1.51	0.131	0.7261928	11.68498
other backward class	1.428163	0.9677874	0.53	0.599	0.3784123	5.390018
Mother's education No education(B)						
< 5 years completed	0.7382356	0.4451573	-0.50	0.615	0.2264222	2.406971
5-7 years completed	2.143415	0.9519666	1.72	0.086	0.8975475	5.118645
8-9 years completed	2.730076	1.627095	1.69	0.092	0.8489227	8.779733
10-11 years completed	0.5953192	0.7507903	-0.41	0.681	0.0502634	7.050952
>12 years	3.071892	3.229132	1.07	0.286	0.3914119	24.10892
Cereal never(B)						
occasionally	0.0787614	0.0762921	-2.62	0.009	0.0117977	0.5258098
3 to 5 days	0.03875	0.0473698	-2.66	0.008	0.0035296	0.4254212
frequently	0.051006	0.043073	-3.52	0.000	0.0097456	0.2669527
Milk never(B)						
occasionally	2.98874	1.932468	1.69	0.090	0.8416197	10.61354
3 to 5 days	0.9696558	1.272664	-0.02	0.981	0.0740327	12.70022
frequently	2.360669	1.765824	1.15	0.251	0.5449045	10.22703
Pulses Never(B)						
occasionally	0.5605354	0.4829516	-0.67	0.502	0.1035658	3.033819
3 to 5 days	0.7872772	0.7171997	-0.26	0.793	0.1320364	4.694201
frequently	0.7717891	0.7358823	-0.27	0.786	0.1190964	5.001483
Vegetables: Never(B)						
never	1	(empty)				
occasionally	1.119707	0.5162452	0.25	0.806	0.4535809	2.764102
3 to 5 days	1.01035	0.5172654	0.02	0.984	0.3704121	2.755869
frequently	1	(omitted)				

Eggs:						
Never(B)						
occasionally	0.5722601	0.3782791	-0.84	0.398	0.1566487	2.090548
3 to 5 days	0.2747838	0.3055673	-1.16	0.245	0.0310764	2.429692
frequently	1.697642	2.565351	0.35	0.726	0.0878161	32.81848
Fruits:						
Never(B)						
occasionally	1.118053	0.9183128	0.14	0.892	0.2235259	5.592381
3 to 5 days	0.5857989	0.6183954	-0.51	0.612	0.0739916	4.637829
frequently	2.899388	3.188457	0.97	0.333	0.3359232	25.02491
Non-veg:						
Never(B)						
occasionally	0.5077399	0.3518604	-0.98	0.328	0.1305462	1.974779
3 to 5 days	2.678732	2.514899	1.05	0.294	0.4253904	16.86828
frequently	1	(empty)				
Fat/oil:						
Never(B)						
occasionally	0.5709835	0.3903361	-0.82	0.412	0.1495287	2.180331
3 to 5 days	1.024688	0.8393835	0.03	0.976	0.2057412	5.103428
frequently	0.9384137	0.6275576	-0.10	0.924	0.2530225	3.480402
Sugar/jaggery:						
Never(B)						
occasionally	0.4204441	0.3222543	-1.13	0.258	0.0936041	1.88852
3 to 5 days	0.6153395	0.5676427	-0.53	0.599	0.1009003	3.752642
frequently	0.5021169	0.3867715	-0.89	0.371	0.1109532	2.272322
Fried:						
Never(B)						
occasionally	2.610898	1.970859	1.27	0.204	0.5946383	11.46375
3 to 5 days	5.286472	5.752861	1.53	0.126	0.6264246	44.61317
frequently	1	(empty)				
Junk:						
Never(B)						
occasionally	1.501523	0.6504582	0.94	0.348	0.6423802	3.509713
3 to 5 days	1.546319	2.081029	0.32	0.746	0.1106003	21.61932
frequently	1	(empty)				
Sweets:						
Never(B)						
occasionally	1.616576	0.9386213	0.83	0.408	0.5180463	5.044561
3 to 5 days	1.210561	1.607499	0.14	0.886	0.0896767	16.34157
frequently	1	(empty)				
Fizzy drinks:						
Never(B)						
occasionally	0.3654328	0.1633672	-2.25	0.024	0.1521517	0.8776841
3 to 5 days	1	(empty)				
frequently	1	(empty)				
_cons	0.1438759	0.2310181	-1.21	0.227	0.0061835	3.347666
_cons estimates baseline odds.						

From this analysis results, it can be concluded that among the wealth quintile 1 (poorest) population, urban children have more than twice the odds of having high BMI as compared to rural children, which is backed by evidence from previously published literature, in which it was found that urban Indian kids between the ages of 8 and 18 had a significant prevalence of overweight, obesity, and abdominal obesity compared to rural children and that children from high SES (socio-economic status) backgrounds who live in urban areas are more likely to develop obesity. (34)

The East Indian population has decreased odds of high BMI, while the Northeast region has more than 6 times the odds. Published literature provides evidence that OSC (Overweight and Stunted Child), which appeared to occur most frequently in the North-Eastern region of the country (6.6%), was the major issue in the North-East in children below 5 years of age. (36)

Muslim children have more than 8 times the odds of having high a BMI in the poorest quintile. In the CNNS data set, out of the 4868 Muslim respondents, 795 (16.33%) were from the state of Jammu and Kashmir, a state with a large number of poor Muslim children, who showcase a high prevalence of obesity among those children. (37) Previous studies done on Kashmiri children show that even the lower wealth quintiles had approximately 24% of children who were overweight/obese (48) due to the existing pattern of diet which includes high amounts of carbohydrates and regular snacking on junk food and fizzy beverages. (49)

Also, the children of mothers with education between 5 and 11 years show more than 2 times the odds of high BMI as compared the uneducated mothers.

Table 9: Poor quintile on wealth Index, socio-economic factors and BMI

overweight	Odds Ratio Err.	Std. Err.	z	P> z	[95% Interval]	Conf.
Sex: Male(B)						
female	1.235867	0.218171 3	1.20	0.23 0	0.8743929	1.746775
Area: Rural(B)						
urban	1.098369	0.313747 3	0.33	0.74 3	0.6274857	1.922616
Region: North(B)						
Central	0.3916489	0.186964 1	- 1.96	0.05 0	0.1536573	0.998253 1

East	0.3692093	0.1650965	- 2.23	0.026	0.1536906	0.8869475
West	1.386532	0.6911778	0.66	0.512	0.5219288	3.683398
South	0.4811879	0.2396577	- 1.47	0.142	0.1812885	1.277201
North-East	2.287584	0.9049357	2.09	0.036	1.053547	4.96707
Religion: Hindu(B)						
Muslim	0.8935562	0.3201721	- 0.31	0.753	0.4427167	1.803507
Christian	1.599212	0.4657132	1.61	0.107	0.9036992	2.83001
Sikh	1	(empty)				
Others	0.7398359	0.3999238	- 0.56	0.577	0.2564556	2.134316
Caste: General(B)						
scheduled caste	0.6705516	0.2598386	- 1.03	0.302	0.3137558	1.433087
scheduled tribe	0.7726764	0.2783614	- 0.72	0.474	0.3813705	1.565482
other backward class	0.5432385	0.1975852	- 1.68	0.093	0.2663139	1.108121
Mother's education: No education(B)						
< 5 years completed	0.5503186	0.1674416	- 1.96	0.050	0.3031273	0.9990871
5-7 years completed	1.143417	0.2604793	0.59	0.556	0.7316344	1.78696
8-9 years completed	1.090217	0.2972511	0.32	0.751	0.6388961	1.860355
10-11 years completed	0.6842958	0.4232995	- 0.61	0.540	0.2035626	2.300329
>12 years	1.069766	0.8182289	0.09	0.930	0.2389092	4.790103
Cereal: Never(B)						
occasionally	0.9080095	0.7523808	- 0.12	0.907	0.1789702	4.606806
3 to 5 days	1.184336	1.094668	0.18	0.855	0.1935169	7.24821
frequently	0.8975036	0.7152394	- 0.14	0.892	0.188233	4.279338
Milk: Never(B)						

occasionally	2.448518	0.844029 7	2.60	0.00 9	1.245906	4.811952
3 to 5 days	3.377134	1.623902	2.53	0.01 1	1.315971	8.666632
frequently	3.621757	1.362925	3.42	0.00 1	1.732203	7.572512
Pulses: Never(B)						
occasionally	1.044207	0.696051 8	0.06	0.94 8	0.2827411	3.856417
3 to 5 days	1.262988	0.867583 1	0.34	0.73 4	0.3286128	4.854162
frequently	1.17314	0.81212	0.23	0.81 8	0.3020614	4.556215
Vegetables: Never(B)						
occasionally	1.303282	1.043126	0.33	0.74 1	0.2714877	6.256427
3 to 5 days	0.9746095	0.799456 6	- 0.03	0.97 5	0.1952556	4.864718
frequently	1.556573	1.259958	0.55	0.58 5	0.3185443	7.606225
Eggs: Never(B)						
occasionally	1.462724	0.62931	0.88	0.37 7	0.6294319	3.399195
3 to 5 days	1.180081	0.639302 8	0.31	0.76 0	0.4081106	3.41229
frequently	1.228033	1.078863	0.23	0.81 5	0.219485	6.870931
Fruits: Never(B)						
occasionally	0.8088599	0.343096 4	- 0.50	0.61 7	0.3522222	1.857505
3 to 5 days	0.824822	0.435201 3	- 0.37	0.71 5	0.2932515	2.319958
frequently	0.3408295	0.249566 5	- 1.47	0.14 2	0.0811446	1.431577
Non-veg: Never(B)						
occasionally	1.139263	0.503209 1	0.30	0.76 8	0.4793482	2.707679
3 to 5 days	2.642446	1.505473	1.71	0.08 8	0.8650748	8.071581
frequently	1	(empty)				
Fat/oil: Never(B)						

occasionally	1.728053	0.624373 3	1.51	0.13 0	0.8511461	3.508406
3 to 5 days	1.215521	0.608223 2	0.39	0.69 7	0.4558665	3.241062
frequently	0.7788163	0.303023 6	- 0.64	0.52 1	0.3632852	1.669638
Sugar/jaggery: Never(B)						
occasionally	0.5577901	0.266545 2	- 1.22	0.22 2	0.2186333	1.423067
3 to 5 days	0.3588765	0.200893 8	- 1.83	0.06 7	0.1197995	1.075066
frequently	0.5548151	0.261978 8	- 1.25	0.21 2	0.2198965	1.399839
Fried: never(B)						
occasionally	0.6457003	0.213610 1	- 1.32	0.18 6	0.3376269	1.23488
3 to 5 days	0.5172103	0.309890 9	- 1.10	0.27 1	0.1598316	1.673677
frequently	1.030953	0.653405 8	0.05	0.96 2	0.2976855	3.570428
Junk: Never(B)						
occasionally	0.5210076	0.125263 5	- 2.71	0.00 7	0.3252321	0.834631 1
3 to 5 days	1.153067	0.571591 7	0.29	0.77 4	0.4364174	3.046543
frequently	1	(empty)				
Sweets: Never(B)						
occasionally	1.581002	0.496642 7	1.46	0.14 5	0.8541676	2.926319
3 to 5 days	0.8890081	0.727268 5	- 0.14	0.88 6	0.1788815	4.418206
frequently	5.331888	3.79239	2.35	0.01 9	1.322666	21.49373
Fizzy drinks: Never(B)						
occasionally	0.8524073	0.214151 2	- 0.64	0.52 5	0.5209534	1.394747
3 to 5 days	1	(empty)				
frequently	1	(empty)				
_cons	0.0268762	0.034973 6	- 2.78	0.00 5	0.0020975	0.344369 6

From this analysis results, it can be concluded that among the wealth quintile 2(poor) population, the East and Central Indian population has decreased odds of high BMI, while the Northeast region has more than 2 times the odds.

The children of mothers with the education of fewer than 5 years with this poor background showed decreased odds of high BMI. According to a published study, children whose mothers had 12 years of schooling or less would have a 1.4%-1.9% lower risk of obesity at the ages of 2 to 18 if they were placed in a non-parental childcare environment for a year. (26)

Also, children who had junk food occasionally had decreased odds of high BMI as compared to the children who had it more regularly, while those who consumed sweets frequently have 5 times higher odds of high BMI as compared to the children consuming sweets less frequently for this quintile. This has been backed by several studies, which state consuming junk food and sweets raised children's risk for both overall and abdominal obesity. (50)

Table 10: Middle quintile on wealth Index, socio-economic factors and BMI

overweight	Odds Ratio Err.	Std. Err.	z	P> z	[95% Interval]	Conf.
Sex: Male(B)						
female	0.6999496	0.085062 1	- 2.94	0.00 3	0.5515992	0.888198 2
Area: rural(B)						
urban	1.052291	0.151539 3	0.35	0.72 3	0.7935147	1.395457
Region: North(B)						
Central	0.2573676	0.118988 3	- 2.94	0.00 3	0.1039966	0.636925 1
East	0.8665501	0.244015 2	- 0.51	0.61 1	0.499	1.504828
West	1.856959	0.567366 8	2.03	0.04 3	1.020305	3.379672
South	1.258955	0.368332 1	0.79	0.43 1	0.7095364	2.233809
North-East	2.343946	0.613911 1	3.25	0.00 1	1.402835	3.916416
Religion: Hindu(B)						

Muslim	1.050929	0.231337 5	0.23	0.82 1	0.6826553	1.617878
Christian	1.088287	0.225440 9	0.41	0.68 3	0.7251292	1.633321
Sikh	1	(empty)				
Others	0.6857273	0.241239 8	- 1.07	0.28 4	0.3441101	1.366487
Caste: General(B)						
scheduled caste	0.8150367	0.183458 1	- 0.91	0.36 4	0.5242986	1.266997
scheduled tribe	1.025903	0.233826 3	0.11	0.91 1	0.6562941	1.603667
other backward class	0.7827105	0.159087 4	- 1.21	0.22 8	0.5255244	1.165761
Mother's education: None						
< 5 years completed	0.9088963	0.185826 7	- 0.47	0.64 0	0.6088124	1.356892
5-7 years completed	1.183885	0.195499 3	1.02	0.30 7	0.8565394	1.636332
8-9 years completed	0.9115205	0.161865	- 0.52	0.60 2	0.6435951	1.290982
10-11 years completed	1.00029	0.236175 7	0.00	0.99 9	0.6297253	1.588915
>12 years	0.9760529	0.318637 3	- 0.07	0.94 1	0.5147477	1.850769
Cereal: Never(B)						
occasionally	0.5499565	0.238665 1	- 1.38	0.16 8	0.2349264	1.287434
3 to 5 days	0.6261205	0.295226 4	- 0.99	0.32 1	0.248486	1.577662
frequently	0.7860543	0.318636 1	- 0.59	0.55 3	0.3551471	1.73979
Milk: Never(B)						
occasionally	1.261339	0.275227 2	1.06	0.28 7	0.8224278	1.934488
3 to 5 days	1.4906	0.434904 3	1.37	0.17 1	0.841416	2.640655
frequently	1.428156	0.326106 5	1.56	0.11 9	0.9128758	2.234292
Milk: Never(B)						
occasionally	1.001551	0.425953	0.00	0.99 7	0.4351735	2.305066

3 to 5 days	1.300057	0.563171 9	0.61	0.54 5	0.556199	3.038747
frequently	1.263034	0.555853 6	0.53	0.59 6	0.5330975	2.992428
Vegetables: Never(B)						
occasionally	1.005272	0.399151 2	0.01	0.98 9	0.4616441	2.189071
3 to 5 days	1.251237	0.503516 7	0.56	0.57 8	0.5685948	2.753442
frequently	1.457282	0.588855 3	0.93	0.35 1	0.6600729	3.217327
Eggs: Never(B)						
occasionally	1.584202	0.472832 4	1.54	0.12 3	0.8825817	2.843586
3 to 5 days	2.129778	0.707360 2	2.28	0.02 3	1.110774	4.083595
frequently	1.732152	0.740817 1	1.28	0.19 9	0.7490987	4.005281
Fruits: Never(B)						
occasionally	0.4481168	0.125525 4	- 2.87	0.00 4	0.2587942	0.775939 4
3 to 5 days	0.6324608	0.203485 1	- 1.42	0.15 4	0.3366447	1.188216
frequently	0.7088275	0.253104 5	- 0.96	0.33 5	0.3520447	1.427195
Non-veg: Never(B)						
occasionally	1.097274	0.301864 6	0.34	0.73 6	0.6399501	1.881413
3 to 5 days	0.7588915	0.289649 4	- 0.72	0.47 0	0.3591683	1.603472
frequently	0.9613513	0.646350 5	- 0.06	0.95 3	0.2573886	3.590666
Fat/oil: Never(B)						
occasionally	0.9495226	0.206095 5	- 0.24	0.81 1	0.6205126	1.452981
3 to 5 days	0.8263285	0.243448	- 0.65	0.51 7	0.4638491	1.472071
frequently	0.7167757	0.157544 3	- 1.52	0.13 0	0.4659	1.102742
Sugar/jaggery: Never(B)						

occasionally	0.8646503	0.3272564	-0.38	0.701	0.4117885	1.815544
3 to 5 days	0.7489553	0.3141052	-0.69	0.491	0.3292073	1.703893
frequently	0.7733676	0.2889502	-0.69	0.492	0.3718391	1.608485
Fried: Never(B)						
occasionally	1.181707	0.300636	0.66	0.512	0.7177231	1.94564
3 to 5 days	1.674699	0.5434446	1.59	0.112	0.8865835	3.1634
frequently	1.60552	0.6294055	1.21	0.227	0.7445996	3.461855
Junk: Never(B)						
occasionally	0.956907	0.1588082	-0.27	0.791	0.6912011	1.324753
3 to 5 days	1.018796	0.3219379	0.06	0.953	0.5484145	1.892629
frequently	0.5729941	0.3003351	-1.06	0.288	0.2051126	1.600692
Sweets: Never(B)						
occasionally	0.9462267	0.212522	0.25	0.806	0.6092783	1.469517
3 to 5 days	0.6420339	0.2448939	-1.16	0.245	0.3040048	1.355925
frequently	1.499872	0.5866393	1.04	0.300	0.6968301	3.228356
Fizzy drinks: Never(B)						
occasionally	0.8740279	0.1508505	-0.78	0.435	0.6231814	1.225847
3 to 5 days	0.8627074	0.4739696	-0.27	0.788	0.2939106	2.53228
frequently	0.7576543	0.4987696	-0.42	0.673	0.208506	2.75311
_cons	0.0621262	0.0461233	-3.74	0.000	0.0144988	0.2662065

The results show that girls have reduced odds of high BMI as compared to boys, which has been demonstrated by several past studies on school children. (32)

The West and Central Indian population has decreased odds of high BMI, while the Northeast region yet again has more than 2 times the odds.

Also, the results are significant in proving that the children who ate fruits occasionally have lower odds of high BMI as compared to those who consumed them more frequently. The possible reason is that children who eat fruits more frequently belong to affluent families with a higher socioeconomic status as compared to those who cannot afford to do so.

Table 11: Rich quintile on wealth Index, socio-economic factors and BMI

overweight	Odds Ratio Std. Err.		z	P> z	[95% Conf. Interval]	
Sex:						
Male(B)						
female	0.7780115	0.0684119	-2.85	0.004	0.6548449	0.924344
Area:						
Rural(B)						
urban	1.117789	0.1023211	1.22	0.224	0.9342044	1.337451
Region:						
North(B)						
Central	0.5158369	0.1568656	-2.18	0.029	0.2842253	0.9361859
East	2.138154	0.4047039	4.01	0.000	1.475454	3.098503
West	1.765043	0.3491882	2.87	0.004	1.197726	2.601077
South	1.776619	0.3302806	3.09	0.002	1.234106	2.55762
North-East	1.747983	0.3332705	2.93	0.003	1.202948	2.539962
Religion:						
Hindu(B)						
Muslim	0.8926927	0.1390366	-0.73	0.466	0.6578512	1.211369
Christian	1.154163	0.1920209	0.86	0.389	0.8330109	1.59913
Sikh	1	(empty)				
Others	1.047886	0.2194564	0.22	0.823	0.6951022	1.579717
Caste:						
General(B)						
scheduled caste	0.8672651	0.1215924	-1.02	0.310	0.6588881	1.141543
scheduled tribe	0.9767573	0.163727	-0.14	0.888	0.7032434	1.356649
other backward class	0.8248514	0.1045679	-1.52	0.129	0.6433797	1.057509
Mother's education:						
No education(B)						
< 5 years completed	1.340582	0.2500875	1.57	0.116	0.9300372	1.932352
5-7 years completed	1.081671	0.1703815	0.50	0.618	0.7943586	1.472902

8-9 years completed	1.366571	0.2016572	2.12	0.034	1.023352	1.824901
10-11 years completed	1.544573	0.2443836	2.75	0.006	1.132741	2.106135
>12 years	1.671312	0.2750883	3.12	0.002	1.210472	2.307599
Cereal: Never(B)						
occasionally	0.9099007	0.2687943	-0.32	0.749	0.5099646	1.623484
3 to 5 days	0.9136558	0.2921665	-0.28	0.778	0.4881886	1.709927
frequently	0.8721657	0.2521047	-0.47	0.636	0.4949418	1.536894
Milk: Never(B)						
occasionally	0.8217088	0.147356	-1.10	0.274	0.5781932	1.167785
3 to 5 days	0.9750415	0.2168651	-0.11	0.910	0.6305245	1.507802
frequently	0.9008791	0.1588345	-0.59	0.554	0.6376622	1.272748
Pulses: Never(B)						
occasionally	1.160566	0.3517219	0.49	0.623	0.6407732	2.102014
3 to 5 days	1.069201	0.330787	0.22	0.829	0.5830644	1.96066
frequently	1.000786	0.3131241	0.00	0.998	0.5420245	1.847837
Vegetables: Never(B)						
occasionally	0.8008117	0.167926	-1.06	0.289	0.5309308	1.207877
3 to 5 days	0.7308129	0.1590145	-1.44	0.150	0.4770862	1.119478
frequently	0.8469284	0.1847022	-0.76	0.446	0.5523477	1.298616
Eggs: Never(B)						
occasionally	1.151843	0.2278157	0.71	0.475	0.7816986	1.697255
3 to 5 days	1.202654	0.267031	0.83	0.406	0.7782951	1.858391
frequently	1.005745	0.2617165	0.02	0.982	0.60393	1.6749
Fruits: Never(B)						
occasionally	1.094077	0.349744	0.28	0.779	0.5847143	2.04716
3 to 5 days	1.024894	0.3431426	0.07	0.941	0.5317282	1.975458
frequently	0.9259843	0.3180586	-0.22	0.823	0.4723148	1.815414
Non-veg: Never(B)						
occasionally	1.223485	0.2248676	1.10	0.272	0.8534028	1.754055
3 to 5 days	1.111397	0.2727561	0.43	0.667	0.6870206	1.797914
frequently	1.893843	0.6673456	1.81	0.070	0.9492934	3.778221
Fat/oil: Never(B)						
occasionally	0.8721209	0.1380543	-0.86	0.387	0.6394903	1.189377
3 to 5 days	0.8086646	0.1801282	-0.95	0.340	0.522595	1.251329
frequently	0.7562028	0.1187495	-1.78	0.075	0.5558667	1.028741
Sugar/jaggery: Never(B)						

occasionally	0.9514773	0.2621855	-0.18	0.857	0.5544272	1.632873
3 to 5 days	1.20176	0.3629509	0.61	0.543	0.6648766	2.172173
frequently	0.9401444	0.2528364	-0.23	0.818	0.5549806	1.592617
Fried: Never(B)						
occasionally	1.100282	0.2257425	0.47	0.641	0.7359779	1.644914
3 to 5 days	0.8048553	0.2096201	-0.83	0.405	0.4830889	1.340937
frequently	0.6370721	0.1977205	-1.45	0.146	0.3467458	1.170485
Junk: Never(B)						
occasionally	1.032992	0.1296436	0.26	0.796	0.8077341	1.321068
3 to 5 days	1.625035	0.3169351	2.49	0.013	1.108793	2.381633
frequently	1.290138	0.3913501	0.84	0.401	0.7119225	2.337972
Sweets: Never(B)						
occasionally	0.7974331	0.1485048	-1.22	0.224	0.5535747	1.148715
3 to 5 days	0.9349499	0.2335437	-0.27	0.788	0.5730129	1.5255
frequently	0.8108193	0.238255	-0.71	0.475	0.45583	1.442265
Fizzy drinks: Never(B)						
occasionally	1.248138	0.1740055	1.59	0.112	0.9497183	1.640327
3 to 5 days	1.783779	0.4615552	2.24	0.025	1.074216	2.962038
frequently	1.702203	0.5674931	1.60	0.111	0.8855875	3.271834
_cons	0.0478417	0.0272954	-5.33	0.000	0.0156375	0.1463684

In the rich quintile,(wealth index=4), the girls again show decreased odds of having high BMI as compared to boys. While all the regions except for the Central region show increased odds of high BMI, the children belonging to mothers with 8 years or more of education show increased odds for the same.

According to published literature, compared to children from lower socioeconomic status groups, children from higher socioeconomic status groups were much more likely to be obese and overweight. Boys were much more likely than girls to be obese among kids from wealthy backgrounds. In developing nations, pediatric obesity is a growing issue, particularly for populations with greater socioeconomic standing. There is a large gender gap, with boys from wealthy backgrounds having a higher incidence. (38)

Table 12: Richest quintile on wealth Index, socio-economic factors and BMI

overweight	Odds Ratio	Std. Err.	z	P> z	[95% Conf. Interval]	
Sex:						

Male(B)						
female	0.7799035	0.0438461	-4.42	0.000	0.6985321	0.8707538
Area: rural(B)						
urban	1.529243	0.1038267	6.26	0.000	1.338705	1.7469
Region: North(B)						
Central	0.6944787	0.1101618	-2.30	0.022	0.5089053	0.9477218
East	1.994615	0.229029	6.01	0.000	1.592652	2.498027
West	1.425444	0.1614419	3.13	0.002	1.141683	1.779734
South	1.520673	0.1594086	4.00	0.000	1.238244	1.86752
North-East	1.470421	0.1847378	3.07	0.002	1.149476	1.880976
Religion: Hindu(B)_						
Muslim	0.7066559	0.0757441	-3.24	0.001	0.5727572	0.8718575
Christian	1.432072	0.165075	3.12	0.002	1.142475	1.795076
Sikh	1.558686	0.2318131	2.98	0.003	1.164568	2.086182
Others	1.151981	0.1902256	0.86	0.392	0.8334643	1.592221
Caste: General(B)						
scheduled caste	0.795657	0.0709486	-2.56	0.010	0.6680736	0.9476051
scheduled tribe	0.6610162	0.0843254	-3.25	0.001	0.5147838	0.8487882
OBC	0.7168997	0.0527191	-4.53	0.000	0.6206733	0.8280446
Mother's education: No education(B)						
< 5 years completed	1.042972	0.2669484	0.16	0.869	0.6315502	1.722414
5-7 years completed	0.9964475	0.1927225	-0.02	0.985	0.6820621	1.455744
8-9 years completed	1.536616	0.2644204	2.50	0.013	1.096707	2.152979
10-11 years completed	1.665498	0.2800565	3.03	0.002	1.197879	2.315662
>12 years	2.422561	0.3910262	5.48	0.000	1.765559	3.324049
Cereal: Never(B)						
occasionally	0.9014605	0.1912709	-0.49	0.625	0.5947571	1.366324
3 to 5 days	1.089679	0.2442427	0.38	0.702	0.7022777	1.690786
frequently	0.8891985	0.1867287	-0.56	0.576	0.5891817	1.341987
Milk: Never(B)						
occasionally	0.6770987	0.1038005	-2.54	0.011	0.5013733	0.9144138
3 to 5 days	0.6050234	0.1103031	-2.76	0.006	0.4232411	0.8648814
frequently	0.7826356	0.1118392	-1.72	0.086	0.5914558	1.035612
Pulses: Never(B)						
occasionally	0.5754963	0.1302397	-2.44	0.015	0.3693247	0.8967609
3 to 5 days	0.6330163	0.1448795	-2.00	0.046	0.4042024	0.9913587
frequently	0.5766265	0.1325801	-2.39	0.017	0.3674372	0.9049113
Vegetables: Never(B)						

occasionally	1.310708	0.197119	1.80	0.072	0.9760967	1.760027
3 to 5 days	1.272198	0.1978831	1.55	0.122	0.9378969	1.725656
frequently	1.56238	0.2426728	2.87	0.004	1.152327	2.118349
Eggs: Never(B)						
occasionally	0.9457511	0.105491	-0.50	0.617	0.7600324	1.176851
3 to 5 days	0.9308183	0.1218579	-0.55	0.584	0.7201617	1.203095
frequently	0.9825774	0.1398981	-0.12	0.902	0.7433165	1.298852
Fruits: Never(B)						
occasionally	0.4831366	0.1101805	-3.19	0.001	0.3089949	0.7554202
3 to 5 days	0.5415152	0.1259251	-2.64	0.008	0.3432973	0.854183
frequently	0.5732595	0.1319882	-2.42	0.016	0.3650642	0.9001881
Non-veg: Never(B)						
occasionally	1.157047	0.1249127	1.35	0.177	0.9363896	1.429701
3 to 5 days	1.236172	0.1848831	1.42	0.156	0.9220875	1.65724
frequently	1.385576	0.296714	1.52	0.128	0.9106468	2.108195
Fat/oil: Never(B)						
occasionally	0.8552933	0.0985922	-1.36	0.175	0.6823301	1.072101
3 to 5 days	0.8549172	0.1373448	-0.98	0.329	0.6239878	1.17131
frequently	0.7781808	0.0863524	-2.26	0.024	0.6260734	0.9672434
Sugar/jagger: Never(B)						
occasionally	0.7411551	0.1473103	-1.51	0.132	0.502026	1.094188
3 to 5 days	0.8155385	0.1805547	-0.92	0.357	0.5284382	1.25862
frequently	0.5980636	0.1133339	-2.71	0.007	0.4125185	0.8670644
Fried: Never(B)						
occasionally	0.9604485	0.154384	-0.25	0.802	0.7008912	1.316126
3 to 5 days	0.977774	0.1775034	-0.12	0.901	0.6850351	1.39561
frequently	0.9356213	0.1917032	-0.32	0.745	0.6261725	1.397997
Junk: Never(B)						
occasionally	1.198051	0.1091291	1.98	0.047	1.002167	1.432222
3 to 5 days	1.40781	0.1995028	2.41	0.016	1.066397	1.858527
frequently	1.155152	0.2275695	0.73	0.464	0.7851438	1.699532
Sweets: Never(B)						
occasionally	0.867907	0.1215647	-1.01	0.312	0.6595509	1.142084
3 to 5 days	0.8216614	0.1424476	-1.13	0.257	0.5849571	1.154149
frequently	0.6028713	0.1168486	-2.61	0.009	0.4123296	0.8814641
Fizzy drinks: Never(B)						
occasionally	0.9370342	0.0844945	-0.72	0.471	0.7852368	1.118176
3 to 5 days	1.03528	0.1684075	0.21	0.831	0.7526515	1.424038

frequently	1.224007	0.2358345	1.05	0.294	0.839034	1.785618
_cons	0.3907832	0.1697423	-2.16	0.031	0.1668032	0.9155193

In the richest quintile(wealth index=5)also, the girls show decreased odds of having high BMI compared to boys, while the urban children and all the regions except Central India and children of all religions except Islam demonstrate increased odds for the same. The SC/ST/OBC categories show decreased odds for high BMI in the richest quintile, while the children of mothers with more than 8 years of education show increased odds, with those of more than 12 years showing more than two times the odds of high BMI as compared to the children whose mothers have received no education at all. The children whose mothers have 10-11 years of education show increased odds as well.

Socio-economic status, residence in an urban area, consumption of a variety of foods, usage of the restroom, and level of education were found to be characteristics positively related to overweight/obesity in women in prior studies. Adolescents and women shared many of the same variables. Socio-economic status played a significant role in the overall changes in women's BMI, accounting for 46% of the rise in overweight/obesity and 29% of the decline in undernutrition. (40)

When castes were taken into account, children from scheduled castes had a 1.2 times substantially higher risk of being underweight, whereas children who did not fall under the SC/ST/OBC categories had a 1.27 times significantly higher risk of being overweight. Children who lived in urban regions had a 0.86 times lower probability of being underweight than children who lived in rural areas. The probability of being overweight was around twice as high among the richest children as it was among the poorest. When compared to children from the North region, those from the North-east of India had a much lower likelihood of being thin and those from the West of India had a significantly higher likelihood. Children from the East and North-East, however, had a higher likelihood of being overweight. (41)

The prevalence of malnutrition was found to be relatively evenly distributed between underweight and overweight among OBCs, but it was observed that underweight was more common in the SC and ST groups and overweight in the Non-SC/ST/OBC communities. (42)

Discussion

It can be observed from the results that as the children move from the poor towards the richer quintiles, and less educated to more educated families, the odds of high BMI increase, thus highlighting the “wealth effect on obesity”. Thus, as India gets wealthier, it is unfortunately, moving closer to obesity. Given that childhood obesity has been associated with a number of medical issues, this is a concerning situation. Some of the conditions that fall under this heading include fatty liver disease, sleep apnea, Type 2 diabetes, asthma, hepatic steatosis (fatty liver disease), cardiovascular disease, high cholesterol, cholelithiasis (gallstones), skin conditions, menstruation abnormalities, unsteadiness, and orthopaedic issues. Previously only encountered by adults, many of the aforementioned health issues are now very common among obese children. In the worst-case scenarios, some of these medical conditions could be fatal. In addition to the numerous medical conditions it is associated to, childhood obesity has an influence on the social and emotional health of children and adolescents. (43)

Obesity has been described as being “one of the most stigmatizing and least socially acceptable conditions in childhood.” Children who are fat or overweight are regularly teased for their appearance. In addition, they face a wide range of other challenges, including prejudice, discrimination, and social exclusion. Discrimination towards obese persons has been seen in kids as early as 2 years old. Children who are obese are typically excluded from activities, particularly ones that require physical effort and are competitive. Because they move slower than their peers and regularly experience shortness of breath, overweight children typically find it difficult to participate in physical activity. These harmful social concerns can have an adverse effect on a child's academic performance as well as their sense of self-worth, self-confidence, and body image. All of the aforementioned negative effects of being overweight or obese can be detrimental for children and teenagers. (43)

There is mounting evidence that early life variables affect people's chance of developing chronic diseases later in life. (44)Overweight children have the danger of developing weight-related health issues later in life as well as beginning to experience negative health effects in their early years. It has been discovered that cardiovascular disease risk factors, such as high cholesterol, elevated insulin levels, and raised blood pressure in childhood, are present in overweight children and adolescents. (45)

The risks for the majority of obesity-related NCDs are influenced by both the age of onset and the duration of obesity. Children and adolescents who are obese experience both immediate and long-term health effects. Obesity in childhood is linked to an increased risk of early death and

impairment in adulthood. Childhood overweight and obesity have serious health repercussions, many of which may not manifest themselves until maturity. These include cardiovascular diseases (primarily heart disease and stroke), diabetes, musculoskeletal issues, including osteoarthritis, and some types of cancer (endometrial, breast, and colon). Being overweight or obese causes at least 2.6 million deaths annually. (45)

A child who is overweight has a greater likelihood of continuing to be overweight when they enter puberty. Strong evidence suggests that higher BMI levels in childhood can predict adult overweight based on data from a variety of research. Children who are overweight or obese are more likely to remain overweight as adults and are at an earlier age to develop non-communicable diseases including diabetes and cardiovascular disorders. Numerous investigations, some of which were conducted in India, have demonstrated this. (45)

Conclusion

Despite the success of localised community and school centred physical activity and nutritional projects and approaches, there is a gap in the locus of intervention in India on comparison with affluent nations. Many Indian studies and reviews focused on the prevalence and etiology of teenage obesity; intervention- based studies yielded a wealth of promising findings, but these weren't incorporated into preventative and treatment strategies in terms of complete stakeholder involvement. The dual burden of malnutrition still affects some population segments in developing nations, while overnutrition affects other segments. There is a need to cooperate at all levels of society in order to properly address this complicated, multidimensional issue. Government policies, the environment, families, individuals, adolescents, and health professionals should all be the focus of these efforts. The government of India has suggested incentives at a national level for physical fitness, enhanced child and adolescent height and weight monitoring, and a well integrated strategy to improve nutrition patterns and lifestyle adjustments throughout the nation, but more extensive, longitudinal research is needed. Also, further research is required to study comprehensively the association between overweight among children and high levels of mother's education.

The prevalence of children and teenage obesity is increasing, and there is a concern that lifestyle diseases will become more prevalent and place a greater strain on the healthcare system. The educational system (school-centred interventions), health promotion for improved food habits and educating the family, increased physical activity and community education, infrastructure to support a favorable built environment, and improved supervision of management programmes to foster planning for future are a few examples of potential tactics. In fact, the NITI Aayog has suggested in 2019 that such tactics be approached from a systems perspective. (39)

Boosting levels of physical activity beginning in childhood and promoting healthy eating practices, such as increasing fiber intake, and cutting back on the consumption of junk food and saturated fat, may have significant positive benefits on public health. Given the impending epidemic of chronic diseases in low- and middle-income nations like India, this is especially concerning. In this sense, children who have a family history of chronic illness require extra care. Approaches to public health should focus on the primary and early prevention of chronic diseases and the associated risk factors. (44) The results from this study establish a clear relation between mothers' education, family's wealth index and child obesity hence mothers, especially those from affluent families should be the focus of obesity intervention in India for their children.

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