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A Comparative Study on Potential Risk Factors for Childhood Obesity among Rural and Urban Population of Bangladesh



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ABSTRACT

Childhood obesity has reached widespread level in developed countries. In Bangladesh, the number of obese children has also increased due to industrialization & urbanization resulting in higher proportion of obese children in the urban areas. There is no published data delineating the risk factors that might potentially influence childhood obesity particularly in the urban areas. The present study was carried out to compare potential risk factors associated with childhood obesity between selected urban and rural areas among 300 students between 5-13 years. Of particular interests, urban children had significantly higher BMIs and were more predisposed to obesity development from their parent, as compared to the rural children. The prevalence of obesity in urban areas was found to be 14.2% and 8% in rural areas. Eating vegetables and fresh fruits, consuming fast food and soft drinks were also varied among the children in the two settings. Daytime sleeping, watching TV, playing computer or video games, finding available places to play, together with total daily physical exertion, all emerged as potential contributing factors. Mother's perception on the child's body weight and of maintaining healthy lifestyle, were also found to play significant role. Overall, the findings revealed the potential risk factors contributing to childhood obesity in both urban and rural settings and that these factors should be addressed and necessary measures should be taken to reduce the incidence of obesity particularly in the urban setting.

INTRODUCTION

Childhood obesity is one of the globally emerging public health concern of the present time. With an alarmingly increasing rate, the problem is progressively affecting many low and middle-income countries, predominantly in urban settings. The number of overweight children under five years was more than 42 million all over the world in 2013 and over 80% of these were from developing countries (WHO, 2014). Overweight children are at increased risk for compromised physical and mental well-being. Childhood obesity, as a long-term effect, eventually leads to serious health consequences such as cardiovascular disease, type 2 diabetes and cancers (including, colorectal cancer, kidney cancer and esophageal cancer). These non-communicable diseases (NCDs) cause premature mortality as well as long-term morbidity. Moreover, overweight and obesity in children are associated with significant reductions in quality of life and a greater risk of teasing, bullying and social isolation (Ezzati et al, 2004).

The incidence of childhood obesity has increased extensively in developing countries including Bangladesh. In low-income countries, the number of obese children has also increased due to rapid industrialization & urbanization (Popkin, 1994). In a recent cross-sectional study, Bulbul and Hoque reported that the proportion of overweight and obese students (aged 6 to 15 years) is more in urban areas as compared to the rural parts of the country (Bulbul and Hoque, 2014). Another case-control study described the risk factors associated with childhood obesity among the students in the urban setting (Bhuiyan et al., 2013). However, no study to date has been reported to compare the risk factors among the rural and urban populations. Therefore, the present study was carried out among rural and urban children to compare and identify the risk factors of childhood obesity between the urban and the rural settings.

MATERIALS AND METHODOLOGY

Study sites, population and design

The study was performed on 300 children (138 children from rural areas & 162 children from urban areas) from some randomly selected rural areas & schools of Lakshmipur and some urban areas and schools of Dhaka district. All the study sites were selected by a convenient sampling method. In order to assess if mother's perception had any impact or influence on child's obesity

status, the mothers were also included as the respondents who were asked the questions set out in the survey questionnaire.

Data collection and analyses

The structured questionnaire used in the survey was developed including demographic characteristics and some common criteria that influence childhood obesity in Bangladesh. The questionnaire was prepared based on some important factors such as food habit, physical activity, sleeping duration, watching TV, playing games in electronic devices etc. as they are mainly responsible for the obesity. Standard procedures of anthropometry were used to measure the heights and weights of the participants and the body-mass index (BMI) was calculated as $\text{weight (kg)} / [\text{height (m)}]^2$. The height and weight of the participants were measured using measuring tape and pre-calibrated weighing scale. Statistical analyses were made using appropriate hypotheses testing and a p-value of < 0.05 (at 95% CI) was considered significant.

RESULTS

Urban children had higher BMI and more positive family history than the rural children

We selected children from both rural and urban settings in such a way as to ensure similar age range and maintaining almost a 1:1 male:female ratio (table 1). We observed significant variability ($P = 0.0078$) in terms of BMI in urban children as compared to those from rural areas (figure 1). Specifically, children from the urban areas had a significantly higher BMI when compared with those from the rural areas. As children grow, their amount of body fat changes and so will their BMI. That's why a BMI calculation for a child must take into account their age and gender. In case of children, there is an age vs. BMI graph was provided by CDC, from which we can determine whether the children are underweight, healthy weight, overweight or obese. If BMI percent is below 5, the children is underweight & if, between 5-85 percent, it is assumed that the children are healthy. When BMI is 85-95 percent, it is assumed that the children are at risk of overweight & above 95 percent it is obese (CDC, 2014). Obesity, as an inheritable trait, has a direct link to family history as the parents' genetic profile influences the obesity status of the child (Lyon and Hirschhorn, 2005). In our study, we found a significant proportion of

children had familial predisposition to obesity in both settings. Noticeably, urban children had more positive family history as compared to the rural children (table 1).

Table 1: Demographic characteristics and obesity status of the study participants

Characteristics	Rural	Urban	P-value*
Total respondents, n	138	162	-
Age in years, mean±SD	8.5±1.8	8.6±1.7	0.394
Sex ratio, Male:Female	1.19:1	1.45:1	-
BMI, mean±SD	16.81±3.1	17.81±3.6	0.0078
Positive family history, %	31.2	43.2	

*paired t-test, ns = not significant, s = significant (P < 0.05)

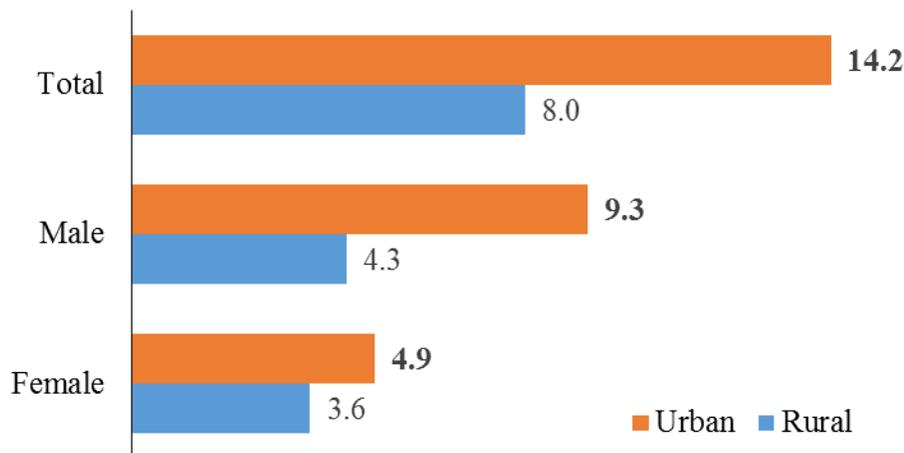


Figure 1: Percentage of obese children in urban and rural areas.

The study participants were categorised as obese at the BMI percentile of >95%, according to the CDC guideline for calculating BMI percentile (CDC, 2014). Note that the percentage of obese children was more in urban areas (percentage is shown in bold) as compared to that in the rural areas.

Potential risk factors associated with childhood obesity

In the present study, we looked for various potential risk factors that might contribute to the development and/or manifestation of obesity among children. We categorized these factors in 3 groups and addressed some relevant questions to get insight into each of these risk factors. The

categories included: 1. Food habits, 2. Physical activity, and 3. Mothers' perception about children's weight. Further, we investigated if these factors have any role to play in contributing to obesity development among urban and rural children.

Food habits among rural and urban children

Eating healthy food is a key to maintain good health and deviation from this practice often leads to health disorders including obesity. Although there were insignificant variation in terms of frequency of eating vegetables and fruits among urban and rural children, the urban children were observed to consume more fast food as compared to the rural children (table 2). We also did not find any variation in terms of drinking sodas (soft drinks) and eating out at restaurants among the urban and rural children.

Table 2: Comparative food habits among the rural and urban children

Food habit	Rural No. (%)	Urban No. (%)
A. On an average day, how often does each child eat vegetables and fruits?		
i. Never or rarely	7 (5.0)	9 (5.5)
ii. 1 time	29 (21.0)	43 (26.5)
iii. 2-3 times	97 (70.3)	109 (67.3)
iv. 4 or more times	4 (2.9)	1 (0.6)
v. Don't know/ not sure	1 (0.7)	0 (0.0)
B. How many times a week does each child eat fast food?		
i. Never or rarely	74 (53.6)	70 (43.2)
ii. 1-2 time	47 (34.0)	71 (43.8)
iii. 3-4 times	11 (7.9)	13 (8.0)
iv. 5 or more times	6 (4.3)	8 (4.9)
C. How many sodas per week does each child drink?		
i. Never or rarely	62 (48.5)	72 (44.4)
ii. 1-4 sodas	68 (49.3)	82 (50.6)
iii. 5-7 sodas	2 (1.5)	5 (3.1)

iv. 8 or more sodas	0 (0.0)	3 (1.9)
v. Don't know/ not sure	1 (0.7)	0 (0.0)
D. How often does your child eat out at a restaurant in a week?		
i. Never or rarely	86 (62.3)	106 (65.4)
ii. 1-2 time	48 (34.8)	50 (30.9)
iii. 3-4 times	4 (2.9)	5 (3.1)
iv. 5 or more times	0 (0)	1 (0.6)

Physical activities and sedentary lifestyle influencing obesity among children

Since physical activities and sedentary lifestyles have strong influences on obesity (CDC, 2013), we asked if there is any variation in terms of total daytime sleeping, time to watch TV, and time to play video or computer games. Noticeably, the percentage of children who used to have a 2-3 hours daytime sleeping was more than 2-fold higher among the urban children as compared to the rural children (table 3). Also, the percentage of urban children who watched TV between 2-3 hours was almost twice as that among the rural children. There were no big differences in terms of playing video or computer games and in finding available place for playing. However, the percentage of children who used to have physical activities >3 hours was less among the urban students (4.3%) as compared to the rural children (13.0%).

Table 3: Comparative physical activities among the rural and urban children

Physical activity	Rural No. (%)	Urban No. (%)
A. Average daytime sleeping hours		
i. Does not sleep	53 (38.4)	37 (22.8)
ii. < 30 minutes	11 (7.9)	9 (5.5)
iii. 30 minutes - 1 hour	35 (25.4)	31 (19.1)
iv. 1-2 hours	29 (21.0)	60 (37.0)
v. 2-3 hours	10 (7.2)	24 (14.8)
vi. > 3 hours	0 (0.0)	1 (0.6)

B. Average time to watch TV in a day		
i. Does not watch	41 (29.7)	41 (25.3)
ii. < 30 minutes	20 (14.5)	19 (11.7)
iii. 30 minutes - 1 hour	40 (28.9)	39 (24.1)
iv. 1-2 hours	22 (15.9)	33 (20.4)
v. 2-3 hours	7 (5.1)	19 (11.7)
vi. > 3 hours	8 (5.8)	11 (6.8)
C. Average time to play computer/video games in a day		
i. Never	80 (57.9)	108 (66.7)
ii. < 30 minutes	34 (24.6)	30 (18.5)
iii. 30 minutes - 1 hour	17 (12.3)	12 (7.4)
iv. 1-2 hours	4 (2.9)	8 (4.9)
v. 2-3 hours	3 (2.2)	3 (1.9)
vi. > 3 hours	0 (0.0)	1 (0.6)
D. Finding good available place for physical activity		
i. Yes	135 (97.8)	158 (97.5)
ii. No	3 (2.2)	4 (2.5)
E. Average duration of physical activity per day		
i. Never	0 (0.0)	3 (1.9)
ii. < 30 minutes	7 (5.1)	5 (3.1)
iii. 30 minutes - 1 hour	15 (10.9)	18 (11.1)
iv. 1-2 hours	55 (39.9)	57 (35.2)
v. 2-3 hours	43 (31.2)	72 (44.4)
vi. > 3 hours	18 (13.0)	7 (4.3)

Variability in physical activities among the urban and rural children are highlighted in bold texts.

Mothers' perception about child's weight and lifestyle

We asked if there is variation in terms of mothers' perception about child's weight and maintaining healthy lifestyle. No remarkable difference was observed among the urban and rural

mothers as such except that 3.1% urban mothers (vs 1.4% rural mothers) perceive their children as slightly overweight (table 4).

Table 4: Mothers' perception about child's weight and lifestyle

Mothers' perception on -	Rural No. (%)	Urban No. (%)
A. child's body weight		
i. very underweight	20 (14.5)	30 (18.5)
ii. slightly underweight	64 (46.4)	70 (43.2)
iii. normal weight	52 (37.7)	56 (34.6)
iv. slightly overweight	2 (1.4)	5 (3.1)
v. very overweight	0 (0.0)	1 (0.6)
B. maintaining healthy lifestyle		
Yes	138 (100)	153 (94.4)
No	0 (0)	9 (5.6)

DISCUSSION

Childhood obesity has been more than doubled in the past 30 years. The percentage of children aged 6–11 years in the United States who were obese increased from 7% in 1980 to nearly 18% in 2012 (Ogden et al., 2014). Bulbul & Hoque performed a similar study on childhood obesity in Bangladesh in 2009 where they included children between age range of 6-15 years in both rural and urban areas. Male to female ratio was 1.3:1 and mean age was 10.3±2.5 years. They also found that both in urban and rural areas 3.5% were obese, 9.5% were overweight and 17.6% were underweight. Moreover, the proportion of obese (5.6%) and overweight (10.6%) students were greater among the students from urban schools compared to the students from rural schools. The proportion of underweight students was lower in the urban schools (16.1%) compared to the rural schools (19.2%) (Bulbul and Hoque, 2014). The prevalence of obesity was found to be 17.9% and that of overweight was 23.6% among affluent school children and adolescents in Dhaka. All these findings are inconsistent with what we found in the present study. Notably, the study population constituted children from 5-13 years of age having comparable male:female ratio and mean age distribution (table 1).

Genetic predisposition to obesity is well-established (Lyon and Hirschhorn, 2005) and genes that influence obesity are likely to be associated with BMI (Haworth et al., 2008). In our study, we found a significantly higher BMI among the urban children (table 1) where a positive family history might be a driving factor for the appearance of higher proportion of obese children in the urban setting (figure 1). Besides genetic factors, lifestyle factors also influence the manifestations of obesity among children. Epstein et al (Epstein et al 2001) indicated that increasing fruit and vegetable intake would decrease high-fat/high-sugar intake for children, and could be a useful approach to preventing childhood obesity. However, children and adolescents, and particularly those from low-income households, do not consume the recommended amounts of fruits and vegetables. Studies have also shown that over the past four decades, consumption of food eaten away from home has risen alarmingly. It is well known that eating out may lead to excess calorie intake and increases the risk of obesity because of large portion sizes and increased energy density of foods. Fast foods affect children and youth often worse than adults. Eating out is major contributor to childhood obesity. Studies show that calorie content of out-of-home meals that children consumed was 55% higher than that of in home meals (Mandal, 2014). Eating take-out or eating out more often is not the only reason for the obesity epidemic, but it is an important factor for many people. Recent studies suggest an association between eating away from home and overweight and obesity in children and teens (Poti et al., 2014) although we did not find any variation between rural and urban areas with this respect (table 2). The association between the consumption of sugar-sweetened drinks and childhood obesity has been established in three separate American studies. It has been found that children who consume these drinks have a higher energy intake and are more likely to become overweight. In the United Kingdom, a school-based initiative focusing on reducing the consumption of these drinks has also been effective in preventing a further increase in obesity (James & Kerr, 2005). In our study, we did not, however, see any variation among the rural and urban children in terms of eating vegetables and fruit and drinking sodas or soft drinks. Childhood sleep habits may even have a long-term effect on weight, well into adulthood. Researchers in New Zealand followed 1,037 children from birth until age 32, collecting information from parents on the average number of hours their children slept at ages 5, 7, 9, and 11. Each one hour reduction in sleep during childhood was associated with a 50 percent higher risk of obesity at age 32 (Landhuis et al, 2008). In our study, 38.4% of the children from rural areas never slept in day time, and 25.4% slept for 30 minutes to

1 hour in day time, as reported by their mothers. In urban setting, 22.8% of the children never slept in daytime; nonetheless, 37% children slept 1-2 hours in daytime, and only 0.67% children were reported to sleep more than 3 hours in daytime. More importantly, we found more than twice as high the proportion of children having an average 2-3 hours daytime sleeping in the urban setting (table 3).

Beside daytime sleeping, other physical activities likely to influence childhood obesity included watching television (TV) and playing video or computer games. A study reported that children of 8-18 years age spend an average of 7.5 hours a day using entertainment media, including TV, computers, video games, cell phones, and movies. Of those 7.5 hours, about 4.5 hours is dedicated to viewing TV (Rideout, Foehr & Roberts, 2010). Eighty-three percent of children from 6 months to less than 6 years of age view TV or videos about 1 hour and 57 minutes a day (Rideout & Hamil, 2006). Watching TV is a contributing factor to childhood obesity because it may reduce the time children could spend in physical activities. Moreover, TV watching also leads to increased energy intake through snacking and eating meals while in front of the TV and influence children to make unhealthy food choices through exposure to food advertisements (Zimmerman & Bell, 2010). We found that the percentage of children watching TV for 2-3 hours was more than twice as that among the rural children (table 3). However, we did not find virtually any differences in terms of playing video games using electronic devices in the two settings. Regular physical activity in childhood and adolescence improves strength and endurance, helps build healthy bones and muscles, helps control weight, reduces anxiety and stress, increases self-esteem, and may improve blood pressure and cholesterol levels (U.S. Department of Health and Human Services, 2008). The U.S. Department of Health and Human Services recommends that young people aged 6–17 years participate in at least 60 minutes of physical activity daily. In 2013, 27.1% of high school students surveyed had participated in at least 60 minutes per day of physical activity on all 7 days before the survey, and only 29% attended physical education class daily (CDC, 2013).

In terms of availability of place for physical activity, we did not find any variation in rural and urban settings. Interestingly, we found that fewer children (4.3%) from the urban areas had regular physical activity for > 3 hours on a day-to-day basis as compared to the rural children (13%). Mothers' perception about child's weight and lifestyle however, was not found to vary

from rural to urban setting (table 4). However, we cannot rule out the possibility of the influence of mother's perception of body weight and lifestyle on child's obesity status since we selected the study population (n = 300) by a convenient sampling method. Overweight and obesity, which are influenced by physical inactivity and poor diet, can increase one's risk for diabetes, high blood pressure, high cholesterol, asthma, arthritis, and poor health status. Physical inactivity increases one's risk of dying prematurely, dying of heart disease, and developing diabetes, colon cancer, and high blood pressure (Daniels et al, 2005). Obesity is a long-term disorder that causes several harmful consequences on a child's health. Overweight and obesity in childhood have a powerful impact on a child's health. Overweight children are more likely to have cardiovascular and digestive diseases in adulthood as compared with those who are lean. It is known that both over-consumption of calories and reduced physical activity are mainly involved in childhood obesity.

CONCLUSION

From our study, it is found that much more dependent on fast food and soft drinks instead of eating vegetables & fruits might play a major role in childhood obesity. Childhood obesity is a great problem in western countries and it can be also a great problem for our country after some years. Government should take proper and powerful steps to decrease the number of obese children by creating awareness among mass population and should highlight the bad impacts of childhood obesity on health. School authority can play important role in decreasing the number of obese children by providing healthy food and creating awareness & inspiring children to be physically active. Despite having certain limitations including small numbers and convenient sampling, the findings emphasise the need for further intensive study with appropriate numbers and sampling. This will help to formulate proper strategy to reduce the burden of childhood obesity by identifying the factors responsible for its emergence, particularly in urban areas of the country.

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