PREVALENCE OF OVERWEIGHT AND OBESITY AMONG URBAN SCHOOL CHILDREN AND ADOLESCENTS IN KHULNA, BANGLADESH

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Abstract

According to WHO, when a child or adolescent possesses a body mass index of 25-29.9 kg/m^2, then, he or she is referred to as overweight. Besides, when a child or adolescent has a body mass equal to or greater than 30 kg/m^2, then, he or she is referred to as obese. Nowadays, childhood obesity is a global talk and gaining more concern day by day. The aims of this study were to explore the present frequency of overweight and corpulence of children and adolescents living in Khulna, Bangladesh and to identify the lifestyle behaviors associated with an increased risk of obesity in children and adolescents. This study was conducted in Khulna city, which is one of the divisional city in Bangladesh. The study was conducted using a self-designed standard structured questionnaire taking after WHO guidelines from June, 2016- December, 2016. 300 randomly chosen children from different parts of the city wer considered as test sample. Among these 300 children, 124 were in overweight and obese category. Moreover, among the 124 overweight and obese study population, 72 were male and 52 were female. Our study revealed that obesity decreased as age increased. Children and adolescents were more overweight and obese in 9-10 hours sleeping category (**P<0.05 vs 7-8 h/day). Children and adolescents who travelled to school with different rides were in more obese category (**P<0.05 vs walk). Children who spent time watching TV more than 5 hours were in the overweight and obese category (**P<0.05 vs 1-2 h/day). Furthermore, our study revealed that excessive fast food consumption and less vegetable intake are associated with overweight and obesity. To conclude, we have to raise awareness and take necessary steps to ameliorate this problem so that the children and adolescents can lead a healthy and sound life in future.

Keywords: *Obesity; Children and adolescents; Urban school; Risk factors; Khulna.*

Introduction

Nowadays obesity in children and adolescents is widely considered a world crisis, not only due to its harmful physiological effects, but also for its negative impact on quality and risk factors associated with life [1]. Presently, the larger part of research has focused on child obesity in the developed world. However, child obesity is also a serious concern in developing countries. Childhood obesity is one of the major public health problems globally. In 2011-2014, for children and adolescents aged 2-19 years, a study found that the prevalence of obesity has remained fairly stable at about 17% and affects about 12.7 million children and adolescents. The study also revealed that prevalence of obesity was 8.9% among 2- to 5-year-olds compared with 17.5% of 6- to 11-year-olds and 20.5% of 12- to 19-year-olds [2]. Though the prevalence of obesity among children aged 2 to 5 years decreased significantly from 13.9% in 2003-2004 to 9.4% in 2013-2014 [3]. During 2000–2010, the overall prevalence of obesity among young low-income children in WIC increased significantly, from 14.0% in 2000 to 15.5% in 2004 and to 15.9% in 2010; during 2010–2014, the overall prevalence decreased significantly to 14.5% [4].

According to a new study, more than 30 percent people died world widely from being obese in 2015 than in 1990. About 25 years ago, 50 deaths of every 10 million were related to being overweight, whereas, in 2015, the number is now 54 out of every 10 million. Another study showed that obesity caused four million deaths in 2015 alone, most of these due to cardiovascular disease (This represents 7.1 percent of the deaths from any cause) [5].

In Bangladesh, nearly 40% of children below the age of 5 years are suffering from lack of healthy sustenance [6]. However, multiple factors such as rapid urbanization, continually decreasing number of playgrounds, increasing purchasing power, and easy access to new mechanical gadgets such as cell phones, probably have led to less physical activity and more attraction to sedentary activity, and thereby have attributed to an emerging overweight and obesity problem among young children in urban settings, especially among affluent families in Dhaka [7]. The nation is presently encountering the two fold burden of malnutrition, with the existence of both under nutrition and over nutrition in urban cities.

Childhood overweight and obesity is a particular public health concern for Bangladesh because children who are overweight or obese have higher risk of becoming overweight or obese adults [8,9] and overweight adults are at increased risk for mortality and morbidity with obesity-associated chronic diseases, which are already a burden to the struggling well-being framework in Bangladesh [10,11]. A study from Bangladesh in Dhaka city reported that, the predominance of corpulence was impressively prevalent among the boys (56.8%) than the girls (43.2%) [12].

Therefore the aims of this study were (1) to investigate the current prevalence of overweight and obesity in children and adolescents living in one of the biggest city Khulna, Bangladesh and (2) to identify the lifestyle behaviors associated with an increased risk of obesity in children and adolescents. This survey also unveils other factors such as economical status, sedentary life style, gender and diseases associated with this obese children.

Materials and Methods

Setting and design

The research was conducted in Khulna city, Bangladesh. Khulna is the third-largest city of Bangladesh. It is the administrative seat of Khulna District and Khulna Division. As of the 2011 census, the city has a population of 663,342. The city is located on the bank of Rupsha River. It is an important hub of Bangladeshi industry and hosts many national companies [13]. In this survey data were taken from- Khulna Public College; Model School and College; National Kindergarten School; Khulna Zilla School; Rottary School, Khalishpur, Khulna. The guardians and students were questioned using pre-determined questionnaire with the permission of school administration. The statistic was done by their answers.

Data collection

This cross-sectional health survey was carried out with a self-designed standard questionnaire by directly interviewing the guardians and students. About 11 Bachelor of Pharmacy (Hons.) students of Jessore University of Science and Technology, Bangladesh were assigned by the chief investigator Md. Abdullah Aziz, Lecturer, Department of Pharmacy, Jessore University of Science and Technology, Bangladesh. No financial or material incentive was offered to participants.

A structured questionnaire was designed by the chief investigator for the study. The questionnaire contained some basic variables: age, class, weight, height, parents occupation, monthly family income, transportation medium, physical activity or sports involvement time, fast food consumption, fruits and vegetables consumption, time of watching television, diseases suffered by the participants etc. The questionnaires were supplied to the participants with proper instruction. The questionnaire took about 10 minutes to complete and contained mainly close ended questions.

The data collectors went to the schools and interviewed the children or their guardians with their teacher's consent between the months of June, 2016 to December, 2016. The patients who were suffering with psychiatric diseases and who were admitted into hospitals were excluded from the study. Few questionnaires were excluded during the data analysis because of inadequate information.

Ethical considerations

The study was conducted following the general principles (section 12) of WMA declaration of Helsinki [14]. This survey based research is also logistically supported by the Department of Pharmacy, Jessore University of Science & Technology, Bangladesh. The institutional ethical review committee of Jessore University of Science and Technology, Bangladesh approved all the protocols used in this survey.

Statistical analysis

Mean difference between normal weight category and other BMI categories were calculated by one way analysis of variance (ANOVA) with descriptive statistics. Results are expressed in frequency distribution, percentages and mean value with standard error value. In addition odd ratio with 95% confidence interval and their significance were determined also. Socio-demographic and dietary correlations were performed by binary logistic regression analysis. In binary regression analysis, we considered both underweight and normal population in normal weight category and overweight and obese population were considered in obese category. All data were analyzed using SPSS software (version 23; IBM Corporation, New York, USA).

Results

It was the first survey made in Khulna city on childhood obesity. The survey data was taken from 300 children from different schools of Khulna city. Among this 300 children, 70 was underweight (23.33%), 106 was in normal weight range (35.33%), 75 was in overweight range (25.00%) and the rest 49 was in obese category which 16.34% of the total sample children. We also observed that (mean ± standard) error BMI of underweight, normal weight, overweight and obese children and adolescents are (15.74±.24) kg/m^2, (20.75±.24) kg/m^2, (27.86±.15)kg/m^2 and (36.74±1.54) kg/m^2 accordingly. And if we notice we can see that the mean difference between normal weight category and other BMI category is significant (*$P<0.05$ vs normal weight). Which means there is a greater propensity of overweight and obesity compared to normal weight. These data are tabulated in table 1.

In table-2, demographic characteristics of these 300 study population are mentioned. We can see that among these 300 children and adolescents 132 are in the range of 7-10 years (44%), 151 are in 11-14 years (50.3%) and another 17 (5.7%) are between ages 15-18 years. Among these 300 children and adolescents 169 are male (56.3%) and 131 are female (43.7%). 171 children study in between class 1-4, 113 children study in between class 5-8 and 16 children and adolescents study in between class 9-12. Of these 300, 104 children and adolescent's fathers are service holder, 124 children and adolescent's fathers are businessmen and 72 children and adolescent's fathers are occupied in other sectors. 59 children and adolescent's mother works as service holder and the rest 241 children and adolescent's mother are housewives. Then in case of family income, 40 children and adolescent's family income is less than or equals to 10000 taka, 145 children and adolescent's family income falls within the range of 11000-20000 taka, 69 children and adolescent's family income is in between 21000-30000 taka, 26 children and adolescent's family income is in between 31000-40000 taka and 20 children and adolescent's family income is more than 40000 taka. Among these 300 children and adolescents, 216 children and adolescent have at least 1 overweight or obese parent.

Obesity and overweight is affected by several factors. In our study we considered these facts which are shown in table-3 and found significant values that prove their correspondence to obesity and overweight. In the study it was revealed that boys are at 1.107 times more risk of overweight and obesity than girls. Overweight and obesity is affected as age increases. The odds of overweight

and obesity is .064 and .058 times lower in case of age group 11-14 and 15-18 when compared with age group 7-10. Propensity of obesity increases as monthly income increases but the obtained values are not significant. Children who sleep 9-10 hours are at 12.618 times greater risk of becoming overweight and obese when compared to control group of children sleeping 7-8 hours. And children who sleeps least (5-6 hours) are at lowest (O.R.: .276 and CI: .080-.953) risk of becoming overweight and obese. Our study reveals that children having at least one overweight or obese parent have a possibility of being affected by overweight and obesity 7.382 (CI: 2.366-23.029) times when compared to children with no obese parent. This obtained data is very significant. Children who travel to school by rides such as bus, car, van or rickshaw are suffering from obesity 16.376 (CI: 5.352-50.113) times more than the children travelling to school by foot. Regular involvement in physical activity is also associated with over-weight and obesity. It is seen from our study that the children and adolescents who are involved in more time in sporting are at lower risk of being overweight or obese. In table 3 it is seen that the odds of being obese or overweight is 2.947 (CI: .921-9.427) times and 1.820 (CI: .494-6.710) times greater in the group showing 1-2 hours and no physical activity compared to the group having 2-3 hours of physical activeness. The less a child becomes involved in physical activity the more propensity there is that the child will become over-weight and obese. Watching television, fast food, fruits and vegetables consumption are also associated with becoming over-weight and obese and these data are both significant and very significant when compared to the arbitrary control group. Figure 1, figure 2 and figure 3 demonstrate the graphical relationship of obese and normal people with watching TV, fast food intake and fruits and vegetables consumption.

Among the 124 overweight and obese children, 75 were suffering from diseases of different magnitude. Among the diseased children 20 were fatigued, 15 had joint pain, 10 had shortness of breath, 10 were disoriented and 9 polyphagia cases were most prevalent. Figure 4 depicts the overall scenario.

Discussion

The principle outcome of this study was dictated by the predominance of over sleeping, transportation, physical inactivity, fast food consumption, watching television, less fruits and vegetables intake and risk of obesity among children in Khulna city. The after effects of this study are exceptionally disturbing with a scourge of corpulence in those children and adolescent, consuming fast foods and leading a sedentary life style. Around 75 (25%) understudy were recognized as overweight where around 49 (16.34%) understudies were recorded as obese with different stages of obesity. Our information propose that having overweight parent and engaging in sedentary activities including watching television, less physical activity and involvement in sports, food habit were potential risk factors for childhood overweight or obesity. The discoveries of this study are consistent with past studies from high and middle-income countries [15-17].

Our findings showed that overweight and obesity in Khulna city children has reached a critical stage, with 24% of boys and 17.33% of girls either overweight or obese in our 300 study population. If we compare our data with Brazilian data we see that the percentage of male obesity in Brazil is 28.30% and female children and adolescent obesity is 20.4% [18]. Our data are comparable with children and adolescent overweight data from developed countries such as the UK (23.6% boys, 27.9% girls) [19], Australia (25.8% boys, 24.0% girls) [20], New Zealand (29.2% in case of both boys and girls) [21] and American study (35.3% boys, 34.1% girls) [22]. From the comparison we can notice that our children and adolescents overweight and obesity rate is slightly lower than other countries but it is not ignorable.

Our information additionally uncovered noteworthy relationship amongst obesity and age. The substantial abatement in overweight and obesity with age was expected given that surveys in developed countries have reported either stable [21, 22] or positive [19, 20] trends. And in our study we found the odds of being overweight and obese lowered as the age increases.

In our study we additionally discovered some new information such as relation between sleeping time and over-weight and obesity. Where we found that the odd ration of (7-8 hours): (9-10 hours) is 1:12.618 (CI: 4.501-35.372). This might be helpful in case of future studies like relating causes of sedentary behavior and obesity prevalence.

Our data demonstrated that having at least one overweight parent increased the probability of a child being overweight, a finding steady with

previous studies in middle- and high- income countries such as Brazil and Australia [15, 23]. Genetic factors are one of the most important and alarming risk factors for overweight and obesity in children throughout the global health sector [23]. However, the commonness of childhood overweight and obesity in the Khulna city has expanded only in the last few years, which might be too short a time for any noteworthy genetic changes in the population. We gathered information about sustenance utilization routine of the study respondents; fast food utilization propensity has been found as a potential risk factor for overweight and obesity among children [23] which goes without hesitation with our studies. We also suspect that it could be the family dietary routine that contributes to weight gain among family members including young children.

A recent review on the connection amongst BMI and transportation to/from school presumed that while the link between active transport to/ from school and overall physical activity levels in children from developed countries is moderately entrenched, the association between active transport and body composition in children is less compelling [24]. However, two more recent studies have posited an alternative perspective. Perhaps the most convincing evidence was provided by Pabayo *et al* [25], whose three-year longitudinal study demonstrated that sustained active transport was associated with a favorable BMI trajectory over the early school years. In addition, Singh *et al* [26] presumed that a more prominent recurrence of active transport to and from school partially explained the relatively low mean BMI observed in Dutch adolescents when contrasted with their non-Western counterparts. These research data were also in harmony with our study data which showed a connection between school transport and weight gain.

Our data suggest that children who spent more time in physical activities such as playing general outdoor games were less prone to being overweight or obese and the association was very significant. This association indicates students' lack of propensity to be engaged in outdoor games in school or any other playground. The reduced physical activity of children and adolescent during home-stay could be linked with the rapid urbanization of Khulna city. The city is expanding in each and every direction as a consequence of the necessity for housing, which leads to a reduction of open spaces for recreation and physical activity and therefore, probably contributing to a change in physical activity pattern of both children and adults. Further exploratory research among young children to comprehend physical activity practices including type of activities practiced would be helpful to outline successful general well-being programs that aim to promote physical activity in this setting.

Technological advances in the form of hand-held electronic devices and computer games, and television programs have likely added to receive a way of life that includes less physical activeness and more stationary movement [27]. A study conducted among children in Iran reported an association between watching television and being overweight [16]. The study demonstrated that watching television decreased the amount of time spent on playing outdoor games which may brought about putting on additional weight. Another study in the US reported that sitting in front of the TV or video games for more than 2 hours a day expanded the danger of being overweight in kids [21]. In this study, we combined the time spent on watching television and found that overweight and obese children (27.33%) invested more time more than 2 hours on sedentary activities compared to healthy children. And the odd of being obese and overweight is 2.458 (CI: .937-6.447) times and 12.042 (CI: 2.813-51.555) times in 3-5 hours and greater than 5 hours compared to control 1-2 hours watching TV category.

Studies conducted in Brazil and Iran has reported lower educational status of parents as a risk factor for overweight and obesity in children [15, 16]. However, in this study we did not find any association between parents' education and obesity or overweight. So we took the liberty to omit this data from the result section.

Obesity in children and adolescents can have a harmful effect on the body in a variety of ways. Children who have obesity are more likely to have hypertensive and high cholesterol complications which may lead to cardiovascular disease (CVD); increased risk of impaired glucose tolerance, insulin resistance and finally to type 2 diabetes; breathing problems, such as asthma; joint problems and musculoskeletal discomfort. Fatty liver disease, gallstones, and gastro-esophageal reflux (also known as GERD or heartburn) [28-34]. In our study we found that 75 overweight and

obese children among the 124 were suffering from diseases. Most prevalent disease was fatigue (20). This might be resultant of problems associated with glucose absorption or lack of ample oxygen supply to the body muscles. In our study 15 children and adolescents were suffering from joint pain which is common side effect of obesity. Moreover, 10 were suffering from shortness of breath which may lead to asthma in near future. And 9 were suffering from polyphagia which is a digestive problem. This is an obvious indication that being overweight and obese is closely associated with prevalence of complicated diseases.

Conclusion

Our study demonstrated that age, socio-demographic status as well as several risk factors such as having overweight parent, limited physical activity at home, excessive fast food consumption and high levels of sedentary activities are associated with overweight and obesity among children in Khulna, Bangladesh. Public health programs are indispensable to increase awareness on these risk factors among children and adolescents in order to reduce the future burden of obesity-associated chronic diseases. Articles on obesity and its side effects should be included in text books for increasing awareness among the children. As well as the parents should be warned and enlightened about this obesity and over-weight phenomenon so that they could take care of the children in the family or in better terms from root level. Among different settings, schools should be the priority setting to target both children and adolescents because it offers huge opportunities to overcome this problem.

Conflict of interests:

The authors declare that there is no conflict of interests regarding the publication of this paper.

List of abbreviations:

BMI: Body Mass Index; CI: Confidence Interval; WHO: World Health Organization; SPSS: Statistical Package for the Social Sciences; ANOVA: Analysis of Variances

References

1. World Health Organization: Obesity: Preventing and managing the global epidemic. WHO technical report series 894. Geneva: World Health organization; 2000.

2. Ogden CL, Carroll MD, Fryar CD, Flegal KM. Prevalence of obesity among adults and youth: United States, 2011–2014. NCHS data brief, no 219. Hyattsville, MD: National Center for Health Statistics. 2015.

3. Ogden CL, Carroll MD, Lawman HG, Fryar CD, Kruszon-Moran D, Kit BK, et al. Trends in Obesity Prevalence Among Children and Adolescents in the United States, 1988-1994 through 2013-2014. JAMA 2016; 315 (21): 2292-9.

4. https://www.cdc.gov/obesity/data/childhood.html [Accession date: Oct 9th, 2017]

5. https://www.theverge.com/2017/6/12/15781314/obesity-health-disability-global-survey-data [Accession date: Oct 9th, 2017]

6. Ahmed T, Ahmed AMS: Reducing the burden of malnutrition in Bangladesh. BMJ 2009; 339:b4490.

7. Ahmed SMM, Islam MS, Razzaque A, Ahmed T. Socioeconomic differentials of childhood obesity among school children in the context of affluent society of Dhaka City. In 11th Annual Scientific Conference (ASCON). Dhaka, Bangaldesh: icddr,b 2007; 129.

8. Singh AS, Mulder C, Twisk JW, van Mechelen W, Chinapaw MJ. Tracking of childhood overweight into adulthood: a systematic review of the literature. Obes Rev 2008; 9:474–488.

9. Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. N Engl J Med 1997; 337:869–873

10. Bangladesh Bureau of Statistics: Statistical Pocketbook of Bangaldesh 2007.Dhaka, Bangladesh: Bangladesh Bureau of Statistics; 2007.

11. Mirelman A, Koehlmoos TP, Niessen L. Risk-attributable burden of chronic disease and cost of prevention in Bangladesh. Global heart 2012; 7:61–66.

12. Rahman SMM, Kabir I, Khaled MA, Bhuyan MAH et al. Prevalence and determination of childhood obesity in Dhaka city, 10th *ASCON* 2002; Abstract no.: 173.

13. https://en.wikipedia.org/wiki/Khulna [accession date: Sep 28, 2017].

14. WMA Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. [http://www.wma.net/en/30publications/10policies/b3/] [Accession date: Sep 28, 2017].

15. Giugliano R, Carneiro EC. Factors associated with obesity in school children. J Pediatr (Rio J) 2004; 80:17–22.

16. Mozaffari H, Nabaei B. Obesity and Related Risk Factor. Indian J Pediatr. 2007; 74:265–267.

17. Salmon J, Campbell KJ, Crawford DA. Television viewing habits associated with obesity risk factors: a survey of Melbourne school children. Med J Aust 2006; 184:64–67.

18. Duncan S, Duncan EK, Fernandes RA et al.: Modifiable risk factors for overweight and obesity in children and adolescents from São Paulo, Brazil. BMC Public Health 2011; 11:585.

19. Stamatakis E, Wardle J, Cole TJ; Childhood obesity and overweight prevalence trends in England: evidence for growing socioeconomic disparities. Int J obes 2010; 34(1):41-47

20. Australian Bureau of Statistics: National Health Survey 2007-08. Canberra: Australian Bureau of Statistics 2008; 18.

21. Ministry of Health: A Portrait of Health: Key Results of the 2006/07 New Zealand Health Survey. Wellington: Ministry of Health 2008.

22. Ogden CL, Carroll MD, Curtin LR et al. Prevalence of high body mass index in US children and adolescents, 2007-2008. JAMA 2010; 303(3):242-249.

23. Gibson LY, Byrne SM, Davis EA et al. The role of family and maternal factors in childhood obesity. Med J Aust 2007; 186:591–595.

24. Faulkner GE, Buliung RN, Flora PK et al. Active school transport, physical activity levels and body weight of children and youth: a systematic review. Preventive medicine 2009; 48(1):3-8.

25. Pabayo R, Gauvin L, Barnett TA et al. Sustained active transportation is associated with a favorable body mass index trajectory across the early school years: findings from the Quebec Longitudinal Study of Child Development birth cohort. Prev med 2010; 50 (Suppl 1): S59-64.

26. Singh AS, Chinapaw MJ, Brug J et al. Ethnic differences in BMI among Dutch adolescents: what is the role of screen-viewing, active commuting to school, and consumption of soft drinks and high-caloric snacks? The international journal of behavioral nutrition and physical activity 2009;6:23.

27. Singh AK, Maheshwari A, Sharma N et al: Lifestyle associated risk factors in adolescents. Indian J Pediatr 2006; 73:901–906.

28. Cote AT, Harris KC, Panagiotopoulos C, et al. Childhood obesity and cardiovascular dysfunction. *J Am Coll Cardiol.* 2013;62(15):1309–1319.

29. Lloyd LJ, Langley-Evans SC, McMullen S. Childhood obesity and risk of the adult metabolic syndrome: a systematic review. *Int J Obes (Lond).* 2012;36(1):1–11

30. Bacha F, Gidding SS. Cardiac abnormalities in youth with obesity and type 2 diabetes. *Curr Diab Rep.* 2016;16(7):62.

31. Mohanan S, Tapp H, McWilliams A, Dulin M. Obesity and asthma: pathophysiology and implications for diagnosis and management in primary care. *Exp Biol Med* (Maywood). 2014;239(11):1531–40.

32. Narang I, Mathew JL. Childhood obesity and obstructive sleep apnea. *J Nutr Metab.* 2012.

33. Pollock NK. Childhood obesity, bone development, and cardiometabolic risk factors. *Mol Cell Endocrinol.* 2015;410:52-63.

34. Africa JA, Newton KP, Schwimmer JB. Lifestyle interventions including nutrition, exercise, and supplements for nonalcoholic fatty liver disease in children. *Dig Dis Sci.* 2016;61(5):1375–1386.

Table 1: Prevalence of obesity among the study population based on BMI (according to WHO)

Category	WHO BMI Range (Kg/m^2)	BMI (Kg/m^2)	Frequency N=300	Percentage (%)
Underweight	<18.5	15.74±.24*	70	23.33
Normal weight	18.5-24.9	20.75±.24	106	35.33
Overweight	25-29.9	27.86±.15*	75	25.00
Obese	30-40 &>40	36.74±1.54*	49	16.34

Values are presented as mean ± standard error of mean. *P<0.05, *vs.* Normal weight (Dunnett's t test).

**Table 2:** Demographic characteristics of study population

Question pattern	Response pattern	Frequency N=300	Percentage (%)
Age	7-10 11-14 15-18	132 151 17	44 50.3 5.7
Sex	Boys Girls	169 131	56.3 43.7
Class	1-4 5-8 9-12	171 113 16	57 37.66 5.34
Father's Occupation	Service holder Business Others	104 124 72	34.67 41.33 24
Mother's Occupation	Service holder House wife	241 59	80.33 19.67
Family Monthly income (BDT)	<10,000 10,000-20,000 21,000-30,000 31,000-40,000 >40,000	40 145 69 26 20	13.3 48.3 23 8.7 6.7
Having at least one overweight/ obese parent	Yes No	213 87	71 29

Table 3: Socio-demographic and dietary correlates of overweight and obesity in Khulna children and adolescents aged 7-18 years.

Risk factors		Number of study population		Odd ratio (95% CI)
Category	Range	Normal weight	Obese and over weight	
Gender	Female	79	52	1
	Male	97	72	1.107 (.431-2.848)
Age	7-10	58	74	1
	11-14	108	43	.064 (.022-.184)**
	15-18	10	7	.058 (.010-.341)**
Monthly income of family (TK BDT)	<10000	25	15	1
	11000-20000	92	53	1.235 (.331-4.606)
	21000-30000	36	33	1.223 (.295-5.070)
	31000-40000	15	11	1.240 (.190-8.081)
	>40000	8	12	1.616 (.213-12.285)
Sleeping time (hours/day)	7-8	75	30	1
	5-6	59	12	.276 (.080-.953)*
	9-10	42	82	12.618 (4.501-35.371)**
At least one overweight/obese parent	No	77	10	1
	Yes	99	114	7.382 (2.366-23.029)**
Travelling to school	Walk	102	32	1
	Bicycle	32	15	2.265 (.754-9.326)
	Other rides	42	77	16.376 (5.352-50.113)**
Physical activity (hours/day)	2-3	52	22	1
	3-4	22	5	1.741 (.315-9.622)
	>4	12	8	2.210 (.225-21.696)
	1-2	59	59	2.947 (.921-9.427)
	None	31	30	1.820 (.494-6.710)
Watching tv (hours/day)	1-2	96	42	1
	3-5	64	53	2.458 (.937-6.447)
	>5	16	29	12.042 (2.813-51.555)**
Fast food consumption (days/week)	1-2	80	22	1
	3-4	41	33	4.369 (1.213-15.740)*
	>5	55	69	12.628 (3.488-45.718)**
Fruits and vegetables consumption (days/week)	5-7	76	22	1
	2-4	20	30	10.650 (2.820-40.220)**
	<2	80	72	13.257 (4.389-40.046)**

*Significantly different from reference group (P < 0.05). **Significantly different from reference group (P < 0.01).
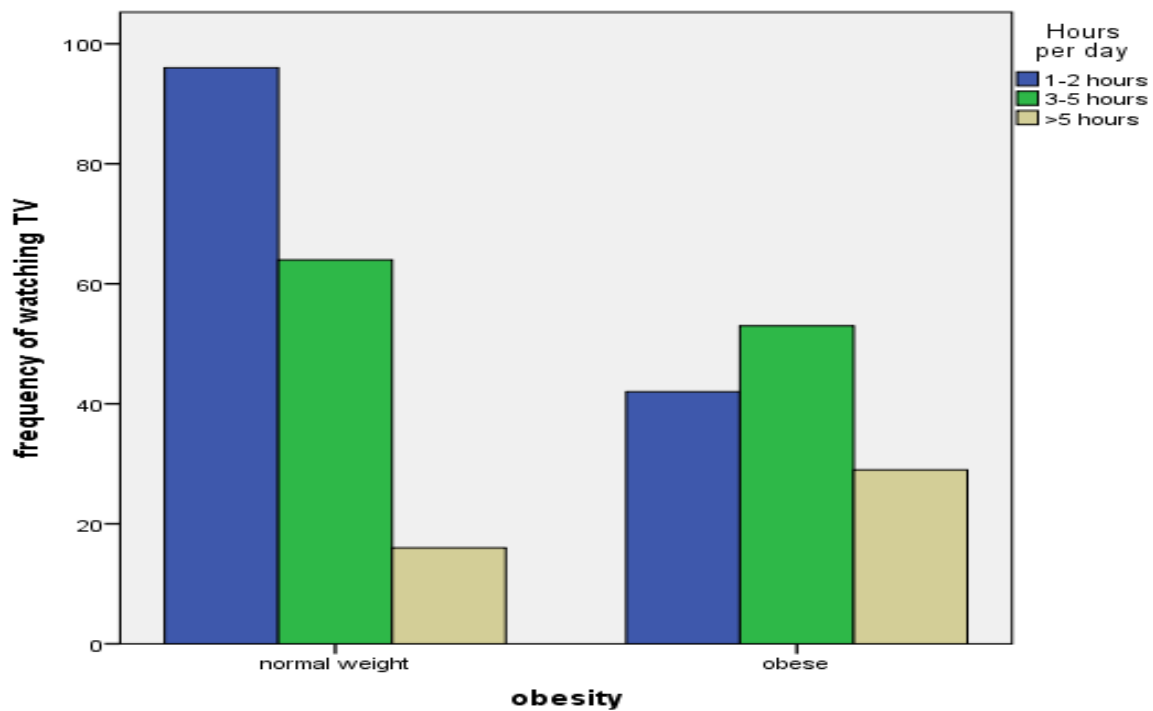
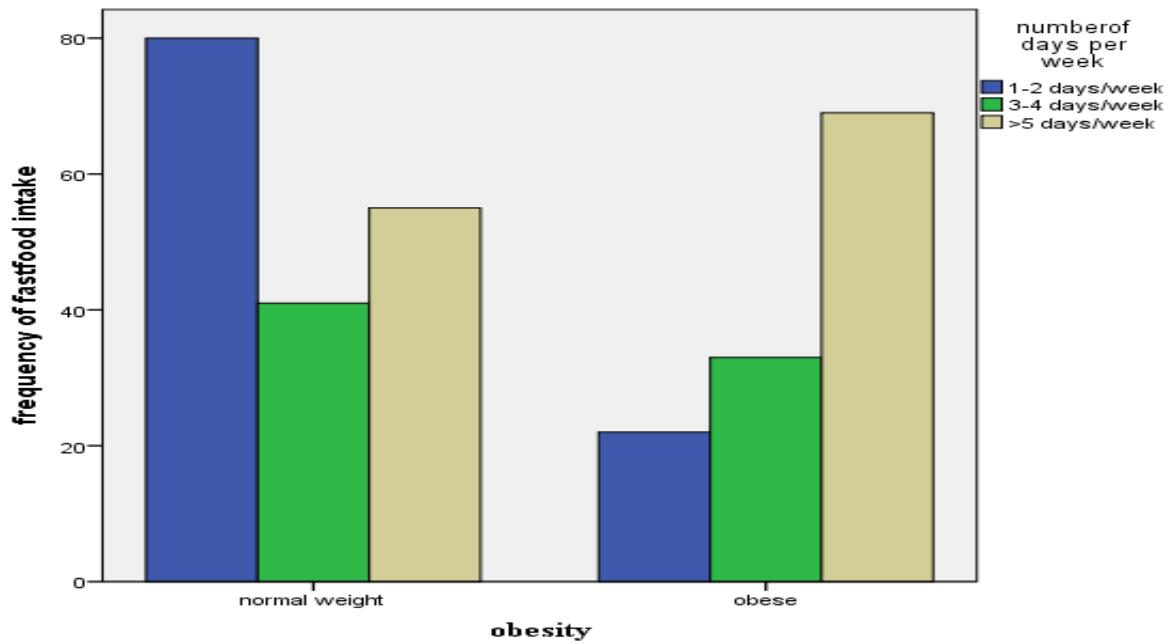**Figure 1:** Clustered bar view of obesity and normal category with watching TV.

Figure 2: Clustered bar view of obesity and normal category with fast food intake.
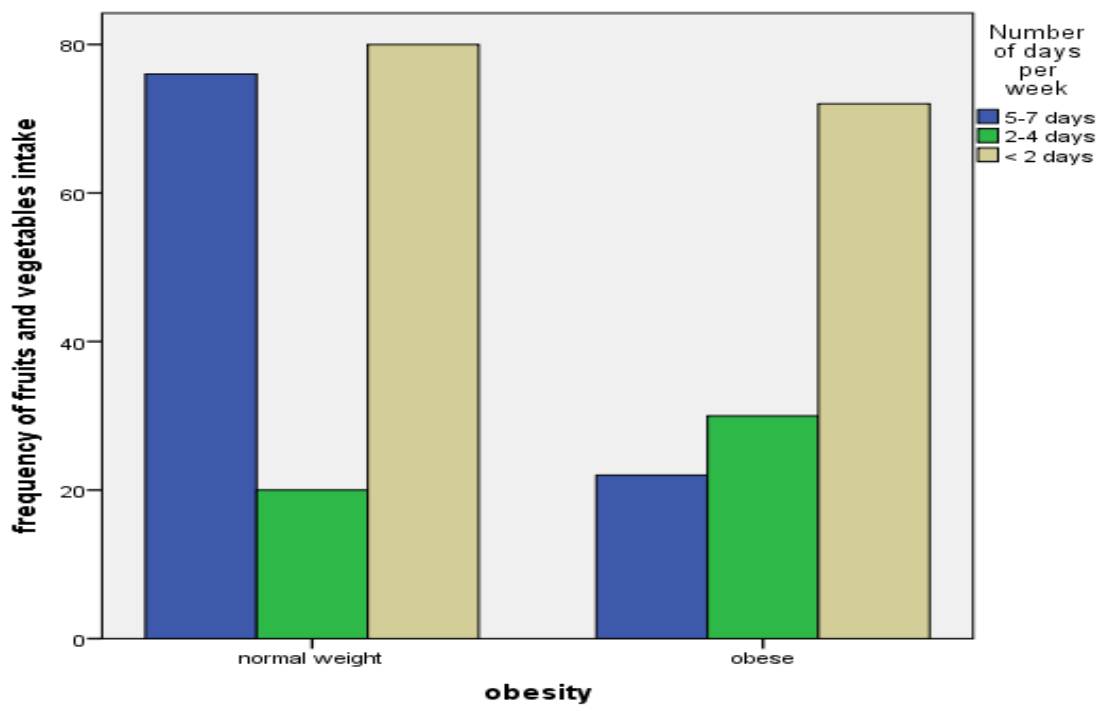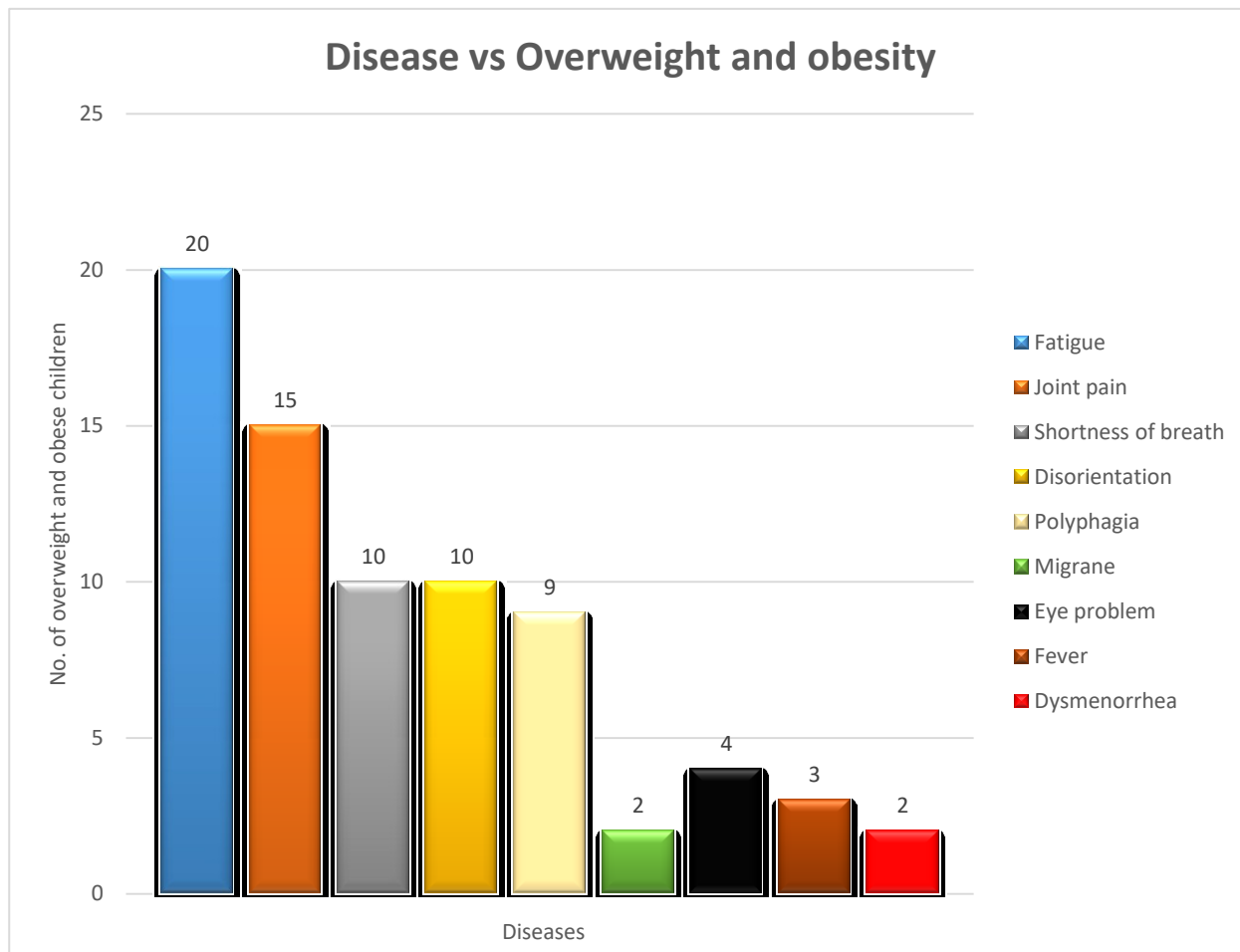

Figure 3: Clustered bar view of obesity and normal category with fruits and vegetables intake.

Figure 4: Prevalence of diseases among overweight and obese.