ASSESSMENT OF RISK FACTORS FOR OBESITY IN SELECTED SCHOOL CHILDREN AGED 4-9 YEARS OLD

Aynul Islam Khan*[1], C. A. Kawser[2], Bijoy Chakraborty[3] and S. M. Shatil Shahriar[4]

*[1]Department of Pediatrics, Colonel Malek Medical College, Manikganj.

[2]Dept. of Paediatrics, Bangabandhu Sheikh Mujib Medical University.

[3,4]Department of Pharmacy, University of Development Alternative.

*Corresponding Author
Aynul Islam Khan
Department of Pediatrics,
Colonel Malek Medical
College, Manikganj
aynulislamkhan@yahoo.com

ABSTRACT

Background and aims: Childhood obesity has reached epidemic proportions in developing countries along with childhood under-nutrition. Childhood obesity increases the risk of dyslipidemia, hypertension, metabolic syndrome, type 2 diabetes and other non-communicable diseases in later years of life. This study was conducted to explore the prevalence of childhood obesity and to identify its risk factors in a selected financially well-to-do Bangladeshi population. **Methodology:** A survey was conducted amongst school children aged between 4-9 years in Dhaka city to estimate the prevalence of obesity in that age population. Children with BMI for age and sex $\geq 95^{th}$ percentile of CDC growth chart were designated as obese. Amongst the obese children, 96 were randomly selected and matched with the same number of normal weight children of the same age and sex, who were taken as control. Data regarding dietary habits, physical activities and life style risk factors were collected from the participants using a structured questionnaire (covering parent's income, expenditures on food, dietary habits, TV watching and video gaming duration, family structure and size, position of index case, and parental education or occupation) to identify the risk factors for development of obesity. **Results:** Prevalence of obesity was 13% amongst studied population (460 out of 3527 children screened). Children's parental income, expenditures on food, dietary habits, prolonged TV watching and video gaming were significant predictors of obesity. No association of obesity with family structure and size, position of index case, and parental education or occupation was found. **Conclusions:** Childhood obesity is an emerging health problem amongst the school children in Dhaka city. Children's family income, expenses on food, dietary habits and

physical inactivity were identified as risk factors. Preventive strategies are to be developed after further confirmation of the findings in larger studies.

KEYWORDS: Childhood obesity, risk factors - dietary habits, physical activities and life style risk factors.

INTRODUCTION

The human race is facing a novel and enormous health challenge due to the rapidly unfolding global epidemic of obesity. The factors responsible for this change are changes in the nature of our diet, transformation of agricultural production, urbanization and the development of sedentary modes of work and leisure (James et al. 2006). Childhood obesity causes bow-legged children, pseudo tumor cerebri, asthma, obstructive sleep apnea syndrome, gallstones and fatty liver, insulin resistance, metabolic syndrome, hyperandrogenemia - in females, impaired glucose tolerance (pre-diabetes) or type 2 diabetes, abnormal menstrual cycle including early and late onset of menarche, hirsutism, acne, acanthosis nigricans etc. (Must and Strauss, 1999).

Socio-economic and socio-demographic risk-factors include family size, birth order, family income, family expenditure, care-giving etc. and these factors are responsible for the development of childhood obesity (Ravelli et al 1979). There is not much published data on prevalence of childhood obesity in our country. Also, there is no study on analysis of risk factors for development of obesity in our population. Thus, this study was designed to focus on a selected population of school children to estimate the prevalence of obesity among them and to identify some risk factors for the development of obesity. The identification of risk factors is the key to prevention of childhood obesity, as there is no single cause for development of obesity. Therefore, this study is to identify the risk factors contributing to obesity in children to help design effective local prevention efforts and to develop recommendations for the prevention and management of obesity for a developing country like Bangladesh for a healthy tomorrow.

MATERIALS AND METHODS

A case-control study was conducted at the department of Paediatrics, Bangabandhu Sheikh Mujib Medical University, Dhaka, and eight (8) schools in Dhaka city during the period of July 1, 2008 to June 30, 2009 (12 months).

Study population and Sampling technique

All school going children aged between 4-9 yrs in 8 schools of Dhaka city were selected for the study. Out of eight schools, four were English medium and four were Bengali-medium schools which were located in different areas of Dhaka city. Written consent were obtained from school authorities initially and then from the students and their guardians to conduct the study. Height and weight of all children in this age group were measured. Thereafter, the BMI for age and sex of all students as per CDC growth chart were determined. Children whose BMI for age were $\geq 95^{th}$ percentile of CDC growth chart were selected as obese. Finally, 12 obese students from each school were selected by lottery method from six age groups belonging to 4 to 9 yrs. From each age group one boy and one girl were selected. Thereafter, for each obese child one non-obese age and sex matched child was also selected. In total, 192 students (8 X 12 =96 obese and 96 non-obese) were selected for the study purpose.

Data collection

Data regarding different risk factors were collected from the participants using structured questionnaire by the researcher. The risk factors were classified into 3 groups - dietary habits, physical activities and life style risk factors. The structured questionnaire gathers information on detailed dietary intake, physical activities and the number of hours of sedentary activities etc. Information on socio-economic and socio-demographic status like position of the index case, family members, family structure, income level, expenditure on food and educational status of parents were also included in the questionnaire.

Data analysis plan

Then data were analyzed by computer based program SPSS (Statistical Package for Social Science) 12.0 version. Confidence interval was set at 95% level. p value < 0.05 was considered as significant. Chi- square test was done for making comparison between qualitative data. Odds ratios were calculated manually for exposing the associations between childhood obesity and risk factors.

Ethics

The Ethical Committee of the Department of Paediatrics, BSMMU, approved the protocol. Informed written consent was taken from all the mothers/parents/guardians after full explanations of the nature and purpose of the procedure to be used for the study. Anonymity was maintained throughout the study, and none of the names were used in the database.

RESULTS

Total 3,527 students were screened (English medium school = 1771 and Bangla medium school = 1756), out of them 460 students were obese (13%). The bivarate analysis among Bengali and English medium obese and non-obese children were found to be significantly different (p < 0.00001).

	Bengali (%)	English (%)	Total (%)
Obese	185(10.5)	275(15.5)	460(13)
Non-obese	1571	1496	3067
Total	1756	1771	3527
df=1, Chi-square (^{2}) Test; p value < 0.00001.			

There were no significant correlation between the number of issues of a family, family structure, birth order, father's and mother's educational level, father's and mother's occupation with childhood obesity. Family income per month and expenditure of money on food per month were significantly related with the development of childhood obesity (P < 0.00001). Majority of the mother of both groups were the main care giver and no added risk was detected in relation to care giver or working mother.

Monthly family income (Tk.)	Cases (n= 96)	Controls (n= 96)	p-value
≥10,001-25,000	2(2.1)	21(21.9)	
25,001-50,000	28(29.2)	60(62.5)	<0.00001
50,001 and above	66(68.8)	15(15.6)	<0.00001
Monthly family expenditure on food (Tk.)	**Cases (n= 96)**	**Controls (n= 96)**	**p-value**
6,001-15000	1(1.0)	21(21.9)	
15,001 -30,000	41(42.7)	59(61.5)	< 0.009
30,001 and above	54(56.2)	16(16.7)	< 0.00001

Some socio-demographic risk factors were analyzed. Family income > 50,000/- per month and spending money > 30,000/- per month on food were associated with the development of childhood obesity with Odds Ratio of 11.88 and 6.4 respectively.

Socio –demographic risk factors for development of childhood obesity.

Socio –demographic Risk-factors	Case (n=96)	Control (n=96)	Odds ratio
Family income >50,000 /- taka	66	15	11.88
Expenditure on food >30,000/- taka	54	16	6.42
Working mother	15	13	1.18
Care-giver Mother only	79	87	0.48

Physical inactivity like watching TV, Video gaming, computer watching and also the availability of playing ground at school or near home were significantly (P < 0.00001) related with the development of childhood obesity. Watching TV for > 4hrs and playing Video

game/computer game for > 2hrs were found to increase risk of development of obesity with the OR of 26.3 and 13.2 respectively. Physical activity (> 2hrs), presence of play ground at or near home and at school were negatively related to the development of childhood obesity with OR of 0.22, 0.08 and 0.77 respectively.

Daily Hrs of TV watching	Cases (n=96)	Controls (n= 96)	p-value
< 4 hrs	47(48.9)	93(96.9)	<0.00001
4-8	44(45.8)	3(3.1)	<0.00001
> 8hrs	5(5.2)	0	
Total	96	96	

Activity-related risk factors for development of obesity in studied children.

Activity related risk factors	Case (n=96)	Control (n=96)	Odds Ratio
Watching TV < 4 hrs	47	93	0.03
Watching TV 4-8 hrs	44	3	26.33
Watching Videogame and computer < 2 hrs	22	27	0.75
Watching Videogame and computer 2-4 hrs	35	4	13.19
Physical activity < 2 hr	71	29	6.5
Physical activity ≥ 2-4 hr	25	59	0.22
Relationship with Play ground at or near home	20	72	.08
Relationship with Play ground at School	66	71	0.77

Dietary risk factors were analyzed for the development of childhood obesity considering the amount of diet and frequency of taking the feed were analyzed. Increased amount of rice, bread taking and the method of egg preparation (boiled/ fried) and the frequency of egg taking daily or weekly were considered. Taking more rice (> 2.5 plate), increased no. of bread (3-4 pcs), preparation of egg (boiled/ fried), increased frequency of taking egg were found to be risk factors for the development of obesity with ORs of 3.08, 1.5, 2.72 and 9.6 respectively. Odds ratios were not significant in case of fruits (OR 0.95) and vegetables (OR 0.58). Odds ratios were found to be more in the cases of increased intake of mutton (OR 6.68), chicken (OR 2.37) and noodles (OR 6.97). Also, daily intake of fish was found to be negatively related to the development of childhood obesity with OR of 0.46, when fish intake decreased to once weekly, the chance of development of obesity was more. The intake of fast foods like noodles (OR 6.9), chips (OR 11.18), burger (OR 6.6), pizza (OR 7.4), chicken roast (OR 6.4), juice (OR 2.3), ice cream (OR 8.09) were significantly working as risk factors in the development of Childhood obesity.

Comparison of possible Dietary habit - related risk factor for development of childhood obesity.

Risk factors		Case	Control	Odds Ratio
Considering the amount of rice	one and half plate	40	65	0.34
	Two and half plate	56	30	3.08
Considering number of taking bread	≤ 2 pcs	50	67	0.47
	3-4 pcs	3	2	1.5
ing frequency of taking potatoes	3 times weekly	62	22	6.13
	once weekly	23	59	0.19
	once fortnightly	1	10	.09

Considering the preparation of egg	Boiled	22	43	0.36
	Omlet/Fried egg	74	53	2.72

Considering frequency of taking egg only	Once daily	75	26	9.6
	3 times weekly	17	64	0.11

Relationship with vegetables intake	Once daily	10	16	0.58
	3 times weekly	47	47	1

Relationship with fruit intake	3 times weekly	55	56	0.95
	5 times weekly	09	26	0.27
Considering frequency of taking mutton	3 times weekly	42	10	6.68
	Once weekly	18	23	0.73
Considering frequency of taking Chicken only	3 times weekly	65	45	2.37
	Once weekly	4	26	0.11
Considering frequency of taking fish only	Once daily	38	56	0.46

	3 times weekly	24	22	1.12
	Once weekly	22	10	2.55
Considering frequency of taking noodles	Once daily	34	7	6.97
	3 times weekly	52	40	1.65
	Once weekly	1	30	0.02
Considering frequency of taking Chips only	Once daily	41	6	11.18
	3 times weekly	42	43	0.99
	Once weekly	3	24	0.09
Considering frequency of taking Burger only	3 times weekly	42	10	6.6
	Once weekly	22	12	2.08
	Once monthly	**6**	**29**	0.15
Considering frequency of taking Juices only	Once daily	11	5	2.3
	3 times weekly	9	7	1.31

	Once weekly	39	35	1.19
Considering frequency of taking chicken roast only	3 times weekly	25	5	6.4
	Once weekly	27	15	2.11
	Once monthly	19	41	0.33
Considering frequency of taking ice cream only	3 times weekly	9	2	4.9

	Once weekly	25	4	8.09
	Once fortnightly	40	15	0.71
Considering frequency of taking sweet meat only	3 times weekly	12	3	4.42
	Once weekly	53	14	7.21
	Once monthly	22	58	0.19
Considering frequency of taking Pizza only	Once weekly	7	1	7.4
	Once fortnightly	13	2	7.3
	Once monthly	15	7	2.3

DISCUSSIONS

This study was conducted among the children of 4-9 yrs of age in 8 schools of Dhaka city, 4 Bangla and 4 English medium schools were purposively selected. The prevalence of obesity was found to be 13% of which 15.5% were boys and 10.5% were girls. Highest rate of obesity was found among the English medium school boys of 8-9 yrs age group. Some studies of India, (Umesh et al. (2002) and Kaushik et al. (2007) in Kolkata) showed that obesity was between 6%-8% and 5.10% respectively among boys and girls, Anoop Misra et al. (2008) showed in his study that in urban New Delhi obesity has increased from 16% in 2002 to 24% in 2006-2007. Our study was done in Dhaka city which nearly matched with that of Anoop Misra's initial findings of 2002 but not with that of Umash and Kaushik et al.

A study was done in 2000-2001 in Dhaka city by Rahman et al. where obesity was found to be 7.6% among the studied population which doubled in our study undertaken after ten years. Our findings also differ with the findings of similar studies in developed countries like USA and Australia. The prevalence of obesity quadrupled over 25 years among the children of USA (Ogden et al. 2002) and Australia. Obesity in Australia has increased by 4.6 fold among girls and 3.4 folds among boys (Magarey, 2001). Boys were more obese in our study; this differs with the Australian study where girls were more obese (Magarey, 2001). Sample size and socio demographic and socio-cultural environment might be the cause of this difference.

Our study showed that no significant association exists between childhood obesity and no. of issues in a family, birth order, family structure and care giving. These study findings were inconsistent with another study (Wilkinson et al. 1997). In the other study of Wilkinson, prevalence of obesity was found to be high among the nuclear family and single child family and the prevalence declined with increase in the size of the family. Our study result was consistent with that of Revali et al. study (1979) regarding birth order. The study of Revali was done in urban area, because of the small sample size, where the family size was usually small with only one or two children and the unavailability of joint family the study did not

show any significant association with childhood obesity and size of the family.

Paternal and maternal educational status had no significant association with the development of childhood obesity. As the study was performed only in urban area where majority of the father and mother were literate and educated with graduate or postgraduate degrees, it was not possible to see the association between childhood obesity and illiteracy and uneducated parents.

WHO (1998) considered income, expenditure, education, occupation and place of residence (urban/rural) to evaluate socio-economic status in relation to obesity. In our study, we analyzed family income as well as family expenditure on foods. Study showed that 68.8% of children were from high income family in obese group. High family income (>50,000/-per month) with OR of 11.9 and spending on foods (30,000/- per month) with OR of 6.4 were associated with the risk of development of childhood obesity.

Previously, the daily life of children was full of activities and movements. Now a days sedentary behavior like watching TV and Videos and using computers are important part of daily routine. Absence of activities may also act as risk factors for development of childhood obesity. By reducing these types of sedentary activities childhood obesity can be prevented. Due to lack of outdoor games facilities, children are habituated to sedentary activities and become obese. It was observed that most of the schools had small playing ground and in some schools there was no playing ground available and children were not allowed to play where there was playground except weekly for 30-45 minutes. No significant association was found between schools having a playground and childhood obesity. On the contrary, who had play ground at or near home, were less prone to develop obesity. Our study was consistent with that of Timperio et al. (2004) which showed that whether there was safe place near home might influence if children almost inactive with indoor games will develop sedentary behaviors and acquire childhood obesity.

We considered the daily total hours of TV watching and computer game playing and found that there was significant association (p= 0.00001) between increased time (4-8 hrs) on TV watching and computer game playing (2-4 hrs) and childhood obesity. A cross-sectional study by Mendoza et al. (2007) found that watching TV / Video > 2 hours / day was associated with a high risk of being over weight or at risk of becoming overweight and developing higher adiposity. The association between TV watching and obesity was

statistically significant and persisted after other potential variables were controlled by another study done by Dietz and Gortmaker (1985).

The study was done in urban area (Dhaka) and most of the children (53.6%) had no access to computer game, total no. of children who were engaged in playing computer game < 2 hrs in a day was forty nine (49) among the 49 children, twenty two (22) were obese and twenty seven (27) were non-obese. No significant association was found by(<.44) Robinson et al. (1999) who conducted research to assess the effect of reducing TV/ Video watching and Video gaming and adiposity. However, introducing physical activities and changing dietary intake revealed that reducing those sedentary activities help to prevent childhood obesity.

Present study considered dietary habit related risk factors for the development of childhood obesity. The intake of the amount of rice, the method of preparation of eggs, taking more than >2.5 plates of rice daily and having egg daily were found as risk factors for development of childhood obesity with OR of 3.08 and 9.6 respectively. Frequency (3 times/ wk) of mutton, chicken and fish intake were considered and odds ratio were significant for mutton, OR of 6.68 and for chicken was 2.37. On the contrary, daily intake of fish was found to be negatively related to obesity with OR of 0.46. Interestingly, it was seen that those who were taking fish once weekly had the chance of being obese 2.55 times less than their counter part, because of the possibility of taking mutton or egg in exchange of fish in other days of the week. The intake of fast foods like noodles, chips, burger, pizza, chicken roast, juice, ice cream and sweat meats were considered, ORs were significantly higher in relation with daily /weekly/ fortnightly/ monthly consumption and ORs for chips taking daily, ice cream weekly were 11.18 and 8.09 respectively for the development of childhood obesity.

The study showed that the prevalence of childhood obesity was 13% amongst the studied population of children of 4-9 yrs age. This clearly indicates that childhood obesity is an emergency health problem among the school going children in Dhaka city. Multiple risk factors as family income, family expenditure on food, dietary habits, sedentary behaviors and physical activities were identified for the development of childhood obesity in the study. This needs further study to confirm that our findings are responsible for the development of childhood obesity in Dhaka city as well as for all the children of the country.

Also, the study had inadequate sample size for representation of childhood obesity and was confined to Dhaka city only and finally schools were selected purposively and nearly of

similar socio-economic background.

CONCLUSIONS

The findings of this study showed that the prevalence of childhood obesity in the studied population was 13% amongst 4-9 years aged children. The prevalence rate indicates that childhood obesity is an emerging health problem among the studied student population of the selected school in Dhaka city.

Multiple risk factors like family income, family expenditure on food, dietery habits, watching TV, watching video and computer game and physical activities were identified in this study.

However, further study is needed to confirm the finding in Dhaka city as well as for all children of the country.

LIMITATIONS

The limitations of the study were the following, study was limited to Dhaka city only and the sample size was quite inadequate to represent this emerging health problem and the schools were selected purposively and represent nearly similar socio-economic background. All these limitations were due to shortage of time and funding and this present study was done as part of MD thesis.

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