



RESEARCH ARTICLE

PREVALENCE OF OBESITY AMONG PRIMARY SCHOOL MALE CHILDREN AGED 10-12 YEARS IN GANDHINAGAR CITY

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ARTICLE INFO

Article History:

Received 05th January, 2016
Received in revised form
07th February, 2016
Accepted 27th March, 2016
Published online 26th April, 2016

Key words:

Obesity,
Primary school male children,
Gandhinagar city.

ABSTRACT

Background: Obesity is a multi-factorial disease that develops from the interaction between genotype and the environment. It is a major public health problem resulting in serious social, physical and psychological damage. The prevalence of obesity and overweight among children is rising to alarming levels in developed and developing countries including Gandhinagar city.

Objectives:

- 1) To assess obesity among primary school male children aged 10-12 years in Gujarat, Gandhinagar city.
- 2) To recognize different sociodemographic data in obese and non obese children.
- 3) To assess feeding, feeding habits and physical activity as risk factors of obesity of the study population.
- 4) To verify relations between BMI and the studied parameters.

Sample size: It comprises all male obese children (n=100 and BMI \geq 23kg/m²) from different classes of the primary schools in the Gandhinagar City. A total of 100 normal weight control male children (BMI=15-20kg/m²) are selected from the same classes. Controls and cases were matched in age and socioeconomic conditions.

Universe: All Primary School Male Children Aged 10-12 Years in Gandhinagar city.

Materials and Methods: This case control study comprised 96 obese children (BMI \geq 23 kg/m²) and 96 non-obese children (BMI 15-20 kg/m²). Controls and cases were matched in age and socioeconomic conditions. Questionnaire interview was applied. BMI for children was calculated by a computer graphs program specially design to this purpose. Sex, age (years and months), height (in meters) and weight (in kilograms) were introduced into the program. Then by one click on calculate button, the BMI was automatically calculated. Data were analyzed using SPSS version 18.0.

Results: The prevalence of obesity among primary school male children aged 10-12 years in Gandhinagar city was 4.3%. Average body mass index of obese children (cases) was 25.8 \pm 2.7 whereas that of control children was 17.4 \pm 1.0. Family history, eating >3 meals/day, eating while watching television and lack of physical activity in terms of doing exercise and playing football were found to be factors that affect the obesity among the children.

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Citation: Nisha Kanabar, 2016. "Prevalence of obesity among primary school male children aged 10-12 years in Gandhinagar city", *International Journal of Current Research*, 8, (04), 29572-29577.

INTRODUCTION

Definition of obesity

Obesity is a condition in which excess body fat has accumulated to an extent that health may be negatively affected. Obesity is the consequence of an overall positive energy balance maintained over time, that is, the metabolizable

energy intake exceeds the energy expenditure for basal metabolic requirements, thermoregulation, physical activity, and growth (Rosenbaum *et al.*, 1997).

Assessment and classification of obesity

Obesity is measured in terms of a person's body mass index which is determined both by weight and height. Body mass index (BMI) of children differs from adult, the assessment of weight status is much more complex. This is because children are growing and the growth patterns (and hence the BMI) of children differs by age (Parliamentary Office of Science and Technology, 2003 and Barbara and Clyde Park, 2009). The

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pattern of growth is dependent upon the sex of the child since the growth pattern for boys is very different from the growth pattern for girls. For children, BMI is determined based on carefully measured height and weight and then graphs or growth charts are used to find each child's BMI percentile-for-age by plotting the BMI value versus age on a growth chart for that child's sex. To use a BMI chart, you must know the birth date of the child, so that you can calculate the age of the child (in months) on the date that his or her height and weight were measured. The BMI graphs or growth charts were developed by Centers for Disease Control and Prevention (2000).

Accordingly, children BMI (BMI for age percentile, age 2-19 years) was classified as follows:

Underweight \leq 5th percentile, healthy weight 5th to the 85th percentile, overweight 85th to the 95th percentile and obese \geq 95th percentile (Benjamin, 2010). In the present study children aged 10-12 years and the normal BMI was calculated at 15.0-20.0 kg/m² whereas the BMI for obese children was calculated to be \geq 23.0 kg/m².

Prevalence of obesity

The prevalence of obesity has reached alarming levels, affecting virtually both developing and developed countries of all socio-economic groups, irrespective of age, sex or ethnicity. Concerning childhood obesity, the prevalence of overweight in Africa and Asia averaging well below 10% and in the Americas and Europe above 20% (Kosti and Panagiotakos, 2006).

MATERIALS AND METHODS

Study design

The present study is a case control.

Study population

The study population included the primary school male obese children (BMI \geq 23.0 kg/m²) in Gandhinagar City aged 10-12 years old. The controls were non-obese children with BMI 15-20 kg/m².

Sample size

It comprised all male obese children (n=96 and BMI \geq 23kg/m²) from different classes of the 13 primary schools in the Gandhinagar city. A total of 96 normal weight control male children (BMI=15-20kg/m²) were selected from the same classes. Controls and cases were matched in age and socioeconomic conditions.

Questionnaire

A meeting interview was used for filling in the questionnaire for both cases and controls (Annex 1). All interviews were conducted face to face with children parents. During the survey the interviewer explained any of the questions that were not clear. Most questions were of one of two types: the yes/no

question, which offer a dichotomous choice; and the multiple choice questions, which offer several fixed alternatives (Backstrom and Hursh-Cesar, 1981). The questions were direct and brief and the validity of the questionnaire was tested by six specialists in the fields of epidemiology, public health, biochemistry and nutrition. The questionnaire included personal information, sociodemographic data (education and occupation of the children parents, family income/month and family history of obesity), feeding and feeding habits (breast feeding, drinking soft drink, eating sweets, eating indomy, number of meals/day and eating while watching television) and physical activity (doing exercise and playing football) and breast feeding and family health education. Pilot study was done prior to beginning real data collection to know the length and clarity of questionnaire and to evaluate the outcome. Twelve individuals were interviewed. At the end of the pilot study, a comprehensive revision to questionnaire was made and modified as necessary. The pilot subjects were not included in the study.

Eligibility

Inclusion criteria

A. Case group

Obese children (BMI \geq 23kg/m²) aged 10-12 years old.

B. Control group

Normal weight children (BMI 15-20kg/m²) aged 10-12 years old.

Exclusion criteria

Apparently not healthy children were excluded

Ethical consideration

Parents of the children were given a full explanation about the purpose of the study assurance about the confidentiality of the information and that the participation was optional.

Body Mass Index (BMI)

BMI was used for evaluation the obesity. To measure BMI, one begins by weighting the child in light clothes and without shoes. Height is measured without shoes. BMI for children was calculated by a computer graphs program specially design for this purpose.

The following parameters were introduce into this program: sex, age (years and months), height (in meters) and weight (in kilograms). Then by one click on calculate button, the BMI was automatically calculated. Body mass index: Normal=15.0-20.0, Obese= \geq 23.0 kg/m².

Statistical analysis

Data were analyzed using Statistical Package of Social Sciences (SPSS) system (version 18.0).

Table 1. Anthropometric measurements of the study population

Anthropometric measurement	Control (n=96) mean± SD	Case (n=96) mean± SD	% difference	t	Pvalue
Weight (kg)* (min-max)	35.7±3.4 (29-44)	57.0±8.8 (43-80)	59.7	22.595	0.000
Height (m)** (min-max)	1.43±0.06 (1.28-1.57)	1.48±0.07 (1.30-1.61)	3.5	5.668	0.000
BMI*** (min-max)	17.4±1.0 (15.0-20.0)	25.8±2.7 (23.0-34.6)	48.3	29.539	0.000

*Kg: kilogram, ** m: meter. ***BMI: Body mass index: Normal=15.0-20.0, Obese≥23.0 (CDC, 2000).
All values are expressed as mean ±SD. p<0.05: significant.

Table 2. Education and occupation of the children parents of both controls and cases

Sociodemographic aspect	Fathers		Mothers	
	Controls (n=96) No. (%)	Cases (n=96) No. (%)	Controls (n=96) No. (%)	Cases (n=96) No. (%)
Education				
Illiterate	2 (2.1)	1 (1.0)	1 (1.0)	0 (0.0)
Primary school	16 (16.7)	12 (12.5)	5 (5.2)	8 (8.3)
Preparatory school	18 (18.8)	26 (27.1)	30 (31.3)	32 (33.3)
Secondary school	32 (33.3)	29 (30.2)	44 (45.8)	38 (39.6)
University	28 (29.2)	28 (29.2)	16 (16.7)	18 (18.8)
Occupation				
Employed	68 (70.8)	70 (72.9)	13 (13.5)	12 (12.5)
Unemployed	28 (29.2)	26 (27.1)	83 (86.5)	84 (87.5)

Table 3. Family income /month and family history of obesity of the study Population

Sociodemographic aspect	Controls (n=96)		Cases (n=96)		χ ²	P-value
	No.	%	No.	%		
Family income /month (INR)*						
<10,000	50	52.1	42	43.8	1.489	0.475
10,000-20,000	34	35.4	38	39.6		
>20,000	12	12.5	16	16.7		
Family history of obesity						
Yes	33	34.4	57	59.4	12.047	0.000
No	63	65.6	39	40.6		

*INR:INDIAN NATIONAL RUPEE, P>0.05: not significant, P<0.05: significant.

Table 4. Breast feeding and family health education about obesity

Breast feeding and health education	Controls (n=96)		Cases (n=96)		χ ²	P-value
	No.	%	No.	%		
Breast feeding						
Exclusive breast feeding*		81.3	69	72.9		
Non-exclusive**	79	13.5	20	19.8	3.009	0.222
Artificial milk	12	5.2	7	7.3		
	5					
Family health education						
Yes	11	11.5	15	15.6	0.712	0.399
No	85	88.5	81	84.4		

*Exclusive breastfeeding: only breast milk, no other liquid or solid from any other source enters the child's mouth (Labbok, 2000).

**Non-exclusive breastfeeding: children received drinks/foods with breast milk. P>0.05: not significant

Table 5. Drinking and eating among the study population

Feeding items	Controls (n=96)		Cases (n=96)		χ ²	P-value
	No.	%	No.	%		
Drinking soft drink						
Yes	78	81.3	80	83.3	0.143	0.705
No	18	18.8	16	16.7		
If yes						
Daily	1	1.3	7	8.8	3.378	0.185
2-3 times/week	19	24.4	21	26.3		
Once/week	58	74.3	52	65.0		
Eating sweets						
Yes	91	94.8	93	96.9	0.130	0.718
No	5	5.2	3	3.1		
If yes						
Daily	31	34.1	42	45.2	3.440	0.179
2-3 times/week	41	45.1	30	32.3		
Once/week	19	20.9	21	22.6		
Eating indomy						
Yes	90	93.8	87	90.6	0.651	0.420
No	6	6.3	9	9.4		
If yes						
Daily	3	3.3	6	6.9	4.553	0.103
2-3 times/week	19	21.1	30	34.9		
Once/week	68	75.6	51	58.6		

P>0.05: not significant

Table 6. Feeding habits of the study population

Feeding habits	Controls (n=96)		Cases (n=96)		χ^2	P-value
	No.	%	No.	%		
meals/day						
2-3	87	90.6	73	76.0	7.350	0.007
>3	9	9.4	23	24.0		
Eating school meal					0.388	0.533
Yes	68	70.8	64	66.7		
No	28	29.2	32	33.3		
Eating while watching television					3.698	0.054
Yes	52	54.2	65	67.7		
No	44	45.8	31	32.3		

P>0.05: not significant, P<0.05: significant

Table 7. Physical activity among the study population

Physical activity	Controls (n=96)		Cases (n=96)		χ^2	P-value
	No.	%	No.	%		
Doing exercise					33.699	0.000
Yes	73	76.0	33	34.4		
No	23	24.0	63	65.6		
Playing football					12.343	0.000
Yes	68	70.8	44	45.8		
No	28	29.2	52	54.2		

P<0.05: significant.

Table 8. Socioeconomic parameters of obese children in relation to their body mass index

Socioeconomic parameters	Cases (n=96)		Test	P-value	
	No.	BMI (mean \pm -SD)			
Education level of the parents			F	0.191	0.902
Primary school	08	26.5 \pm 3.3			
Preparatory school	32	25.8 \pm 2.6			
Secondary school	38	25.7 \pm 2.8			
University	18	25.8 \pm 2.6			
Occupation of the parents			t	0.824	0.412
Employed	12	25.2 \pm 2.9			
Unemployed	84	25.9 \pm 2.7			
Family salary/month (INR)*			F	0.753	0.474
<10,000	42	26.2 \pm 2.6			
10,000-20,000	38	25.7 \pm 3.0			
>20,000	16	25.3 \pm 2.2			
Family history of obesity			t	0.358	0.721
Yes	57	25.9 \pm 2.5			
No	39	25.7 \pm 3.1			

P>0.05: not significant

Table 9. Breast feeding and health education of obese children in relation to their BMI

Breast feeding and health education	Cases (n=96)		Test	P-value	
	No.	BMI (mean \pm -SD)			
Breast feeding			F	0.377	0.687
Exclusive breast feeding	69	25.3 \pm 2.2			
Non-exclusive	20	25.5 \pm 2.9			
Artificial milk	7	26.0 \pm 2.7			
Family health education			t	1.249	0.215
Yes	15	25.7 \pm 2.5			
No	81	26.6 \pm 3.5			

P>0.05: not significant

Table 10. Drinking and eating of obese children in relation to their body mass index

Feeding habit	Cases (n=96)		t	P value
	No.	BMI (mean \pm -SD)		
Drinking soft drink			1.372	0.173
Yes	80	26.0 \pm 2.7		
No	16	25.0 \pm 2.6		
Eating sweets			1.242	0.218
Yes	93	27.7 \pm 2.6		
No	3	25.8 \pm 2.7		
Eating chips and indomy			0.317	0.317
Yes	87	25.8 \pm 2.7		
No	9	25.6 \pm 2.4		

P>0.05: not significant

Table 11. Feeding habits of obese children in relation to their body mass Index

Feeding habit	Cases (n=96)		t	P value
	No.	BMI (mean±SD)		
meals/day				
2-3	73	25.7±2.8	0.615	0.540
>3	23	26.1±2.6		
Eating school meal				
Yes	64	25.7±2.4	0.726	0.470
No	32	26.1±3.2		
Eating while watching television				
Yes	65	26.4±2.8	2.962	0.004
No	31	24.7±2.2		

P>0.05: not significant, P<0.05: significant

Table 12. Physical activity of obese children (cases) in relation to their body mass index

Physical activity	Cases (n=96)		t	P value
	No.	BMI (mean±SD)		
Doing exercise				
Yes	33	25.6±2.8	0.027	0.979
No	63	25.8±2.7		
Playing football				
Yes	44	25.5±2.6	1.100	0.274
No	52	26.1±2.8		

P>0.05: significant

The following statistical tests were applied:

- Frequency distributions
- Independent-samples *t*-test
- Chi-square test
- ANOVA test
- Correlation test

The percentage difference was calculated according to the formula:

Percentage difference= mean of cases / mean of controls x 100. Probability values (p) were obtained from the students table of *t*. and significance was at $p < 0.05$. Range as minimum and maximum values was used. Microsoft Excel program version 11.0 was used for correlation graphs plotting. Out of 3409 primary school male children, 148 was found to be obese. Therefore, the prevalence of obesity among primary school male children aged 10-12 in Gandhinagar city was 4.3%. A total number of 96 obese children parents were respond to questionnaire interview. Therefore the response rate was 64.9%. A total of 96 non obsess children were served as controls. The age of the study population ranged from 10-12 years with mean of 11.1±0.7 for controls and 11.2 ±0.6 for cases (t=0.855, P=0.394).

DISCUSSION

Obesity is a major public health problem resulting in serious social, physical and psychological damages. The prevalence of obesity and overweight among adult and children is increasing in developed and developing countries. Despite that, there are under-diagnosis and underreporting of the disease. Data on obesity were limited to annual reports emerged from the Palestinian Ministry of Health. Recently, few studies have been carried out on adult obesity in the Gaza Strip (Zabut *et al.*, 2007; Zabut *et al.*, 2009 and Al-Jedi, 2010).

The present study is a case control investigation included 96 obese children (BMI ≥ 23.0 kg/m²) and 96 control (non obese individuals, BMI=15.0- 20.0 kg/m²) matched with age. Body mass index of children differs from adult, the assessment of weight status is much more complex. This is because children are growing and the growth patterns (and hence the BMI) of children differs by age (Parliamentary Office of Science and Technology, 2003 and Barbara and Clyde Park, 2009). The pattern of growth is dependent upon the sex of the child since the growth pattern for boys is very different from the growth pattern for girls. Therefore, BMI for male children in present study was calculated by a computer graphs program specially design to this purpose. A very low level of illiteracy was found among parents of both cases and controls, reflecting a well educated community. Feeding and feeding habits of the study population revealed higher number of cases who drunk soft drink and ate sweets than their counterparts with no significant differences . On the other hand the number of cases who had more than 3 meals/day was significantly higher than controls. Eating while watching television showed a borderline significant difference with higher number of cases. Obese children and adolescents consumed significantly more servings of grain products, food away from home, sugar-sweetened drinks and potato chips which contributed to a higher calorie, fat and sugar intake compared to non-obese children and adolescents. Eating while watching television was significantly associated with BMI in obese children. Three potential mechanisms have been suggested to link television viewing and obesity. The first mechanism is reduced energy expenditure from television viewing displacing physical activity (Epstein *et al.*, 1997). The second mechanism is increasing dietary energy intake from eating during viewing or from the effect of food advertising. A third potential mechanism is that television viewing decreases resting metabolic rate (Buchowski and Sun, 1996). However, the relation between BMI and other items of feeding and feeding habits was not significant. Concerning physical activity in

terms of doing exercise and playing football, the present results revealed that the number of cases doing physical activity was significantly lower than controls. This indicates that physical activity has a preventive effect on obesity. However, this effect was masked within obese children. Such inverse relationship between physical activity and obesity was exhibited by many authors (Trost *et al.*, 2001; Lioret *et al.*, 2007 and Fernandes and Sturm, 2011). In the context of etiology of obesity, Afridi and Khan, (2004) reported that obesity develops as a result of a complex interaction between a person's genes and the environment characterized by long-term energy imbalance due to excessive caloric consumption, insufficient energy output (sedentary lifestyle, low resting metabolic rate) or both. In addition, Yu *et al.* (2002) pointed particularly to the potential benefit of increasing physical exercise time relative to sedentary activities to reduce the prevalence of childhood obesity.

Conclusion

- The prevalence of obesity among primary school male children aged 10-12 years in Gandhinagar City was 4.3%.
- Body mass index of obese children (cases) was 25.8 ± 2.7 whereas that of control children was 17.4 ± 1.0 .
- Family history was a risk factor of obesity.
- The number of cases who exclusively breastfed was lower than controls whereas those who had more than 3 meals/day was significantly higher than controls, implying that lack of breast feeding and having >3 meals/day could contribute to obesity.
- Eating while watching television showed a borderline significant difference with higher number of cases. However, eating while watching television was significantly associated with BMI in obese children.
- Concerning physical activity in terms of doing exercise and playing football, the number of cases was significantly lower than controls, indicating that physical activity has a preventive effect on obesity.

Recommendations

- Launching of health education programs among children parents on childhood obesity in terms of avoiding factors contributing to weight gain and the benefit of follow up a healthy diet.

- Eating >3 meals/day as well as eating while watching television must be avoidable as far as possible.
- Exclusive breast feeding is appreciated at least for the first six months.
- Regular physical activity is highly recommended.

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