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Determination of The Primary Reasons For Overweight and Obesity Among First Grade Elementary School Students in Shiraz During The Academic Year 2010-2011

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Background: The epidemic peak of obesity and overweight began in 1980. Obesity during childhood and adolescence, particularly in the second decade of life, is a strong predictor of obesity in adulthood. The significant risk factors for obesity and overweight in childhood include breastfeeding, obese parents, socioeconomic status, birth weight, physical activities and diet. Breastfeeding is one of the most important strategies for weight loss and reduction in childhood obesity.
Objectives: The purpose of this study is to investigate the relationship between overweight, obesity, breastfeeding patterns and birth weight among first grade elementary school students in Shiraz, Iran.
Patients and Methods: This case-control study included 200 obese (case group) and 200 normal weight (control group) children. A sample size of 400 children was determined. Study participants were selected from among elementary schools in Shiraz by multistage sampling. First, schools were chosen according to a stratified random sampling method. Then, we chose all overweight or obese first grade students. For each case, we chose a control student matched in terms of age, sex, grade and elementary school. The General Information Questionnaire, Socioeconomic Questionnaire, Questionnaire of Breastfeeding during Infancy, Physical Activity Questionnaire and 24-Hour Dietary Recall Questionnaire were completed. Mothers' height and weight were also measured. Data analysis was carried out by SPSSversion 15.
Results: There was a significant difference in breastfeeding duration between the case and control groups. No relationship was found among birth weight, overweight and obesity in the case group. Mother's body mass index (BMI) and obesity in immediate family members showed a significant difference between case and control groups. There was no significant difference in the socioeconomic status of the two groups.
Conclusion: Obesity and overweight in first grade elementary school students is related to breastfeeding pattern; however, this may not be an independent relationship.

Keywords: Overweight; Obesity; Breast feeding; Birth weight

1. Background

The epidemic peak of obesity and overweight began around 1980. In 1997, WHO declared that obesity was a threat to public health (1-3). Obesity during childhood and adolescence, especially during the second decade of life, is a strong predictor for obesity in adulthood. The prevalence of obesity is increasing among children and adolescents in many countries including those where malnutrition attributed to nutrient deficiencies is still a public health problem (4, 5). The prevalence of obesity among 6 to 14 year-old children has tripled in the US during the last 30 years. The number of 6 to 14 year-old overweight children in Europe has been estimated to be 14 million. Childhood obesity is a serious health problem in the US and worldwide. More than 30% of American children and adolescents are overweight or obese. Rates of overweight North American children and adolescents have increased dramatically since the 1970 s (6, 7). Childhood obesity has reached epidemic proportions and there are calls for prevention and treatment programs to reverse this trend. During the past two decades the prevalence of obesity in children has risen greatly worldwide. According to reported statistics in Iran, childhood obesity existsin6.5% of 5 to 10 year-old children from Tehran, 6% of 6 to 14 year-old children from Shiraz, 11.9% of 7 year-old children from Khoy, and 20% of 6 to 14 year-old children from Yazd (8, 9). Evidence shows that obesity and overweight during

Implication for health policy/practice/research/medical education:
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childhood will result in undesirable health and socioeconomic impacts during adulthood (10). Among major risk factors for obesity and overweight in childhood, we can refer to breastfeeding, obesity of parents, socioeconomic status, birth weight, physical activities and diet (11, 12). Numerous studies have focused on the relationship between birth weight and risk of overweight and obesity during childhood (13, 14). Although a great number of studies report that the prevalence of overweight and obesity is usually higher in children with higher birth weights, this has been disputed by other researchers (15). The Centers for Disease Control and Prevention has recommended breastfeeding as one of the most important strategies for reducing overweight and obesity in childhood. Thirty Research on 5-6 and 9-14 year-old children has revealed a protective effect for breastfeeding on reducing the risk of obesity among these age groups (16). Obesity in childhood causes a wide range of serious complications and increases the risk of premature illness and death later in life which raises public-health concerns. Results of research have provided new insights into the physiological basis of bodyweight regulation. However, treatment for childhood obesity remains largely ineffective (17). Although a positive effect has been observed for breastfeeding in some studies, a number of studies from different countries have reported different and sometimes contradictory results (13, 18).

2. Objectives

Based on the above-mentioned studies, breastfeeding can be considered as a preventive method for childhood obesity. However, other studies have not reported a positive effect of breastfeeding on the reduction of childhood obesity. No investigation has been carried out in Iran regarding the relationship between breastfeeding and birth weight, as well as childhood obesity prevention and control- one of the major health problems in Iran. Therefore this study focuses on the investigation of the relationship between overweight and obesity among first grade elementary school students and their breastfeeding pattern, birth weight and socioeconomic status in Shiraz, Iran.

3. Patients and Methods

This was a case-control study. The sample included first grade elementary school students in Shiraz, Iran. The case group consisted of 200 overweight and obese children and the control group included 200 normal weight children for a total number of 400 children (50 subjects from each one of the 4 municipal zones in Shiraz). Subjects were selected from public, non-profit and exceptional elementary schools in Shiraz according to the multistage sampling method. First, schools were classified based on their education zones by a stratified random sampling method. Then all first grade students who were obese or overweight were chosen by the cluster sampling method. For each case student, a control student who was similar to the case student with regards to age, sex, grade and elementary school was selected. Subjects were told about the study protocol by school workers.

Height and weight of all first grade elementary school students were measured at the time they entered school (weight was measured using a Seca digital scale with an accuracy of 10 g and height was measured by a Seca height gauge with an accuracy of 0.1 cm). The obtained weight (kg) was divided by the square of the height (m) to estimate body mass index (BMI) in order to determine if the student was obese or overweight. Overweight and obesity were defined based on standard BMI charts for age and sex based on CDC 2000 (Centers for Disease Control and Prevention, WHO) with $85^{th} \leq BMI \leq 95^{th}$ considered as overweight and a $BMI \geq 95^{th}$ considered obese. Therefore, a number of 200 first grade elementary school students who were overweight or obese were selected as the case group. A total of 200 students with normal BMI ($5^{th} \leq BMI \leq 85^{th}$ from BMI charts) who were similar to the case group were chosen as the control group. Mothers were invited by the school authorities. Questionnaires on general information, socioeconomic status, breastfeeding at infancy, physical activities (Standard Met.Hour Questionnaire) and 24-hour diet recall were filled out by trained nutrition experts through interviews with participants' mothers. Each mother's weight and height was also measured Data analysis was done by SPSS version 15. Initially we used the Kolmogorov-Smirnov one-sample test to determine whether the distribution of quantitative variables was normal. If the distribution was normal, the independent t-test was performed to identify the relationship between quantitative variables and obesity. In cases where the distribution of variables was not normal, we used the Mann-Whitney test. To identify the relationship between qualitative variables, overweight and obesity, the chi-square test was used. Logisticr Regression test identified the relationship between independent factors and obesity. In this test, initially, variables that had significant or near significant relationships with obesity and overweight were introduced into the model to yield the independent effect of each variable. Next, variables that had no relationship with obesity were respectively excluded from the model. The final model was subsequently prepared using the forward RL logistic regression method.

4. Results

In the case group, 26.5% of students had a family size of 5 members or more. However, this household size was 2.5% for control group students. We observed difference between case and control groups with regards

to their level of education.Parents'occupation, house ownership, and life facilities were not statistically significant between the two groups (Table 1) and (Table 2). Smoking parents, smoking during pregnancy and the number of bedrooms also were not significantly different between case and control groups. There were 11% of students from the case group and 6% from the control group who had not been breastfed. Of those who were breastfed, 64.5% of case group students and 77% of the control group were breastfed for more than 12 months. Duration of breastfeeding had a significant relationship between case and control groups (P = 0.005). A total of 42.5% of students from the Case group and 55.5% of those from the control group first consumed supplementary food at 6 months of age. There was a significant relationship between the age of starting supplementary food to overweight and obesity in the case group (P = 0.036). Birth weight showed no significant relationship with overweight and obesity in the case group (P = 0.06) (Table 3). There was no significant difference between case and control groups with regards to history of chronic diseases. The mean physical activity rate (met. hour), time spent on watching TV, playing video games and other electronic games did not significantly differ between case and control groups. However mother's BMI was significantly different between case and control groups (P = 0.001). The obesity background for siblings showed a significant relationship with overweight and obesity in the case group (P = 0.001). The mean ± SD of daily energy intake was 1937.79 ± 708.6 (case) and 1881.65 ± 619.8 (control). The difference of the mean calorie intake was not significant between the two groups (P = 0.64) (Table 4) and (Table 5) and (Table 6). Initially we introduced variables that had significant or nearly significant relationships into the model. In the initial model, breastfeeding duration [odds ratio (OR) = 0.45; 95% confidence interval (CI): 0.20-0.99; P = 0.04) showed a reverse significant relationship with overweight and obesity at the age of 7 years. In the next step, mother's BMI (OR = 3.219; 95%CI: 2.07-5.00; P = 0.001), age of starting supplementary food (OR = 0.75; 95%CI: 0.47-1.22; P = 0.25), and birth weight (OR = 1.03; 95%CI: 0.41-2.59; P = 0.94) were introduced into the model. As these three variables were introduced into the model, breastfeeding duration still showed an independent relationship with overweight and obesity. However by the introduction of sibling obesity (OR = 0.24; 95%CI: 0.15-0.4; P = 0.001), breastfeeding duration lost its independent relationship.

5. Discussion

In this case-control analytical study, we observed that breastfeeding, by itself, was not the only effective factor for overweight and obesity. Although the prevalence of obesity has been related to breastfeeding this finding did not agree with the results of the present study (19). Our results showed a significant relationship between case and control groups with regard to the age at starting supplementary nutrition; however, when introduced into the logistic regression model, this variable was excluded and did not show a direct relationship with obesity and overweight during childhood. The age of starting supplementary nutrition has not been investigated in other studies. Results showed that the time of breastfeeding at infancy was related to the prevalence of overweight and obesity at this age. The OR of obesity in children who had never been breastfed was twice more than breastfed children (OR = 2.06; 95%CI: 1.04-4.16) (20). The risk factors of obesity have revealed that breastfeeding has a positive protective effect on overweight during adolescence (21). The protective effect of breastfeeding over childhood and adolescence obesity has been proven (22). Another cross-sectional study indicated that children's nutrition was not related to BMI in adolescence and adulthood. In this research performed in the USA, no relationship was observed between breastfeeding, overweight and obesity in childhood and ages 20 to 30 years (23, 24). Breast feeding had no preventive role for obesity at the age of 5. Most studies verified the hypothesis of this study (25). In this study, we observed a strong positive relationship between mothers'BMI, overweight and obesity of 7 year-old children. The results of this study indicated that the risk of overweight and obesity in first grade students whose mothers had BMI values higher than 25 was more than children whose mothers had normal BMI values. In this study, a significant relationship was observed between obesity of the immediate family members (father, sisters, and brothers) and overweight and obesity at the age of 7 (26). Parents' obesity or overweight showed a significant direct relationship with overweight or obesity of their children at adolescence. This research assessed the effect of parent's obesity on children's obesity to be stronger than any other risk factors for obesity. Investigations revealed a significant relationship between a mother's obesity and the child's obesity (25, 26). Mother's BMI with odds ratio adjusted for age (OR = 1.07; 95%CI: 1.05-1.12) was directly related with the risk of childhood obesity at the age of 5. The risk of having obese children for obese mothers was higher than mothers with normal BMI (26). In this study, birth weight of case group students was more than control group students. However, the difference was not significant between the two groups (P = 0.06). In the logistic regression model birth weight with an OR of 0.03 had a direct relationship with childhood overweight and obesity. However, this relationship was negligible (P = 0.9). A positive significant relationship between obesity of first grade elementary school children and birth weight was proven (21). In a cohort study, birth weight of two obese and normal groups was compared. Although the average birth weight of the obese group was more than the normal group, it was not a significant relationship (27-29).

Table 1. Socioeconomic Status Among Case And Control Group Students

Socioeconomic Status	Case group No. (%)	Control Group No. (%)	P-Value [a]
Father's Educational Level			0.56
Elementary School	31 (15.5)	36 (18)	
Junior high School	40 (20)	34 (17)	
Senior high School Diploma	79 (39.5)	71(35.5)	
Undergraduate or College	50 (25)	59 (29.5)	
Mother's Educational Level			0.08
Elementary School	39 (19.5)	25 (12.5)	
Junior high School	26 (13)	41 (20.5)	
Senior high School Diploma	87 (43.5)	91 (45.5)	
Undergraduate or College	48 (24)	43 (21.5)	
Father's Occupation			0.75
Unemployed	12 (6)	13 (6.5)	
Pensioner	13 (6.5)	12 (6)	
Subaltern employee	44 (22)	9 (4.5)	
Senior employee	12 (6)	47 (23.5)	
Tradesman	55 (5.27)	17 (8.5)	
Employer	18 (9)	31 (62)	
Worker	45 (22.5)	17 (8.5)	
Farmer	1 (0.5)	35 (17.5)	
Mother's Occupation			0.52
Housewife	160 (80)	165 (82.5)	
Employed	40 (20)	35 (17.5)	
House Ownership			0.95
Owned	113 (56.5)	116 (58)	
Leased	69 (34.5)	67 (33.5)	
Other	18 (9)	17 (8.5)	
Household Facilities			0.44
No	14 (7)	14 (7)	
Yes	186 (93)	186 (93)	
Parents Smoking			0.90
Father or Mother	49 (24.5)	50 (25)	
None	151 (75.5)	150 (75)	
Number of Bedrooms			0.83
1	20 (10)	24 (12)	
2	92 (46)	84 (42)	
3	56 (28)	60 (30)	
4	32 (16)	32 (16)	

[a] P-value was Obtained by Using The Chi-Squaretest.

Table 2. Demographic Information For Case and Control Group Students

Demographic Information	Case Group No. (%)	Control Group No. (%)	P-Value [a]
Family Size [b]			0.06
3 >	59 (29.5)	127 (63)	
3 to 4	88 (44)	68 (34)	
5 and More	53 (26.5)	5 (2.5)	
Birth Order			0.95
First	106 (53)	89 (44.5)	
Second	60 (30)	64 (32)	
Third	25 (12.5)	37 (18.5)	
Fourth	7 (3.5)	5 (2.5)	
Fifth or More	2 (1)	5 (2.5)	

[a] P-value for quantitative variables with non-normal distribution obtained by using the Mann Whitney test.For qualitative variables, the p-value was obtained by using the chi-square test.
[b] Average number of family members.

Table 3. Data on Breast Feeding Conditions and Birth Weight in The Case And Control Groups

Feeding Conditions	Case group No. (%)	Control group No (%)	P-value [a]
Breast Feeding			0.07
Yes	178 (89)	188 (94)	
No	22 (11)	12 (6)	
Duration of Breast Feeding			0.005
None	22 (11)	12 (6)	
Less Than 3 Months	17 (8.5)	4 (2)	
3 to 6 Months	14 (7)	18 (9)	
6 to 12 Months	18 (9)	12 (6)	
More Than 12 Months	129 (64.5)	154 (77)	
Foods Other Than Breast Feeding in the First 6 Months			0.053
Yes	91 (45.5)	72 (36)	
No	109 (54.5)	128 (64)	
Age When Supplementary or Weaning Food Was Initiated			0.036
Less Than 4 Months Old	14 (7)	6 (3)	
4-6 Months Old	54 (27)	42 (21)	
6 Months	85 (42.5)	111 (55.5)	
Older Than Six Months	47 (23.5)	41 (20.5)	
Birth Weight			0.06
Less Than 2500 g	15 (7.5)	23 (11.5)	
2500 to 4000 g	125 (62.5)	135 (67.5)	
More Than 4000 g	60 (30)	42 (21)	

[a] P-value was obtained by using the chi-square test.

Table 4. Specifications Related to Physical Activity of Students in The Case and Control Groups

-	Case (Mean ± SD)	Control (Mean ± SD)	P-value[a]
Physical Activity Rate (Met. Hour)	27.7 ± 9.5	28.5 ± 8.9	0.39
Mean Time Spent Watching TV (Hours)	3.65 ± 1.6	3.4 ± 1.67	0.14
Mean Time Playing Video Games or Other Electronic Entertainment	4.6 ± 3.5	4.3 ± 1.6	0.27

[a] P-value was Obtained by Using The Mann-Whitney Test For Quantitative Variables Without Normal Distribution.

Table 5. Age and Anthropometric Specifications of Mothers And Sibling Obesity For Case And Control Groups

-	Case	Control	P-value [a]
Mother's Age at Pregnancy [b]	25.9 ± 5.2	26 ± 5.4	0.71
BMI For Mother [c]			
Slim	0 (0)	14 (7)	
Normal	54 (27.5)	95 (47.5)	0.001
Overweight	91 (45.5)	69 (34.5)	
Obese	55 (27.5)	22 (11)	
Mother's Smoking During Pregnancy			
Yes	3 (1.5)	3 (1.5)	
No	197 (98.5)	197 (98.5)	1.00
Sibling Obesity			
Yes	105 (52.5)	40 (20)	0.001
No	95 (47.5)	160 (80)	

[a] P-value was obtained by using the Mann-Whitney test for quantitative variables without normal distribution andchi-square for qualitative variables.
[b] Mean ± SD
[c] No (%)

Table 6. Relationship between breastfeeding over weight and obesity after adjustment for the effects of confounding factors

Time of Breast Feeding		**OR [a] (95% CI) [b]**	
None	1 (Reference)	1 (Reference)	1 (Reference)
Breast fed More Than 12 Month	(0.20-0.97) 0.44	(0.20-0.97) 0.45	(0.21-1.18) 0.50
P-Value	0.04	0.04	0.11
BMI for Mother			
< 25		1 (Reference)	1 (Reference)
≥ 25		(2.07-5) 3.21	(2.07-5) 3.21
P-value		0.00	0.00
Age at Starting Supplementary Nutrition			
< 6 Months		1 (Reference)	1 (Reference)
> 6 Months		(0.47-1.22) 0.75	(0.47-1.22) 0.75
P-Value		0.25	0.25
Birth Weight			
< 2500 g		1.03	1 (Reference)
2500-4000 g		(0.4-2.59)	(0.4-2.59) 1.03
P-Value		0.94	0.94
Obesity Inimmediate Family Members			
No			1 (Reference)
Yes			(0.15-0.4) 0.24
P-Value			0.00

[a] OR: Odds ratio
[b] CI: Confidence interval

Analysis of demographic characteristics and socioeconomic status of case group families revealed that birth order; household size; parents' education; parents' job; household facilities; parents who smoked, especially during pregnancy, showed no significant differences between the case and control groups. There was no relationship between overweight and obesity of case group students with demographic characteristics and socioeconomic status of families. We observed no relationships when these variables were excluded from the logistic regression model. In a cohort study, the relationship between demographic characteristics and socioeconomic status and obesity of 5 year-old children was determined. The results of this study revealed that smoking during pregnancy increased the risk for obesity (OR = 1.43; 95%CI: 1.05-1.95) (26). In another case-control study it was observed that pregnancy smoking increased the risk of obesity in adolescence by70% (OR=1.27; 95%CI: 0.55-2.95) (27). Another study reported relationship between household size and children's obesity. The prevalence of obesity in households with one child was less than those with more children (29).

Although the results of these studies verified the hypothesis of the present research, they have not investigated other socioeconomic dimensions. In the present research, there was no significant difference between physical activity and prevalence of overweight and obesity among case and control group students. Physical activity rate (met. Hour) and the mean time spent watching TV, computer games and other electronic entertainments had no significant relationship with overweight and obesity of case group students. Another case-control study showed that the time spent on watching TV, video games and other electronic entertainments were the most significant risk factors for childhood obesity. In this study, the time spent on watching TV and playing video games with an OR of 1.76 and 95%CI of 2.21-2.56 revealed a direct relationship with childhood obesity. Although, abovementioned studies verified that hypothesis our study has not confirmed it (20, 21). In this study, the mean daily energy intake was not significant between case and control groups. In addition, the mean energy intake based on weight was not significant between the two groups. The introduction of this variable in the final logistic regression model caused no change in the model. Therefore, overweight and obesity of case group students was not related with daily calorie intake. In another case-control study, diet analysis and investigation of its relationship with childhood obesity showed that the number of meals per day played a protective role for childhood obesity and overweight. Consumption of sodas, pre-made foods, fruits and vegetables were not related with childhood obesity. The results of these studies verified the hypothesis of this research (27-29).

This study showed that breastfeeding, by itself, did not affect a reduction in the prevalence of overweight and obesity. However the time spent breastfeeding showed significant and independent relationship with overweight and obesity among 7 year-old students in Shiraz. After the adjustment of confounding variables in the logistic regression model (including mother's BMI, birth weight, and age of starting supplementary nutrition), children who were breastfed more than 12 months were 55% less likely to become obese compared with children who were not breastfed. However, in the final model by taking into consideration obesity of the immediate family members, the time spent breast feeding lost its independent relationship with the consequences of overweight and obesity. In this study, obesity and overweight of first grade elementary school students is related with the breastfeeding pattern; however, this relationship may not be independent.

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