Pattern of Nutritional Obesity Among 4-6-Year-Old Children in Sulaymaniyah City, Iraq

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Abstract
Objectives: Considering the rising prevalence of obesity in children and its many adverse health effects in childhood period, this study was conducted to understand the pattern of nutritional obesity in kindergarten children (4-6 years old) and investigate the effect of family history, healthy diet, physical activities, and other environmental factors on overweight and obesity.
Materials and Methods: In this cross-sectional study which was conducted from November 19, 2015, to August 29, 2016, 476 children from 5 different kindergartens in Sulaymaniyah city, Iraq, were included. Height and weight were measured in kindergartens and plotted on CDC chart for both age and gender, and those with a BMI of > 85th percentile (77 children) were sent to Pediatric Teaching Hospital in Sulaymaniyah for investigation. The data were analyzed using SPSS version 21.0.
Results: The prevalence of overweight and obesity was reported to be 8% and 8.2%, respectively, while the total prevalence of overweight and obesity was 16.2% in kindergarten children, indicating no statistically significant difference between genders. The incidence of obesity in children whose both parents are overweight or obese is high. Spending more time (hours) watching TV or playing video games, consuming fast food, and decreasing outdoor activities increase the probability of developing overweight and obesity. Most of the children included in the study had normal or borderline results except for 2 obese children who had borderline HbA1C which predisposes them to diabetes mellitus.
Conclusions: The prevalence of overweight and obesity is high in preschool age children mostly due to wrong idea that an obese child has good health. It is recommended that the time of watching TV and playing video games and the intake of high caloric diet should be decreased and sports and physical activities be encouraged.
Keywords: Nutritional obesity, Preschool age children, Sulaymaniyah

Introduction

Obesity, as an important pediatric public health problem, is associated with the risk of complications in childhood and increased morbidity and mortality throughout adult life (1).

Obesity in children is a complex disorder. Its prevalence has increased in a significant way in recent years and many consider it a major health concern of the developed world and also the developing world but to a lesser extent. The National Health and Nutrition Examination Survey (NHANES) indicates that the prevalence of obesity is increasing in last decades in all pediatric age groups, both genders, and various ethnic and racial groups. Many factors, including genetics, environment, metabolism, eating habits, and lifestyle are believed to play a major role in the development of obesity. However, about more than 90% of cases are idiopathic, while less than 10% are associated with hormonal or genetic causes (2).

Overweight is technically defined as an excess of body weight, while obesity refers to an excess of fat; however, the methods used to measure body fat are usually not available in daily practice since obesity is often assessed by means of indirect estimates of body fat (i.e., anthropometric) (3). A good measure to identify overweight and obesity is body mass index (BMI). Obesity or increased adiposity is defined using the BMI, which is considered as an excellent indicator of body fat (BMI = weight in kg/height in meters) (4).

Consequences of obesity include increased risk of impaired glucose tolerance, insulin resistance, type II diabetes mellitus, breathing problems (such as asthma and sleep apnea syndrome), joint problems, musculoskeletal discomfort, fatty liver disease, gastro-esophageal reflux, and gallstones. Childhood obesity is also related to psychological problems such as anxiety, depression, low self-esteem, and lower self-reported quality of life, as well as social problems such as bullying and stigma (5).

Considering these obesity-associated problems, this study was carried out to identify the prevalence and the pattern of nutritional obesity among preschool age children (4-6 years) in Sulaymaniyah and investigate the possible environmental factors that influence its occurrence in this age group.

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Materials and Methods

This cross-sectional study was conducted on preschool age children (4-6 years) including 476 children (239 boys and 237 girls) with different socio-economic backgrounds from November 9, 2015, to August 29, 2016, in five kindergartens (governmental and nongovernmental) in Sulaymaniyah city, Kurdistan, Iraq.

Data were collected using a special questionnaire. It included information about gender, birthweight, gestational age, type of food, physical activity, duration of watching TV and video games, parents' information (occupation and comorbidities). The questions were answered directly during the interview with parents, and measurements of both parents' height, weight, and BMI percentile for age and gender were done.

Inclusion Criteria

- Preschool age children (4-6 years old)
- Obesity due to nutritional problem (nutritional obesity)
- Both genders
- Parents who accept to be included in the study along with their children

Exclusion criteria:

- Children below 4 years or above 6 years
- Obesity confirmed due to other problems, such as hormonal or chromosomal, etc.
- Parents who refused to be included in the study

Regarding ethical consideration, verbal permission was obtained from all parents to include their children in this study with the ethical code number 6/3/2128 (August 3, 2015).

The height and weight of the patients were measured in kindergarten while standing shoeless with feet and back against the wall. Weight measurement was done by a digital weight scale (model: EB9373) and before each measurement, the digital scale was set to zero and weighed to the nearest0.1 kg.

Body mass index has been calculated as BMI = weight (kg) divided by height (meter) [2] and used as the criteria for diagnosis of overweight and obesity, respectively. We used age and gender specific BMI percentiles according to growth charts of Centers for Disease Control (CDC) and Prevention. Children were classified as normal (BMI of 5-85th percentile), overweight (BMI of 85-95th percentile), and obese (BMI of >95th percentile). Their height and weight were checked again in the hospital. Anthropometric measurements including mid-upper arm circumference, head circumference, and waist were also estimated (5,6).

Overweight and obese children were sent for thorough physical examination including blood pressure measurement and estimated using a special chart for both systolic and diastolic values for age and gender, respectively. Additionally, they were sent for laboratory investigations including complete blood count (CBC), erythrocyte sedimentation rate (ESR), HbA1C, thyroid function tests, steroid and lipid profiles, blood sugar, and left wrist X-ray for bone age (7).

Of all patients, 77 children presented with overweight and obesity and only 41 referred to the hospital. The interview with parents was conducted, and then they were sent for investigations.

Statistical Analysis

After data collection and prior to data entry and analysis, all the questions and findings of the study were coded. The data entry was performed using an excel spreadsheet program. Afterwards, the statistical analysis was performed by SPSS version 21.0. The data were presented in tabular form showing the frequency and the relative frequency of distribution of different variables among the different groups of patients. Chi-square tests were used to compare the categorical data between the different groups of patients. P values of less than 0.05 were considered statistically significant.

Results

Based on Table 1, girls are relatively more affected by overweight and obesity than boys, but no statistically significant difference was found using chi-square test (P value = 0.28).

Children whose both parents are overweight and obese are at greater risk of developing obesity (17, 41.5 %). However, having obese grandfather and/or grandmother does not affect the risk of developing obesity in children (Table 2).

Table 1. Distribution of Normal, Overweight and Obesity Categories According to Gender

Gender	Normal (5-85%) No. (%)	Overweight (85-95%) No. (%)	Obesity (>95%) No. (%)	Total No. (%)	P Value
Girls	19 5 (40.1)	23 (29.9)	19 (24.7)	237 (49.8)	
Boys	204 (42.8)	15 (19.5)	20 (26.0)	239 (50.2)	0.28
Total	399 (83.8)	38 (8)	39 (8.2)	476 (100)	

There are clear differences in nutrition and activity of the children with nutritional disorders. Most of the overweight and obese children watch TV during feeding (34 (82.2%)), all of them are inactive and do not do any exercise or do exercise for less than 1 hour (100%, < 1 hour), and most of them are taken to kindergarten by car or bus (Table 3).

As shown in Table 4, overweight is more common in children with mixed feeding while obesity is more common in children with breastfeeding.

Based on the data presented in Table 5, we can notice that obesity started since infancy in majority of obese children. The waist was measured in centimeters and calculated according to CDC measurement. Waist measurement of

>95th percentile means abdominal obesity (37.8 %) (6).

One patient with hypothyroidism was excluded from the study because this study focused on nutritional obesity. All patients had normal fasting blood sugar, ESR, steroid profile.

Discussion

Obesity is considered as one of the most serious public health challenges of the 21st century, the prevalence of which has increased at an alarming rate. Generally, overweight and obesity are linked to more deaths worldwide than undernutrition, and childhood obesity is associated with a higher risk of adulthood obesity, death that occurs prematurely due to complications, and some

Table 2. Family History of Obesity or Overweight in Overweight and Obese Children (41 Patients)

Family History of Overweight and Obesity	Mother No. (%)	Father No. (%)	Both parents No. (%)	Both normal No. (%)	Grandfather and Grandmother No. (%)	Total
Overweight	3 (15)	3 (15)	7 (35)	6 (30)	1 (5)	20 (48.78)
Obesity	7 (33.3)	3 (14.2)	10 (47.6)	1 (4.8)	0 (0)	21 (51.21)
Total	10 (24.4)	6 (14.6)	17 (41.5)	7 (17.1)	1 (2.4)	41 (100)

Table 3. Physical Activity and Duration of TV Watching among Children with Overweight and Obesity

	Watching TV During Meals		Time of watching TV and or Playing Video Games			Transportation to Kindergarten		Exercise	
	Yes No. (%)	No No. (%)	1-2 h No. (%)	3-5 h No. (%)	>6 h No. (%)	By Walking No. (%)	By Car or Bus No. (%)	>1 h No. (%)	<1 h No. (%)
Overweight	15 (75)	5 (25)	0 (0)	1 (5)	19 (95)	2 (10)	18 (90)	0 (0)	20 (100)
Obese	19 (90.5)	2 (9.5)	0 (0)	1 (4.8)	20 (95.2)	2 (9.5)	19 (90.5)	0 (0)	21 (100)
Total	34 (82.2)	7 (17.8)	0 (0)	2 (4.9)	39 (95.1)	4 (9.7)	37 (90.3)	0 (0)	41 (100)

Table 4. Effects of Nutritional Habits and Type of Feeding on Overweight and Obese Children

	Type of Feeding			Snacks	
	Breast Feeding No. (%)	Bottle Feeding No. (%)	Mixed Feeding No. (%)	1-2 Per Day No. (%)	3-5 Per Day No. (%)
Overweight	5 (25)	4 (20)	11 (55)	19 (95)	1 (5)
Obese	10 (47.6)	2 (9.5)	9 (42.8)	19 (90)	2 (9.5)
Total	15 (36.5)	6 (14.6)	20 (48.7)	38 (92.7)	3 (7.3)

Table 5. Descriptive Criteria among Overweight and Obese Children

		Overweight according to BMI No. (%)	Obese according to BMI No. (%)	Total N (%)
Gestational age	Preterm	2 (10%)	0 (0%)	2 (4.9%)
	Full-term and post-term	18 (90%)	21 (100%)	39 (95.1%)
Birthweight	Small for gestational age	1 (5%)	0 (0%)	1 (2.4%)
	Normal or large for gestational age	19 (95%)	21 (100%)	40 (97%)
Waist (according to CDC measurement) (5)	<95%	13 (65%)	15 (71.4%)	28 (68.2%)
	>95%	7 (35%)	6 (28.5%)	13 (37.8%)
Bone age	Normal	18 (90%)	18 (85.8%)	36 (87.8%)
	Advanced	2 (10%)	3 (14.2%)	5 (12.1%)
Time of the appearance of overweight and obesity	Infancy	7 (35%)	9 (42.8%)	16 (39%)
	Toddler	8 (40%)	6 (28.6%)	14 (34.1%)
	Preschool age	4 (20%)	7 (33.3%)	11 (26.9%)

forms of disability in adulthood.

Based on BMI, patients included in this study were classified as overweight (8%) and obese (8.2%), and there was no statistical difference between genders. The total prevalence of both overweight and obesity in the present study is 16.2 %, which is higher compared to a previous study conducted in Iraq in 2010, in which, 6% of children under 5 years were overweight and obese. Additionally, 8.7% of girls were overweight and 4% of them were obese, while 10.8% of boys were overweight and 5.1% of them were obese (8). Another study in Pakistan showed that 12% were obese and 8% were overweight (9). In Erbil city, around 9.3% of children were overweight and 1.6% were obese (10). In another study performed in Birjand, Iran, in 2008, 10.6% and 7.6% of the 2-5-year-old children were overweight and obese, respectively (11). The differences between our study and other studies may be due to differences in age group in studied sample and sample size; however, it is clear that obesity is more prevalent in our study than in other studies, which is an alarming sign that needs further evaluation and further education of the public about the obesity and its consequences.

In our study, no difference was found in the rate of obesity between genders (8.4% of boys and 8% of girls), which is consistent with a study by Tiwari et al in 2014 (12), while in a study by Langendijk et al, boys were more likely to be obese (15.65% of boys versus 10.1% of girls) in urban Khon Kaen, Northeast Thailand (13). This may be due to easy access of boys to outside and fast foods or unhealthy foods. In a study by Al-Mohaimeed et al in 2012, it was revealed that girls have a higher prevalence of being overweight than boys, 16.4% of girls were overweight, while 15.6% of them were obese. Among boys, the prevalence of overweight and obesity was reported to be 7.4% and 7.8%, respectively (14). This may be due to cultural differences in treating genders and more access of boys to outdoor activities than girls. The difference in the prevalence of nutritional disorder (overweight and obesity) in different areas may be due to differences in lifestyle and consumption of unhealthy foods as well as spending most of their time indoor. This comparison is important to understand the environmental factors that influence the occurrence of obesity in boys and girls.

Most of the overweight and obese children included in the study watched TV during main meals (82.1%) and around 95.1% of the children watched TV for more than 6 hours a day, as Viner and Cole indicated in their study that television viewing in early childhood predicts the adult body mass index (15). In another study conducted by Barr-Anderson et al, adolescents as children watched television for more than 5 hours a day, had lower intake of fruits and vegetables, and consumed more sugar-sweetened beverage five years later compared to their peers who had watched TV less than 5 hours a day as children (16). Additionally, in a study conducted in Kuwait, the majority of children included ate mostly from (fast food

restaurants) and they usually pursued sedentary activities (e.g., watching TV, spending time on the computer, video games, tablet, and phone every day of the week). (17) Moreover, eating meals while watching TV was reported to be positively associated with adiposity, indicating that watching TV may influence the development of obesity through mechanisms explained by decreases in physical activity (18). In India, the prevalence of overweight and/or obesity was found to be significantly higher among the students who did not participate in various physical activities such as outdoor games, household activities, and watching television daily for longer durations (12). All the affected children in our study had a sedentary lifestyle (inactive <30 minutes of exercise), which is considered as an important environmental factor for obesity as this is a global problem in last decades, so it is so important to encourage outdoor activities and exercises.

The prevalence of overweight and obese children in the current study is higher in children whose both parents are overweight and/or obese (41.5%) than in children with one overweight (24.4 %) or obese (14.6%) parent, respectively, which is consistent with a study conducted by Dieu et al in Vietnam (19). This factor is important to be investigated in further studies to understand the effect of family history of overweight and obesity on developing obesity in the next generation because it mostly followed multifactorial inheritance.

Based on the results, 48.7% of the children had mixed feeding while 36.5% had exclusive breastfeeding previously. In our study, obesity and overweight were more prevalent in children with a history of breast or mixed feeding than in children with a history of bottle feeding, which is not consistent with many studies included in meta-analysis conducted by Yan et al in China in 2014 in which breastfeeding is considered as a significant protective factor against obesity in children (20). Further studies are required to prove it or indicate that it could be related to the early introduction of foods (other than milk) before recommended age, which is common in our society especially when the babies depend on breastfeeding (because most mothers wrongly believe that breast milk is not enough till 6 months of age). Additionally, mothers should be educated about breastfeeding. They need to be informed that foods other than breast milk should not be given before 6 months of age.

It was found in this study that 100% of overweight and obese children consumed snacks, which is the same finding that was reported by Hasanein and Abdul Jawad in 2014 (21). However, based on a study conducted in China, there was a significant association between childhood overweight and obesity and a higher frequency of unhealthy snack consumption (22). There is a wrong idea that slimming means poverty and bad caring, obesity means good health, and complications of obesity occur only in adulthood not in childhood. In a study in Erbil, no relationship was found between BMI and eating habits

of school students (23). Therefore, in our study and other studies, the consumption of snacks between the meals is a significant factor in developing overweight and obesity. Additionally, the type of snacks they consume is of great importance because most children consume snacks of high caloric values.

Waist circumference was used because it is a simple and noninvasive measure, and based on the results, 37.8% of the children had waist circumference of >95th percentile specific for age. In their study, Brannsether-Ellingsen in 2015 mentioned that waist circumference has a closer relationship with body mass index than with other anthropometric measures and it mirrors the tendency for greater fat deposit in the central region (24). This implies that more than one-third of our patients have large waist circumference which means they have a large amount of adipose tissue in their waist and this is mostly related to a decrease in their physical activities and exercises.

Unfortunately, only 41 patients (21 obese and 20 overweight) out of 77 patients referred to the hospital for interview and investigations. Most of our patients had normal or borderlines results, and only one patient had hypothyroidism who was excluded from the study and sent to an endocrinologist for further evaluation and management because our study focused on nutritional obesity. As seen in Table 6 HbA1C ranged from 5.7 to 6.4% in 2 obese children and this may predispose them to diabetes mellitus based on a study by DuBose et al, suggesting an association between type 1 diabetes mellitus and obesity (25). Therefore, this should be taken seriously and all obese or overweight children should be followed regularly to diagnose diabetes mellitus earlier and to develop programs for controlling their weight in order to prevent such chronic complication.

No patient in our study had abnormal lipid or steroid profiles except for some obese patients with borderline lipid profiles, which could be controlled by diet and avoiding weight gain.

Further studies are recommended with larger sample sizes and different age groups of children in order to identify the age of starting obesity and overweight and to better understand childhood obesity and its consequences. In fact, there were many limitations in this study such as the small sample size of patients studied (because 36 patients did not refer for interview and investigations), the unavailability of many blood tests needed in government hospitals (most of patients cannot do the tests in private laboratories), and the wrong understanding of the public about overweight and obesity.

Conclusions and Recommendations
The prevalence of overweight and obesity in children aged 4-6 years is presently high (16.2%). Overweight and obese children have a sedentary lifestyle. Overweight and obesity are more common in children whose both parents are overweight and/or obese. Obesity and overweight are significant health problems that require more studies and follow-ups.

It is essential to educate the family about the disadvantage of obesity, concentrate on the point that obese child means sick child (not as healthy as they believe), and encourage the family who has a child with overweight or obesity to change their lifestyle by avoiding snacks between the main meals, decreasing the time of sitting in front of the

Table 6. Laboratory Findings in Overweight and Obese Children (41 Children)

Laboratory Tests		Overweight No. (%)	Obese No. (%)	Total (Both Overweight and Obese) No. (%)	Mean ± SD
Hemoglobin	<9.5	2 (10)	1 (4.76)	3 (7.31)	12 ± 1.38
	9.6-11.5	8 (40)	5 (23.8)	13 (31.70)	
	>11.5	10 (50)	15 (71.42)	25 (60.97)	
HbA1C (%)	4-5.6%	20 (100)	19 (90.47)	39 (95.12)	4.98 ± 0.341
	5.7-6.4%	0 (0.0)	2 (9.52)	2 (4.87)	
	>6.5%	0 (0.0)	0 (0.0)	0 (0.0)	
Cholesterol (mg/dL)	<200	19 (95)	19 (90.47)	38 (92.68)	178.51 ± 33.01
	200-239	1 (5)	2 (9.52)	3 (7.31)	
	>240	0 (0.0)	0 (0.0)	0 (0.0)	
Triglyceride (mg/dL)	<150	20 (100)	20 (95.23)	40 (97.56)	128.63 ± 14.53
	150-199	0 (0.0)	1 (4.76)	1 (2.43)	
	>200	0 (0.0)	0 (0.0)	0 (0.0)	
HDL (mg/dL)	<35	0 (0.0)	0 (0.0)	0 (0.0)	50.36 ± 8.81
	35-45	0 (0.0)	0 (0.0)	0 (0.0)	
	>35	20 (100)	21 (100)	41 (100)	
LDL (mg/dL)	60-130	18 (90)	18 (85.71)	36 (87.80)	104.34 ± 25.35
	131-159	2 (10)	3 (14.28)	5 (12.19)	
	160-189	0 (0.0)	0 (0.0)	0 (0.0)	

HDL, high density lipoprotein; LDL, low density lipoprotein.

television and playing video games, reducing the intake of high caloric foods, and increasing physical activity at school and home.

Authors' Contribution

The basic idea of study and gaudiness in collecting, analyzing data, and writing the article were presented by AMHA. Collecting data from patients, analyzing them, and writing introduction, materials and methods, and discussion parts were done by SAA. Finally, writing materials and methods, discussion, conclusion, and references parts was done by HFM who is the corresponding author.

Conflict of Interests

Authors have no conflict of interests.

Ethical Issues

The Ethics Committee of Sulaimani University, School of Medicine approved the study with a code number of 6/3/2128 (August 3, 2015).

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