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Prevalence of Obesity and its Risk Factors among Preschoolers in the Kingdom of Bahrain

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Abstract

Background: The increasing rates of obesity have raised worldwide concern due to its impact on the individual and society. The prevalence and modifiable risk factors of obesity among preschoolers are crucial to identify for early intervention.

Materials and Methods: A total of 500 Bahrainis aged 3-6 years were selected via a multistage convenient sampling technique. This cross-sectional study was conducted in 10 health centers from five health regions in Bahrain during September 2018. A data sheet and questionnaire were filled out by parents. The World Health Organization (WHO) body mass index (BMI) growth charts were used to assess the weight status in children by interpreting z-score. The data was entered and analyzed using SPSS v23, MINITAB, and WHO Anthroplus.

Results: The prevalence of obesity among Bahrani preschoolers in 2018 was 6%. Physical activity, maternal education, and sleeping duration (in males) were associated with obesity. At the same time, the type of delivery, feeding during the first six months, screen-based media use, paternal education, sleeping duration (in females), and dietary habits were not associated with an increased risk of obesity.

Conclusion: The prevalence of obesity in preschoolers increased from 5.2% in 2013 to 6% in 2018. A positive correlation was found between decreased duration of physical activity and obesity in preschoolers. Likewise, preschoolers with mothers of no formal education or with a post-graduate degree had a higher risk of being obese. In addition, sleeping for more prolonged durations showed an increased risk of obesity in male preschoolers. All other studied factors lacked a significant relationship with obesity.

Keywords: BMI; Obesity; Z-score; Bahrain

Introduction

Obesity is a complex disorder characterized by increased body fat and weight, which can be assessed using BMI in adults. However, in children, it is interpreted using WHO BMI growth charts, which assess weight status by analyzing *z*-scores.[1] The increasing rates of obesity have raised worldwide concern due to its impact on the individual and society as a whole. WHO stated that the prevalence of obesity worldwide has doubled between 1980 and 2008.[2]

Regarding the worldwide trends, the age-standardized prevalence of obesity increased from 4.6% in 1980 to 14.0% in 2019. A constant predominance in females is noted compared to the prevalence rates of obesity in males.[3] A similar trend is observed in the Gulf region. In adult females, there is a significant increase in obesity with a prevalence of 2%–55%, and in adult males 1%–30%.[4] Focusing on younger age groups, the rates have risen wherein the prevalence of obesity among Gulf Cooperation Council children and adolescents ranges from 5% to 14% in males and 3% to 18% in females.[5] Focusing on children aged 3 to 60 months in the Kingdom of Bahrain, the prevalence of obesity in 2013 was 5.2%.[6]

In the long run, obesity has multiple consequences on an individual's health, quality of life, society, and economy. There are many health morbidities, some of which include type 2 diabetes mellitus and cardiovascular diseases. Furthermore, the psychological impact involves depression and social isolation, leading to a low quality of life. Additionally, it affects the health care system either through direct or indirect costs.[7] There are many possible risk factors contributing to childhood obesity; among those that will be explored are cesarean section, breastfeeding, sleep duration, screen-based media use duration, parental educational level, physical activity duration, and dietary habits.[8-14]

Obesity among preschoolers is significant to identify to provide early intervention as they are a crucial age group in society. Identifying the possible risk factors will enable us to implement preventive measures to avoid further morbidities and mortalities. This research aims to quantify the prevalence and identify the presence of modifiable risk factors contributing to obesity among preschoolers. Children represent the future of this society, and as such, targeting modifiable risk factors in this population presents a valuable opportunity to intervene more effectively than in adulthood.

Materials and methods

Population

The population of this cross-sectional study involves preschoolers aged 3 to 6 years old who attend health centers in Bahrain for school checkups, vaccinations, or general illness. The sample size was determined based on the prevalence of obesity among preschoolers in Bahrain, which was 5.2% in 2013. To calculate the sample size, the following equation was used:

[p: prevalence = 0.084, z: confidence interval = 1.96, e: error = 0.025]

$$n = \frac{z^2 \times p(1-p)}{e^2}$$

This resulted in a calculated sample size of 473 subjects, which was rounded up to a total of 500 preschoolers between the ages of 3 and 6.

Sampling technique

The Ministry of Health in the Kingdom of Bahrain divides the country into five health regions. From each of the five regions, two health centers were chosen randomly, except for one that was excluded as it did not meet the population criteria, accepting adults exclusively. Based on the information provided by the Ministry of Health regarding the number of Bahraini patients attending each health center, the coverage was calculated by:

$$\text{Percentage of each health center} = \frac{\text{Coverage of each health center}}{\textit{Total Bahraini patients served}}$$

By this, we were able to divide the 500 subjects proportionally by multiplying the percentage of each health center by the total Bahraini patients served among the chosen health centers, and the questionnaires were distributed accordingly. Samples were taken via a multistage sampling technique, and the participants were chosen by convenience (Table 1).

Table 1: Samples Based on Health Center Coverage

Health region	Health Center	Total Bahraini patients served	Percentage of Total	Sample
1.	BBK Health Center - Hidd	31,000	8.908 = 9 %	45
	Muharraq Health Center	34,000	9.770 = 10 %	50
2.	Shaikh Sabah Health Center	17,000	4.885 = 5 %	25
	Bilad Al Qadeem Health Center	19,000	5.459 = 5 %	25
3.	Yousif Engineer Health Center	45,000	12.931 = 13 %	65
	Jidhafs Health Center	35,000	10.057 = 10 %	50
4.	Hamad Kanoo Health Center	44,000	12.643 = 13 %	65
	East Riffa Health Center	43,000	12.356 = 12 %	60
5.	Hamad Town Health Center	46,000	13.218 = 13 %	65
	Mohammad Jassim Kanoo Health Center	34,000	9.770 = 10 %	50
	Total	**348,000**	**100%**	**500**

For this study, the inclusion criteria for participants were Bahraini preschoolers aged 3 to 6 years old attending primary health care centers in Bahrain. At the same time, the exclusion criteria were preschoolers with severe illnesses, which include conditions that require hospitalization or ongoing medical treatment, mental health conditions, developmental disorders, physical disabilities, or those who refused to participate in the research.

Data collection

Data collection involved the use of a data sheet and a questionnaire. The data sheet captured important information such as date of birth, gender, weight (measured by researchers to the nearest 200 grams using a balance beam scale), height (measured by researchers to the nearest 0.2 cm using a stadiometer in the health center), and BMI (based on the WHO growth charts).

The questionnaire, self-filled by parents of the preschoolers and included questions about various variables such as cesarean-section (those who are not delivered through the vaginal pathway), breastfeeding (those who are exclusively dependent on breast milk in the first six months), sleep duration (standard sleeping duration in preschoolers is about 10-13 hours), screen-based media (any screen used by children for less than 2 hours daily), educational level (highest grade that has been achieved by parents [elementary, intermediate, secondary, undergraduate, graduate, post-graduate]), physical activity (any kind of physical activity performed by the child for 60 minutes or more daily), diet (eating habits followed by the child including [change in food consumption, snacking/frequency of eating, skipping breakfast, having sugary beverages, eating outside]).

Ethical consideration

Ethical approval was obtained from the Research and Ethics Committee at the College of Medicine and Medical Sciences (CMMS), Arabian Gulf University (AGU), and the research technical support team at the Ministry of Health of the Kingdom of Bahrain. First, the study participants were briefed about the purpose of the study. They were also informed that they could withdraw at any time. In addition, the privacy of each participant was assured, as no personal data was revealed. Finally, verbal consent was also taken from each participant before completing the questionnaire.

Statistical analysis

The data was entered and analyzed using SPSS v23 and MINITAB. Continuous variables (age, prevalence of obesity) were expressed as ± SD, while qualitative variables were reported as absolute number and percentage. Furthermore, the chi-square test was used for statistical differences

between obese and non-obese preschoolers. The data collected was presented in charts and tables. The prevalence of obesity was calculated and graded based on BMI.

Results

The study involved 500 participants, with 51.6% being female. The research subjects (3-6 years old) were distributed as follows: 39.4% were aged 3-4 years, 28.6% were aged 4-5 years, and 32% were aged 5-6 years. The mean age was 4 years and 4 months.

Among the study participants, 94% were non-obese, with 48.6% being female. Of those, 7.8% were overweight. On the other hand, 6% were obese, equally distributed among both genders. (Table 2)

Table 2: Classification of Weights According to Z-score

Classification		Gender		Total
		Male	Female	
Underweight	Number	26	26	52
	Total (%)	5.2	5.2	10.4
Normal	Number	182	197	379
	Total (%)	36.4	39.4	75.8
Overweight	Number	19	20	39
	Total (%)	3.8	4	7.8
Obese	Number	15	15	30
	Total (%)	3	3	6
Total	Number	242	258	500
	Total (%)	48.4	51.6	100

Out of all the candidates born through vaginal delivery, 7.5% were obese, while those born through C-section, 5.5% were obese. The *p*-value was 0.405, indicating no significant correlation between obesity and the type of delivery (Table 3).

Among preschoolers who were exclusively breastfed during the first six months, 3.8% were obese. It was found that 8.2% of obese preschoolers were mixed-fed, whereas 4.2% of the obese were only bottle-fed. The *p*-value (0.129) showed no significant relationship between obesity and the type of feeding during the first six months (Table 3).

Out of preschoolers who used screen-based media for less than two hours, 6.2% were obese, while only 6% of those who used screen-based media for more than two hours were obese. The *p*-value (0.937) showed no significant relationship between obesity and screen-based media use (Table 3).

Preschoolers who were active for less than an hour per day had the highest percentage of obesity (16.9%). Moreover, those who were active between one to two hours per day had only 3.7% obesity. Of those who were active for more than two hours per day, 5% were obese. There was a significant relationship between obesity and physical activity (*p*-value <0.05) (Table 3).

Regarding preschoolers' parental education, among preschoolers' mothers with no formal education, 18.2% were obese. As for preschoolers' fathers

Table 3: Relationship between Obesity and Some Potential Risk Factors

Factors		Obese	Non-obese	*p*-value*
		n (%)	n (%)	
Delivery	Vaginal	20 (7.5)	346 (92.5)	0.405
	C-section	10 (5.5)	124 (94.5)	
Feeding during first 6 months	Breast-fed	7 (3.8)	177 (96.2)	0.129
	Mixed-fed	20 (8.2)	224 (91.8)	
	Bottle-fed	3 (4.2)	69 (95.8)	
Screen-based media use / h	<2	16 (6.2)	243 (93.8)	0.937
	>2	12 (6)	188 (94)	
Physical activity / h	<1	11 (16.9)	54 (83.1)	0.000
	1-2	8 (3.7)	206 (96.3)	
	>2	11 (5)	210 (95)	

**P*-value related to Chi-square test

with no formal education, 14.3% were obese. Of those preschoolers with post-graduate maternal education, 18.8% were obese compared to the post-graduate paternal education in which 2.8% were obese. The *p*-value showing the relationship between obesity and maternal education was 0.038, which is significant. However, the p-value showing the relationship between obesity and paternal education was not significant (0.175) (Table 4).

As illustrated, 6.1% of preschoolers who had 2-3 meals daily were obese. Furthermore, of those who had 4-5 meals per day, 5.5% were obese. The percentage of obese preschoolers increased in those who had more than five meals per day (6.7%). There was no significant correlation between obesity and the number of meals per day, as indicated by the *p*-value (0.961) (Table 5).

Among preschoolers who skip breakfast, 6.6% were obese, while for those who did not skip breakfast, 5.4% were obese. The *p*-value was 0.562, indicating no significant correlation between obesity and skipping breakfast (Table 5).

It was found that 95.2% of preschoolers snack daily. Of those who snack once a day, 6.9% were obese. Of those who snack twice a day, 5.8% were obese, while those who snack more than twice a day, 5.7% were obese. There was no significant correlation between obesity and the number of snacks per day (*p*-value: 0.898) (Table 5).

Table 4: Relationship between Parental Education and Obesity

Parental Education	Paternal n (%)		Maternal n (%)	
	Obese	Non-obese	Obese	Non-obese
No formal education	2 (14.3)	12 (85.7)	2 (18.2)	9 (81.8)
Secondary and less (Elementary, Intermediate and Secondary)	13 (4.6)	269 (95.4)	15 (6)	234 (94)
Graduate (Diploma and Bachelor)	14 (8.3)	154 (91.7)	10 (4.5)	214 (95.5)
Post-graduate	1 (2.8)	35 (97.2)	3 (18.8)	13 (81.3)
P*-value	0.175		0.038	

P*-value related to Chi-square testP*-value related to Chi-square test

Table 5: Relationship between Dietary Habits and Obesity

Dietary Habits		Obese	Non-obese	*p*-value*
		n (%)	n (%)	
Number of meals	2-3 meals	22 (6.1)	336 (93.9)	0.961
	4-5 meals	7 (5.5)	120 (94.5)	
	>5 meals	1 (6.7)	14 (93.3)	
Skipping breakfast	Yes	16 (6.6)	225 (93.4)	0.562
	No	14 (5.4)	245 (94.6)	
Snacks/day	1 time	9 (6.9)	121 (93.1)	0.898
	2 times	13 (5.8)	211 (94.2)	
	>2 times	7 (5.7)	115 (94.3)	
Types of Snacks	Fruits & Vegetables	15 (5.5)	258 (94.5)	0.950
	Dairy products	13 (6.7)	181 (93.3)	
	Chocolates & Sweets	15 (6.1)	232 (93.9)	
	Chips & Crackers	22 (6.4)	324 (93.6)	
	Sugary Beverages	5 (4.7)	102 (95.3)	
Eating from	Home	23 (5.6)	391 (94.4)	0.359
	Restaurant	7 (8.1)	79 (91.9)	

**P*-value related to Chi-square test

Among preschoolers who snack daily, the most selected type of snack among obese preschoolers was dairy products (6.7%), the least popular option among the non-obese. At the same time, the least selected snack among the obese was sugary beverages (4.7%), the most popular snack among the non-obese. The *p*-value (0.950) showed no significant correlation between obesity and the type of snacks (Table 5).

Of those preschoolers who eat meals prepared at home, 5.6% were obese, while those who eat meals from restaurants, 8.1% were obese. The *p*-value was 0.359, indicating no significant correlation between obesity and where the child eats (Table 5).

Regarding the sleeping duration in female preschoolers, most of those who slept less than 13 hours were non-obese. In addition, it was found that 100% of those who slept more than 13 hours were non-obese. Female preschoolers' *p*-value (0.837) showed no significant relationship between obesity and sleep duration. In contrast, it was found that 50% of male preschoolers who slept more than 13 hours were obese, while the majority of those who slept less than 13 hours were non-obese. Male preschoolers' *p*-value (0.036) showed a significant relationship between obesity and sleep duration (Table 6).

Discussion

There are many risk factors affecting obesity in preschoolers; however, the above study focuses on seven risk factors, including cesarean section, breastfeeding, sleep duration, screen-based media use, educational level, physical activity, and diet. This research cannot be generalized to all preschoolers in the Kingdom of Bahrain due to the fact that not all preschoolers nor risk factors were included.

This study revealed that the prevalence of obesity in 2018 in the Kingdom of Bahrain was 6%, equally distributed between both genders. Comparing it with the previous study, where the prevalence was 5.2% in 2013. This concludes that the prevalence of obesity among preschoolers increased by 0.8% in 9 years.

Cesarean section is not a risk factor contributing to obesity as opposed to previous studies, which have shown a relationship.[8] This might be a result of the preschoolers' BMI being influenced by other risk factors rather than cesarean section solely.

No relationship was found between bottle-feeding and obesity, as the study suggested that the significant feeding source during the first 6 months of life was mixed feeding. Previous studies strongly suggested that exclusive breastfeeding is considered one of the protective factors against obesity.[9]

Sleep duration does not follow a specific trend. The insignificance could be due to the influence of other factors: bedtime, quality of sleep, and nap time. In addition, there is a positive correlation between increased sleep duration in males and obesity; this may be attributed to the influence of behavioral, genetic, and hormonal mechanisms.

Screen-based media use is considered an independent risk factor for obesity. Likewise, previous studies further confirmed the same conclusion.[11] This could

Table 6: Relationship between Sleep Duration and Obesity

Factors			Obese n (%)	Non-obese n (%)	*P*-value*
Sleep duration / h	Males	<10	6 (5.7)	100 (94.3)	0.036
		10-13	8 (6)	126 (94)	
		>13	1 (50)	1 (50)	
	Females	<10	8 (6.5)	115 (93.5)	0.837
		10-13	7 (5.3)	125 (94.7)	
		>13	0 (0)	3 (100)	

**P*-value related to Chi-square test

be due to the interactive nature of videos, shows, and games used nowadays, which encourage movement and imitate actions. This, in return, minimizes the sedentary lifestyle that was initially thought to be a risk factor.

Regarding physical activity, there is a positive relation between decreased physical activity and increased risk of obesity. This is analogous to previous studies, which concluded that increased physical activity is related to decreased fat accumulation.[13] This can be explained as preschoolers exercise more, they burn more calories; hence, they are less prone to obesity.

Regarding paternal education, most fathers of obese preschoolers had formal education. However, the percentage of fathers with no formal education who had obese children was higher than in other groups (14%). These finding contrasts previous studies that suggested that higher educational levels are associated with increased risk of obesity.[12] In contrast, the relationship between maternal education and obesity was significant. Most obese preschoolers' mothers had formal education, and the percentage of mothers with post-graduate education who had obese children was higher than in other groups (18.8%). This finding may be attributed to a stronger maternal bond with the child at this age.

Dietary habits are influenced by several factors. Results revealed that most obese preschoolers skipped breakfast, which is considered a contributing risk factor of obesity based on previous studies. Furthermore, obese preschoolers consume the recommended number of snacks (twice), in contrast to previous studies that suggested that snacking between breakfast and lunch is a protective factor against obesity. As for the type of snacks, most preschoolers were found to consume chips and crackers, while previous studies suggested a positive relationship between obesity and fatty snacks. Lastly, most preschoolers tend to have meals prepared at home, while previous studies suggest that obese children are more likely to eat meals prepared at restaurants.[14] The relationship between the aforementioned dietary habits and obesity was found to be insignificant, as all *p*-values are more than 0.05. This could be due to the inconsistency of dietary habits and the difference in basal metabolic rate. Additionally, this could be attributed to parental awareness of their child's dietary habits and their attempts to correct them.

Conclusion

A previous study from 2013 about the prevalence of obesity among preschoolers in the Kingdom of Bahrain revealed that 5.2% were obese. Meanwhile, our study showed an increase in the prevalence of obesity in preschoolers, reaching 6% in 2018. Regarding the factors that had a significant relationship with obesity, there was a positive correlation between decreased duration of physical activity and obesity in preschoolers. Moreover, preschoolers with mothers with no formal education or post-graduate degrees had a higher risk of being obese. Furthermore, sleeping for more prolonged durations showed an increased risk of obesity in male preschoolers. All other studied factors lacked a significant relationship with obesity.

Conflict of Interest

Not declared

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