

Influence of lifestyle factors on Body Mass Index in preschoolers in Behbahan city, southwest Iran, 2016

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Abstract

Background and aim: The body mass index (BMI) of Iranian preschoolers is noticeably increasing. Thus, studying the factors influencing BMI in preschool children is crucial. The purpose of this study was to identify the effects of lifestyle factors on BMI of preschool children, residing in Behbahan city, southwest Iran, in 2016.

Methods: A total of 120 preschool children, aged 4 to 6 years, participated in this cross-sectional study. Multi-stage random sampling was done. Using researcher-developed questionnaires whose validity and reliability was confirmed, demographic and lifestyle data were obtained, as the questionnaires were completed by the subject's mothers. Lifestyle factors included physical activity, fruit and vegetable consumption, sugar-free beverage intake, and screen time. Multiple logistic regression was conducted to analyze the influence of lifestyle-related behaviors on BMI. Data were analyzed by means of the SPSS 22 software and $p < 0.05$ was resulted as the meaningful level of statistics.

Results: The average BMI values for children was 15.13 ± 1.90 kg/m². A total of 88.3% of children did not receive 5 cups of fruits and vegetables each day. Also, 12.5% consumed more than one serving of sweetened beverages per day. Only 2.5% engaged in 60 minutes of structured physical activity every day and 40% did not limit screen-time viewing to 2 hours per day or less. The findings indicated that the physical activity and screen time affected the BMI ($p < 0.05$), and the duration of physical activity had inverse relationship with obesity, and screen time was directly related to obesity.

Conclusion: Understanding the factors affecting the BMI of preschool children can inform the development of interventions to impact children's weight-related behavior and it can be used as the basis for future healthy body weight policies. Efforts to lower the obesity rate of preschoolers should be focused on the lifestyle behaviors, especially on the physical activity and screen time.

Keywords: Children, Preschool, Body Mass Index, Lifestyle, Health promotion program

1. Introduction

The world is experiencing an alarming increase in the prevalence of childhood overweightness and obesity (1). If current trends continue, by 2025 around 70 million children will be classified as overweight or obese. All over the

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world, there is a marked increase in the prevalence of obesity, but little data is available among Iranian preschoolers (3). The prevalence of obesity in children in various Iranian cities is varies and ranges from 0.57 to 17.7% (4). When the CDC criteria was used, it was found that 9.09% of boys and 9.72% of girls were overweight while 5.26% of boys and 4.32% of girls were obese in preschool children aged 5 to 6 years (3). Based on a study conducted in 2007 on children from 31 provinces in Iran (5), according to CDC standards, it was found that the prevalence of overweightness and obesity in children entering school was 13.5 and 3.5%, respectively. Obesity is associated with various diseases such as type 2 diabetes, cardiovascular and respiratory diseases, and affects the general health status of society (6). Regarding social, psychological, emotional and academic functional performance, obesity has a major role in the psychosocial limitations in the quality of life in children (7). One of the main concerns is that childhood obesity is likely to continue through adolescence and on to adulthood (8). Studies show that 30% of obesity cases begin in childhood, and among them, 50 to 80% continue to be obese as adults (9). One study revealed that children who were overweight during the preschool period of their lives, had a 60% increase in probability of becoming overweight at 12 years of age (10). It has been confirmed that the preschool years are a very important period for studying the determinants of childhood obesity (3, 11). This is because during this period, eating and physical activity habits become established (3, 12). To prevent childhood obesity, a public health approach which addresses the risk factors of this health problem needs to be put into place (13, 14). Factors like eating habits, environment, genetics, metabolism, and lifestyle play a major part in the advancement of obesity. More than 90% of obesity cases are idiopathic and less than 10% develop through genetic or hormonal origins (15). The research, in which these associated factors were investigated, included mainly school-aged children. Research is limited among younger children (below 6 years old) as prevalence and risk factors have been less studied (16, 17). Many of these lifestyle choices are related to risk factors for obesity, such as unhealthy diet patterns, increased TV watching, and lack of physical activity, all of which are largely modifiable (9). In this study, the key lifestyle behaviors identified by the American Medical Association, served as the basis for the behavioral factors. These behavioral factors include physical activity, fruit and vegetable consumption, sugar-free beverage intake, and screen time (18, 19). To the best of our knowledge, no study to date has focused on the factors affecting the BMI among 4 to 6-year-old children in Behbahan city, and there is insufficient data about this condition. In order to develop effective strategies for healthy body weight, it is critical to study influencing lifestyle factors to enable more specific guidance and intervention strategies in the future. This study investigated the effects of lifestyle factors on BMI of preschool children in Behbahan city, during 2016.

2. Material and Methods

2.1. Methods and Subjects

A total of 120 preschool children, aged 4 to 6 years, participated in this cross-sectional study, using multi-stage random sampling. In the first stage, 4 preschools were chosen randomly from 20 preschools in the city. In the second stage, there was a random selection of 30 children (aged 4 to 6 years), from each preschool. This sample size was calculated with a test power of 90% and a type 1 error of 5%. According to preschool child health records, the 120 subjects selected for this study were physically fit with no health problems. Mothers with a child between 4 and 6 years old and without physical disabilities that prevented walking were included in this research. Ethical issues (including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

2.2. Measurements and data collection

Anthropometric data were obtained after measuring children in their preschools. This study categorized the BMI for age and sex, based on CDC criteria in four groups as obese ($BMI \geq 95^{\text{th}}$ percentile), over-weight ($BMI \geq 85$ and $< 95^{\text{th}}$ percentile), normal ($BMI \geq 5^{\text{th}}$ and $< 85^{\text{th}}$ percentile) and underweight ($BMI < 5^{\text{th}}$ percentile) (20). Using a researcher-developed questionnaire, demographic and lifestyle data were obtained, as the questionnaires were completed by their mothers. The questionnaire was approved through the establishment of a panel of health education and promotion experts, and assessed by CVR and CVI. In the initial review, the CVR index was above 0.8 and CVI was more than 0.9. In order to measure the reliability of the questionnaire in a preliminary study, Cronbach's alpha coefficient was examined while 30 mothers were interviewed. The lifestyle behaviors of children were measured by the mother's report in the previous 24 hours. Sample items included, "yesterday, how many total cups of fruit did your child eat?" The children's mothers were requested to answer in short format, demonstrating the full amount of the given behavioral unit in the 24 hours prior to interview. Illustrated examples of each behavior were provided to assist the participants in contextualization. Quantity of fruit and vegetables were divided into meeting guidelines (≥ 5 servings, coded 1) or failing to meet guidelines (coded 0). Sugar-sweetened beverage consumption was divided into meeting guidelines (≤ 1 cup, coded 1) or failing to meet guidelines (coded 0). Engagement in structured physical

activity was separated into meeting guidelines (≥ 60 minutes, coded 1) or failing to meet guidelines (coded 0). Screen time was dichotomized into meeting guidelines (≤ 2 hours, coded 1) or failing to meet guidelines (coded 0) (21).

2.3. Statistical Analysis

Data were analyzed by IBM® SPSS® Statistics version 22 (IBM® Corp., Armonk, NY, USA) using descriptive statistics, Chi-squared test, and multiple logistic regression. P-value less than 0.05 was considered as the level of significance.

2.4. Research ethics

The ethics of study was approved by the Research and Ethics Committee of Tehran University of Medical Sciences (Ref. no.: IR.TUMS.REC.1394.1557). Prior to the participation of the children, informed consent was obtained from their parents.

3. Results

The average age of the participants was 5.1 ± 0.68 years, and 66 (55%) were male and 54 (45%) were female. The BMI of children ranged between 11.18 and 21.16 kg/m^2 , with an average value of $15.13 \pm 1.90 \text{ kg/m}^2$. According to CDC criteria, the BMI of the participants was classified into underweight ($n=27$; 22.5%), normal weight ($n=73$; 60.8%), overweight ($n=12$; 10%), and obese ($n=8$; 6.7%) groups. No statistical significance was found between BMI and demographic factors (Table 1). A total of 88.3% of children did not receive 5 cups of fruits and vegetables each day. Also, 12.5% consumed more than one serving of sweetened beverages per day. Only 2.5% engaged in 60 min of structured physical activity every day and 40% did not limit screen-time viewing to 2 hours per day or less (Table 2). Table 3 shows the mean (\pm SD) of lifestyle behaviors. Multivariate logistic regression results indicated that physical activity and screen time viewing had a significant effect on BMI. Given that the value of odds ratio (OR) in all states for the physical activity variable was less than one, it indicates the inverse effect of this variable. But the value of OR in all positions for the screen time variable was greater than one, it implies the direct effect of this variable. Fruits and vegetables consumed and sugar-sweetened beverages consumed did not have a significant effect on BMI (Table 4).

Table 1. Demographic characteristics of the study population

Demographic Factors		n	%
Child's gender	Male	66	55
	Female	54	45
Child's age (yrs.)	4-5	82	68.3
	5-6	38	31.7
Mother's age (yrs.)	<30	43	35.8
	30-40	68	56.7
	>40	9	7.5
Mother's educational degree	\leq High school diploma	59	49.2
	Associate degree and Bachelor	56	46.7
	\geq Master	5	4.2
Mother's occupation status	Housewife	91	75.8
	Employed part time	15	12.5
	Employed full time	14	11.7

Table 2. The percentage of adhering to recommended dietary intake, physical activity and screen time guidelines.

Life style behaviors	Adhering recommended guidelines	n	%
Fruits and vegetables consumed (cup)	<5	Not	106 88.3
	≥ 5	Yes	14 11.7
Sugar-sweetened beverages consumed (8-ounce glass)	≤ 1	Yes	105 87.5
	>1	Not	15 12.5
Structured physical activity (Minute)	<60	Not	117 97.5
	≥ 60	Yes	3 2.5
Screen time viewing (Minute)	≤ 120	Yes	72 60
	>120	Not	48 40

Table 3. The mean (\pm SD) lifestyle behaviors

Life style behaviors	Mean \pm SD	Score range
Fruits and vegetables consumed (cup)	2.42 \pm 1.72	0-8
Sugar-sweetened beverages consumed (8-ounce glass)	0.73 \pm 0.75	0-4
Physical activity (Minute)	2.83 \pm 11.01	0-60
Screen time viewing (Minute)	137.38 \pm 87.63	0-440

Table 4: Multivariate logistic regression among lifestyle behaviors and BMI

Variables	Underweight		Normal weight		Overweight	
	OR	p-value	OR	p-value	OR	p-value
Fruits and vegetables consumed	1.234	0.542	1.416	0.291	1.112	0.786
Sugar-sweetened beverages consumed	1.843	0.418	2.329	0.239	1.965	0.405
Physical activity	0.967	0.001	0.889	0.001	0.798	0.001
Screen time viewing	1.014	0.035	1.013	0.036	1.007	0.049

The reference category is: obese category (95th percentile or greater).

4. Discussion

The etiology of overweightness and obesity is complex, therefore developing effective preventive programs and strategies is a challenging issue (22). Behavioral and social factors rather than changes in biological or genetic factors seem to play significant roles in increasing the prevalence of childhood obesity (23). Previous research into these topics provided limited information on obesity-related behaviors among 4 to 6-year-old children (17, 24, 25). Based on guidelines used in our study, consumption of fruit at <5 cups a day, consumption of sugar-sweetened beverages at > 1 glass a day, screen time viewing for > 2 hours a day and structured physical activity for < 60 minutes were potential risk factors for childhood overweightness or obesity. This study, for the first time in Iran, examined a proportion of children adhering to recommended physical activity, screen time and dietary intake guidelines, in an approach that is necessary to provide a more complete picture of key lifestyle behaviors that may contribute to promote a healthy lifestyle in childhood. Previous research provided limited information on obesity-related behaviors among 4 to 6-year-old children (17, 24, 25). To our knowledge, key lifestyle behaviors among young children in this area had not been studied previously. A total of 88.3% of children did not receive 5 cups of fruits and vegetables each day. Also, 12.5% consumed more than one serving of sweetened beverages per day. Only 2.5% engaged in 60 minutes of structured physical activity every day and 40% did not limit screen-time viewing to 2 hours per day or less. It was reported by Kunin-Batson et al. that physical activity recommendations were met by only 36% of the children in the St. Paul area of Minneapolis, USA, which was higher and better than the results of our study, screen time recommendations were met by 48% which was rather similar to that reported by our study, the guidelines for avoidance of sugar-sweetened beverage was met by 42% which was higher and better than the results of our study, while 14% met the guidelines for 5 servings of fruits and vegetables per day which was rather similar to that reported by our study (21). In the study of Aranceta Bartrina et al., 83% of Spanish children reported low fruit and vegetable intake (<5 servings/d) (26). Also, in their sample, Dennison et al. found that most children consumed <5 fruit and vegetable servings per day (27) which were rather similar to that reported by our study. The findings of the present study showed that only 11.7% of children ate \geq 5 servings of fruit and vegetable per day, higher than that reported by Basch and Perez-Rodriguez (28, 29). A total of 40% of participants in this study exceeded the 2-hour limit of screen time recommended by the American Academy of Pediatrics as reported by other studies (29-31). Promotion of a healthy lifestyle in childhood may require fundamental social and political changes. Initiatives in education and community planning are necessary to encourage and facilitate adherence to dietary intake, physical activity and screen time guidelines on a daily basis. The low physical activity and high screen time of children in our study could be due to the warm weather, dust storms and dust phenomenon in Behbahan city, the lack of sports and recreational spaces for children, the inappropriateness of existing clubs and parks and the low knowledge and skill of mothers to encourage children to take up a physical activity. Thus, to bring about a change in the physical activity and screen time patterns of children, public playgrounds and recreational spaces should be provided. Due to screen time reduction, a variety of fun and creative activities and games should be designed for the lesser time of children. So, it is important that educational classes be strictly followed by mothers, and it is recommended that mothers should encourage children to adhere to screen time guidelines and give preference to physical activities over screen time. Further exploratory research is needed among young children to understand physical activity practices. The type of activities practiced would be useful in effectively designing public health programs aimed at promoting physical activity. Findings of the present study highlighted that a low proportion of

children had adequate intake of fruits and vegetables and of those who drank sugar-sweetened beverages, was relatively high. All economic classes can be found in our study sample because the kindergartens and children were randomly selected. At this point in time, economic problems are not a reason for the low consumption of fruits and vegetables. It could be said that it was due to the low knowledge and skill of the mothers. This finding implies the importance of spending regular class hours on teaching healthy food habits and the nutritive values of different food items for mothers. To reduce intake of sugar-sweetened beverages, public health experts need to constantly train the mothers about the complications that can develop from the consumption of these beverages. Alerting mothers to the fact that fruit-flavored water, like any other sugar-sweetened beverage, is harmful, plays an important role. However, the general view is that suitable and adequate approaches need to be implemented to promote a healthy lifestyle in childhood. Our study showed that fruit and vegetables intake did not have a significant impact on BMI. It has been stated that fruit and vegetable intake protects against obesity (29). According to Ledoux et al., the increase in fruit and vegetable intake, in addition to other behaviors, contributed to a decrease in adiposity among overweight or obese adults. This relationship remains unclear in children. To clarify the nature and mechanisms of the effects of fruit and vegetable intake on adiposity, more research is needed (32). Field et al. reported that the recommendation for consumption of fruits and vegetables may be well founded, but should not be based on the beneficial effect of BMI regulation (33, 34). This study found that the consumption of sugar-sweetened beverages did not have a significant impact on BMI. According to Perez-Rodriguez et al, with the exception of fruit-flavored water, there was no relationship between sugar-sweetened beverages and adiposity or weight status (29). Veldhuis et al. did not find a statistically significant relationship between the drinking of sweet beverages and the risk of overweightness or obesity at the age of 5 years (35). Based on a study conducted by Harrington, for each additional can or glass of sugar-sweetened drink consumed beyond the usual daily beverage intake, the tendency of the child becoming obese, increases by 1.6 times (36). The methodological limitation of the cross-sectional nature of this study, can cause a lack of relationship between BMI and intake of fruits and vegetables and also, consumption of sugar-sweetened beverages. This study showed that physical activity had a protective effect against obesity. Veldhuis et al. did not find a statistically significant relationship between playing outside and the risk of becoming overweight or obese at the age of 5 years (35). Hajian et al. showed that there was no significant relationship between the physical activity level of children and overweightness/obesity (7). Bhuiyan et al. observed that children, who spent greater time in physical activities, were less at risk of being overweight or obese, although the association was not significant (37). Our study showed that screen time had a significant impact on overweightness and obesity. Studies that examined sedentary habits in children have reported the existence of a strong relationship between television watching and obesity (38). Studies that examined the relationship between the time spent on computers and obesity yielded contradictory findings. For example, a number of studies found no relationship between television viewing, computer usage and obesity (9, 39, 40), other studies found that obesity was related to computer time and not television viewing time (38, 41). Veldhuis et al. found that spending >2 hours per day watching TV is associated with an increased risk of overweightness (obesity included) in children below 6 years (35).

5. Strengths and Limitations

The strength of our study was the objective measurement of the children's height and weight by trained raters, rather than by parental reports, random method of selection of children and research on children aged 4 to 6 years old. The findings of this study should be understood within the context of potential limitations. The lifestyle behaviors of the children were assessed by means of parental reports which may lead to socially desirable answers, and our results may have been biased by these self-reports. As a result of time and budgetary constraints, a single 24-hour dietary recall was used (as opposed to the three recall gold standard), and this may not be representative of the usual behavior.

6. Conclusions

This study showed that the rates of unhealthy lifestyle-related behaviors among 4 to 6-year-old children from Behbahan city are alarmingly high. Monitoring the levels of these lifestyle-related behaviors during childhood, provides health professionals with information on the specific behaviors that need special attention for the prevention of childhood obesity. This study suggests that interventions targeting obesity in preschoolers should focus on the lifestyle behaviors, especially on the physical activity and screen time. Although several risk factors for obesity have been identified among school-aged children and adolescents, it is limited among 4 to 6-year-old children. The present investigation is one of the first to determine obesity-related behaviors among preschool children (4-6 years old). Further research should be conducted about influencing factors of BMI among this age group. Future research should include longitudinal analyses to gain a better understanding of these factors and their influence on obesity among 4 to 6-year-old children.

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Conflict of Interest:

There is no conflict of interest to be declared.

Authors' contributions:

All authors contributed to this project and article equally. All authors read and approved the final manuscript.

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