

**Demographic determinants of obesity, and adherence to dietary and physical activity guidelines among 4 to 6-year-old children in Behbahan city, southwest Iran, 2016**

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**Abstract**

**Background and aim:** The world is experiencing an alarming increase in prevalence of childhood obesity. The aim of this study was to determine the demographic determinants of obesity and adherence to dietary and physical activity guidelines among children aged 4 to 6 years old in Behbahan city, southwest Iran, in 2016.

**Methods:** This cross-sectional study was conducted on 120 preschool children aged 4 to 6 years old in Behbahan city, southwest Iran, in 2016. Multi-stage random sampling was done. The weight and height of the children were measured with standard methods. The demographic and behavioral factors data were collected in self report questionnaires which were completed by the children's mothers. The Chi-square test, Independent-samples t-tests, One-way analysis of variances and logistic regression analysis were used for data analysis. SPSS software (version 22) was employed.

**Results:** This study showed that 88.3% of the children did not meet the guideline of 5 servings per day of fruit and vegetables. Only 2.5% met the guideline of 60 minutes of structured physical activity every day. Sex and mother's occupation status were associated with adhering to screen time guideline. This study found a significant difference in the mean of screen time between sexes. Boys were more likely to meet the screen time guideline. A significant association between adhering to physical activity guidelines and mother's occupation status was revealed. Significant statistical relationship between demographic factors and BMI categories was not illustrated. Demographic covariates were not significantly related to adherence to dietary and physical activity guidelines.

**Conclusion:** In preventive programs of obesity among 4 to 6-year-old children key lifestyle behaviors and demographic factors need to be considered.

**Keywords:** Childhood obesity, Physical activity, Diet, Guidelines, Health promotion, Program development

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## 1. Introduction

Due to its accelerated growth rate, obesity has been named the epidemic phenomenon of the century (1). Throughout the world, there is an alarming increase in the prevalence of overweightness and obesity in children (2). It has been recognized by the World Health Organization (WHO) as one of the most difficult challenges for public health in the 21st century (3). According to the WHO, 42 million children worldwide under the age of five were estimated to have been overweight or obese in 2010 (4). Moreover, if the current trends continue, by 2025 there could be around 70 million young children classified as overweight or obese (5). Although the increasing prevalence of obesity is reported from all regions throughout the world, there is little data regarding the young children of Iran (6). The prevalence of obesity in children in various Iranian cities differed from 0.57% to 17.7% (7). In 5 to 6-year-old preschool children using CDC criteria 9.09% of boys, and 9.72% of girls were overweight; 5.26% of boys and 4.32% of girls were obese (6). In the study performed in 2007 on children entering school from 31 provinces in Iran, the prevalence rates of overweightness and obesity were, according to CDC standards, 13.5% and 3.5% respectively (8). Due to its high prevalence and consequential morbidity and mortality rate (9), obesity is a major public health problem throughout the world. Obesity is associated with, metabolic, psychological and cardiovascular complications, and a risk of premature mortality in adulthood (10). Worldwide, overweightness and obesity are said to be accountable for 44% of diabetes, 41% of various cancers and 7% of ischemic heart diseases (9). Obesity is associated with various diseases such as hypothalamic-pituitary disorders, adrenal hyperfunction, hypothyroidism, hypertension, cardiovascular complications, type 2 diabetes, gonadal function, metabolic and hormonal disorders, respiratory diseases, atherosclerosis (11), psychological problems such as negative emotions low self-esteem, and body image disparagement (12), and affects the general health status in society (13). Obesity and related diseases impose heavy human and economic burdens upon societies (11). There is a growing concern that childhood obesity is likely to persist into adolescence and continue to adulthood (9). Documented reports state that 30% of cases of obesity begin in childhood, and among them, 50% to 80% continue to obesity in adulthood (12). The results of one study showed that children who were overweight during their preschool years had a 60% greater possibility of being overweight at twelve years old (14), and another study found that 34% of children who were classified as overweight at seven years old, were obese at age thirteen (15). It has been established that preschool years are the most important time to study the determinants of obesity in childhood (6). While it is a period when diet and physical habits begin to form (6, 16), it is also the period immediately preceding the rise in body mass index (BMI) known as adiposity rebound (6, 17). Thus, it has become an extremely important issue among health professionals, since child obesity conveys into adulthood (6, 18) and is a strong antecedent to increased morbidity and mortality in adult life (6, 19). In order to prevent childhood obesity, a public health approach is needed, which addresses its probable risk factors (4). More than 90% of obesity cases are idiopathic, and less than 10% have been found to be associated with genetic or hormonal origin (20). Previous research have been conducted in school- children on causality of obesity field; but, prevalence of obesity among preschool children was considered more (4, 21). A number of these lifestyle choices, such as unhealthy diet pattern, prolonged TV watching, and other sedentary activities, are related to risk factors for obesity, all of which can be regulated (12). To the best of our knowledge, no study to date has focused on associated factors of overweightness and obesity among 4 to 6-year-old children in Behbahan city, and there is no sufficient data to document this condition. In order to develop effective strategies for obesity prevention, it is critical to determine associated factors to enable more specific guidance and intervention strategies in the future. This study sought to determine the correlate of demographic factors with obesity and adherence to dietary and physical activity guidelines among 4 to 6-year-old children in Behbahan city, during 2016.

## 2. Material and Methods

This cross-sectional study was conducted on 120 preschool children aged 4 to 6 years old. Multi-stage random sampling was done. In the first stage, 4 preschools were chosen randomly from 20 preschools in Behbahan city. In the second stage, 30 children aged 4 to 6 years were chosen randomly from each preschool. This sample size was calculated with a test power of 90% and a type 1 error of 5% (8). All 120 selected subjects were healthy with no debilitating conditions or congenital disorders based on preschool child health records. Mothers of the children who were between 4 and 6 years old and were free of physical disability that prevented them from walking, participated in this research. All mothers gave an informed consent for participation of their children into the study.

### 2.1. Measurements and data collection

The data were collected for anthropometric measurements of the children in the preschools. Weight was measured to the nearest 0.1 kg using a digital portable scale with light clothes and no shoes. For height, children were instructed to stand as straight as possible with his/her back against a wall-mounted vertical ruler. Feet were flat on the floor with shoes removed. Then, BMI was calculated. In this study, the diagnosis of childhood overweightness and

obesity was based on CDC criteria. BMI for age and sex were categorized into four groups as obese (BMI $\geq$ 95<sup>th</sup> percentiles), over-weight (BMI $\geq$ 85 and <95<sup>th</sup> percentiles), normal (BMI $\geq$ 5<sup>th</sup> and <85<sup>th</sup> percentiles) and underweight (BMI<5<sup>th</sup> percentiles) (22). We obtained information on demographic characteristics and behavioral factors by a designed questionnaire which was completed by the mothers. We considered sex and age of the child, and age, educational level and occupation status of the mother. With the collaboration of the American Medical Association and 15 health care organizations, a series of recommendations for the prevention and treatment of child and adolescent obesity was developed (23). Specific lifestyle behaviors identified by the committee would serve as the key points for the behavioral factors in this study. The behavioral factors are 1) the child engaging in 60 minutes of physical activity each day, 2) consuming at least 5 items of fruit and vegetables each day, 3) changing from sugar-sweetened beverages to sugar-free beverages (consumption of no more than one serving of sweetened beverages), and 4) restriction of time in front of a television screen or computer monitor to no more than 2 hours per day. Lifestyle behaviors of the participants' children measured by using maternal, self-report, in the previous 24 hours was as follows: 1) Total minutes of child physical activity (minutes of structured and unstructured daily physical activity). Child physical activity behavior operationally defined as child engagement in 60 minutes of structured and 60 minutes of unstructured physical activity each day (120 minutes total) (24), 2) Cups of fruits and vegetables consumed, 3) Eight-ounce glasses of sugar-sweetened beverages consumed, and 4) Minutes of screen time (television and computer) measured. Fruit and vegetable servings were summed and dichotomized into meeting ( $\geq$  5 servings, coded 1) or not meeting guidelines (coded 0). Sugar sweetened beverage consumption was dichotomized into meeting ( $\leq$ 1cup, coded 1) or not meeting guidelines (coded 0). Structured physical activity engagement was dichotomized into meeting ( $\geq$  60 minutes, coded1) or not meeting guidelines (coded 0). Screen time was dichotomized into meeting ( $\leq$  2 hours, coded 1) or not meeting guidelines (coded 0) (24).

## 2.2. Statistical Analysis

Means and standard deviations or percentages were calculated for quantity and quality variable respectively. The Chi-square test was used to compare overweightness, obesity and behavioral factors between the different demographic factors. Independent-samples t-tests and one-way analysis of variances were used to compare mean of variables between two groups (for instance, boys and girls) and for more than two groups, respectively. When a significant difference was revealed, the Tukey's post-hoc test was used to specify where the difference occurred. In addition, we applied the logistic regression analysis to estimate the odds ratio (OR) of demographic factors on the risk of overweight/obesity and adherence to dietary and physical activity guidelines. All tests for statistical significance were two-tailed and performed assuming a type 1 error probability of  $\leq$  0.05. Data were analyzed using IBM® SPSS® Statistics version 22 (IBM® Corp., Armonk, NY, USA).

## 2.3. Ethics of research

The Research and Ethics Committee of Tehran University of Medical Sciences granted approval of the study protocol (Code: IR.TUMS.REC.1394.1557).

## 3. Results

Of 120 participants, 66 (55%) were male and 54 (45%) female, and the mean age ( $\pm$ SD) was 5.1 $\pm$  0.68. There is no significant difference in the mean of weight, height and BMI between boys and girls and with a similar mean age. Of the girls, 3.7% and 13% were overweight and obese respectively, while in the boys, it was respectively 15.2% and 1.5%. Respectively, 9.8% and 8.5% of children aged 4 to 5 years were overweight and obese, while the 5 to 6-year-old children were 10.5% and 2.6%. With regard to mother's age, the highest percentage of overweight and obesity was in children of mothers less than 30 years old, and 30 to 40-year-old mothers respectively. Regarding maternal educational level, children of mothers who were in master and a higher group of educational level had the highest percentage of overweightness and obesity. With regard to mother's occupation status, children of part-time employed and housewife mothers had highest percentage of overweightness and obesity respectively. Significant statistical relationships between BMI categories and demographic factors was not illustrated (Table 1). In total, 88.3% of children did not meet guidelines for 5 servings per day of fruit and vegetables. Furthermore, 12.5% did not meet guidelines for sugar-sweetened beverage and 40% did not meet screen time recommendations. It was found that 25.9% of girls and 51.5% of boys did not meet screen time recommendations. Our study shows a significant association between adhering to screen time guidelines and sex. A total of 39.6% of children of housewife mothers, 20.0% of children of part-time employed mothers and 64.3% of children of full-time employed mothers did not meet screen time recommendations. Our study found a significant association between adhering to screen time guidelines and mother's occupation status (Table 2). Only 2.5% met guidelines for 60 min of structured physical activity every day. A total of 20% of children did not meet guidelines for unstructured physical activity. Moreover, 52.5% of

children did not adhere to structured and unstructured physical activity guidelines. In total, 53.8% of children of housewife mothers, 60% of children of part-time employed mothers and 35.7% of children of full-time employed mothers did not meet structured and unstructured physical activity recommendations. Our study found a significant association between adhering to structured and unstructured physical activity guideline and mothers' occupation status (Table 3). Mean of screen time ( $\pm$ SD) was respectively 160.06 $\pm$ 88.87 and 109.66 $\pm$ 78.32 in boys and girls. This study found a significant difference in the mean of screen time between boys and girls ( $p=0.001$ ) and mean of boys was higher than mean of girls. Mean of screen time ( $\pm$ SD) was respectively 129.51 $\pm$ 82.22, 128 $\pm$ 111.36 and 198.57 $\pm$ 74.61 in children of housewives, part time employed and full time employed mothers. This study found a significant difference in the mean of screen time between these three groups ( $p=0.02$ ). The mean of screen time of children of full time employed mothers was not homogeneous with two other groups and placed in a separate category. Table 4 shows the results of logistic regression analysis. Significant OR was not found. The main reason for no significant OR of logistic regression could probably have been the disproportion in distribution samples. Boys were more likely to meet screen time guidelines (OR=0.3, 95% CI: 0.15-0.71). Demographic covariates were not significantly related to adherence to fruit/vegetable, sugar-sweetened beverages, physical activity guidelines.

**Table 1.** Demographic characteristics of the study population according to BMI category (n=120)

| Demographic Factors        |                             | BMI category |           |            |          | Total     | p-value |
|----------------------------|-----------------------------|--------------|-----------|------------|----------|-----------|---------|
|                            |                             | Underweight  | Normal    | Overweight | Obese    |           |         |
| Child's sex                | Male                        | 11 (16.7)    | 44 (66.7) | 10 (15.2)  | 1 (1.5)  | 66 (55.0) | 1.00    |
|                            | Female                      | 16 (29.6)    | 29 (53.7) | 2 (3.7)    | 7 (13.0) | 54 (45.0) |         |
| Child's age (year)         | 4-5                         | 21 (25.6)    | 46 (56.1) | 8 (9.8)    | 7 (8.5)  | 82 (68.3) | 0.48    |
|                            | 5-6                         | 6 (15.8)     | 27 (71.1) | 4 (10.5)   | 1 (2.6)  | 38 (31.7) |         |
| Mother's age (year)        | <30                         | 8 (18.6)     | 28 (65.1) | 6 (14.0)   | 1 (2.3)  | 43 (35.8) | 0.93    |
|                            | 30-40                       | 15 (22.1)    | 40 (58.8) | 6 (8.8)    | 7 (10.3) | 68 (56.7) |         |
|                            | >40                         | 4 (44.4)     | 5 (55.6)  | 0 (0.0)    | 0 (0.0)  | 9 (7.5)   |         |
| Mother's educational level | $\leq$ High school diploma  | 13 (22.0)    | 34 (57.6) | 8 (13.6)   | 4 (6.8)  | 59 (49.2) | 0.28    |
|                            | Associate degree & Bachelor | 13 (23.2)    | 37 (66.1) | 3 (5.4)    | 3 (5.4)  | 56 (46.7) |         |
|                            | $\geq$ Master               | 1 (20.0)     | 2 (40.0)  | 1 (20.0)   | 1 (20.0) | 5 (4.2)   |         |
| Mother's occupation status | Housewife                   | 19 (20.9)    | 54 (59.3) | 10 (11.0)  | 8 (8.8)  | 91 (75.8) | 0.10    |
|                            | Employed part-time          | 3 (20.0)     | 10 (66.7) | 2 (13.3)   | 0 (0.0)  | 15 (12.5) |         |
|                            | Employed full-time          | 5 (35.7)     | 9 (64.3)  | 0 (0.0)    | 0 (0.0)  | 14 (11.7) |         |
| Total                      |                             | 27 (22.5)    | 73 (60.8) | 12 (10.0)  | 8 (6.7)  | 120 (100) |         |

**Table 2.** Rates of meeting dietary intake & screen time guidelines according to demographic factors (n=120)

| Demographic Factors        |                            | Dietary Intake and Screen Time Guidelines |           |   |           |                        |           |
|----------------------------|----------------------------|---|-----------|---|-----------|------------------------|-----------|
|                            |                            | Cups of fruits and vegetables consumed    |           | Glasses of sugar-sweetened beverages consumed |           | Minutes of screen time |           |
|                            |                            | <5  | $\geq$ 5  | $\leq$ 1                                      | >1        | $\leq$ 120             | >120      |
| Child's sex                | Male                       | 56 (84.8)                                 | 10 (15.2) | 56 (84.8)                                     | 10 (15.2) | 32 (48.5)              | 34 (51.5) |
|                            | Female                     | 50 (92.6)                                 | 4 (7.4)   | 49 (90.7)                                     | 5 (9.3)   | 40 (74.1)              | 14 (25.9) |
| Child's age (year)         | 4-5                        | 73(89.0)                                  | 9 (11.0)  | 74 (90.2)                                     | 8 (10.8)  | 51 (62.2)              | 31 (37.8) |
|                            | 5-6                        | 33 (86.8)                                 | 5 (13.2)  | 31 (81.6)                                     | 7 (18.4)  | 21 (55.3)              | 17 (44.7) |
| Mother's age (year)        | <30                        | 41 (95.3)                                 | 2 (4.7)   | 38 (88.4)                                     | 5 (11.6)  | 26 (60.5)              | 17 (39.5) |
|                            | 30-40                      | 57 (83.8)                                 | 11 (16.2) | 58 (85.3)                                     | 10 (14.7) | 42 (61.8)              | 26 (38.2) |
|                            | >40                        | 8 (88.9)                                  | 1 (11.1)  | 9 (100)                                       | 0 (0.0)   | 4 (44.4)               | 5 (55.6)  |
| Mother's educational level | $\leq$ High school diploma | 52 (88.1)                                 | 7 (11.9)  | 51 (86.4)                                     | 8 (13.6)  | 36 (61.0)              | 23 (39.0) |
|                            | Associate & Bachelor       | 50 (89.3)                                 | 6 (10.7)  | 49 (87.5)                                     | 7 (12.5)  | 33 (58.9)              | 23 (41.1) |
|                            | $\geq$ Master              | 4 (80.0)                                  | 1 (20.0)  | 5 (100)                                       | 0 (0.0)   | 3 (60.0)               | 2 (40.0)  |
| Mother's occupation status | Housewife                  | 81 (89.0)                                 | 10 (11.0) | 80 (87.9)                                     | 11 (12.1) | 55 (60.4)              | 36 (39.6) |
|                            | Employed part-time         | 13 (86.7)                                 | 2 (13.3)  | 12 (80.0)                                     | 3 (20.0)  | 12 (80.0)              | 3 (20.0)  |
|                            | Employed full-time         | 12 (85.7)                                 | 2 (14.3)  | 13 (92.9)                                     | 1 (7.1)   | 5 (35.7)               | 9 (64.3)  |
| Total                      |                            | 106 (88.3)                                | 14 (11.7) | 105 (87.5)                                    | 15 (12.5) | 72 (60.0)              | 48 (40.0) |

**Table 3.** Rates of meeting physical activity guidelines according to demographic factors (n = 120)

| Demographic Factors        |                             | Physical Activity Guidelines            |         |   |           |  |           |
|----------------------------|-----------------------------|---|---------|---|-----------|--|-----------|
|                            |                             | Minutes of structured physical activity |         | Minutes of unstructured physical activity |           | Minutes of structured and unstructured physical activity |           |
|                            |                             | <60                                     | ≥60     | <60                                       | ≥60       | <120   | ≥120      |
| Child's sex                | Male                        | 63 (95.5)                               | 3 (4.5) | 11 (16.7)                                 | 55 (83.3) | 31 (47.0)  | 35 (53.0) |
|                            | Female                      | 54 (100)                                | 0 (0.0) | 13 (24.1)                                 | 41 (75.9) | 32 (59.3)  | 22 (40.7) |
| Child's age (year)         | 4-5                         | 80 (97.6)                               | 2 (2.4) | 15 (18.3)                                 | 67 (81.7) | 43 (52.4)  | 39 (47.6) |
|                            | 5-6                         | 37 (97.4)                               | 1 (2.6) | 9 (23.7)                                  | 29 (76.3) | 20 (52.6)  | 18 (47.4) |
| Mother's age (year)        | <30                         | 42 (97.7)                               | 1 (2.3) | 9 (20.9)                                  | 34 (79.1) | 20 (46.5)  | 23 (53.5) |
|                            | 30-40                       | 66 (97.1)                               | 2 (2.9) | 12 (17.6)                                 | 56 (82.4) | 38 (55.9)  | 30 (44.1) |
|                            | >40                         | 9 (100)                                 | 0 (0.0) | 3 (33.3)                                  | 6 (66.7)  | 5 (55.6)   | 4 (44.4)  |
| Mother's educational level | ≤ High school diploma       | 59 (100)                                | 0 (0.0) | 14 (23.7)                                 | 45 (76.3) | 37 (62.7)  | 22 (37.3) |
|                            | Associate degree & Bachelor | 53 (94.6)                               | 3 (5.4) | 9 (16.1)                                  | 47 (83.9) | 22 (39.3)  | 34 (60.7) |
|                            | ≥ Master                    | 5 (100)                                 | 0 (0.0) | 1 (20.0)                                  | 4 (80.0)  | 4 (80.0)   | 1 (20.0)  |
| Mother's occupation status | Housewife                   | 89 (97.8)                               | 2 (2.2) | 21 (23.1)                                 | 70 (76.9) | 49 (53.8)  | 42 (46.2) |
|                            | Employed part-time          | 15 (100)                                | 0 (0.0) | 1 (6.7)                                   | 14 (93.3) | 9 (60.0)   | 6 (40.0)  |
|                            | Employed full-time          | 13 (92.9)                               | 1 (7.1) | 2 (14.3)                                  | 12 (85.7) | 5 (35.7)   | 9 (64.3)  |
| Total                      |                             | 117 (97.5)                              | 3 (2.5) | 24 (20.0)                                 | 96 (80.0) | 63 (52.5)  | 57 (47.5) |

**Table 4.** The odds ratio (OR) of demographic factors on the risk of overweight/obesity and its 95% confidence interval (95% CI) and P-value

| Demographic factors        |                             | n  | OR    | 95% C.I for OR |        | p-value |
|----------------------------|-----------------------------|----|-------|----------------|--------|---------|
|                            |                             |    |       | Lower          | Upper  |         |
| Child's sex                | Male                        | 66 | 1.187 | 0.430          | 3.282  | 0.741   |
|                            | Female                      | 54 | 1 (-) |                |        |         |
| Child's age                | 4-5 years                   | 82 | 1.423 | 0.460          | 4.398  | 0.541   |
|                            | 5-6 years                   | 38 | 1 (-) |                |        |         |
| Mother's educational level | ≤ High school diploma       | 59 | 1 (-) |                |        | 0.205   |
|                            | Associate degree & Bachelor | 56 | 0.260 | 0.034          | 1.982  | 0.194   |
|                            | ≥ Master                    | 5  | 0.159 | 0.020          | 1.252  | 0.081   |
| Mother's occupation status | Housewife                   | 91 | 3.184 | 0.617          | 16.442 | 0.167   |
|                            | Employee                    | 29 | 1 (-) |                |        |         |

#### 4. Discussion

The aim of this study was to determine the demographic determinants of obesity and adherence to dietary and physical activity guidelines among children aged 4 to 6 years in Behbahan city in 2016.

##### 4.1. Demographic factors associated with overweightness and obesity

Our study did not find significant statistical relationship between BMI categories and sex. The findings from studies conducted in Babol (25), Zanjan (26), rural areas in northern Iran (27), and Yazd (28) indicate that there was no significant difference between the two sexes. Overweightness and obesity were found to be more prevalent among boys (29-34). Girls overrode boys in overweight and obesity rates (35-37). Our study showed the odds ratio (OR) of sex on the risk of overweight/obesity was not significant. Hajian (25) and Taha (38) showed that the OR of overweight/obesity was elevated respectively 1.15 and 0.9 in girls compared with boys. Nabavi et al. reported that in the range of 7-12 years age, the risk of obesity in boys was 2.24 times more than in girls (39). This study did not find significant statistical relationship between BMI categories and age. Hajian et al. reported that increasing age had the most determinants of childhood obesity (25). While Veghari et al. saw an inverse association between extra weight and age (28). Furthermore, Patricia et al. indicated that there was no significant difference among various age groups (40). Our study showed the OR of age on the risk of overweight/obesity was not significant. Hajian (25) showed that the OR of overweight/obesity was elevated 2.53 in age 4-5 years compared with 2-3 years. Nabavi et al. reported that in the range of 7-12 ages, the risk of obesity became 1.26 times more per year (39). Our study did not find significant statistical relationship between BMI categories and mother's age. Tchoubi et al. saw no significant association between mother's age and obesity (9), while Ebrahimzadeh et al. reported that maternal age was significantly influenced on prevalence rate of obesity (41). This study did not find significant statistical relationship

between BMI categories and mother's education. The findings of this study are consistent with previous studies (25, 41). A variety of studies report an association between childhood obesity and maternal education (42, 43). Our study showed that the odds ratio (OR) of mother's education on the risk of overweight/obesity was not significant. Studies conducted in Brazil and Iran have reported lower educational status of mother as a risk factor for overweightness and obesity in children (44, 45). The odds ratio of maternal education at university level on the risk of overweightness and obesity significantly decreased compared with primary level. (45) Some studies showed a significant positive association between a higher level of paternal and maternal education and overweightness and obesity among the students (12, 46). Our study did not find significant statistical relationship between BMI categories and mother's occupation such as that reported by Tchoubi et al. (9). Likewise, Mushtaq et al. (47), Fatemeh et al. (48) and Taha (38) found a positive association with employed mothers. In a study of school children in Yazd, the lowest prevalence of obesity was in children whose mothers were housewives (27). In this study, no significant effect of mother's occupation status on childhood obesity may be due to the low number of employed mothers in the study sample; because employed mothers were not willing to participate in the study. Our study showed that the odds ratio (OR) of mother's occupation on the risk of overweight/obesity was not significant. Taha showed that mother's employment was significantly associated with overweightness and obesity (38).

#### ***4.2. Factors associated with adherence to dietary intake, physical activity and screen time guidelines***

This study examined rates of adherence to physical activity, screen time, and dietary intake guidelines among children aged 4 to 6 years in Behbahan city, an approach that is necessary to provide a more complete picture of weight-related behaviors that may contribute to a child's obesity risk. Understanding demographic determinants of guideline adherence can inform the development of interventions to impact children's weight-related behavior. In the fruit and vegetables guideline 88.3% of children did not meet guidelines for 5 servings per day, which implies the importance of spending regular class hours on teaching healthy food habits and the importance of consumption of fruit & vegetables for mothers. Our study showed demographic covariates were not significantly related to adherence to fruit guidelines. The low numbers of children meeting guidelines for fruit and vegetable consumption in this study (11.7%) may have reduced our ability to document associations between demographic and fruit and vegetable consumption. Kunin-Batson et al. reported that older children were more likely to meet fruit and vegetable guidelines, females were less likely to meet fruit and vegetable guidelines and parent education was not significantly related to adherence to fruit guidelines (49). This study showed demographic covariates were not significantly related to adherence to sugar-sweetened beverages guidelines. Kunin-Batson et al. reported that age, gender, and parents' education were strongly associated with adherence to sugar-sweetened beverages guidelines. Children who met guidelines for sugar-sweetened beverage avoidance were more likely to be younger and to have parents with at least a college education (49). In other studies, children of parents who had at least a college education were more likely to meet guidelines for sugar-sweetened beverage consumption (50). A total of 97.5% of children did not meet structured physical activity recommendations. Our study found a significant association between adhering to structured and unstructured physical activity guidelines and mother's occupation status. Therefore, educational planning according to the occupation status of mothers is necessary to promote physical activity in children. It is important that physical education class be strictly followed for mothers, and it is recommended that mothers encourage children to participate in physical activity. Our study showed that demographic covariates were not significantly related to adherence to physical activity guidelines. Kunin-Batson et al. reported that age and gender were strongly associated with physical activity, but parental education was not associated (49). As many as 40% of participants in this study did not meet screen time recommendations. To prevent obesity in children, it is necessary that screen time be replaced by fun, creative, healthy and new activities which are not harmful to health. Our study showed that sex and mother's occupation status are associated with adhering to screen time guidelines. So, educational planning should be done according to the different training needs of groups. Our study showed that sex was significantly related to adherence to screen time guidelines, but other factors were not associated. Kunin-Batson et al. reported that age, gender, and parent education were not associated with screen time (49).

#### ***4.3. Strength and limitations of study***

Strength of our study is the objective measurements of the child's height and weight by trained raters, rather than by parental reports, random method of selection of preschool and children, and research on this age group. Study results must be understood within the context of potential limitations. The cross-sectional design of this study does not allow for causal inferences. Access to 4 to 6-year-old children was through kindergarten, and the study sample consisted of children with whose parents agreed to participate in this study, which may not be representative of children aged 4 to 6 years.

## 5. Conclusions

This study showed that the rates of unhealthy lifestyle-related behaviors among 4 to 6-year-old children of Behbahan city were alarmingly high. Findings suggest that each guideline had unique domain-specific predictors. Therefore, interventions designed to increase adherence to guidelines for obesity prevention in children should be tailored to address the particular factors relevant to the behavior. Conclusions about a causal role of demographic factors in children's adherence to dietary and activity guidelines cannot be made given the cross-sectional nature of these data. However, these findings extend our understanding of factors that influence adherence to guidelines. The present investigation is one of the first to determine obesity-related behaviors among preschool children (4-6 years old). It is recommended that further research be conducted about risk factors of obesity among this age group.

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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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