

Determinants of Weight Disorders in Two- Year- Old Children in Isfahan, Iran

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Abstract

Background: Considering the importance of weight disorders in childhood and its impact until adulthood, this study was conducted to assess the determinants of weight disorders in 2-year-old Iranian children.

Materials and Methods: This cross-sectional study was conducted in 2020 among on 2300 children registered in Comprehensive Health Centers of Isfahan, Iran. Weight disorders, including underweight and overweight were defined according to the standardized National Center for Health Statistics (NCHS)/Centers for Disease Control (CDC) growth charts. Demographic data including gender, birth weight, maternal educational levels and occupation, duration of breastfeeding and the age of beginning complementary food were gathered.

Results: In the present study, 750 children (i.e., 32.6%) had weight disorders. Among them, 53.6% were underweight, 26.3% were overweight, and 12.9% were obese, 7.2% had severe underweight. Female gender, university education of mothers and higher levels of socio-economic status significantly increased the chance of overweight by 14.79%, 22.28%, 27.33% and 24.48%, respectively. Although with the increase in the duration of breastfeeding and the increase of family members, overweight, respectively, decreased by 0.86 and 0.93 fold, but it was not statistically significant. There was an inverse, significant relationship between the duration of breastfeeding with overweight versus underweight.

Conclusion: Underweight and overweight were the two most common weight disorders among 2-year- children, respectively. Control of modifiable risk factors for weight disorders in early life should be underscored in the primary health care system.

Keywords: Pediatric, prevalence, risk factor, weight

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INTRODUCTION

Growth is the enlargement of body parts that plays a very important role in health and is one of the important pillars of community health.^[1] The use of children's growth as a measure of health and nutritional status is based on the fact that poor growth indicates a deviation from appropriate environmental conditions.^[2] Growth disorders are a global problem, and according to the World Health Organization, more than 30 percent of children under the age of 5 have kind of growth

disorder. Of these, 80 percent are stunted and 20 percent are underweight.^[3]

Weight disorder is one of the main components in developmental disorders in children, which has a bad prognosis, especially in the first year of life; because the maximum growth of the brain after birth occurs in the first 6 months of life and this disorder has adverse effects on neurodevelopment.^[4] One of the main reasons that is effective in weight disorder; non-organic factors such as insufficient food intake, decreased appetite, lack of

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sufficient knowledge of the mother about the correct ways of feeding the child and the employment status of the parents.^[5,6] It is estimated in terms of prevalence that 52 million children are underweight and approximately 8,000 deaths occur annually because of underweight. Prenatal and perinatal conditions such as maternal smoking during pregnancy, maternal overweight and obesity, and socio-economic status are among the factors influencing weight problems among children,^[7] to assess the status of a weight disorder, the child weight is usually measured longitudinally from birth to age of two years.^[4]

The index of weight for age indicates the weight of the child for his/her age in a given day, which according to this index is lower than -3 Z-scores severe underweight, equal to -3 Z-scores to -2 Z-scores underweight, equal to -2 Z-scores to equal to $+1$ Z-scores the growth trend is parallel or the growth trend is normal to the middle. The index equal to $+1$ Z-scores to $+3$ Z-score is defined as overweight and above $+3$ Z-score is obesity.^[8-10] Weight disorders could also be defined using body mass index (BMI). Based on world health organization (WHO) growth charts to categorize BMI, underweight is defined as the age and sex specific percentile of BMI less than 5th percentile, overweight is defined as the age and sex specific percentile of BMI $>85^{\text{th}}$ percentile and $<95^{\text{th}}$ percentile and obesity as BMI $>95^{\text{th}}$ percentile.^[11]

To date, few studies have evaluated the prevalence of childhood weight disorders among general population in Iran and no previous study is performed in Isfahan, Iran. Therefore, this study aims to investigate the determinants of weight disorders in a sample of 2-year-old Iranian children.

MATERIALS AND METHODS

Study design, population

This cross-sectional study was conducted in 2020 among all 2300 children with two years of age who were registered in Comprehensive Health Centers in Isfahan, Iran. The study protocol was approved by the Research Committee of Isfahan University of Medical Sciences and the Ethics Committee (Approval code: IR.MUI.MED.REC.1399.535).

Those 2-year-old children with Iranian nationality, who were registered in the health system, and their parents signed informed consent were included in this study. If the child's anthropometric information was incomplete or it was not possible to communicate with the family to complete the information, they were excluded from the study.

Classification of weight disorders

We used the standardized classification of the National Center for Health Statistics (NCHS)/Centers for Disease Control (CDC) for determining the weight disorders in children. Severe underweight was defined as lower than -3 Z-scores, equal to -3 Z-scores to -2 Z-scores was defined as underweight, equal to -2 Z-scores to equal to $+1$ Z-scores the growth trend is parallel or the growth trend is normal to the middle. And equal to $+1$ Z-scores to $+3$ Z-score is

defined as overweight and above $+3$ Z-score is obesity. The obesity epidemic is probably the result of evolutionary legacy interacting with our technologically advanced and consumerist society.^[10]

A total number of 2300 children were included based on the inclusion criteria. Demographic data such as gender, weight at the time of birth, educational levels and occupation of mothers, duration of breastfeeding and age of beginning complementary food were documented. The self-reported socio-economic status of the family was obtained.

Statistical analysis

The collected data were assessed by SPSS software version 25 (SW Statistics for Windows, IBM). Quantitative variables are presented as means \pm standard deviation (SD) and qualitative variables as frequency (%). The Chi-square test and independent samples *t*-test were used to compare the frequency distribution of qualitative data and the mean of quantitative data among weight disorders, respectively. Logistic regression analysis was used to examine the association between weight disorders (underweight and severe underweight versus overweight and obesity) and demographic parameters. The odds ratio (OR) is reported with a 95% confidence interval. The significance level of less than 0.05 was considered in all analyses.

RESULTS

In the present study, out of 2300 children, 750 cases (32.6%) had weight disorders. Of them, 53.6% were underweight, 26.3% overweight, 12.9% obese and 7.2% were severely underweight. Among them, 41.6% were girls and 58.4% were boys (*P* value <0.001). In addition, there was a significant difference in the frequency distribution of mothers' education levels and occupation and family income levels among different weight disorders of children (*P* value < 0.001). However, the number of family members was not significantly different among different types of weight disorders (*P* value = 0.450) [Table 1].

On the other hand, the chance of being overweight compared to underweight was significantly higher in girls than the boys (OR: 14.79; *P* value < 0.001). Also, the university education level of mothers increases the chance of being overweight in children (OR: 22.28; *P* value < 0.001). Children of homemaker mothers also had a higher chance of being overweight than occupied mothers (OR: 27.33; *P* value < 0.001). In addition, at higher levels of socio-economic status, the chance of being overweight was higher (*P* value < 0.001). On the other hand, with increasing the age of complementary food onset the chance of being overweight increased slightly and insignificantly (*P* value = 0.315). Although with longer duration of breastfeeding and more family members, the chance of being overweight has decreased by 0.86 and 0.93 fold, respectively; but this relationship was not statistically significant (*P* value > 0.05) [Table 2].

Table 1: Comparison the basic characteristics of the child, mother and the family on children's weight disorders

Variables	Total (n=750)	Underweight (n=402)	Overweight (n=197)	Obesity (n=97)	Severe underweight (n=54)	P
Sex						
Boy	438 (58.4%)	345 (85.8%)	40 (20.3%)	27 (27.8%)	26 (48.1%)	<0.001
Girl	312 (41.6%)	57 (14.2%)	157 (79.7%)	70 (72.2%)	28 (51.9%)	
Mother's educational level						
Illiterate and undergraduate	174 (23.2%)	149 (37.1%)	12 (6.1%)	10 (10.3%)	3 (5.6%)	<0.001
Diploma	276 (36.8%)	226 (56.2%)	23 (11.7%)	20 (20.6%)	7 (13.0%)	
College education	300 (40.0%)	27 (6.7%)	162 (82.2%)	67 (69.1%)	44 (81.5%)	
Mother's occupation						
Employed	457 (60.9%)	398 (99.0%)	59 (29.9%)	0 (0%)	0 (0%)	<0.001
Housewife	293 (39.1%)	4 (1.0%)	138 (70.1%)	97 (100%)	54 (100.0%)	
Socio-economic status						
Low	278 (37.1%)	235 (58.5%)	13 (6.6%)	12 (12.4%)	18 (33.3%)	<0.001
Medium	366 (48.8%)	163 (40.5%)	176 (89.3%)	18 (18.6%)	9 (16.7%)	
High	106 (14.1%)	4 (1.0%)	8 (4.1%)	67 (69.1%)	27 (50.0%)	
Number of family members						
1	159 (21.2%)	83 (20.6%)	40 (20.3%)	24 (24.7%)	12 (22.2%)	0.450
2	297 (39.6%)	153 (38.1%)	89 (45.2%)	35 (36.1%)	20 (37.0%)	
3	137 (18.3%)	83 (20.6%)	33 (16.8%)	14 (14.4%)	7 (13.0%)	
4	157 (20.9%)	83 (20.6%)	35 (17.8%)	24 (24.7%)	15 (27.8%)	

Table 2: Factors related to weight disorders (overweight vs. underweight)

Variables	OR	95% CI	P
Sex			
Boy	Reference		
Girl	14.79	10.31-21.20	<0.001
Mother's educational level			
Illiterate and undergraduate	Reference		
Diploma	1.27	0.73-2.22	0.389
College education	22.28	13.24-37.49	<0.001
Mother's occupation			
Employed	Reference		
Housewife	27.33	18.38-40.34	<0.001
Socio-economic status			
Low	Reference		
Medium	11.41	7.21-18.07	<0.001
High	24.48	13.62-44.01	<0.001
Number of family members	0.93	0.81-1.07	0.333
Duration of breastfeeding	0.86	0.76-1.23	0.386
Age of onset of complementary food	1.04	0.96-1.12	0.315

DISCUSSION

According to the results of the present study, about one third of 2-year-old children of Isfahan had kind of weight disorders with higher frequency of underweight than excess weight.

Underweight as a significant indicator of nutritional and health status is manifested whenever the children are either short or thin for their age.^[12] Although the prevalence of underweight in children has globally declined from 25% in 1990 to 15% in 2015, a uniform decline was not reported across the world. For instance, the United Nation.^[13] and Sub-Saharan Africa and

Southeast Asia.^[14] had around 90% of underweight children. The association of underweight with numerous factors including sex, age of children, occupation and education level of caregivers, birth order, decision making, and low birth weight has been indicated.^[15] Some other studies have reported the significant association of underweight with late initiation of breastfeeding, frequency of feeding, inadequate food intake, consanguinity, poor complimentary food and dietary diversity.^[16,17]

In addition, the present findings are in line with the study of Aslani *et al.*^[18] in showing that weight disorders were significantly more common in girls. We also showed that the differences in gender distribution of children with weight disorders could be because of variations in age and living area of the studied children.

In examining other factors related to children's weight disorders, they were categorized into two groups of overweight and obesity and underweight and severe underweight. In this study, the risk of overweight in children was significantly higher in higher educational levels of mothers, homemaker mothers and those with higher socio-economic family. In contrast, the number of family members and the age of starting complementary food did not have significant relationship with the prevalence of weight disorders.

Some previous studies have evaluated the possible factors influencing weight disorders in children. Some studies showed that underweight and overweight are the two most prevalent childhood weight disorders. It was stated that overweight is the most important problem in developed countries due to cultural and socio-economic conditions while on the other hand, underweight could be observed more often in developing

nations. They also explained that increasing the duration of breastfeeding and also parent educational levels could prevent weight disorders.^[18-20]

Other studies in developing countries also emphasized on the importance of underweight as the most common weight disorder during childhood.^[21,22] They also mentioned that increased parental educational level and increased duration of breastfeeding in children could prevent weight disorders in children.^[9,23] Our findings were in line with these data. An important point of the current study was that we figured the possible correlations between different influencing factors and weight disorders of children.

In addition, it should be noted that although the risk of being overweight was lower with longer duration of breastfeeding, but this relationship was not statistically significant.

In this regard; Bracale *et al.*^[24] evaluated different childhood weight disorders in 2013 in Milan. They showed that both overweight and underweight disorders were common in children of primary schools and children with higher duration of breastfeeding had mostly normal weight distribution. Dereñ *et al.*^[25] also showed that both underweight and overweight disorders in late childhood have significant correlations with weight disorders and breastfeeding duration in the first 3 years of life. They also showed that significantly more girls were underweight than boys. We also believe that duration of breastfeeding could be an important factor in decreasing the prevalence of weight disorders among children. Based on our results, there was also an inverse relationship between age of onset of complimentary food and prevalence of weight disorders among 2-year-old children. This issue was mentioned in previous studies in 2017 and in India.^[26,27] These studies also reported that weight disorders especially overweight and obesity could be resulted from early beginning of complementary food.

A review on childhood obesity was conducted in the United States in 2017. It reported that the positive energy balance caused by excess caloric intake rather than the caloric expenditure combined with a genetic predisposition as the most common cause of obesity and weight gain. In addition, no underlying endocrine or single genetic cause was observed in most obese children. Specification of the underlying reason for weight gain as well as the evaluation of the comorbidities caused by excess weight are addressed in studies examining children with obesity. Furthermore, it is also shown that the prevalence of overweight and obesity has significant inverse relationship with the duration of breastfeeding.^[28]

Study strengths and limitations are important to mention that this study was conducted in one of the big cities of Iran, sampling several centers from several different cities can increase the study external validity. On the other hand, only children with periodic information in the health system were used due to the incompleteness of the files and the lack of regular visits to all children admitted to health centers. This

protocol can lead to bias selection, that a more comprehensive study in this field will reduce possible biases.

The possibility of unknown confounders, the intentional collection of data for the purpose of this study, lack of inclusive information in this regard, and the cross-sectional nature of the study can be regarded as the limitations of this study. Considering the small sample size of this study, conducting further studies with larger sample sizes can be illuminative in this respect. Parents of children should be made aware that weight loss and weight gain disorders in the child at each stage of development have medium-term effects and interfere with the child's growth for a period of time. Parents should pay more attention to the factors and diseases that cause this disorder. Control of modifiable risk factors for weight disorders in early life should be underscored in the primary health care system

CONCLUSION

Based on the results of our study, underweight and overweight were two most common weight disorders among 2-years children, respectively. Significant relationships were observed between weight disorders and factors including duration of breastfeeding, age of onset of auxiliary food and birth weight. We believe that preventive strategies such as encouraging mothers for breastfeeding should be made especially in developing countries.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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