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Comparison of Growth Indices After Food Intervention Program for Children Aged 2-5 Years in Day Care Centers in Northern (Rasht) and Southern (Bushehr) of Iran

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ABSTRACT

Background: The adequate growth of children is an important phenomenon, having a great impact on the growth and psychological health of children in the future. Nutritional intervention to have a better dietary intake could be affected by geographical and cultural issues. This study aimed to compare the impact of food intervention between the children of two different provinces of Northern and southern area of Iran. **Methods:** In an interventional study, anthropometric indices of 520 children (205 Bushehr, 315 Rasht) were measured using World Health Organization (WHO) Anthro and Anthro plus software, based on the WHO standards. **Results:** In Bushehr, a total of 205 children under the age of 5 years were assessed. Before the intervention, about 11% of them were moderately to severely malnourished, based on weight for height, which decreased to about 6% after the intervention. In Rasht, a total of 315 children under the age of 5 were assessed before the intervention; nearly 6% of them were moderately to severely underweight, based on weight for height, which decreased to about 4% after the intervention. Also, there was no significant difference between boys and girls in this index. **Conclusion:** Due to the relative achievement of the present intervention plan, nutritional education along with these kinds of projects might be useful for Iranian health policy-makers to promote children's growth.

Keywords: *Anthropometry; Child malnutrition; Obesity; Underweight; Preschool children*

Introduction

Proper health and growth are important from the birth of a child and have an important impact on the growth and mental health of the body in future. For this reason, standard growth

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curves have been defined around the world. These growth curves indicate a child's height and weight, and their proportions for the child's age, in comparison with global standards (Rysha *et al.*, 2017, Uauy *et al.*, 2008).

Annually, 3 million children worldwide die from hunger, equaling to half the deaths of children under the age of five. In 2013, it was found that 3.6 million children under the age of 5 died from malnutrition, which was equivalent to the deaths of 17,000 children per day. The highest child mortality rate, in Africa, was found to be seven times the death rate in Europe. Children with poor nutrition spend 160 days a year suffering from disease. The risk of infectious diseases, including malaria, is also higher in malnourished children (Kiserud *et al.*, 2017, Neumann *et al.*, 2004, UNICEF., 2005).

Malnutrition is a major problem for general childhood health in developing societies. This issue has two aspects, including health and nursing, each of which has several health consequences. Malnutrition affects all aspects of health, growth, cognition, and neuropsychiatric development. At school age, it leads to weight problems, psychological, cognitive, educational, and self-confidence problems in children, and increases the risk of developing a variety of diseases, such as cardiovascular disease, in adulthood. Underfeeding leads to an increased risk of death from infections, an increase in the number and severity of infections, and a delay in the recovery of children. In addition, the relationship between malnutrition and infection is a vicious cycle that can make both cases worse over time, and ultimately leads to death (Leung *et al.*, 2012, Martins *et al.*, 2011, Shields *et al.*, 2012).

Due to the huge importance of childhood nutrition status, various interventions have been launched around the world to prevent the consequences of malnutrition and the imposition of health and economic burdens on communities. Improving the outcome of interventions requires improved quality of service provision, as well as monitoring and improving service quality. Improving the quality of services should be one of the main components of health care, and special attention should be paid to high-risk groups globally, including infants, pre-school children, school-aged children, and mothers (Bredekamp, 1997, World Health Organization, 2000, Young *et al.*, 2012).

Malnourished children have a variety of nutritional deficiencies, including protein deficiency, energy shortages and micronutrients, frequent infections, feeding problems, and many other nutritional and health problems (Kirby and Danner, 2009).

Protein energy malnutrition (PEM) leads to underweight, stunting, and wasting of children. It also increases the risk of infection and delayed recovery (De Onis *et al.*, 1993, Kirby and Danner, 2009).

Malnutrition, counterintuitively, may lead to obesity and overweight in babies, and today it is one of the major global health problems; obesity is the most commonly reported childhood disorder worldwide. There are about 43 million obese children, and 21% to 24% of children and adolescents are overweight. A study in 2016, reported that there were 41 million obese children under the age of 5 years. Given the importance of this issue, the Ministry of Health has developed programs to prevent malnutrition in children in different regions of Iran (Kelishadi *et al.*, 2008, Ng *et al.*, 2014).

Bushehr is among the Bushehr provinces of Iran and the Persian Gulf. It is part of the strategic coast of the Persian Gulf, with export, maritime import, and fishing industries. The oil and gas reserves (Bushehr and North Pars), agriculture, date-palm trees, as well as nuclear power plants have lent it strategic and economic significance and have been dubbed as Iran's energy capital.

Bushehr Province is among the top provinces in terms of population growth rates (3.11), and is also among the youngest provinces in Iran (with a 5% elderly population). Bushehr is ranked seventh in the country for literacy, at a rate of 89.2% and has the third highest household size in the country (Sadeghifar *et al.*, 2014).

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Gilan is the 10th most populated province of the country, and is one of the Northern provinces along the Caspian Sea. The urban population of the province is only 37.7% due to the high population density in rural zones and its relatively low industrialization level. Major industries include processing agricultural products, rice cookers, tea, fish and caviar processing, dairy, and oil.

The average household size in Gilan is the lowest nationwide. Gilan province has 11.5% of the elderly population, thus it is the oldest province in Iran (Rokni *et al.*, 2002).

In this study, the effects of nutritional interventions in two cities of Rasht and Bushehr were compared. For reference, "south" refers to Bushehr province, while "north" refers to Gilan province.

Materials and Method

Study design and participants: In this cross-sectional study, the Ministry of Health and Medical Education of Iran carried out an intervention with financial support of Welfare Organization of Iran (WOI) over a period of 6 months. All the rural day care centers of both Rasht in the Rasht and Bushehr in the south of Iran were asked to serve a warm food dish to their children at the centers, which was funded by WOI and planned by a nutritionist in each center. Children who left their area or their parents did not fill the requested information were excluded.

Overall, 315 children from Rasht (161 boys, 154 girls) and 205 children from Bushehr (97 boys, 108 girls) were included in this study.

Measurements: The weight and height of all registered children were measured before and after the intervention. Weight was measured using a Seca weighing scale to the nearest 0.1 kg. Height was measured using a Seca Bodymeter to the nearest 0.1 cm.

For children under the age of 5, anthropometric z-scores, including the weight for age (WAZ), height for age (HAZ), and body mass index (BMI) for age (BAZ) were added using Anthro V.3.2.4, and for those over the age of 5, AnthroPlus V.1.04 software from the World Health Organization (WHO) was used. All of the data were categorized based on the WHO child growth standards guideline.

Ethical consideration: According to ethical issues that have a bearing on human rights in this study, informed consent forms were considered for the parents of all children who participated in the study and several meetings were held to inform them about the processes of the project.

Data analysis: In order to test normality of the data, Kolmogorov Smirnov test was used. The data were expressed as Means ± SEM and frequencies, using IBM SPSS statistics software (V.24, Chicago, IL). Statistical differences between "Before" and "After" interventions were determined using Paired t-test and independent sample t-test was used to find differences between groups. A P-value less than 0.05 was considered significant.

Results

Based on **Table 1**, the WHZ score shows that almost 9% of children in the whole samples in both provinces had moderate to severe underweight before the intervention, which decreased in both genders to 7% after the intervention. Obesity prevalence slightly increased in the Rasht from 2% to 3% and in the Bushehr from 2% to 2.2%. **Table 1** illustrates that about 6% of children from the Rasht and 13% from the Bushehr showed moderate to severe underweight based on the WHZ score. After the intervention, they became 10% in the Bushehr and 4% in the Rasht. Moderate underweight in Rasht boys decreased from 6% to 3%. In the Bushehr, moderate underweight changed for girls from 8% to 5% and boys from 9% to 6% after the intervention. The prevalence of overweight and obesity in the Rasht changed from 10% to 12.5%, and in the Bushehr from 8% to 6%. The prevalence of overweight and obesity in boys in both provinces (Rasht and Bushehr) was higher than girls. In the Bushehr, these rates were 10.3% in boys in comparison with 5.5% in girls; while in the Rasht 10.5% of boys in comparison with 9.7% in girls before the intervention. The percentage of overweight children in this study slightly changed towards obesity, notably in Rasht girls (from 9.7%

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to 15.3%) and Bushehr girls (from 5.6% to 7.4%). Between the two genders, obesity in Rasht girls and Bushehr boys was found to be higher than the opposite gender, and similar trends continued.

Based on **Table 2**, the WAZ score shows that 3% of children had moderate to severe underweight in both provinces. The effectiveness of the intervention was observed in how the rate of moderate underweight Rasht boys declined (3.7% to 2.1%). According to the WAZ score, the percentage of normal-weight children in the Bushehr increased from 70% to about 73%, but in the Rasht it decreased from 76% to 72%. The WAZ score showed that up to 3% of children of both provinces had moderate to severe underweight before the intervention. This rate remained stable in the Bushehr and decreased to 2% in the Rasht after the intervention. Based on this indicator, the prevalence of obese and overweight children before and after the intervention did not change much. No significant changes were observed between boys and girls in terms of the number of normal children in the WAZ category in the Bushehr and the Rasht, before and after the intervention. Bushehr boys had both obesity and overweight at a higher rate than girls, and boys also showed underweight more than girls.

According to **Table 3**, the HAZ score shows the prevalence of moderate to severe stunting in the Rasht which was higher than in the Bushehr. After the intervention, HAZ in Rasht children changed from 4.2% to 4.5%, and in the Bushehr increased from 3.5% to 2.7%. In general, moderate to severe stunting is more common in boys than girls. The prevalence of severe stunting in Rasht boys increased from 1.5% to 2.10% and moderate stunting in Rasht girls increased from 1.7% to 2.6%. Normal height in Bushehr children slightly increased after the intervention from 96.6% to 97.1%.

According to the BAZ score and **Table 4**, up to 6% of children were moderately to severely underweight before the intervention, which decreased to 5% after the intervention. No significant change was found in either overweight or obese children. BAZ score decreased from approximately 5% in the Rasht and 9% in the Bushehr before the intervention to about 4% in the Rasht and 7% in the Bushehr. The most reduction occurred in Bushehr boys from 10.4% to 8%. After the intervention, the prevalence of both severe/moderate underweight changed positively; however, overweight/obese children increased, especially in Bushehr girls. Moderate to severe underweight was more common in the Bushehr (9% vs 5%), while overweight and obesity was more common in the Rasht (9% vs. 5%). This project was successful in decreasing moderate to severe underweight in children based on BAZ score in both provinces (in the Bushehr from 9% to 7% and in the Rasht from 5% to 4%). After the intervention, the prevalence of overweight and obesity in the Bushehr was higher than in the Rasht (0.1% vs. 0.5%).

As **Table 4** shows, like the other scores, BAZ results revealed that boys were more severely underweight than girls, and overweight and obesity also were higher among boys than girls. In the Bushehr, boys showed more severe underweight than girls (10.4% vs 7.6%), and in the Rasht, boys were also worse than girls (5.6% vs 4%). The intervention on boys was more effective than girls in both provinces. Overweight/obesity was higher in boys than girls in the Bushehr (7.5% vs. 3%) and in the Rasht (10.6% vs. 7.3%) and relatively similar trends continued after the intervention. Even though boys showed a higher increase of obesity, the trends of obesity in girls were similar in both provinces. A slight increase in the rates of overweight and obesity after the intervention was shown: in the Bushehr overweight of girls increased from 2% to 4% and in the Rasht obesity of boys increased from 2.9% to 3.2%. After the intervention, weight and height in both genders in both provinces improved significantly (P = 0.0001), while WAZ, BAZ, and HAZ did not change significantly.

As **Table 5** shows, despite significant differences was observed among both genders before and after intervention in both cities, no significant differences were found for WAZ, HAZ, WHZ and BAZ.

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Table 1. Comparison of weight status (according to weight for height) in children based on gender in Bushehr and Rasht cities before and after the intervention

Weight status	Rasht (n = 315)				Bushehr (n = 205)			
	Before		After		Before		After	
	Boys	Girls N)	Boys	Girls N	Boys	Girls N	Boys	Girls
Severe underweight	1 (0.62)[a]	1 (0.65)	-	1 (1.02)	4 (4.12)	4 (3.7)	2 (3.23)	4 (4.94)
Moderate underweight	9 (5.59)	8 (5.19)	3 (2.73)	5 (5.1)	9 (9.28)	9 (8.33)	4 (6.45)	4 (4.94)
Normal	121 (75.16)	119 (77.27)	82 (74.55)	67 (68.37)	64 (65.98)	80 (74.07)	44 (70.97)	60 (74.07)
At risk of overweight	13 (8.07)	11 (7.14)	14 (12.73)	10 (10.2)	10 (10.31)	9 (8.33)	10 (16.13)	7 (8.64)
Overweight	14 (8.7)	10 (6.49)	9 (8.18)	10 (10.2)	7 (7.22)	5 (4.63)	-	5 (6.17)
Obese	3 (1.86)	5 (3.25)	2 (1.82)	5 (5.1)	3 (3.09)	1 (0.93)	2 (3.23)	1 (1.23)
Total	*161 (100)*	*154 (100)*	*110 (100)*	*98 (100)*	*97 (100)*	*108 (100)*	*62 (100)*	*81 (100)*

[a]: N (%)

Table 2. Comparison of weight status (according to weight for age z-score) in children based on gender in Bushehr and Rasht cities before and after the intervention

Weight status	Rasht (n = 315)				Bushehr (n = 205)			
	Before		After		Before		After	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Severe underweight	-	-	-	-	-	-	-	-
Moderate underweight	6 (3.7)[a]	3 (2.15)	2 (2.1)	2 (2.35)	3 (3.2)	3 (2.7)	2 (2.6)	2 (2.7)
Normal	124 (76.8)	123 (79.6)	86 (78.25)	77 (79)	78 (80.2)	95 (88.1)	50 (80)	69 (85)
At risk of overweight	20(12.6)	19 (12.23)	15 (13.25)	12 (11.8)	11 (11.7)	9 (7.3)	7 (11.7)	8 (10)
Overweight	7 (4.4)	7 (4.3)	4 (3.5)	5 (5.35)	2 (2.6)	1 (1.3)	2 (2.7)	2 (2)
Obese	4 (2.5)	3 (1.72)	3 (2.7)	1 (1.5)	3 (3)	-	2 (2.7)	-
Total	161 (100)	154 (100)	110 (100)	98 (100)	97 (100)	108 (100)	62 (100)	81 (100)

[a]: N (%)

Table 3. Comparison of height status (according to height for age z-score) in children based on gender in Bushehr and Rasht cities before and after the intervention

Height status	Rasht (n = 315)				Bushehr (n = 205)			
	Before		After		Before		After	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Severe stunting	2 (1.5) [a]	2 (1.5)	2 (2.1)	1 (1.02)	-	1 (0.8)	-	-
Moderate stunting	6 (3.7)	3 (1.7)	4 (3.3)	2 (2.04)	2 (2.4)	2 (1.9)	1 (3.2)	2 (2.5)
Normal	152 (94.2)	147 (95.3)	104 (94.6)	94 (95.92)	94 (96.8)	105 (97.3)	60 (96.8)	79 (97.5)
Tall	1 (0.6)	2 (1.5)	-	1 (1.02)	1 (0.8)	-	-	-
Total	161 (100)	154 (100)	110 (100)	98 (100)	97 (100)	108 (100)	62 (100)	81 (100)

[a]: N (%)

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Table 4. Comparison of weight status (according to body mass index for age z-score) in children based on gender in Bushehr and Rasht cities before and after the intervention

Weight status	*Rasht (n = 315)*				Bushehr (n = 205)			
	Before		After		Before		After	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Severe underweight	2 (1.45) [a]	1 (0.4)	-	-	3 (2.9)	2 (2.2)	1 (2.4)	2 (2.2)
Moderate underweight	7 (4.15)	6 (3.9)	4 (3.3)	4 (4.1)	7 (7.5)	6 (5.4)	3 (5.6)	3 (4.3)
Normal	115 (71.4)	116 (75.1)	81 (73.7)	73 (74.7)	70 (71.9)	88 (81.8)	46 (74.9)	66 (81.6)
At risk of overweight	20 (12.4)	20 (13.3)	15 (13.3)	12 (12.6)	10 (10.2)	8 (7.6)	6 (10.2)	6 (7.3)
Overweight	14 (8.7)	7 (4.7)	7 (6.2)	6 (5.8)	4 (4.6)	3 (2.4)	2 (3.7)	3 (4.1)
Obese	3 (1.9)	4 (2.6)	3 (3.1)	3 (2.6)	3 (2.9)	1 (0.6)	2 (3.2)	-
Total	*161 (100)*	*154 (100)*	*110 (100)*	*98 (100)*	*97 (100)*	*108 (100)*	*62 (100)*	*81 (100)*

[a]: N (%)

Table 5. Gender-based comparison of mean z-score of children aged 2-5 years based on the WHO criteria, in Rasht and Bushehr cities before and after the intervention

Variables	Boys			Girls		
	Before	After	P-value[a]	Before	After	P-value
Rasht (n = 315)						
Age (y)	62.14 ± 10.08	67.76 ± 1.20	0.0001	62.05 ± 9.86	67.68 ± 10.00	0.0001
Weight	19.30 ± 3.70	20.29 ± 3.88	0.0001	18.99 ± 3.91	19.91 ± 4.17	0.0001
Height	110.90 ± 7.25	113.4 1 ± 7.35	0.0001	110.10 ± 7.39	112.58 ± 2.24	0.0001
Body mass index	15.63 ± 2.08	15.71 ± 2.11	0.540	15.58 ± 2.24	15.63 ± 2.37	0.745
Weight for height z-score	0.06 ± 1.41	0.17 ± 1.25	0.509	0.07 ± 1.44	0.31 ± 1.56	0.206
Weight for age z-score	0.12 ± 1.21	0.07 ± 1.18	0.529	0.08 ± 1.17	0.01 ± 1.18	0.413
Height for age z-score	0.04 ± 1.20	-0.05 ± 1.19	0.244	0.02 ± 1.21	-0.0 6± 1.17	0.299
Body mass for age z-score	0.12 ± 1.46	0.13 ± 1.39	0.888	0.08 ± 1.34	0.04 ± 1.36	0.702
Bushehr (n = 205)						
Age (y)	63.91 ± 9.25	67.90 ± 9.24	0.0001	62.45 ± 10.28	66.51 ± 10.21	0.0001
Weight (kg)	19.07 ± 3.69	19.96 ± 3.78	0.001	17.89 ± 3.11	18.15 ± 3.26	0.0001
Height (cm)	111.70 ± 6.80	113.71 ± 6.70	0.0001	109.72 ± 7.51	111.93 ± 7.28	0.0001
Body mass index	15.22 ± 2.08	15.37 ± 2.04	0.327	14.81 ± 1.73	15.00 ± 1.84	0.149
Weight for height z-score	-0.21 ± 1.70	-0.18 ± 1.49	0.904	-0.52 ± 1.43	-0.35 ± 1.51	0.417
Weight for age z-score	-0.12 ± 1.21	-0.06 ± 1.19	0.483	-0.33 ± 0.99	-0.24 ± 0.99	0.170
Height for age z-score	0.001 ± 1.11	-0.01 ± 1.08	0.942	-0.10 ± 1.06	-0.07 ± 1.01	0.718
Body mass for age z-score	-0.23 ± 1.51	-0.12 ± 1.45	0.340	-0.43 ± 1.19	-0.31 ± 1.22	0.193

[a]: *Paired t-test*

Discussion

The data analysis indicated that males suffered more from nutritional disorders than females. However, this difference was not statistically significant based on WAZ or HAZ. A crucial indicator of chronic malnutrition is stunting, based on the WHO child growth standards. Moreover, despite the benefits of BMI in this issue, due to the effect of height on BAZ, reports about obesity and overweight could be a false alarm in some studies due to low HAZ. It has been indicated that even after food support, stunting is still a large problem, and affects all other outcomes. Even though significant positive results were observed in WAZ and BAZ in the present study, the decrease in HAZ scores remains an alarming issue.

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In this study, the effects of nutritional interventions in two cities of Rasht and Bushehr were compared, and the results were reported based on BAZ and WAZ scores.

Underweight from light to severe (based on WAZ score) in the rural zone of the Rasht was less than half of the same rate in the Bushehr. Underweight from light to severe (based on BAZ score) in the rural zone of Rasht was also less than half of the rate in the Bushehr. Wasting from light to severe (based on BAZ score) in the rural zone of Rasht was 17.8% vs. 37.7% in the Bushehr, and light wasting in the Rasht was about half of the rate of in the Bushehr. Stunting from light to severe (based on HAZ) score in the rural zone of the Rasht was 18.3% and in the Bushehr was 24.6%. Overweight from light to severe based on the BAZ score in the rural zone in the Rasht was more than triple of the rate in the Bushehr (17.8% vs. 5%). The Rasht zone of Iran had the greatest prevalence of overweight from light to severe all around the country. The prevalence of anemia in the rural zone of the Rasht was lower than the Bushehr. The prevalence of zinc deficiencies in the Rasht was lower than half of the rate in the Bushehr.

In Bushehr, a total of 205 children under the age of 5 years were assessed. Before the intervention, about 11% of them were moderately to severely malnourished, based on weight for height, decreased to about 6% after the intervention. In Rasht, a total of 315 children under the age of 5 were assessed before the intervention; nearly 6% of them were moderately to severely underweight, based on weight for height, which decreased to about 4% after the intervention. Also, there was no significant difference between boys and girls in this index.

In a study from Azerbaijan (Madani *et al.*, 2018), the incidence of underweight among children was estimated at 3%. Lower levels in girls were more common than in boys. After the intervention, there was a significant change in underweight children. At the same time, the number of overweight children also increased, but did not change the number of normal children. A study from Madani *et al*. also showed that the prevalence of underweight children was 7%, while after nutritional interventions, it was 4% (Madani *et al.*, 2017) .

According to National Integrated Micronutrient Survey 2012 (NIMS-2), 11.9% of boys and 9.7% of girls suffered from moderate and severe underweight based on WAZ, and the prevalence of stunting was 16.8% in boys and 13.9% in girls (Siassi *et al.*, 2015). A study that analyzed the data from 102 countries showed that the overall prevalence of underweight was higher than overweight, but statistics from Asia and Africa showed 2.5 to 3.5 times higher than overweight (De Onis *et al.*, 1993). According to the Hoshyar's study, overweight was more prevalent (Houshiar Rad *et al.*, 2009). However, in the Hoshyar's study, the prevalence of underweight was 4.5%. The prevalence of underweight in rural zones was 2.9%, which was lower than in urban zones, while the national prevalence was 3.9%. In a cross-sectional study on 500 children in Birjand, it was shown that the prevalence of overweight was 10.6% and girls had more overweight than boys (Houshiar Rad *et al.*, 2009). In a recent study in Bandar Turkmen district, the prevalence of wasting, stunting, underweight, and obesity was found to be 3.9%, 7%, 3.7%, and 6%, respectively (Ebrahimzadehkor *et al.*, 2014).According to a report from the Ministry of Health and Medical Education, the prevalence of wasting, stunting, and underweight in children under the age of 5 years in Golestan province were 0.4%, 11.1%, and 2.4%, respectively (Chaman *et al.*, 2009). Sadat *et al*., in Kashan, reported that the prevalence of wasting, stunting, and underweight were 1%, 5.3%, and 1.46%. Better nutritional status in this study compared to the present study might be due to the better economic status in Kashan compared to Bandar Turkmen, Rasht or Bushehr (Sadat *et al.*, 2005).

In a study performed in Nahavand, researchers reported that the prevalence of wasting, stunting, and underweight were 2.7%, 12.3%, and 3%, respectively. The higher stunting rate in this study in comparison to the present study could be due to the poor agricultural and economic status of this zone. The difference between the studied age

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groups may also have been effective in the differences in the incidence of malnutrition (Mohseni *et al.*, 2017). Wasting is a key index of evaluation movement of countries towards Millennium Development Goals, which showed that more than a quarter of children under the age of 5 globally were wasting. The prevalence of wasting in developing countries was 10.26% (Houshiar Rad *et al.*, 2009).

The prevalence of wasting in children under the age of 5 in Iran was 7.6% and, amongst its neighbors Turkey (3.1%) and Azerbaijan (6.8%) was in the third place. According to the WHO global reports, wasting prevalence in the regions including Iran was 17% (Nikooyeh *et al.*, 2016). The prevalence of wasting in the rural zones was 1.6 times more than in urban zones. In girls, it was higher than boys.

Weight for height – especially for stunted children – is an important measurement. According to Hoshyar, while 13.1% of children under the age of 5 were suffering from stunting and 7.6% suffering from wasting based on WAZ, only a third of these children were considered underweight based on weight for height (Houshiar Rad *et al.*, 2009).

In the present study, the fact that no significant difference was observed in the prevalence of underweight, stunting, and wasting among both boys and girls, could indicate a change in family attitudes towards gender, and non-discrimination between boys and girls in terms of food intake.

It should be noted that chronic malnutrition is the main problem of stunting, as shown by several studies, indicating the prevalence of global malnutrition. The prevalence of stunting in the world was 31%, and among developing countries was 32% (Mohammadinia *et al.*, 2012).

The malnutrition statistics in some countries were also examined. In a school in Kuala Lumpur, Malaysia, 6.7%, and 7.1% of children were suffering from stunting and underweight, respectively (Khambalia *et al.*, 2012). According to the Waterloo classification, 28.8% and 9% of children aged 4-6 years in Mexico were suffering from stunting and underweight (Mohammadinia *et al.*, 2012).

The malnutrition trend in Iran was examined with a sample size of 34,200 children in 2004 (Mohammadinia *et al.*, 2012). The results showed that 4.7% of children aged 0 to 60 months were suffering from nutritional stunting, based on the HAZ index. The prevalence of nutritional stunting in girls and boys was 4.4% and 5%, respectively. A total of 5.2% of children under the age of 5 were suffering from moderate and severe underweight throughout the country.

A comparison of short-term outbreaks in Iran (13.1%) shows that the situation in Iran currently lies between Azerbaijan (13.3%) and Turkey (12.2%) (Mohseni *et al.*, 2017, Nouri Saeidlou *et al.*, 2014). Global statistics show the rate at 31%, and developing countries at 32% (UNICEF., 2005).

Conclusion

The prevalence of underweight in the studied populations was much lower than in the whole country, which might be due to the better economic situation of these provinces. Due to the relative achievement of the present intervention plan, nutritional education along with these kinds of projects might be useful for Iranian health policy-makers and planners to plan for the proper growth of this age group children to improve the pediatric nutritional status and prevent their malnutrition.

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Authors' contributions

Naderi M wrote the 1st draft, Dorosty-Motlagh A and Abdollahi Z were the supervisor of the project, Minaei M helped in analyzing, Aminian M was the coordinator of the project from Gilan university, Nazari F was the coordinator of the project from Bushehr university & Movahedi A was the main analyzer, editor and correspondent of the written article.

Conflict of interest

The authors declare that there is no conflict of interest

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