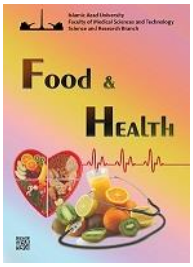

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Comparison of the effectiveness of an intervention program to improve the nutritional status of children aged 2-6 years in Day Care Centers of East and West of Iran

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ABSTRACT

Child health is very vital in all societies, which is prejudiced by the interaction of numerous factors. Pediatric healthy nutrition is one of the most imperative and influential elements in the health of children which affects anthropometric indices. In this study, the effectiveness of one meal warm food for the rural kindergarten of two main cities in the East and West of I.R. Iran Urmia and Mashhad have been carried out. In this cross-sectional study, anthropometric z scores of 5508 children (2750, Urmia vs 2758, Mashhad) were measured by using WHO Anthro and Anthro plus software based on WHO 2007 standards and analyzed using SPSS. Based on the present findings, 16% of children from West and 15% of children from the East showed moderate to severe lower weight for height. In addition, girls showed more severe underweight than boys did. BMI-for-age children from the West and the East approximately showed 14% and 15% of moderate to severe underweight and dropped to about 9% and 12% respectively. Moreover, the percentage of overweight of children in the study was lightly changed to obese especially in boys from the West. Between the two genders, male and female, overweight in girls and obesity in boys found higher than the opposite sex, and relatively similar trends have continued after the intervention in the west. This project was successful to lower moderately severe wasting in children based on body mass index from 7% to about 5% in the west and from 6% to about 5% in the east too. The slight increase in the scale of overweight and obesity and a half percent of overweight children from the west after the program was shown. Even though boys from the West showed a higher increase of obesity than girls had more overweight than boys did, but there was no change before and after intervention in the east, reduction of moderate and severe underweight found similarly in both genders. Due to the relative success of the present intervention plan, nutritional education along these kinds of projects may improve the nutritional status of children in society and prevent pediatric malnutrition.

1. Introduction

Malnutrition in late infancy and childhood remains a significant public health issue in developing nations as well as for those in the transition to an industrialized economy. In addition, in these settings and particularly in developed nations, overweight is becoming a very serious threat to both the immediate and the long-term health of children (1). Malnutrition permeates all aspects of health, growth, cognition, motor and social development of young children in developing countries. More than 50% of deaths in these children can be attributed to malnutrition, most often in conjunction with a serious infection. Irreversible and lifelong sequelae prevent children from reaching their full potential. Child survival initiatives and programs have accomplished much to save the lives of children from common and preventable illnesses, but the quality of the survivors' health needs to be improved, with much more attention paid to the

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nutrition of the preschool and school child. Promotion of nutritional health must become an integral part of primary health services, especially for infants, preschoolers, schoolchildren, and women. Promotion of exclusive breastfeeding and appropriate complementary feeding and weaning are essential inputs. A daunting challenge is to improve diet quality through the raising and consumption of small animals by rural subsistence households to enhance mother and child nutrition. School feeding from preschool onward must be an integral part of education so children are in a condition to learn. An excellent example of such programs is the WHO initiated Integrated Management of Childhood Illness, which integrates nutrition into the care of both sick and well children. The Early Child Development Program (ECDP) initiated by the World Bank and UNICEF has taken hold in many countries (2).

As UNICEF has mentioned, nearly half of all deaths in children under 5 are attributable to undernutrition. This translates into the unnecessary loss of about 3 million young lives a year. Undernutrition puts children at greater risk of dying from common infections, increases the frequency and severity of such infections, and contributes to delayed recovery. In addition, the interaction between undernutrition and infection can create a potentially lethal cycle of worsening illness and deteriorating nutritional status (3).

Malnutrition is a violation of a child's right to existence and improvement, which its consequences often continue undetectable until it is too late. Unluckily, millions of children are suffering from malnutrition. 6.3 million children under age five died in 2013, nearly 17,000 every day. The risk of a child dying before completing five years of age is highest in Africa (90 per 1000 live births), about 7 times higher than in Europe (12 per 1000 live births) (4). Approximately 3.1 million children die from hunger each year. Poor nutrition caused nearly half (45%) of deaths in children under five in 2011. Children who are poorly nourished suffer up to 160 days of illness each year. Undernutrition magnifies the effect of every disease, including measles and malaria Proper feeding of infants and young children can increase their chances of survival.

Suitable feeding from 6 months onwards can prevent undernutrition and decrease Malnutrition can also be initiated by diseases, such as the diseases that cause diarrhea, by dropping the body's ability to convert food into usable nutrients (5). In children, protein-energy malnutrition (PEM) is definite by measurements that drop below two standard deviations under the normal weight for age (underweight), height for age (stunting) and weight for height (wasting). Wasting indicates recent weight loss, however, stunting usually fallouts from chronic weight loss. Of all children under the age of 5 years in developing countries, about 31% are underweight, 38% have stunted growth and 9% show wasting. Closely half of all deaths in children under five are attributable to undernutrition (6). This means that needless loss of about 3 million young lives a year. Undernutrition puts children at superior risk of dying from common infections, increases the frequency and severity of such infections, and contributes to delayed recovery4. For instance in Singapore, the most common cause of failure to thrive in children is malnutrition secondary to psychosocial and caregiver aspects (7, 8).

'Picky eating' is common in the local background and best managed with an authoritative feeding style from caregivers. Other causes are malabsorption and existing congenital or chronic medical conditions. Child mistreatment or abuse should always be ruled out (9). Chronic malnutrition early in life leads to stunting, which prevents children's bodies and brains from growing to reach their full potential. The damage caused by stunting is permanent and has far-reaching concerns; from weaken learning and school performance, to lower future earnings (10, 11).

Apart from undernutrition, the prevalence of childhood obesity seems to be alleviating in various countries, it remains high and an important public health issue (12). Pediatric or childhood obesity is the most prevalent nutritional disorder among children and adolescents worldwide. Roughly 43 million individuals are obese, 21–24% of children and adolescents are overweight, and 16–18% of individuals have abdominal obesity (13). The prevalence of obesity is highest among specific ethnic groups. Pediatric obesity is the foremost health concern of the developed world. The National Health and Nutrition Examination Survey has reported that the prevalence of obesity is on the increase in all the pediatric age groups, in males and females, and in various ethnic and racial groups (9). Globally, in 2016 the number of overweight children under the age of five is estimated to be over 41 million (14). Childhood overweight poses children at risk for numerous severe chronic circumstances such as type 2 diabetes mellitus and cardiovascular diseases (15), as well as for overweight or obesity throughout later life (16). Due to all over mentioned problems, and in order to increase insight in the role of childcare centers, the present study has been carried out by the Ministry of Health and Medicinal Education of Iran, in order to compare possible advantages and disadvantages of food support in children in two different cities of Iran. Mashhad is the second most populous city in Iran and capital of Razavi Khorasan province in the eastern part of Iran, and Urmia is the largest city in West Azerbaijan province of Iran and the 10th most populated city in Iran.

2. Materials and Methods

In this cross-sectional study, the Ministry of Health and Medicinal Education of Iran has done an intervention through financial support from the Welfare Organization of Iran (WOI) in a period of 6 months. All the rural day care centers of both Urmia in the west and Mashhad in the east part of Iran were asked to serve a warm food dish for their children at the centers, which was founded by WOI and planned by a nutritionist in each center. Overall, 2750 children from Urmia (1374 boys, 1376 girls) and 2758 children from Mashhad (1376 boys, 1382 girls) were included in this study. Weight and height of all registered kids were measured before and after the intervention. The weight was measured using the Seca weighing scale to the nearest 0.1 kg. The height was

measured using the Seca Bodymeter to the nearest 0.1 cm. For under 5 years children anthropometric Z scores, including weight for age (WAZ), height for age (HAZ), and BMI for age (BAZ) were added by using Anthro V.3.2.4 and for above 5 years old using Anthro Plus V.1.04 software of the World Health Organization. All of these data categorized based on WHO child growth standards guideline (17). Data were expressed as Means±SEM and Frequencies, by using IBM SPSS Statistics Software (V.24, Chicago, IL). Statistical differences between "Before" and "After" intervention were determined by using McNemar and independent sample T-tests. Differences between groups were considered significantly different when the p value was less than 0.05.

3. Results

As Fig. 1 shows, WHZ score almost was close to 7% of children with moderate to severe underweight before interference, which has been decreased to 4% after interference in both genders to some extent. Prevalence of obesity has been slightly increased from 4.3% to 6.6% after interference.

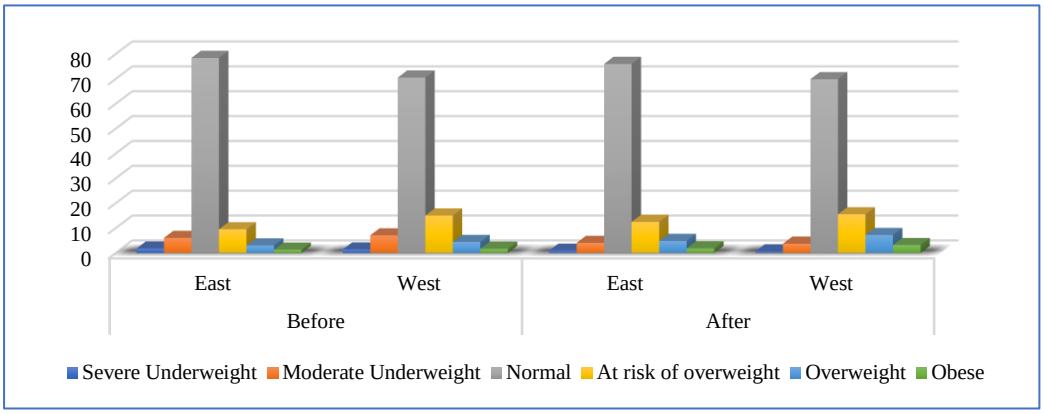

Fig. 1. Comparison of weight for length of 2-6 years old children based on WHO, in the East and the West cities before and after intervention.

As Table 1 illustrated, girls showed a higher rate of malnutrition than boys did. Actually, WHZ score reveals that moderate to severe underweight is more prevalence in girls before and after interference. Unlike before interference among overweight/ obese children, boys showed a higher rate of obesity than girls did after interference.

Table 1. Gender based comparison of weight for height of 2-6 years old children based on WHO, in the West and the East cities before and after intervention.

	West (n=2750)				**East (n=2758)**			
	Before		After		Before		After	
Weight situation	*Boys (%)*	*Girls (%)*	*Boys (%)*	*Girls (%)*	*Boys (%)*	*Girls (%)*	*Boys (%)*	*Girls (%)*
Severe Underweight	1.09	1.62	0.96	0.21	1.43	2.05	0.94	0.80
Moderate underweight	5.94	8.10	2.87	4.46	5.69	6.41	2.91	5.14
Normal	67.34	73.49	65.31	73.89	77.74	79.13	75.29	76.70
At risk of Overweight	18.75	11.49	17.94	13.38	10.56	8.41	13.15	11.79
Overweight	4.53	4.27	7.89	6.58	2.96	3.05	5.67	3.98
Obese	2.34	1.03	5.02	1.49	1.62	0.95	2.03	1.59
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Based on Fig. 2, WAZ score showed that about to 6% of children had moderate to severe underweight before interference that decreased to 5% after interference. However, we have no significant difference between obese and overweight children before and after interference.

Table 2. Gender based comparison of weight for age of 2-6 years old children based on WHO, in the West and the East cities before and after intervention.

	West (n=2750)				**East (n=2758)**			
	Before		After		Before		After	
Weight situation	*Boys (%)*	*Girls (%)*	*Boys (%)*	*Girls (%)*	*Boys (%)*	*Girls (%)*	*Boys (%)*	*Girls (%)*
Severe Underweight	0.95	0.58	0.44	0.51	0.90	0.99	0.55	0.76
Moderate underweight	3.71	4.14	3.20	2.40	4.97	5.92	4.31	4.54
Normal	84.79	85.97	85.44	87.65	85.70	86.74	85.91	87.89
At risk of Overweight	8.52	8.14	8.95	8.50	6.45	5.28	7.30	5.64
Overweight	1.60	1.02	1.60	0.87	1.68	1.00	1.60	1.00
Obese	0.44	0.15	0.36	0.07	0.30	0.08	0.32	0.18
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

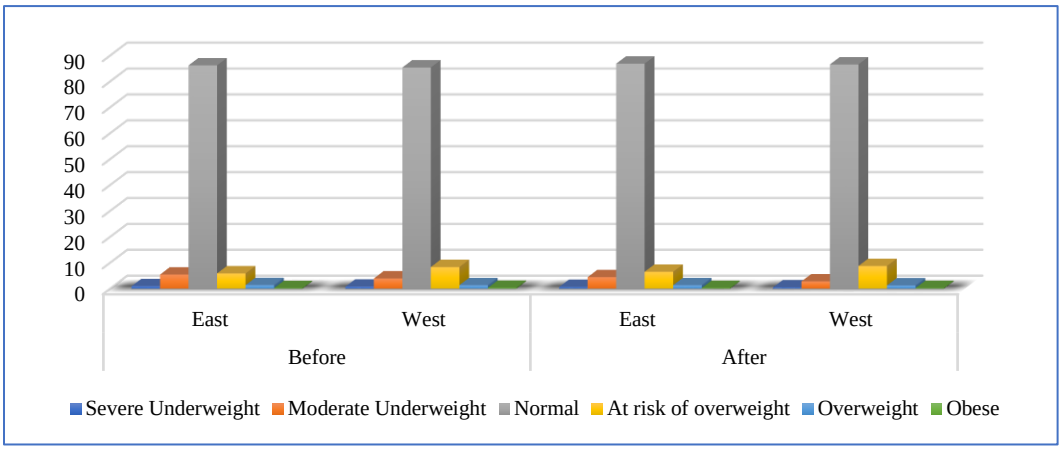

Fig. 2. Comparison of weight for age of 2-6 years old children based on WHO, in the East and the West cities before and after intervention.

As Table 2 displays, no significant changes were seen in the rate of obesity and overweight in boys before and after interference. Similarly, no meaningful changes were observed between boys and girls in a matter of number of normal children in WAZ category in both west and east cities. Girls had a higher rate of underweight than boys did before and after interference. As Fig. 3 and Table 3, HAZ score showed that the prevalence of moderate to severe stunting was 6% before interference it has increased to 7% after interference. Prevalence of moderate to severe stunting was the same in both.

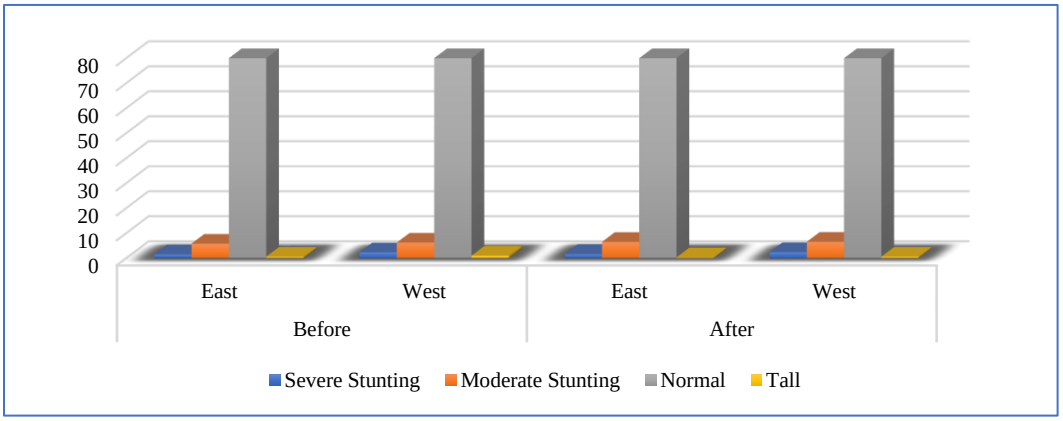

Fig. 3. Comparison of length for age of 2-6 years old children based on WHO, in the East and the West cities before and after intervention.

Table 3. Gender based comparison of length for age of 2-6 years old children based on WHO, in the West and the East cities before and after intervention.

	West (n=2750)				**East (n=2758)**			
	Before		After		Before		After	
Length situation	*Boys (%)*	*Girls (%)*	*Boys (%)*	*Girls (%)*	*Boys (%)*	*Girls (%)*	*Boys (%)*	*Girls (%)*
Severe Stunting	2.40	2.18	2.33	2.40	1.39	1.58	1.62	1.56
Moderate Stunting	5.90	6.54	6.77	6.32	5.69	5.92	6.46	6.53
Normal	90.90	90.19	90.39	90.63	92.36	92.00	91.60	91.62
Tall	0.80	1.09	0.51	0.65	0.56	0.51	0.32	0.30
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

According to BAZ score and Fig. 4, up to 6% of children were moderate to severe underweight before interference, while it decreased to 5% after interference. No significant change was found in both obese and overweight children. As Table 4 shows, despite other scores, BAZ revealed that boys have had more severe underweight than girls have and like other scores, obesity and overweight were higher among boys than girls (Table 5 and 6).

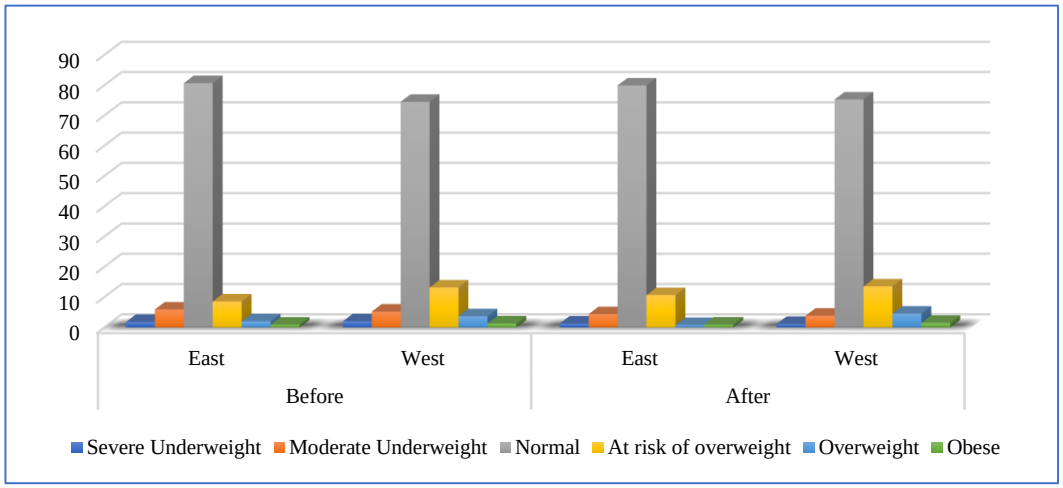

Fig. 4. Comparison of BMI for age of 2-6 years old children based on WHO, in the East and the West cities before and after intervention.

Table 4. Gender based comparison of BMI for Age of 2-6 years old children based on WHO, in the West and the East cities before and after intervention.

	West (n=2750)				East (n=2758)			
	Before		After		Before		After	
Weight Situation	*Boys (%)*	*Girls (%)*	*Boys (%)*	*Girls (%)*	*Boys (%)*	*Girls (%)*	*Boys (%)*	*Girls (%)*
Severe Underweight	2.33	1.74	1.60	0.73	2.00	1.66	1.36	1.17
Moderate underweight	4.73	5.74	3.93	3.85	5.73	6.15	4.31	4.45
Normal	71.69	77.33	71.69	78.85	79.41	82.03	78.37	81.54
At risk of Overweight	15.43	10.97	15.87	11.26	9.41	7.71	11.51	9.80
Overweight	4.08	3.34	4.66	4.51	2.16	1.92	3.20	2.37
Obese	1.75	0.87	2.26	0.80	1.30	0.53	1.25	0.67
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 5. Gender based comparison of mean z-score of 2-6 years old children based on WHO, in the West and the East cities before and after intervention.

	West (n=2750)				East (n=2758)			
	Boy		Girl		Boy		Girl	
Indices	Before	After	Before	After	Before	After	Before	After
Age	59.67±10.72	65.41±10.53	58.70±10.97	64.45±10.75	62.49±10.70	67.92±10.73	62.24±10.80	67.66±10.84
Weight	17.97±2.99	19.11±3.05	17.27±2.97	18.44±3.00	18.04±2.96	19.17±3.15	17.42±2.97	18.50±3.14
Length	107.94±8.14	110.54±7.95	106.91±8.04	109.46±7.94	109.28±7.59	111.72±7.65	108.09±7.53	110.48±7.60
BMI	15.41±1.86	15.63±1.84	15.09±1.90	15.39±1.86	15.07±1.67	15.32±1.72	14.87±1.74	15.13±1.80
WHZ	0.15±1.40	0.42±1.45	-0.18±1.33	0.12±1.26	-0.16±1.28	0.13±1.28	-0.31±1.29	-0.05±1.29
WAZ	-0.22±1.07	-0.17±1.03	-0.32±1.00	-0.24±0.94	-0.40±1.05	-0.33±1.04	-0.51±1.02	-0.43±0.99
HAZ	-0.34±1.29	-0.41±1.23	-0.28±1.29	-0.37±1.25	-0.35±1.17	-0.42±1.14	-0.41±1.15	-0.47±1.12
BAZ	-0.02±1.41	0.11±1.35	-0.23±1.28	-0.05±1.19	-0.30±1.27	-0.12±1.25	-0.40±1.19	-0.23±1.16

Table 6. Comparison of mean z-score of 2-6 years old Children based on WHO, in the West and the East cities before & after Intervention.

	West (n=2750)			East (n=2758)		
Index	Before	After	P value	Before	After	P value
Age	59.19±10.86	64.93±10.65	0.0001	62.37±10.75	67.80±10.79	0.0001
Weight	17.62±3.00	18.77±3.04	0.0001	17.74±2.98	18.85±3.16	0.0001
Length	107.43±8.11	110.00±7.96	0.0001	108.71±7.59	111.12±7.65	0.0001
BMI	15.25±1.88	15.51±1.86	0.0001	14.97±1.71	15.23±1.76	0.0001
Weight for Height	-0.02±1.37	0.26±1.36	0.0001	-0.23±1.28	0.04±1.28	0.0001
Weight for Age	-0.27±1.04	-0.21±0.99	0.025	-0.45±1.04	-0.38±1.02	0.0001
Length for Age	-0.31±1.29	-0.39±1.24	0.017	-0.38±1.16	-0.45±1.13	0.0001
BMI for Age	-0.13±1.35	0.03±1.27	0.0001	-0.34±1.23	-0.17±1.21	0.0001

4. Discussion

Nutritionally related health shapes in the Middle East have changed expressively during the last two decades. The main forces that have contributed to these vicissitudes are the rapid fluctuations in the demographic characteristics of the region, swift urbanization, and social development in the absence of steady and significant economic growth (18). These changes are mirrored in nutritional and health upshots. Expanding obesity rates and high levels of chronic and degenerative illnesses are observed. While several nations of the region have obesity rates exceeding 30%, rates of undernutrition, particularly stunting, among under-five children in low- and middle-income countries persist high (19). The present study, likewise global data, stunting was a major risk. In a cross-sectional and descriptive- analytical study on 500 children, who were 2–5 years-old, in kindergartens of Birjand, the prevalence of overweight was 10.6% (11.7% in girls and 9.6% in boys) and obesity 7.6% (6.3% in girls and 9.6% in boys) (20). However, it was less than the result of similar studies in Tehran and most studies in other countries. In a study on preschool children in Tehran during 2007-2008, the prevalence of overweight and obesity in boys were 9.81% and 4.77%, and 10.31% and 4.49% in girls (21). Another research on preschool children in Yazd province in 2006, found the rate of overweight and obesity as 4.25% and 3.57%, respectively (21).

As we showed, even after food support stunting is still a big problem, which affects all other outcomes. Even though magnificent results were observed in WAZ and BAZ in the present study, decreasing in HAZ score is still an alarming issue. Similar to the present study, Payandeh et al. also found high risk of stunting in Iranian children (22). Prevalence estimations for stunting and overweight are robust, therefore it is thinkable to track global and regional deviations in these two conditions over time (3). A crucial indicator of chronic malnutrition is stunting based on WHO child growth standards. Weight and height both imitate the size of the kids. However, weight by itself is a deprived indicator of thinness or obesity. Moreover, despite the benefits of BMI in this issue, due to the effect of height on BMI for the age of children, reports about obesity and overweight could be a false alarm in some of the studies due to low HAZ which has mentioned in previous studies. Even in normal WAZ for children, low HAZ could lead to higher BAZ which it totally changes all the outcome revelation. Despite geographical, economical and cultural differences between Mashhad and Urmia, a similar pattern was observed in changes of anthropometric indices after food support in both cities. The prevalence of underweight in the studied populations was much lower than a whole country (1.7% to 2.3% *vs* 4.9%), which might be due to the better economic situation of these proveniences of Iran. Urmia as the center of West Azerbaijan is kind of industrial provinces and Mashhad as the center of Razavi Khorasan due to its religion importance is not only one of the main touristic cities in the region also it has many important land farms like saffron which make people in a better economic situation than some other proveniences. A similar explanation could be used for differences between the present study and a recent study in Bandar Turkmen and Zahedan districts (23-25).

5. Conclusion

Due to the comparative success of the present intervention plan, nutritional education along these kinds of projects may advance the nutritional status of children in society and prevent pediatric malnutrition. It should be noted that preschool age and especially in the first three years of life are most vital and vulnerable to the threats of undernutrition, which could affect the entire health. Due to observed stunting among the children, it is vital to support preschool children with high vitamin and protein foods. All efforts should be equipped so that preschool children are given a balanced and nutritious home-based diet.

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