



# The Effect of Daily Meal Support Program on Improvement of Anthropometric Indices in 2-6 Years Old Children in Iranshahr, Iran

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## Abstract

### Original Article

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**Introduction:** pediatric malnutrition is prevalent in developing countries including Iran. One of the most important factors that effects on children growth is nutritious food intake. This study was designed to study the effect of daily ready to use meal in 2-6 years children in daycare centers.

**Methods:** 715 children have been assessed in this study and weight and height were measured before and after the 6-month intervention with daily ready to use meal. Anthropometric indices compared with WHO standards of 2007.

**Results:** Wasting decreased significantly from 29% to 19% in 2-5 children before and after the intervention, respectively. Also, the underweight prevalence decreased significantly from 27% to 19% in all 2-6 children. Furthermore, the prevalence of wasting and underweight in boys was more than girls. According to BMI/age Z-score, thinness prevalence lowered significantly from 23% to 15%. But height/age Z-score didn't change significantly.

**Conclusion:** The results of this study showed that nutrition intervention can improve health indicators in children suffering from malnutrition.

**Keywords:** *Obesity, Overweight, Pediatric, Malnutrition, Underweight*

## Introduction:

In any culture, food nurtures both the physical and emotional process of growth for each infant, child, and adolescent. Food and eating during these critical years of childhood do not exist apart from the overall process of psychosocial development and physical growth. Proper nutrition throughout infancy and childhood promotes normal physical growth and development of mind, thus influences health and academic performance in future life. Furthermore, it helps to prevent obesity, diabetes, cardiovascular diseases,

cancer and other chronic diseases in adulthood<sup>1</sup>. Malnutrition is a condition which refers to deficient food intake and therefore not providing sufficient amounts of energy, protein and micronutrients<sup>2</sup>. On the other hand of this spectrum, excesses in energy intake can lead to overweight and obesity<sup>3</sup>. moreover, insufficient gestational nutrition, lack of breastfeeding, infectious illnesses, malabsorption, and food scarcity lead to malnutrition too<sup>2</sup>. Underweight (<-2 Z-score of weight for age), wasting (<-2 z-score of weight for height), stunting (<-2 Z-score of height for age), overweight (+2 < Z-score <+3 of weight



for age or BMI for age) and obesity ( $+3 < Z$ -score of weight for age or BMI for age) are all forms of malnutrition<sup>4</sup>. Undernutrition is one of the causes of morbidity and mortality among children under 5 in developing countries<sup>5</sup>. Nearly half of all deaths in children under 5 are attributable to undernutrition, which means losing about 3 million children a year. Prevalence of stunting of linear growth of children younger than 5 years has decreased during the past two decades but is higher in South Asia and Africa than elsewhere. Deficiencies of vitamin A and zinc result in deaths and deficiencies of iodine and iron together with stunting, can contribute to children not reaching their developmental potential. Proper feeding of infants and children can increase their chances of survival<sup>6</sup>. Based on global data, an estimated 22.9% (155 million) children under 5 were stunted in 2016. Moreover, an estimated 6% (41 million) children under 5 around the world were overweight and about 7.7% (52 million) children were wasted globally in 2016<sup>7</sup>. On the other hand, the incidence of childhood obesity has more than doubled over the past generations<sup>8,9</sup>. Many studies have warned that the prevalence of childhood overweight and obesity in Iran has increased during the last years<sup>10,11</sup>. Prevalence of overweight and obesity among Iranian children was 9.27% and 3.22% respectively in 2011<sup>12</sup>. Dietary intakes and its quality are not favorable in most parts of the country and should be improved<sup>13</sup>. In Iranshahr which is located in Sistan and Baluchistan province, the status of food security and food availability among people is not appropriate at all that can affect on the growth of children, especially after the infancy. Therefore, the ministry of health and medical education of Iran decided to consider the effect of nutritional intervention on preschool children.

## Materials and Methods:

A cross-sectional study has been done by the Ministry of Health and Medical Education of Iran on the effect of a 6 months intervention on children aged 2-6. The participants of this study were 715 preschool children (311 boys and 404 girls) in rural areas of Iranshahr in the southwestern part of Iran (Sistan and Baluchistan province). In this study, we asked all rural day care centers of Iranshahr to serve a warm food meal for the children who daily recourse to them. Welfare Organization of Iran (WOI) supported this study and a professional nutritionist planned the meals. The protocol of this study was confirmed in the department of public nutrition of ministry of Iran health and medical education. Children's anthropometric indices including weight and height were measured before and after the intervention while children were less-dressed and barefooted. The nutritionists measured weight by Seca weighing scale and  $\pm 0.1$  kilogram error and height by 0.1 centimeter error using Seca Bodometer. Anthropometric z-scores including weight for age (WAZ), weight for height (WHZ), height for age (HAZ) and BMI for age (BAZ) were determined by Anthro V.3.2.4 software for 2-5 years old children and Anthro Plus V.1.04 software of World Health Organization for children older than 5 based on WHO child growth standards guideline.

## Statistical analysis:

Quantitative data were reported as mean $\pm$ SD and frequencies, by using IBM SPSS Statistical Software (V.24, Chicago, 2016). McNemar and sample T-tests were used to compare the data of before and after intervention and P values less than 0.05 were considered as significant.

## Results:

As shown in table 1, from the total of 328 children under the age of 5 years who were





examined before the intervention, almost 29% of them had moderate to severe wasting. this prevalence decreased to 19% after the intervention. Although boys had more moderate to severe wasting in comparison with girls, they showed a better improvement after the intervention. According to table 3 and the total of 715 children considered, WAZ score for those who had moderate to severe of low weight was about 27% which this number decreased to 19% at the end of the study. In addition, the frequency of children having normal and overweight or the ones with obesity didn't change significantly after the intervention. As table 4 shows, in a comparison between the groups of boys and girls, boys were more

underweight than girls. Based on tables 5 and 6, results showed a slight decrease in HAZ score before and after the intervention. Comparing to boys, Girls had more reduction of HAZ score in this trial. Also based on BMI for age z-score, moderate to severe wasting of children decreased from almost 23% to almost 15%. But as there is a similar reduction in children's HAZ score, this difference could not be due to the children's improvement in weight and growth condition. In accordance with this scale, Overweight and obesity had an insensible increase and the prevalence of overweight in children augmented by 0.5%. Altogether based on the results of this study, all the indicators except HAZ score, showed an increase.

**Table 1- Comparison of weight for height in 2-5-year-old children, before and after the intervention based on WHO Z-scores**

Situation	Before		After	
	n	%	n	%
Severe Wasting	48	14.63	32	13.45
Moderate Wasting	48	14.63	16	6.72
Normal	201	61.28	151	63.45
At Risk of Overweight	24	7.32	30	12.61
Overweight	4	1.22	7	2.94
Obese	3	0.91	2	0.84
Total	328	100.00	238	100.00

**Table 2- Gender-based comparison of weight for height in 2-5-year-old children, before and after the intervention, based on WHO Z-scores**

Situation	Before				After			
	Boys		Girls		Boys		Girls	
	n	%	n	%	n	%	n	%
Severe Wasting	25	17.12	23	12.64	16	15.24	16	12.03
Moderate Wasting	26	17.81	22	12.09	5	4.76	11	8.27
Normal	81	55.48	120	65.93	65	61.90	86	64.66
At Risk of Overweight	13	8.90	11	6.04	16	15.24	14	10.53
Overweight	-	-	4	2.20	3	2.76	4	3.01
Obese	1	0.68	2	1.10	-	-	2	1.50
Total	146	100.00	182	100.00	105	100.00	133	100.00

**Table 3- Comparison of weight for age in 2-6-year-old children before and after the intervention based on WHO Z-scores**

Situation	Before		After	
	n	%	n	%
Severe Underweight	44	6.15	26	3.64
Moderate Underweight	149	20.84	114	15.94
normal	518	72.45	570	79.72
At Risk of Overweight	4	0.56	4	0.56
Overweight	-	-	1	0.14
Obese	-	-	-	-
Total	715	100.00	715	100.00



**Table 4- Gender-based comparison of weight for age in 2-6-year-old children before and after the intervention, based on WHO Z-scores**

Situation	Before				After			
	Boys		Girls		Boys		Girls	
	n	%	n	%	n	%	n	%
Severe Underweight	24	7.72	20	4.95	18	5.79	8	1.98
Moderate Underweight	65	20.90	84	20.79	54	17.36	60	14.85
normal	221	71.06	297	73.51	238	76.53	332	82.18
At Risk of Overweight	1	0.32	3	0.74	1	0.32	3	0.74
Overweight	-	-	-	-	-	-	1	0.25
Obese	-	-	-	-	-	-	-	-
Total	311	100.00	404	100.00	311	100.00	404	100.00

**Table 5- Comparison of height for age in 2-6-year-old children before and after the intervention based on WHO Z-scores**

Situation	Before		After	
	n	%	n	%
Severe Stunting	78	10.91	78	10.91
Stunting	95	13.29	114	15.94
normal	539	75.38	520	72.73
Tall	3	0.42	3	0.42
Total	715	100.00	715	100.00

**Table 6- Gender-based comparison of height for age in 2-6-year-old children before and after the intervention, based on WHO Z-scores**

Situation	Before				After			
	Boys		Girls		Boys		Girls	
	n	%	n	%	n	%	n	%
Severe Stunting	37	11.90	41	10.15	38	12.22	40	9.90
Stunting	42	13.50	53	13.12	49	15.76	65	16.09
normal	230	73.95	309	76.49	222	71.38	298	73.76
Tall	2	0.64	1	0.25	2	0.64	1	0.25
Total	311	100.00	404	100.00	311	100.00	404	100.00

**Table 7- Comparison of BMI for age in 2-6-year-old children before and after the intervention based on WHO Z-scores**

Situation	Before		After	
	n	%	n	%
Severe Wasting	79	11.05	53	7.41
Moderate Wasting	96	13.43	59	8.25
normal	472	66.01	503	70.35
At Risk of Overweight	46	6.43	72	10.07
Overweight	15	2.10	19	2.66
Obese	7	0.98	9	1.26
Total	715	100.00	715	100.00





**Table 8- Gender-based comparison of BMI for age in 2-6-year-old children before and after the intervention, based on WHO Z-scores**

Situation	Before				After			
	Boys		Girls		Boys		Girls	
	n	%	n	%	n	%	n	%
Severe Wasting	37	11.90	42	10.40	24	7.72	29	7.18
Moderate Wasting	50	16.08	46	11.39	30	9.65	29	7.18
normal	192	61.74	280	69.31	208	66.88	295	73.02
At Risk of Overweight	20	6.43	26	6.44	34	10.93	38	9.41
Overweight	8	2.57	7	1.73	11	3.54	8	1.98
Obese	4	1.29	3	0.74	4	1.29	5	1.24
Total	311	100.00	404	100.00	311	100.00	404	100.00

**Table 9- Comparison of mean Z-Score of 2-6-year-old children before and after the intervention**

Indices	Before	After	P
Age	60.41±10.76	64.57±10.83	0.0001
Weight	15.37±2.46	16.41±2.54	0.0001
Height	104.21±7.75	105.70±7.62	0.0001
BMI	14.23±2.28	14.76±2.31	0.0001
WHZ	-1.17±1.78	-0.73±1.83	0.005
WAZ	-1.38±1.01	-1.16±0.98	0.0001
HAZ	-1.10±1.53	-1.21±1.49	0.175
BAZ	-1.02±1.71	-0.60±1.62	0.0001

**Table 10 Gender-based comparison of mean Z-Score of 2-6-year-old children before and after the intervention**

Indices	Boys			Girls		
	Before	After	P	Before	After	P
Age	59.77±10.98	63.95±11.12	0.0001	60.90±10.57	65.05±10.59	0.0001
Weight	15.43±2.43	16.44±2.48	0.0001	15.33±2.49	16.38±2.59	0.0001
Height	104.46±7.56	105.96±7.44	0.013	104.01±7.89	105.50±7.76	0.007
BMI	14.22±2.33	14.73±2.33	0.007	14.23±2.24	14.78±2.30	0.001
WHZ	-1.30±1.85	-0.77±1.92	0.027	-1.07±1.73	-0.71±1.76	0.074
WAZ	-1.41±1.04	-1.22±1.04	0.019	-1.35±0.99	-1.12±0.93	0.001
HAZ	-1.07±1.63	-1.19±1.58	0.356	-1.13±1.46	-1.23±1.42	0.321
BAZ	-1.11±1.83	-0.68±1.75	0.003	-0.95±1.61	-0.54±1.51	0.0001

## Discussion:

The feature of malnutrition has been changed in recent years. Pediatric overweight and obesity prevalence have been grown up in last decades and low weight has been reported less than before <sup>14</sup>. But in different countries, the distribution of various aspects of malnutrition depends on different factors like food security, socio-economic characteristics and food availability <sup>15</sup>. This study reports the effect of nutrition intervention on anthropometric indices of 2-6 years old children in rural day care centers of Iranshahr.

According to the results of this study, 29% of children were in moderate and severe wasting status at the baseline which were more than the prevalence in the last wide survey -National Iranian Micronutrients Status (NIMS)- that reported 19.8% wasting in Sistan and Baluchistan and its similar provinces <sup>16</sup>. Also in our study, the number of wasted girls were less than their boy peers ( 24.7% and 34.9% respectively) and it was same in NIMS (22.7% in boys and 18.7% in girls) <sup>16</sup>. The prevalence of total moderate and severe underweight before the intervention was 26.9% and 26.3% in our study and NIMS, respectively <sup>16</sup>. The



percent of underweight girls and boys were not significantly different (25.7% and 28.8%, respectively) as the percent of underweight in girls and boys in NIMS (20.2% and 32.4%), but the difference in NIMS was so eye-catching<sup>16</sup>. In terms of stunting in our study, 25.4% of boys, 23.3% of girls and 24.2% of all children were moderately and severely stunted. While in NIMS there were 11.1%, 17.2%, and 5.9% moderately and severely stunted children, boys and girls, respectively<sup>16</sup>. The percentage of overweight and obesity according to BMI for age Z-score before the intervention was 9.51% in comparison with 10.1% in NIMS<sup>16</sup>. Also, in our study, the percent of overweighed and obese boys and girls was 10.3% and 8.9%, respectively. In comparison with the percent of overweight and obesity in NIMS among boys and girls were 6% and 5.4% respectively<sup>16</sup>. This difference between the results of our study and NIMS may be caused by the different extent of these studies. In NIMS, researchers investigated children aged six in three similar provinces as a unique area so the results can be different from the data of a small city in Sistan and Baluchistan province. Also, it may be caused by actions done by the health system to educate families about children's growth during 2 year-interval between this study and NIMS and children evaluation before school entrance. Another study which has been done on children under 6 showed 19.4% underweight, 32.1% stunting and 9.4% wasting in Sistan and Baluchistan in 2014<sup>17</sup>. The wide spectrum of age, which was assessed in this study, may be the reason for the difference between our results and theirs. In addition, the mean percentage of underweight before and after the intervention has been changed by about 8%, but the number of normal weight or obese children did not change through the intervention. After the nutritional intervention, all anthropometric indices included WAZ, WHZ, and BAZ have been increased significantly among all children

( $P<0.05$ ) but HAZ did not change significantly ( $P=0.175$ ). The percentage of moderate and severe wasting decreased about 10 percent (19%) and boys responded better than girls did. In line with our study, a study in South Africa which assessed the impact of a nutritional intervention on 12-60 months children showed a significant improvement in WAZ, WHZ, HAZ and BAZ ( $P<0.05$ ) after a ready to use supplementary food plan<sup>18</sup>. Another study, which was designed in China, 6-18 months children have been assessed after an intervention. In this study, the prevalence of underweight, stunting and wasting at the baseline was 4.5%, 8.9%, and 3.5%, respectively and they decreased to 3.3%, 5% and 1.7%, respectively.

### Conclusion:

According to the results of this study, it seems that nutrition intervention in form of daily ready to use meal has a significant effect on anthropometric indices and may influence on future health. However, the improvement of height growth during the intervention would observe in a longer time.

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