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Nutritional Intervention of Malnutrition in Children Aged 2-6 Years in IranShahr City, Iran

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ABSTRACT

Introduction: Malnutrition is a major cause of mortality in children in developing countries. More than 90% of children with malnutrition live in developing countries. The present study aimed to assess the effects of nutritional intervention based on the consumption of cooked meals for 120 days on the status of malnutrition in the children aged 2-6 years in the rural nurseries in IranShahr city, Iran.

Methods: This interventional study was conducted on 1,115 children, including 603 females and 512 males, aged 24-72 months in the rural nurseries in IranShahr city, Iran. The growth status of children (body weight, height, and body mass index [BMI]) was assessed before and after the consumption of a cooked meal containing 250 kilocalories of energy per meal, 15 grams of protein, 25 grams of carbohydrates, and 10 grams of fat. After 120 days, weight-for-age, height-for-age, and BMI-for-age of the children were measured and compared before and after the intervention based on the World Health Organization (WHO) standards and the z-scores using Chi-square and paired t-test.

Results: The prevalence of underweight (weight-for-age), stunting (height-for-age), and wasting weight (BMI-for-age) before the intervention was 63%, 58.5%, and 29.6%, respectively. After the intervention, these values were estimated at 58%, 58.8%, and 22.9%, respectively. The prevalence of underweight and wasting weight reduced significantly ($P<0.05$), while no improvement was observed in height-for-age (short stature) ($P<0.05$).

Conclusion: According to the results, nutritional intervention had significant effects on weight-for-age and BMI-for-age in the growth process of the children. However, it had no significant effect on the height-for-age index.

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Introduction

Child malnutrition is considered to be an important public health concern in developing countries, including Iran. Undernutrition in children is a critical problem since its adverse health effects may extend to adulthood. Undernutrition is associated with short-term and long term consequences (1). According to the World Health Organization (WHO), approximately 22.9% and 7.7% of children suffer from stunting and wasting weight, respectively (2).

In 2016, estimations showed that 155 million children aged less than five years suffered from stunting, and approximately 45% of the deaths among these children were due to malnutrition, which often occurs in developing, low-income countries (3). In 2008 and 2012, the findings of a national survey indicated that more than 9% of the children aged less than five years were moderately and severely underweight. In the mentioned study, the prevalence of stunting and wasting weight was 13.9% and 5.3%, respectively (4). In 2020, the promotion of health and healthy behaviors is predicted to be

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one of the main objectives of the public health program in every stage of life (5).

Concentrating on the nutrition and education of children is considered to be a valuable health investment and national development (6). Malnutrition has been associated with the mortality rate of higher than 35%, and these deaths are mostly preventable through economic development and public health measures. Protein-energy malnutrition is regarded as a major health issue in developing countries. Long-term malnutrition adversely affects the evolution of the brain system, task performing capacity, reproduction, and economic growth in the community (4, 7). Meanwhile, the anthropometric indices of height and weight are considered to be the most reliable indicators to assess the nutritional status of the children in a community.

Recent studies have indicated that despite the efforts to improve the nutrition of children aged less than five years, the nutritional status of these children is not desirable. Several interventions have been conducted in various countries to reduce the prevalence of malnutrition and its complications with varying degrees of success. This interventional study aimed to investigate the effects of nutritional interventions using daily cooked meals for 120 days on the growth indices of children aged 2-6 years for the first time in the rural nurseries in IranShahr city, Iran.

Material and methods

Sample Population and Sampling

This interventional study was conducted on 1,115 children aged 2-6 years, including 603 females (54%) and 512 males (45%) in 14 regions in IranShahr (30 rural nurseries, 716 children), four region in Qasreqand (four rural nurseries, 94 children), and 17 areas in Nikshahr (17 rural nurseries, 315 children), which were selected randomly. The children were subjected to anthropometric evaluation, and growth indices (e.g., weight and height) were measured in those who had been monitored before the intervention.

The children in rural nurseries received daily cooked meals at lunchtime for 120 days, containing rice and lentil, rice and green beans, rice and chicken, and spaghetti and revalenta. The meals were served for lunch from Saturday to Thursday. Calorie and macronutrients were measured per meal using Dorosty Food Processor software (DFP; version 2003) at Tehran University in Tehran, Iran. The meals contained 250 kilocalories of energy, 15 grams of protein, 25 grams of carbohydrates, and 10 grams of fat. After 120 days, the subjects were examined in terms of growth indices.

Anthropometric Evaluation

The height of the children was measured using a tape meter mounted on a wall in a standing position without shoes at the precision of 0.1 centimeter, and their weight was measured using the Seca scale with minimal clothing and without shoes at the precision of 0.1 kilogram. After collecting the anthropometric data, WHO Anthro software was used to assess the growth indices of the children. In this study, the z-scores of weight-for-age, height-for-age, and weight-to-height were used to assess the growth status and determine the severity and prevalence of underweight, stunting, and wasting weight.

Moderate underweight was indicated by the weight-for-age z-scores of between -2 and -3, and the values of less than -3 were defined as severe underweight. Moderate stunting was assessed as the rate of height-for-age z-scores of between -2 and -3, and the values of less than -3 were defined as severe stunting. Moreover, moderate wasting weight was evaluated as the rate of weight-for-height z-scores of between -2 and -3, and the values of less than -3 were defined as severe wasting weight. Mild underweight, stunting, and wasting weight z-scores were between -1 and -2, and the weight-for-age, height-for-age, and weight-for-height z-scores were between -1 and 1 and defined as normal weight and height.

Statistical Analysis

Data analysis was performed in SPSS version 17.0 (SPSS Inc., Chicago, IL, USA) using paired t-test to determine the differences before and after the measurements. In addition, Chi-square was applied to compare the differences in the levels of underweight, stunting, and wasting weight based on z-scores before and after the intervention. In all the statistical analyses, P-value of less than 0.05 was considered

significant.

Results

The present study was conducted in 2016 on 1,115 children aged 2-6 years (mean age: 70±14 months), 54% of whom were female, and 45% were male. The growth status of the children was evaluated before and after the intervention. Based on the weight-for-age index, 33.5% of the children were severely underweight, which significantly decreased to 27.1% after the intervention (P<0.05) (Table 1). After the intervention, the prevalence of severe underweight in the male and female children significantly decreased from 30% to 25% and 36% to 29%, respectively (P<0.05). Furthermore, the prevalence of normal weight-for-age increased from 12% to 15%.

Table 1. Prevalence of Underweight Severity in Children before and after Intervention

Underweight	Before Intervention		After Intervention		P-value
	Frequency	Percentage	Frequency	Percentage	
Severe Underweight	349	33.5	305	27.1	0.03
Moderate Underweight	317	30.4	353	31.6	0.08
Mild Underweight	241	23.1	286	25.6	0.76
Normal	132	12.7	169	15.1	0.04
Overweight	4	0.4	3	0.3	-

Paired t-test; P=0.03

Comparison of the children showed that males had lower body weight compared to females (Table 2).

Table 2. Gender-specific Rate of Underweight Severity in Children before and after Intervention

Underweight	Before Intervention				After Intervention				P-value
	Male		Female		Male		Female		
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	
Severe Underweight	187	36	192	30	152	29	153	25	0.02
Moderate Underweight	126	24	206	34	155	30	198	32	0.64
Mild Underweight	118	24	153	25	115	23	171	28	0.41
Normal	79	16	70	11	88	18	81	13	0.04
Overweight	2	0	0	0	2	0	0	0	-
Total	512	100	603	100	512	100	603	100	

Paired t-test; Chi-square; P=0.00

Before the intervention, the prevalence of severe, moderate, and mild stunting in the female and male children was 85% and 81%, respectively, which changed to 82% and 81%, respectively after the intervention. However, this change was not considered statistically significant (Table 3).

Table 3. Prevalence of Stunting Severity in Children before and after Intervention

Stunting	Before Intervention		After Intervention		P-value
	Frequency	Percentage	Frequency	Percentage	
Severe Stunting	321	28.2	314	28.8	0.76
Moderate Stunting	342	30.7	337	30.3	
Mild Stunting	262	23.5	263	23.6	
Normal	201	18	189	17.4	

Paired t-test; P=0.76

According to the information in Table 4, there was no significant change in the height-for-age index after the intervention in the male and female children compared to the baseline values (Table 4).

Table 4. Gender-specific Rate of Stunting Severity in children before and after Intervention

Stunting	Before Intervention	After Intervention	P-

	Male		Female		Male		Female		value
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	
Severe Stunting	154	30	169	28	159	31	157	26	0.07
Moderate Stunting	143	28	199	33	138	27	199	33	
Mild Stunting	118	23	145	24	117	23	138	23	
Normal	97	19	90	15	98	19	109	18	
Total	512	100	603	100	512	100	603	100	

Paired t-test; Chi-square; P=0.07

On the other hand, the prevalence of severe and moderate wasting weight significantly decreased from 29.6% to 22.9% in the children (Table 5).

Table 5. Prevalence of Wasting Weight Severity in Children before and after Intervention

Wasting Weight	Before Intervention		After Intervention		P-value
	Frequency	Percentage	Frequency	Percentage	
Severe Wasting Weight	153	13.7	108	9.7	0.00
Moderate Wasting Weight	177	15.9	147	13.2	0.04
Mild Wasting Weight	279	25	269	24.1	-
Normal	440	39.5	502	45	0.02
Overweight	66	5.9	87	7.8	-

Paired t-test; P=0.00

After the intervention, the prevalence of severe and moderate wasting weight in the male and female children decreased from 31% and 32% to 25% and 24%, respectively, which was considered statistically significant (P<0.05). The rate of weight gain was similar in the male and female children, which was estimated at approximately 22% (Table 6).

Table 6. Gender-specific Rate of Wasting Weight Severity in Children before and after Intervention

Wasting Weight	Before Intervention				After Intervention				P-value
	Male		Female		Male		Female		
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	
Severe Wasting Weight	77	15	90	15	61	12	66	11	0.00
Moderate Wasting Weight	87	17	96	16	61	12	84	14	0.03
Mild Wasting Weight	133	26	157	26	123	24	151	25	0.07
Normal	205	40	253	42	251	49	296	49	0.00
Overweight	10	2	7	1	15	3	6	1	-
Total	512	100	603	100	512	100	63	100	

Paired t-test; Chi-square; P=0.00

In addition, obesity and overweight showed an unobtrusive increase based on the BMI, and the increase in the proportion of overweight was estimated at 0.5 after the intervention.

Discussion

Stunting, wasting weight, and underweight in children continue to be important health concerns in many developing countries. Malnutrition is a consequence of a sudden period of food shortage, which is associated with the loss of body fat and wasting of skeletal muscles. According to the results of this community-based, interventional study, the nutritional intervention could effectively reduce the prevalence of underweight, stunting, and wasting weight in the children.

In the present study, the prevalence of underweight, stunting, and wasting weight in 1,115 rural children aged 2-6 years was 78.3%, 83%, and 54.6%, respectively. In 2011, the WHO reported that 26% (one in every four children), 16% (one in every six children), and 8% of children (one in every 12 children) had stunting,

underweight, and wasting weight, respectively. Similarly, Siassi et al. reported the prevalence rate of stunting, underweight, and wasting weight to be 8%, 3.3%, and 4.9% in the children aged 15-23 months in Iran, while these values were estimated at 4.9%, 6.5%, and 7.9%, respectively in the children aged six years (8). Moreover, Sotoudeh et al. observed that 1.8% of the children in Zahedan (Iran) had stunting with concurrent overweight (9). According to a Western-Indian study in this regard, the prevalence rate of underweight, stunting, and wasting weight was 63%, 58.5%, and 22.9%, respectively (10).

Nutritional interventions are considered to be proper approaches to the improvement of nutritional indices. In the current research, the nutritional intervention with cooked meals for 120 days significantly reduced the rates of underweight (58%), stunting (58%), and wasting weight (22.9%). Consistently, Zavoshi et al. reported that a nutritional intervention could decrease the prevalence of wasting weight in the children aged less than five years from 15.2% to 2.1% (11). In another interventional study by Dong et al., the rates of wasting weight, stunting, and underweight declined from 3.5%, 8.9%, and 4.5% to 1.7%, 5%, and 3.3%, respectively, which was considered to be a statistically significant improvement (12). This finding is in line with the results obtained by Jayatissa et al. (13), Kumar and Bhawani (14), Pera et al. (15), and Columbatti et al. (16). However, no significant differences were reported by Rah et al. in the studied children in the intervention who consumed a minimum of 75% of the micronutrient sachets, and the prevalence of stunting significantly decreased in these children compared to those consuming less than 75% of the nutrients (17).

According to the results of the present study, the prevalence of underweight was higher in the females compared to males, while no significant difference was observed in the prevalence of stunting and wasting weight between the male and female children. Similarly, Zavoshi et al. reported the prevalence of wasting weight to be higher in female children compared to males (11). The higher prevalence of malnutrition in female children could be due to the traditional attitude in the community where boys tend to be more cared for in terms of nutritional status than girls.

Some of the limitations of the present study included the lack of access to the socioeconomic data of the households and unavailable dietary intake of children before the intervention. The main strength of the research was the nutritional intervention using cooked meals.

Conclusion

According to the results, the intervention with cooked meals could decrease the prevalence rate underweight and wasting weight in the children. Therefore, it is recommended that such interventions be continued with cooked meals in rural nurseries. Furthermore, improving malnutrition requires intersectional collaboration between healthcare organizations, and a single institution cannot prevent and recover malnutrition. Nutritional interventions based on using daily cooked meals are effective in reducing the prevalence of underweight and wasting weight.

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Conflicts of interest

None declared.

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