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PJBS

ISSN 1028-8880

**Pakistan
Journal of Biological Sciences**

ANSI*net*

Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Nutritional Intervention on Malnutrition in 3-6 Years Old Rural Children in Qazvin Province, Iran

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Abstract: Malnutrition is one of the major causes of mortality and morbidity in children. Not only include acute effects on children's health, but also it has long-term effects on their cognitive development and economic growth in the society. Wasting (weight for height with $Z < -1$) is one of the malnutrition indices in children. The aim of this study was to determine the effect of a cooked meal for 175 days on the anthropometric indices of weight, height and weight for height (wasting) of 3-6 years old children in all the rural nursery of Qazvin province, in Iran. In this interventional study, 2385 children (48.8% female and 51.2% male) were recruited. Data were collected by a census in 2010. The children were received a cooked meal based on 360 ± 20 kcal energy, 17% protein, 53% carbohydrate and 30% fat per day for 175 days at lunch time. The anthropometric indices were collected before and after the intervention. The results were analyzed using paired t-test by SPSS V.16 software. Prevalence of wasting (mild and moderate) and (sever malnutrition) after intervention reduced from 14.2 and 0.95-12.6 and 0.5%, respectively ($p < 0.05$). Receiving a cooked meal significantly decreased wasting (15.2-13.2%) in all children ($p < 0.05$). Nutritional intervention with cooked meal for 175 days had significant reduction in wasting in all children.

Key words: Nutritional intervention, wasting, cooked meal, rural nursery, malnutrition, Iran

INTRODUCTION

One of the well-known indicators of economic development is the nutritional status of children. Growth index in the form of weight for height is an important tool for the assessment of nutritional status of children. The prevalence of nutritional indicators in the form of wasting in children less than 6 years of age is one of the ways of assessment of nutritional status of the population. This indicator is commonly practiced regularly in many countries as a measure of public health status. The recent data indicate that the prevalence of nutritional indicators is lowest in Western countries such as the United States and highest in much less developed countries such as Yemen and Nigeria (El Mouzan *et al.*, 2010). Among etiologies of malnutrition, factors such as unavailability of food, instability of social conditions, infectious diseases, parent's education, family size and income may be mentioned (WHO, 2005; Nemati *et al.*, 2008; Rayhan and Khan, 2006). Due to need more energy and nutrients, children are more vulnerable to malnutrition (Walker, 2007). Malnutrition is one of the major causes of mortality and morbidity in children. Evidence indicates that malnutrition not only has an effect on the child's

health, but also it has long-term effects on cognitive and social development, physical work capacity, productivity and economic growth of the society (Kliegman, 2008). About 35% of all preschool children in developing countries are underweight (Olsen *et al.*, 2003). In comparison to children with normal growth, studies have shown, children with severe wasting have about 8-times higher rate of mortality and children with moderate and mild malnutrition have 4 and 2 times higher rates of mortality, respectively. This high prevalence of mortality even in children with moderate and mild malnutrition indicates that more than 50% of mortalities in children are directly or indirectly due to malnutrition (Kliegman, 2008). Anthropometric indices of height and weight in children are considered as the outcome of nutrition status of the community. Because of being easy and available, these indices are used frequently and would be judged the children health (Hall *et al.*, 2007). Wasting is defined as underweight for height (weight for height with $Z < -1$) a good criteria for assessing the health of children (Waterlow, 1973). This is an acute phenomenon which is the result of a disease or crisis in the recent past so that the child has lost weight. The most common cause of wasting in children is acute diseases such as severe

diarrhea, the upper respiratory infections and the crises of shortage of food in which families do not have enough food (WHO, 2005). Underweight is the reflection of both types of acute and chronic malnutrition (WHO, 2006a, b). Children who are at high risk of nutritional disorders should be carefully evaluated (Kuczmarski *et al.*, 2000). Depending on the level of physical activity the daily energy need for 3-6 years old boys and girls is 1200-1600 kcal (Mei *et al.*, 2002). So, far, nutritional intervention for reducing this type of malnutrition (wasting) has been made rarely or less so that its effect on reducing malnutrition rates can be assessed. This study was conducted to determine the prevalence of mild, moderate and severe malnutrition and also intervention with a daily cooked meal for 175 days in two groups of 3-6 years old children being malnourished and well-nourished in all the rural nurseries of Qazvin province, Iran.

MATERIALS AND METHODS

This interventional study was done by a census on 2385 children of 3-6 years old including 1165 (48.8%) girls and 1220 (51.2%) boys were recruited from all the rural nurseries in Qazvin province, in 2010. Children living in villages of five regions in Qazvin, Iran from 59 rural nurseries included Qazvin (29 rural nurseries), Takestan (4 rural nurseries), Buin Zahra (5 rural nurseries), Abyek (3 rural nurseries) and Alvand (18 rural nurseries) were enrolled. Children age was controlled before entering into the study. Height was measured in a standing position without shoes and with the accuracy of 0.5 cm. Children weight was measured by trained health care team, using Seca scale, without shoes with the accuracy of 50 g under supervision of a clinical nutritionist. Height and weight measurement was done based on the WHO children growth curves standard (De Onis *et al.*, 2007; Mei *et al.*, 2008) which was used in health centers. The children in the rural nurseries received a daily cooked meal within 175 days at the lunch time, including lentil meal, Istanbuly rice, lentil with rice, spaghetti, potato sauce with rice and a traditional soup (Ash) were cooked at rural nurseries. No change in daily physical activity was occurred. The meals were based on 360±20 kcal energy 17% protein, 53% carbohydrate and 30% fat. The average amounts of energy, protein, carbohydrate and fat of the meals were calculated by Dorosty Food Processor (DFP) software, version 2003, Shahid Beheshti University, Tehran, Iran. Children were divided in two groups of with (less than M-1SD) and without malnutrition (greater than

M-1SD). Wasting was defined in three categories, proportion of children whose weight for height were mild ($-2 \leq Z < -1$), moderate ($-3 \leq Z < -2$) and severe ($Z < -3$) malnutrition. Results are presented as mean±standard deviation. Data were analyzed with the SPSS package Version 16 (SPSS Inc., Chicago. IL). Paired t-test was applied to determine the difference between before and after measurements and chi-squared test was used for comparing different levels of wasting (by means of Z-scores) before and after intervention. The p-value <0.05 was accepted as statistically significant for all tests.

RESULTS

This study was conducted on 2385 children of 3-6 years old. The majority number of the children who participated in this study was at the age of five, 911 (38.2%) and the minority group was related to the age of six by 298 children (12.5%). In the girls' group at the age of 3, 4, 5 and 6 before the intervention, the mean of the weight was 14.23±2.24, 16.04±2.36, 17.79±2.87 and 19.03±3.65 kg, respectively. This index was increased after the intervention to 15.44±2.34, 17.23±2.47, 18.96±3.15 and 20.31±3.83 kg, respectively. In the boys' group at the age of 3, 4, 5 and 6 before the intervention, the mean of the weight was 15.18±2.35, 16.68±2.72, 18.4±3.11 and 19.10±2.90 kg, respectively. This index was increased, after the intervention to 16.33±2.34, 17.88±2.87, 19.64±3.26 and 20.28±2.90 kg, respectively. Mean and percentiles of height and weight, before and after the intervention in 3-6 years old children are summarized in Table 1. Intervention with a cooked meal significantly increased the weight in well-nourished and malnourished group (1145 and 1267 g), respectively ($p < 0.05$). The prevalence of mild, moderate and severe wasting in the girls after the nutritional intervention was significantly reduced from 11.7, 4.1 and 0.7 to 9.8, 3.3 and 0.3%, respectively ($p < 0.05$). The overall prevalence of wasting in the girls after nutritional intervention was significantly reduced from 16.5-13.4% ($p < 0.05$). The prevalence of mild, moderate and severe wasting in the boys after the nutritional intervention was significantly reduced from 10.7, 2.5 and 0.8 to 9.3, 2.4 and 0.4%, respectively ($p < 0.05$). Also, the overall prevalence of wasting in the boys after nutritional intervention was significantly reduced from 14 to 12.1% ($p < 0.05$). Generally the nutritional intervention resulted in a significant reduction in the prevalence of wasting (mild, moderate and severe) from 15.2 to 13.1% ($p < 0.05$) (Table 2). The weekly menu and food composition of the cooked meals are summarized in Table 3.

Table 1: Percentiles, Mean±SD of weight and height of rural children before and after intervention

Age (year)		Height (cm)		Weight (kg)	
		Before	After	Before	After
3	Percentiles	†14.67± 2.34	15.84±2.38*	94.69±9.17	97.76±9.64*
	3	11	12.39	68	69.46
	5	11.5	13	72.2	75.1
	25	13	14.5	91	94
	50	14.5	16	96.5	100
	75	16	17	100.5	103
3	95	18	19.99	105.9	110
	97	19	21	107	113
	Percentiles	†16.35 ± 2.56	17.54±2.69*	102.66±7.7	105.46±7.72*
	3	12	13	85	88.88
	5	13	14	89	93
	25	15	16	99	102
4	50	16	17	103	106
	75	18	19	107	110
	95	20	22	114	116
	97	21	23	115	118
	Percentiles	†18.11±3.02	19.32±3.22*	108.88±6.65	111.53±6.59*
	3	13.68	14.68	96	99
5	5	14	15	99	102
	25	16	17	105	108
	50	18	19	109	112
	75	20	21	113	116
	95	23	25	118	120
	97	25	26	119	122
6	Percentiles	†19.08±3.22	20.29±3.30*	112.35±5.87	115.15±5.83*
	3	14	15.5	100	103.97
	5	15	16	102	104.95
	25	17	18	109	112
	50	19	20	112	115
	75	20	21.92	116.25	119
6	95	25	26.03	122	124
	97	26	28.06	123	125

Values are Mean±SD, *p<0.001, N: 2385

Table 2: Prevalence of different levels of malnutrition among rural children

	Z-score	Nutritional intervention			
		Before		After	
		No.	%	No.	%
Without wasting (well nourished)	Z<-1	2022	84.8	2081	86.9
Wasting†					
Mild malnutrition	-2≤Z<-1	266	11.1	228	9.8
Moderate malnutrition	-3≤Z<-2	79	3.1	67	2.8
Severe malnutrition	Z<-3	18	0.9	9	0.5
Moderate and severe malnutrition	Z<-2	97	4.1	76	3.3
Total malnutrition	Z<-1	363	15.2	304	13.1
Total		2385	100.0	2385	100.0

†Underweight for height, *p<0.05

Table 3: Weekly menu and food composition of cooked meal

Day	Kind of meal	Meal composition
Saturday	Lentil meal	Lentil, potato, tomato paste, bone, fried onion
Sunday	Istambuly with rice	Rice, potato, tomato paste, fried onion
Monday	Lentil with rice	Rice, lentil, tomato paste, fried onion
Tuesday	Potato sauce with rice	Rice, meat, split peas, potato, tomato paste, fried onion
Wednesday	Traditional soup (Ash)	Dried peas, beans, bone, noodle, lentil, tomato paste, fried onion
Thursday	Spaghetti	Spaghetti, soy protein, potato, tomato paste, fried onion
Friday (weekend)	-	-

DISCUSSION

This study showed the prevalence of wasting in all categories of mild, moderate and severe malnutrition among 2385 rural children of 3-6 years old was 15.2%.

Intervention with cooked meal for duration of 175 days was associated with a significant reduction (2.1%) in the prevalence of wasting in these children. Malnutrition arises as a consequence of a sudden period of food shortage and is associated with loss of a persons body fat

and wasting of their skeletal muscles. Many of those affected are already undernourished and often susceptible to disease (Picot *et al.*, 2012) and failure in their growth (height or weight) (Kliegman, 2008). Nutritional interventions are appropriate approaches in improving nutritional indices. Consistent with our result, Malekafzali *et al.* (2000), reported that by nutritional intervention the prevalence of malnutrition, in under five years old children, decreased from 6.5 to 1.8%. In an intervention study in two villages in India, the prevalence of wasting in 525 children of 0-5 years old was 16%. After the nutritional intervention with packed food for 8 months, 6.1% of wasting malnutrition children reached their normal weight for their age, but 25.3% of cases did not improve their weight, it may be due to diarrhea, recurrent respiratory infection, inappropriate feeding parents and lack of parent's nutritional knowledge (Bhargava *et al.*, 1982). In the present study, the prevalence of malnutrition (wasting) and its severity was more in girls than boys. This finding is in agreement with results of WHO (2006a,b). Others (Veghari and Jahanshahi, 2007; Singh *et al.*, 2006; Rezaeian *et al.*, 2009) in their study reported the same results. Perhaps this higher prevalence of malnutrition in girls could be due to traditional thought in rural community in which boys could earn more money for family by working in the factories and farms. Thus, this attitude attracts more attention of the family to get boys' nutritional need than girls, so malnutrition is less prevalent in boys in this community. However, in some other countries the opposite of this issue has been seen (Bisai and Mallick, 2011). Its reason may be that girls tend to be trained by their mothers, especially in the kitchen and simply have more access food. This difference appears to be linked with gender distribution in the community. Although, Khattak and Ali (2010) reported no significant differences between the children's sex in height and weight was seen. The present study showed that the overall prevalence of moderate and severe wasting was 4%. Compared with neighboring countries, the rate of wasting was lower in the present study than that of Pakistan (13.2%) and Afghanistan (6.7%), similar to Iraq (4.8%) and higher than Azerbaijan (2.4%) (De Onis and Blossner, 2003; Corvalan *et al.*, 2008). In a study in Turkey was carried out on 1400 children under the age of 5 years, the prevalence of wasting has been reported as 8.2% (Ergin *et al.*, 2007). Also, in rural areas of Nigeria, the prevalence of wasting in children has been 9% that both of those studies showed the higher prevalence compared to the present study (Senbanjo *et al.*, 2007). Compared with other countries, the prevalence of malnutrition in our study has been less than that of Bangladesh, Yemen, Brazil, Egypt, Nigeria, Oman, Indonesia and more than that of United States (El Mouzan *et al.*, 2010),

Argentina (1.2%) and Mexico (1.6%) (Sheikholeslam *et al.*, 2004). Nutritional intervention can cause improvement of physical growth. In the most intervention studies in other countries the children were receiving preventive supplements with either ready-to-use supplementary foods (RUSFs) or ready-to-use therapeutic foods (RUTFs) (Isanaka *et al.*, 2010). To our knowledge this is the first intervention study with cooked meal has been done to reduce the occurrence of malnutrition in the country. Interventions in reducing child malnutrition in the country were generally based on maternal education and monitoring the children's health in health centers. However, it must be mentioned that there are limitations in the present study including the lack of detailed information on socioeconomic status, non-availability of data on micronutrients of dietary intake and children's physiological growth has also been during the intervention. Strengths of the study are that used cooked food that are commonly available and consumed by the public, also the meal was prepared in the nursery. According to our results some health strategy such as nutritional intervention that carried out by health managers in other region of country can improve the anthropometric indices and reduce acute malnutrition in children. It is recommended that nutritional intervention with cooked meal continues in other rural communities. Reducing the rate of malnutrition in the country more effectively requires serious intersectional collaboration between the liable organizations such as Ministries of Education, Agriculture, Health and so forth. Future studies are necessary to follow the physical growth among these children in this region.

ACKNOWLEDGMENTS

Hereby, the authors express their sincere gratitude to Mr. Azizkhani, the head of Nutrition Unit, Department of Health, Qazvin University of Medical Sciences and all nutrition experts who helped us do this project in the province.

REFERENCES

- Bhargava, A., S.D. Gupta, D.K. Mangal, S. Joshi and T.P. Jain, 1982. Nutritional intervention among rural pre-school children: An evaluatory study. *Indian J. Pediatrics*, 49: 695-699.
- Bisai, S. and C. Mallick, 2011. Prevalence of undernutrition among kora-Mudi children aged 2-13 years in paschim medinipur district, West Bengal, India. *World J. Pediatr.*, 7: 31-36.

- Corvalan, C., A.D. Dangour and R. Uauy, 2008. Need to address all forms of childhood malnutrition with a common agenda. *Arch Dis. Child*, 93: 361-362.
- De Onis, M. and M. Blossner, 2003. The world health organization global database on child growth and malnutrition: Methodology and applications. *Int. J. Epidemiol.*, 32: 518-526.
- De Onis, M., C. Garza, A.W. Onyango and E. Borghi, 2007. Comparison of the WHO child growth standards and the CDC 2000 growth charts. *J. Nutr.*, 137: 144-148.
- El Mouzan, M.I., P.J. Foster, A.S. Al Herbish, A.A. Al Salloum, A.A. Al Omar and M.M. Qurachi, 2010. Prevalence of malnutrition in Saudi children: A community based study. *Ann. Saudi. Med.*, 30: 381-385.
- Ergin, F., P. Okyay, G. Atasoylu and E. Beser, 2007. Nutritional status and risk factors of chronic malnutrition in children under five years of age in Aydn, a western city of Turkey. *Turk. J. Pediatr.*, 49: 283-289.
- Hall, J.G., U.G. Froster-Iskenius and J.E. Allanson, 2007. *Handbook of Physical Measurements*. Oxford University Press, New York, pp: 240-242.
- Isanaka, S., T. Roederer, A. Djibo, F.J. Luquero, N. Nombela, P.J. Guerin and R.F. Grais, 2010. Reducing wasting in young children with preventive supplementation: A cohort study in Niger. *Pediatrics*, 126: e442-e450.
- Khattak, M.M.A.K. and S. Ali, 2010. Malnutrition and associated risk factors in pre-school children (2-5 Years) in District Swabi (NWFP)-Pakistan. *J. Med. Sci.*, 10: 34-39.
- Kliegman, R., 2008. *Nelson Textbook of Pediatr.* 18th Edn., Chapter 43, Saunders Elsevier, Philadelphia, PA., pp: 900-943.
- Kuczarski, R.J., C.L. Ogden, L.M. Grummer-Strawn, K.M. Flegal and S.S. Guo *et al.*, 2000. CDC growth charts: United States. *Adv. Data*, 314: 1-27.
- Malekafzali, H., Z. Abdollahi, A. Mafi and M. Naghavi, 2000. Community-based nutritional intervention for reducing malnutrition among children under 5 years of age in the Islamic republic of Iran. *East Mediterranean Health J.*, 6: 238-245.
- Mei, Z., C.L. Ogden, K.M. Flegal and L.M. Grummer-strawn, 2008. Comparison of the prevalence of shortness, underweight and overweight among US children aged 0 to 59 months by using the CDC 2000 and the WHO, 2006 growth charts. *J. Pediatr.*, 153: 622-624.
- Mei, Z., L.M. Grummer-Strawn, A. Pietrobelli, A. Goulding, M.I. Goran and W.H. Dietz, 2002. Validity of body mass index compared with other body-composition screening indexes for the assessment of body fatness in children and adolescents. *Am. J. Clin. Nutr.*, 75: 978-985.
- Nemati, A., M. Barak, A.N. Baghi, N. Abbasgholizadeh and F. Homapour *et al.*, 2008. Relationships between anthropometrical indices and socio-economic differences for children at 6 years old living in urban areas of Ardebil, Iran. *J. Applied Sci.*, 8: 3748-3752.
- Olsen, I.E., M.R. Mascarenhas and V.A. Stallings, 2003. *Clinical Assessment of Nutritional Status*. In: *Nutrition in Pediatrics Basic Science and Clinical Applications*, Walker, W.A., J.B. Watkins and C. Duggan (Eds.). 3rd Edn., B.C. Decker Inc., Hamilton, Ontario, pp: 6-20.
- Picot, J., D. Hartwell, P. Harris, D. Mendes, A. Clegg and A. Takeda, 2012. The effectiveness of interventions to treat severe acute malnutrition in young children: A systematic review. *Health Technol. Assess.*, 16: 1-316.
- Rayhan, M.I. and M.S.H. Khan, 2006. Factors causing malnutrition among under five children in Bangladesh. *Pak. J. Nutr.*, 5: 558-562.
- Rayhan, M.I. and M.S.H. Khan, 2006. Factors causing malnutrition among under five children in Bangladesh. *Pak. J. Nutr.*, 5: 558-562.
- Rezaeian, M., G. Hassanshahi, Z. Salem, A. Shamsaee, A. Tourousian, R. Hazare and S.Z. Tabatabai, 2009. Nutritional status in a sample of the Afghan immigrant children within Iran. *Pak. J. Biol. Sci.*, 12: 726-729.
- Senbanjo, I.O., O.O. Adeodu and E.A. Adjuyigbe, 2007. Low prevalence of malnutrition in a rural Nigerian Community. *Trop. Doct.*, 37: 214-216.
- Sheikholeslam, R., M. Kimiagar, F. Siasi, A. Abdollahi and A. Jazayeri *et al.*, 2004. Multidisciplinary intervention for reducing malnutrition among children in the Islamic Republic of Iran. *East Mediterr. Health J.*, 10: 844-852.
- Singh, M.B., R. Fotedar, J. Lakshminarayana and P.K. Anand, 2006. Studies on the nutritional status of children aged 0-5 years in a drought-affected desert area of Western Rajasthan, India. *Public Health Nutr.*, 9: 961-967.
- Veghari, G. and M. Jahanshahi, 2007. Changes in malnutrition among under 5 years old children in North of Iran. *J. Biol. Sci.*, 7: 1424-1429.

- WHO, 2005. Management of severe malnutrition: A manual for physicians and other senior health workers. WHO, Geneva, www.who.int/nutrition/publications/malnutrition/en/index.html
- WHO, 2006a. Child growth standards based on length/height, weight and age. *Acta Paediatrica*, 450: 76-85.
- WHO, 2006b. The WHO child growth standards. World Health Organization. <http://www.who.int/childgrowth/standards/en/>
- Walker, R., 2007. Recommendations for preventive pediatric health care. *Pediatrics*, 120: 1376-1379.
- Waterlow, J.C., 1973. Note on the assessment and classification of protein-energy malnutrition in children. *Lancet*, 302: 87-89.