Malnutrition Frequency and Its Family-Related Factors among Infants in Yasuj City in Iran, 2011

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Abstract

Background: Malnutrition is one of the most common hazards which compromise children's health. Previous studies have reported high rates of malnutrition in Kohkilouyeh and Boyer Ahmad.

Objective: This study was conducted to evaluate the frequency of child malnutrition in Yasuj and to explore the association between family characteristics and malnutrition.

Methods: Data were collected from healthcare files of 285 infants aged 18 months and younger in Yasuj health care centers. Data included demographic information and anthropometric measurements at birth and at the last referral to health centers.

Results: Rates of underweight, stunting, wasting, and low head circumference at birth were 17.9%, 13.4%, 27.8%, and 19%, and at the last referral they were 22.5%, 11.3%, 29%, and 15.5%, respectively. The frequency of underweight and wasting had significantly increased and that of stunting and low head circumference significantly decreased during the period between birth and the last referral. Birth wasting was significantly more common in younger mothers, families with fewer children, and shorter birth interval. Birth underweight and small head circumference was significantly associated with shorter birth interval. Child stunting was related to father's education level and child wasting was associated with mother's education. Parents' education did not have any association with birth malnutrition.

Conclusion: Wasting appeared to be the major form of malnutrition among infants in Yasuj. It was very high at birth, and continued to elevate after birth. Elevating educational level of parents (over Diploma), educating parents to keep sufficient interval between pregnancies, and paying more attention to young mothers and those who are delivering their first baby are among strategies to ameliorate child wasting.

Introduction

Despite increasing economic development and appreciable improvement in health, malnutrition is still one of the most important health problems of Iranian children. According to the latest reports from Iran national surveys, the prevalence of moderate to severe cases of malnutrition is approximately 5% in children aged 5 years and younger.[1] Given that the population of children under the age of five was estimated to be about 3,200,000 in national census in 2011,[2] 160,000 children under 5 years of age in Iran are assumed to be involved in moderate and severe malnutrition.

The effects of malnutrition among children are not limited to their childhood but its adverse

effects can be extended to their adulthood and even next generations. Children who are in good nutritional status grow faster, have better educational progress, begin adulthood with better health and well-being, and at last bring physically and mentally healthier children into the society. On the contrary, malnourished children not only have less potential for producing a healthy and productive generation but also due to multiple medical complications usually implicate large magnitude of healthcare system and impose big financial burden on families and societies. Therefore, child malnutrition could be considered as an indicator of nutrition and health status of societies.

Growth indicators commonly used for determination of child malnutrition (protein-energy malnutrition) include weight for age, height for age, and weight to height ratio and their corresponding malnutrition is called underweight, stunting, and wasting, respectively.[3] Generally, underweight is an indicator of recent (acute) malnutrition while stunting results from chronic malnutrition. Children aged 6-24 months are typically at increased risk of protein-energy malnutrition.[3]

Anthropometry and Nutritional Indicators Survey (ANIS) in Iran in 1998 estimated the rates of moderate to severe cases of underweight, stunting, and wasting in children less than five years of age to be 9.5%, 13.9%, and 5.3%, respectively.[1] The next ANIS study in 2004 showed considerable improvements in these rates as moderate to severe cases of underweight, stunting, and wasting were reported to be 5.2%, 4.7%, and 3.7%, respectively.[1] Among Iranian provinces, Kohkilouyeh and Boyer Ahmad had the fourth rank of underweight children less than five years of age in 1998 and the eighth rank in 2004.[1] For wasting, it had the sixth rank in 1998 and the sixteenth rank in 2004 and for stunting this province had the second highest level of stunting in both ANIS studies.[1] Although during the 6-year period from 1998 to 2004 the rate of all forms of malnutrition improved nationally, the rate of stunting, unlike underweight and wasting, did not ameliorate in Kohkilouyeh and Boyer Ahmad province. This study was conducted to determine if the rates of the major forms of malnutrition had changed ever since. On the other hand, as far as we know head circumference has not been assessed as one of the growth indices in such studies and it would be worthwhile to add such information to the literature. Moreover, many studies have investigated associations between child malnutrition and family-related demographic factors, but no study has focused on the possible relationship between family characteristics and malnutrition in newborns. The aim of the current study was to assess the growth status and frequency of malnutrition in infants less than 18 months of age in Yasuj, the capital city of Kohkilouyeh and Boyer Ahmad province, and to evaluate the possible associations between family characteristics and malnutrition.

Methods

This study was conducted in Yasuj, the capital city of Kohkilouyeh and Boyer Ahmad province in Iran, in 2011. By systematic sampling, of the current files of children 18 months old and younger in 4 healthcare centers in Yasuj, 285 files were selected. A questionnaire was used to gather data from the files. Collected information was on age, sex, weight, height, and head circumference of children at birth and at the time of the last referral to the centers, as well as parents' age and literacy, number of children, and birth interval with the previous child. The collected data were kept confidential and used only for research purposes.

Data were statistically analyzed using SPSS software, version 16. To determine the degree of malnutrition, Z scores were determined using Epi Info software according to CDC/WHO standards. Mild, moderate, and severe forms of malnutrition were defined as Z scores <-1, <-2, and <-3, respectively. Normal distribution of the data was examined by Kolmogorov-Smirnov test. In cases of abnormality in distribution of data, non-parametric tests were applied. Chi-squared test was used to compare the frequency of malnutrition between times of birth and the last referral and the association of parents' literacy with the frequency of malnutrition. To compare the frequency of various degrees of malnutrition between different age groups and to compare the frequency of children with one, two, or all three forms of growth (weight, height, and head circumference) failures between birth and the time of the last referral, Chi-squared for trend test was performed. Associations of family characteristics with frequency of malnutrition were examined using Mann-Whitney U test. Statistical significance was set at 5%.

Results

Gender and age of children
Of 285 children whose files were studied, 62 (21.8%) were younger than 6 months old, 118 (41.4%) were between 7 and 12 months old, and 105 (36.8%) were between 13 and 18 months old (Table 1). Totally, 137 (48.1%) were females and 148 (51.9%) were males.

Table 1: Age and sex distribution of the children

Age (months)*	Males	Females	Total
	N (%)	N (%)	N (%)
0-6	32 (11.2%)	30 (10.5%)	62 (21.8%)
7-12	67 (23.5%)	51 (17.9%)	118 (41.4%)
13-18	49 (17.2%)	56 (19.7%)	105 (36.8%)
Total	148 (51.9%)	137 (48.1%)	285 (100%)

*At the time of the last referral to health centers

Frequency of malnutrition

At the time of the last referral to health centers, 22.5% of children were underweight, 11.3% stunted, 29% wasted, and 15.5% had small head circumference (Figure 1). Comparison of the frequencies of malnutrition between birth and the time of the last referral showed that frequency of weight malnutrition (i.e. underweight and wasting) at the time of the last referral was significantly higher than that at birth (underweight: 22.5% compared to 17.9%, P=0.0004; wasting: 29% compared to 27.8%, P=0.025). In contrast, stunting and small head circumference were significantly lower at the last visit in comparison with the time of birth (stunting: 11.3% compared to 13.4%, P=0.001; small head circumference: 15.5% compared to 19%, P=0.006) (Figure 1). At both time points, wasting was the most prevalent and stunting was the least common form of malnutrition among the studied children.

At birth, there was no significant difference in the frequency of underweight and stunting between boys and girls but the frequency of wasting was significantly higher in girls than boys (36.4% compared to 20.5%, P=0.007) (data not shown). Nevertheless, this difference vanished gradually over time because at the time of the last referral there was no difference in frequencies of different forms of malnutrition between the two sexes.

Frequency of malnutrition in different age categories

To see if the frequency of malnutrition is associated with the age of children, frequencies of various degrees of underweight, stunting, wasting, and small head circumference at the time of the last referral were compared between three age categories. Weight malnutrition (i.e. underweight and wasting) was significantly lower in infants less than 6 months of age compared to those aged 7-12 and 13-18 months, while the frequency of small head circumference gradually decreased along with increasing the age of the child (Table 2). The frequency of stunting was not significantly different between different age categories.

Frequency of growth failures

Number of growth failures in weight (wasting), height (stunting), and head circumference (small head circumference) was calculated for each child and the percentages of children with zero,
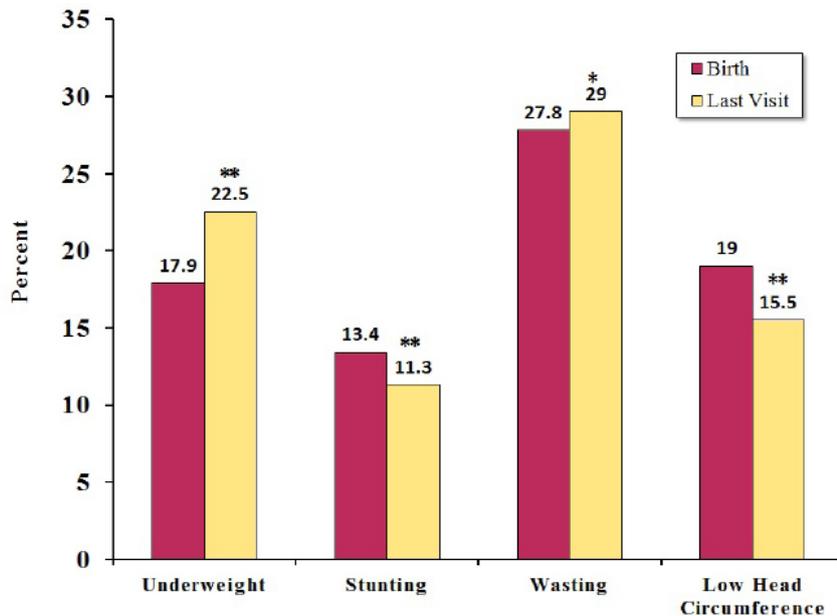

Figure 1: Percentage of various types of malnutrition at birth and the time of the last referral to health centers. *and ** indicate significant differences between birth and the time of the last referral (P<0.05 and P<0.01, respectively).

Table 2: Percentage of malnutrition in different age categories[1]

Malnutrition degree	0-6 months	7-12 months	13-18 months	Total	*P*[2]
Underweight					
Mild	16.1	18.6	22.9	19.7	
Moderate & severe	0	2.5	4.8	2.8	0.038
Total	16.1	21.1	27.7	22.5	
Stunting					
Mild	9.7	6.9	13.3	9.9	
Moderate & severe	1.6	1.7	1	1.4	0.6
Total	11.3	8.6	14.3	11.3	
Wasting					
Mild	14.5	27.6	25.7	24	
Moderate & severe	3.2	1.7	9.5	5	0.008
Total	17.7	29.3	35.2	29	
Small head circumference					
Mild	21	13.7	9.5	13.7	
Moderate & severe	4.8	0.9	1	1.8	0.008
Total	25.8	14.6	10.5	15.5	

[1]The numbers are in percentages. [2]*P* is for the difference in frequencies of malnutrition between different age categories.

one, two, or all three failures were compared between birth and the time of the last visit. At birth, 66.1% of the children were in suitable growth condition regarding weight, height, and head circumference, while this rate had decreased to 56% at the last visit (Figure 2). On the contrary, the percentage of children born with one failure was 26.2% whereas this rate had increased to 37.1% at the last visit. The percentage of children with two types of failure was not considerably different between the two time points. None of children had all three forms of malnutrition.

The number of growth failure in weight (wasting), height (stunting), and head circumference in each child was calculated, and the data were expressed as the percentage of children with zero, one, two, or all three types of failure. Chi-square test for trend showed a significant difference in the frequency of the failure types between the birth and the time of the last visit (*P*=0.009).
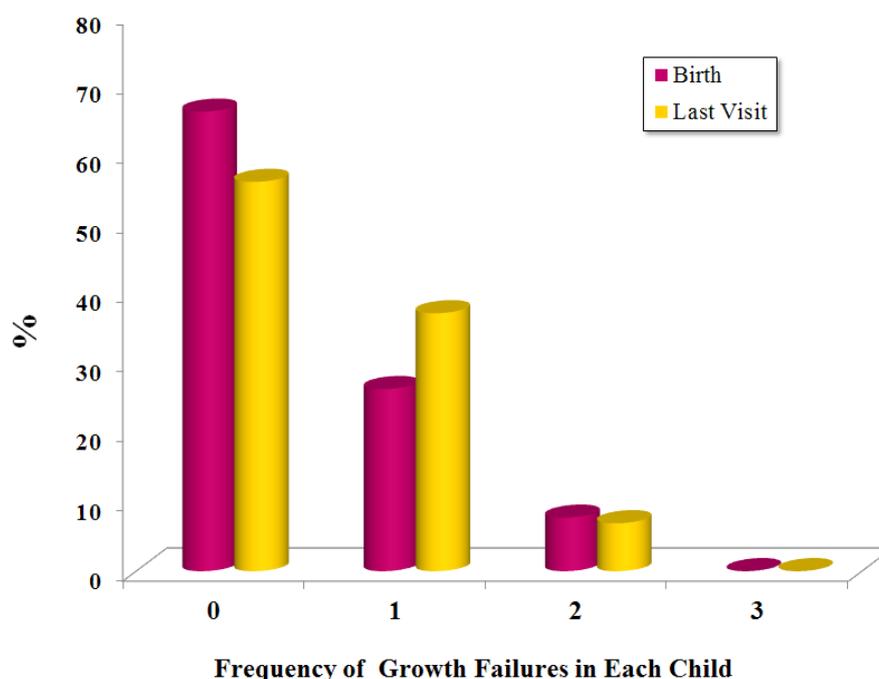

Figure 2: Percentage of children with various number of growth failures at birth and the time of the last visit.

Associations of family-related factors with children malnutrition

The frequency of all types of malnutrition was higher in children whose parents were either illiterate or had an education level less than Diploma, although the difference was only significant for children's wasting with mother's education and their stunting with father's education (Table 3). There was no significant association between the parents' education and any form of malnutrition at birth (data not shown).

The mean age of the mothers whose children had underweight, wasting, or small head circumference at birth was lower than those with normal children, although this association was only statistically significant for children's wasting (Table 4). Also, infants with underweight, wasting, and small head circumference at birth were more likely to be from families with low number of children, although again this was only statistically significant for wasting and was close to the significance level for small head circumference. Infants with underweight, wasting, and small head circumference at birth had significantly less interval with the previous child (Table 4). None of the mentioned family parameters was significantly associated with birth stunting.

Evaluation of the relationship between frequencies of malnutrition at the time of the last referral with mother's age, number of children, and birth interval showed a significant association only between wasting and the number of children; the rate of wasting was higher in families with more children (data not shown).

Discussion

Analysis of growth indices of 285 children aged 0 to 18 months who had healthcare files in Yasuj city health centers showed that at the time of the last referral to the centers 22.5% of children were underweight, 11.3% were stunted, 29% were wasted, and 15.5% had small head circumference. The frequency of underweight and wasting increased and that of small head circumference decreased gradually from the first month of age towards the age of 18 months. Besides, the frequency of stunting was significantly lower at the time of the last visit to health centers compared to the time of birth.

The prevalence of stunting in Kohkilouyeh and Boyer Ahmad has decreased over the last decade. Similarly, Sheykholeslam and colleagues reported that the prevalence of moderate and severe cases of stunting in Iranian children less than 5 years of age diminished from 13.9% in 1998 to 4.7% in 2004.[1] Likewise, Moradi Lakeh and colleagues[4] reported that during a 10-year period from 1997 to 2007 the rate of stunting decreased in children less than 6 months of age in villages of Robat Karim.[4]

Comparison of the rates of various forms of malnutrition between birth and the time of

Table 3: Percentage of malnutrition at the time of the last referral to health centers based on parents' education

Parents' literacy	Underweight	Stunting	Wasting	Small head circumference
Father				
<Diploma	27%	20%	35%	22%
≥Diploma	21%	9%	28%	14%
P value	0.34	0.02	0.32	0.13
Mother				
<Diploma	27%	13%	36%	19%
≥ Diploma	19%	10%	24%	13%
P value	0.12	0.42	0.03	0.15

Table 4: Comparison of mother's age, number of children, and interval with the previous child with different types of malnutrition at birth[1]

Family characteristics	Underweight		Stunting		Wasting		Small head circumference	
	Yes	No	Yes	No	Yes	No	Yes	No
Mother's age	28.8±6.1	30.7±6.8	30.7±6.3	30.1±6.7	29.1±7.0	30.4±6.5	29.2±6.1	30.4±6.7
P value	0.09		0.59		0.03		0.15	
Number of children	1.8±1.1	2.3±1.5	2.5±1.6	2.2±1.4	2.1±1.5	2.2±1.4	1.9±1.4	2.3±1.4
P value	0.21		0.21		0.009		0.052	
Birth interval	1.8±2.8	3.5±4.3	3.6±5.1	3.0±4.0	2.6±4.9	3.2±4.0	2.3±4.5	3.3±4.1
P value	0.027		0.73		0.002		0.007	

[1]The numbers are the Mean ± SD.

the last visit to the health centers revealed that the rate of wasting and underweight had significantly increased and that of stunting and small head circumference decreased during this time interval. In agreement with this study, Nakhshab and Nasiri[5] reported that the rate of underweight increased after 6 months of age in children aged 2 years and younger in Sari. Nevertheless, Kabir and colleagues reported an increase in the prevalence of wasting, stunting, and underweight with increasing age in children younger than 2 years,[6] which is in the same line with the results of the present study for wasting and underweight but is contradictory for stunting. Numerous studies have demonstrated fever, diarrhea, and respiratory infections as the major causes of wasting in children.[7-9] Adherence to hygiene guidelines, which prevent transmission of infections to children could effectively improve their nutritional and growth status and positively prevent occurrence of diseases and subsequent weight loss.

Improvement in neonatal small head circumference after birth, as observed in children of this investigation, is desirable and can be accompanied with neurocognitive development.[10] On the contrary, amelioration of fetal weight and height shortcomings, commonly called catch-up growth, is suggested to be associated with central obesity, insulin resistance, and cardiovascular diseases later in life.[11-13] Even though the association of catch-up growth with obesity and insulin resistance is more reasonable and expected for weight catch-up, height catch-up has also been shown to increase the risk of insulin resistance.[13] Therefore, strategies to improve fetal growth development and to prevent bearing low weight and height babies might enhance the health of the individual in future life.

The relationship between children's malnutrition and parents' education has been reported in previous studies as well. For instance, in two independent studies underweight was more prevalent in children under the age of 2 years whose mothers were illiterate.[5, 6] Likewise, underweight was negatively associated with parent's educational level in 6-30 months old children.[14] We did not find an association between mothers' educational level and forms of malnutrition at the time of birth. Investigators from Qom also reported no association between mothers' education and the rate of low birth weight neonates.[15] In contrast, a study from Kerman showed that mothers with high school or academic education delivered heavier babies compared to either illiterate or low literate mothers.[16] Cultural diversities and economic variations could be reasons of such discrepancies.

The frequency of birth wasting was associated with mothers' age; younger mothers were more likely to bear a baby with wasting. In the literature, we did not find studies reporting associations between birth wasting (low birth weight to height ratio but not birth weight itself) and maternal characteristics, but there are a number of reports indicating associations between maternal factors and low birth weight. A group of investigators in Babol reported that mothers aged 19-30, compared to those younger than 19 or older than 35, were at lower risk of delivering a low birth weight baby.[17] In contrast, a study from Tonekabon found no relationship between mothers' age and low birth weight.[18] We also did not find a significant association between mother's age and birth underweight (although it was close to be significant, P=0.09) but the association was significant for wasting. The positive effect of mother's age on the child's birth weight could be a consequence of age-related increase of visceral adipose tissue,[19] which through raising glucose, free fatty acids, and triglycerides in mother's blood[20] can contribute to the fetus's growth. The positive association between mother's age and fetal growth has been reported.[21]

Birth wasting was the only form of malnutrition investigated in the current study with a significant association with the number of children; wasted newborns were more likely from families with lower number of children. A part of negative association between birth wasting and the number of children was related to children who are the first child of their mothers. In agreement, in Bandarabas, children who were the first child were at increased rate of having low birth weight.[22] A similar association has been reported between the prevalence of wasting and the number of siblings in Brazilian children under the age of 5 years.[23] The association of birth wasting (or underweight) with the number of children is in parallel with the aforementioned association of wasting with mother's age. It is generally assumed that the higher the age of the mother, the higher the number of her children. So, as stated in the previous paragraph, the lower rate of wasting in families with more children could be a result of higher amounts of mothers' adipose tissue.

Children with any case of wasting, underweight, or small head circumference had significantly shorter birth interval with the previous child. Similarly, in a study in Bandarabas the risk of low birth weight was higher in children with the previous birth interval less than 2 years.[22] Likewise, in a study in Tonekabon the likelihood of having a low birth weight child was higher when birth interval was less than 3 years.[18] Also, numerous investigators reported associations

between short birth interval and occurrence of various forms of malnutrition including wasting, stunting, and underweight.[24, 25]

Unfortunately, none of previous investigations, as far as we know, have paid attention to possible associations between infants' head circumference and family characteristics such as parents' education, mother's age, birth interval, etc. In this study, among the examined family parameters a significant association was found between birth interval and small head circumference. It is good to note that the growth of head has been recognized as a marker of brain growth and cognitive development in early life, with presumably subsequent rise in intelligence quotient and psychosocial and educational functioning.[10, 26, 27] Therefore, it would be worthwhile to have investigations on possible parameters affecting head growth.

Limitations

One limitation of the present study was that all children less than 18 months of age may not have been taken to public healthcare centers for growth monitoring; instead their growth may have been monitored by physicians in private clinics and offices. However, because the vaccination in the healthcare system is performed free of charge, most people prefer to attend such a system for vaccination as well as growth monitoring of their children. Therefore, the estimated rates of malnutrition reported herein are expected to be close to the actual situation of malnutrition.

Future research

Rural areas of Yasuj were not included in this study. It would be worthwhile to conduct similar studies in rural regions of Yasuj city as well. Also, performing widespread investigations throughout the country every five years or so is necessary to delineate the status of children's growth and malnutrition and outline future strategies for improvement. As stated above, data is also lacking on family-related risk factors of small head circumference and the impact that malnutrition may have on head growth and cognitive development in children.

Conclusion

The current study shows increases of wasting and underweight and decreases of stunting and small head circumference during the first 18 months of life in Yasuj children. Although the reduction of stunting and small head circumference is promising, the high rate of underweight and wasting is alarming considering that the rate of wasting was quite high in the studied children. On the other hand, wasting which is a form of acute malnutrition could lead, in long term, to stunting that is a form of chronic malnutrition and can impact the child's future life more seriously. Promoting educational level over Diploma in the society is of ways to prevent wasting and stunting among children. Another way to decrease the rate of child wasting is to improve fetal growth in order to prevent the birth of wasted newborns, and to achieve this, parents should be encouraged to keep enough time interval between pregnancies. In addition, younger mothers and those who are delivering their first baby are at increased risk of bearing a wasted child; and therefore, they should take more care of their diet during pregnancy.

Acknowledgments

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