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Nutritional Status of Infants and Some Related Risk Factors in Shahroud, Iran

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Abstract

Background: *This study aimed to assess the nutritional status of children under two years old in two time periods in 1995 and 2016 in rural areas of Shahroud.*

Methods: *This cross-sectional descriptive analytical study enrolled 1443 participants selected by cluster sampling in 1995 and 2016. We calculated the mean standard deviation of weight for age, height for age, and weight for height and compared them with international reference values (WHO/NCHS). The obtained values which were two standard deviations below the mean reference values were defined as wasting, underweight, and stunting. The collected data was analyzed in SPSS software at a significance level of 0.05 using descriptive statistics, chi-square test, and regression analysis.*

Results: *In this study, 1443 children under two years old were studied over two time periods in 1995 and 2016. The results showed 14.9%, 29.5%, and 7.3%, in 1995 and 9.2%, 10.1%, and 4% in 2016 suffered from underweight, wasting, and stunting, respectively. Among the factors involved in malnutrition in 1995 were parents' education, family size, child gender, birth order, type of the first complementary food, diarrhea, acute respiratory infection in the two weeks prior to the study, and exclusive breastfeeding. In 2016, we observed significant relationships between the body mass index (BMI), underweight, wasting, exclusive breastfeeding, and all three types of malnutrition.*

Conclusions*: Despite a reduction in the prevalence of different types of malnutrition, it is still a common problem. When designing family physician program and children growth and development, special attention must be paid to promote breastfeeding.*

Keywords: Nutritional status, Infancy, Iran.
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Introduction

Nutritional status evaluation is one of the most fundamental global strategies for preventing malnutrition and improving child health.[1] Due to the high prevalence of malnutrition and its relationship with high rates of child mortality, impaired physical growth, and inadequate social and economic growth in affected communities, malnutrition is considered the most important nutritional disease in developing countries.[2] The results of previous studies have shown that 70% of children suffering from malnutrition live in Asia and the highest prevalence of malnutrition is observed among toddlers and pre-school children.[1] During the first two years of life, which is characterized by rapid physical and social growth and development, adequate dietary intakes in babies impacts their reactions to the environment.[3,4] For several decades, researchers have conducted many studies searching for the cause or set of causes for malnutrition and adopting appropriate intervention strategies. Malnutrition is a multi-dimensional problem and its causes are complex and interrelated.[5] Factors affecting the nutritional status of children in a region may not have any impact on the nutritional status of children in another region; hence, the assessment of the nutritional status and identification of risk factors leading to or intensifying the problem can be the first step to solving the problem.[6] In addition, some studies emphasize and recommend direct investments in health services to improve the nutritional status of children in low-income and middle-income countries.[7] Studies carried out in Iran in recent decades show a marked decline in the percentage of children suffering from malnutrition and growth disorders across the country. However, in low-income and middle-income countries and also Iran, the problem is still considered a major issue needing high priority intervention.[8] Also, due to the presence of family physicians in comprehensive health centers in villages as the country's protocol, and since a family physician is responsible for providing comprehensive health services, including child growth monitoring services, results will inevitably lead to continuous follow-up care for children in the community to maintain or improve their health and make further progress.[9, 10] In another study (urban infants, Shahroud 2015), the percentage of underweight, wasting, and stunting was determined to be 1.7%, 5.4%, 9.5% respectively.[11] A child without access to adequate food, health, and educational services will probably suffer from developmental disabilities such as physical, mental, and individual problems. Each person has only one chance for growth; if deprived of this, his/her health will not be restored with better hygiene and nutrition in the future. The aim of this study was to assess the nutritional status of children under two years old in two time periods in 1995 and 2016 in the rural areas of Shahroud covered by the health and nutritional services provided by the Family Physician Health Team.

Materials and Methods

This cross-sectional study was conducted as a descriptive analytical study. Taking into account the prevalence of the disease in the region and country reported by a similar study,[12] we set a significance level of 0.05 to determine the sample size in 1995; as a result, the sample size was estimated to be about 656 children under two years old.

The initial population of the study comprised all children of 0-24 months old living in villages around Shahroud city. Of these, 737 children were selected by cluster sampling.

We used two-stage cluster sampling method. For this purpose, the total number of people living in the villages of Shahroud city was cumulatively calculated to be 88,327; thirty clusters were considered in the area. To determine the distance between

the clusters, the cumulative number was divided into the number of clusters, so that the distance between each cluster with the next cluster was 2944. At this stage, a random number was selected between one and 2944. The resulting number (1420) was the determinant of the location of the first cluster. In other words, the closest cumulative frequency to 1259 was the first place and by adding the number of distances between each cluster to the number of previous clusters, the location of the next cluster was determined; in the end, 30 clusters were determined. After determining the villages under study, the teams visited the geographical center of each village with the questionnaires. After adjusting the north side of the navigation, the designated houses and route of movement were numbered. Then between the first and the last house number, numbers were selected randomly with the aid of a calculator. The selected number was the number of the first house chosen for sampling. Sampling continued from this house until at least 25 infants aged 0-24 months were selected in each cluster. The same villages were visited in 2016. If the number of samples in the cluster was small, sampling was carried out from the neighboring village.

The members of the study group included two teams consisting of team leader, questioners and driver.

During this study, the researcher tried to observe the following points.

1. Permission to carry out the research was obtained from Shahroud University of Medical Sciences.

2. The title and objectives of the study were explained to each of the sample population at the beginning of the study.

3. Participants in the study were informed of the voluntary nature of the study. They were fully informed and consented to participate in the study. They were able to quit the study at every stage of research.

4. The participants were thanked for their participation in this study.

5. Participants in the study were reassured that results would be available to them on request.

The questionnaire was completed by interviewing the mother. The questionnaire included information about the household and anthropometric measurements of the mother and child. In order to ensure a higher level of certainty, 738 children under two years old were enrolled in the study. The samples were selected with the two-stage cluster sampling method. After determining the villages under study, the required data was collected by the research team using a self-administered questionnaire, face-to-face interviews with mothers, and visiting their homes. Anthropometric data was collected using a weight scale (designed for children under two years old) which was calibrated by a control weight and a supine baby stadiometer. Weight was recorded while the participants were minimally clothed using a digital weighing scale (Seca, Germany) with 0.10 kg accuracy. Infants' and toddlers' height and length were measured barefoot using a measuring board for babies and toddlers with 0.10 cm accuracy by trained health service staff. In this study, we calculated the mean standard deviation of weight for age, height for age, and weight for height, and then compared them with international reference values (WHO/NCHS). The obtained values which were two standard deviations below the mean reference values were defined as wasting, underweight, and stunting.[13, 14, 15] In 2016, a total of 705 children were selected from the same clusters. Using the same methods used in 1995, the anthropometric measurements were carried out in the same months of the year. The collected data was analyzed in SPSS software at a significance level of 0.05 using descriptive statistics, chi-square test, and regression analysis.

Results

In this study, 1443 children under two years old were studied in two time periods in 1995 and 2016. The results showed that in studied infants under 24 months old, 14.9%, 29.5%, and 7.3% in 1995, and 9.2%, 10.1%, and 4% in 2016 respectively, suffered from underweight, wasting, and stunting. Table 1 presents the frequency distribution of the infants' age and gender in 1995 and 2016.

Table 1. Frequency distribution of children age and gender in 1995 and 2016

Variables	1995 N (%)	2016 N (%)
Gender		
- Female	344 (46.6)	49.9 (352)
-Male	53.4(394)	353 (50.1)
Total	100(738)	100 (705)
Age (Months)		
0-11	50.14 (370)	374 (53)
12-24	49.86 (368)	331 (47)
Total	100(738)	705 (100)

The results showed that in studied infants under 2 years old, 14.9%, 29.5%, and 7.3% in 1995, and 9.2%, 10.1%, and 4% in 2016 respectively, suffered from underweight, wasting, and stunting. The results showed underweight, wasting, stunting were found to be 0.15 (CI: 0.12-0.17), 0.073 (CI: 0.05-0.09), 0.29 (CI: 0.26-0.33) and 0.09 (CI: 0.07-0.11), 0.1 (CI: 0.08-0.12), 0.04 (CI: 0.03-0.05) in 1995 and 2016 respectively. Figures 1, 2 and 3 present the status of malnutrition by gender in the study population.

In 1995, all three indices of nutritional status were linked to gender, as girls had a poorer nutritional status. However, we did not observe such a significant relationship in 2016. Considering the age of the participants, the relationships were statistically significant in both years, except for wasting in 2016. (Table 2)

Regarding the socioeconomic characteristics of the participants in 1995, 60.3% of the households had a family size of less than four people, 14.4% of the fathers and 17.5% of the mothers were illiterate, 4.3% of the fathers were unemployed and 93.8% of the mothers were employed. In 2016, 78.2% of the households had a family size of less than four people, 3% of the mothers and 2.1% of the fathers were illiterate, 41.1% of the mothers were educated up to high school, 1.4% of the fathers were unemployed, and 93.5% of the mothers were housewives. The 2016 socioeconomic factors, nutritional status, literacy, and parents' jobs showed the three indices of malnutrition. Concerning the relationship between maternal factors and the infants' nutritional status,there was a significant

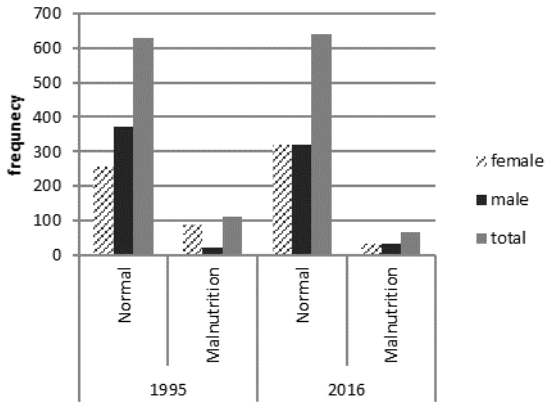

Figure 1. Comparison of nutritional status (underweight) in infants in 1995 and 2016

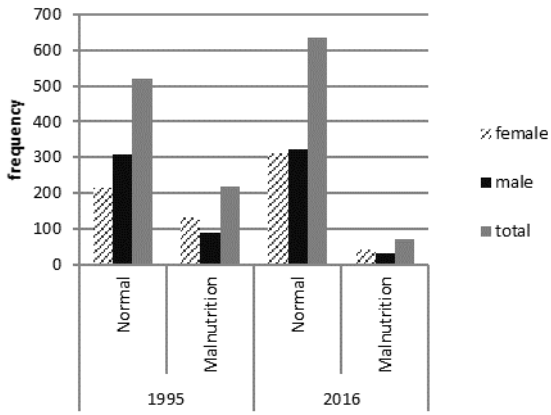

Figure 2. Comparison of nutritional status (stunting) in infants in 1995 and 2016

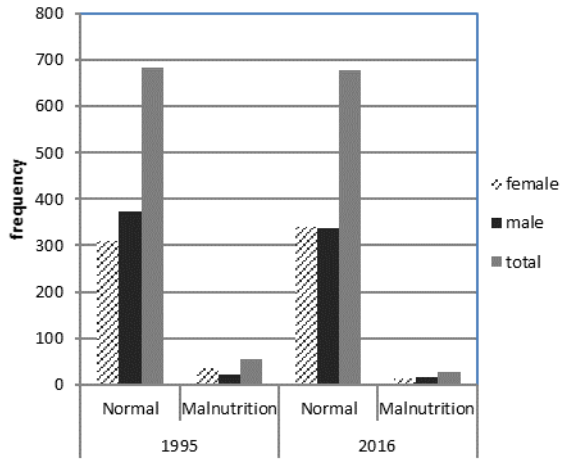

Figure 3. Comparison of nutritional status (wasting) in infants in 1995 and 2016

relationship between the mother's BMI and underweight (P=0.028) and wasting (P=0.004). However, the mother's BMI and history of malnutrition had no significant relationship with low birth weights. Factors related to infant nutrition, stunting, wasting (P=0.028) and underweight (P=0.006) had a significant relationship with exclusive breastfeeding. In addition, on-time use of complementary foods had a statistically significant relationship with underweight (P=0.041). The factors of height for age (stunting) (P=0.023) and weight for age (underweight) (P=0.011) had significant relationships with weaning time. However, we did not observe a significant relationship between the infants' nutritional status and weaning methods.

As the results showed, malnutrition had no significant relationship with incidences of diarrhea in the previous two weeks and the frequency of pneumonia in the last month before the study. Overall, 6.4% of babies were born to mothers who had had another delivery within a time interval of less than three years. There was no significant relationship between delivery time interval and anthropometric indices. Table 3 presents the relationships between some socioeconomic factors and maternal physiological factors, factors related to infants (nutritional and non-nutritional factors), and the nutritional status of infants in the two studied time periods.

Multivariate logistic regression analysis showed that in 1995, mothers' illiteracy rates (P<0.004), family size (0.04) and employment (0.002) were the most important independent variables influencing underweight. Nutritional status (Weight for age) of the infants. The most important factor influencing nutritional status in the past was found to be the family size (P<0.008), whereas the mothers' illiteracy (P<0.007) was the most important variable influencing nutritional status today.

Physiological factors related to the mother: birth spacing (P<0.03) and mother's height (P<0.002) were the most important variables influencing underweight. Mother's height (P<0.0001) and age (P<0.001) were the factors that influenced stunting. Factors related to the child: birth spacing (P<0.04), number of diarrhea episodes within the previous two weeks (P<0.0001), child care (P<0.0008), and birth weight (P<0.0005) were found to be the most important factors influencing Wt./age. Moreover, ARI (P<0.001) and birth weight (P<0.002) were found to be the most important influencing factors influencing stunting, and birth spacing (P<0.001), diarrhea during the previous two weeks (P<0.001), and healthcare (P<0. 04) were all found to be the most important influencing factors on the current nutritional status (wasting). Results analysis in 2016 also showed that infants whose birth weights were below 2500 grams were approximately seven times more likely to have height for age (HAZ) than other infants. Infants who had been breastfed for less than 6 months had approximately a three-fold increase in HAZ. Infants whose birth weights were less than 2500 grams were about four times more likely weight for age (WAZ), and mothers who were overweight were more than five times more likely to have weight for height (WHZ) than other mothers.

Table 2. Frequency distribution of malnutrition in infants under two years of age by age and gender.

Variables	1995						2016					
	Underweight		Stunting		Wasting		Underweight		Stunting		Wasting	
	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal
Age												
<12	331 (89)	39 (11)	264 (71)	106 (29)	358 (97)	12 (3.25)	363 (95.5)	17 (4.5)	335 (93.3)	25 (6.6)	369 (97.1)	11 (2.9)
12-24	297 (80.7)	71 (19.3)	256 (69.6)	112 (30.4)	326 (88.7)	42 (11.4)	277 (85.2)	48 (14.8)	279 (85.8)	46 (14.2)	308 (94.8)	17 (5.2)
P.V	0.005*		0.0001*		0.0005*		0.001*		0.001*		0.113	
Gender												
Female	257 (74.4)	87 (25.3)	213 (61.9)	131 (38.1)	310 (90.1)	34 (9.9)	302 (92.6)	24 (7.4)	311 (95.6)	15 (4.6)	311 (95.4)	15 (4.6)
Male	371 (94.2)	23 (5.8)	307 (77.9)	87 (22.1)	374 (94.9)	20 (5.1)	354 (93.2)	26 (6.8)	353 (92.9)	27 (7.1)	368 (95.5)	17(4.5)
P.V	0.0001*		0.0001*		0. 05*		0.788		0.161		0.0935	

* Significance level of 0.05

Table 3. The effect of different factors on malnutrition by multiple logistic regression in 2016.

Variables	β	S.E	Wald	P.V	OR	Confidence Interval
HAZ						
Age	0.096	0.02	20.6	<0.001	1.1	(1.05,1.15)
Birth weight <2500 g	1.99	0.402	24.55	<0.001	7.3	(3.33,16.1)
Birth weight >2500 g	-	-	-	-	-	-
Breastfeeding <6 months	1.12	0.57	3.8	0.04	3.1	(1,9.4)
Breastfeeding >6 months	-	-	-	-	-	-
WAZ						
Age	0.07	0.02	14.5	<0.001	1.07	(1.03,1.12)
Birth Weight <2500	1.43	0.36	15.4	<0.001	4.16	(2.04,8.4)
>2500	-	-	-	-	-	-
WHZ						
Mother's normal BMI	-	-	-	-	-	-
Overweight	1.65	0.75	4.9	0.02	5.2	(1.2,22.5)
Obese	0.22	0.87	0.06	0.7	1.25	(0.22,6.9)

Discussion

The results of this study indicate a reduction in different types of malnutrition in 2016, as compared with 21 years ago; however, malnutrition still exists. According to the results of a study conducted by Emamian et al (2011) on children under five years old, the prevalence of underweight, wasting, and stunting were 7.7%, 4.5%, and 10.3% respectively.[16] The prevalence of wasting and stunting is almost similar, but the prevalence of underweight has increased. The observed discrepancy appears to be due to differences in the age groups of the participants. This finding highlights the important role of nutrition and family after weaning. Furthermore, it suggests the lack of appropriate interventions for wasting which results in malnutrition in the present time.

In a study by Namakin et al. (2014) conducted using NCHS standards, the prevalence of underweight, stunting, and wasting in children under two years old age were 6.5%, 37.3% and 1% respectively;[17] thus, the children in our study had a better status in terms of malnutrition (stunting). Onis et al. (2004) conducted a review study to estimate the prevalence of underweight among 31 million children under five years old in 139 countries between 1990 and 2015. According to the results of their study, time plays a major role in reducing the prevalence of malnutrition (underweight), such that in the Eastern Mediterranean region it went down from 12.9% in 1990 to 9.2% in 2015. This finding is consistent with our results.[13]

The status of the children in our study in 2015 was better than that in Cameroon (2015), Peru and Haiti (2014).[6, 18, 19] In comparison with children living in poor areas of China (2009), the children in our study had a worse status in terms of wasting; however, our participants had a better status in terms of other anthropometric indices.[20] In a meta-analysis study, researchers evaluated the results of the mentioned study in the mentioned region and compared them with those of some developing countries like India. The results showed that all anthropometric indices had a worse status, as compared to those of the infants in the region.[21] The results of this study and other studies indicate that chronic malnutrition (stunting) is more prevalent than other anthropometric indices of malnutrition. Although this type of malnutrition is lower than that in previous years, it is still a problem for all communities, including those living in this region.[22,23] In our study, consistent with the results of Emamian et al's study,[6] girls had a worse status than boys in terms of underweight and stunting, however, the difference was not statistically significant. Nevertheless, it is inconsistent with the results of a meta-analysis by Wamani and a study conducted in southwestern Iran.[24,25] Some studies in Iran reported no differences between the two genders in terms of nutritional status.[26] It appears that differences in Asian and African ethnicities and cultures can be influencing factors. The improvement in anthropometric measures can be attributed to higher rates of literacy among parents (as compared with the past), increased accessibility of healthcare facilities, and the presence of health teams headed by a family physician in all rural areas.

In this study, mother's BMI had a significant relationship with underweight and wasting. In addition to mother's BMI, her diet quality must be taken into consideration, because in this study we had some cases of overweight and obesity which could impact the birth weight.[27,28]

No significant relationship was observed between parents' education and employment, and diarrhea and respiratory infections in the last two weeks of diarrhea or acute respiratory infection, whereas in the study conducted 20 years ago, all these parameters were effective in malnutrition and affected all three anthropometric indices. These results suggest an increasing progress in developing countries, better accessibility to primary healthcare services, and the availability of mobile or resident physicians in rural health centers. Moreover, exclusive breastfeeding is one of the positive factors influencing underweight, stunting, and wasting because like two years ago, it is still affecting these three indices; this finding is consistent with the results of a study by Mushtaq.[29] The effects of exclusive breastfeeding and its importance have been reported by other studies as well. For instance, according to a study by Sharifzadeh, breastfeeding was reported as one of the factors affecting infant mortality. Other studies have also confirmed this finding.[30-32] Even complementary feeding can be effective in children's nutritional status;[33] its ingredients can also be effective.[34] These results highlight the importance of breastfeeding; as a result, special attention must be paid to complementary foods and proper nutrition for children.

In this study, age had a statistically significant relationship with stunting and underweight. As observed, children over one year old suffered from chronic malnutrition, stunting, and current and past underweight. This finding is in line with the results of studies which investigated the prevalence of malnutrition in two regions in Libya where the highest rate of malnutrition was observed in the age group 1-2 years old; it is also consistent with the results of a study in Egypt.[34-36] It highlights the significance of family food basket.

Seemingly, it is necessary to make the effort of training mothers in breastfeeding, especially exclusive breastfeeding. In addition, it is essential to provide resident physicians and health staff with the required training and frequent update of information. In addition, baby-friendly hospitals must play their part to train people in exclusive breastfeeding.

The results of other studies confirm that the time of starting breastfeeding, its insufficiency in early infancy, reduced levels of proper breastfeeding, and the late start and inadequate use of complementary feeding are among the factors involved in the prevalence of malnutrition after six months of age. Based on the obtained results, it can be concluded that the prevalence of malnutrition in Shahroud is higher than previously estimated provincial rates. However, as compared to 21 years ago, there is a lower prevalence of all indices, although malnutrition is still prevalent. Except for some factors such as breastfeeding, complementary feeding, and BMI, the other factors did not affect malnutrition. Hence, it is necessary to quickly adopt interventional training programs and pay special attention to breastfeeding promotion plans while designing such programs.

Despite a reduction in the prevalence of malnutrition over the past 21 years, which might be the outcome of nutritional services and the presence of family practitioners, malnutrition is still observed in Shahroud at a higher prevalence than international standards. Therefore, it is still necessary to conduct further research in this field and also employ and implement interventional training programs. When designing such programs, special attention must be paid to promote breastfeeding. It might also be helpful to hold workshops for physicians working in this field.

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Conflict of Interest

The authors declared that they have no conflict of interest.

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