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Prevalence and Its Related Factors of Undernutrition among Under 5-Year-Old Children, Fars, Iran 2017-2018

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ABSTRACT

Background: The present study aimed to investigate the prevalence and related factors of under-nutrition among under 5-year-old children in Fars province, Iran. **Methods:** This cross-sectional survey was conducted during 2017-2018 in Fars province of Iran. The study consisted of 606 children (0-59 months) from 13 regions of Fars province**.** A structured questionnaire collected the data, and under-nutrition indices, including stunting, wasting, and underweight, were investigated by the mixed-effects ordinal logistic regression model. **Results:** The prevalence of stunting, underweight, and wasting were 2%, 4%, and 4.1%, respectively. Low birth weight was a risk factor for three undernutrition indices ($P < 0.001$; $P < 0.001$; and $P = 0.004$). Urban children were significantly more underweight and wasted than rural children ($P = 0.001$; and $P = 0.002$, respectively). Under-nutrition rates were impressed by the family size, mother's education, and father's occupation. **Conclusion:** The prevalence of undernutrition in children can be reduced by identifying and controlling significant factors, including birth weight, maternal education, type of settlement, family size, and father's occupation.

Keywords: *Malnutrition; Children; Multilevel models*

Introduction

Malnutrition is one of the prevalent public health problems worldwide, leading to morbidity and mortality among 5-year-old children, especially in developing countries with lower socioeconomic status (Popat *et al.*, 2014, United Nations Children's Fund *et al.*, 2018). Malnourished children are vulnerable to diseases such as measles, diarrhea, kwashiorkor, marasmus, and infectious problems (Kavosi *et al.*, 2014, Mohseni *et al.*, 2018). The effects of malnutrition on children include physical growth retardation, severe weight loss, weak bones, low resistance to chronic diseases and infections, mental development disorders, and other disabilities

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(Kavosi *et al.*, 2014, Mohseni *et al.*, 2018).

The term "under-nutrition," including stunting, wasting, and underweight, is a common form of malnutrition resulting from low intake of energy and protein (Akombi *et al.*, 2017b). Stunting (low height for child's age) is related to chronic malnutrition or illnesses and wasting (low weight for child's height) indicates current nutritional status. Underweight (low weight for child's age) is associated with chronic and acute malnutrition (Janevic *et al.*, 2010). These indicators of malnutrition among children are related to different factors such as lack of paternal awareness or education, low birth weight, family size, birth order, poor socioeconomic history, breastfeeding, inadequate complementary feeding, inaccessibility to health services, and vaccination (Janevic *et al.*, 2010, Kavosi *et al.*, 2014). Under-nutrition is annually indicated around 45% of total childhood deaths in Pakistan (Sand *et al.*, 2018). Asia and Africa suffer from the highest rate of malnutrition in the world. Based on the World Bank data report in 2011, the prevalence of stunting, wasting, and underweight among under 5-year-old Iranian children have been reported to be 6.8%, 4%, and 4.1%, respectively (World Bank, 2017).

Childhood malnutrition is considered as one of the public health problems in Iran. Fars province was located in the south of Iran, considered as one of the relatively food-insecure areas (Kavosi *et al.*, 2014). The prevalence of underweight and wasting in Iran among under 5-year-old children were predicted to be 11%, and 5%, respectively (Moradi *et al.*, 2018). Based on a survey in 2014, the prevalence of stunting, wasting, and underweight among under 6-year old children in Fars province were 9.53%, 8.19%, and 9.66%, respectively (Kavosi *et al.*, 2014). The result of a population-based study in the Northeast of Iran has shown that the rate of underweight, stunting, and wasting were 7.5%, 12.5%, and 4.4%, respectively (Payandeh *et al.*, 2013). The study results have shown that in Southeast Iran (Zahedan), the prevalence of underweight, stunting, and wasting in 0-59-month-old children were 7.6%, 20.6%, and 5.8%, respectively (Dehghan Haghighi *et al.*, 2021). According to the findings of a community-based study in the North-West of Iran, 13.2% of the under 5-year-old children had stunting (Farrokh-Eslamlou *et al.*, 2021).

Studies have shown that malnutrition is still one of the fundamental problems for governments despite the economic and social progress and change in lifestyle. Childhood malnutrition is considered as one of the public health problems in Iran. Fars province located in the south of Iran, has been reported as one of the relatively food-insecure areas (Kavosi *et al.*, 2014). Therefore, evaluating the determinants of malnutrition could lead to controlling it and improving health conditions. This study was conducted to determine the main factors of malnutrition and estimate the prevalence of under-nutrition among 0-59-month-old children of Fars province.

Materials and Methods

Study design: This community-based cross-sectional study was conducted from October 2017 to January 2018 in thirty-three regions of Fars province, Iran. Six hundred and eleven children aged 0-59 months were recruited from urban and rural areas of Fars province. By a multi-stage cluster sampling technique, 611 children were selected among 13 areas under the coverage of Shiraz University of Medical Sciences. Actually11 regions were selected out of the initial 33 regions under the coverage of Shiraz University of Medical Sciences, based on their large population and geographical location. However, one region was divided into three districts because of its large population. Then 100 health centers were selected from all 13 areas (80 health centers from urban areas and 20 from rural areas). The health centers in each region were selected based on the number of residents in either urban areas or rural ones.

Given that children's documents were in each center and the sample of under 5-year-old children was randomly selected, they were asked to refer to the respective health center. The parents were informed about the study's aims, and then written informed consent was obtained from them. The inclusion criteria consisted of Iranian 0-59-month-

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old children with low socioeconomic status, while other nationalities were not recruited.

Data collection: Dataset was collected using a structured questionnaire. Then anthropometric indices were measured by trained health care professionals. The questionnaire consisted of some information such as family size, marital status, parental education and occupation, location, type of settlement, iodized salt intake, house meter, and household facilities including flat TV, computer, personal car, internet, freezer, and microwave, and also child's information like age, gender, birth order, birth weight, number of younger siblings, breastfeeding, and supplemental nutrition.

Measurements: Anthropometric data comprised the length/height and weight of all children. Weight was recorded using a digital scale (SECA, Germany) with 100 g accuracy and without shoes with minimum clothing. Recumbent length was measured for children under two years. The infant should only wear a clean disposable diaper and light clothing with no shoes, sweaters, and coats. The infant was laid on the platform, while one person held the infant's head, and the other person kept the infant's knees straight and brought the adjustable footplate up to the infant's heels. Height was measured for children above two years in standing position using a wooden board with 0.1 cm accuracy. Measurement tools were based on the United Nations Children's Fund (UNICEF). The indices of malnutrition were defined as height for age (HAZ), weight for age (WAZ), and weight for height (WHZ), according to WHO Child Growth Standards. Based on the WHO classification, the HAZ score below -2 SD is considered as stunting, the WHZ score below -2 SD as wasting, and the WAZ score below -2 SD as underweight. All three indices below -3 SD were defined as severe malnutrition.

Data analysis: Before conducting the statistical analyses, data were checked for outlier values, missing data, and normality assumptions. Skewness and Kurtosis tests and histogram with normal curves were applied (Kim, 2013). In total, five values were missed, which were left out in the analysis. The descriptive statistics such as frequency (percentage) for categorical variables and the mean and standard deviations for continuous variables were used. A generalized linear mixed-effects ordinal logistic regression model with the geographic region for random effect term was used to evaluate the determinants of under-nutrition indicators. Ordinal logistic regression was performed separately for three dependent variables, including stunting, wasting, and underweight. The results were represented in two parts including the frequency of independent variables and the ORs with 95% CIs and $P < 0.05$ for significant level. The WHO Anthro software program, version 3.2.2, calculated anthropometric indicators using weight, height/length, and age values. The Stata software version 14 was used for data analyses.

Results

A total sample of 611 children aged 0-59 months was selected for the present study. Among them, 606 children (322 boys and 284 girls) had complete information for final analyses. Of these children, 77.6% resided in urban areas, while 22.4% resided in rural areas. Also, 55% of children were from families with low economic status, while 45% belonged to families with moderate to high economic status. The characteristics of children and their households are described in **Table 1**.

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Table 1. Socio-demographic characteristics of children (n=606).

Variables	Mean ± SD
Age (month)	27.16 ± 16.53
Birth_weight (kg)	3.16 ± 0.51
Weight (kg)	11.87 ± 3.58
Height/Length(cm)	86.32 ± 14.21
Child's gender	N (%)
Male	322 (53.1)
Female	284 (46.9)
Birth order	
1st	349 (57.6)
2nd	203 (33.5_
3rd and more	54 (8.9)
Family size	
3	216 (35.6)
4	284 (46.9
5 and more	106 (17.5)
Under 5 siblings	
1	489 (80.7)
2 and more	117 (9.3)
Head gender	
Male	602 (99.3)
Female	4 (0.7)
Mother education	
Non-academic	376 (62.0)
Academic	230 (38.0)
Father education	
Non-academic	387 (63.9)
Academic	219 (36.1)
Mother occupation	
Working	80 (13.2)
Non-working	526 (86.8)
Father occupation	
Employee	177 (29.2)
Worker	126 (20.8)
Self-employment	296 (48.8)
Unemployed	7 (1.2)
Economic status	
Weak	333 (55.0)
Moderate to high	273 (45.0)
Settlement	
Urban	470 (77.6)
Rural	136 (22.4)
Geographic region	
Center	311 (51.3)
South	130 (21.5)
North	165 (27.2)
Birth weight	
Low	45 (7.4)
Normal	557 (91.9)
High	4 (0.7)

According to **Table 2**, the overall prevalence of underweight, wasting, and stunting in total population was 4%, 4.1%, and 2%, respectively. The prevalence of severe underweight, stunting and wasting were 0.7%, 0.5%, and 1%, respectively. Moreover, the prevalence of moderate underweight, stunting, and wasting was 3.3%, 1.5%, and 3.3%, respectively. Based on the information in **Table 2**, there were no significant differences in the prevalence of underweight, stunting, and wasting between boys and girls. Also, mean anthropometric Z-scores of under 5-year-old children were higher in boys compared to girls (**Table 3**).

Determinants of wasting, underweight, and stunting have been demonstrated in **Table 4**. Large family size was identified as one of the wasting risk factors. Children with a family size of four were more likely to be wasted than children with a family size of three (OR= 2.47, CI: 1.12-5.44). Children who lived in urban areas were 2.93 times more susceptible to wasting than children in rural areas. The odds of wasting were significantly lower in children with normal birth weight than those with low birth weight (OR= 0.23, CI: 0.1-0.63). Children in families with more than three members were more likely to be underweight than those with three members (OR=2.9, CI: 1.0-8.7). Children who lived in urban areas were markedly more likely to be underweight than those who lived in rural areas (OR=3.1, CI: 1.57-5.96). The odds ratio of stunting was lower in children whose fathers were self-employed than children whose fathers were employees (OR= 0.21, CI: 0.05-0.9). Also, the odds ratio of being underweight was lower in children whose fathers were workers or were self-employed than children whose fathers were employees (OR= 0.5, CI: 0.24-0.9; OR= 3.2, CI: 1.3-8.2, respectively). Children born with low weight were more likely to be underweight compared to those with normal birth weight. Children whose mothers were not academically educated were 4.3 times more likely to be stunted than those whose mothers were academically educated (OR= 4.3, CI: 1.01-18.10). Children with low birth weight had a significantly higher stunting risk than those with normal birth weight.

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Table 2. Proportion of undernutrition indices in total population (0-59 months children).

Anthropometric measures	Girls (n=284) N (%)	Boys (n=322) N (%)	P-value[a]	Total population N (%)
Weight-for-age (WAZ)				
Severe Underweight	3 (1.1)	1(0.3)	0.52	4 (0.7)
Moderate Underweight	9 (3.2)	11(3.4)		20 (3.3)
Mild Underweight to Normal Status	272 (98.5)	310 (96.3)		495(81.7)
Length/height-for-age (HAZ)				
Severe stunting	2 (0.7)	1(0.3)	0.78	3 (0.5)
Moderate stunting	4 (1.4)	4 (1.6)		9 (1.5)
Mild stunting to normal status	277 (97.9)	316 (98.1)		584 (96.5)
Weight-for-length/height (WHZ)				
Severe wasting	2 (0.7)	4 (1.2)	0.73	6 (1.0)
Moderate wasting	8 (2.8)	11 (3.4)		19 (3.1)
Mild wasting to normal status	273 (96.5)	307 (95.3)		505 (83.3)
Body mass index-for-age				
Severe wasting	2 (0.7)	4 (1.2)	0.68	6 (1.0)
Moderate wasting	9 (3.2)	13 (4.0)		22 (3.6)
Mild wasting to normal status	272 (96.1)	305 (94.7)		504 (83.3)

[a]: Chi-square *test*.

Table 3. Mean anthropometric Z-scores among gender categories.

Anthropometric measures	Girls (n=284) Mean (SD)	Boys (n=322) Mean (SD)	Mean differences (95% CI)	P-value[a]
Weight-for-age (WAZ)	-0.233 (1.18)	-0.045 (1.24)	0.188 (-0.006,0.382)	0.05
Length/height-for-age (HAZ)	-0.021 (1.11)	0.153 (1.20)	0.174 (-0.012,0.360)	0.06
Weight-for-length/height (WHZ)	-0.304 (1.27)	-0.211 (1.35)	0.093 (-0.117,0.303)	0.38
Body mass index-for-age	-0.316 (1.30)	-0.192 (1.39)	0.110 (-0.093,0.339)	0.26

[a]: Independent *t-test*

Table 4. Mixed-effects ordinal logistic regression analysis on determinants of under-nutrition indicators among children aged 0-59 months.

Variables	Stunting		Underweight		Wasting	
	OR (95%CI)	P-value	OR (95%CI)	P-value	OR (95%CI)	P-value
Child's gender						
Male	1		1		1	
Female	1.6 (0.54-4.8)	0.39	1.003 (0.61-1.65)	0.99	0.95(0.57-1.58)	0.84
Birth order						
1st	0.78 (0.1-7.1)	0.83	1.6 (0.5-5.3)	0.5	3.2 (0.96-10.7)	0.06
2nd	0.91 (0.1-8.8)	0.94	1.3 (0.4-4.6)	0.7	3.1 (0.9-10.7)	0.07
3rd and more	1		1		1	
Family size						
3	1		1		1	
4	3.6 (0.7-19.9)	0.14	4.5(2.02-10.1)	<0.001	2.5 (1.12-5.4)	0.025
5 and more	3.7(0.44-31.7)	0.23	2.9 (1.004-8.7)	0.049*	2.4 (0.8-7.2)	0.12
Under 5 siblings						
1	1		1		1	
2 and more	0.75(0.21-2.8)	0.67	0.67(0.34-1.35)	0.27	0.81 (0.40-1.61)	0.55

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Table 4. Mixed-effects ordinal logistic regression analysis on determinants of under-nutrition indicators among children aged 0-59 months.

Variables	Stunting		Underweight		Wasting	
	OR (95%CI)	P-value	OR (95%CI)	P-value	OR (95%CI)	P-value
Mother education						
Non-academic	4.3(1.01-18.1)	0.048	1.54 (0.8-3.01)	0.21	0.9 (0.45-1.8)	0.77
Academic	1		1		1	
Father education						
Non-academic	0.64 (0.15-2.7)	0.54	1.07 (0.54-2.1)	0.85	1.5 (0.74-2.9)	0.26
Academic	1		1		1	
Mother occupation						
Working	1		1		1	
Non-working	0.65(0.12-3.5)	0.61	1.3 (0.6-2.9)	0.5	0.86 (0.4-2.03)	0.74
Father occupation						
Employee	1		1		1	
Worker	1.1 (0.2-6.3)	0.92	3.2 (1.3-8.2)	0.01	2.3 (0.9-5.7)	0.08
Self-employment	0.21 (0.05-0.9)	0.03	0.5 (0.24-0.9)	0.03	0.54 (0.3-1.1)	0.08
Unemployed	1.25 (0.03-44.6)	0.9	7.2 (0.8-66.5)	0.08	4.4 (0.5-40.4)	0.2
Economic status						
Weak	0.3 (0.1-1.01)	0.052	0.7 (0.44-1.3)	0.34	0.9 (0.53-1.7)	0.82
Moderate to high	1		1		1	
settlement						
Urban	0.93 (0.2-4.3)	0.93	3.1 (1.57-5.9)	0.001	2.93 (1.5-5.7)	0.002
Rural	1		1		1	
Birth weight						
Low	1		1		1	
Normal	0.08 (0.02-0.3)	<0.001	0.06 (0.03-0.2)	<0.001	0.23 (0.1-0.63)	0.004
Hhigh	0.09 (0.004-18.9)	0.64	0.33 (0.002-59.2)	0.68	0.1 (0.005-1.3)	0.075

Discussion

This study estimated stunting, wasting, and underweight as 2%, 4.1%, and 4%, respectively. The associated factors of stunting in children were mother's education, father's occupation, and birth weight. Some factors, including family size, father occupation, settlement, and birth weight, were associated with underweight. Also, family size, settlement, and birth weight were associated with the wasting of children.

Based on the global report 2018, the stunting, underweight, and wasting rates in Asia were 23.2, 16.6, and 9.7%, respectively. Hence, Asia was introduced as a home for most wasted children 0-5 years old (United Nations Children's Fund *et al.*, 2018, Vardell, 2018, Wold Health Organization, 2018). Based on previous reports, 13.1%, 7.6%, and 4.5% of Iranian children 0-5 years old suffered from stunting, underweight, and wasting, respectively, in 2009, and these rates decreased to 6.8%, 4.1%, and 4% in 2011 (Rad *et al.*, 2009, World Bank, 2017). Accordingly, studies conducted in different regions of Iran showed differences in rates of malnutrition. For example, the prevalence rates of stunting, underweight, and wasting in Chadegan located in Isfahan province were 37%, 34.5%, and 17.8% in 2011, respectively, higher than the global prevalence (Naderi Beni *et al.*, 2013). Stunting (8.7%) and underweight (4.3%) in the Western Azerbaijan province were lower than global rates, and the wasting rate was in a warning status (7.5%) (Farrokh-Eslamlou *et al.*, 2013). The latest report on the prevalence of under-nutrition in adjacent countries like Pakistan and Turkey was as follows: stunting, underweight, and wasting rates were 31.5%, 45%, and 10.5% in Pakistan and 9.5%, 1.9%, and 1.7% in Turkey, respectively (Asim and Nawaz, 2018, World Bank, 2017).

The present study showed that the significant factors associated with three indicators were the type of settlement, birth weight, family size,

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mother's education, and father's occupation. This study noted that the prevalence of stunting was higher in children with low birth weight than normal birth weight. This result is compatible with several studies conducted in Nigeria, Bangladesh, and India (Akombi *et al.*, 2017a, Popat *et al.*, 2014, Rahman *et al.*, 2016). For example, through a survey of 24529 Nigerian children aged 0-59 months, Akombi *et al.* demonstrated that the risk factors of stunting and especially severe stunting were gender, birth weight, economic status, and type of settlement (Akombi *et al.*, 2017a). Also, Rahman *et al.* showed that birth weight, mother education, and household socioeconomic status were related to the children's malnutrition (Rahman *et al.*, 2016).

The present study showed that wasting and being underweight were more prevalent in children who lived in urban areas than in rural areas. This finding was in line with the studies conducted by Kavosi *et al.* and Janevic *et al.* (Janevic *et al.*, 2010, Kavosi *et al.*, 2014). However, several studies expressed inconsistent results (Akombi *et al.*, 2017b, Asim and Nawaz, 2018). According to the study results on 24,529 Nigerian children aged 0–59 months, the prevalence of undernutrition indices in children who resided in rural areas was more than those living in the urban areas (Akombi *et al.*, 2017b). In a review study, Asim *et al.* reported that pediatric malnutrition was lower in urban areas than in rural areas of Pakistan (Asim and Nawaz, 2018). They justify the results, as the prevalence of under-nutrition may be higher in rural areas due to the lack of facilities, low educational and social levels. However, about the present study findings, we can claim that the cost of living in urban areas is higher than rural ones, and urbanization growth has led to an increase in the poverty rate and poor nutritional status of children (Kavosi *et al.*, 2014).

Wasting and underweight rates were higher in children who lived in crowded families. Some studies reported the same results in this field (Kavosi *et al.*, 2014, Meshram *et al.*, 2012). Accordingly, through a survey on 15408 Iranian children (aged 0-6 years old), Kavosi *et al.* reported that the odds ratio of being underweight in large family size was 1.35 times higher than the small ones (Kavosi *et al.*, 2014). Also, Meshram *et al.* in a study on 14,587 Indian children (0-5 years old) showed that the risk of being underweight, wasted, and stunted was 1.43, 1.30, and 1.15 times higher in children with a large family size (≥10 family members) than those with a small family size (≤ 4 family members) (Meshram *et al.*, 2012). This result could be due to lower access to facilities and health care in large families.

Moreover, the present study showed that the prevalence of underweight and stunting in children whose fathers were self-employed was lower than others. This finding is consistent with the survey conducted by Adekunle (Adekunle, 2005). These results may be due to the higher economic power of fathers who were self-employed. Also, the stunting rate was lower in children whose mothers had academic education than those with a diploma degree or less. In line with the study findings, many studies have shown that a high maternal education level effectively reduces malnutrition (Demissie and Worku, 2013, Popat *et al.*, 2014). Popat *et al.* in India showed that the prevalence of stunting, wasting, and underweight in children with illiterate mothers was significantly higher than those with literate mothers (Popat *et al.*, 2014). Also, Demissie *et al.* demonstrated that mother's education had a significant association with undernutrition indices in Ethiopia, and the prevalence of malnutrition in children with illiterate mothers was higher than those with literate ones (Demissie and Worku, 2013).

The present study has several strengths. The study was a community-based cross-sectional survey with an acceptable sample size. Also, the experts were trained to measure the anthropometric measurements following the World Health Organization (WHO). Moreover, the valid questionnaire and the standard measurement tools with UNICEF authority were utilized in this survey. Data collection and recording were performed by trained and accurate experts, so that

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about 99% of the participants' information was available. However, there was a limitation, too. It was difficult to establish any potential temporal relationships because of the cross-sectional nature of the study. Other limitations included no referral of the mother to the health center to measure the child's weight and height. Also, going to the participants' houses was impossible due to the unique weight and height measurement scales. There was commuting problems to other cities due to the limited number of assessors who were used to increase the accuracy of the project.

Conclusions

This study showed that, as one of the major public health problems, under-nutrition in 0-59-month-old children has been prevalent, depending on many factors such as birth weight, family size, maternal education, type of settlement, and father's occupation. So, control of the known risk factors reduces the prevalence of malnutrition and improves the quality of life in children. Therefore, despite the decline in under-nutrition rates in recent years, more precise studies are still needed in this field.

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Authors' contribution

Study concept and design: Hemmati A, Shenavar R, and Farmani A. Analysis and interpretation of data: Hemmati A, Shenavar R, and Farmani A. Manuscript preparation: Derakhshandeh-Rishehri SM, Faghih S, Shenavar R, Farmani A, and Zarmehr M. Statistical analysis: Zarmehr M. Review of the manuscript: Derakhshandeh-Rishehri SM, Faghih S, Hemmati A, Shenavar R, Farmani A, and Zarmehr M.

Conflicts of interests

The authors declare that they have no conflict of interest.

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