

Maternal Performance in Relation to Food Security among Infants Aged 1-2 Years

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Abstract

Background: In spite of increasing awareness about food security, countries are still dealing with food insecurity. The aim of this study was to evaluate maternal performance in relation to food security during the complementary feeding in Bushehr, Iran.

Methods: A cross-sectional study was carried out to select 400 mothers of children aged 1-2 years in Bushehr, using random quota sampling method. Data were collected using a localized reliable version of a 32-item food frequency questionnaire containing six subgroups (Cronbach's α : 0.81). Anthropometric indicators of height and weight were estimated in accordance with the World Health Organization (WHO) recommendations. Data analysis was performed using the Mean \pm SD, Median, Chi-square test, Fisher's exact test, multinomial logistic regression, and odds ratio in SPSS, version 18.

Results: As a standard serving, only 24% of the mothers fed their infant cereals, whereas 54.8%, 36.3%, 39.8%, and 20.3% of the mothers provided meat, fruits, vegetables, and dairy products, respectively. The highest correlation was found between attendance at educational classes and vegetable consumption, age at the onset of complementary feeding and the consumption of meat and fruits, and maternal educational level and dairy products. No significant relationship was found between the food groups and anthropometric indicators.

Conclusions: Mothers in Bushehr performed poorly in providing a balanced diet. However, this performance can be improved by enhancing basic nutrition knowledge, holding practical education classes on food preparation, periodic evaluation of anthropometric indicators of infants, and by focusing on mothers with infants in high-risk groups (e.g., excessive weight, obesity, and malnutrition).

Background

Subsequent to the Universal Declaration of Human Rights, improvement of the nutritional status, especially of mothers and children, has attracted the attention of all countries. It has become the subject of food security and its corresponding dimensions (Olafsen, Rukooko, Iversen, & Andreassen, 2018). Food security is defined as a condition whereby all people have physical, social, and economic access to regular and sufficient amounts of nutritious food (Islam et al., 2021). In recent years, there has been an increased awareness about food security in Asia ("FAO, UNICEF, WFP and WHO. 2019. Placing Nutrition at the Centre of Social Protection. Asia and the Pacific Regional Overview of Food Security and Nutrition 2019. Bangkok, FAO,"). However, for various reasons, many countries such as Iran are still dealing with food insecurity to the extent that it is widespread throughout these countries (Behzadifar et al., 2016; Siahipour, Khodabakhshi, Mehrad-Majd, Noroozi, & Moghadam, 2019).

According to a national report on food security in Iran, Bushehr is among those cities suffering from food insecurity ("National Nutrition and Food Security Document of Iran. available in: <http://research.kaums.ac.ir//UploadedFiles/sanad%20melli.pdf>," access date 23/07/2017). Previous studies have reported a high level of food insecurity in Bushehr among those mothers and children.

Subsequently, infants are the most affected group (Yeganeh, Motamed, Najafpour Boushehri, & Ravanipour, 2019). Food insecurity among infants can be associated with physical, developmental, and behavioral problems. Particularly during the first two years of life, it can increase the risk of diseases that may lead to mental and behavioral dysfunction in adulthood (Betebo, Ejajo, Alemseged, & Massa, 2017; Gallegos, Eivers, Sondergeld, & Pattinson, 2021; Thomas, Miller, & Morrissey, 2019). Hence complementary feeding must supplement breastfeeding and provide the required level of nutrition (Iheme, Nzeagwu, Uzokwe, Matthew, & Edafioghor, 2021). According to the latest statistics, nutritional shortage accounts for at least 35% of child mortality under the age of 5, of which 6% could be prevented with proper complementary feeding (Agize, Jara, & Dejenu, 2017). Mothers, as the key providers of household food security, play an important role in the healthcare and nutrition of infants. Subsequently, their performance in the area of nutrition is directly associated with food security for infants, particularly during the complementary feeding period (Shagaro, Mulugeta, & Kale, 2021; Yeganeh, Motamed, Najafpour Boushehri, Pouladi, & Ravanipour, 2018). This period is from 6 months to 2 years of age, during which accessibility to food and the manner of feeding depends on the quality of maternal feeding practices and behaviors (Ahmed, Sadeta, & Lenbo, 2022).

There are various methods for assessing food security, among which determination of food frequency and measurement of anthropometric indicators are the most common methods. Food frequency is extensively used for the long-term evaluation of food intake and to predict the health status of people (Beacom, Furey, Hollywood, & Humphreys, 2021). It is influenced by various factors such as culture, belief, social status, geographical location, regional dietary pattern, and the availability of food resources. Hence it is important to accurately measure food frequency (Briones Alonso, Cockx, & Swinnen, 2018).

Food insecurity is associated with food accessibility, cultural characteristics, social issues, and place of residence. These parameters play an important role in food selection, preparation, and storage. Additionally, any type of intervention requires basic knowledge about maternal performance and the nutritional status of children. However, despite these associations and requirements, there are limited studies on maternal performance and food frequency in developing countries. Moreover, considering the extent of food insecurity in Bushehr, no studies have been conducted on this topic. Consequently, with a specific focus on infants aged 1–2 years, the present study aimed to evaluate maternal performance in relation to food security during the complementary feeding period in Bushehr, Iran.

Methods

The present study was a part of a larger descriptive and analytical cross-sectional research conducted in 2016 in Bushehr, Iran. Bushehr is the capital of Bushehr province in southern Iran. This region has a warm and humid climate for most of the year.

The sample size was calculated in accordance with comparable studies on awareness-performance (Soheili Azad, Ghasemi, & Naserkhaki, 2013) and food security in Iran (Alimoradi, Kazemi, Estaki, &

Mirmiran, 2014) using the $n = Z^2_{1-\alpha/2} P(1-P)/d^2$ formula. A total of 400 individuals were selected from all the ten comprehensive health service centers in Bushehr using the random quota sampling method. The inclusion criteria were: mothers with infants aged 1–2 years, absence of psychological disorders and chronic musculoskeletal diseases according to self-report and medical files, infants with birth weight between 2.5-4 kg, initiation of complementary feeding after 6 months of age, absence of diagnosed chronic diseases in neonates affecting their appetite and feeding, and the absence of acute gastrointestinal diseases in the months prior to the start of the study. The sampling process was carried out within a 3-month period during which the questionnaire was thoroughly explained to the mothers. It was then completed by the participants during a 15–20 minute session in the presence of the researcher. The questionnaire of illiterate participants was filled in by the researcher, based on the input of the participant, following a clear explanation of each item.

Data Collection

The data were collected using a dedicated demographic data sheet and a localized food frequency questionnaire. Additionally, the anthropometric indicators were measured. A dedicated 23-item demographic data sheet was developed in accordance with a previous study and the required demographic variables of our research. Demographic characteristics of the mothers included age, number of children, and the kind of childcare (center-based or home-based daycare). Additionally, infant's characteristics such as weight at birth, age, birth order, and the age of introduction of first complementary feeding were recorded. The measured anthropometric indicators in accordance with those of the WHO and Iranian Ministry of Health (Talachyan et al., 2015; Yeganeh, Motamed, NajafpourBoushehri, & Ravanipour, 2018) was: weight-for-age (WFA), height-for-age (HFA), and weight-for-height (WFH).

The design and psychometrics of the localized food frequency questionnaire (FFQ) were based on the Waltz method (Waltz, 2010). To design our dedicated FFQ, different types of questionnaires were reviewed among which the Harvard FFQ was selected to report on the consumed food over the past month (Harvard, 2017). The main reason for selecting this questionnaire was due to the fact that children regularly follow behavioral patterns in complementary feeding and may not daily consume a particular food group (Netting & Makrides, 2017; Rezazadeh, Omidvar, & Tucker, 2020). Additionally, the questionnaire provides more efficient reports on food problems through periodic evaluations (Institute, 2017). The items of the questionnaire were localized to incorporate the usual diet of the families in Bushehr, particularly during the complementary feeding period. Accordingly, six food groups were defined, namely grains and cereals (7 items), meat and meat products (6 items), fruits and fruit juice (7 items), vegetables (3 items), dairy products (8 items), and nuts (1 item). These groups were listed in a tabular format with specified servings for infants aged 1–2 years (e.g., 45 g of fish equals three tablespoons) and scored based on 8 scales (2–3 times a day: 90 points, once a day: 30 points, 3–4 times a week: 12 points, once a week: 4 points, 2–3 times a month: 3 points, once a month: 1 point, rarely: 0 points, and never: 0 points). The participants were requested to mark the column related to the nutritional intake of their infants. For instance, mothers were asked to mark the scale based on how often their infants

consumed ½ cup rice. The daily servings of food were calculated by dividing the total score by 30 days. The adequacy of daily food consumption was measured according to the minimum and maximum food servings: 4–6 portions of cereals, 1–2 portions of fruits, vegetables, and meat (each), and 2–3 portions of dairy products.

The face validity of the questionnaire was examined among 10 mothers of infants aged 1–2 years with different educational levels. The face validity coefficient was > 1.5 for all the items in the questionnaire. The content validity was evaluated by 12 experts in child nutrition (nutritionists, community medicine specialists, nurses, and public health education specialists). The content validity ratio for each item was > 0.81 . The reliability of the questionnaire was examined among 30 eligible mothers and the Cronbach's alpha equaled 0.81. Hence the validity and reliability of the questionnaire were confirmed.

Data Analysis

The data were analyzed using the SPSS software (version 18.0). The Chi-square test, Fisher's exact test, and logistic regression analysis were used to determine the relationship between the anthropometric indicators and maternal performance. The odds ratio was calculated based on a 95% confidence interval. Descriptive data (demographic characteristics and anthropometric indicators) were presented as median and mean \pm SD. $P < 0.05$ was considered statistically significant.

Ethical Considerations

The study was approved by the Ethics Committee of Bushehr University of Medical Sciences (Bushehr, Iran) as also described in our previous studies (Yeganeh, Motamed, Najafpour Boushehri, Pouladi, & Ravanipour, 2017; Yeganeh, Motamed, Najafpour Boushehri, et al., 2018). The participants of the present study were personally informed about the goals of the research, methodology, and confidentiality of the information. A written informed consent was obtained from all participants.

Results

Demographic characteristics of the participants showed that 81% of the mothers were housewives and the rest of them were employed. The mean age of the participants was 29.53 ± 4.92 years (range 17-45). Most participants had a high school diploma (41%) or a university degree (43.3%). At the time of the research, 54.5% of the participants lived in a family-owned house, 37.8% in a rented accommodation, and 7.5% lived together with a relative. The mean birth order of the infants was 1.72 ± 0.75 (range 1-6), and 53.8% of them were girls. The mean age of the infants was 16.44 ± 3.96 months and complementary feeding started at the mean age of 6.25 ± 0.88 months. The mean number of children in a family was 1.77 ± 0.78 (range 1-6). A detailed description of demographic characteristics has already been presented in our previous study (Yeganeh et al., 2017).

In terms of maternal performance during the complementary feeding period, 40% of the infants consumed grains and cereals (rice, wheat, barley, bread, spaghetti, biscuits, cakes, and potato) below the standard amounts. Meat and meat products (red meat, chicken, eggs, fish, and shrimps) were adequately

consumed by 54.7% of the infants. The consumption of fruits and fruit juice (citrus fruits, apples, peaches, bananas, cherries, mangos, pineapple, dates, and date products) in 56.3% of the infants was above the standard amounts. Furthermore, 50.3% of the infants consumed vegetables (raw or steamed) below the standard amounts. Dairy products (milk, dried milk, yogurt, cheese, ice cream) were consumed above the standard amounts by 49% of the infants (figure 1). Fruits, vegetables, and dairy products were not consumed by 0.5%, 4%, and 1.3% of the infants, respectively. In addition, 25.9% of the infants were only fed formula milk, 12.3% were fed both formula milk and breastmilk, while 11.5% consumed none of the types.

In terms of anthropometric indicators, the mean weight of the infants was 10.74 ± 1.66 kg (range 7.50-18.91) and the mean HFA was 80.16 ± 4.82 cm. Normal and short heights were observed in 93.5% and 4.6% of the infants, respectively (figure 2, 3). Based on logistic regression analysis, there was no significant relationship between the amount of food consumption (all food groups) and anthropometric indicators (table 1).

Table 1

The results of the logistic regression analysis between the food frequency and anthropometric indicators in infants aged 1-2 years (n=400).

Variables		HFA (normal-tall)			WFA (underweight-normal)			WFH (wasted-normal-risk of overweight)		
		OR	CI	P	OR	CI	P	OR	CI	P
Cereals	Insufficient	1.20	0.29-4.94	0.79	0.86	0.48-1.54	0.63	1.12	0.43-2.92	0.81
	Sufficient	1			1			1		
	Excess	2.06	0.54-7.83	0.28	1.00	0.55-1.78	1.00	0.78	0.26-2.13	0.58
Meat	Insufficient	2.33	0.59-9.10	0.22	0.93	0.39-2.18	0.87	1.75	0.54-5.59	0.34
	Sufficient	1			1			1		
	Excess	0.98	0.34-2.83	0.97	1.07	0.67-1.73	0.75	0.72	0.30-1.74	0.47
Fruits	Insufficient	1.46	0.28-7.41	0.64	0.86	0.34-2.18	0.75	1.40	0.36-5.38	0.62
	Sufficient	1			1			1		
	Excess	0.81	0.29-2.24	0.69	0.93	0.58-1.50	0.79	0.80	0.35-1.82	0.60
Vegetables	Insufficient	1.96	0.67-5.67	0.21	0.88	0.55-1.42	0.62	0.91	0.41-2.04	0.83
	Sufficient	1			1			1		
	Excess	0.79	0.9-6.95	0.83	0.75	0.33-1.72	0.50	0.64	0.13-3.00	0.57
Milk	Insufficient	2.38	0.48-11.77	0.28	0.85	0.46-1.58	0.62	0.75	0.24-2.33	0.62
	Sufficient	1			1			1		
	Excess	1.90	0.40-8.99	1.90	0.66	0.37-1.18	0.17	1.03	0.38-2.77	0.94

Significance $P \leq 0.05$.

OR: Odds ratio, CI: Confidence Interval (95%)

The correlation between the food groups and demographic characteristics was assessed using the multinomial logistic regression analysis. For comparison, the standard serving in each group was

regarded as the baseline. The results showed no correlation between the consumption of cereals and demographic characteristics. Excessive consumption of meat (OR=1.30, CI=1.02-1.66, P=0.03) and fruits/fruit juice (OR=1.44, CI=1.03-2.03, P=0.03) correlated with the age at the onset of complementary feeding. With respect to vegetables, the results only showed a correlation between vegetable consumption and attending educational classes (a demographic characteristic). Excessive consumption of vegetables was more often observed in infants whose mothers attended educational classes compared to those who did not (OR=2.09, CI=1.03-4.21, P=0.03). Additionally, a correlation was found between the consumption of dairy products and the education level of the mothers. There was less chance of excessive consumption of dairy products by those infants whose mothers had an elementary education compared to those with a university degree (OR=0.29, CI=0.09-0.90, P=0.03).

Discussion

The present study aimed to evaluate maternal performance in relation to food security during the complementary feeding period and its correlation with anthropometric indicators of infants. The results indicated that more than 50% of the mothers in Bushehr performed inadequately in providing their infants with an acceptable daily intake from all food groups. The only exception was meat, which was included by slightly more than 50% of the mothers. We believe that the main issue was the mothers' lack of practical knowledge about food for infants, despite a good academic education and general knowledge of complementary feeding (Yeganeh et al., 2017). This indicated that although Iran has made major improvements in the level of education on complementary feeding (as provided by comprehensive health service centers) the feeding performance of the mothers was still inadequate particularly beyond the infants' first year of age. Apparently, the complementary feeding education in Bushehr's health service centers had mainly focused on the onset of complementary feeding and infants' readiness, but less on their needs beyond the first year of age. Note that nutritional education is not taught at Iranian schools, nor does Iran have special centers that provide the mothers with practical training on nutrition.

In a study by Farivar et al. (Farivar et al., 2009), the mean level of knowledge among the people in Bushehr about the role of different food groups was 50%. Shuo Wang (China, 2021) reported that the infants aged 12-23 months were not fed according to nutrition standards (Wang et al., 2021). In line with our results, Beshadu Bedada Feyisa et al. reported that vegetable intake only among 37.8% in Southern Ethiopia infants, aged 6-23 months, was sufficient (Feyisa, Tefera, Endris, Asayehu, & Gebreyesus, 2020). Despite the importance of vegetable consumption on a child's health and in the prevention of chronic diseases (Liu et al., 2021), the intake of vegetables by children in Bushehr was only 1-3 times weekly. Such deficiency could be due to the short shelf life of vegetables, the misperception that children cannot digest vegetables, or the fear of parasitic contamination of raw vegetables. In a review study, Hendrie et al. (2016) proposed measures to increase vegetable consumption among children. They recommended additional availability of vegetables in the market, increased vegetable consumption by families, and providing the necessary education and social support (Hendrie, Lease, Bowen, Baird, & Cox, 2017).

One of the highly consumed food groups in complementary feeding is cereals, for which the maternal performance of the mothers in Bushehr was inadequate. Some of the commonly consumed cereals by children in Bushehr were rice and wheat bread. The intake of other cereals, such as barley and ready-to-eat cereals (e.g., corn flakes), was significantly lower. This could be due to the lack of access and product knowledge (as a suitable breakfast) or higher costs. Michelle Klerks (2019) considers it necessary to introduce cereals for use in complementary feeding (Klerks & Bernal, 2019).

Dairy products, as well as breastmilk, form the other important food group during the complementary feeding period and play an important role in the growth of children. Moreover, among Muslims, breastfeeding is strongly associated with Islamic culture, beliefs, and practices (Kamoun & Spatz, 2018; Mehrpisheh, Memarian, Ameri, & Saberi Isfeedvajani, 2020). Among the Iranians, the traditional belief is to breastfeed for two full years with a difference of 2-month for male and female infants. Some mothers tend to breastfeed beyond the first year and consider breast milk as the main food source for their infants. In the absence of solid food and the irregularity of the feeding times, formula milk is also used. Note that the Iranian health centers recommend the consumption of Iranian adult food as suitable for infants older than 1 year. However, the appropriateness of this recommendation is questionable (Abdi, Atarodi, Mirmiran, & Esteki, 2015).

In the present study, we found no association between the anthropometric indicators and the consumption of food groups by infants (i.e., maternal performance). In contrast, in a study, Thaweekul et al. (2021) reported a negative relationship between the infant and child feeding index and nutritional status (Thaweekul, Sinlapamongkolkul, Tonglim, & Sritipsukho, 2021). However, in line with our findings, a study among 1,816 children under five years by Joe et al. (2019) reported very weak association between anthropometric indicators and the food failure (Joe et al., 2019). Such discrepancies could be explained by the fact that we only included the main food groups for the evaluation of maternal performance, while other foods (e.g., fat, snacks, and fast food) could also have been consumed. Furthermore, anthropometric indicators are affected not only by nutrition, but also by parameters such as genetics, environment, climate, and physical activities. The lack of estimation of the calorie intake and level of children's physical activities could also have contributed to the difference in the findings.

Our results showed that the risk of overweight and obesity among the infants aged 1-2 years was 26% (i.e., one in four of the sample size). Based on previous studies, weight gain and obesity can continue into adolescence, and obese adolescents can become obese adults (Su-Jung & Jong-Ho, 2021). Obesity stigma is one of the problems in long-term childhood obesity that can cause psychosocial damage in the future of these infants (Haqq, Kebbe, Tan, Manco, & Salas, 2021). Jones et al. (2017) reported that the level of obesity in European children aged >5 years was 28.6% (Jones, Jewell, Saksena, Ramos Salas, & Breda, 2017). The guiding principles for feeding infants, in addition to undergrowth and underweight prevention, are also concerned with excess weight, obesity, and imbalanced nutrition. Appropriate dietary habit and education of the parents are the key factors in ensuring a healthy food regimen during both childhood and adulthood ("Samuel, F., Akintayo, B. and Eyinla, T. (2021) Complementary Feeding Knowledge and Practices of Caregivers in Orphanages Improved after Nutrition Education Intervention in

Ibadan, Nigeria. Open Journal of Nursing, 11, 642-652. "). Considering the high overweight/obesity rate (26%) in Bushehr, implementation of such intervention programs, particularly for the mothers of infants aged 1-2 years, is essential.

To the best of our knowledge, this is the first study that evaluated maternal performance in food security in Bushehr using a localized questionnaire and allowing for cultural sensitivities. We strongly recommend educating the mothers in Bushehr on complementary feeding to achieve the required level of food security in infants and children. This could be in the form of an educational booklet, taking the local cuisine into account that specifies the quantity of the servings of each food type, how to estimate food portions, and how to properly prepare and store food. To determine the cause of the weight gain in Bushehr, further studies are required on the way the parents gather the nutritional information and accurate measurement of food consumption both in the form of micro- and macro-nutrients, as well as whole foods, is needed.

Limitation in study

The main limitation of the present study was the mothers' lack of understanding of some items in the questionnaire, despite extensive explanations. They had inadequate knowledge about the quantity of the servings of each food type, and at times could not remember the food groups. This in turn adversely affected the accuracy and generalizability of the results. In addition, by excluding other foods (e.g., fat, snacks, and fast food) we could not evaluate their association with anthropometric indicators.

Abbreviations

CVI: Content validity index

CVR: Content validity ratio

HFA: Height-for-age

WFA: Weight-for-age

WFH: Weight-for-height

WHO: World Health Organization

Declarations

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Ethics approval and consent to participate

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the ethical committee (code: IR.BPUMS.REC.2016.9) of Bushehr University of Medical Sciences, Bushehr, Iran. Informed consent was obtained from all the subjects involved in the study or their legal guardians. The authors do not have any conflict of interest to declare.

Consent for publication

Not applicable

Availability of data and material

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

The contribution of the authors to the research were: Research design by SY, NM, SN-B, RB, MR; data collection by SY; research execution by SY, NM, MR; data analysis by NM; draft manuscript by SY; documentation by SY, NM, SN-B, RB, MR; and primary responsible for the final content by MR and SY. All authors have read and approved the final manuscript.

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Figures

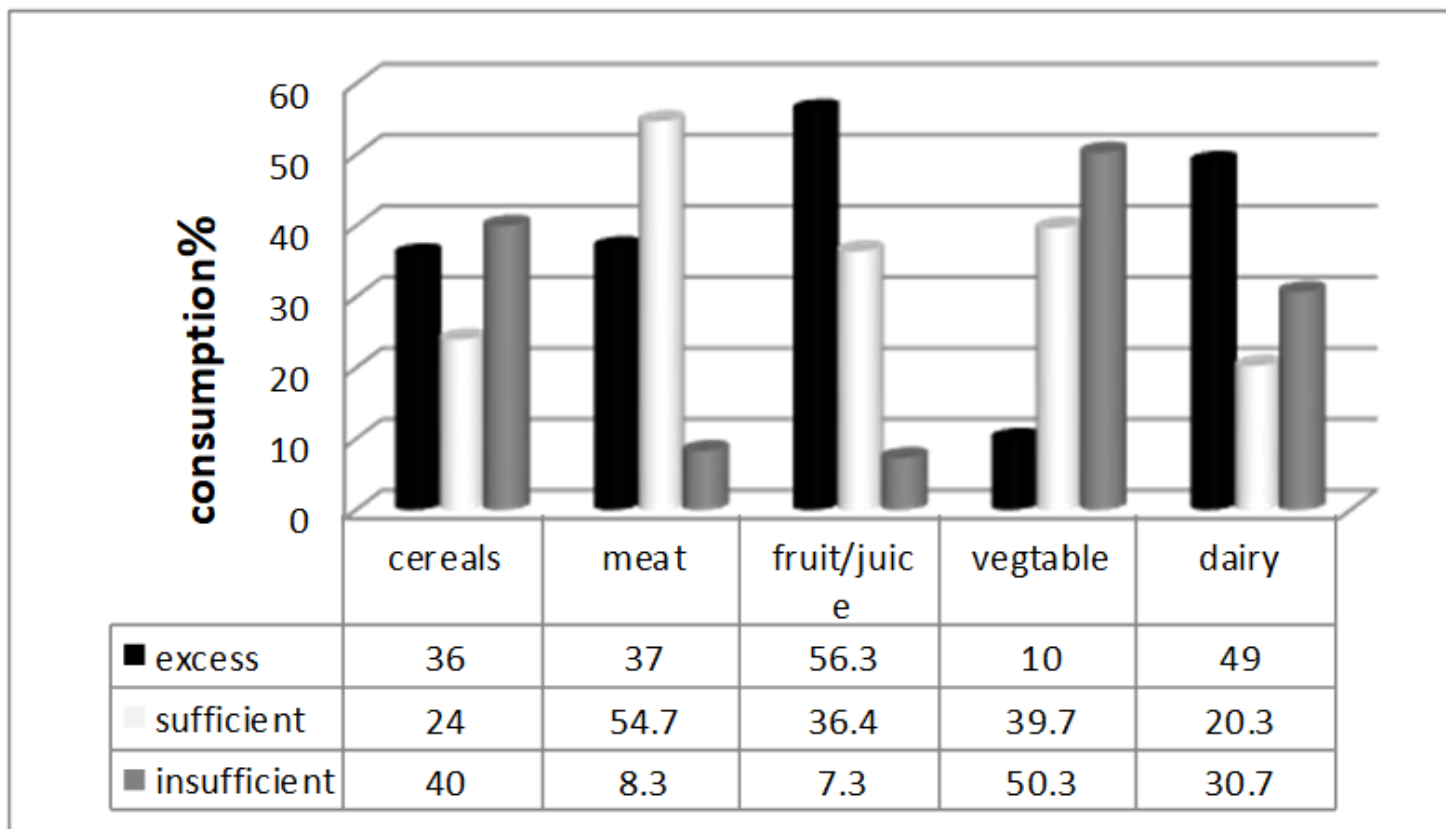


Figure 1

An overview of maternal performance in complementary feeding with respect to food groups. Cereals: 4-6 serving; Vegetables, fruits, and meat: 1-2 serving; Dairy products: 2-3 serving

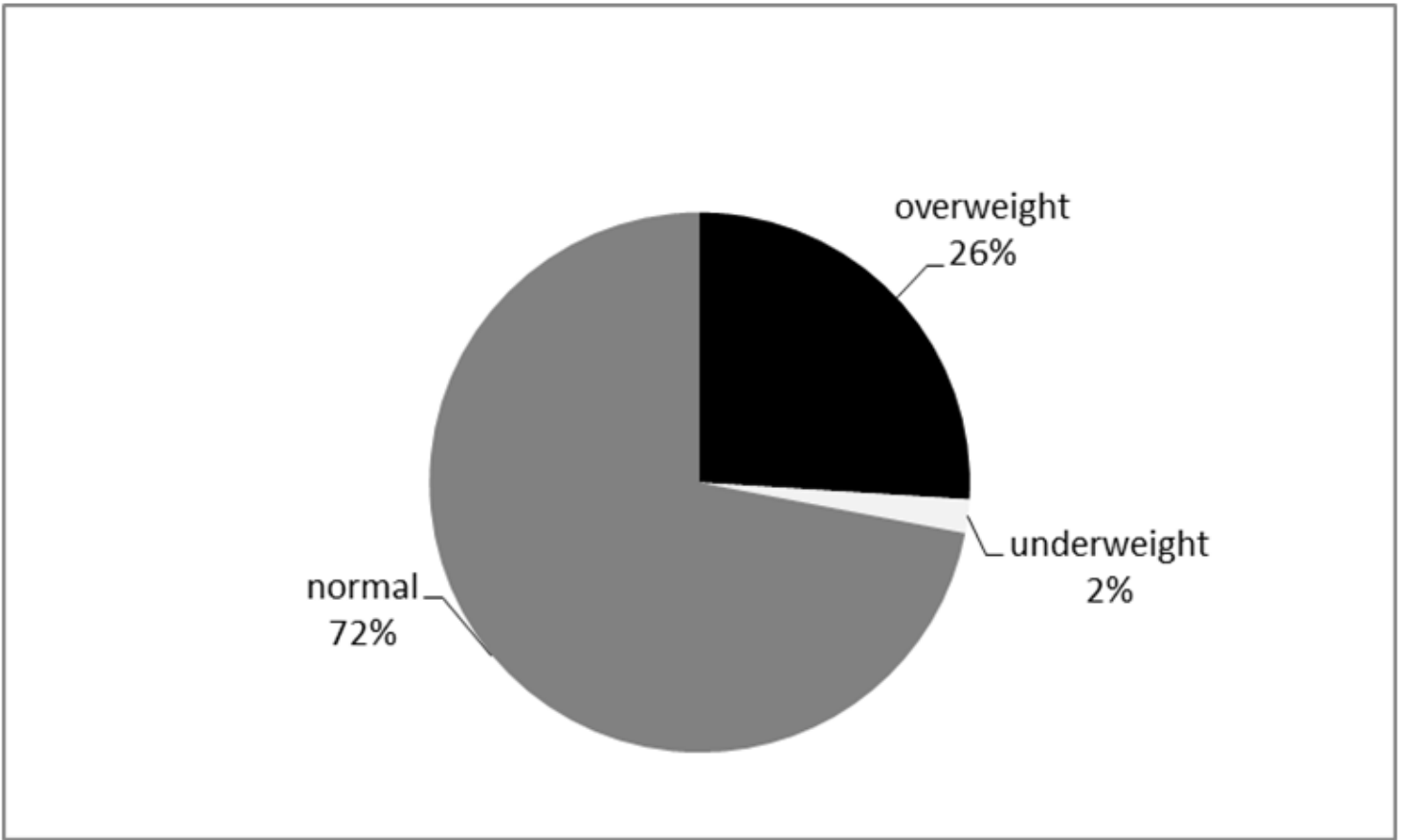


Figure 2

Distribution of anthropometric indicators (WFA) in terms of the Z-score as defined by the WHO.

Underweight: -3 to -2, Normal: -2 to +1, Overweight: >+1

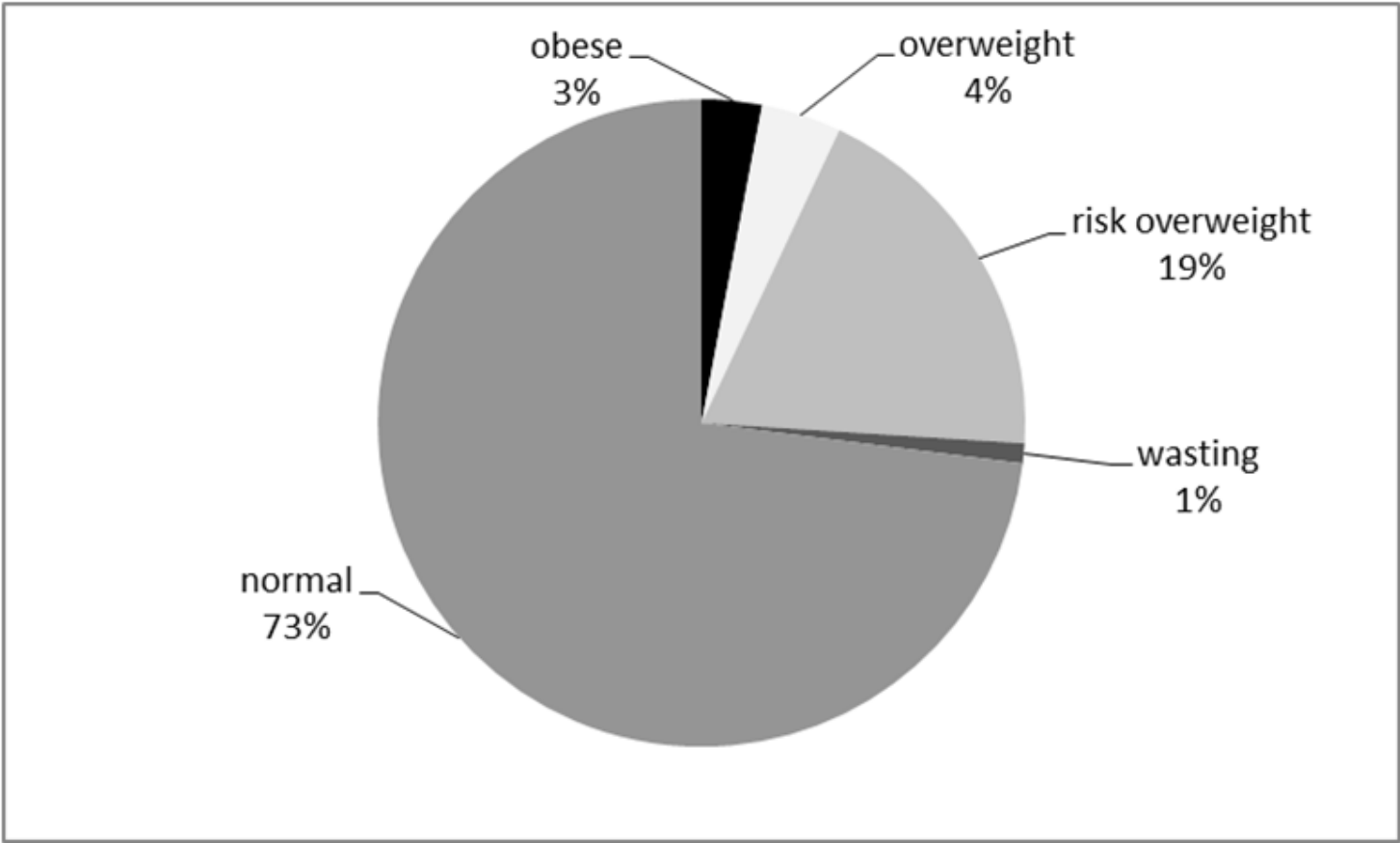


Figure 3

Distribution of anthropometric indicators (WFH) in terms of the Z-score as defined by the WHO.

Wasting: <-2 , Normal: -2 to $+1$, Overweight risk: $>+1$ to $\leq+2$, Overweight: $>+2$ $\leq+3$, Obese: $>+3$