ORIGINAL ARTICLE

Assessment of Nutritional Status and Related Factors of Lactating Women in the Urban and Rural Areas of Southwestern Iran: A Population-Based Cross-Sectional Study

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Abstract

Background: During the lactation period, mothers are at an increased risk of nutritional deficiencies due to improper dietary patterns, physiological changes, and various socio-demographic factors. The present study aimed to examine the nutritional status, dietary intake, and related factors among lactating women in the urban and rural areas of Khorramabad, Lorestan province in the southwest of Iran.

Methods: The present population-based cross-sectional study was conducted in Khorramabad (Iran) during April-July 2012. The study population included 708 lactating mothers who were referred to the health centers in Khorramabad (10 urban health centers and 30 rural health/community centers). A multi-stage sampling method was used to recruit the participants. The nutritional status and food intake of the participants were assessed over three days using the 24-hour dietary recall (24HDR) and dietary record (DR) questionnaires. The data were analyzed using SPSS software (version 16.0) with the Chi-square test, Fisher's exact test, paired t test, independent t test, and Pearson correlation coefficient. $P<0.05$ was considered statistically significant.

Results: The mean age and body mass index (BMI) of the mothers were 29.78±6.24 years and 26.11±3.70 kg/m^2, respectively. There was a significant difference in calorie intake between the different categories of age, BMI, education level, job status ($P<0.001$) and lactation stage ($P=0.034$). The energy and nutrient intakes, except iron and phosphor, were statistically lower ($P<0.05$) than the prescribed Recommended Dietary Allowances (RDA). The intake of vitamins K, B1, B2, B3, and C; protein, magnesium, phosphor, zinc, copper, and iodine by mothers in the rural areas was significantly higher ($P<0.05$) than those in the rural areas. Higher intakes of energy and macronutrients by the lactating mothers had a significant negative correlation with an increase in age and had a significant positive correlation with a higher BMI ($P<0.001$).

Conclusion: Lactating women in the urban and rural areas of Khorramabad (Iran) had a poor nutritional status. Nutrition education and a modified dietary pattern during the lactation period are recommended.

Keywords: Lactation, Breastfeeding, Nutritional status, Dietary records

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Introduction

Breastfeeding is considered the ideal method to provide newborns and infants with energy and nutrients for optimal growth, development, and good health.[1] A study among lactating women has shown that a healthy diet has both short- and long-term beneficial health effects for both mothers and children.[2] Especially during the lactation period, mothers are at an increased risk of nutritional deficiencies due to improper dietary patterns, physiological changes, and various socio-demographic factors.[3] A recent study demonstrated that the vitamins B1, B2, B6, B12, A, and D; iodine, and essential fatty acids are important nutrients for an optimal level of breast milk production.[4] Long term insufficient caloric intake can also affect the quality and quantity of breast milk; resulting in malnutrition of the infants.[5]

The nutritional status of women and children is a good indicator of the overall well-being of a society and reflects the household food security status, general health, and social conditions.[6] Therefore, it is vital to continuously monitor dietary intake and the nutritional status of lactating mothers, particularly in resource-poor settings.[7] Few studies have addressed the dietary intake of lactating women in Iran.[8-12] Two studies have reported that the calorie intake of lactating mothers in the northern provinces of Iran (Mazandaran and East Azerbaijan) was lower than the Dietary Reference Intake (DRI).[9, 11] Another study also conducted in Khorramabad reported an adequate intake of energy and macronutrients by lactating mothers; however, a lack of certain micronutrients (calcium, iodine, magnesium, phosphorus, and zinc; the vitamins A, D, B2, B9, and C) was observed.[10] The majority of the reported studies have solely focused on prenatal nutrition, but the nutritional status of lactating women has been overlooked.[13] Studies in other countries have also reported improper nutritional patterns and nutrient deficiencies among lactating women.[2, 14, 15] Further research on this topic was considered necessary because of the importance of a sufficient dietary intake during lactation, limited studies in the literature, discrepancy in the findings of various Iranian studies, and the low sample size of many studies. As a direct result, the present study aimed to examine the nutritional status, dietary intake, and related factors among lactating women in the urban and rural areas of Khorramabad, Iran. We believe that the outcome of the present study would significantly contribute to the design of national dietary guidelines for lactating women.

Materials and Methods

The present population-based cross-sectional study was conducted in Khorramabad; the capital of Lorestan province (Iran) with a total area of 6,233 square kilometers. The study population included 708 lactating mothers who were referred to some health centers in Khorramabad (10 urban health centers and 30 rural health/community centers) during April-July 2012. A multi-stage sampling method was used to recruit the participants. First, based on the stratified sampling method, the city of Khorramabad was divided into two categories, namely urban and rural areas. Then, a two-stage cluster sampling was carried out in each area. The selection method for each cluster (health centers and community centers) was random systematic sampling. The inclusion criteria were lactating women 18 years or higher, lactation period of 12 months or less, and willingness to participate. The exclusion criteria were suffering from chronic diseases (e.g., diabetes mellitus, gastrointestinal, cardiovascular, renal, or other disorders) and breastfeeding less than three times a day. A total of 736 lactating women were assessed for eligibility, out of which 708 individuals met the above-mentioned criteria. The participants were breastfeeding mothers aged 18-49 years from both the urban (n=303) and rural (n=405) areas.

A general questionnaire was used to obtain the socio-demographic characteristics, clinical data, current medication, and the

breastfeeding routine of the participants. A trained dietitian extracted the information through individual face-to-face interviews with the lactating women. The height of the participants was measured to the nearest 0.1 cm with a standard measuring tape, and the weight was recorded to the nearest 0.1 kg using a digital weighing scale (Seca GmbH & Co. KG, Hamburg, Germany) placed on a firm and flat surface. To ensure accuracy, the scale was calibrated daily using a standard 20 kg weight and the participants were requested to wear lightweight clothing and no shoes. The body mass index (BMI) was calculated by squaring the height in meters and then dividing the weight by height in meters squared (kg/m^2). All measurements were done in duplicates.

The nutritional status and food intake of the participants were assessed using the 24-hour dietary recall (24HDR) and dietary record (DR) questionnaires over three days (two weekdays and one weekend day). A previous study confirmed the validity and reliability of the 24HDR questionnaire with an acceptable Cronbach's alpha coefficient (α=0.80).[16] Trained dietitians administered the questionnaires and the participants were asked to recall and report all the foods, beverages, and dietary supplements consumed over the previous 24 hours. A manual for household measures was used to convert the amount of consumed food to the daily intake in grams.[17] The energy, macronutrients, and micronutrients content of the foods was computed using the Nutritionist IV software (N-Squared Computing, San Bruno, CA, USA). Moreover, Azar and Sarkisian (1980) added computer codes to include the composition of Iranian foods, which also updated the software computation as new foods were aded.[18] The adequacy of the energy intake (%) was calculated by dividing the actual intake by the recommended calorie intake. An energy intake <80%, 80%-100%, and >100% was designated as low intake, adequate intake, and high intake, respectively.

The data were analyzed using SPSS software (version 16.0). The descriptive data were expressed as frequency distribution in tabular format and the Kolmogorov-Smirnov test was used to test the normality of the data. The association between categorical variables was determined using the Chi-square test or Fisher's exact test. The independent t test or Mann-Whitney *U* test was used to compare nutritional variables in rural versus urban participants and also between the first 6 months and second 6 months of lactation. The one-sample t test was used to compare the mean of the nutritional variables with the mean of the DRI system of nutrition recommendations. The Pearson correlation coefficient was used to measure the statistical correlation between nutritional variables and the parameters of interest. P<0.05 was considered statistically significant. The study was approved by the Ethics Committee of Lorestan University of Medical Sciences, Khorramabad, Iran (code: IR.LUMS.REC.1396.401).

Results

The socio-demographic characteristics of the participants are shown in Table 1. The mean age

Table 1: Socio-Demographic Characteristics of The Participants

Variables	Frequency (%)
Age (years)	
18-24	202 (28.53)
25-34	399 (56.36)
≥35	107 (15.11)
Education Level	
None/primary	83 (11.72)
Middle school	115 (16.25)
High school	414 (58.47)
University or higher	96 (13.56)
Number of children	
≤4	504 (71.20)
>4	204 (28.80)
Employment status	
Unemployed	660 (93.23)
Employed	48 (6.77)
BMI (kg/m2)	
<18.5	162 (22.90)
18.5-24.9	196 (27.70)
25-29.9	284 (40.10)
≥30	66 (9.30)

of the participants was 29.78±6.24 years and 399 (56.36%) of them fell in the 25-35 years category. The mean weight, height, and BMI of the participants were 68.86±10.05 kg, 162.40±6.13 cm and 26.11±3.70 kg/m^2, respectively.

There was a significant difference in calorie intake between the different categories of age, BMI, education level, employment status (P<0.001) and lactation stage (P=0.034) (Table 2).

The energy and nutrient intakes of the participants with respect to DRI are shown in Table 3. The measured values for energy were statistically lower (P<0.001) than the prescribed Recommended Dietary Allowances (RDA), whereas the amount of consumed carbohydrate was significantly higher (P<0.001). Except for Iron and phosphor, the mean intake of other micronutrients was lower than the recommended values (% DRI). Moreover, the vitamins A, D, B2, B5, B6, B9, and C; potassium, calcium, magnesium, zinc, copper, and iodine levels of the lactating mothers were considerably less than the dietary recommended levels (<75% DRI). There was no significant difference (P=0.7) between the energy intake by the lactating mothers in the urban and the rural areas. However, the intake of vitamins K, B1, B2, B3, and C; protein, magnesium, phosphor, zinc, copper, and iodine by mothers in the rural areas was significantly higher (P<0.05) than those in the urban areas (Table 4).

The correlation between energy and macronutrients with the age and BMI of the lactating mothers is presented in Table 5. Higher intakes of energy and macronutrients by the lactating mothers had a significant negative correlation with an increase in age and had a significant positive correlation with a higher BMI (P<0.001).

Discussion

The present study aimed to examine the nutritional status, dietary intake, and related factors among lactating women in Khorramabad in the southwest of Iran. Similar to previous studies among lactating women in other regions of Iran, the majority of our participants were aged 25-35 years.[19, 20] Based on the BMI classification, about half of

Table 2: The status of calorie intake with respect to socio-demographic characteristics and BMI classification

Variables	Calorie intake, N (%)			P value
	Low	Adequate	High	
Age (year)				
18-24	40 (19.80)	65 (32.20)	97 (48)	<0.001*
25-34	155 (38.80)	118 (29.60)	126 (31.60)	
≥35	60 (56.10)	44 (41.10)	3 (2.80)	
BMI (kg/m2)				
<18.5	116 (71.60)	38 (23.50)	8 (4.90)	<0.001*
18.5-24.9	47 (24)	49 (25)	100 (51)	
25-29.9	90 (31.70)	99 (34.90)	95 (33.40)	
≥30	2 (3)	41 (62)	23 (34.80)	
Education Level				
None/primary	47 (56.60)	20 (24.10)	16 (19.30)	<0.001*
Middle school	12 (10.50)	35 (30.40)	68 (59.10)	
High school	172 (41.50)	116 (28)	126 (30.50)	
University or higher	24 (25)	56 (58.30)	16 (16.70)	
Employment status				
Unemployed	253 (38.30)	184 (27.90)	223 (33.80)	<0.001**
Employed	2 (4.20)	43 (89.50)	3 (6.30)	
Lactation stage				
First 6 months	124 (41.40)	86 (28.80)	89 (29.80)	<0.034**
Second 6 months	131 (32)	141 (34.50)	137 (33.50)	

*Chi-square test, **Fisher's exact test

Table 3: The energy and nutrient intakes by the lactating mothers in terms of DRI.

Macro- and micro-nutrients	DRI[a]	Energy and nutrient intake Mean±SD	%DRI	P value*
Energy (kcal)	2,380	1,750.67±412.05	73.55	<0.001
Protein (g)	71[$]	67.86±20.72	95.57	<0.001
Carbohydrate (g)	210[$]	218.85±61.46	104.21	<0.001
Lipid (g)	N.D[b]	64.17±18.92	-	-
Vitamin A (µg RAE)	1,300[$]	631.98±367.46	48.61	<0.001
Vitamin D (µg)	5[$]	1.52±1.8	30.40	<0.001
Vitamin E (mg)	19[$]	14.63±6.01	77	<0.001
Vitamin K (µg)	90[#]	72.41±32.57	80	<0.001
Vitamin B_1 (mg)	1.4[$]	1.04±0.5	74.28	<0.001
Vitamin B_2 (mg)	1.6[$]	1.05±0.5	65.62	<0.001
Vitamin B_3 (mg)	17[$]	13.26±5.2	78	<0.001
Vitamin B_5 (mg)	7[#]	3.01±1.11	43	<0.001
Vitamin B_6 (mg)	2[$]	1.11±0.55	55.50	<0.001
Vitamin B_9 (µg)	500[$]	195.14±97.01	39.02	<0.001
Vitamin B_{12} (µg)	2.8[$]	2.17±0.84	77.50	<0.001
Vitamin C (mg)	120[$]	70.46±41.48	58.71	<0.001
Sodium (mg)	1,500[#]	1,443.31±659.08	96.22	0.02
Potassium (mg)	5,100[#]	2,209.38±768.09	43.32	<0.001
Iron (mg)	9[$]	12.5±5.7	138.8	<0.001
Calcium (mg)	1,000[$]	640.54±318.9	64.05	<0.001
Magnesium (mg)	310[$]	211.93±85.9	68.36	<0.001
Phosphor (mg)	700[$]	725.56±296.22	103.65	0.02
Zinc (mg)	12[$]	7.37±2.76	61.41	<0.001
Copper (mg)	1.3[$]	0.85±0.35	65.38	<0.001
Iodine (µg)	290[$]	122.52±45.67	42.24	<0.001

[a]DRI: Dietary reference intake, [b]ND: Not determinable, *Paired t test [$]Recommended dietary allowances (RDAs), [#]Adequate intakes (AIs)

the participants fell in the category of overweight or obese. This was in line with the results of previous studies reporting that lactating women were generally overweight.[11, 21] However, there were also studies reporting that lactating women were either of a normal weight or were obese.[15, 22] Weight gain during pregnancy had a significant positive correlation with weight retention after the delivery, however, pre-pregnancy BMI had a significant impact.[23] It has also been shown that the risk of weight gain during the 2 year period postpartum is higher in women who were already obese before the pregnancy and after the delivery.[24] However, in the absence of specific classifications for the weight of nursing mothers, the data on postpartum BMI should be interpreted with caution.[25]

Our results showed significant differences in calorie intake with respect to variables such as age, BMI, education level, and employment status. In terms of age, those in the range of 18-24 years had a high calorie intake, whereas those over 35 years old had a low calorie intake. Mothers under the age of 18 and over 35 years require more attention since they are vulnerable to complications due to malnutrition. However, some Iranian studies have reported adequate calorie intake among these women.[9, 11] According to the WHO guidelines, adolescent mothers have greater nutritional requirements than adults; due to their physical growth.[26] Based on our results, adolescents undergo several changes in dietary habits after getting pregnant. It has been reported that the consumption of dairy products, fruits, and vegetables during pregnancy is often low, whereas the consumption of fast food, spicy foods, and soda is high.[27] The age difference between adolescents and adults is known to affect dietary habits. However, differences in dietary habits between younger and older

Table 4: The energy and nutrient intakes by the lactating mothers in the urban and rural areas in terms of DRI.

Macro-and micro nutrients	DRI[a]	Urban (N=303)		Rural (n=405)		P value**
		Mean±SD	P value*	Mean±SD	P value*	
Energy (kcal)	2,380	1,745.11±465.78	<0.001	1,758.01±324.65	<0.001	0.7
Protein (g)	71[$]	65.73±21.1	<0.001	70.69±19.88	0.8	<0.001
Carbohydrate (g)	210[$]	216.72±68.88	0.05	221.66±49.98	<0.001	0.27
Lipid (g)	N.D[b]	61.93±19.6	-	67.14±17.58	-	<0.001
Vitamin A (µg RAE)	1,300[$]	617.29±387.94	<0.001	651.39±338.17	<0.001	0.21
Vitamin D (µg)	5[$]	1.55±1.85	<0.001	1.47±1.73	<0.001	0.54
Vitamin E (mg)	19[$]	14.66±5.66	<0.001	14.6±6.44	<0.001	0.89
Vitamin K (µg)	90[#]	68.12±29.47	<0.001	78.08±35.52	<0.001	<0.001
Vitamin B_1 (mg)	1.4[$]	0.97±0.47	<0.001	1.13±0.51	<0.001	<0.001
Vitamin B_2 (mg)	1.6[$]	1.02±0.47	<0.001	1.11±0.51	<0.001	0.02
Vitamin B_3 (mg)	17[$]	12.37±4.96	<0.001	14.43±5.27	<0.001	<0.001
Vitamin B_5 (mg)	7[#]	3.08±1.22	<0.001	2.92±0.94	<0.001	0.04
Vitamin B_6 (mg)	2[$]	1.1±0.53	<0.001	1.13±0.57	<0.001	0.37
Vitamin B_9 (µg)	500[$]	193.58±103.87	<0.001	197.2±87.24	<0.001	0.61
Vitamin B_{12} (µg)	2.8[$]	2.21±0.9	<0.001	2.12±0.77	<0.001	0.11
Vitamin C (mg)	120[$]	64.54±38.6	<0.001	78.28±43.86	<0.001	<0.001
Sodium (mg)	1,500[#]	1,416.71±724.63	0.02	1,478.46±560.08	0.5	0.2
Potassium (mg)	5,100[#]	2,185.33±793.04	<0.001	2,241.15±733.91	<0.001	0.33
Iron (mg)	9[$]	12.72±6.28	<0.001	12.2±4.79	<0.001	0.2
Calcium (mg)	1,000[$]	638.22±361.63	<0.001	643.61±252.09	<0.001	0.81
Magnesium (mg)	310[$]	205.97±91.23	<0.001	219.81±77.71	<0.001	0.03
Phosphor (mg)	700[$]	680.35±280.85	0.16	785.31±305.74	<0.001	<0.001
Zinc (mg)	12[$]	6.99±2.85	<0.001	7.88±2.55	<0.001	<0.001
Copper (µg)	1.3[$]	0.82±0.37	<0.001	0.91±0.32	<0.001	<0.001
Iodine (µg)	290[$]	117.2±48.18	<0.001	129.55±41.17	<0.001	<0.001

[a]DRI: Dietary reference intake, [b]ND: Not determinable, *paired t test, ** Independent t test, [$]Recommended dietary allowances (RDAs), [#]Adequate intakes (AIs)

Table 5: Correlation of energy and macronutrients with the age and BMI of lactating mothers.

Parameters	Age		BMI	
	R	P value*	R	P value*
Energy (kcal)	-0.36	<0.001	0.33	<0.001
Protein (g)	-0.18	<0.001	0.19	<0.001
Carbohydrate (g)	-0.42	<0.001	0.24	<0.001
Lipid (g)	-0.11	<0.001	0.16	<0.001

*Pearson correlation coefficient

pregnant adolescents have rarely been reported. The cause of low-calorie intake among older mothers may be attributed to a low socioeconomic status, lifestyle, and inadequate prenatal care. Further research on the effect of age on the nutrient intake of mothers is recommended.

A high percentage of women who were overweight or obese achieved an adequate or high caloric intake respectively, whereas the majority of the underweight women had a low calorie intake. Previous studies also reported high calorie intake among overweight women and low caloric intake among underweight lactating women.[28, 29] In contrast, low calorie intake by mothers with low BMI was not observed in another study, however, most mothers who had an adequate caloric intake were either obese or overweight.[11] Moreover, the study concluded that the recommended calorie intake for lactating mothers was above their required level.[11] It has been well documented that low calorie intake which leads to weight loss, especially in normal

and underweight lactating women, may be harmful to both mother and child. Therefore, dietary counseling on the consumption of a variety of healthy foods containing the recommended calorie level would contribute to achieving normal weight and good health for both mother and child.[30]

Previous studies have shown an association between the nutritional status of mothers and their educational level and employment.[7, 10] Our results also showed that mothers who had a higher level of education and those who were employed had an adequate level of daily calorie intake. Therefore, it is hypothesized that both nutrition knowledge and financial ability would promote nutritional status. In terms of the two lactation stages, we found significant difference between the status of caloric intake and the different lactation stages. Various studies have evaluated the nutritional status of mothers in different stages of lactation,[9, 11, 29] of which one study reported that most of the mothers had an adequate level of calorie intake during the first 6 months of lactation.[9] However, we observed a low calorie intake during the first and adequate calorie intake in the second 6 months of lactation. Another study examined the nutritional status of women in the Brazilian Amazon rainforest during the first 40 days after childbirth.[29] They concluded that cultural factors and local food taboos were the main reasons for inadequate nutrition. The authors recommended a specific focus on nutritional status during the first month of lactation; the most intensive breastfeeding period.

In line with other studies conducted in Bangladesh[31] and Brazil,[32] we found that the calorie intake among lactating mothers was below the recommended intake. Two other Iranian studies reported that the calorie intake among lactating women in Tabriz[11] and Shiraz[8] was lower than the RDA. However, the reported average calorie intake among American mothers was higher compared to our results.[7] Regardless of the breastfeeding stage, one reason for the low calorie intake might be due to the social pressure on mothers to return to their pre-pregnancy body weight.[3] Insufficient caloric intake in mothers can lead to the depletion of body reserves and cause damage. Although a previous Iranian study concluded that the recommended daily calorie intake was higher than required by lactating mothers,[11] further research on this topic is recommended. In line with other studies conducted in Iran,[11, 33] we did not observe a significant difference between the calorie intake of the lactating mothers in the urban or rural areas.

The results of the present study showed that the intake of micronutrients (the vitamins A, D, B2, B5, B6, B9, and C; potassium, calcium, magnesium, zinc, copper, and iodine) by lactating women was highly inadequate. A similar study in Khorramabad likewise reported calcium, iodine, magnesium, phosphorus, zinc, and vitamins C, B9, B2, and D deficiency in lactating mothers.[10] These findings revealed nutritional deficiencies and inadequacies in the dietary pattern of lactating mothers in Khorramabad. Another study conducted in Tehran (Iran) also reported a low intake of vitamins B6 and B9; calcium, and zinc among urban women.[34] Calcium deficiency is mainly associated with lower consumption of dairy products and is a serious risk factor during lactation. A previous study reported that the intake of vegetables and fruits among pregnant women in Maku (Iran) was less than three servings a day.[33] A low intake of some micronutrients in our study was probably also related to a lower intake of fruits and vegetables. Lactating mothers must consume more fruit and vegetables than the general public, to meet their nutrient requirements.[30] Vitamin A deficiency is one of the most common forms of micronutrient deficiency in developing countries.[35] Considering a high correlation between the fat content in breast milk and maternal diet, the intake of fat-soluble vitamins by infants can vary substantively.[1] It is recommended that lactating mothers should consume more fat and animal products to produce more retinol.[1] Another study also recommended the intake

of iodine supplements during pregnancy and lactation,[12] since the recommended dosage of iodized salt for lactating women may not be sufficient. Moreover, considering the marginal zinc deficiency and a high prevalence of malnutrition in Iran, administration of zinc supplementation to lactating mothers is another recommendation.[13]

The results of the present study showed that the intake of proteins and some micronutrients (the vitamins K, B_1, B_2, B_3, B_5, and C; magnesium, phosphorus, zinc, copper, and Iodine) by lactating mothers in urban areas was statistically lower than that in rural areas. Previous studies also reported that the intake of meat and dairy products in rural areas was higher than in urban areas.[33, 36] This could be due to a higher intake of protein by lactating mothers living in rural areas. Note that protein intake should be more than the required daily amount to prevent a negative nitrogen balance. The consumption of fruits and vegetables, as the main source of vitamins and minerals, should be increased during pregnancy and lactation. The findings of a previous study in Maku (Iran) indicated that the consumption of fruits and vegetables by pregnant women in the rural areas was higher than in urban areas.[33] This is probably because agriculture is the primary industry in most rural areas and homegrown fruits and vegetables are readily available at low cost. A further interpretation and comparison of the measured nutrients in the present study was not possible due to the lack of comparable studies on dietary intakes of nursing mothers in the urban and rural areas of Iran.

The results showed that the intake of total energy and macronutrients negatively correlated with age, but had a positive correlation with BMI. The caloric intake is influenced by many factors such as age, pregnancy stage and lactation period, hormonal status, and dietary pattern. A study conducted in the United States reported that the caloric intake in women peaked in the second decade of life and declined thereafter.[37] A review of cohort and cross-sectional data in the United States indicated an age-related dietary intake and the energy intake by elder women was significantly reduced; leading to a subsequent reduction of the intake of most nutrient.[38] In line with the findings of the present study, a significant positive correlation between the energy intake and BMI was reported among Malaysian women.[39] They showed that the effect of energy consumption on body weight was greater compared to the macronutrient composition of the diet.[39]

The main strength of the present study was the relatively large sample size, which was stratified by diverse socio-demographic characteristics. This enabled us to observe important differences between the various groups and provide a good representation of lactating mothers in both the rural and urban areas. Furthermore, the simultaneous application of 24HDR and DR questionnaires was another strength of the present study. The benefits of using these methods were: (i) collecting the actual intake on specific days, (ii) less burden of memory than with the food frequency questionnaire (FFQ) which requires recall over a long period (e.g., the previous 12 months), and (iii) the usual intake can also be estimated if repeated.[40] The limitation of the present study was related to its cross-sectional design, which did not provide definite information about cause-and-effect relationships. However, it provided interesting associations between the study parameters.

Conclusion

Our findings indicated that the recommended dietary allowance of calories and some key essential nutrients (the vitamins A, D, B, and C; potassium, calcium, magnesium, zinc, copper' and iodine) was not met during the lactation period. There is a need to address the observed lower intake of protein and some micronutrients (vitamins B and C; magnesium, zinc, and iodine) among lactating mothers in urban areas compared to those in rural areas. To promote health and improve the nutritional status of lactating women, it is essential to

provide nutrition education. This will create awareness on appropriate nutritional practices and the need for dietary diversity during the lactation period. Further research is required to evaluate the adequacy of the nutritional intake by lactating women in other regions of Iran.

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