O RIGINAL ARTICLES

The relationship between food security, dietary patterns, and socioeconomic status in Iranian pregnant women

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Summary. *Background and aim:* According the World Health Organization definition, food security is defined as physical, social and economic access to nutritionally adequate and safe food for a healthy and active life. Inappropriate diet in pregnancy may have detrimental effect on fetus. The aim of this study was to investigate the association of socio-economic variables with dietary patterns in food secure and not secure pregnant women of Khodabandeh, Zanjan, Iran. *Materials and methods:* Two hundred eight pregnant women were enrolled to the current study. The housholds food security was assessed using 18 item USDA questionnaire. Dietary patterns were identified by principal components analysis using a validated 132 item food frequency questionnaire (FFQ). *Results:* This population-based cross-sectional study was carried out on 208 pregnant women with mean age of 28.08± 5.99. The prevalence of food insecurity was 33.6%. Monthly income, family number, dietary supplements, parents educationlevel have role in food insecurity status. Three dietary patterns were identified: *Traditional, western and Un-healthy snack. Conclusion:* Considering the asociation of socio-economic factors with food security status in pregnant women and determining dietary patterns during pregnancy, these factors should be considered to provide effective screening during the pregnancy and reduce the risk of food insecurity.

Key words: pregnancy, food security, Iran, food insecurity

Introduction

The term food security is defined as physical, social and economic access to nutritionally adequate and safe food for a healthy and active life(1). This definitional framework consists of four essential parts:availability,access,utilization, stability(2). The latest FAO available estimates indicate that about 800 million people in the world, just over one in nine were undernourished(3). Most of them are inhabitants of Africa and different regions of Asia(3) in various studies Iran has been reported in a medium-risk condition due to food insecurity(4). In 2016 a systemic review study re-

ported that the prevalence of food insecurity among Iranian households was 49%(5).

Household Food insecurityhas adverse social and psychological effects in addition to its health effects and also is associated with poverty, poor dietary intake, limited social capital, and depressive disorders (6, 7) Hence, address this issue for the community is one of the major objectives of development planning.

Food insecuritymay be chronic, seasonal, or transient(8) and also is notable in different stages of life, especially during pregnancyBecause of the sensitive conditions of the mother and the fetus is a global concern(9).It is important for pregnant women to have

both an adequate quantity and quality of food(10). It is suggested that food insecurity is associated with poor pregnancy outcomes, increased risk of low birth weight, some neonatal defects, gestational diabetes and other pregnancy complications(9). Prior USDA research estimated that 76.6% of U.S pregnant women were fully food securewhile 33.4% were indifferent grades ofinsecurity (11).

Pregnant women have increased nutritional requirements (12).The importance of some nutrients during pregnancy has been discussed frequently in previous studies.Many analyses of the relationship between diet and outcome are based on a single or a few food items or nutrients(13). However, foods and nutrients are not eatenseparately andcombination of them is consumed. Considering the dietary patterns comprise the complexity of food intakesand provides a good picture of the diet and nutrition habits of people in the community (14).

Thus, it is important to understand the factors associated with the dietary patterns in pregnant women, in our study, the aim was to understandthe socio-economic factors association with dietary patterns in food secure and not secure pregnant women.

Materials and methods

The study was carried out among pregnant women in Khodabandeh, Iran. 208 pregnant women aged 18-45 with simple random sampling included in this study. The subjects were excluded if they had diagnosis of chronic diseases such as cardiovascular or diabetes, malignancy and psychiatric illness.

Anthropometric measurements
Weight was measured without shoes with minimal clothing using a SECA electronic scale with 0.1 kg sensitivity. Height was measured using tape to the nearest.5 cmwhen the bare foot participants were standing against the side wall. Body mass index (BMI) was calculated as weight in kilograms divided by the square of the height in meters (kg/m²).

Food security assessment
To assess the household food security status in the last 12 months, we used the 18-statement question-naire proposed by the USDA(15). The validity of this questionnaire for Iranian households has been previously approved (16). The subjects were divided into fourgroups based on number of positive responses according the questionnaire:Food secure (0-2), food insecurewithout hunger (3-7), Food insecure with moderate hunger (8-12) and food insecure with severe hunger (13-18). To have enough sample size in each group, the participants were divided into two groups: Food insecure and Food secure groups.

Dietary Assessment
Dietary intake was assessed using a validated 132 item food frequency questionnaire (FFQ). Food items were grouped into ten food groups as follows: meat, eggs, milk and milk products, fruits, vegetables, beverages, cereals, oil and fats, sugars, salt and additives. The frequency of consumption (never, times a day, times a week, times a month or times per year), as well as the usual amount of consumption per meal for each item were askedduring theface-to-face interviews with the participants.

Dietary patterns were identified using principal components analysis (PCA), for this purpose the items of the FFQ were grouped into 25 predefined food groups according to nutrient profile and culinary use,to minimize the number of indicators that have high loading on one factorthe components were extracted after varimax rotation. Factor loading score greater than 0.3 was used to determine food groups in each food pattern

Statistical analysis
In this study, SPSS version 19 was used for statistical analysis. To evaluate the normality of quantitative variables, The Kolmogorov-Smirnov test was used. Quantitative and qualitative data were reported by frequency (%) and mean± SD respectively. Independent sample T-test,Chi-Square test and logistic regression were used fordata analysis.

Results

General characteristics of the study subjects are presented in table 2. Current study examined the association of food insecurity and dietary patterns with

Table 1. Food groups used in dietary pattern analysis

SUB GROUPS	Food Items
Traditional breads and cereals	Sanghak, lavash, shyrmal bread, barbari, wheat germ, oat bread, samanou, rice, oat, maize, grout, noodles, pasta, wheat flour
Industrial bread and cereals	short cake, toasted flour, toasted bread, baguette, popcorn, pizza dough
High fat dairies	High fat milk, high fat yogurt, cream cheese, pasteurized ice cream, traditional ice cream, cream lighvan cheese
Low fat dairies	Low fat milk, low fat yogurt, dough,, pasteurized cheese, curd, cocoa milk, chocolate milk
Fruits	Apple, citrus, banana, melon and water melon, peach, berry, lemon, kiwi, cherry, grape, plum, persimmon, pineapple, fig, date, compotes, drupelet, strip, peach strip, pomegranate, blueberries
Fruit juices	Natural and commercial juice, fruit syrup
Condiments	Verjuice, lemon juice, pomegranate Sause, ketchup, salt
Vegetables	Carrot, cabbage, spinach, green peppers, lettuce, stewed vegetable, cucumber, garlic, onion, eggplant, okra, celery, green bean, turnip, squash, mushroom, tomato
Potato	Potato
Pizza	Pizza
Legumes	Beans, pea, lentil, soy, split pea
Processed meats	Sausage, hamburger, canned tuna fish
Red meat	Beef, mutton
Organ meat	Liver, tongue
Chicken	Chicken, egg
Fish	Fish
Nuts	Almond, peanut, pistachio, hazelnut, roasted seeds, walnut
Olive	Olives, olives oil
Mayonnaise	Mayonnaise
Saturated fats	Butter, animal fats, ghee
Unsaturated fats	Vegetable oils (except for olive oil)
Sweets and desserts	Sugar, candies, jam, honey, jelly, cookies, cake, creamy cake, chocolate, cream-caramel, halva, gaz, cotton candy, baklava, zoolbia, grape juice, shole-zard donuts,
Tea and coffee	Tea, coffee
Pickles	Pickles
Drinks	Carbonated drinks, non-alcoholic beer, diet drinks
Broth	Broth
Snacks	Crackers, gums, wafers, puffs, biscuits
chips	Potato chips, French fries

socio-economic factors in pregnants. Two hundred and eight pregnant women were recruited to this study. All of the questionnaires were completed in a in a face-to-face interview.

The prevalence of food security among the study subjects surveyed was 66.34 % (n= 138), with 33.66 % (n= 70) having food insecurity. Approximately one in three assessed subjects were food insecure (Fig.1). The multivariate regression results suggest that women with low education (P= 0.006; OR= 3.64), low husband education (P= 0.025; OR= 3.88), low family income (P<0.001; OR= 7.39) and low number of deliveries (P= 0032 OR= 9.80) were more likely to be food insecure. Also the age of women (P= 0.025; OR= 2.52) positively was associated with food insecurity. In the current study no significant association was seen between other examined socio-economic factors (family number, supplement intake disease

Table 2. General characteristics of the study population (n=208)

Income	High	33 (15.9)
	Moderate	76 (36.5)
	Low	99 (47.6)
Family number	2	52 (25)
	3	69(33.2)
	4 and more	87 (41.8)
Dietary supplements	Yes	195 (93.8)
	No	13(6.2)
Husband education	Academic	60 (28.8)
	Diploma and Under diploma	123 (59.1)
	Elementary	25 (12)
education	Academic	60 (28.8
	Diploma and Under diploma	117 (56.3)
	Elementary	31 (14.9)
Disease history	No	201 (96.6)
	Yes	7 (3.4)
Abortion history	No	167 (80.3)
	Yes	41 (19.7)
Weight gain adequacy	Adequate	53 (25.5)
	Inadequate	80 (38.5)
	Exceeded	75 (36.1)
Number of Deliveries	4 and more	22 (10.6)
	2-3	111 (53.6)
	First	74 (35.7)
pre-gravid BMI	>25	78 (62.5)
	<25	130 (37.5)
age	<25	60 (28.8)
	25-34	107 (51.4)
	34 and more	41 (19.7)
Husband age	<29	64 (30.8)
	29-34	68 (32.7)
	34 and more	76 (36.5)
Age of marriage	<18	53 (25.5)
	18-21	79 (38)
	21 and more	76 (36.5)

Table 3. the association of food insecurity and socio-economic factors.

Variables		P-value	OR	95% CI	
				Lower	Upper
Income	High	Ref.	Ref.	Ref.	Ref.
	Moderate	0.274	1.93	0.593	6.30
	Low	<0.001	7.39	2.42	22.60
Family number	2	Ref.	Ref.	Ref.	Ref.
	3	0.02	2.47	1.12	5.46
	4 and more	0.22	1.72	0.710	4.16
Dietary supplements	Yes	Ref.	Ref.	Ref.	Ref.
	No	0.02	4.78	1.18	19.31
Husband education	Academic	Ref.	Ref.	Ref.	Ref.
	Diploma and Under diploma	0.188	1.71	0.768	3.82
	Elementary	0.025	3.88	1.18	12.73
education	Academic	Ref.	Ref.	Ref.	Ref.
	Diploma and Under diploma	0.912	1.04	0.475	2.30
	Elementary	0.006	3.64	1.45	9.11
Disease history	No	Ref.	Ref.	Ref.	Ref.
	Yes	0.602	1.50	0.326	6.89
Abortion history	No	Ref.	Ref.	Ref.	Ref.
	Yes	0.239	1.52	0.755	3.07
Weight gain adequacy	Adequate	Ref.	Ref.	Ref.	Ref.
	Inadequate	0.471	1.32	0.619	2.82
	Exceeded	0.158	1.62	0.828	3.19
Number of Deliveries	7 and more	Ref.	Ref.	Ref.	Ref.
	4-6	0.403	2.46	0.297	20.47
	3 and less	0.032	9.80	1.21	79.44
pre-gravid BMI	>25	Ref.	Ref.	Ref.	Ref.
	<25	0.325	1.354	0.740	2.47
age	34 and more	Ref.	Ref.	Ref.	Ref.
	25-34	0.025	2.52	1.12	5.65
	<25	0.600	0.775	0.299	2.01
Husband age	34 and more	Ref.	Ref.	Ref.	Ref.
	29-34	0.309	1.42	0.719	2.83
	<29	0.809	0.915	0.444	1.88
Age of marriage	21 and more	Ref.	Ref.	Ref.	Ref.
	18-21	0.232	0.662	0.336	1.30
	<18	0.918	1.03	0.503	2.14

Data analysis was done by multinomial logistic Regression. The reference category was Secure group.
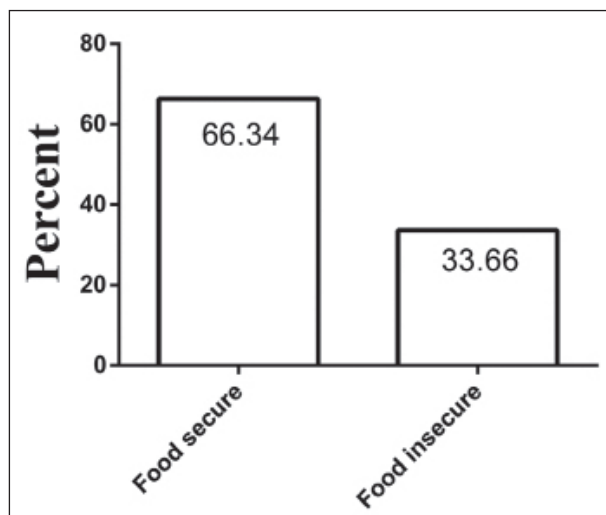
history, abortion history, weight gain adequacy during pregnancy, pre-gravid BMI, husband age and age of marriage) and food insecurity (Table 3).

Three major patterns of diet were identified for the study population. The first pattern was named "*traditional* consumption pattern". The foods that mostly

Figure 1. Food insecurity in the study population

Table 4. Factor loading matrix for major dietary patterns in pregnant women.

	Component		
	Traditional	**Un-healthy snack**	**Western**
Processed meat	0.905		
Industrial bread and cereals	0.806		
Fruit juice	0.806		
Pizza	0.754		
Legumes	0.746		
Poultry	0.651		
Organ meats	0.648		
Fishes	0.635		0.409
Nuts	0.615		0.340
Vegetables	0.581	0.380	0.388
Sweets and desserts	0.477		0.355
High-fat dairies	0.430	0.333	
Low-fat dairies	0.430		
Potato	0.373		
Broth	0.364		
Tea and coffee		0.666	
Traditional breads and cereals		0.518	
Condiments		0.464	
Chips		0.453	
Saturated fats	0.372	0.442	
Drinks			0.692
Mayonnaise			0.782
Snack			0.713
Red meat	0.373		0.473
Unsaturated fats			0.486
Fruits	0.503		0.596
Pickles			0.501
Olive			0.483

consumed in this dietary pattern were processed meat, industrial bread and cereals, fruit juice, pizza, legumes, poultry, organ meat, fishes, nuts, vegetables, high and low fat dairies etc. The second dietary pattern was characterized with high consumption of red meat, unsaturated fats and olive. This pattern was named "*western* diet". The third pattern that named "*un-healthy snack*" contains dietary items such as tea and coffee, chips, saturated fats, traditional bread and cereals and condiments (Table 4).

Three dietary patterns were identified: *Traditional, western and Un-healthy snack*. In the Multivariate analysis, subjects with lower education (OR = 2.98; P= 0.021) and low husband education (OR = 3.36; P= 0.019) had higher adherence to the *Traditional* pattern (Table 5). The highest adherence to the *unhealthy snack* pattern was found for the subjects with lower pregravid BMI (OR= 1.78; P= 0.046) (Table 6). Family monthly income (OR= 0.67; P= 0.046), husband education (OR= 0.45; P= 0.009) and age (OR= 2.00; P= 0.034) were the socioeconomic and demographic factors that determined the adherence to *western* pattern (Table 7).

In the current study the association of identified dietary patterns and food insecurity also was assessed. As it is shown in table 8, no significant association was seen between the identified dietary patterns and food insecurity after adjustment of monthly income.

Discussion

Approximately one-third of allsurveyed pregnantwomen were food insecure. Our results are similar to the results of other studies conducted in Iran;Hojaji et al. demonstrated that the prevalence of food insecurity among mothers was 34.8%(17). Laraia et al. in a cross-sectional study reported the prevalence of food insecurity in the families of pregnant women in the state of Carolina 25%(18).The differences between the results of our study and foreign studies may be rooted

Table 5. The association of *traditional* dietary pattern and socio-economic factors.

Variables		P-value	OR	95% CI	
			Lower	Upper	
Income	High	Ref.	Ref.	Ref.	Ref.
	Moderate	0.233	0.606	0.266	1.380
	Low	0.999	1.00	0.453	2.206
Family number	2	Ref.	Ref.	Ref.	Ref.
	3	0.205	0.663	0.351	1.251
	4 and more	0.418	0.752	0.378	1.498
Dietary supplements	Yes	Ref.	Ref.	Ref.	Ref.
	No	0.775	1.179	0.382	3.634
Husband education	Academic	Ref.	Ref.	Ref.	Ref.
	Diploma and Under diploma	0.489	1.24	0.669	2.31
	Elementary	0.019	3.36	1.22	9.24
education	Academic	Ref.	Ref.	Ref.	Ref.
	Diploma and Under diploma	0.800	1.08	0.580	2.02
	Elementary	0.021	2.98	1.18	7.55
Disease history	No	Ref.	Ref.	Ref.	Ref.
	Yes	0.702	1.34	0.294	6.17
Abortion history	No	Ref.	Ref.	Ref.	Ref.
	Yes	0.239	1.52	0.755	3.07
Weight gain adequacy	Adequate	Ref.	Ref.	Ref.	Ref.
	Inadequate	0.378	0.909	0.400	1.41
	Exceeded	0.909	0.753	0.449	1.83
Number of Deliveries	7 and more	Ref.	Ref.	Ref.	Ref.
	4-6	0.416	0683	0.273	1.71
	3 and less	0.943	1.035	0.398	2.96
pre-gravid BMI	>25	Ref.	Ref.	Ref.	Ref.
	<25	0.325	1.354	0.740	2.47
age	34 and more	Ref.	Ref.	Ref.	Ref.
	25-34	0.415	1.35	0.655	2.78
	<25	0.444	1.36	0.615	3.03
Husband age	34 and more	Ref.	Ref.	Ref.	Ref.
	29-34	0.710	0.883	0.458	1.70
	<29	0.372	1.35	0.695	2.64
Age of marriage	21 and more	Ref.	Ref.	Ref.	Ref.
	18-21	0.798	1.08	0.578	2.04
	<18	0.166	1.65	0.813	3.35

Data analysis was done by logistic Regression. The reference category was Upper median of traditional dietary pattern score.

Table 6: the association of *Un-healthy snack* and socio-economic factors.

Variables		P-value	OR	95% CI	
			Lower	Upper	
Income	High	Ref.	Ref.	Ref.	Ref.
	Moderate	0.626	1.22	0.540	2.78
	Low	0.481	0.753	0.342	1.65
Family number	2	Ref.	Ref.	Ref.	Ref.
	3	0.576	1.19	0.636	2.25
	4 and more	0.346	0.717	0.359	1.43
Dietary supplements	Yes	Ref.	Ref.	Ref.	Ref.
	No	0.163	0.422	0.126	1.41
Husband education	Academic	Ref.	Ref.	Ref.	Ref.
	Diploma and Under diploma	0.881	1.04	0.565	1.94
	Elementary	0.101	0.440	0.165	1.17
education	Academic	Ref.	Ref.	Ref.	Ref.
	Diploma and Under diploma	0.375	0.752	0.402	1.40
	Elementary	0.107	0.483	0.199	1.17
Disease history	No	Ref.	Ref.	Ref.	Ref.
	Yes	0.265	0.388	0.076	2.04
Abortion history	No	Ref.	Ref.	Ref.	Ref.
	Yes	0.384	1.35	0.682	2.69
Weight gain adequacy	Adequate	Ref.	Ref.	Ref.	Ref.
	Inadequate	0.812	0.926	0.943	1.73
	Exceeded	0.975	1.01	0.500	2.04
Number of Deliveries	7 and more	Ref.	Ref.	Ref.	Ref.
	4-6	0.548	0.835	0.463	1.50
	3 and less	0.149	0.486	0.182	1.29
pre-gravid BMI	>25	Ref.	Ref.	Ref.	Ref.
	<25	0.046	1.78	1.01	3.15
age	34 and more	Ref.	Ref.	Ref.	Ref.
	25-34	0.442	0.779	0.413	1.47
	<25	0.083	0.489	0.218	1.09
Husband age	34 and more	Ref.	Ref.	Ref.	Ref.
	29-34	0.752	1.11	0.647	2.13
	<29	0.498	1.25	0.577	2.45
Age of marriage	21 and more	Ref.	Ref.	Ref.	Ref.
	18-21	0.463	0.674	0.674	2.38
	<18	0.186	0.795	0.795	3.26

Data analysis was done by logistic Regression. The reference category was Upper median of Un-healthy snack dietary pattern score.

Table 7: the association of *Western dietary* pattern and socio-economic factors.

Variables		P-value	OR	95% CI	
			Lower	Upper	
Income	High	Ref.	Ref.	Ref.	Ref.
	Moderate	0.792	0.89	0.486	1.57
	Low	0.046	0.67	0.21	0.85
Family number	2	Ref.	Ref.	Ref.	Ref.
	3	0.872	1.05	0.560	1.98
	4 and more	0.948	1.02	0.515	2.03
Dietary supplements	Yes	Ref.	Ref.	Ref.	Ref.
	No	0.775	0.848	0.275	2.61
Husband education	Academic	Ref.	Ref.	Ref.	Ref.
	Diploma and Under diploma	0.187	1.52	0.815	2.85
	Elementary	0.009	0.45	0.12	0.69
education	Academic	Ref.	Ref.	Ref.	Ref.
	Diploma and Under diploma	0.432	1.28	0.687	2.40
	Elementary	0.058	2.37	0.971	5.82
Disease history	No	Ref.	Ref.	Ref.	Ref.
	Yes	0.265	0.388	0.074	2.04
Abortion history	No	Ref.	Ref.	Ref.	Ref.
	Yes	0.384	0.737	0.371	1.46
Weight gain adequacy	Adequate	Ref.	Ref.	Ref.	Ref.
	Inadequate	0.128	0.611	0.324	1.15
	Exceeded	0.572	0.816	0.403	1.65
Number of Deliveries	7 and more	Ref.	Ref.	Ref.	Ref.
	4-6	0.999	1.00	0.555	1.80
	3 and less	0.391	1.52	0.581	4.00
pre-gravid BMI	>25	Ref.	Ref.	Ref.	Ref.
	<25	0.775	1.08	0.619	1.90
age	34 and more	Ref.	Ref.	Ref.	Ref.
	25-34	0.034	2.00	1.05	3.80
	<25	0.896	0.896	0.398	2.01
Husband age	34 and more	Ref.	Ref.	Ref.	Ref.
	29-34	0.597	0.838	0.435	1.61
	<29	0.580	1.20	0.620	2.35
Age of marriage	21 and more	Ref.	Ref.	Ref.	Ref.
	18-21	0.932	0.973	0.518	1.82
	<18	0.643	0.847	0.420	1.71

Data analysis was done by logistic Regression. The reference category was Upper median of western dietary pattern score.

in socio-economic factors and development status of societies.

The results from multivariate regression confirmed the critical importance of income and education level as indicators of risk for food insecurity among pregnant women. These findings are consistent withNweze et al. study(19).As suspected, by increasing the level of education of mothers and husbands, they will have a better nutritional knowledge and function in choosing food groups. Also, a higher level of education can pave the way for a better job and higher income, which ultimately leads to more family access to high-quality foods(20).

In this study, there was a significant association between the low number of deliveries and food insecurity. Our resultis inconsistent with other studies, they have indicatedthat the increase of household member decreases the chances of household food security(21). We suppose that large family size is considered as labor source especially in developing countries. Bashir *et al.* showed that Pakistani households with three earning members as opposed to households with one earning member were 20 times more likely to become food secure(22).

The following three dietary patterns were identified: *traditional* pattern that explained most of the dietary variance and was characterized by processed meat, industrial bread and cereals, fruit juice, legumes, fishes, nuts, vegetables, high and low fat dairies etc. *un–healthy snack*patterncharacterized by tea and coffee, chips, saturated fats, *traditional* bread and cereals and condiments.*Western* pattern consisted of a consumption of red meat, unsaturated fats and olive.

The women with a lower education level or low educated husbandsare more likely to adhere to the*traditional* pattern.These findings are in agreement with Hoffmann study which verified that pregnant women with lower education were more likely to consume the traditional Brazilian food items(23).

Low adherence to *western* pattern was associated with low household income and low Husbands' education. According to Cunha et al. study The *Western* pattern was positively associated with family income. They also found that even small increases in income are related to increased adherence to the '*Western*' pattern(24).*Western* dietary pattern included some expen-

sive food items such as red meat and etc. this creates barriers to access by low-income population.

In our study the extracted food patterns did not show significant association with food security status. This finding is inconsistent with the results of other similar studies. In a cross-sectional study, Beck et al. surveyed the relationship between food security and dietary patterns in 4567 over-15-year-old individuals in New Zealand. The results of this study showed a correlation between the pattern of healthy diet and food insecurity(25). Lack of association between the identified dietary patterns and food insecurity in the present study is probably because of low sample size.

The results of present study imply that low monthly income and low education level was strongly associated with increased risk of food insecurity in pregnant women. Socioeconomic factors also determine dietary patterns during pregnancy. Family income, parent's education level, pre-gravid BMI and age were associated with different dietary patterns. So these factors should be considered to provide effective screening during the pregnancy and reduce the risk of food insecurity.

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