



The Relationship between Structural Social Determinants of Health and Food Insecurity among Pregnant Women

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Abstract

Background: Food insecurity, as a major public health concern, is a useful indicator of an individual's health and wellbeing.

Objectives: This study aimed to identify the relationship between the structural social determinants of health and food insecurity among pregnant women.

Methods: This cross sectional study was conducted on 837 pregnant women, using stratified cluster sampling. The number of samples from each city of Ilam Province was determined, based on the proportion of women at reproductive age in every city. Urban healthcare centers were selected from each city, and eligible samples were recruited at 24-28 weeks of gestation, based on the inclusion criteria. Data were collected on women's demographic and obstetric characteristics, socioeconomic status, and food security status. Data were analyzed using SPSS version 19.

Results: The results showed that the mean age of women was 28.73 ± 4.41 years. Overall, 35.1% of samples had food insecurity (mild, moderate, and severe insecurity: 24.9%, 7.5%, and 2.9%, respectively). Food insecurity had a significant relationship with the structural social determinants of health ($P < 0.001$). The logistic regression analysis revealed that the structural social determinants of health were protective factors against food insecurity, as the probability of household food insecurity was lower in women with college education, employees, and high-income households (OR, 0.118, 0.411, and 0.050, respectively).

Conclusions: Food insecurity is a common problem, associated with the social determinants of health. Therefore, establishment of food security requires access to the necessary nutrients for all family members, especially the vulnerable ones.

Keywords: Food Security, Food Insecurity, Pregnant Women, Social Determinants of Health

1. Background

Proper nutrition is a key factor that contributes to a healthy life, especially in pregnant and lactating women (1). Food security is defined as having sufficient access to sufficient food to maintain a healthy life for all people at all times (2, 3). On the other hand, food insecurity refers to limited or uncertain access to adequate and safe food or uncertain ability to acquire adequate food in a socially acceptable way (4, 5).

Studies on pregnant women have reported different prevalence rates of food insecurity. For instance, Laraia et al. (2006) and Yadegari et al. (2017) reported the prevalence of food insecurity to be 24% and 30.9%, respectively (6, 7). Overall, food insecurity, as a useful indicator of health and

wellbeing, is a major public health concern, which can be considered a social determinant of health (SDH) (8). Today, special attention has been paid to the nonmedical determinants of health. Each determinant strongly influences a person's health status independently or through mutual impact with other factors (9).

According to the commission on social determinants of health (CSDH) of the world health organization (WHO), the health determinants are as follows: (i) structural SDH including education, income, gender, and race; (ii) intermediate SDH including living conditions, access to food, and psychosocial and behavioral factors; (iii) underlying socioeconomic policy factors including macroeconomic and social policies, such as labor market, housing, culture, and social values; and (iv) level of health inequalities.

These determinants have mutual relationships, which affect one's health (10, 11).

In industrialized countries, there is a positive correlation between diet quality and socioeconomic status, as described by conventional indicators, such as occupation, education, or income level (12). It has been also suggested that low income is an important determinant of food insecurity. While families with food insecurity are not necessarily poor, other demographic and socioeconomic factors may be associated with the increased risk of food insecurity, including unemployment, limited access to food aid programs, low level of education, drug and tobacco abuse, and heavy costs of housing, transportation, and healthcare (12, 13).

Food insecurity is related to various nutritional problems, which can reduce individuals' health and wellbeing. Food insecurity is associated with the poor intake of food and nutrients, physical and mental health problems, obesity, nonadherence to medications, increased use of healthcare services, and poor management of chronic diseases (14, 15). Borders et al. (2007) and Laraia et al. (2010) showed that food insecurity is associated with poor pregnancy outcomes, such as gestational diabetes and low birth weight (16, 17).

Recently, proper nutrition has been introduced as an indicator of health and economic/social development by policymakers in developing countries. Women are of particular importance in economic and national development, as they are responsible for raising the next generation. Lack of proper nutrition in women during vulnerable periods can have long-term effects on the nutritional security of the country. Therefore, improvement of the nutritional status of pregnant women is necessary through providing proper education and nutritional programs in accordance with nutritional standards. Moreover, appropriate interventions are needed to resolve nutritional deficiencies in a way that the burden of disease is reduced. According to the literature review, this study is among recent research, examining food security and its predictive factors among pregnant women in an Iranian context.

2. Objectives

This study aimed to identify the relationship between structural SDH and food insecurity among pregnant women.

3. Methods

3.1. Study Design and Sampling Criteria

This study is part of a PhD dissertation, entitled "Design and analysis of social determinants of health in a com-

munication model on the pregnancy outcomes of pregnant women at Ilam health centers". The final sample size was calculated according to the outcomes with the lowest prevalence rate (n, 669; P, 6%; d, 0.018) (18). Considering an attrition rate of 20%, the final sample size was calculated at 837.

Additionally, the sample size was determined with respect to each goal of the study. The sample size for evaluating the relationship between SDH and food insecurity was 329 with respect to a prevalence rate of 31% (P, 31%; d, 0.05) (6). In addition, with regard to the sampling method (cluster sampling) and design effect of 2, the sample size was measured at 658. Since the sample size for the main purpose of the study was larger than the target sample size, a larger population was considered as the main sample size (n, 837).

A total of 837 eligible women were randomly selected and invited to participate in the study. Ilam province in Southwest of Iran includes 10 cities with 197 896 women of reproductive age. For each city, the number of samples was determined, based on the proportion of women at reproductive age. This study was conducted from April to December 2016. After obtaining permission from the research council of Shahid Beheshti University of Medical Sciences (SBMU) and Ilam University of Medical Sciences (IUMS), the researchers visited urban healthcare centers. After explaining the objectives of the study and obtaining informed consents from the participants, sampling was carried out.

3.2. Inclusion and Exclusion Criteria

The inclusion criteria were as follows: i) being literate and able to read and write Farsi; ii) gestational age of 24 - 28 weeks; iii) no known medical conditions hindering participation in the study; and iv) consent to participate in the study. On the other hand, women who did not cooperate or did not complete the data collection forms were excluded from the study.

3.3. Sampling

Stratified cluster sampling method was applied in the study to recruit samples. All cities of Ilam Province were divided into 5 geographical regions (Central, North, South, East, and West), and then centers (governmental centers) were randomly selected from each region for sampling. Each region was considered as a cluster, and then, the sample size for each center was calculated considering the main sample size and number of prenatal documents. The urban healthcare centers were selected accordingly, and women at gestational weeks of 24 - 28 were recruited, based on the abovementioned criteria. After obtaining written

informed consent forms, data were collected using different tools.

3.4. Measurement Tools

Three questionnaires were used for data collection: (i) demographic and obstetric characteristics; (ii) socioeconomic status; and (iii) household food insecurity access scale (HFIAS).

3.4.1. Demographic and Obstetric Questionnaire

It consists of 35 questions on pregnancy, spouse's age, ethnicity, number of pregnancies, interpregnancy intervals, history of chronic diseases such as diabetes and hypertension, history of premature birth, low and high birth weight, abortion, and use of supplements. The questionnaire was designed by the research team.

3.4.2. Socioeconomic Status Questionnaire

This researcher-made questionnaire consists of 22 questions on the education and occupation of women and their spouse, number of people living at home, number of working people at home, monthly household income, individual's independent income, household expenses per month, type of housing, and form of house ownership. The face and content validity of the questionnaire were assessed. This questionnaire was developed based on the literature search and was presented to 10 faculty members at the School of Nursing and Midwifery, as well as 10 women. Some minor suggestions were made, which were incorporated in the questionnaire.

The impact scores of items ranged from 3.5 to 5. According to the Lawshe table, the questionnaire had high content validity, as the mean relevance, simplicity, and clarity of questions were 0.94, 0.98, and 0.98, respectively. In terms of reliability, 20 women were requested to complete the questionnaire in 2 phases within a 14-day interval. Cronbach's alpha was reported to be 0.794, indicating a high internal consistency.

3.4.3. HFIAS

HFLAS consists of 9 questions, rated on a 4-point scale (often, sometimes, rarely, and never). It classifies individuals into 4 groups of food security, mild food insecurity, moderate food insecurity, and severe food insecurity, with scores of 0 - 1, 2 - 7, 8 - 14, and 15 - 27, respectively. The lowest and highest scores for each question are 0 and 3, respectively. This scale collects information on food insecurity in terms of access to food at the household level. The questionnaire was validated in Iran by Mohammadi et al. indicating its high validity and reliability. Its validity was also confirmed using face, content, and construct validity.

Additionally, Cronbach's alpha of HFLAS was 0.86, demonstrating its high internal consistency (19).

3.5. Statistical Analysis

Data were analyzed using descriptive (mean, standard deviation, frequency, and percentage) and inferential (Chi square and logistic regression analysis) statistics in SPSS version 19 (IBM© SPSS©, Armonk, NY, USA). P-value less than 0.05 was considered statistically significant.

3.6. Ethical Considerations

This article was part of a PhD dissertation on reproductive health, granted by the Research Council of SBMU, Tehran, Iran (decree code, SBMU.REC.1394.112; September 7, 2015). Written informed consent forms were signed by the participants after receiving information about the study objectives and processes.

4. Results

In this study, 103 out of 837 pregnant women were excluded, as they did not meet the inclusion criteria and were unwilling to continue the study. Accordingly, information was collected from 734 participants. The mean age of women and their spouses was 28.73 ± 4.41 and 33.41 ± 5.47 years, respectively. The mean number of pregnancies was 1.82 ± 0.96 . Among women with a history of pregnancy, 34 (8.6%) had a history of preterm delivery, and 15 (3.8%) had a history of infant's low birth weight. In terms of ethnicity, the majority of women (599, 81.6%) were Kurds (Table 1).

Data on socioeconomic factors showed that primary school (4%) and university education (57%) accounted for the lowest and highest frequencies of education level, respectively. The majority of women (86.3%) were housewives, and their partners were mostly employees (64%). Overall, 637 (86.8%) women reported the presence of a working person at home. Regarding the income level, most women (57.4%) had a household income of 10 to 20 million Rials (Table 2). Review of the status of food security showed that the majority of women (64.9%) had food security, while 35.1% reported food insecurity.

Regarding the association between structural SDH and food security in pregnant women, the Chi square test results showed no significant association between food insecurity and age of women or the household head ($P > 0.05$). However, the status of food insecurity was significantly correlated with structural SDH in pregnant women ($P < 0.001$) (Table 3).

Table 1. The Demographic and Obstetric Characteristics of Pregnant Women

Variables		No. (%)
Women's age, y	< 20	16 (2.2)
	20 - 30	435 (59.2)
	31 - 35	283 (38.6)
Spouse's age, y	20 - 30	245 (33.4)
	≥ 31	489 (66.6)
Age at marriage, y	< 18	77 (10.5)
	18 - 28	583 (79.4)
Ethnicity	Kurd	599 (81.6)
	Lur	77 (10.5)
	Others	58 (7.9)
Number of pregnancies	1	340 (46.3)
	2	238 (32.4)
	≥ 3	156 (21.3)
Interpregnancy interval, y	< 1	60 (15.2)
	1 - 2	52 (13.2)
	> 2	282 (71.6)
History of low birth weight	Yes	15 (3.8)
	No	379 (96.2)
History of preterm delivery	Yes	34 (8.6)
	No	360 (91.4)
History of abortion	Yes	114 (15.5)
	No	620 (84.5)
History of cesarean section	Yes	165 (41.9)
	No	229 (58.1)

The binary logistic regression analysis was used for investigating the association between SDH and food insecurity (Table 4). The results of logistic regression analysis (unadjusted) revealed that the education level was a protective factor against food insecurity.

The probability of household food security was higher in women and household heads with college education (or higher), compared with those who had lower educational levels. Women with college education had an 89% lower odds of food insecurity, compared to those with elementary education (CI, 0.051 - 0.276; OR, 0.118). Also, women whose husbands had college education had an 84% lower risk of food insecurity, compared to those with elementary education (CI, 0.068 - 0.412; OR, 0.167).

The relationship between women's occupation and food insecurity indicated that employees and self-employed women had 59% and 2% lower odds of food insecurity, compared to housewives, respectively. More-

Table 2. The Socioeconomic Characteristics of the Participants

Variables		No. (%)
Women's education	Elementary school	29 (4)
	Secondary school	49 (6.6)
	Middle school	284 (38.7)
	High school	372 (50.7)
Spouse's education	Elementary school	22 (3)
	Secondary school	51 (6.9)
	Middle school	307 (41.9)
Women's job	High school	354 (48.2)
	Housewife	633 (86.2)
	Employee	82 (11.2)
Spouse's job	Self-employed	19 (2.6)
	Unemployed	12 (1.6)
	Employee	470 (64.1)
Family size	Self-employed	252 (34.3)
	1 - 3	566 (77.2)
	4 - 6	160 (21.8)
Number of working family members	7 - 10	8 (1)
	1	637 (86.8)
	2	95 (12.9)
Household income, Rials, million	3	2 (0.3)
	< 10	125 (17)
	10 - 20	421 (57.4)
Average household costs, Rials, million	> 20	88 (25.6)
	< 10	367 (50)
	10 - 20	342 (46.6)
Ownership of a bank account	> 20	25 (3.4)
	Yes	417 (56.8)
Living area, m ²	No	317 (43.2)
	< 80	222 (30.2)
	80 - 120	328 (44.7)
Type of housing	> 120	184 (25.1)
	House	488 (66.5)
	Apartment building	246 (33.5)

over, women with employed husbands had a 98% lower odds of food insecurity (CI, 0.003 - 0.174; OR, 0.022). The relationship between household income and food insecurity showed that women with income levels above 20 million Rials had a 95% lower odds of food insecurity than households with income below 10 million Rials (CI, 0.028 - 0.090; OR, 0.050).

Table 3. Relationship Between Food Insecurity and Structural Social Determinants of Health (SDH) in Pregnant Women^a

Variables		Food Security	Food Insecurity	P Value
Women's age, y	< 20	9 (56.2)	7 (43.8)	0.621
	20 - 30	287 (66)	148 (34)	
	31 - 35	180 (63.6)	103 (36.4)	
Spouse's age, y	20 - 30	157 (64.1)	88 (35.9)	0.758
	≥ 31	319 (65.2)	170 (34.8)	
Women's education	Elementary school	8 (27.6)	21 (72.4)	< 0.001
	Secondary school	21 (42.9)	28 (57.1)	
	Middle school	163 (57.4)	121 (42.6)	
	High school	284 (76.3)	88 (23.7)	
Spouse's education	Elementary school	8 (36.4)	14 (63.6)	< 0.001
	Secondary school	20 (39.2)	31 (60.8)	
	Middle school	174 (56.7)	133 (43.3)	
	High school	274 (77.4)	80 (22.6)	
Women's job	Housewife	398 (62.9)	235 (37.1)	0.007
	Employee	66 (80.5)	16 (19.5)	
	Self-employed	12 (63.2)	7 (36.8)	
Spouse's job	Unemployed	1 (8.3)	11 (91.7)	< 0.001
	Self-employed	272 (57.9)	198 (42.1)	
	Employee	203 (80.6)	49 (19.4)	
Family size	1 - 3	386 (68.2)	180 (31.8)	< 0.001
	≥ 4	90 (53.6)	78 (46.4)	
Household income, Rials, million	< 10	33 (26.4)	92 (73.6)	< 0.001
	10 - 20	278 (66)	143 (34)	
	> 20	165 (87.8)	23 (12.2)	
Average household cost, Rials, million	< 10	190 (51.8)	177 (48.2)	< 0.001
	10 - 20	262 (76.6)	80 (23.4)	
	> 20	24 (96)	1 (4)	
Living area, m ²	< 80	120 (54.1)	102 (45.9)	< 0.001
	80 - 12	213 (64.9)	115 (35.1)	
	> 120	143 (77.7)	41 (22.3)	

^aValues are expressed as No. (%).

Also, food insecurity increased with the household size. The results of the logistic regression analysis (adjusted) revealed that women with high school, middle school, and secondary school education had 66%, 48%, and 27% lower odds of food insecurity, compared with the reference group, respectively. Examination of the relationship between family size and food insecurity showed that households with 4 individuals or more (reference family size < 4) had a 60% higher odds of food insecurity (CI, 1.020 - 2.519; OR, 1.603). In addition, it was found that households

with an area of more than 120 m² had a 53% lower odds of food insecurity, compared with the reference group (CI, 0.279 - 0.797; OR, 0.472) (Table 4).

5. Discussion

Food insecurity encompasses social, cultural, and psychological dimensions at family and regional levels and is identified as a complex multidimensional phenomenon. It

Table 4. Relationship Between Food Insecurity and Social Structural Determinants of Health (SDH) in Pregnant Women

Variables		Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Women's education	Elementary school	Ref.	Ref.
	Secondary school	0.508 (0.188 - 1.369)	0.732 (0.225 - 2.384)
	Middle school	0.283 (0.121 - 0.660)	0.520 (0.182 - 1.486)
	High school	0.118 (0.051 - 0.276)	0.340 (0.116 - 0.996)
Spouse's education	Elementary school	Ref.	Ref.
	Secondary school	0.886 (0.315 - 2.493)	1.128 (0.352 - 3.620)
	Middle school	0.437 (0.178 - 1.072)	0.959 (0.342 - 2.684)
	High school	0.167 (0.068 - 0.412)	0.662 (0.221 - 1.977)
Women's occupation	Housewife	Ref.	Ref.
	Employee	0.411 (0.232 - 0.726)	3.334 (1.418 - 7.838)
	Self-employed	0.988 (0.384 - 2.544)	3.031 (0.951 - 9.662)
Spouse's occupation	Unemployed	Ref.	Ref.
	Self-employed	0.066 (0.008 - 0.517)	0.092 (0.010 - 0.824)
	Employee	0.022 (0.003 - 0.174)	0.087 (0.010 - 0.791)
Family size	1-3	Ref.	Ref.
	≥ 4	1.859 (1.308 - 2.640)	1.603 (1.020 - 2.519)
Household income, Rials, million	< 10	Ref.	Ref.
	10 - 20	0.185 (0.118 - 0.288)	0.274 (0.166 - 0.453)
	> 20	0.050 (0.028 - 0.090)	0.071 (0.030 - 0.169)
Average household cost, Rials, million	< 10	Ref.	Ref.
	10 - 20	0.328 (0.237 - 0.453)	0.861 (0.566 - 1.309)
	> 20	0.045 (0.006 - 0.334)	0.240 (0.029 - 1.968)
Living area, m ²	< 80	Ref.	Ref.
	80 - 120	0.635 (0.448 - 0.900)	0.833 (0.554 - 1.254)
	> 120	0.337 (0.218 - 0.522)	0.472 (0.279 - 0.797)

Abbreviations: CI, confidence interval; OR, odds ratio; Ref., reference group (adjusted for structural SDH including education, occupation, family size, household income, average household cost, and living area).

is not limited to individuals without adequate access to energy and nutrients. It occurs when individuals do not have the right to choose their food, fear running out of food, or even experience major changes in their food preferences (20). The aim of this study was to investigate the relationship between structural SDH and food insecurity among pregnant women. The prevalence of food security and insecurity was discussed first, and then, related factors were described.

This study reported the prevalence of food insecurity among pregnant women to be 35.1% in Ilam Province. Also, 24.9%, 7.5%, and 2.9% of subjects had mild, moderate, and severe food insecurities, respectively. A few studies have measured the status of food insecurity among pregnant women. Yadegari et al. (2014) reported a prevalence of 30.9% in Rasht province (6). Moreover, Laraia et al. (2006) reported a marginal prevalence of 15% (7). Another study on food insecurity from Latin America indicated that 46% of pregnant women had food insecurities (21, 22). Such differences in the prevalence of food insecurity in different regions may be due to factors, such as community policies, socioeconomic status, and family size. Therefore, awareness of factors affecting food insecurity can improve our understandings of what affects food insecurity in families.

Various studies have confirmed the effect of socioeconomic and cultural factors on food security. For instance, age, education of household head, employment status, family size, loss of food support, ethnicity, and regional eating habits affect food insecurity (23, 24). In this study, education and occupation of women and their spouse, household income, living area, and family size were significantly correlated with women's food insecurity. Zhai (2013) from China showed that food security occurs relative to specific national conditions, resource allocation, and structural optimization (25). In developing countries, food insecurity is caused by poverty, war, governmental policies, environmental damage, underdeveloped agriculture, and cultural issues (26).

The results of this study revealed a significant relationship between the education level of women and their spouse and household's food insecurity. Women with college education had an 89% lower risk of food insecurity, compared to those with primary education. Costa et al. (2013) from Brazil reported a significant relationship between the household head's level of education, presence of juveniles in the family, productivity of farmers, and food insecurity (27). Factors affecting food insecurity consisted of age, education of household head, economic status, lack of a steady job, single parenthood, ethnicity, large household size, and local eating habits (23, 28, 29); the findings of the present study are consistent with those reported by Costa et al.

The socioeconomic status is one of the most important determinants of health and mortality. Some believe that the socioeconomic index is a combination of education, occupation, and income. In this study, women with employed partners had a 98% lower risk of food insecurity. Also, those with income levels above 20 million Rials had a 95% lower odds of food insecurity, compared to households with income below 10 million Rials (CI, 0.028 - 0.090; OR, 0.050). Nord et al. also showed that food insecurity and family income were so closely related that poor families were 3 times more prone to food insecurity, compared to others (22).

The relationship between family size and food insecurity suggested that food insecurity increased with an increase in household size. Payab et al. (2012) indicated a significant relationship between family size, education level, employment status, economic status, and food insecurity (28). Studdert et al. (2001) also confirmed the significance of economic, social, and cultural factors in food security.

A large group of the society shows inappropriate food behaviors and choices, while they have considerable economic and physical access to food. For the analysis of the root causes of eating behaviors in the society, the share of food and household income, as well as sociocultural factors, such as household head's level of education, employment, and social status, should be assessed (29). In this regard, Rahimi et al. (2007) revealed that food insecurity had a significant relationship with family size, education level, and employment status (30).

With an increase in the household size, life necessities are endangered and food insecurity may appear. Lack of adequate education reduces employment opportunities and deteriorates individuals' abilities to earn money. A low level of literacy can reduce the level of nutritional literacy, affect shopping, preparation, cooking, and consumption of foods, and finally result in household's food insecurity (31). In developing countries, women living in deprived areas are at a greater risk of nutritional issues. Considering the discriminations between men and women, particularly in deprived areas, women are the last priority in terms of food distribution from both quantitative and qualitative aspects (32).

Numerous studies have confirmed the importance of nutrition during prenatal periods. However, a few studies have specifically examined the role of food security at this stage of life. Therefore, maintaining and promoting the nutritional health of pregnant women require proper nutritional-educational programs, development of nutritional standards based on socioeconomic and cultural factors, and design of appropriate strategies for resolving problems and nutritional deficiencies in the course of the disease.

The main strength of this study is investigation of the association between different parameters, such as structural SDH and food security. Since food security has positive effects on pregnancy outcomes, its analysis is essential among pregnant women in different populations. Since there is no comprehensive information in this area, the present study can be a starting point for future research with a large sample size on different populations.

5.1. Limitations

Although subjects were recruited from a variety of geographical regions in Ilam Province, the study sample does not represent all variations in the country's population. Therefore, such studies should be designed in future in other provinces of Iran.

5.1. Conclusions

This study showed the prominent role of socioeconomic factors in structural SDH and food insecurity. It was found that food insecurity, as a prevalent problem, is associated with structural SDH. Furthermore, the relatively high prevalence of food insecurity in this study and its negative consequences on the mother and fetus necessitate the evaluation of food security during prenatal care and requires special attention to pregnant women with food insecurity. Therefore, establishment of food security requires access to the required nutrients for all family members, especially the vulnerable ones.

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Footnote

Conflicts of Interest: The authors declare no conflicts of interest.

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