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Household Food Insecurity: Prevalence and Determinants among Less Studied Rural Communities in Tehran Province

Naser Kalantari; PhD[1], Morteza Abdollahi;PhD[2], Zahra Ghanbari; MSc[3], Parisa Amiri; PhD[4], Farid Zayeri; PhD[5]; Neda Ezzeddin; PhD[6*] & Nastaran Miri, MSc[7]

[1] Department of Community Nutrition, Shahid Beheshti University of Medical Sciences, Tehran, Iran; [2] Social Determinants of Health Research Cancer, National Nutrition and Food Technology Research Institute, Shahid Beheshti University of Medical Sciences, Tehran, Iran; [3] Student Research Committee, Faculty of Health, Qazvin University of Medical Sciences, Qazvin, Iran; [4] Research Center for Social Determinants of Health, Research Institute for Endocrine Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Iran; [5] Proteomics Research Center, Department of Biostatistics, Faculty of Allied Medical Sciences, Shahid Beheshti University of Medical Sciences, Darband Street, Tehran, Iran; [6] Department of Community Nutrition, Faculty of Health, Qazvin University of Medical Sciences, Qazvin, Iran; [7] Food and Drug Administration, Iran Ministry of Health and Medical Education, Tehran, Iran.

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****Corresponding author:***
neda.ezedin@yahoo.com
Department of Community Nutrition, Faculty of Health, Qazvin University of Medical Sciences, Qazvin, Iran

Postal code: 3419759772
Tel: +98 2833336001(3732)

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ABSTRACT

Background: Food insecurity (FI) in rural areas is a considerable concern that impacts numerous families worldwide. The study aimed at investigating the prevalence of household food insecurity and its determinants among rural women in Tehran province. **Methods:** This cross-sectional study was conducted on 303 rural women of Tehran province. Women were selected randomly from rural health canters or houses of 32 villages. Then, data were collected by questionnaires including demographic and socio-economic information, household food insecurity access scale (HFIAS) and nutritional knowledge assessment. **Results:** The results indicated that more than 64% of women were food insecure, and socio-economic factors were the main predictors. Monthly household income (OR=0.85, CI:0.78-0.94, *P*<0.05) and age of household head (OR=0.96, CI:0.93-0.99, *P*<0.05) were significantly higher in food insecure households. Household heads who were unemployed or housekeepers (OR=14.59, CI:3.31-64.26, *P*<0.05) and workers, farmers, or stockbreeder were also more likely to be food insecure (OR=5.44, CI:2.07-14.33, *P*<0.05). However, women's nutritional awareness or their membership in the village microcredit fund were not significantly associated with FI. **Conclusion:** The prevalence of FI was high in rural areas of Tehran province. Factors related to socio-economic status, including household income and employment status of the household head, were identified as significant determinants of household food security status.

Introduction

Food insecurity (FI) in rural areas is a considerable concern that impacts numerous families and affects approximately 733 million people worldwide (Hamad and Fernald, 2015). It is characterized by the inability to consistently obtain sufficient food intake to maintain an effective and healthful lifestyle (Al-Jilaihawi S *et al.*, 2017).

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Development Goals is to end starvation and attain food security (Gil *et al.*, 2019). In recent years, the prevalence of FI has increased due to the COVID-19 pandemic, which has made it challenging to achieve sustainable development goals by 2030 (Adedokun, 2021). In Iran, FI affects 55.9%. People in rural areas are more at risk of food insecurity, up to 66.1% (Arzhang *et al.*, 2022). In the countryside, FI can be impacted by a variety of interconnected determinants, such as demographic factors, income, inflation, nutrition knowledge, education level, employment status, distance to cities, and family size (Abu, 2016, Gholizadeh *et al.*, 2017, Okati *et al.*, 2020, Zhou *et al.*, 2019).

Additionally, women are more vulnerable to FI than men (Grimaccia and Naccarato, 2022). In Iran, 51.3% of women are food insecure (Arzhang *et al.*, 2022). Pandey *et al.* found that FI affected 56% of women in Nepal (Pandey and Fusaro, 2020). In a study conducted in Kabul, Afghanistan, 69.9% of women were food insecure (Zahidi *et al.*, 2022). Disparity between men and women may be related to different factors, including education, number of children, and marital status (Grimaccia and Naccarato, 2022).

FI can lead to irreparable consequences at several levels - individuals, families, and communities (Mansour *et al.*, 2020). It is linked to a range of health problems, including malnutrition, obesity, diabetes, and cardiovascular diseases (Mosadeghrad *et al.*, 2019). Micronutrient deficiencies resulting from food insecurity can negatively affect cognitive function. This is especially concerning for children, as it can hinder their development and learning abilities. These effects reinforce the cycle of poverty and FI (Aceves-Martins *et al.*, 2018, Hendriks, 2016). Furthermore, food insecurity can have socio-economic implications. Individuals suffering from FI are more likely to feel depressed, experience anxiety, and consequently, have a decreased quality of life (Seivwright *et al.*, 2020). Ultimately, these consequences can lead to long-term economic costs and place a burden on communities and governments (Mosadeghrad *et al.*, 2019).

Rural areas of Tehran province have been less studied. A study conducted by Haghighian *et al.* indicated a high prevalence of FI (60%) in 5 villages in Tehran province (Haghighian-Roudsari *et al.*, 2023). Given the high rates of FI in villages, particularly among women (Ahmadi Dehrashid *et al.*, 2021, Arzhang *et al.*, 2022, Jozi *et al.*, 2020), and the limited number of studies in Tehran province, the authors carried out a study aimed at investigating the prevalence of household food insecurity and its determinants among rural women in Tehran province. The results can provide insight into the current situation for policymakers and planners, enabling them to make effective interventions to improve FI in rural areas.

Materials and Methods

Study design and population

This cross-sectional study was conducted on rural women of Tehran province from January to October 2022. Totally 303 rural women were selected randomly from rural health centers and health houses of 32 villages in five counties (including: Ray, Islamshahr, Mallard, Varamin and Shahryar). The selection of participants from health houses was done by systematic random sampling from the list of names covered in the system. Participants were then invited to attend the health houses and complete the questionnaire. The selection of participants from rural health centers, which cover a larger population, was done by randomization from the individuals present in the centers. The sample size was calculated to be 267, using OpenEpi software (https://www.openepi.com/Sample Size/SSPropor.htm), considering the 49% prevalence of food insecurity in Iran (Daneshi-Maskooni *et al.*, 2017), based on the following formula. Then, the sample size was increased to about 300 people, considering a 10% dropout rate.

$N = [DEFF*Np(1-p)]/ [(d^2/Z^2_{1-\alpha/2}*(N-1)+p*(1-p)]$

Population size(for finite population correction factor or fpc)(N):	*1000000*
Hypothesized % frequency of outcome factor in the population (p):	*39%+/-6*
Confidence limits as % of 100(absolute +/- %)(d):	*6%*
Design effect (for cluster surveys-DEFF):	*1*

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The inclusion criteria were being less than 70 years old, interested in participating in the study and answering at least 90% of the questions. Those who did not meet the inclusion criteria were not included in the study. Data were collected by the main study administrator and trained interviewers from selected women. Interviewers received training both through online communication networks (such as Telegram and WhatsApp applications) and in person, in the field.

Measurements

Demographic and socio-economic assessment: Demographic and socio-economic information was gathered by a questionnaire. This information included: age of women and their husbands, household head, household size, residence status**,** native status, monthly household income**,** education level of women and heads of household, employment status of women and heads of household, the status of agricultural, livestock, or home garden production, membership status in the Rural Women's Microcredit Fund and time distance to supermarket.

Household food security assessment: In this study, Household food insecurity access scale (HFIAS) was applied to evaluate the status of household food security among rural women during the previous month. This measure is a simple and valid tool, widely used by different countries (Gebreyesus *et al.*, 2015). This questionnaire contains 9 items, based on 4-Likert scale and the frequency of occurrence (most of the time to never). Scoring for each item is as follows: Most of the time=3; sometimes=2; rarely=1; and never=0. Therefore, the range of obtained score is from 0 to 27, and higher score indicates more severity of food insecurity (Mohammadi *et al.*, 2012).The four statuses of household food security are categorized based on the total score obtained as follows: Food secure (0-1), mild food insecure (2-7), moderate food insecure (8-14) and severe food insecure (15-27) (Salarkia *et al.*, 2014). In current study, the Persian version of the questionnaire was used, which has been developed by Mohammadi *et.al* with acceptable validity and reliability (Mohammadi *et al.*, 2012).

Nutritional knowledge assessment: In this study, the nutritional knowledge of participants was assessed by an 18-item questionnaire, which contained basic information of nutrition (for examples: food groups and their roles, micronutrient and etc.). If the participant gave the correct answer, a score of one was awarded to that question, otherwise a score of zero. Each question could have between 1 and 6 answers, so the total score range was between 0 and 52. This questionnaire was developed and validated in Iran, by Azemati *et.al* (Azemati *et al.*, 2013, Heshmat *et al.*, 2016).

Ethical considerations

This study was approved by the Ethics Committee of the National Nutrition and Food Technology Research Institute, Shahid Beheshti University of Medical Sciences, 26 July 2020 (ethical code: IR.SBMU.NNFTRI.REC.1399.021). It should be noted that all stages of the study were performed in accordance with relevant guidelines and regulations of the country, and all participants were agreed to participate in the study and signed the informed consent form.

Data analysis

Data normality was checked by Kolmogorov-Smirnov test. Descriptive and analytical tests were done by SPSS version 22. Descriptive analysis was presented as mean, standard deviation and frequencies. Before analysis, three food insecure groups were merged as a food insecure group. To compare the association of household food security with qualitative variables, Chi-square test was used. T test was also applied to compare the mean and standard deviation of quantitative variables between two foods secure and food insecure groups. Finally, logistic regression model was applied to determine the household food security predictors by adjusting variables. P-value of less than 0.05 was considered as significant.

Results

The mean and standard deviation of the participant's age were 42.72±8.92 years. Most of

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the women were married (91.4%), housekeepers (88.1%), natives of the village (63%), and had middle school or lower education (48.2%).

The household food security situation in the studied community was as follows: Food secure (35.6%), mild food insecure (33%), moderate food insecure (22.4%), and severe food insecure (8.9%). To examine the association between food security status and the studied variables, three food insecure groups were merged as a group named the "food insecure group".

Table 1 shows the mean differences of quantitative variables in the two food secure and food insecure groups, by independent *t-test*. Based on the results, there was no significant difference between the two groups in the age of participants or the head of household (P>0.05). However, the average monthly income in the food-secure group was significantly higher than in the food-secure group (P<0.05). The mean and standard deviation of time distance to the supermarket (minutes) among participants was reported to be 4.67±5.43 minutes, and it was significantly higher in the food-insecure group (P<0.05). The mean and standard deviation of women's nutritional awareness score among studied women was 16.94±7.96, and it was higher in the food-secure group (P<0.05). The average household size did not differ between the two groups (P>0.05).

Table 1. The association of household food security status with quantitative variables.

Variables	Food-secure (N=108)	Food-insecure(N=195)	Total(N=303)	P-value[a]
Women ages	42.82±9.35[b]	42.67±8.70	42.72±8.92	0.891
Household head ages	49.35±12.31	47.01±9.49	47.84±10.62	0.088
Household size	3.71±1.08	3.84±1.21	3.79±1.16	0.343
Monthly household income	7.11±3.62	4.89±3.30	5.68±3.57	<0.001
Time distance to supermarket	3.67±4.27	5.23±5.91	4.67±5.43	0.009
Score of women's nutritional awareness	18.52±7.96	16.06±7.84	16.94±7.96	0.010

[a]: t-test; [b]: Mean±SD

Table 2 presents the frequency of qualitative variables in two groups, using the chi-square test. Most of the studied women were not household heads (89.4%), and they were more food-secure than those who were (P<0.05). Having home ownership and being a village native were also factors associated with better food-security status (P<0.05). Based on the results, food-security status was not significantly associated with women's employment status (P>0.05), but it was associated with the employment status of household heads (P<0.05). Also, the educational status of both women and household heads was associated with food security status, so higher educational levels were related to better food security status (P<0.05). Food security was also positively related to having agricultural and horticultural production (P<0.05), but it was not associated with having a home garden or livestock production (P>0.05). In this study, about 7.3% (n=22) of women had membership in the rural microcredit fund which was not related to their food security status (P<0.05, **Table 2**). About half of the women reported that they had received a loan from this fund.

Finally, the regression logistic was applied to determine the food security predators by adjusting variables. For this purpose, variables whose significance level was less than 0.1 were entered into the regression (**Table 3**). Since the educational level of women and household heads was correlated, only women's education was included, which also moderated the variable of women's nutritional awareness. Based on the results, increasing the age of the household head (OR=0.96) and monthly household income (OR=0.85) reduced the odds of food insecurity. The employment status of the household head was another determinant so unemployed or housekeeper individuals (OR=14.59) and workers, farmers, or stockbreeders (OR=5.44) had a higher odds of food insecurity than the employed ones. Having agricultural and horticultural production

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was another protective determinant against food insecurity (OR=2.62, **Table 3**).

Discussion

The current study was conducted to inquire about the prevalence of FI and its determinants among women in rural areas of Tehran province. The results indicated that more than 64% of women were food-insecure, and socio-economic factors were its main predictors. However, women's nutritional awareness or their membership in the village microcredit fund was not significantly associated with FI.

Table 2. The association of household food security status with qualitative variables.

Variables	Food-secure(N=108)	Food-insecure(N=195)	Total(N=303)	P-value[a]
Employment status of women				
Housekeepers	93(86.1)	174(89.2)	267 (88.1)	0.422
Employment	15(13.9)	21(10.8)	36 (11.9)	
Employment status of household head				
Unemployed or housekeepers	4(3.7)	31(15.9)	35 (11.6)	
worker, stockbreeder or farmer	38(35.2)	102(52.3)	140 (46.2)	<0.001
Self-employed	44(40.7)	53(27.2)	97 (32.0)	
Employee	22(20.4)	9(4.6)	31 (10.2)	
The education levels of women				
Middle school and lower	52(48.1)	122(62.6)	174 (57.4)	0.015
High school and higher	56(51.9)	73(37.4)	129 (42.6)	
The education levels of household head				
Middle school and lower	59(54.6)	142(72.8)	201 (66.3)	0.001
High school and higher	49(45.4)	53(27.2)	102 (33.7)	
Residence status				
Owner	80(74.1)	122(62.6)	202(66.7)	0.043
Others	28(25.9)	73(37.4)	101(33.3)	
Being a village native				
Yes	78(72.2)	113(57.9)	191(63)	0.014
No	30(27.8)	82(42.1)	112(37)	
Household head				
Women	3(2.8)	22(11.3)	32(10.6)	0.010
Others	105(97.2)	173(88.7)	271(89.4)	
Producer of agricultural and horticultural products				0.004
Yes	21(19.4)	16(8.2)	37(12.2)	
No	87(80.6)	179(91.8)	266(87.8)	
Producer of livestock products (eggs, milk, etc.)				0.118
Yes	15(13.9)	16(8.2)	31(10.2)	
No	93(86.1)	179(91.8)	272(89.8)	
Having an active home garden				
Yes	17(15.7)	20(10.3)	37(12.2)	0.163
No	91(84.3)	175(89.7)	266(87.8)	
Women's membership in the rural microcredit fund				
Yes	10(3.9)	12(6.2)	22(7.3)	0.318
No	98 (90.7)	183(93.8)	281(92.7)	

[a] *Chi-square test*

In studies conducted by Rafat *et al.* and Haghighian-Roudsari *et al.* FI in rural areas of Tehran was 69% and 60.9% respectively (Haghighian-Roudsari *et al.*, 2023, Rafat *et al.*, 2021). Studies in other provinces of Iran, such as Zanjan and Kurdistan, showed a higher prevalence

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of FI in rural areas (about 96% and 80% respectively) (Ahmadi Dehrashid *et al.*, 2021, Jozi *et al.*, 2020). In a systematic review conducted by Arzhang *et al.* FI in rural areas of Iran was 66.1% which is close to the findings this study (Arzhang *et al.*, 2022). A study done in India by Nagappa *et al.* showed that 31% of residents in villages were food- insecure, which is lower than this study's results (Nagappa *et al.*, 2020). FI depends on different factors that vary in different regions of Iran and the world, illustrating the wide variation (Arzhang *et al.*, 2022, Harris-Fry *et al.*, 2017). Also, policies and nutrition programs can influence FI in different regions (Loopstra, 2018).

Table 3. Final logistic regression model for the association of household food security status with variables.

Variables	SE	OR	95 % CI		P-value
			Lower	Upper	
Age of household head	0.015	0.966	0.938	0.996	0.026
Being a village native *(ref: yes)*	0.311	1.799	0.977	3.312	0.059
Residence status *(ref: owner)*	0.336	1.444	0.748	2.790	0.274
The education levels of women *(ref: high school and higher)*	0.336	1.633	0.846	3.152	0.144
Time distance to supermarket	0.032	1.039	0.975	1.107	0.241
Monthly household income	0.048	0.857	0.780	0.942	0.001
Employment status of household head (ref: *Employee*)					
Unemployed or Housekeepers	0.756	14.598	3.316	64.267	<0.001
worker, stokbreeder or farmer	0.494	5.446	2.070	14.332	0.001
self-employed	0.497	2.119	0.800	5.608	0.131
Household size	0.134	1.170	0.899	1.522	0.242
Producer of agricultural and horticultural products *(ref: yes)*	0.434	2.622	1.119	6.142	0.027
Score of women's nutritional awareness	0.020	1.004	0.965	1.045	0.844

***Note**: table is based on results of binary logistic regression (for significant variables based on Table 2 and 3); SE: Standard error; **OR**: Odds ratio; **CI**: Confidence interval.*

According to Sinclair *et al.*, the prevalence of FI is high among rural women, which is in agreement with the study results (Sinclair *et al.*, 2019). This study indicated that demographic characteristics and socio-economic factors, including age, income, and employment status of household heads, are effective determinants of FI. However, family size does not affect FI. In line with the results, Okati *et al.* found that income and household head occupation can affect food security levels. In addition, family size was a determinant of FI, which contrasts with the findings of the present study (Okati *et al.*, 2020). In the other study conducted in rural areas of Tehran, influential factors on food insecurity were education, the household head's job, family size, and rooms in rural areas (Haghighian-Roudsari *et al.*, 2023). According to Ahmadi Dehrashid's study, economic factors and income among them are the most important determinants of FI in rural areas of Iran (Ahmadi Dehrashid *et al.*, 2021). Higher income is associated with greater dietary diversity (Gokhale and Rao, 2022). Families with higher incomes can purchase different groups of food, and consequently, have more food security. Also, in rural areas, families tend to spend a greater share of their income on food following an income improvement (Aliabadi *et al.*, 2021).

The present study found that having agricultural production is linked to food security in women. Agricultural production can affect food security through various routes, including increasing income, diet diversity, availability, and access to food (Hazell, 2020, Krause *et al.*, 2021, Sibhatu and Qaim, 2017). For example, in a study, agricultural production ameliorates food security by increasing availability and access to food (Krause *et al.*, 2021). In another study, agricultural production can improve FI through an increase in income (Hazell, 2020). In Ethiopia, subsistence agriculture can influence diet diversity, which is one of the

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determinants of food security (Sibhatu and Qaim, 2017). In contrast with the finding of this study, *Sly et al*. found that there was no change in FI following an agricultural intervention. However, the intervention increased diet diversity so that households could use home-grown products. Moreover, they could buy nutritious food with increased income from selling agricultural products. Cultural factors and duration of intervention may be the reason why these changes did not lead to food security (Sly *et al.*, 2023). Unlike agricultural production, no significant association is seen between dairy product and FI. Inconsistent with the result, in a study by Banda et al, dairy product was positively associated with food security (Banda *et al.*, 2021). This conflict may be related to different amounts of dairy production, market access, and cultural factors

Microcredit funds are known to be an effective way to improve food security through addressing socio-economic status and women's empowerment (Al-Jilaihawi S *et al.*, 2017, Gichuru *et al.*, 2019, Hamad and Fernald, 2015). Women can improve their income through microcredit funds, and this can lead to a better place for women in decision-making in the family (Kapila *et al.*, 2016). No meaningful connection has been observed between microcredit funds and FI in the present study. Aligned with the results, Namayengo found that microcredit diminishes household food security. A possible reason is that women invest the loan in microenterprises and the burden of loan repayment (Namayengo *et al.*, 2018). In a study done in Bangladesh, microcredits positively influenced the food security of rural women (Haque, 2021). In another study, FI decreased following a microcredit program (Chilimba *et al.*, 2020). The lack of association in this study may be related to the low number of women supported by this program or the low loan amount. It indicates that this program needs to be revised to be more effective.

The present study indicated that women's nutritional awareness was not significantly associated with food security among rural women. However, in a study done by Jozi *et al.*, higher nutritional awareness was associated with food security (Jozi *et al.*, 2020). While other studies have found that increased nutritional knowledge leads to better food security, factors such as economic conditions may act as barriers, which could explain why the authors did not find such a relationship in this study (Gholizadeh *et al.*, 2017, Yavari and Athari, 2023).

This study, like any study, had strengths and limitations. The villages of Tehran province are often under-researched due to their location in the capital. However, according to the results of the present study, their socio-economic status and food security are not satisfactory. This study extensively studied 5 counties and 32 villages, which is one of its strengths. However, the cross-sectional nature of the study does not allow for the examination of longitudinal relationships between variables. It is recommended that prospective studies be conducted in these areas to identify longitudinal relationships between variables and also to examine the impact of development programs on the socio-economic status and food security.

Conclusion

This study showed a high prevalence of food insecurity among rural areas of Tehran province. Socio-economic factors are recognized as the main predictors of household food insecurity. It is recommended that policies and programs be developed and implemented in rural areas to improve the socio-economic and food security status. Empowering rural people, especially women, can help improve their livelihoods by improving their production and marketing capabilities. If such programs are being implemented, including the Rural Women's Microcredit Fund, it is recommended that they be monitored and evaluated to determine their impacts as well as their challenges and weaknesses. Therefore, further studies as well as assessing the food security situation and its determinants in other unstudied counties of Tehran province or other provinces are recommended.

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Authors' contributions

Kalantari N participated in research design, guiding and monitoring the implementation of research and critically reviewed the manuscript. Abdollahi M, Amiri P and Zayeri F participated in research design and providing advices on implementation. Ghanbari Z prepared the manuscript. Ezzeddin N participated in research design, gathering and analyzing the data, and preparing the manuscript. Miri N participated in gathering the data and revising the manuscript. The manuscript content was approved by all authors.

Conflict of interests

The authors declared no conflict of interest.

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