



## *The Relationship of Food Security and Economical-Social Issues with Osteoporosis in Women Over 45 Years*

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### ABSTRACT

**Background:** Today food security is one of the most important issues throughout the world. Every year, millions of people die due to the shortage of food and nutrient products. The current study aimed to investigate the effect of food security and economic-social issues on women over 45 years who referred to the Bone Density Assessment Center in Kermanshah City in 2015. **Methods:** A 9-item questionnaire was applied to collect the required data. The collected data were analyzed using the liner regression and Kruskal-Wallis one-way analysis of variance. **Results:** Bone density was significantly correlated with the participants' household size, number of children, history of menopause, familial history of osteoporosis, number of pregnancies, calcium supplementation, use of sunscreen, and reception of some food elements. **Conclusion:** Since economic and social issues play a critical role in food security, these cases can significantly affect the density of bones.

**Keywords:** Food security; Economical-Social factors; Bone density; Kermanshah

### Introduction

Food security is related to the food supply and accessibility of foods to individuals. Food and its related issues are important determinant factors in providing a healthy life for human being (Loolaie *et al.*, 2017, Rasouli *et al.*, 2014, Rasouli and Najafi, 2014, Rasouli *et al.*, 2018). Evidences show that over 10,000 years ago civilizations such as ancient China and ancient Egypt distributed food among their people from the food storage at

the time of famine. At the 1974 World Food Conference, the term "food security" was defined with an emphasis on supply. Food security was defined as the availability of adequate, nourishing, diverse, balanced, and moderate basic foodstuffs at all times to sustain a steady expansion of food consumption and to offset fluctuations in the production and prices (Chen *et al.*, 2016). Later, demand and access issues were added to the

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definition. The final report of the 1996 World Food Summit states that food security exists when all people have physical and economic access to sufficient, safe, and nutritious food at all times to meet their dietary needs and food preferences for an active and healthy life (Kanis *et al.*, 2002, Tarasuk, 2001).

Osteoporosis is a chronic and progressive systemic disease characterized by bone dysfunction and loss of its microscopic structure, which leads to the bone vulnerability (Kanis *et al.*, 1994). Osteoporosis is increasing with an ascending trend in the developing and developed countries of the world. According to diagnostic methods, the prevalence of osteoporosis was 2% - 8% in men and 9% - 38% in women. In the United States, it was estimated that 8 million women and 2 million men with 50 years of age and older had osteoporosis (Tarasuk, 2001). In the European continent, 5.5 million men and 22 million women had osteoporosis in 2010. A survey in China showed that the prevalence rates of osteoporosis in women and men older than 50 years of age were 57.6% and 6.64%, respectively. Although the prevalence of osteoporosis was precisely determined, it is considered as a health concern all over the world (Bernstein *et al.*, 1966, Chen *et al.*, 2016). Osteoporosis not only limits the individual's physical activity and increases the risk of fractures, but also increases the risk of hospitalization in relation to some complications. It also increases the burden on the public health system and causes hip fracture that increases the risk of mortality 10 to 20%. Furthermore, research showed that about 25% of people with pelvic fracture need long-term home care in the United States (Tandon *et al.*, 2014, Wade *et al.*, 2014). The current study aimed to investigate the effect of food security and economic-social issues on women over 45 years of age who referred to Bone Density Assessment Center in Kermanshah city in 2015.

### Materials and Methods

*Targeted community and case study:* The study population included women over 45 years of age who lived in Kermanshah city. The bone mineral

density (BMD) test was performed for all participants in the winter of 2015 to diagnose osteoporosis.

*Sample size:* The sample size was calculated as 144 individuals using the GPower software version 3.1.9.2 (Faul, 2014) based on the Linear Bi-variate Regression studies and Correlation. Considering the 20% odds of loss, a total of 172 individuals were selected to participate in the study

*Data collection:* To conduct the study, the researcher referred to the centers of Bone Density Assessment in Kermanshah affiliated with the officials of the Bone Density Assessment Centers. Later, the necessary coordination was made with the authorities and 172 women with 45 years old entered the study by simple sampling method. The participants were explained about the study goals and procedures and were asked to sign the written consent. Patients were also ensured about confidentiality of information. First, the bone density of the patients who referred to the Bone Density Assessment Center was determined by DEXA test and then the required demographic information was collected from each participant: age, employment, education, exposure to smoking, medical history, diseases, and medications. The Food Security Inventory, the 9-item USDA questionnaire, and the 3-day meal reminder were also administered.

*Measurement of BMD and determination of osteoporosis:* The women's BMD was measured by technicians of the bone densitometry centers of Kermanshah using the DEXA method in the left femoral neck and lumbar spine / L1-L4 regions in grams per centimeter. The rheumatologic studies were conducted in the related laboratories within the studied areas. Bone mass was determined based on the criteria provided by the World Health Organization. Osteoporosis was diagnosed by comparing a person with the average adult population of the same age and gender. In this definition, T score of more than 1 indicates normal osteoporosis, values between 1 and 2.5 represent osteopenia, and values less than 2.5

standard deviations from the average young healthy population of the same gender indicate osteoporosis (Ahmadi *et al.*, 2016).

*Measurement of food security:* In this study, HFIAS questionnaire was used as a tool for measuring food insecurity. This questionnaire was developed by the United States Food Security Agency for International Development. In fact, it was initially derived from the 18-item questionnaire designed by the US Department of Agriculture to investigate food insecurity in the United States. A sample item in this questionnaire is "Has the household experienced any worries about the quantity and quality of food in the past?" Each option in this questionnaire receives a score and the total score shows the degree of food insecurity. The Persian version of this questionnaire is validated by Ahmadi-firozjani *et al.* (Ahmadi *et al.*, 2016) in Iran. During the statistical analysis, the data were classified according to the score calculated in four categories of food safety (0-2 points), insecure mild (2-7 points), moderate insecurity (8 -14 points), and severe insecurity (15-27 points).

*Data analysis:* Data analysis was performed using SPSS version 24. To describe the mean indexes, standard deviation, frequency, and percentage were used. In order to compare the level of parametric quantitative variables among different groups, ANOVA and nonparametric Kruskal-wallis were used. The Spearman correlation was used to study the relationship between food safety level and quantitative variables. It should be noted that in the analysis of single-variable and multi-variable *P-value* was considered as less than 0.5.

*Ethical considerations:* The present cross-sectional study was approved by the Medical Ethics Committee of Islamic Azad University of Tehran, Science and Research Branch.

## Results

Based on our results, 172 women with the mean age of  $54.6 \pm 9.27$  years were selected from the patients who referred to bone density

measurement centers in Kermanshah city in 2015. The quantitative and qualitative results of the variables are summarized in the following:

As shown in **Table 1**, body mass index (BMI) is correlated with age in women studied for food insecurity. The BMI status was not statistically significant ( $P = 0.556$ ) between the four levels of food safety in the participants.

In contrary to the findings of this study, many studies have shown a strong relationship between obesity and food insecurity in households with poor and unsafe food status.

The multi-track record in women surveyed in terms of food security is shown in Table 3. According to the findings, the multi-stationing history was significantly different between the four levels of food security in women ( $P = 0.003$ ).

The correlation between number of children in families and food is shown in **Table 1**. As it can be seen, the number of children was significantly different between the four levels of food security in the studied women. Based on the results, with the increased level of food security, the number of children decreased ( $P = 0.003$ ). Moreover, the household size of the participants in terms of food security is shown in **Figure 1**. Household situation ( $P = 0.99$ ) was not statistically different between the four levels of food security in the women.

The relationship between the number of employed households and women's food security is shown in **Table 1**. As it can be seen, no statistically significant difference was observed between the four levels of food security in this regard ( $P = 0.089$ ).

The relationship between the participants' employment status and their food security is shown in **Figure 2**. According to the findings, employment status had a significant relationship with four levels of food security in women. In other words, decreased food security decreased the rate of ignition outside home ( $P < 0.001$ ).

**Table 1** shows the comparison between status of smoking and food security in the studied women. No significant difference was observed

between the status of smoking ( $P = 0.61$ ) and four levels of food safety in the participants.

**Figure 3** illustrates the relationship between the family history of osteoporosis and food security in

women. Based on the results, the familial history of osteoporosis was not statistically different between the four levels of food safety in women ( $P = 0.71$ ).

**Table 1.** Distribution of studied variables in term of food security status

Variables	Food security		Faint insecure		Moderate insecure		Sever insecure		p-value
	n	%	n	%	n	%	n	%	
Body mass index status									
Lowered weight	1	1	-	-	-	-	-	-	0.55
Normal	28	29.2	6	30	12	37.5	12	50	
Overweight	27	28.1	5	25	7	21.9	4	16.7	
Obese	40	47.7	9	45	13	40.6	8	33.3	
Number of pregnancy									
<3	36	37.5	10	50	1	3.1	2	8.3	0.005
3-5	44	45.8	8	40	11	34.4	12	50	
5<	14	14.6	2	10	13	34.6	10	41.7	
Multi-stationing history									
Yes	5	5.2	3	15	-	-	6	25	0.003
No	91	94.8	17	85	32	100	18	75	
Number of children									
0	4	4.2	-	-	-	-	-	-	0.003
1	5	5.2	-	-	4	12.5	-	-	
2	27	28.1	11	55.0	7	21.9	3	12.5	
3	21	21.9	4	20.0	6	18.8	3	12.5	
4	22	22.9	1	5.0	6	18.8	7	29.2	
5	7	7.3	2	10.0	3	9.4	3	12.5	
6	2	2.1	1	5.0	1	3.1	2	8.3	
7	5	5.2	1	5.0	4	12.5	2	8.3	
8	1	1.0	-	-	1	3.1	1	4.2	
9	1	1.0	-	-	4	12.5	1	4.2	
10	1	1.0	-	-	-	-	2	8.3	
Number of households employed									
0	6	6.3	-	-	2	6.3	1	4.2	0.089
1	45	46.9	15	75.0	23	71.9	13	54.2	
2	28	29.2	5	25.0	4	12.5	5	20.8	
3	11	11.5	-	-	2	6.3	2	8.3	
4	5	5.2	-	-	1	3.1	3	12.5	
5	-	-	-	-	-	-	-	-	
6	1	1.0	-	-	-	-	-	-	
Smoking condition									
No	94	97.9	20	100.0	32	100.0	23	95.8	0.615
Yes	2	2.1	-	-	-	-	1	4.2	
Total	96	100.0	20	100.0	32	100.0	24	100	

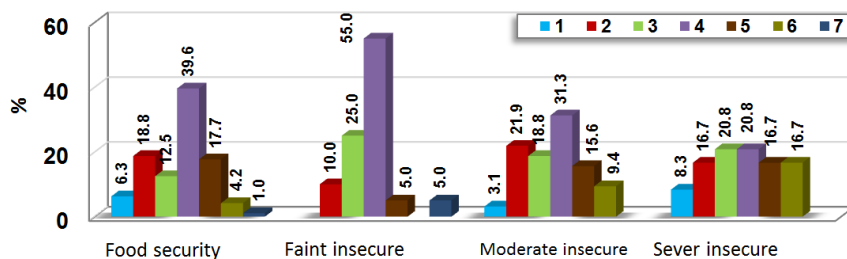


Figure 1. Comparison of the household size in terms of food security

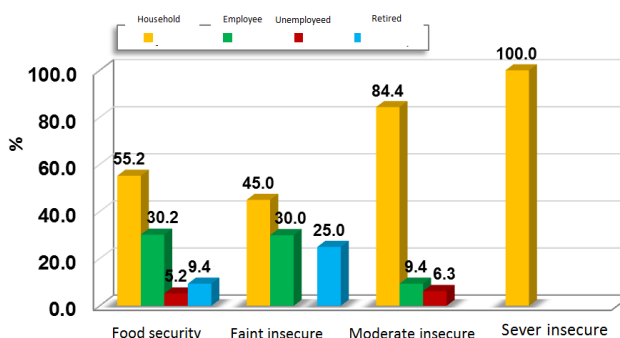


Figure 2. Comparison of the participants' employment status and food security

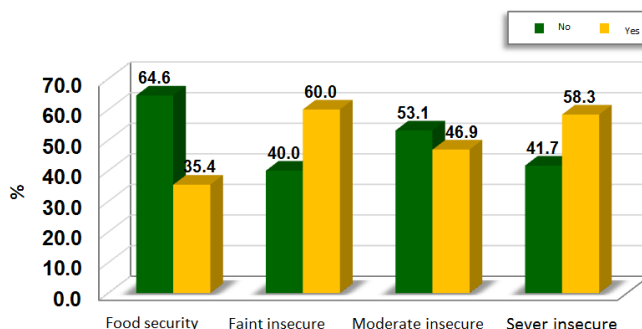


Figure 3. The relationship between familial history of osteoporosis and food security

### Discussion

Increase of the household size changes the family work-force, which results in higher incomes. For example, more number of workforces in families of the agricultural societies has led them to a more prosperous livelihood. This is due to the fact that this household size is associated with employment; otherwise, this increase will reduce the family food security. Considering the today's living conditions and socio-cultural transition in most societies, we observe more urbanization and consumerism. This shows a decrease in the probability of employment and

increase of incomes (Fa *et al.*, 2003). On the other hand, findings of some studies showed that the odds of food insecurity was  $1.4 \leq$  times higher in households with more children compared to the families with no children and elderly households (Al-Faris *et al.*, 2010). For example, Martin and Ferris found that the presence of a child under the age of 18 in the US state of Los Angeles increased the odds of household food insecurity by 1.7 (Martin and Ferris, 2007). In the same vein, previous studies indicated that food insecurity increased in Malaysia with an increase in the number of children (Robaina and Martin, 2013).

Findings of the study on South African households suggested that with increased household size, poverty increased while food security decreased. Higher number of children in the family is associated with costs of education, school driving, clothing, and health care. In limited-income households, increase of the non-food costs reduced the food costs. In other words, with increase of the household size, the volume and number of snacks are reduced and food insecurity emerges. In crowded households, mothers are at higher risk for nutritional problems, especially osteoporosis, because they consume the least amount of food (Godfray *et al.*, 2010). In another study, Rasouli *et al.*, 2019 reported that regular consumption of functional foods correlated with lower risk of chronic human diseases. Therefore, it should be said that available foods and lifestyle are two important factors to determine the healthy status of individuals everywhere.

Some other researchers believe that the type of food consumed by women who live in food-insecure households may cause overweight; since refined grains, sugar, and fat, which have higher calories are cheaper than fruits and vegetables. In poor financial conditions, women may buy and consume cheap and low-energy foods to save their hunger. In other words, fruits and vegetables are not purchased to avoid high prices (Martin and Ferris, 2007, Rooney and Gabbert, 2015). Others argue that food insecurity and obesity arise simultaneously and are both caused by poverty. In particular, poverty in childhood may play such a role. Two studies in New Zealand and the United Kingdom showed that poverty in childhood is correlated with obesity in young people. In addition, food insecurity may act as a stimulus that leads to stress responses, eating disorders, physical activity, and depression; all of which are related to weight gain or food insecurity and poverty may trigger hormonal stress response (Coleman-Jensen *et al.*, 2014, Rafiei *et al.*, 2009, Rooney and Gabbert, 2015).

One of the first large-scale studies on the relationship between food insecurity and over-the-

counter studied the United States National Events in the Continued Surveillance of Food Intakes by Individuals (Townsend *et al.*, 2001).

After modifying the model for demographic and lifestyle intervening variables, the food insecurity remained a significant predictor of overweight in women. In the logistic regression analysis, women with mild food insecurity were 30% more likely to be overweight than women with food security (Townsend *et al.*, 2001). In another study in Congo, John *et al.* evaluated the association of obesity with food insecurity. They found that obesity was more frequent in females with food insecurity than food-safe women (31% vs. 16.2%) (Fa *et al.*, 2003).

The results of studies conducted in Iran are completely in line with the conducted global studies. A study on low-income families in Bushehr City reported that food insecurity was estimated as 86% and BMI was significantly higher among food insecure families. In other words, food security was a supportive factor to reduce BMI.

In another study over 7158 Iranian urban and rural households, the level of food insecurity was 22.2%, which was related to women's weight, but it was not associated with the women's food insecurity (Eshraghian *et al.*, 2007). Another study showed that the level of food insecurity was 8 (37%). The BMI of women with a significant family-related food insecurity, the women's age and the household size was significantly negative and had an inverse relationship with the social-economic status (Mohammadzadeh *et al.*, 2010).

Reasons underlying the correlation between household insecurity and obesity in women are unclear. One of the possible reasons is that women, as household food managers, are more likely to remain hungry when exposed to food insecurity than other household members. In other words, they sacrifice themselves in order to feed the rest, especially children. As a result, a special dietary pattern is formed that varies between consuming food at the time of deficiency and overeating in abundance conditions. The fat content in women, caused by overeating, is higher than that of men,

which can be explained by the relationship between household insecurity and overweight in women (Godfray *et al.*, 2010, Mohammadzadeh *et al.*, 2010).

With decrease of the food security level, the multi-ethnicity increased. Although multiplication should be in line with physiological conditions, our findings indicated that this relationship was commonly observed in poorer African countries. This may be related to the hormonal changes caused by the maternal body biopsy following food poverty, stress, and other possible conditions (Hunskar *et al.*, 2000, Kim *et al.*, 2015, Moradzadeh *et al.*, 2016)

Although the composition and dimensions of households can affect food insecurity, this relationship may be two-way. In the present study, the frequency of pregnancy, the number of births, and the number of children were significantly different in women with varying degrees of food security. However, no significant difference was observed with regard to the household size. The results of previous studies were controversial considering the effects of these factors on food security. Many previous studies showed that the household size was significantly different in different levels of food security. Considering the cause of the relationship between household size and food security, it can be stated that increased household size decreased the amount of available food in the family. In certain conditions, such as temporary loss of employment or seasonal fluctuations in food prices, the households' access decreases to raw materials. As a result, when the amount of food reduces, food security decreases in women. Therefore, larger number of people in a family decreases the amount of food available to each family member, which results in poor access to food (Eshraghian *et al.*, 2007). This suggests that osteoporosis does not have a genetic and familial root, but is a personality disorder based on factors affecting the individual. A macro level research of the community confirmed this finding by indicating that only a small fraction of osteoporosis was attributed to genetic factors (Hakim *et al.*, 2010). However, more than 56 different genes have been

found to be effective on osteoporosis (Ahmed and Del Ninno, 2002, Liu *et al.*, 2009).

No statistically significant difference was found between different levels of food safety and bone densitometry. However, the level of significance was close to 0.05, which suggests the necessity of similar studies with larger sample size by applying the cluster sampling method. Today, enriched foods play a great role in our life and affect people's mental and physical health significantly (Mahamed-Khosroushahi *et al.*, 2014, Rasouli *et al.*, 2017). Therefore, results of the current study can provide useful information for future experimental analyses, since it provides an accurate perspective about the importance of foods and food security in maintenance of people's health.

In contrary to the previous findings, food insecurity in Colombia was only indicative of low birth weight in adults and did not increase the risk of obesity. In this regard, various studies in the households showed that hunger had a significant relationship with maternal inertia, but food insecurity was unrelated to overweight. It seems that the degree of social development in different societies is contradictory with the results of these studies (Godfray *et al.*, 2010, Rafiei *et al.*, 2009)

Absence of a significant relationship between food security status and BMI in the present study may be due to the fact that the food insecurity of some households is temporary. In other words, the economic pressures on the household are due to temporary job loss or seasonal changes that have a sustained effect, but did not have anthropometric indices.

## Conclusion

Considering the above-mentioned results as well as the information reported by other researchers, osteoporosis and malnutrition are one of the most important issues that pose a serious threat to the individuals' health all over the world. Hence, paying attention to food security and food problems can fortify the health quality of our society. Studies indicated that these issues are important factors to improve the women's health. Considering significance of the factors studied in

this study, a healthy diet should be considered for women with higher than 45 years of age to prevent osteoporosis. Confirmation of the present observation using clinical trials is strongly recommended to other researchers. Finally, lack of adequate facilities to measure some of the factors associated with bone density, such as biochemical factors, was one of the limitations of this study. The strength and novelty of this plan was investigation of the food safety, osteoporosis, and food intake at the same time, which has not ever been studied. However, whether our premise is true or not, the reported data herein should be investigated under large-scale clinical trials to get a broad-spectrum of high-quality data for further studies.

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### Author's contribution

Movahedi A conceived the research main idea and guided the analyses; Ahmadi N conducted the experimental research, data analysis, and prepared the manuscript's first draft; Djazayeri SA revised the final version of the manuscript.

### Conflict of interest statements

Not declared.

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