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Prediction of Food Security Levels in Rural Households Based on Socio-Economic Factors (The Case of Nahavand County, Iran)

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Abstract

The role of nutrition in the health area, increasing efficiency and its relationship with economic development has been approved through extensive research in the world using scientific foundations and empirical evidence. Therefore, accessing to food security is the basic pillar of development. The main purpose of this study was to investigate the role of socioeconomic factors affecting the food security of rural households in Nahavand County, Iran. The statistical population consisted of 26599 rural households of Nahavand County that 255 people were selected using Cochran formula and stratified random sampling technique. A questionnaire was used to data collection, which its validity was confirmed by a panel of faculty members in the University of Tehran and its reliability was confirmed by Cronbach's alpha which its range was 0.72 to 0.91 for different sections of the questionnaire. Data analysis was performed in two parts of descriptive and inferential statistics using the software SPSS21. Results showed that the difference in various levels of household income in terms of food insecurity levels was statistically significant at the 0.01 level. The results of logit regression (probit) analysis suggested that variables of decision-making ability, nutritional awareness of head of the household and the household income have the greatest impact on rural households' food security.

Keywords:
food security, rural households, Nahavand County

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INTRODUCTION

Food security is one of the most important and widely used terms discussed in development documents and applied by the authorities and development planners. Food insecurity is an enormous barrier in the way of prosperity and development and if a serious and root means is not found to overcome it, humanity will undoubtedly be faced with an uncertain future (Sheykhaleslam, 2011). Therefore, accessing to sufficient food and food security is the basic pillar of development, and is considered as the foundation of growing the next generation of the country. However, despite all efforts for eliminating hunger around the world over the past decade, there are still about 850 million undernourished people in the worldwide (Babatunde et al., 2007). Today, with the development of the concept of human development, food security issue has taken on new dimensions and has become one of the most important issues in all countries of the world. Food insecurity is not only a lack of access to food but also is perceived as inadequate in terms of quantity and quality, unacceptable and a big concern (Mohammadzadeh et al., 2011). Therefore, providing food security of the society is one of the major planning of socio-economic development in all countries. There are many definitions of food security. The 1996 World Food Summit adopted the following definition: "Food security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 2005). Providing food security according to its accepted definition at the global level is not only a national duty for governments, but also is a general duty for the international community. Therefore, wide efforts have been made at the national, regional and international level to get rid of the problem of malnutrition. Continuous and reliable access to food is not a process that can be achieved on its own, but its creation in the society has a domain and a wide range of causes. Food security requires not only supplying adequate food, but also monitoring the fair distribution of food and income for public access to it (Chizari & Balali, 2007).

Much research has been conducted on various factors affecting the food security of rural households around the world that each of them has investigated the effect of various factors on the food security and a few types of research have investigated all the factors affecting the food security of rural households at the same time. In the case of food security, many factors affect it and are involved in its quality and quantity. These factors can be categorized into four groups of political, natural, social and economic factors. Some of the political factors affecting the food security are inadequate government policies and organizational weakness that are the main causes of food shortages, poverty, and backwardness. Natural factors, in turn, have harmful effects on food security of rural households that environmental degradation and drought are of the natural factors jeopardizing food security so that the impact of drought on food security is obvious and food security of rural households are severely affected by reducing agricultural production and a sharp drop in productivity. Other factors, which had an impact on food security, are socioeconomic factors that can be considered as the most important and influential factors affecting the food security of rural households. According to research performed in this field, it can be stated that the most important economic factors that affect the food security of rural households are the household income (Cook, 2008; Power, 2005a, b; Che & Chen, 2001), household assets (Bashir et al., 2013), economic conditions of society and expenses of households (Headey, 2013), and job status of head of households. On the other hand, social factors also affect the food security of rural households and have a key role in improving food security of them that the most important social factors influencing food security are the nutritional awareness (Arene & Anyaeje, 2010), women's participation in improving household food security (Katz et al., 2001), the decision-making ability, the quality of human capital in family, education of household head (Ajani et

Figure 1. The theoretical framework of the research

al., 2006), family structure (Adeniyi, & Ojo, 2013), family size (Hackett et al., 2010) and age of household head (Bashir et al., 2013).

According to a report food security in rural areas of Iran is under threat due to many factors such as seasonal fluctuations of access to essential food items like fruits, vegetables, and dairy products (Shaikholeslami, 2016). Since the food security largely depends on economic conditions and sociocultural awareness, as a result, in the poor population of rural areas abdominal fullness replaced instead of cell satiety and the starvation of individual can be only solved rather than actual supply of food and physiological needs and healthy nutrition, and this despite the fact that over time, their food security will have a worse situation than the past. The most of the rural population worked in agriculture section and agriculture section provides food security of a country through its productions and also, a significant portion of Gross Domestic Product (GDP) of the country and a high share of employment has been related to this section. Therefore, the problem of this research is that considering this fact that a high percentage of the country population live in rural areas and the rural and agricultural sector supply the country's food security, the growth of GDP, financial and political independence and provides a high share of employment, why are rural population suffered from food insecurity and the majority of the undernourished population in the country live in rural areas? In this regard, the present research, in addition to designing a model of socioeconomic factors affecting food security, investigates the reason of impact of these factors on food security of rural households and the main thing is to figure out what combination of socioeconomic factors can simultaneously distinguish levels of food security. In the other words, achieving a function, which can predict the best food security situation based on studied socio-economic factors.

Overall, this study seeks to achieve the following specific objectives:

a. Investigating the food security status of rural households;

b. Investigating the economic factors affecting the food security of rural households, and

c. Investigating the social factors affecting the food security of rural households.

A model of social factors affecting the food security of rural households presented in this study consisted of three parts of the decision-making ability of household head, participation of women in promoting food security and the nutritional awareness of households head. On the other hand, the economic factors affecting food security were studied in three areas of employment and income status of household, financial

independence of household mother and economic conditions of the society. Also, according to what mentioned above, various factors affect the food security of households that each of them was noted. According to the survey, the household food security conceptual framework is as follows that has been presented as a conceptual model framework in Figure 1.

METHODOLOGY

This study adopted a correlational-descriptive approach to analyze the data. Logit regression was the main statistical procedure used to develop a model describing factors affecting food security in rural households. The statistical population included all rural households in the Nahavand County, Iran (N = 26599). The stratified random sampling method was used due to the gamut of the County (four sections and nine districts). In addition, Cochran's formula was used to estimate the sample size as follows:

$$n = \frac{N(t.s)^2}{Nd^2 + (t.s)^2}$$

n=size of sample S= standard deviation (statistical population)

N= volume of population 0.2=d= desired possible accuracy t=1.96

To determine the standard deviation of the studied population, and determine the desired possible accuracy, 30 samples of the statistical population of the study were randomly selected and pre-tested. The standard deviation was obtained from this pre-determined and the desired possible accuracy was calculated using the following formula (S=1.5).

$$n = \frac{15421\,(1.96 \times 1.5)^2}{(15421 \times .2^2) + (1.96 \times 1.5)^2} = 214.44$$

In this study, the sample size was calculated using Cochran's formula at 5 percent level. Out of 280 questionnaires collected during the fieldwork work, were recognized as to be suitable for future analysis. House the hold Food Insecurity Access Scale (HFIAS) was used to measure the availability of food. The scale of Food and Nutrition Technical Assistance Project (FANTA) was provided by Coates et al., (2007) at the Academy of Educational Development under supervision of the United States Agency for International Development (USAID) provided support, operational and has been released (Coates et al., 2007). To measure the social and economic factors affecting food security, a five-point Likert scale from very low to very high was used. Furthermore, two approaches of logit and probit can be used to differentiate ordinal dependent variable levels based on studied independent variables.

The basis for choosing these two approaches was the parallel test (PT) or the parallel test for sharing equal levels. Since the ordinal functions of logit (probit) assume the ordinal dependent variable levels are separated from each other in an equal form and there is not this supposed in link function of probit, if this test has a significant level of 0.05, link function of probit has more reliable results compared with the logit link function. Accordingly, this test was evaluated.

RESULTS AND DISCUSSION

The current status of the main variables (dependent and independent) has been examined and described in the form of descriptive statistics. The results showed that the average age of the rural household's heads was 48.34 years and they ranged in terms of age from 25 to 82 years. According to the results presented in Table 1, it can be seen that the most frequent age category is 45-60 years in which 140 of rural households (54.9 percent) are located. The frequency distribution of the education level of the households' heads in Table 1, indicated that maximum frequency belongs to primary to guidance or 4-6 years of education with 41.2 percent of frequency. According to the findings and as shown in Table 1, the average family size among rural households was 5.21 (SD= 1.5). Family size (number of family members) among rural households was in the range of 1-13 people. According to the results shown in this table, most of the rural households (54.5 percent) belongs to the group of 4-6 people.

Table 1
Frequency Distribution of Participants by selected personal variables

Variable(s)	Group	Frequency	Percentage	Cumulative percentage
Family size	Less than 4 persons	77	30.2	30.2
	4-6 persons	139	54.5	84.7
Job status	More than 6 persons	39	15.3	100
	Agriculture	141	55.3	-
Age (Years)	Non-agricultural	114	44.7	-
	Younger than 30 years	13	5.1	5.1
	30-45 years	80	31.4	31.5
	45-60 years	140	54.9	91.4
Educational level	Greater than 60 years	22	8.6	100
	Uneducated	61	23.9	23.9
	4-6 years schooling	105	41.2	65.1
	Diploma	65	25.5	90.6
	Post diploma	9	3.5	94.1
	Bachelor of Science	15	5.9	100

The results of this study on rural households in the city of Nahavand that has been also summarized in Table 1, showed that the job of the most rural households (55%) of this county is agriculture and about 45 percent of households have non-agricultural jobs.

To investigate the prevalence of food insecurity among rural households, the household food insecurity measure scale guideline was used. Based on the criteria given in this guideline, households in terms of food security were classified into four categories viz., food secure, mild food insecure, moderate food insecure and severe food insecure. As shown in Table 2, about 0.4% of households has been in the food secure class. During the time of the study, none of the food insecurity conditions occurred for these household categories and the concern about inadequate intake of favorable food has rarely been reported. However, 41.6 percent of the households have been classified as mild food insecure. During the period of the study, these households have expressed that sometimes or often are concerned about the insufficient food consumption of household or they were unable to eat their favorite foods or they rarely have a repetitive diet with the same foods rather than the desired diet or them rarely ate a food that did not like to eat. In addition, 26.2% of the households were classified as a medium food insecure class. These households sometimes or often had just some kind of repetitive food to eat for several days or to eat their unfavorite foods and them rarely or occasionally had to eat less food than their need during a meal or they rarely or sometimes had to eat the less number of meals during the day. Finally, 31.28 percent of rural households were classified as severely food insecure. During the period of the study, these households often ate less food in one meal or less meal in a day. The problems such as a lack of access to any kind of food to eat at home, going to bed hungry and not eating during a day have occurred rarely, sometimes and often at this household level.

The households of food secure class were

Table 1
The Prevalence of Food Insecurity among Rural Households

Number	Class	Frequency	Percentage
1	Food secure	1	0.4
2	Mild food insecure	106	42
3	Moderate food insecure	67	26.2
4	Severe food insecure	81	31.8
Total		255	100

Table 3
The Results of t-test to compare the Food Insecurity of Rural Households based on classification variables

Classification variable	Groups	Chi-Square	SD	t- value	p-value
Gender	Male	8.92	3.32	3.087**	0.002
	Female	6.10	3.21		
The main occupation of household head	Agriculture	4.97	2.95	-.614**	0.000
	Non-agriculture	7.81	2.97		
Second occupation of household head	I have	5.14	2.91	3.422**	0.000
	I do not have	6.94	3.30		

** p<0.01

households who had enough food at their household level and adequate access to food. In addition, the food consumed by these households had enough quality and quantity, or in other words, they had both abdominal fullness and cell satiety. Moreover, 41.6% of the households were in the mild food insecure class, they only suffered from cell satiety and the rest of the households that were in the group of moderate and severe food insecurity suffered from both abdominal fullness and cell satiety.

Based on the findings of the study, it was revealed that there was a significant difference with at one percent level among households whose heads are men as compared with the households whose heads are women, and there is enough evidence to reject the null hypothesis for no difference between the food security of households whose heads are men with households whose heads are women. Moreover, according to the t-test results, there is sufficient evidence to reject the null hypothesis for no significant difference between the average food security of rural households whose head's job is agriculture as compared with rural households whose head's job is non-agriculture and it can be stated that rural households that the main occupation of household head is non-agriculture were less food secure because the average score of their food insecurity was higher than the average of food insecurity score of households whose head has worked in an agricultural sector. According to Table 3, it can be stated that the average rural household food insecurity has a significant difference at one percent level based on the second job of the household's head. So that at the one percent level, the null hypothesis was rejected for no difference between food security of rural households whose head has the second job and households whose head does not have a second job.

Based on the findings in Table 4 it can be stated that the average food insecurity among rural households with different income levels is significantly different at one percent level. Accordingly, the assumption of the research for the presence of a difference between the averages of food insecurity among different income lev-

Table 4
The One Way ANOVA Results to Compare the Rate of Food Insecurity among Rural Households with Different Income levels

variable	F- value	First group	Mean	Second group	Mean	Mean difference	P-value
Income	20.625**	High	2.86	Medium	5.59	-2.72**	0.000
				Low	9.07	-6.21**	0.000
		Medium	5.59	High	2.86	2.72**	0.000
				Low	9.07	-3.48**	0.000
		Low	9.07	High	2.86	6.21**	0.000
				Medium	5.59	3.48**	0.000

**p<0.01

Table 5
The Parallel Test for Sharing Equal Levels

Model	-2 Log Likelihood	Chi-Square	df	P-value
Empty model(null)	529.685	-	-	-
Final model	475.672	54.014	6	0.000

**p<0.01

Table 6
The Regression Model Fitting

Model	-2 Log Likelihood	Chi-Square	df	P-value
Empty model(null)	556.521	-	-	-
Final model	529.685	26.835	3	0.000

Link function: probit

els can be supported with a confidence interval of 99 percent. Toki test results showed that the average food insecurity of high-income households has a significant difference at one percent level with the households who are in the middle and low-income levels. It should be noted that average of food insecurity of low-income households (9.07) is higher than the average of food insecurity of high-income households (2.86), and also families with high income have a lower average of food insecurity as compared to the other households classified as a moderate food insecure class (5.59). This finding shows that rural households with higher income levels have better food security situation as compared with the other households.

The ordinal logistic regression technique was used to determine the socioeconomic factors affecting the food security of rural households. In this regard, the dependent variable was a categorical variable with ordinal measuring level. In following, the results of socioeconomic factors affecting the food security of rural households have been presented in the form of logit model of household income, nutritional awareness of household head and the ability of decision-making of household head.

Table 5 shows the results of the similarity of model-independent parameters between the dependent variable levels. Chi-square statistic indicates the difference between the likelihood ratio of the null hypothesis and the general model. Based on the contents of this table, chi-square test (54.014) with a freedom degrees of 6 and P value of less than 1 % has been significant. This suggests that there is sufficient evidence to reject the null hypothesis which reveals the dependent variable levels are not separated from each other as same as independent variables. In other words, independent parameters are significantly different at the levels of food secure, mild food insecure and moderate food insecure. Therefore, the probit link function has been used for analyzing the present logit model.

Table 7
The Fitting Goodness Test

	Chi-Square	df	P-value
Pearson	567.622	720	1.000
Deviation	524.140	720	1.000

Link function: probit

Table 8
Pseudo-R^2 Test

Cox and Snell	0.100
Nagelkerke	0.112
McFadden	0.048

Link function: probit

Table 6 presents a summary of the information about fitting the regression model (prediction). Based on the results of this table, the significant chi-square test at 1 percent level and confidence level of 99 percent suggests that there is enough evidence to reject the null hypothesis for no difference between the model with at least one independent variable and a model with a fixed value (basic model). In other words, entering variables of the household's income, decision-making ability and nutritional awareness of households head statistically cause a significant increase in the estimation and separation power of the extracted function as compared with the null model so that the extracted logit function indicates a higher performance as compared to all possible models. Because reduction of the amount of -2Log Likelihood in the final model as compared to the original model resulted in 26.735 improvements based on chi-square distribution that indicates the better efficacy of the final model as compared to the original model.

Table 7 shows the results of fitting goodness test. This table shows the result of two statistics of Pearson's chi-square and deviation's chi-square. This statistics test reveals the incompatibility of the observed data with the fitted model. Considering the significant levels of these two tests, it is found that none of these tests are significant at the 5% level. In other words, it can be found that similar classes in terms of the household income, nutritional awareness and decision-making ability of household head are different with each other at different levels of the dependent variable so that they cannot be combined at other levels of this variable. In other words, as these tests are not significant at 5 percent level, there is not enough evidence to reject the null hypothesis for the compatibility of the observed data with the fitted model. Therefore, the food security regression model with three variables of household income, nutritional awareness and decision-making ability of household head has enough fit with the data.

Table 8 indicates the pseudo-R^2tests. These tests include Cox and Snell, Nagelkerke and McFadden. These tests are used to compare similar models (tested by the same data) and as there is not another model for comparison. These values can be explained in this section and are only a basis for comparison with other possible models in other research positions.

Table 9 shows the estimation of model parameters. In this Table, standard deviation errors, tests of significance and confidence intervals for all parameters of the model are separately presented to the estimate parameters. Based on the contents of this Table, the value of parent statis-

Table 9
The Estimation of Parameters of the Model

		Estimation (coefficient)	SD	Parent statistic	df	P-value
The dependent variable levels (food security)	Food secure	-5.291	0.739	51.278	1	0.000
	Mild food insecure	-2.688	0.609	19.498	1	0.000
	Moderate food insecure	-1.960	0.602	10.595	1	0.001
independent	income	-0.005	0.003	3.863	1	0.049
	decision-making ability of household head	-0.049	0.021	5.428	1	0.020
	nutritional awareness of household head	-0.037	0.018	4.414	1	0.036

**p<0.01

tic for the household income, nutritional awareness and decision-making ability of household head is significant at the level of 5 percent and confidence interval of 95 percent. In the other words, variables of the household income, nutritional awareness and decision-making ability of household head had a significant role in the separation of variable levels of food security.

The logit function of the effect of variables of the household income, nutritional awareness and decision-making ability of household head on food security of rural households:

$F_a(-5.291) = -5.291-0.005\ X_1-0.049\ X_2\ -0.037\ X_3$

$F_b(2.688) = -2.688-0.005\ X_1-0.049\ X_2-0.037\ X_3$

$F_c(-1.960) = -1.960-0.005\ X_1\ -0.049\ X_2-0.037\ X_3$

F_a: Cumulative logit function of the food secure class

F_b: Cumulative logit function of the mild food insecure class

F_c: Cumulative logit function of the moderate food insecure class

X_1: Household income

X_2: Decision-making ability of the household head

X_3: Nutritional awareness of household head

Due to the significant independent variables in the logit model 9, it can be found that influence of variables of household's income, nutritional awareness and decision-making ability of household head on separating the household food security levels at a level of 5 percent is significant. Moreover, the coefficient and direction of these three variables are negative for the household food insecurity. Considering the coefficient of the food secure level (-5.291), the coefficient of mild food insecure level (-2.688) and the coefficient of moderate food insecure level (-1.96), it can be stated that by going from the food secure level to the food insecure levels, the intensity of negative values is gradually reduced. Since the coefficient and coefficient's direction of these three variables has the same direction with the coefficient of the food secure level, it can be stated that by increasing the amounts of these three variables, the possibility of locating in the food secure level is increased for rural households. It can be concluded that with one unit increase in the standard deviation of the variable of household income, the possibility of locating in the food insecure level is decreased for households as much as 0.005 if other independent variables remain constant. In the other words, rural households with appropriate annual income are more likely to be in a better level of food security. However, with the constant income and nutritional awareness of rural households, one unit increase in the standard deviation of the decision-making ability of household head decreases the possibility of locating rural households in lower food secure level as much as 0.049. Furthermore, income and decision-making ability, one unit increase in the standard deviation of the nutritional awareness of household head increases the possibility of locating rural households in more secure food level as much as 0.037. In other words, it can be stated that the possibility of locating in a better level of food security is more for rural households whose head has more nutritional awareness.

CONCLUSION AND RECOMMENDATIONS

The results of the current study showed that food security is significantly different between rural households that the main occupation of the household' head was agriculture and those that the main occupation of the household's head was non-agriculture. In fact, it can be said that the rural households in which the main occupation of the household' head is non-agriculture, have less food security. Considering this finding, it can be noted that rural households who have no agricultural land are divided into several groups where most of them are workers who are the poorest population of rural communities in terms of economic status as well asocial status. Therefore, it could be concluded that the non-farmer population will have more food insecurity as compared to farmers and landowners. Moreover, the results showed that rural households whose head does not have a second job had more food insecurity as compared to households whose head has the second job. It can be stated that in the rural environment and rural lifestyle, having the second job is an important factor for the welfare of the family and achieving the food security because the business

practices in rural areas is in such a way that they have no work at certain seasons of the year, if they could have a second job in these seasons as well as other seasons, they could increase household income and make possible to reach the food security for their family. In addition, the effect of variables of the household income, nutritional awareness and decision-making ability of the household head on separating the food security levels of the household was significant at 5% level. In the other word, the relation of variables of the household income, nutritional awareness and decision-making ability of household head with the rate of the food security of rural households has been positive and direct, and by increasing the magnitude of these variables, it is expected that rural households will be far from mild, moderate and severe food insecurity levels and will be closer to the food secure level.

The findings showed that there is a significant difference between different levels of household income and household food security so that families with higher income levels had a more suitable level of food security. Therefore, it is recommended: since, there are seasonal and hidden unemployment in rural areas and these two are potential sources of new businesses, with financial support of national and local institutions, family-owned businesses can be created in the field of rural industries or new agricultural businesses, such as mushroom farming, beekeeping and etc. and areas can be prepared to reach sustainable income for rural population. It is also recommended: Families with low-income levels have been identified and will be supported by the government through various institutions with giving those cash subsidies as well as the basic goods, which have a key role in energy supply. Almost to increase the income of households that the occupation of the head of the household is agriculture, development plans on modern irrigation methods and taking advantage of high-yielding and improved seeds are suggested. Because they reduce the cost of production, increase household income and stabilize production.

On the other hand, according to the research findings, as with an increase in the nutritional awareness of the head of household, food security of rural households are located in a better situation, holding training programs about nutrition, healthy diet and the nutritional value of foods by nutrition consultants and local institutions at rural areas is recommended to increase awareness of households, specially parents. Moreover, training courses related to nutrition should be conducted by nutritionists in schools and higher education institutions. There are other suggestions in this regard; health and food science promoters can help to improve the nutrition knowledge and awareness of household head. So that the higher education system and organizations related to food security at different levels train students with the ability to spread knowledge of food security in this field.

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