



## Association between Malnutrition and Depression in Elderly People in Razavi Khorasan: A Population Based-Study in Iran

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### Abstract

**Background:** To determine the prevalence of malnutrition and depression in free-living elderly people and their relationships (If any) in Razavi Khorasan, Iran 2007.

**Methods:** To evaluate nutritional status, we used Mini Nutritional Assessment (MNA) method in free-living elderly people (n=1565 using cluster sampling, 720 males and 845 females, aged  $\geq 60$  yr) and their relationship to Socio Economic Conditions (SECs). Based on the final scores, our patients were classified into three groups: score 17-23.5 (at risk for malnutrition), score less than 17 (with malnutrition), and score 24-30 (well nourished). To determine the mood status (here depression), we used Geriatric Depression Score (GDS). According to this score our participants turned out to be in two distinct groups: depressed (score  $\geq 8$ ) and non-depressed (score  $< 8$ ).

**Results:** From the total subjects entered the study (1495), 22.07% were depressed and 11.5% and 44% were malnourished or at risk of malnutrition respectively. In depressed group, the prevalence of malnutrition was 14.5% (48 out of 330) and the prevalence of "at risk of malnutrition" was 45.8%, whereas the prevalence of malnutrition and at risk of malnutrition in non-depressed population were 10.6% and 43.3% respectively. From the aforementioned information we have concluded that there is a significant statistical difference between the prevalence of malnutrition in depressed and non-depressed individuals ( $P= 0.047$ ).

**Conclusions:** With respect to the high rate of vegetative symptoms in elderly depressed individuals, malnutrition would have a higher prevalence in the depressed people.

**Keywords:** *Depression, Malnutrition, Geriatric depression score (GDS), Mini nutritional assessment (MNA), Iran*

### Introduction

There is a high prevalence of mental and physical disorders in the community population of older adults (1). Therefore, clinicians who treat geriatric patients cannot neglect the psychiatric vulnerability of the elderly population. In the geriatric population the psychological functioning like the experience of loss and the biological

elements like the lowering of neurotransmitters and the original sources of supplies are the two factors which cause the decrease of psychological flexibility (1). Thus, the other point that geriatric clinicians should pay attention to is the powerful mind-body connection in the elderly. Depression in the elderly can often lead to malnutrition or dehydration, which can induce vari-

ous kinds of physical illnesses. On the other hand, physical conditions such as malnutrition in the elderly can induce depression, because of the psychological vulnerability of the elderly. Because there is a strengthened relationship between the body and the mind in the elderly the psychiatric care seems to be necessary (1). Providing the elderly with psychiatric care, the clinician should attend to all symptoms, not minimizing the importance of biological treatment, while also trying to support the elderly patients physiologically and pay attention to their nutritional needs. The process of aging may cause the atrophic inflammation of the stomach but by itself, it could not be a reason for malabsorption or malnutrition (2).

However, malnutrition is common in older people and has serious adverse effects and one of correctable causes is depression (3,4). In other word, a reduced energy intake causing body weight loss may be caused by social or physiological factors, or a combination of both. One of the most common causes of the depression, which leads to psychological issues and malnutrition in elderly, is related to the experience of loss or breakage of social networks (5).

As mentioned before, malnutrition in elderly people is therefore a consequence of somatic, psychic or social problems. Difficulty in chewing, swallowing, inability of the heart to perform properly, lonesomeness, lack of social companionship and depression are determined to be the typical causes of malnutrition in elderly.

Undernourishment is associated with a worse prognosis and is an independent risk factor for morbidity and mortality. Awareness of this problem is therefore important (2).

As some studies revealed that high levels of depression symptoms was associated with nutritional state and it is concluded that emotional well-being is the important factor for maintaining nutritional environment in community-dwelling disabled older adults (6), to ensure a healthy elderly population, improving the nutrition is one of the most important approaches. Furthermore, there are some evidences to show the effect of

some special nutritional supplements on the elderly depression. Folic acid deficiency may result in psychiatric symptoms such as depression or the increases in severity of other organic and non-organic mental diseases (7,8). An already with moderately reduced vitamin B<sub>12</sub> level is associated with neurocognitive disorders such as depression (9). Anemia related to iron deficiency especially in females is related to apathy and depression (10). These findings confirm the association between nutritional condition and depression especially in elderly.

There is a very limited data on the prevalence of malnutrition and its association with any factors in community-dwelling elder individuals. In Iran, most recorded data is about nutritional status of home care elderly individuals (11, 12). In addition, depression among elderly in Iran, has not been well studied, the objectives of the present study were to determine the prevalence of malnutrition and depression in free living elderly people and its relationship with each other, and also with some demographic factors such as place of living (rural and urban), education, gender, type of living (alone or with family), occupation, source of income and supplement in Razavi Khorasan, Iran.

## **Material and Methods**

Subjects were all recruited from the free-living elderly people, who could participate in questioning, in Razavi Khorasan (with total elderly population of 115832). Each subject gave informed written consent to participate in the study, which was approved by the Mashhad University of Medical Science Ethics Committee.

After the initial consultation with the statistical consultant and by using cluster sampling, a sample size of 2000 people was chosen. Some of these people did not know their exact age and some others could not stand up properly; hence, the measurement of weight was difficult. Such elderly people were excluded from the study. To avoid bias, socioeconomic questions were set in the final part of questionnaire. A sample of 1565 people was selected. The information resulting

from interviews, inspections and completion of the data forms were used for this research. The team in charge for questioning included health care officers and medical students. Educated people were defined as any person can read and write and non-educated people were defined any person cannot read and write.

The questionnaire form, used for this study was the Mini Nutritional Assessment (MNA) and the Iranian version of the Geriatric Depression Scale-15 (GDS).

The MNA is an assessment tool that can be used to identify patients at risk of malnutrition. It is both a screening and assessment tool for the identification of malnutrition in the elderly. This tool eliminates the need for more invasive test such as blood sampling. The MNA has been validated internationally (13,14). According to the MNA, in screening part, if the score of patient is 12 points or more, the patient is not at risk and there is no need to complete the rest of questionnaire (although in the present study, for collecting more data, questionnaire was filled completely), if the score is 11 points or less, the patient may be at risk and the full MNA form should be completed. Based on final scores, our patients were classified into three groups: score 17-23.5 (at risk of malnutrition), score less than 17 (malnutrition), and score 24-30 (well nourished) (15,16). The GDS is a tool that can be used to screen the elderly patients at risk of depression. This tool has been validated in Iran. According to the GDS, in screening part, if the score of patient is 8 points or less, the patient is not at risk (17).

The MNA and GDS were completed based on interviews, filling in questionnaires after recognizing sample size of each city.

Admission and data analyzing was followed by examining the relationship between malnutrition and depression as well as place of living (rural and urban), education, gender, type of living (alone or with family), occupation, source of income, supporting system (such as charities), and supplementation. Moreover, the effects of the MNA factors and also some of socio economic state

(such as education and place of living), on nutritional status were determined and studied.

### **Statistical analysis**

Data are expressed as means $\pm$ SDs for continuous variables and as frequencies and percentages for categorical variables. Differences in nutritional status were analyzed by the chi-square test for categorical variables. Pearson correlation coefficients were calculated for linear relations between total MNA scores as well as GDS score and continuous variables such as the measures of BMI, length of education, waist and hip circumference, and waist/hip ratio. Multivariate analyses with multinomial logistic regression were used to determine the effects of the MNA factors and some of SECs, such as education and place of living on depression in this study. A  $P \leq 0.05$  was considered significant. The statistical analysis has done by SPSS 11.5 software.

## **Results**

### **Demographic data of total samples**

The subjects' mean ( $\pm$ SD) age was 70.14 $\pm$ 7.57 yr (range: 60-106) and 53.51% of the subjects were women (Table 1). Body mass index (BMI) averaged 24.40 $\pm$ 4.83. The subjects' mean ( $\pm$ SD) height was 156.76 $\pm$ 9.83 cm. The subjects mean ( $\pm$ SD) waist circumference was 91.44 $\pm$ 14.03 cm and hip circumference averaged 95.94 $\pm$ 11.83 cm.

### **Geriatric Depression Scale**

As shown in Table 2, according GDS score, 22.07% of the subjects were depressed. The percentage of depression was higher in subjects living with others than those living alone (26.6% vs. 24.8%  $P < 0.001$ , respectively and depression in those have family support was much lesser (20.2%). There are significant differences between depression scores in elderly with personal wealth and retirement salary in comparison with those without these financial supports ( $P < 0.001$ ). Moreover the percentages of people at risk of depression were higher in females than in males (23.7% vs. 20.1%), higher in rural than in urban

(23.0% vs. 21.0%) and also higher in non-educated than in educated (22.0% vs. 21.9%). Self-employment and farming variables in comparison with unemployment show a positive effect in reducing the depression, and different occupations in comparison with retirement. Binary logistic regression between depression (with or without) as a dependent variable and location of life (urban/rural), sex, live alone or no education, job, source of income has done, Result shows that just the source of income correlated to depression and others has no role with depression ( $P= 0.01$ ).

### Mini Nutritional Assessment

As shown in Table 2, only 44.5% of the subjects were well nourished. 11.50% of the subjects were malnourished and 44% were at risk of malnutrition. Percentages of people with malnutrition and those at risk of malnutrition were higher in females than in males (12.1 and 50.2% vs. 10.9% and 36.8%;  $P< 0.001$ , respectively), higher in rural than in urban (13.1% and 47.8% vs. 10.5% and 41.7%;  $P< .001$ ) and also higher in non educated than in educated (12.7% and 49.1% vs. 7.6% and 25.9%;  $P< 0.001$ ). Moreover the percentages of malnutrition and at risk of malnutrition were higher in subjects living alone than those living with others (14.4% and 52.8% vs. 14.0% and 53.8%;  $P< 0.001$ , respectively) and with their family (10.3% and 39.4;  $P< 0.001$ , respectively). The elderly people, who were self-employed, had lower percentage of malnutrition than the employed, farmers or animal farmers, laborers and unemployed (5% vs. 6.3%, 9.5, 9.6, 12.7;  $P< 0.001$ , respectively). The elderly people on drug supplement were more malnourished than those who were not on drug (15.4% vs. 10.9%;  $P< 0.005$ ). Using ordinal regression analysis, the results show that, some of the variables like education status, occupation, source of income and taking supplements, have significant indications. Education, self-employment and farming variables in comparison with unemployment show a positive effect in reducing the malnutrition, and different occupations in comparison with retirement and supplements show a negative ef-

fect in reducing the malnutrition. Total MNA score were significantly correlated with BMI, age, waist circumference, hip circumference and length of education ( $r= 0.43, 0.14, 0.35, 0.36$  and  $0.27$ , respectively).

To determine the most effective factors, the effect of the MNA and some of SECs (education, place of living and etc) on nutritional status were determined, using the multinomial logistic regression model. The results showed that neuropsychological problems, mobility, living independently were significant for nutritional status ( $P< 0.001$ ). The "Source of income", "education" and "occupation" were the most effective significant SECs on nutritional status ( $P< 0.001$ ).

### Relationship between GDS and MNA

From the total subjects studied (1495), 22.07% were depressed and 11.5% and 44% were malnourished or at risk of malnutrition respectively. The prevalence of malnutrition in our study in 2007 was 14.5% (48 out of 330) and the prevalence of "at risk of malnutrition" was 45.8% in depressed group, whereas the prevalence of malnutrition and at risk of malnutrition in non-depressed population were 10.6% and 43.3% respectively (Table 3). From the aforementioned information we have concluded that there is a significant statistical difference between the prevalence of malnutrition in depressed and non-depressed individuals ( $P= 0.047$ ).

**Table 1:** Population Demographics

Variable	Number
Age (Mean±SD) years	
Total	70.14±7.57
Male	71.22±7.56
Female	69.20±7.46
Gender	
Total	1565
Male n (%)	720 (46.0)
Female n (%)	845 (54.0)
Educated vs. Non educated	341 vs. 1219
Male	220 (64.5) vs. 497 (40.77)
Female	121 (35.4) vs. 722 (59.22)
Urban vs. Rural (n (%))	946 vs. 601
Male	441(45.74) 279(46.42)
Female	523(54.25) 322(53.57)

SD: Standard Deviation

**Table 2:** Depression Scales Regarding Gender

			Gender		Total
			Male n (%)	Female n (%)	
Depression Based on GDS*	Depressed	Count Within	546	623	1169
		Gender	(79.9)	(76.3)	(78.0)
	Non depressed	Count	137	193	330
		Within gender	(20.1)	(23.7)	(22.0)
Total	Count	683	816	1499	
	Within gender	(100.0)	(100.0)	(100.0)	
Malnutrition Scores based on MNA**	Malnourished	Count	78	102	180
		Within Gender	(10.9)	(12.1)	(11.5)
	At Risk of Malnutrition	Count	264	423	687
		Within Gender	(36.8)	(50.2)	(44.0)
	Well Nourished	Count	376	318	694
		Within Gender	(52.4)	(37.7)	(44.5)
Total	Count	718	843	1561	
	Within Gender	(100.0)	(100.0)	(100.0)	

\*Geriatric depression score

\*\*Mini nutritional assessment

**Table 3:** Depression Malnutrition Correlations

		Malnutrition			Total
		Malnourished N (%)	At Risk of Malnutrition N (%)	Well Nourished N (%)	
Depression	Non Depressed	124(10.6)	504(43.3)	537(46.1)	1165
	Depressed	48(14.5)	151(45.8)	131(39.7)	330
Total		172(11.5)	655(44.4)	668(44.7)	1495

## Discussion

The purposes of this study were to determine the prevalence of malnutrition and depression in free living elderly people and their relationship with each other based on MNA and GDS, and also with some demographic factors.

The MNA test is a simple, noninvasive, well-validated screening tool for malnutrition in elderly people and is recommended for early detection of malnutrition (18). Since depression has a great clear effect on appetite and eating habits (in typical and atypical depressed people), it seems that having depression could be a risk factor for geriatric people to be malnourished (19). Furthermore food insecurity might have an association with depression (20), particularly in elderly (21) and eating regular may lead to im-

proved mood and cognitive performance (22). Both obese elderly men and women in Hong Kong were less likely to suffer from depressive symptoms than those of normal weight. Therefore the relationship between depression and nutritional status would be associated with several etiologic factors.

The present study has shown this association and the relevant justification for this fact can be made by these reasons.

Malnutrition and depression in a given individual afflicted to both have a common origin (i.e. financial paucity, lack of family support, etc). Furthermore, studies indicate that diet may be related to the occurrence of some complications such as brain lesions in late life which would lead to depression (23).



Although the prevalence of vegetative symptoms in depressed elderly people is higher and variable, the overall effect of depression is negative on BMI. An inverse relationship between BMI and depressive symptoms may indicate greater physiologic and functional reserve from greater muscle mass that protects patients against depressive symptoms (24, 25).

The prevalence of depression and malnutrition in persons who were living with their family were lower than others and the role of family support in depression among the elderly has been suggested (26). Another study showed that family factors were important predictors of depression for Chinese elderly (27). The findings indicate that the effects of caregivers' resources on mental health may differ by relationship type (28). However the poor marital or family relations experienced by many depressed elderly persons are usually consequences rather than predictors of depression (29).

In this study depression in patients with personal income was lower than those were dependent on charities. Prior studies have consistently found the incidence and persistence of depression to be higher among persons with low incomes. And employment status and financial strains are causally related to depression, but causal mechanisms for this relationship are not well understood (30).

As previous studies have shown (31-34) both depression and malnutrition were higher among female. However, a recent study, controlled the confounders such as age-related changes in risk factors, detected that the effect of gender on depressive symptoms was not significant (35).

Depressive symptoms and malnutrition were higher in rural than urban areas. This finding protect the result of some previous researches (36-39). It might be the result of poor financial status in rural areas in Iran.

The greatest advantage of this study was its novelty to evaluate the association between depression and malnutrition, as similar study has not been done before in Iran. Its other advantage was its acceptability by elderly and the simplicity of its method. It may seem that not gathering

the blood samples for evaluating the serum markers of malnutrition may cause negative effects on the final results but positive effect of obtaining data from large sample size has neutralized such negative effects. Furthermore, it makes the method more practical and rational for both geriatric population and researchers, since evaluating blood markers may cause them pay considerable unnecessary expenses.

In addition, MNA and GDS scores are both validated and standardized techniques of diagnosing malnutrition and depression in geriatric population that obviate the need of having each individuals to be examined by nutritionist and psychologist to rule out their disease, which is not cost effective.

In conclusion, from the present finding, it was concluded that companionship of malnutrition and depression must make us vigilant enough to refer our old depressed patients to nutritionists to be fully worked up according to their nutritional status and their socioeconomic conditions.

### Ethical Considerations

Ethical issues including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc. have been completely observed by the authors.

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### Introduction

There is a high prevalence of mental and physical disorders in the community population of older adults (1). Therefore, clinicians who treat geriatric patients cannot neglect the psychiatric vulnerability of the elderly population. In the geriatric population the psychological functioning like the experience of loss and the biological

elements like the lowering of neurotransmitters and the original sources of supplies are the two factors which cause the decrease of psychological flexibility (1). Thus, the other point that geriatric clinicians should pay attention to is the powerful mind-body connection in the elderly. Depression in the elderly can often lead to malnutrition or dehydration, which can induce vari-

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As mentioned before, malnutrition in elderly people is therefore a consequence of somatic, psychic or social problems. Difficulty in chewing, swallowing, inability of the heart to perform properly, lonesomeness, lack of social companionship and depression are determined to be the typical causes of malnutrition in elderly.

Undernourishment is associated with a worse prognosis and is an independent risk factor for morbidity and mortality. Awareness of this problem is therefore important (2).

As some studies revealed that high levels of depression symptoms was associated with nutritional state and it is concluded that emotional well-being is the important factor for maintaining nutritional environment in community-dwelling disabled older adults (6), to ensure a healthy elderly population, improving the nutrition is one of the most important approaches. Furthermore, there are some evidences to show the effect of

some special nutritional supplements on the elderly depression. Folic acid deficiency may result in psychiatric symptoms such as depression or the increases in severity of other organic and non-organic mental diseases (7,8). An already with moderately reduced vitamin B<sub>12</sub> level is associated with neurocognitive disorders such as depression (9). Anemia related to iron deficiency especially in females is related to apathy and depression (10). These findings confirm the association between nutritional condition and depression especially in elderly.

There is a very limited data on the prevalence of malnutrition and its association with any factors in community-dwelling elder individuals. In Iran, most recorded data is about nutritional status of home care elderly individuals (11, 12). In addition, depression among elderly in Iran, has not been well studied, the objectives of the present study were to determine the prevalence of malnutrition and depression in free living elderly people and its relationship with each other, and also with some demographic factors such as place of living (rural and urban), education, gender, type of living (alone or with family), occupation, source of income and supplement in Razavi Khorasan, Iran.

## **Material and Methods**

Subjects were all recruited from the free-living elderly people, who could participate in questioning, in Razavi Khorasan (with total elderly population of 115832). Each subject gave informed written consent to participate in the study, which was approved by the Mashhad University of Medical Science Ethics Committee.

After the initial consultation with the statistical consultant and by using cluster sampling, a sample size of 2000 people was chosen. Some of these people did not know their exact age and some others could not stand up properly; hence, the measurement of weight was difficult. Such elderly people were excluded from the study. To avoid bias, socioeconomic questions were set in the final part of questionnaire. A sample of 1565 people was selected. The information resulting

from interviews, inspections and completion of the data forms were used for this research. The team in charge for questioning included health care officers and medical students. Educated people were defined as any person can read and write and non-educated people were defined any person cannot read and write.

The questionnaire form, used for this study was the Mini Nutritional Assessment (MNA) and the Iranian version of the Geriatric Depression Scale-15 (GDS).

The MNA is an assessment tool that can be used to identify patients at risk of malnutrition. It is both a screening and assessment tool for the identification of malnutrition in the elderly. This tool eliminates the need for more invasive test such as blood sampling. The MNA has been validated internationally (13,14). According to the MNA, in screening part, if the score of patient is 12 points or more, the patient is not at risk and there is no need to complete the rest of questionnaire (although in the present study, for collecting more data, questionnaire was filled completely), if the score is 11 points or less, the patient may be at risk and the full MNA form should be completed. Based on final scores, our patients were classified into three groups: score 17-23.5 (at risk of malnutrition), score less than 17 (malnutrition), and score 24-30 (well nourished) (15,16). The GDS is a tool that can be used to screen the elderly patients at risk of depression. This tool has been validated in Iran. According to the GDS, in screening part, if the score of patient is 8 points or less, the patient is not at risk (17).

The MNA and GDS were completed based on interviews, filling in questionnaires after recognizing sample size of each city.

Admission and data analyzing was followed by examining the relationship between malnutrition and depression as well as place of living (rural and urban), education, gender, type of living (alone or with family), occupation, source of income, supporting system (such as charities), and supplementation. Moreover, the effects of the MNA factors and also some of socio economic state

(such as education and place of living), on nutritional status were determined and studied.

### **Statistical analysis**

Data are expressed as means $\pm$ SDs for continuous variables and as frequencies and percentages for categorical variables. Differences in nutritional status were analyzed by the chi-square test for categorical variables. Pearson correlation coefficients were calculated for linear relations between total MNA scores as well as GDS score and continuous variables such as the measures of BMI, length of education, waist and hip circumference, and waist/hip ratio. Multivariate analyses with multinomial logistic regression were used to determine the effects of the MNA factors and some of SECs, such as education and place of living on depression in this study. A  $P \leq 0.05$  was considered significant. The statistical analysis has done by SPSS 11.5 software.

## **Results**

### **Demographic data of total samples**

The subjects' mean ( $\pm$ SD) age was 70.14 $\pm$ 7.57 yr (range: 60-106) and 53.51% of the subjects were women (Table 1). Body mass index (BMI) averaged 24.40 $\pm$ 4.83. The subjects' mean ( $\pm$ SD) height was 156.76 $\pm$ 9.83 cm. The subjects mean ( $\pm$ SD) waist circumference was 91.44 $\pm$ 14.03 cm and hip circumference averaged 95.94 $\pm$ 11.83 cm.

### **Geriatric Depression Scale**

As shown in Table 2, according GDS score, 22.07% of the subjects were depressed. The percentage of depression was higher in subjects living with others than those living alone (26.6% vs. 24.8%  $P < 0.001$ , respectively and depression in those have family support was much lesser (20.2%). There are significant differences between depression scores in elderly with personal wealth and retirement salary in comparison with those without these financial supports ( $P < 0.001$ ). Moreover the percentages of people at risk of depression were higher in females than in males (23.7% vs. 20.1%), higher in rural than in urban

(23.0% vs. 21.0%) and also higher in non-educated than in educated (22.0% vs. 21.9%). Self-employment and farming variables in comparison with unemployment show a positive effect in reducing the depression, and different occupations in comparison with retirement. Binary logistic regression between depression (with or without) as a dependent variable and location of life (urban/rural), sex, live alone or no education, job, source of income has done, Result shows that just the source of income correlated to depression and others has no role with depression ( $P= 0.01$ ).

### Mini Nutritional Assessment

As shown in Table 2, only 44.5% of the subjects were well nourished. 11.50% of the subjects were malnourished and 44% were at risk of malnutrition. Percentages of people with malnutrition and those at risk of malnutrition were higher in females than in males (12.1 and 50.2% vs. 10.9% and 36.8%;  $P< 0.001$ , respectively), higher in rural than in urban (13.1% and 47.8% vs. 10.5% and 41.7%;  $P< .001$ ) and also higher in non educated than in educated (12.7% and 49.1% vs. 7.6% and 25.9%;  $P< 0.001$ ). Moreover the percentages of malnutrition and at risk of malnutrition were higher in subjects living alone than those living with others (14.4% and 52.8% vs. 14.0% and 53.8%;  $P< 0.001$ , respectively) and with their family (10.3% and 39.4;  $P< 0.001$ , respectively). The elderly people, who were self-employed, had lower percentage of malnutrition than the employed, farmers or animal farmers, laborers and unemployed (5% vs. 6.3%, 9.5, 9.6, 12.7;  $P< 0.001$ , respectively). The elderly people on drug supplement were more malnourished than those who were not on drug (15.4% vs. 10.9%;  $P< 0.005$ ). Using ordinal regression analysis, the results show that, some of the variables like education status, occupation, source of income and taking supplements, have significant indications. Education, self-employment and farming variables in comparison with unemployment show a positive effect in reducing the malnutrition, and different occupations in comparison with retirement and supplements show a negative ef-

fect in reducing the malnutrition. Total MNA score were significantly correlated with BMI, age, waist circumference, hip circumference and length of education ( $r= 0.43, 0.14, 0.35, 0.36$  and  $0.27$ , respectively).

To determine the most effective factors, the effect of the MNA and some of SECs (education, place of living and etc) on nutritional status were determined, using the multinomial logistic regression model. The results showed that neuropsychological problems, mobility, living independently were significant for nutritional status ( $P< 0.001$ ). The "Source of income", "education" and "occupation" were the most effective significant SECs on nutritional status ( $P< 0.001$ ).

### Relationship between GDS and MNA

From the total subjects studied (1495), 22.07% were depressed and 11.5% and 44% were malnourished or at risk of malnutrition respectively. The prevalence of malnutrition in our study in 2007 was 14.5% (48 out of 330) and the prevalence of "at risk of malnutrition" was 45.8% in depressed group, whereas the prevalence of malnutrition and at risk of malnutrition in non-depressed population were 10.6% and 43.3% respectively (Table 3). From the aforementioned information we have concluded that there is a significant statistical difference between the prevalence of malnutrition in depressed and non-depressed individuals ( $P= 0.047$ ).

**Table 1:** Population Demographics

Variable	Number
Age (Mean±SD) years	
Total	70.14±7.57
Male	71.22±7.56
Female	69.20±7.46
Gender	
Total	1565
Male n (%)	720 (46.0)
Female n (%)	845 (54.0)
Educated vs. Non educated	341 vs. 1219
Male	220 (64.5) vs. 497 (40.77)
Female	121 (35.4) vs. 722 (59.22)
Urban vs. Rural (n (%))	946 vs. 601
Male	441(45.74) 279(46.42)
Female	523(54.25) 322(53.57)

SD: Standard Deviation

**Table 2:** Depression Scales Regarding Gender

			Gender		Total
			Male n (%)	Female n (%)	
Depression Based on GDS*	Depressed	Count Within	546	623	1169
		Gender	(79.9)	(76.3)	(78.0)
	Non depressed	Count	137	193	330
		Within gender	(20.1)	(23.7)	(22.0)
Total	Count	683	816	1499	
	Within gender	(100.0)	(100.0)	(100.0)	
Malnutrition Scores based on MNA**	Malnourished	Count	78	102	180
		Within Gender	(10.9)	(12.1)	(11.5)
	At Risk of Malnutrition	Count	264	423	687
		Within Gender	(36.8)	(50.2)	(44.0)
	Well Nourished	Count	376	318	694
		Within Gender	(52.4)	(37.7)	(44.5)
Total	Count	718	843	1561	
	Within Gender	(100.0)	(100.0)	(100.0)	

\*Geriatric depression score

\*\*Mini nutritional assessment

**Table 3:** Depression Malnutrition Correlations

		Malnutrition			Total
		Malnourished N (%)	At Risk of Malnutrition N (%)	Well Nourished N (%)	
Depression	Non Depressed	124(10.6)	504(43.3)	537(46.1)	1165
	Depressed	48(14.5)	151(45.8)	131(39.7)	330
Total		172(11.5)	655(44.4)	668(44.7)	1495

## Discussion

The purposes of this study were to determine the prevalence of malnutrition and depression in free living elderly people and their relationship with each other based on MNA and GDS, and also with some demographic factors.

The MNA test is a simple, noninvasive, well-validated screening tool for malnutrition in elderly people and is recommended for early detection of malnutrition (18). Since depression has a great clear effect on appetite and eating habits (in typical and atypical depressed people), it seems that having depression could be a risk factor for geriatric people to be malnourished (19). Furthermore food insecurity might have an association with depression (20), particularly in elderly (21) and eating regular may lead to im-

proved mood and cognitive performance (22). Both obese elderly men and women in Hong Kong were less likely to suffer from depressive symptoms than those of normal weight. Therefore the relationship between depression and nutritional status would be associated with several etiologic factors.

The present study has shown this association and the relevant justification for this fact can be made by these reasons.

Malnutrition and depression in a given individual afflicted to both have a common origin (i.e. financial paucity, lack of family support, etc). Furthermore, studies indicate that diet may be related to the occurrence of some complications such as brain lesions in late life which would lead to depression (23).



Although the prevalence of vegetative symptoms in depressed elderly people is higher and variable, the overall effect of depression is negative on BMI. An inverse relationship between BMI and depressive symptoms may indicate greater physiologic and functional reserve from greater muscle mass that protects patients against depressive symptoms (24, 25).

The prevalence of depression and malnutrition in persons who were living with their family were lower than others and the role of family support in depression among the elderly has been suggested (26). Another study showed that family factors were important predictors of depression for Chinese elderly (27). The findings indicate that the effects of caregivers' resources on mental health may differ by relationship type (28). However the poor marital or family relations experienced by many depressed elderly persons are usually consequences rather than predictors of depression (29).

In this study depression in patients with personal income was lower than those were dependent on charities. Prior studies have consistently found the incidence and persistence of depression to be higher among persons with low incomes. And employment status and financial strains are causally related to depression, but causal mechanisms for this relationship are not well understood (30).

As previous studies have shown (31-34) both depression and malnutrition were higher among female. However, a recent study, controlled the confounders such as age-related changes in risk factors, detected that the effect of gender on depressive symptoms was not significant (35).

Depressive symptoms and malnutrition were higher in rural than urban areas. This finding protect the result of some previous researches (36-39). It might be the result of poor financial status in rural areas in Iran.

The greatest advantage of this study was its novelty to evaluate the association between depression and malnutrition, as similar study has not been done before in Iran. Its other advantage was its acceptability by elderly and the simplicity of its method. It may seem that not gathering

the blood samples for evaluating the serum markers of malnutrition may cause negative effects on the final results but positive effect of obtaining data from large sample size has neutralized such negative effects. Furthermore, it makes the method more practical and rational for both geriatric population and researchers, since evaluating blood markers may cause them pay considerable unnecessary expenses.

In addition, MNA and GDS scores are both validated and standardized techniques of diagnosing malnutrition and depression in geriatric population that obviate the need of having each individuals to be examined by nutritionist and psychologist to rule out their disease, which is not cost effective.

In conclusion, from the present finding, it was concluded that companionship of malnutrition and depression must make us vigilant enough to refer our old depressed patients to nutritionists to be fully worked up according to their nutritional status and their socioeconomic conditions.

### Ethical Considerations

Ethical issues including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc. have been completely observed by the authors.

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