

ORIGINAL PAPER  
ΕΡΕΥΝΗΤΙΚΗ ΕΡΓΑΣΙΑ

## Geriatric depression and malnutrition in the community and in long-term care facilities

**OBJECTIVE** To assess nutritional status, estimate the prevalence of depression, and investigate possible associated clinical and socio-demographic factors among community-dwelling older adults. **METHOD** A cross-sectional study was conducted, involving 634 elderly people (>60 years old). We used the Greek validated version of the Geriatric Depression Scale (GDS-15) to assess the level of depression and the Mini-Nutritional Assessment-Short Form (MNA-SF) scale to assess nutritional status. **RESULTS** Among the participants, 45.6% had symptoms of depression, 60.7% were found to be in normal nutritional status, 22.9% at risk of malnutrition and 16.4% malnourished. Statistically significant differences were observed in the levels of depression ( $p < 0.001$ ) among the different health units and in the levels of malnutrition ( $p < 0.001$ ), with higher rates occurring in nursing homes and in participants of help at home programs compared to open-care centers. Furthermore, a statistically significant negative relationship between the malnutrition score and the depression score was found ( $p < 0.005$ ). **CONCLUSIONS** Finding the determinants of malnutrition and depression among elderly is of utmost importance, as it may contribute to the implementation of appropriate screening programs and health policies to ensure healthy life and promote well-being in the elderly population.

The World Health Organization (WHO) reports that the population of people over the age of 60 is expected to double from 12% to 22% from 2015 to 2050, almost a quarter of the world's population will be at least 60 years old by 2050.<sup>1</sup> The rapid increase in the number of elderly people in recent decades has resulted in the emergence of physical and mental disorders, which require intervention. Depression and malnutrition are two interrelated disorders encountered in the elderly population.<sup>2</sup> They represent geriatric syndromes with complex and multifactorial etiology, which have serious implications on health, quality of life, and the health care system.<sup>3,4</sup>

In fact, aging is an irreversible biological phenomenon,

an inevitable process and one of the most important causes of a decrease in the quality of life due to the biological, social and psychological changes that occur in humans during their lifetime.<sup>5,6</sup> Aging causes physiological changes and affects all organs. Several physiological factors such as impaired vision, loss of taste and smell, chewing or swallowing problems, gastrointestinal disorders, psychological, social and environmental factors, chronic diseases, loneliness, social isolation and depression affect appetite and consequently contribute to the appearance of malnutrition.<sup>7-9</sup>

Malnutrition has emerged as a major health problem among the elderly, which is expected to increase as the number of elderly people increases rapidly.<sup>10</sup> Malnutrition

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Γηριατρική κατάθλιψη  
και υποσιτισμός στην κοινότητα  
και σε οίκους ευγηρίας

Περίληψη στο τέλος του άρθρου

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appears to be a global health problem affecting more than one billion people of any age group.<sup>11</sup> The number of undernourished people in the world has been increasing since 2014. The Food and Agriculture Organization of the United Nations (FAO) reported that nearly 690 million people, 8.9% of the world's population, were undernourished in 2019, which is 60 million more than in 2014. About 1 in 7 older adults live in the community and about half of the ones in long-term care facilities.<sup>12</sup> The cost of undernourishment to society is enormous. It is estimated that malnutrition costs over £ 7.3 billion a year and more than half of this cost is spent on people aged over 65.<sup>13</sup> Studies in developed countries have shown that around 85% of long-term care residents, 23% up to 62% of hospitalized people and 15% of community-dwelling elderly suffer from malnutrition.<sup>14,15</sup> The increasing prevalence of malnutrition in the elderly has been associated with several negative clinical outcomes, such as decreased functional status, decreased immune system, poor trauma healing and muscle weakness, delayed recovery from surgery, longer hospital stays, increased cost of care, increased morbidity and mortality.<sup>15–17</sup> Recent studies have found that malnutrition can lead to the development of depressive symptoms and, vice versa, depression can affect the nutritional status and thus lead to an increase in malnutrition.<sup>2,18–22</sup> Depression in the elderly can lead to changes in appetite and weight that result in malnutrition, and conversely, poor diet, physical illness, and endocrine disorders can also lead to loss of appetite and depression. Depression and malnutrition appear to share common risk factors such as loneliness, lack of social support, physical illness, functional impairment, and economic instability.<sup>23</sup>

Depression and malnutrition are common geriatric syndromes worldwide that should be addressed early, as they affect the physical and mental health of individuals of all ages, causing significant morbidity and mortality. However, depression and malnutrition remain under-recognized and under-treated in all healthcare settings. Systematic assessment of nutritional status and depression, as well as valid treatment can improve their health, quality of life and reduce health care costs. The purpose of the present research was to investigate the prevalence of depression and malnutrition, to assess the relationship between depression and malnutrition, as well as to investigate their possible determinants, in an elderly population, in community settings and at the primary care level.

## MATERIAL AND METHOD

### Study design

A cross-sectional study was conducted in nine health and social units (open care centers for the elderly, nursing homes, day care

centers and help at home programs), in areas of the Municipality of Katerini, with elderly people aged >60 years old. The study population included 634 elderly people. The researchers informed the elderly regarding the purpose and methodology of the study, stressing that participation is anonymous and voluntary. Data collection took place between June 2021 and February 2022. The questionnaires were completed by the elderly with the assistance of the researchers, where necessary. The duration of completing the questionnaires was approximately 15 minutes. The weight and height of the elderly were measured by the researchers using a scale and a stadiometer.

### Questionnaires

The "Geriatric Depression Scale (GDS-15)" and "Mini Nutritional Assessment Short-form (MNA-SF)" questionnaires were used to collect the data, after taking permission from their creators.

The GDS-15 questionnaire is used to assess depression in geriatric patients and consists of 15 questions. Answers to this questionnaire receive closed-ended "Yes/No" answers. For the severity of depression, the categorization according to Argyropoulos et al and Papadopoulos et al was followed, where 0–5 points correspond to "absence of depressive symptoms", 6–10 to "moderate depression" and 11–15 to "severe depression".<sup>24,25</sup>

The MNA-SF questionnaire is used to assess nutritional status. It consists of 6 questions for different areas of assessment, such as eating problems, weight loss, mobility, acute illness or stress, dementia/depression and body mass index. The MNA-SF total score ranges from 0–14. A score of 12–14 indicates normal levels of nutrition, a score between 8–11 risk of malnutrition and a score of 0–7 malnutrition.

Finally, the following demographic and clinical data were collected: Gender, age, educational level, area of residence, occupation, monthly income, marital status, cohabitation, chronic disease and comorbidity.

### Ethical issues

The researchers informed the elderly about the purpose of the study, the content of the questionnaires and about the security of their personal data. Participants were kept anonymous as no personal data was collected. The necessary written permits to carry out the study were ensured from the municipal organizations/bodies to which the units in question, where the study was conducted, belong.

### Statistical analysis

The continuous variables used in the study are described through centrality measures (mean value and median), as well as dispersion measures (first and third quartile, standard deviation, minimum and maximum value), while qualitative variables are expressed as number and percentage of participants in each category of the variable. A Pearson Chi-square test was performed

to assess possible differences that may exist in two categorical variables. Multivariable linear regression analysis was applied to find the relationship between a dependent continuous variable and one or more independent variables. Statistical analysis was performed with the Statistical Package for Social Sciences (IBM SPSS Statistics), version 25.0. Furthermore,  $p < 0.05$  was set as the level of statistical significance.

## RESULTS

### Demographic and clinical characteristics

The study population consisted of 634 elderly people, who came from nine health and social primary care units. Table 1 presents the demographic and clinical characteristics of the sample. In particular, it is observed that women made up 53%, 96.2% were retired, 58.5% came from urban areas and 24.6% from rural areas. The largest percentage of people (43.5%) belonged to the category of  $< 600$  € and 29% from € 600–1,000. Regarding their educational level, it was observed that it was low, as 75.1% had completed some elementary school grades or were elementary school graduates. Concerning their marital status, 46.9% were married and 43.9% were widowed. Of the total participants, 413 (65.1%) were members of Open Elderly Care Centers (KAPI), 172 (27.1%) members of "Help at Home" program, while 49 (7.8%) lived in the two nursing homes under study.

### Malnutrition and depression

According to the MNA-SF nutritional assessment scale, 60.7% were found to be in normal nutritional status, 22.9% were at risk of malnutrition and 16.4% were found to be malnourished.

Depressive symptoms based on the diagnostic tool GDS-15 were shown by 45.6% of the elderly, of which 24.3% were estimated to suffer from moderate depression and 21.3% from severe depression.

### Relations

Table 2 presents the results of the Pearson Chi-square tests between demographics, clinical characteristics, unit of origin of the participants and the MNA-SF score. The results showed that female sex, old age, place of residence, occupation, low monthly income, marital status, chronic diseases, as well as elderly inmates of nursing homes and help at home programs were significantly associated with the occurrence of malnutrition or risk of malnutrition ( $p < 0.05$ ).

### Relations between GDS-15 and socio-demographic and clinical variables

The results of the Pearson Chi-square tests between demographics, clinical characteristics and GDS-15 score are shown in table 3. The prevalence of depression was higher in residents of nursing homes and help at home programs compared to elderly open care centers (30.8% versus 16.9%,  $p < 0.001$ ). At this point it should be noted that significant differences were observed in the occurrence of depression and comorbidities ( $X^2 = 55.63$ ,  $p < 0.001$ ). More specifically, the highest prevalence of depression was observed among people with Parkinson's disease (56.5%) and those suffering from mental illnesses (47.1%).

### Multivariable linear regression

Multiple linear regression was then applied with the malnutrition score as the dependent variable to explore a set of independent variables. The overall test for this model was statistically significant [ $F(31,599) = 12.72$ ,  $p < 0.001$ ], with  $R^2$  equal to 0.40. According to the findings of the analysis, only age ( $b = -0.073$ ,  $p < 0.001$ ), area of residence ( $b = -0.849$ ,  $p = 0.003$ ), marital status ( $b = -1.581$ ,  $p = 0.016$ ), as well as chronic diseases ( $b = -1.331$ ,  $p = 0.030$ ) were significantly associated with the malnutrition score (tab. 4).

In addition, potential determinants of participants' depression were explored using multiple linear regression. According to the findings of the analysis, it was found that for every one year of increase in age, an increase in the depression score is expected, therefore higher levels of depression ( $b = 0.050$ ,  $p = 0.048$ ). Illiterates ( $b = 3.728$ ,  $p < 0.001$ ), as well as those who have completed some primary school grades ( $b = 1.622$ ,  $p = 0.045$ ) have higher levels of depression compared to university graduates. In addition, those living in rural areas ( $b = 0.936$ ,  $p = 0.017$ ) are expected to have more severe symptoms of depression compared to participants living in urban areas. Married participants were found to show fewer depressive symptoms compared to singles ( $b = -2.080$ ,  $p = 0.002$ ). Participants with one ( $b = 1.671$ ,  $p = 0.002$ ) or two or more chronic diseases ( $b = 3.460$ ,  $p < 0.001$ ) showed more severe depressive symptoms compared to healthy participants (tab. 5).

## DISCUSSION

A cross-sectional study was conducted in health and social primary care units, in areas of the municipality of Katerini, to determine the prevalence of malnutrition and depression, in elderly residents of rural and urban areas.

**Table 1.** Demographic characteristics of respondents (n=634).

		n	%
<i>Gender</i>	Male	298	47.0
	Female	336	53.0
<i>Age (years)</i>	60–65	31	4.9
	66–70	109	17.2
	71–75	135	21.3
	76–80	141	22.2
	81–85	121	19.1
	86–90	66	10.4
	91 and above	31	4.9
<i>Educational level</i>	Illiterate/some Elementary School grades/ Elementary School graduate	476	75.1
	Middle-High School graduate	127	20.0
	University/TEI graduate	27	4.3
	Master's degree holder	4	0.6
<i>Area of residence</i>	Rural	156	24.6
	Urban	371	58.5
	Semi-urban	107	16.9
<i>Working status</i>	Workers	24	3.8
	Retired	610	96.2
<i>Occupation</i>	Farmer/stockbreeder	170	26.9
	Civil servant	68	10.8
	Private employee	112	17.7
	Freelancer	64	10.1
	Housewife/pensioner/other	218	34.5
<i>Monthly income (€)</i>	<600	276	43.5
	600–1,000	184	29.0
	1,000–1,500	59	9.3
	1,500–2,000	13	2.1
	>2,000	1	0.2
	I don't want to answer	101	15.9
<i>Marital status</i>	Single	30	4.7
	Married	297	46.9
	Divorced	28	4.5
	Widow(er)	278	43.9
<i>Living with</i>	Cohabitate with others	378	59.6
	Alone	208	32.8
	Other	48	7.6
<i>Regarding the health unit</i>	KAPI (Open Elderly Care Centers)	413	65.1
	Help at home	172	27.1
	Nursing homes	49	7.8

**Table 2.** Occurrence of malnutrition in relation to demographic and clinical characteristics of participants.

		Malnutrition			X <sup>2</sup> (p-value)
		Malnutrition (<8)	Risk of malnutrition (8–11)	Normal (>11)	
<i>Gender</i>	Male	35 (11.7%)	51 (17.1%)	212 (71.1%)	25.63 (<0.001)
	Female	69 (20.5%)	94 (28.0%)	173 (51.5%)	
<i>Age (years)</i>	60–75	11 (4%)	46 (16.7%)	218 (79.3%)	135.15 (<0.001)
	76–80	24 (17%)	23 (16.3%)	94 (66.7%)	
	81–85	34 (28.1%)	33 (27.3%)	54 (44.6%)	
	86 or above	35 (36.1%)	43 (44.3%)	19 (19.6%)	
<i>Educational level</i>	Illiterate/some Elementary School grades/ Elementary School graduate	100 (21%)	127 (26.7%)	249 (52.3%)	61.41 (<0.001)
	Middle-School/High-School graduate	2 (1.6%)	12 (9.4%)	113 (89%)	
	University/TEI graduate/Master's degree holder	2 (6.5%)	6 (19.4%)	23 (74.2%)	
<i>Area of residence</i>	Rural	34 (21.8%)	46 (29.5%)	76 (48.7%)	13.89 (0.008)
	Urban	52 (14%)	74 (19.9%)	245 (66%)	
	Semi-urban	18 (16.8%)	25 (23.4%)	64 (59.8%)	
<i>Occupation</i>	Farmer/stockbreeder	33 (19.4%)	48 (28.2%)	89 (52.4%)	30.74 (<0.001)
	Civil servant/private employee/freelancer	21 (8.6%)	44 (18%)	179 (73.4%)	
	Housewife/pensioner/other	50 (22.9%)	52 (23.9%)	116 (53.2%)	
<i>Monthly income (€)</i>	<600	57 (20.7%)	82 (29.7%)	137 (49.6%)	47.85 (<0.001)
	≥600	16 (6.2%)	41 (16%)	200 (77.8%)	
<i>Marital status</i>	Single/divorced/widow(er)	85 (25.3%)	91 (27.1%)	160 (47.6%)	60.71 (<0.001)
	Married	19 (6.4%)	53 (17.8%)	225 (75.8%)	
<i>Living with</i>	Cohabitate with others	39 (10.3%)	72 (19%)	267 (70.6%)	47.09 (<0.001)
	Alone	57 (27.4%)	55 (26.4%)	96 (46.2%)	
	Other	8 (16.7%)	18 (37.5%)	22 (45.8%)	
<i>Chronic diseases</i>	No	1 (0.9%)	6 (5.1%)	110 (94%)	66.67 (<0.001)
	Yes	100 (19.8%)	136 (26.9%)	269 (53.3%)	
<i>Comorbidities</i>	Hypertension	56 (21.1%)	64 (24.2%)	145 (54.7%)	66.06 (<0.001)
	Respiratory system disease	11 (20%)	15 (27.3%)	29 (52.7%)	
	Cardiovascular disease	43 (28.5%)	43 (28.5%)	65 (43%)	
	Osteoporosis	12 (19%)	19 (30.2%)	32 (50.8%)	
	Diabetes	30 (15.5%)	54 (27.8%)	110 (56.7%)	
	Mental illnesses	17 (50%)	11 (32.4%)	6 (17.6%)	
	Stroke	17 (29.8%)	20 (35.1%)	20 (35.1%)	
	Parkinson's disease	8 (34.8%)	7 (30.4%)	8 (34.8%)	
	Other	28 (23.9%)	40 (34.2%)	49 (41.9%)	
<i>Regarding the health unit</i>	KAPI (Open Elderly Care Centers)	42 (10.2%)	65 (15.7%)	306 (74.1%)	95.61 (<0.001)
	Help at home	54 (31.4%)	61 (35.5%)	57 (33.1%)	
	Nursing homes	8 (16.3%)	19 (38.8%)	22 (44.9%)	

**Table 3.** Occurrence of depression in relation to demographic and clinical characteristics of participants.

		Depression			X <sup>2</sup> (p-value)
		Absence of depressive symptoms (0–5)	Moderate depression (6–10)	Severe depression (11–15)	
<i>Gender</i>	Male	196 (65.8%)	53 (17.8%)	49 (16.4%)	29.33 (<0.001)
	Female	149 (44.3%)	101 (30.1%)	86 (25.6%)	
<i>Age (years)</i>	60–75	206 (74.9%)	49 (17.8%)	20 (7.3%)	121.08 (<0.001)
	76–80	73 (51.8%)	41 (29.1%)	27 (19.1%)	
	81–85	44 (36.4%)	34 (28.1%)	43 (35.5%)	
	86 or above	22 (22.7%)	30 (30.9%)	45 (46.4%)	
<i>Educational level</i>	Illiterate/some Elementary School grades/ Elementary School graduate	215 (45.2%)	133 (27.9%)	128 (26.9%)	71.53 (<0.001)
	Middle-School/High-School graduate	104 (81.9%)	20 (15.7%)	3 (2.4%)	
	University/TEI graduate/Master's degree holder	26 (83.9%)	1 (3.2%)	4 (12.9%)	
<i>Area of residence</i>	Rural	66 (42.3%)	44 (28.2%)	46 (29.5%)	14.01 (<0.001)
	Urban	220 (59.3%)	83 (22.4%)	68 (18.3%)	
	Semi-urban	59 (55.1%)	27 (25.2%)	21 (19.6%)	
<i>Occupation</i>	Farmer/stockbreeder	80 (47.1%)	44 (25.9%)	46 (27.1%)	41.32 (<0.001)
	Civil servant/private employee/freelancer	165 (67.6%)	57 (23.4%)	22 (9%)	
	Housewife/pensioner/other	99 (45.4%)	53 (24.3%)	66 (30.3%)	
<i>Monthly income (€)</i>	<600	120 (43.5%)	82 (29.7%)	74 (26.8%)	45.44 (<0.001)
	≥600	185 (72%)	44 (17.1%)	28 (10.9%)	
<i>Marital status</i>	Single/divorced/widow(er)	130 (38.7%)	94 (28%)	112 (33.3%)	84.61 (<0.001)
	Married	214 (72.1%)	60 (20.2%)	23 (7.7%)	
<i>Living with</i>	Cohabitate with others	248 (65.6%)	79 (20.9%)	51 (13.5%)	55.12 (<0.001)
	Alone	75 (36.1%)	61 (29.3%)	72 (34.6%)	
	Other	22 (45.8%)	14 (29.2%)	12 (25%)	
<i>Chronic diseases</i>	No	103 (88%)	11 (9.4%)	3 (2.6%)	65.90 (<0.001)
	Yes	237 (46.9%)	140 (27.7%)	128 (25.3%)	
<i>Comorbidities</i>	Hypertension	126 (47.5%)	72 (27.2%)	67 (25.3%)	55.63 (<0.001)
	Respiratory system disease	22 (40%)	11 (20%)	22 (40%)	
	Cardiovascular disease	61 (40.4%)	47 (31.1%)	43 (28.5%)	
	Osteoporosis	29 (46%)	22 (34.9%)	12 (19%)	
	Diabetes	99 (51%)	55 (28.4%)	40 (20.6%)	
	Mental illnesses	6 (17.6%)	12 (35.3%)	16 (47.1%)	
	Stroke	18 (31.6%)	19 (33.3%)	20 (35.1%)	
	Parkinson's disease	5 (21.7%)	5 (21.7%)	13 (56.5%)	
	Other	46 (39.3%)	33 (28.2%)	38 (32.5%)	
<i>Regarding the health unit</i>	KAPI (Open Elderly Care Centers)	263 (63.7%)	80 (19.4%)	70 (16.9%)	43.45 (<0.001)
	Help at home	59 (34.3%)	60 (34.9%)	53 (30.8%)	
	Nursing homes	23 (46.9%)	14 (28.6%)	12 (24.5%)	

**Table 4.** Multivariable linear regression analysis with malnutrition score as dependent variable.

	<b>Coefficient beta</b>	<b>Standard error</b>	<b>t</b>	<b>p</b>	<b>95% confidence interval</b>
<i>Gender, male</i>	0.260	0.221	1.18	0.240	-0.174, 0.695
<i>Age</i>	-0.073	0.018	-4.02	<0.001	-0.108, -0.037
<i>Educational level (versus university/TEI graduate/Master's degree holder)</i>					
Illiterate	-0.942	0.636	-1.48	0.139	-2.191, 0.307
Some Elementary School grades	0.257	0.572	0.45	0.653	-0.866, 1.38
Elementary School graduate	0.336	0.541	0.62	0.535	-0.727, 1.4
Middle-School/High-School graduate	0.957	0.527	1.82	0.070	-0.078, 1.993
<i>Area of residence (versus urban)</i>					
Rural	-0.849	0.286	-2.97	0.003	-1.41, -0.288
Semi-urban	-0.540	0.273	-1.98	0.049	-1.077, -0.003
<i>Occupation (versus farmer/stockbreeder)</i>					
Civil servant/private employee	0.023	0.330	0.07	0.944	-0.625, 0.671
Freelancer	0.115	0.406	0.28	0.778	-0.683, 0.912
Housewife/pensioner	-0.197	0.321	-0.61	0.540	-0.828, 0.434
Other	-0.612	0.380	-1.61	0.108	-1.358, 0.135
<i>Monthly income (versus &lt;600) (€)</i>					
600–1,000	0.147	0.266	0.55	0.580	-0.375, 0.669
1,000–1,500	-0.114	0.425	-0.27	0.789	-0.949, 0.721
1,500 and above	0.427	0.747	0.57	0.568	-1.04, 1.894
I don't want to answer	-0.403	0.304	-1.32	0.186	-1.001, 0.195
<i>Marital status (versus single)</i>					
Married	-0.049	0.482	-0.10	0.919	-0.995, 0.896
Divorced	-1.581	0.656	-2.41	0.016	-2.869, -0.292
Widow(er)	-0.326	0.497	-0.66	0.512	-1.301, 0.649
<i>Do you suffer from any chronic diseases? (versus No, I don't)</i>					
Yes, I have one	-0.635	0.377	-1.69	0.092	-1.375, 0.105
Yes, I have two or more	-1.331	0.611	-2.18	0.030	-2.531, -0.13
I don't know/I don't want to answer	-1.830	0.754	-2.43	0.015	-3.31, -0.35
<i>Hypertension, Yes</i>	0.210	0.301	0.70	0.486	-0.381, 0.801
<i>Respiratory system disease, Yes</i>	-0.312	0.416	-0.75	0.454	-1.129, 0.506
<i>Cardiovascular disease, Yes</i>	-0.783	0.312	-2.51	0.012	-1.397, -0.169
<i>Osteoporosis, Yes</i>	-0.115	0.391	-0.29	0.769	-0.882, 0.653
<i>Diabetes, Yes</i>	0.212	0.293	0.72	0.471	-0.364, 0.788
<i>Mental illnesses, Yes</i>	-2.666	0.478	-5.58	<0.001	-3.604, -1.728
<i>Stroke, Yes</i>	-0.637	0.405	-1.57	0.116	-1.432, 0.158
<i>Parkinson's disease, Yes</i>	-0.796	0.589	-1.35	0.177	-1.952, 0.36
<i>Other, Yes</i>	-0.437	0.306	-1.43	0.153	-1.038, 0.164

**Table 5.** Multivariable linear regression analysis with depression score as dependent variable.

	<b>Coefficient beta</b>	<b>Standard error</b>	<b>t</b>	<b>p</b>	<b>95% confidence interval</b>
<i>Gender, male</i>	-0.207	0.312	-0.66	0.508	-0.820, 0.406
<i>Age</i>	0.050	0.025	1.98	0.048	0.001, 0.100
<i>Educational level (versus university/TEI graduate/Master's degree holder)</i>					
Illiterate	3.728	0.897	4.16	<0.001	1.967, 5.490
Some Elementary School grades	1.622	0.807	2.01	0.045	0.038, 3.207
Elementary School graduate	0.779	0.764	1.02	0.308	-0.721, 2.279
Middle-School/High-School graduate	-0.391	0.744	-0.52	0.600	-1.851, 1.070
<i>Place of residence (versus urban)</i>					
Rural	0.963	0.403	2.39	0.017	0.171, 1.755
Semi-urban	0.466	0.386	1.21	0.227	-0.291, 1.223
<i>Occupation (versus farmer/stockbreeder)</i>					
Civil servant/private employee	-0.298	0.465	-0.64	0.522	-1.212, 0.616
Freelancer	-0.370	0.573	-0.65	0.519	-1.494, 0.755
Housewife/pensioner	0.666	0.453	1.47	0.142	-0.224, 1.556
Other	0.343	0.536	0.64	0.523	-0.71, 1.395
<i>Monthly income (versus &lt;600) (€)</i>					
600–1,000	-0.024	0.375	-0.06	0.948	-0.761, 0.712
1,000–1,500	0.103	0.600	0.17	0.863	-1.074, 1.281
1,500 and above	-1.227	1.054	-1.16	0.245	-3.296, 0.843
I don't want to answer	0.753	0.429	1.75	0.080	-0.09, 1.596
<i>Marital status (versus single)</i>					
Married	-2.080	0.679	-3.06	0.002	-3.414, -0.746
Divorced	0.539	0.925	0.58	0.560	-1.278, 2.357
Widow(er)	-1.314	0.700	-1.88	0.061	-2.69, 0.061
<i>Do you suffer from any chronic diseases? (versus No, I don't)</i>					
Yes, I have one	1.671	0.531	3.15	0.002	0.628, 2.715
Yes, I have two or more	3.460	0.862	4.01	<0.001	1.767, 5.153
I don't know/I don't want to answer	2.402	1.063	2.26	0.024	0.314, 4.489
<i>Hypertension, Yes</i>	-0.799	0.425	-1.88	0.060	-1.633, 0.035
<i>Respiratory system disease, Yes</i>	1.043	0.587	1.78	0.076	-0.111, 2.196
<i>Cardiovascular disease, Yes</i>	-0.010	0.441	-0.02	0.983	-0.875, 0.856
<i>Osteoporosis, Yes</i>	-0.401	0.551	-0.73	0.468	-1.484, 0.682
<i>Diabetes, Yes</i>	-0.749	0.414	-1.81	0.071	-1.562, 0.063
<i>Mental illnesses, Yes</i>	2.624	0.674	3.89	<0.001	1.301, 3.948
<i>Stroke, Yes</i>	0.320	0.571	0.56	0.576	-0.801, 1.441
<i>Parkinson's disease, Yes</i>	0.607	0.830	0.73	0.465	-1.023, 2.238
<i>Other, Yes</i>	0.219	0.431	0.51	0.611	-0.628, 1.067

In addition, potential determinants associated with the occurrence of malnutrition and depression were explored. An additional objective of the present study was to assess the possible association of malnutrition with depression. For this purpose, the GDS-15 and MNA-SF questionnaires were used.

In the present study, it was found that the percentage of individuals at risk of malnutrition (22.9%), but also of those already malnourished (16.4%) was quite high, given that the majority of the sample came from a phenotypically healthy population. A similar or even higher prevalence of malnutrition is, however, found in other studies conducted in Greece.<sup>26–30</sup> In comparison to these studies, a possible reason for this agreement in the prevalence of free-living older adults at risk of malnutrition in Greece, are poor economic conditions, which may be closely related to food insecurity in older populations. It is estimated that in Greece, 69% of the elderly population is experiencing some degree of food insecurity as a result of the economic crisis and the austerity measures taken by the government, including the sharp reductions in pensions.<sup>31</sup>

Findings from recent studies confirm that food insecurity among the elderly appears to be related to the risk of malnutrition.<sup>29,32,33</sup> The elderly population is particularly vulnerable to malnutrition. Malnutrition is a major health problem in developed societies, where average life expectancy increases. Although this condition is more common among institutionalized older people, its prevalence rates are not insignificant and vary according to the degree of independence among community-dwelling older people. In studies conducted in various European countries (Germany, Italy, Netherlands, Belgium, Spain), using the MNA scale as a measurement tool, malnutrition was reported among the elderly ranging from 3.5% to 57%.<sup>9,34–38</sup> In Turkey, a neighboring country of Greece, the risk of malnutrition, based on the MNA scale, ranged from 28% to 30%, among elderly people living in the community.<sup>39–42</sup>

One of the interesting things of the present study was the comparison of nutritional status assessments based on socio-demographic and clinical factors. In the present study, it was found that increasing age, area of residence (rural), comorbidity, marital status (divorced/widowed), poor educational level, cardiovascular and mental illnesses, as well as Parkinson's disease, were associated with poorer nutritional condition. These findings were in full agreement with the results of other researches, where it was found that old age,<sup>41,43–46</sup> place of residence (rural area),<sup>47–49</sup> comorbidity,<sup>45</sup> low educational level,<sup>41,48–50</sup> marital status,<sup>41,43,51,52</sup> and chronic diseases, such as heart failure and coronary artery disease,<sup>53</sup>

were associated with an increased risk of malnutrition.

A secondary objective of the present study was to assess the relationship between malnutrition and depression. In the present study, depression and malnutrition were significantly related to each other. Significant differences were observed in depression levels in relation to the occurrence of malnutrition. More specifically, it was found that those who had no depressive symptoms had a normal nutritional status (76.9%) and on the contrary, those who showed severe symptoms of depression had higher rates of malnutrition (70.2%). Furthermore, a statistically significant negative relationship between the malnutrition score and the depression score was found, suggesting that better nutritional status is associated with milder symptoms of depression or absence of depression.

Several studies around the world have investigated the prevalence of depression, as well as the dietary habits of the elderly and the occurrence of malnutrition. Up to now, however, the causal relationship between malnutrition and depression in the elderly is still unclear.<sup>2,54</sup> Some studies have found a strong relationship between nutritional deficiency and depression, showing that depression increases the risk of malnutrition,<sup>55,56</sup> while other studies have shown a moderate correlation<sup>54,57</sup> or no correlation.<sup>58</sup>

Although studies quantifying the relationship between diet and depression in the elderly are lacking in Greece, studies in Norway,<sup>56</sup> India,<sup>6,8,59</sup> Mexico,<sup>21</sup> Turkey,<sup>60</sup> Poland,<sup>22</sup> Bangladesh,<sup>61</sup> Japan,<sup>62</sup> argue that malnutrition and depression are significantly associated with each other in older adults.

Although it is not clear whether depression is the cause of malnutrition or whether malnutrition causes depression. Depression is clearly an aggravating factor that affects appetite, eating behavior and food intake, thereby leading to malnutrition. According to the Diagnostic and Statistical Manual for Mental Disorders (DSM), both anorexia and weight loss are among the diagnostic criteria for depression.<sup>63</sup> On the other hand, malnutrition may also be associated with micronutrient deficiencies that affect mental health. Malnutrition, especially if it causes folate and vitamin B12 deficiency, can lead to depression.<sup>16</sup> Studies have shown that older adults who have folate deficiency and low vitamin B12 levels are more likely to develop depressive symptoms.<sup>64</sup>

In addition, in our study, an extremely significant percentage of the elderly suffered from two chronic diseases or more (50.2%). When chronic diseases were examined, mental illness, Parkinson's disease, stroke and cardiovas-

cular disease were associated with poor nutritional status. Chronic diseases such as diabetes, hypertension, and heart disease are treated with dietary restrictions and medications that affect food intake. Drugs can reduce appetite or promote weight loss through side effects (nausea, anorexia, altered taste perception), and through altered absorption, metabolism and excretion of nutrients (malabsorption).<sup>53</sup>

The present study confirmed that malnutrition is strongly associated with depression especially in older people living in nursing homes. These findings were in full agreement with the results of other studies.<sup>4,21,36,54,65</sup> Nutritional risk is increased in elderly people living in nursing homes. Older people suffer from many chronic diseases and their emotional health is often affected by feelings of sadness, despair and unhappiness. The decline in cognitive and physical status and the loss of skills related to activities of daily living (shopping, cooking, managing finances) lead to dependence on others and subsequent social isolation. Institutionalized people experience change and loss of friends and family. Loneliness, bereavement, isolation, living situation, poor eating habits, facilities, attitudes and insufficient knowledge of healthcare professionals can be additional factors affecting the nutrition and mental health of older people. However, further studies in the nursing home setting are needed to establish this. Management of malnutrition in this elderly population requires a multidisciplinary approach that addresses pathology and uses social and nutritional interventions.

In the present study, there were some limitations that should be taken into account when interpreting the results.

First, it was a cross-sectional study in which it was not possible to draw firm conclusions, as the information on the determinant and the outcome were obtained at the same time, so they cannot establish causal relationships. In addition, the questionnaires used are tools for detecting and not diagnosing diseases. Also, the studied population came only from a specific municipality, in a specific region of Greece, which does not allow the generalization of the research results for the entire elderly population. Finally, the assessment of the nutritional status of the elderly was based on the measurement of anthropometric data, measuring height and weight with standardized measurement tools (scales and mechanical height measuring rod). The ideal planning would include hematological and biochemical analyses by the researchers but these could not be done in the present study due to financial and time cost. On the other hand, the present study also had strong points, such as the significant number of elderly people included and the originality of the subject to assess the association between depression and malnutrition, as no similar study has been done in Greece before. Furthermore, the importance of the present study is based on the fact that finding the determinants of malnutrition and depression is a necessary condition for the formulation and implementation of appropriate health policies.

In conclusion, the valid recognition and treatment of symptoms of malnutrition and depression at an early stage is of utmost importance, as not only do they have a significant impact on the overall health and improvement of the quality of life of the elderly population, but can also reduce the overall cost for the health system.

## ΠΕΡΙΛΗΨΗ

### Γηριατρική κατάθλιψη και υποσιτισμός στην κοινότητα και σε οίκους ευγηρίας

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**ΣΚΟΠΟΣ** Η αξιολόγηση της διατροφικής κατάστασης, η εκτίμηση του επιπολασμού της κατάθλιψης, καθώς και η διερεύνηση των πιθανών κλινικών και κοινωνικοδημογραφικών προσδιοριστών μεταξύ των ηλικιωμένων που ζουν στην κοινότητα. **ΥΛΙΚΟ-ΜΕΘΟΔΟΣ** Διεξήχθη μια συγχρονική μελέτη, στην οποία συμμετείχαν 634 ηλικιωμένα άτομα ηλικίας >60 ετών. Χρησιμοποιήσαμε την ελληνική σταθμισμένη έκδοση της κλίμακας γηριατρικής κατάθλιψης για την εκτίμηση της κατάθλιψης και την κλίμακα Mini-Nutritional Assessment-Short Form για την αξιολόγηση της διατροφικής κατάστασης. **ΑΠΟΤΕΛΕΣΜΑΤΑ** Το 45,6% των συμμετεχόντων είχαν συμπτώματα κατάθλιψης. Το 60,7% βρέθηκε σε φυσιολογική διατροφική κατάσταση, το 22,9% σε κίνδυνο υποσιτισμού και το 16,4% ήταν υποσιτισμένο. Παρα-

τηρήθηκαν στατιστικά σημαντικές διαφορές στα επίπεδα κατάθλιψης ( $p < 0,001$ ) μεταξύ των διαφορετικών μονάδων υγείας και στα επίπεδα υποσιτισμού ( $p < 0,001$ ), με υψηλότερα ποσοστά να εμφανίζονται στους οίκους ευγηρίας και σε συμμετέχοντες των προγραμμάτων «Βοήθεια στο Σπίτι» σε σύγκριση με τα κέντρα ανοικτής φροντίδας. Επί πλέον, βρέθηκε στατιστικά σημαντική αρνητική σχέση του υποσιτισμού με την κατάθλιψη ( $p < 0,005$ ). **ΣΥΜΠΕΡΑΣΜΑΤΑ** Η εύρεση των προσδιοριστών του υποσιτισμού και της κατάθλιψης στους υπερήλικες είναι καθοριστικής σημασίας, καθώς μπορεί να συμβάλλει στην εφαρμογή κατάλληλων προγραμμάτων προσυμπτωματικού ελέγχου και πολιτικών υγείας για τη διασφάλιση υγιούς ζωής και προαγωγής της ευημερίας του ηλικιωμένου πληθυσμού.

**Λέξεις ευρετηρίου:** Διατροφική αξιολόγηση, Ηλικιωμένοι, Κατάθλιψη, Παράγοντες κινδύνου, Υποσιτισμός

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