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URBAN ENVIRONMENT, PHYSICAL INACTIVITY AND UNHEALTHY DIETARY HABITS CORRELATE TO DEPRESSION AMONG ELDERLY LIVING IN EASTERN MEDITERRANEAN ISLANDS: THE MEDIS (MEDITERRANEAN ISLANDS ELDERLY) STUDY

E. MAMPLEKOU[1], V. BOUNTZIOUKA[1], T. PSALTOPOULOU[2], A. ZEIMBEKIS[3], N. TSAKOUNDAKIS[4], N. PAPAERAKLEOUS[1], E. GOTSIS[1], G. METALLINOS[1], G. POUNIS[1], E. POLYCHRONOPOULOS[1], C. LIONIS[4], D. PANAGIOTAKOS[1]

1. Department of Nutrition Science - Dietetics, Harokopio University, Athens, Greece; 2. Department of Hygiene, Epidemiology and Medical Statistics, School of Medicine, University of Athens, Athens, Greece; 3. Health Center of Kalloni, General Hospital of Mitilini, Mitilini, Greece; 4. Clinic of Social and Family Medicine, School of Medicine, University of Crete, Heraklion, Greece. Address for correspondence, Dr. Demosthenes B Panagiotakos, 46 Paleon Polemiston St., Glyfada, 166 74, Attica, Greece, Tel. +30210-9603116 & Fax. +30210-9600719, E-mail. D.b.Panagiotakos@usa.net

Abstract: *Aims:* To evaluate factors associated with depression in elderly. *Methods:* During 2005-2007, 553 men and 637 women (aged 65 to 100 yrs) living in various Greek islands and in Cyprus participated in the study. The sampling was random and multistage (according to age–sex distribution of the referent population). Depressive symptoms were evaluated using the Geriatric Depression Scale (GDS). *Results:* Twenty five per cent of men and 35% of women were classified in the highest GDS category (i.e. GDS score > 10), indicating intense depressive symptoms, while 54% of men and 70% of women scored above the depression cut-off (i.e. GDS score > 5) indicating mild-to-severe depressive symptoms. Among the investigated characteristics, living in urban environment, physical inactivity and history of hypertension were correlated with the presence of depressive symptoms ($p<0.05$), after adjusting for various confounders. Moreover, the consumption of fish, vegetables and cereals is more prevalent among people with low or moderate depression ($p<0.05$). *Conclusions:* The prevalence of depression is quite high between elderly people living in Greek islands and Cyprus. Urban environment that may also interact with sedentarism and unhealthy dietary habits seems to promote depression in the studied population. Efforts to lower the prevalence of depression in the elderly should target on the aforementioned factors that employ functional impairment, social environment and dietary habits.

Key words: Depression, elderly, diet, mental health, epidemiology, fish.

Introduction

According to the World Health Organization, depression has been the leading cause of disability as measured by years leading to disability (YLDs) and the forth leading contributor to the global burden of disease (DALYs) in 2000, whereas by 2020 these figures will probably deteriorate (1). Medical comorbidities, including dementia, isolation, chronic pain, and higher life expectancy, often contribute to a late-onset first episode of depression, which risk increases after the age of 75 (2). Moreover, it has been observed that those with depressive symptoms have increased risk for functional disability, mortality and use of health services (3, 4). Nevertheless, geriatric depression is a disease largely underdiagnosed and undertreated (5).

The prevalence of depression in late life has been reported to range between 3% and 57% (2, 6, 7) and it varies through the lifespan, between genders, as well as from culture to culture and country to country. However, methodological differences between studies, particularly concerning sampling, definition and assessment methods of results make it difficult to reach definite conclusions about cross-cultural and geographical differences (8). In Greece, some previous studies have reported high prevalence of depression among middle-aged and older individuals (6, 9-11). More specific, one of the studies conducted in central Greece (6) showed that the prevalence of mild or severe depression was 36%, whilst another study from Cyprus (11) indicated a total reaching 60% of the participants with mild or severe depression.

Several studies have tried to assess correlates of depression in elderly individuals. Medical, biological, psychological, socio-demographic, genetic and dietary factors have collectively been associated with late-life depression (12, 13). The "vascular depression hypothesis", social influences, such as widowhood, lower socioeconomic level, transition from active profession to retirement, the presence of chronic diseases, like diabetes, have all been examined for their implication in geriatric depression (12). Among dietary predictors, fish oil has most extensively studied through epidemiological studies yielding inconclusive results, whereas a reasonable number of clinical trials is lacking (14, 15).

There is, however, limited data from Greece focusing closely on the factors that are related to the emotional status of the elderly community population of the Greek islands. The MEDIS study is a health and nutrition survey which aimed to evaluate bio-clinical, lifestyle, behavioural and dietary

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characteristics of elderly people living in eastern Mediterranean islands (16). Thus, in the context of the MEDIS (MEDiterranean ISlands) study, we aimed to evaluate predictors of the presence of depression in a random sample of elderly population living in Greek islands and Cyprus, particularly, concerning dietary factors, such as alcohol, olive oil and fish, as well as different lifestyle patterns. Olive oil is the main added lipid in the Mediterranean countries, and alcohol, mainly as wine, is largely consumed due to the high productivity of grapes in several areas, while fish is, as expected, easier to be found in the islands. Furthermore, the extend to which lifestyle patterns, such as sedentary life and occupation status are related to depression is important to be analysed, as an effort to formulate appropriate public health messages for psychological health in these vulnerable, due to their age and living area, populations.

Materials and methods

Study sample

A random, population-based, multistage sampling method (i.e. age group, 3 levels (65-75, 75-85, 85+) and 2 sex levels) was used to select men (76±7 years) and women (74±7 years) from the Republic of Cyprus and the islands of Mitilini, Samothraki, Cephalonia, Crete, Corfu, Lemnos and Zakynthos in Greece. Individuals residing in assisted-living centers, as well as those with a clinical history of cardiovascular disease (CVD) or cancer were not included in the survey. Of the initially selected people, 553 men and 637 women (n=1190) agreed to participate (Cyprus, n = 300; Mitilini, n = 142; Samothraki, n = 100; Cephalonia, n = 115; Crete, n = 131; Corfu, n=149; Lemnos n=150; Zakynthos, n=103). Of them, 460 (39%) were living in the rural areas of the islands. The participation rate varied between 75% and 89% from island to island. A group of health scientists (physicians, dieticians and nurses) with experience in field investigation collected all the required information using a quantitative questionnaire and standard procedures.

Ethics

Participants were informed about the aims and procedures of the study and offered their consent. The retrieved data were confidential, and the study followed the ethical considerations provided by the World Medical Association (52nd WMA General Assembly, Edinburgh, Scotland, October 2000). Moreover, the Institutional Review Board approved the design, procedures and aims of the study.

Assessment of depressive symptomatology

Symptoms of depression during the past month were measured using a shortened, reliable and valid version of the self-report Geriatric Depression Scale (GDS) (17, 18). Moreover, this tool has been validated in the Greek population in 168 control subjects and 103 patients suffering from clinically diagnosed depression. The range of the depression variable that refers to possible scores is from 0 to 15 and had been divided into three groups for clinical purposes (0-5: no signs of depression; 6-10: mild depression; 11-15: severe depression) (19). To increase the precision of the retrieved psychological information from the participants, a close friend, companion, or sibling was asked to answer the same questions regarding the participant's psychological status. Both data sets (i.e. from the participants and their friends, companions or siblings) were compared using Kendall's - coefficient. Participants with significant discordance from their counterparts were excluded from the psychological analyses (four participants were excluded).

Socio-demographic and lifestyle measurements

The retrieved information included basic socio-demographic characteristics, such as age, gender, annual income, living conditions, current working status (i.e., "at work" or retired), and years of retirement. Occupational skills were recorded in a 5-class scale in which '0' denotes an unskilled and '4' a fully skilled occupation. Moreover, current smokers were defined as those who smoked at least one cigarette per day or have stopped cigarette smoking during the past 12 months. Former smokers were defined as those who previously smoked but have not done during the last year or more. The remaining participants were defined as rare- or non-current smokers. Dietary habits were assessed through a semi-quantitative, validated and reproducible food-frequency questionnaire. Frequency of consumption of various food groups and beverages on a daily, weekly or monthly basis was assessed. Furthermore, intake of various alcoholic beverages was measured in terms of wineglasses adjusted for ethanol intake (e.g. one 100-ml glass of wine was considered to have 12% ethanol). The participants reported a consistency of their dietary habits throughout the last ten years. To evaluate overall dietary habits the MedDietScore (possible range 0-55) was used (20). Higher values of this diet score indicates greater adherence to the Mediterranean diet. Physical activity was evaluated using the shortened version of the self-reported International Physical Activity Questionnaire (IPAQ) (21). Participants were classified as inactive, minimally active and HEPA active (health enhancing physical activity; a highly active category).

Bio-clinical characteristics

Diabetes mellitus (type 2) was determined by fasting plasma glucose tests and was defined in accordance with the American Diabetes Association diagnostic criteria (i.e. fasting blood glucose levels greater than 125 mg/dl or use of special medication indicating the presence of diabetes). Participants who had blood pressure levels ≥140/90 mmHg or used antihypertensive medications were classified as hypertensive. Fasting blood lipids levels were also recorded and hypercholesterolemia was defined as total serum cholesterol levels >200 mg/dl or the use of lipid-lowering agents. HDL-, LDL-cholesterol and triglycerides were also recorded. Weight and height were measured to attain body mass index (BMI)

scores (kg/m^2). Obesity was defined as BMI > 30 Kg/m^2.

Statistics

Continuous variables are presented as mean ± SD. Categorical variables (i.e. financial status, smoking habits, physical activity and prevalence of clinical disorders) are presented as absolute and relative frequencies (%). After controlling for equality of variances (homoscedacity) using Levene's test, associations between continuous variables and group of participants (e.g. low, moderate and high depression score) were evaluated with analyses of variance (ANOVA). Associations between categorical variables and depression groups were tested by the use of the chi-square test without the correction of continuity. Multi-adjusted logistic regression analysis evaluated the association between participants' characteristics and GDS groups (i.e. 0-10 as reference category, vs. >10). Deviance residuals and Hosmer-Lemeshow criterion evaluated model's goodness-of-fit. A p-value <0.05 was considered as statistically significant. SPSS version 14 software was used for all calculations (SPSS Inc., Chicago, Il, USA).

Results

Participants' characteristics

Table 1 presents several characteristics of the study sample by gender. As it can be seen men were more educated, with better financial status and had reported higher occupation skills as compared to women. The average years of school were below 9, which is normally the minimum of obligatory education in Greece, for both men and women, and almost half of men and 6 out of ten women had annual income <8.000,00 €, which is the limit for poverty in our country. Although smoking is more prevalent among men, women had higher prevalence of cardiovascular disease risk factors (i.e. hypertension, hypercholesterolemia, obesity and diabetes).

Table 1
Selected socio-demographic, clinical and lifestyle characteristics of the participants in the MEDIS epidemiological study

	Men (n = 553)	Women (n = 637)	p
Age (years)	75±7	73±7	<0.001
Education level (years at school)	6.5±3.4	5.3±3.0	<0.001
Occupation (0-4)1.9±1.1	1.8±0.9	0.262	
Financial status, N (%)		<0.001	
Low	271 (49)	401 (63)	
Middle	171 (31)	153 (24)	
High	111 (20)	83 (13)	
Current or former smoker, N (%)	144 (26)	25 (4)	<0.001
Physical activity, N (%)	315 (57)	274 (43)	<0.001
Obesity, N (%)149 (27)	261 (41)	<0.001	
Hypertension, N (%)348 (63)	459 (72)	<0.001	
Diabetes mellitus, N (%)	116 (21)	147 (23)	<0.001
Hypercholesterolemia, N (%)	254 (46)	395 (62)	<0.001
MedDietScore (range 0 – 55)	33.3±4.3	33.7±3.8	0.09

Epidemiology of depression among the elderly

Regarding depression status, women had higher GDS score values compared to men (men vs. women: 7.4±4.4 vs. 8.9±4.1, p<0.001). Twenty five per cent of men and 35% of women were classified in the highest GDS category (i.e. GDS score > 10), indicating intense depressive symptoms, while 54% of men and 70% of women scored above the depression cut-off (i.e. GDS score > 5) indicating mild-to-severe depressive symptoms. People living in rural areas of the islands were less likely to express depressive symptoms as compared to those living in the urban areas. Table 2 illustrates various socio-demographic, lifestyle and clinical characteristics of the participants expressed by depression status. Well educated people were classified in the lowest GDS tertile (i.e. no or rare depressive symptoms). Smoking, physical activity and alcohol consumption are more prevalent in participants belonging in the lowest GDS category as well, while participants in this group seem to follow a diet with a higher consumption of fish, fresh green vegetables and cereals than the others. Moreover, participants with low depressive symptomatology were more likely to be still working, although their occupational skills were lower than those in the highest GDS score category. Furthermore, participants with no or mild depression had less CVD risk factors than those with severe symptomatology. No associations were observed between depression status and overall dietary patterns as assessed through the MedDietScore.

However, residual confounding may exist, thus the aforementioned unadjusted analyses were repeated taking into account all the investigated factors. Multi-adjusted logistic regression analysis (Table 3) revealed that history of hypertension (p=0.06) and sedentary lifestyle (p=0.02) were associated with higher likelihood of having severe depressive symptoms, while annual income greater than 8.000,00 Euros (p=0.06), living in rural areas (p=0.03) and light smoking habits (p=0.04) were associated with lower odds of having GDS score above the threshold of 10 (i.e. severe depressive symptomatology). Further analysis revealed that from the nutritional factors only fish intake was inversely associated with depression status, since increase by 1 portion of fish per week was associated with 0.58-times lower likelihood (95% CI 0.45-0.73) of having GDS score >5. The benefits from fish intake remained similar even when adjusted for age, sex, education status, BMI and physical activity status, as well as the presence and management of hypertension, hypercholesterolemia and diabetes (multi-adjusted odds ratio of having GDS>5 per 1 fish intake/week = 0.64, 95%CI 0.48-0.84). Finally, olive oil intake was inversely associated with depression status, since increase of olive oil use by 1 time per week was associated with 0.62-times lower likelihood (95% CI 0.67-1.00) of having GDS score >5.

Table 2
Socio-demographic, clinical and lifestyle characteristics of participants by depression status, in men and women from the MEDIS epidemiological study

	Geriatric Depression Score (0 – 15)			
	≤5	5 – 10	>10	P*
N (%)	**188 (32%)**	**161 (27%)**	**246 (41%)**	
Socio-demographic characteristics				
Age (years)	74±7	76±7	76±8	0.01
Sex, N (% male)	73 (39)	47 (29)	79 (32)	< 0.001
Education level (years at school)	6.4±3.3	5.7±3.4	5.0±2.9	< 0.001
Living alone, N (%)	49 (26)	45 (28)	71 (29)	0.80
Retired, N (%)	23 (12)	6 (4)	17 (7)	0.01
Years in retirement (years)	11±8	11±7	13±7	0.23
Occupation skills (0:unskilled to 4:skilled)	1.7±0.8	1.8±0.8	2.1±1.0	0.006
Living in rural areas, N (%)	100 (53)	82 (51)	84 (34)	0.001
Marital status, N (%)			0.16	
Married	133 (71)	105 (65)	165 (67)	
Divorced	4 (2)	5 (3)	7 (3)	
Never married	8 (4)	6 (4)	0 (0)	
Widowed	43 (23)	45 (28)	74 (30)	
Lifestyle characteristics				
Physical activity, N (%)	77 (41)	42 (26)	84 (34)	< 0.001
Current or former smoker, N (%)	100 (53)	39 (24)	59 (24)	< 0.001
MedDietScore (0-55)	34.2±4.2	34.2±3.8	34.2±3.3	0.99
Fish intake (times / week)	2.4±1.2	1.9±1.1	1.7±1.1	0.001
Fresh green vegetables (times / week)	3.8±1.6	3.1±1.6	3.1±1.4	< 0.001
Cereals (times / week)	4.4±1.8	3.1±2.0	3.1±1.9	< 0.001
Fruit (times / day)	4.7±1.8	5.0±1.8	5.0±1.6	0.15
Olive oil use (times / week)	6.1±1.0	4.9±1.1	5.1±1.3	0.12
Alcohol (> 6 gr ethanol/day), N (%)	86 (46)	35 (22)	79 (32)	< 0.001
Clinical characteristics				
Body Mass Index (kg/m2)	27.8±4.3	29.3±5.1	29.6±5.5	0.001
Hypertension, N (%)	51 (27)	43 (27)	113 (46)	< 0.001
Diabetes, N (%)	41 (24)	50 (31)	111 (45)	< 0.001
Hypercholesterolemia, N (%)	55 (29)	42 (26)	111 (45)	< 0.001

*P<0.05 for the differences between: GDS score 5-10, >10 vs. <5, after correcting the inflation of type-I error using the Bonferroni rule.

Table 3
Results from multi-adjusted logistic regression analysis that evaluated the association of socio-demographic, lifestyle and bio-clinical characteristics of the elderly participants in relation to the presence of severe depressive symptoms (i.e., GDS>10)

	Odds ratio	95% confidence interval	
Age (per 1 year)	1.02	0.987	1.052
Male vs. female sex	0.80	0.492	1.309
Body Mass Index (per 1 kg/m2)	1.02	0.985	1.065
Living alone (yes vs. no)	0.93	0.595	1.481
Good financial status (>8.000,00€)	0.58	0.273	1.256
Sedentary vs. active	1.53	1.001	2.345
Current smoking (yes vs. no)	0.59	0.293	1.198
MedDietScore (per 1 unit)	1.03	0.976	1.090
Hypertension (yes vs. no)	1.71	1.087	2.694
Diabetes (yes vs. no)	0.91	0.561	1.475
Hypercholesterolemia (yes vs. no)	1.17	0.763	1.794
Years at school	0.96	0.894	1.032
Alcohol (>6 gr ethanol/day) (yes vs. no)	1.10	0.685	1.787
Retired (yes vs. no)	0.61	0.274	1.357
Living in rural vs. urban areas	0.64	0.437	0.960

Discussion

Studying the epidemiology of depression in a large sample of elderly men and women living in Greek islands and Cyprus revealed that almost 3 out of ten individuals had severe depressive symptoms, while half of men and 7 out of ten women reported mild to severe depressive symptoms. Female gender, living in urban environment and sedentarism seem to be the main characteristics of people who reported mild to severe depressive symptoms. These results are consistent with the literature (3) and confirm observations that depressive symptoms in old age are associated with female gender, somatic illness, cognitive and functional impairment, and a lack or loss of close social contacts (22). Moreover, unadjusted analysis revealed that people with depressive symptoms are more likely to have other co-morbidities (hypertension, diabetes and hypercholesterolemia) compared to the rest of the elderly participants.

The prevalence of depressive disorders and depressive-symptom cases vary widely among elder populations. The prevalence of major depression varies from 0.86% in a

Canadian community (23) to 42% among US nursing home residents (24), and clinically depressive-symptom cases from 7.2% in the US (25) to 48% in Italy (26) in corresponding settings. Some of the variation in the prevalence rates in these studies is rooted in the use of different methods of assessment, such as the use of clinical interviews by experienced clinicians or the use of structured diagnostic interviews by trained non-professionals or/and the use of different scales estimating depression. Rates of participation may also affect the results as researchers have presented evidence suggesting that depressed elderly may be particularly resistant to research invitations, which may imply underestimation of prevalence and depression predictors (27, 28).

The study of factors linked with depression helps identify possible risk factors, aetiologies and prevention strategies of depression. Our study, in accordance with other studies (27, 29), has shown that women are more at risk for developing depression than men. This association may be due to the fact that more women than men are widowed in late life, suffering from grief and the consequent social isolation (30). It has been suggested that the high degree of depressive symptoms among older women reflects the gender-related disadvantaged status in women in terms of being less often married and having poorer access to economic resources than men (31). However, some studies concluded that men and women report similar depression patterns (6, 32, 33). Associations between lower schooling level and depression have also been frequently described (30). Notwithstanding, some studies fail to reveal this relationship, either due to different definitions of schooling level or because they were carried out in areas/countries with an educational level higher than that of our study population (34).

It has been recognized that social distress factors are associated with depressive symptom cases (35). Loneliness in terms of social isolation, loss of close social contacts, low emotional support, widowhood, being single, separated or divorced are potential risk factors for the onset of depressive symptoms and depressive episodes in later life (36). Living in a rural or urban area affects people's social life in many ways. Existing research on the association between rurality and depression displays disputable outcomes. Some researchers found no rural-urban differences in the prevalence of depression, although different factors were associated with depressive symptoms (37). A study conducted in Great Britain (38) found that living in an area with a low population density was associated with lower risk of depression. It has also been shown that good social networks reduce the risk of depression, compensating for the negative aspects of rural or urban life (39).

The results of the present work suggest that living in a rural area, where the relationships among its inhabitants are closer, may play a protective role against the development of severe depression. Perhaps, smaller communities seem to promote a greater sense of neighbourliness, and the residential stability of small communities tends to encourage long-term friendships and a sense of belonging to a community. The potential regional economic decline may create an environment with fewer services and facilities often driving young people to migration, but it seems that in Greece this is not necessarily enough to outshine the benefits of rural life.

However, the literature suggests that low socio-economic status, particularly when assessed by indices of material standards of living, is associated with a higher prevalence of depression in cross-sectional studies (40). This meta-analysis has also revealed that the effect of low socio-economic status on depression is greater for episode maintenance than for onset (40). Our study showed that annual income greater than 8,000 euros is associated with less severe depressive symptoms. Nevertheless, it is not clearly known whether factors associated with depression are the same for different socio-economic walks of life.

It is suggested that the most 'central' issue in late-life depression is the functional impairment (41) and the lack of social activities (42). The elderly are increasingly subject to muscular aches, joint pain and stiffness, loss of strength and endurance, diminishing physical mobility, decreased vitality and resilience, at times along with insomnia, anxiety and cognitive decline. The current study indicates that sedentary life is a risk factor for depressive symptoms in the elderly. Concurrently, there are studies noting that older adults who are healthy, active and normally functioning may be at no greater risk of depression than younger adults, and that age-related results on depression are the consequence of physical health problems and health-related functional impairment, driving old people to inactivity and isolation (43).

Apart from the previous factors that contribute to the development of depressive symptoms, the parameter of nutrition is proposed to play a significant role in the pathogenesis of depression in all ages and, specifically so, in the elderly. Some clinical trials and epidemiological data have found that fatty acids, and especially omega-3 and omega-6, are associated with the expression of depression (43, 44). The present study proposes that fish and olive oil consumption are inversely related with depression in old people. Literature regarding fish consumption and depression provides mixed results. Fish consumption was negatively associated with depression in women, but not in men, in a Northern Finish population (45), while other studies suggest that neither fish nor omega-3 intake was associated with depression in either gender (46, 47). This divergence of views may be the result of a number of reasons, like different cooking methods or cultural differences between the various populations or consumption of different kinds of fish. For olive oil, on the other hand, which seems to offer some protection from cardiovascular disease, there is scant literature for its relation to depression. In a clinical trial, there was no evidence that intake of 8gr fish oil improved mood more than 8gr olive oil intake; however, mood improved significantly in both groups (48). Thus, though in the

present study a favorable relation between olive oil consumption and depression in an elderly population was found, the question of the olive oil's same efficacy in depression as for fish oil still exists, and, in addition, the question of olive oil's relation to geriatric depression in particular, remains to be answered, as well.

Finally, alcohol has a complex relation with depression in the ageing. Substance abuse, such as alcoholism, could persist into late life, making difficult to assess if geriatric depression is a risk factor for constant alcoholism, or vice versa (49). However, in our study, those with higher alcohol intake scored less in the geriatric depression scale, suggesting either the presence of residual confounding, or a non-linear shape on the relation between alcohol (mainly wine-derived) and depressive symptomatology.

In addition to the dietary factors that are correlated to depression, recent review studies have revealed potential mechanisms explaining the link between depression and cardiovascular disease. While the mechanisms linking depression and coronary heart disease are not well understood, a number of relationships have been identified which demonstrate the plausibility and coherence of a causal relationship. These include both direct biological mechanisms and indirect pathways mediated through behavioral, lifestyle and social factors as mentioned previously. According to Goldston and Baillie (2008), there are several potential mechanisms that link depression to heart disease and specifically through the dysregulation of the hypothalamic-pituitary-adrenocortical (HPA) axis, the adverse impact that depression has on cardiac autonomic tone and heart rate variability, disturbances in blood clotting mechanisms where substantial disturbance in platlet function occurs in depression. Moreover, impaired vascular endothelial function has been found to occur in a variety of cohorts of depressed patients, while an increased sub-acute inflammatory immune response has been associated with depression and this may contribute to coronary artery atherosclerosis (50).

Limitations

This is an observational study that cannot suggest evidence for causality; however, the presented findings are adequate for developing research hypotheses that may be confirmed by prospective studies and clinical trials. Furthermore, it has been suggested that self-reported questionnaires, like the GDS questionnaire, are supposed to be used as screening tools rather than substitutes for an in-depth interview. Thus, the proportion of men and women that were defined as having mild or severe depression, although the tool used was validated for the reference population, may be under- or over-estimated.

Conclusion

Jeste noted (1997) that "psychiatry of old age is coming of age" (51). As depression in elderly people has become a predominant health care problem in our societies, there is an obvious need for education and information on the subject of depression among the elderly. Immediate observation of depressive symptoms in primary care could be a very important step towards improving the assistance offered to old people. The present work revealed that the prevalence of depression is quite high among elderly people living in Greek islands and Cyprus. Urban environment that may interact with sedentarism and unhealthy dietary choices seems to promote depression. Improved guidance for appropriate nutritional choices and physical mobility could finally help substantially in lessening depression morbidity in the elderly.

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References

1. WHO, 2009. (http://www.who.int/mental_health/management/depression /definition/en/, assessed August 1, 2009).
2. Adamek ME, Slater GY. Depression and anxiety. J Gerontol Soc Work, 2008; 50: 153-189.
3. Cole MG, Dendukuri N. Risk factors for depression among elderly community subjects: a systematic review and meta-analysis. Am J of Psychiatry, 2003; 160: 1147-1156.
4. Roman MW, Callen BL. Screening instruments for older adult depressive disorders: updating the evidence-based toolbox. Issues Ment Health Nurs, 2008; 29: 924-41. Review.
5. Steffens DC. A multiplicity of approaches to characterize geriatric depression and its outcomes. Curr Opin Psychiatry, 2009 (in press).
6. Papadopoulos FC, Petridou E, Argyropoulou S, Kontaxakis V, Dessypris N, Anastasiou A, et al. Prevalence and correlates of depression in late life: a population based study from a rural Greek town. International Journal of Geriatric Psychiatry, 2005; 20: 350–7.
7. Sokoya OO, Baiyewu O. Geriatric depression in Nigerian primary care attendees. Int J Geriatr Psychiatry, 2003; 18: 506–510.
8. Beekman AT, Copeland JR, Prince MJ. Review of community prevalence of depression in later life. Br J Psychiatry, 1999; 174: 307-311.
9. Argyriadou S, Melissopoulou H, Krania E, Karagiannidou A, Vlachonicolis I, Lionis C. Dementia and depression: two frequent disorders of the aged in primary health care in Greece. Family Practice, 2001; 18: 87-91.
10. Psaltopoulou T, Kyrozis A, Stathopoulos P, Trichopoulos D, Vassilopoulos D, Trichopoulou A. Diet, physical activity and cognitive impairment among elders: the EPIC-Greece cohort (European Prospective Investigation into Cancer and Nutrition). Public Health Nutr, 2008; 11: 1054-1062.
11. Panagiotakos DB, Kinlaw M, Papaerakleous N, Papoutsou S, Toutouzas P, Polychronopoulos E. Depressive symptomatology and the prevalence of cardiovascular risk factors among older men and women from Cyprus; the MEDIS (Mediterranean Islands Elderly) epidemiological study. J Clin Nurs, 2008; 17: 688–695.
12. Lapid MI, Rummans TA. Evaluation and management of geriatric depression in primary care. Mayo Clin Proc, 2003; 78: 1423-9.
13. Alves de Rezende CH, Coelho LM, Oliveira LM, Penha Silva N. Dependence of the geriatric depression scores on age, nutritional status, and haematologic variables in elderly institutionalized patients. J Nutr Health Aging, 2009; 13: 617-621.
14. van de Rest O, Geleijnse JM, Kok FJ, van Staveren WA, Hoefnagels WH, Beekman AT, de Groot LC. Effect of fish-oil supplementation on mental well-being in older subjects: a randomized, double-blind, placebo-controlled trial. Am J Clin Nutr, 2008; 88: 706-713.
15. Dangour AD, Allen E, Elbourne D, Fletcher A, Richards M, Uauy R. Fish Consumption and Cognitive Function among Older People in the UK: Baseline Data from the Opal Study. J Nutr Health Aging, 2009; 13(3):198-202.
16. Panagiotakos D, Bountziouka V, Zeimbekis A, Vlachou I, Polychronopoulos E. Food pattern analysis and prevalence of cardiovascular disease risk factors among elderly people from Mediterranean islands. J Med Food, 2007; 10: 615-621.
17. Yesavage JA, Brink TL, Rose TL, Lum O, Huang V, Adey MB & Leirer VO. Development and validation of a geriatric depression screening scale: a preliminary report. J Psych Research, 1983; 17: 37–49.
18. Sheikh JI, Yesavage JA. A knowledge assessment test for geriatric psychiatry. Hosp Community Psychiatry, 1985; 36: 1160-1166.
19. Fountoulakis KN, Tsolaki M, Iacovides A, Yesavage J, O'Hara R, Kazis A, et al. The

validation of the short form of the Geriatric Depression Scale (GDS) in Greece. Aging (Milano), 1999; 11: 367-372.
20. Panagiotakos DB, Pitsavos C, Arvaniti F, Stefanadis C. Adherence to the Mediterranean food pattern predicts the prevalence of hypertension, hypercholesterolemia, diabetes and obesity, among healthy adults; the accuracy of the MedDietScore. Prev Med, 2007; 44: 335-340.
21. Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc, 2003; 35: 1381-1395.
22. Pinquart M, Sorensen S. Gender differences in self-concept and psychological well-being in old age: a meta-analysis. J Gerontol B Psychol Sci Soc, 2001; 56: P195-P213.
23. Newman SC, Sheldon CT, Blanc RC. Prevalence of depression in an elderly community sample: a comparison of GMS-AGEGAT and DSM-IV diagnostic criteria. Psychol Med, 1998; 28: 1339-1345.
24. Snowdon J, Burgess E, Vaughan R, Miller R. Use of antidepressants and the prevalence of depression and cognitive impairment in Sydney nursing homes. Int J Geriatr Psychiatry, 1996; 11: 599-606.
25. West CG, Reed DM, Gildengorin GL. Can money buy happiness? Depressive symptoms in an affluent older population. J Am Geriatr Soc, 1998; 46: 49-57.
26. Rozzini R, Boffelli S, Franzoni S, Frisoni GB, Trarucchi M. Prevalence and predictors of depressive symptoms in a nursing home. Int J Geriatr Psychiatry, 1996; 11: 629-634.
27. Palsson SP, Östling S, Skoog I. The incidence of first-onset depression in a population followed from the age of 70 to 85. Psychol Med, 2001; 31: 1159-1168.
28. Thompson MG, Heller K, Rody CA. Recruitment challenges in studying late-life depression: do community samples adequately represent depressed older adults? Psychol Aging, 1994; 9: 121-125.
29. Norton MC, Skoog I, Toone L, Corcoran C, Tschanz JT, Lisota RD, et al. Three-year incidence of first-onset depressive syndrome in a population sample of older adults: the Cache Country Study. Am J Geriatr Psychiatry, 2006; 14: 237-45.
30. Djernes JK. Prevalence and predictors of depression in populations of elderly: a review. Acta Psychiatr Scand, 2006; 113: 372-387.
31. Nolen-Hoeksema S. Gender differences in depression. Cur Dir in Psychol Sc, 2001; 10: 173-176.
32. Sonnenberg CM, Beekman ATF, Deeg DJH, Van Tilburg W. Sex differences in late life depression. Acta Psychiatr Scand, 2000; 101: 286-292.
33. Bogner HR, Gallo JJ. Are higher rates of depression in women accounted for by differential symptom reporting? Soc Psychiatry Psychiatr Epidemiol, 2004; 39: 126-132.
34. Schoevers RA, Beekman AT, Deeg DJ, Geerlings MI, Jonker C, van Tilburg W. Risk factors for depression in later life: results of a prospective community based study (AMSTEL). J Affect Disord, 2000; 59: 127-137.
35. Cervilla JA, Prince MJ. Cognitive impairment and social distress as different pathways to depression in the elderly. Int J Geriatr Psychiatry, 1997; 12: 995-1000.
36. Jones RN, Marcantonio ER, Rabinowitz T. Prevalence and correlates of recognised depression in U.S. nursing homes. J Am Geriatr Soc, 2003; 51: 1404-1409.
37. St John PD, Blandford AA, Strain LA. Depressive symptoms among older adults in rural and urban areas. Int J Geriatr Psychiatry, 2006; 21: 1175–1180.
38. Walters k, Breeze E, Wilkinson P. Local area deprivation and urban-rural differences in anxiety and depression among people older than 75 years in Britain. Am J Public Health, 2004; 94: 1768-1774.
39. Copeland JRM, Chen R, Dewey ME. Community-based case-control study of depression in older people. Cases and sub-cases from the MRC-ALPHA study. Br J Psychiatry, 1999; 175: 344 -347.
40. Lorant V, Deliege D, Eaton W, Robert A, Philippot P, Ansseau M. Socioeconomic inequalities in depression: a meta-analysis. Am J Epidemiol, 2003; 15(157): 98-112.
41. Prince MJ, Harwood RH, Blizard RA, Thomas A, Mann AH. Impairment, disability and handicaps as risk factors for depression in old age. The Gospel Oak Project V. Psychol Med, 1997; 27: 311-321.
42. Prince MJ, Harwood RH, Thomas A, Mann AH. A prospective population-based cohort study of the effects of disablement and social milieu on the onset and maintenance of late-life depression. The Gospel Oak Project VII. Psychol Med, 1998; 28(2):337-350.
43. Maes M, Christophe A, Delanghe J, Altamura C, Neels H, Meltzer HY. Lowered omega-3 polyunsaturated fatty acids in serum phospholipids and cholesteryl esters of depressed patients. Psychiatry Res, 1999; 85: 275-291.
44. Bountziouka V, Polychronopoulos E, Zeimbekis A, Ladoukaki E, Papairakleous N, Panagiotakos D et al. Long-Term Fish Intake Is Associated With Less Severe Depressive Symptoms Among Elderly Men and Women. The MEDIS (MEDiterranean ISlands Elderly) Epidemiological Study. Journal of Aging and Health, 2009 (in press).
45. Timonen M, Horrobin D, Jokelainen J, Laitinen J, Herva A, Resanen P. Fish consumption and depression: the Northern Finland 1966 birth cohort study. J Affect Dis, 2004; 82: 447-452.
46. Hakkarainen R, Partonen T, Haukka J, Virtamo J, Albanes D, Lönnqvist J. Is low dietary intake of omega-3 fatty acids associated with depression? Am J Psychiatry, 2004; 161: 567-569.
47. Sánchez-Villegas A, Henríquez P, Bes-Rastrollo M, Doreste J. Mediterranean diet and depression. Public Health Nutr, 2006; 9: 1104-1109.
48. Silvers KM, Woolley CC, Hamilton FC, Watts PM and Watson RA. Randomized double-blind placebo-controlled trial of fish oil in the treatment of depression, Prostaglandins Leukot. Essent. Fatty Acids, 2005; 72: 211–218.
49. Blow FC, Serras AM, Barry KL. Late-life depression and alcoholism. Curr Psychiatry Rep, 2007; 9: 14-19. Review.
50. Goldston K, Baillie AJ. Depression and coronary heart disease: a review of the epidemiological evidence, explanatory mechanisms and management approaches. Clin Psychol Rev. 2008; 28(2): 288-306.
51. Jeste DV. Psychiatry of old age is coming of age. Am J Psychiatry, 1997; 154: 1356-1358.