(RESEARCH ARTICLE)

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Are there any links between blood statuses of vitamin B12, B9, and D with depression in the elderly population living in nursing homes? A descriptive-analytical study from Tehran-Iran

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Abstract

Background: Nutritional deficiency has been suggested as a cause of depression in old age. The present study was performed to evaluate statuses of vitamin B12, Folate (vitamin B9), and vitamin D and their associations with depression among the elderly population living in nursing homes in Tehran-Iran.

Methods: One-hundred and seventy subjects from 17 randomly selected nursing homes (NH) (Tehran-Iran) were enrolled in the study. Depression, nutritional statuses, history of chronic diseases, dental health, the levels of exposure to sunlight, the level of satisfaction associated with food quality, and NH staff were evaluated for determining possible relations between depression with vitamin B12, Folate, and vitamin D levels.

Results: In the present study Folate and vitamin D deficiencies were found in 96% and 56% of subjects. No correlations were observed between depression with vitamin B12 (P=0.47), Folate (P=0.16) and Vitamin D (P=0.24) levels.

Conclusion: The results delineate the high prevalence of vitamin deficiencies among elderly nursing home residents; however, no associations were observed between depression and these nutritional factors. Further studies considering other risk factors and more nutritional micronutrients are suggested.

Keywords: Vitamin B12; Folate; Vitamin D; Depression; Elderly; Nursing Homes

1. Introduction

Depression is a common disorder in the elderly; however, it is often undiagnosed because of difficulties in recognizing the disorder. It was reported that depression is diagnosed in only 30-50% of all cases. Depression is also responsible

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for a wide range of disabilities and prolonged adverse health outcomes [1]. It is not a normal part of aging [2] but constrains excessive costs due to the high use of health care and medical services [3-6].

Both minor and subsyndromal depressions are clinically important states in the elderly [7]; which is at least twice as common as major depression in old age [8]. Cardiovascular and neurological changes also increase vulnerability to depression [9, 10]. Older women are at greater risk (more than three times) for major depressive disorders compared to older men [11]. Several other risk factors including nutritional deficiencies have been identified as the risk factors for depression in the elderly [12].

Nutritional status affects and is affected by the disease, especially among elderly people. Therefore, diagnosis of nutritional deficiencies seems important to find risk factors for depression [13]. There are several indirect indicators that show proper and healthy eating in the elderly population; socio-economic status, lifestyle, and quality of life are some of them that may represent important tools for assessing nutritional risk [14, 15]. Several investigations have demonstrated an association between depression and inadequate intakes of some nutrients, such as Folate [16], vitamin B12 [17], and vitamin D. Vitamin B12 deficiency is found in 10% and 17% of the general and demented elderly population, respectively [16-18].

The results of a survey on older Chinese adults showed that low levels of serum folate and B12 deficiency were associated with a greater risk of depression symptoms in elderlies [19]. It has been suggested that vitamin B12 and Folate probably have antidepressant properties [20]. The results of randomized placebo–controlled trials studies have indicated that Folate and/or vitamin B12 were responsible for a 50% reduction in the severity of depression symptoms [1, 21]. However, the associated mechanisms are not clearly understood.

Up to our knowledge, the role of nutritional deficiency in depression among the nursing home population in Tehran has not been investigated before. So, the present study aimed to evaluate the prevalence of vitamin B12, D, Folate deficiencies, and their possible relationships with depression among the NH residents of Tehran.

2. Material and methods

A descriptive-analytical study was conducted in the selected Nursing homes at Tehran by the School of public Health (affiliated with Tehran University of Medical Sciences), National Health Research Association, and National Institute of Health Research (Tehran-Iran) in 2012.

Totally, there were 44 public and private nursing homes with 2500 elderly residents in Tehran (Iran). The inclusion criteria were age of 60 years or older, living in the nursing home, and signing informed consent for participating in the survey. Exclusion criteria included participant's death or their unwillingness to cooperate in the study.

According to the sample size calculations, 17 NHs were randomly selected and 10 residents from each NH (totally: 170 cases) were enrolled based on the inclusion criteria after signing the informed consent.

Data related to the subjects' demographic characteristics, nutritional and health statuses were gathered and recorded in a checklist. Demographic characteristics included gender, educational level, marital status, birthplace, previous job, the numbers of children, the numbers of medical visits per month, the person who visited, exposure to sunlight, smoking status, supplementation, special diet, history of chronic diseases (blood pressure, renal or digestive problems, heart disease, dental problem, sleeping pattern, the levels of satisfaction related to the food quality, food consumption status, and satisfaction with the NH staff.

Depression was assessed using the 15-item Geriatric Depression Scale (GDS) which is a short screening measure for symptoms of depression often seen in the elderly [22]. The reliability and validity of GDS for evaluating depression symptoms in the elderly population have been demonstrated [23]. The 15 symptoms are rated as present or not present, and subscribing to five or more items is indicative of depression [24]. The GDS-15 scores were classified into four categories. The scores are classified as follows: 0-4: not depressed; 5-8: mild depression; 9-11: moderate depression; and >12: severe depression [25, 26].

We used the Mini Nutritional Assessment (MNA) for specifying the nutritional status of the elderlies [27]. This questionnaire consists of indicators including information on eating patterns and self-cognition of health in the elderly. The scale was classified as MNA<17: Malnourished, 17-23.5: at risk of malnutrition, and > 23.5: well-nourished.

Five milliliters (ml) of fasting blood were drowned for all cases and transported to the laboratory. Serum was isolated and stored at – 80° C until analysis. Serum Vitamin B12 and Red Blood Cell Folate were measured using ECLIA (electrochemiluminescence immunoassay) method; Roche B II and III reagent kit. Normal ranges for serum levels of B12 and Folate were considered 160-970 pg/ml and 120-860 ng/ml, respectively. Vitamin D was also assessed using CLIA (Chemiluminescent immunoassay) method by Diasorin D3 kit. The results were classified into 4 groups; Deficient: <10 ng/ml, insufficient: 10-29 ng/ml, sufficient: 30-100 ng/ml, and potential intoxication: >100 ng/ml).

The study was approved by the Ethical Committee of Tehran University of Medical Sciences (ID: 4656).

2.1. Statistical Analysis

Recorded data were entered and analyzed using SPSS software (Version; 17.0) and STATA (11.0, Stata Corp, College Station, TX). As the nursing homes formed a cluster in our sampling scheme, Complex Sample Survey (SVY) ordinal regression analysis was performed in STATA to account for the data structure. Pearson correlation coefficient was used to determine the frequency, type, and correlations between variables. The relationships between the independent categorical variables were also evaluated by the Chi-square test. Qualitative data were analyzed through the Fisher test. P-value<0.05 was considered as the significant level.

3. Results

Of all participants, 20 (11.8%), 120 (70.5%), and 30 (17.6%) subjects had vitamin B12 levels <160, 160-970, and >970 pg/ml, respectively. As data are shown in Table 1, no statistically relationships were observed between the level of vitamin B12 with participant's depression (P= 0.47), heart disease (P= 0.44), diabetes (P= 0.61), teeth health condition (P= 0.83), hypertensive disorders (P=0.06) and renal disease (P>0.05). Vitamin B12 deficiency was not found in subjects who took supplementation while vitamin B12 deficiency was observed in 13% of unsupplemented cases. Vitamin B12 deficiency was slightly more frequent in malnourished elderlies compared to the well-nourished counterparts (20% vs. 18.75%). Moreover, the frequency of vitamin B12 deficiency was slightly lower among elderlies who were satisfied with NH food quality than those who were not (12.3% vs. 14.3%). However, the differences were not significant (P>0.05). Sunlight exposure was not also related to vitamin B12 deficiency (P=0.87).

Table 1 Correlation between Vitamin B12 levels with diabetes, hypertension, heart disease, renal disease, dental health, satisfaction of food quality, satisfaction of personal, sunlight exposure, and depression through SVY ordinal regression and Chi-Square test

B12 levels / Variables		<160 pg/ml	160-970 pg/ml	>970 pg/ml	P value
Diabetes	Yes	15.0	81.5	3.7	0.61
	No	12.0	79.0	9.2	
Hypertension	Yes	2.4	90.5	7.1	0.06
	No	15.1	76.2	9.0	
Heart Disease	Yes	13.2	73.7	13.2	0.44
	No	12.0	80.8	7.0	
Renal Disease	Yes	0	100	0	<0.9
	No	12.0	79.0	9.0	
Bad Dental Health	Yes	12.5	81.3	6.2	0.83
	No	12.4	78.5	9.1	
Satisfaction of Food Quality	Yes	12.3	79.4	8.4	0.87
	No	14.3	78.6	7.1	
Satisfaction of Personal	Yes	12.1	79.8	9.0	0.63
	No	16.7	83.3	0	

Sunlight Exposure	No	14.0	77.0	9.5	0.87
	>2h	10.0	83.0	7.4	
	2-8h	15.0	76.1	9.0	
Depression	No	8.0	85.0	8.0	0.47
	Mild	16.5	75.0	9.0	
	Moderate	9.1	89.0	2.3	
	Severe	6.7	80	13.3	

Folate deficiency (the red blood cell Folate<120 ng/ml) was observed in 96.47% of participants. Only 6 subjects (3.53%) had a Folate level between 120 and 860 ng/ml. The Folate levels were not significantly associated with participant's depression (P=0.16), nutritional status (P=0.25), and other variables like heart disease, diabetes, hypertension, teeth health condition, kidney disease, and sunlight exposure (P>0.05). There was not also a significant correlation between Folate level and satisfaction of NH staff (P=0.06) (Table 2).

Table 2 Correlation between Folate levels with diabetes, hypertension, heart disease, renal disease, dental health, satisfaction of food quality, satisfaction of personal, sunlight exposure, and depression through SVY ordinal regression and Chi-Square tests

Folate levels / Variables		<120 ng/ml	120-860 ng/ml	P value
Diabetes	Yes	100	0	0.59
	No	95.8	4.2	
Hypertension	Yes	100	0	0.33
	No	95.3	5.0	
HeartDisease	Yes	100	0	0.33
	No	95.4	5.0	
Renal Disease	Yes	100	0	P>0.05
	No	95.3	4.0	
Bad Dental Health	Yes	96.0	4.3	P>0.05
	No	97.0	3.3	
Satisfaction of Food Quality	Yes	97.0	3.2	0.43
	No	93.3	7.0	
Satisfaction of Personal	Yes	97.5	2.6	0.06
	No	85.0	15.4	
Sunlight Exposure	No	97.1	3.0	0.72
	>2h	95.1	5.0	
	2-8h	100	0	
Depression	No	92.3	8.0	0.16
	Mild	99.0	1.3	
	Moderate	93.2	7.0	
	Severe	93.8	6.0	

According to the results, 44 (25.8%), 51 (30%), 62 (36.5%), and 13 (7.6%) of the elderlies were vitamin D deficient, insufficient, sufficient, and in potential intoxication level, respectively. Vitamin D level was not related to nutritional status (P=0.7) or the severity of malnutrition (P=0.85). There was no significant correlation between vitamin D level and depression (P=0.24). Vitamin D deficiency was less frequent among subjects who had sunlight exposure 2-8 hours/day in comparison with those who had a lack of exposure to sunlight (24.0% vs. 29%; P= 0.80). Vitamin D levels were not also correlated to hypertension, diabetes, and heart disease (P>0.05). Of all subjects with renal disease, 50% showed vitamin D insufficiency. There was no correlation between vitamin D levels with participant's renal disease (P>0.05). Vitamin D deficiency was more frequent among elderlies with teeth problems compared to those who had not have this complication; However, the difference was not significant (32% vs. 23.1%; P= 0.21). Using supplements resulted in a lower rate of vitamin D deficiency (14.3% in the using supplement group vs. 26.3% in the no supplementation group). Elderlies who were not satisfied with NH staff showed a higher frequency of vitamin D deficiency (50% vs. 24%; P= 0.11). All detailed data are shown in Table 3.

Table 3 Correlation between Vitamin D levels in elderlies and diabetes, hypertension, heart disease, renal disease, dental health, satisfaction of food quality, satisfaction of personal, sunlight exposure and depression through SVY ordinal regression and Chi-Square tests

Vitamin D status / Variables		Deficiency (%)	Insufficiency (%)	Sufficiency (%)	Potential Toxicity (%)	P value
Diabetes	Yes	35	26	44	0	0.57
	No	25	31	35	9	
Hypertension	Yes	21.4	33.3	33.3	12.0	0.47
	No	27.2	29.6	37.0	6.4	
Heart Disease	Yes	16.0	34.2	42.1	8.0	0.23
	No	29.0	29.0	35.0	8.0	
Renal Disease	Yes	0	50	50	0	0.70
	No	26.5	29.0	36.4	8.0	
Bad Dental Health	Yes	32.0	32.0	28.0	8.5	0.21
	No	23.1	30.0	40.0	7.4	
Satisfaction of Food Quality	Yes	26.0	29.2	36.4	8.4	0.63
	No	21.4	43.0	36.0	0	
Satisfaction of Personal	Yes	24.0	31.4	36.5	8.3	0.11
	No	50	17.0	33.3	0	
Sunlight Exposure	No	29.0	24.2	38.0	9.1	0.80
	>2h	23.5	32.1	37.0	7.4	
	2-8h	24.0	43.0	29.0	5.0	
Depression	No	15.4	15.4	69.2	0	0.24
	Mild	29.5	33.3	26.0	11.5	
	Moderate	18.2	27.3	48.0	7.0	
	Severe	20	47.0	33.3	0	

4. Discussion

The strength of this population-based study was assessing statuses of different vitamins and their associations with depression among elderlies living in nursing homes that have not been done before.

According to the results, Folate deficiency (96.47%) and vitamin D insufficiency (55.8%) were frequently observed in our participants. These findings may relate to several reasons including the participant's diet, lack of appetite and inadequate intake, presence of malabsorptive disorders, skin phototype, using different medications like antibiotics, long-term residency at a nursing home, type of clothing, or old age-associated changes in conversion of vitamin D to its active form [28, 29]. Consistent with our results, Wendyet al. reported a high prevalence of Folate deficiency in elderly individuals (>10% among people aged ≥75 years) to indicate the importance of screening for folate deficiency and prescribing the supplements for this high-risk population [30].Assis et al. demonstrated a high prevalence (98.6%) of the inadequacy of Folate intake in the elderlies above 60 years living in NHs [31]. Regarding vitamin D, it was shown a high rate of vitamin D insufficiency by 82% among 545 Swedish nursing home residents with mean age of 86 years [29]. WHO also reported such a high frequency of vitamin D insufficiency (40–100%) among elderlies worldwide [32].

Although mild to severe depression is prevalent in old patients, the related risk factors are not yet clear [33, 34]. Very few studies have examined the role of nutritional elements on mental health and depression among older adults [12, 35]. The results of our previous study showed that the majority (90.2 %) of elderly residents of nursing homes in Iran suffered from mild to severe depression. Moreover, it was found that the elderlies who were satisfied with the quality of the food suffered from lower grades of depression compared to those who were not satisfied [35]. According to the results of the present study, no significant correlations were observed between vitamins B12, D, and Folate levels with depression. It seems that psychosocial factors, economic status, and poor physical health as the main risk factors for old adults' depression may mask the influences of nutritional micronutrients [36, 37]. Moreover, it is supposed that the association between vitamins levels and depression may be confounded by differences in our participants' ages, sexes, duration of staying in nursing homes, etc. So, further studies with more risk factors especially psychosocial factors, or including other nutritional micronutrients should be designed. In accordance with our results, Kamphuis et al. demonstrated no significant relationships between dietary intake of folate and vitamin B12 with depressive symptoms in 70-90 years old Dutch men [38]. An Pan et al. also did not show any significant correlation between vitamin D levels and depressive symptoms among elderly Chinese participants [39]. In contrary to our results, there is little established knowledge regarding the positive correlations between lack of vitamin B12, folic acid, vitamin D, and depression. Kentaro et al. showed a significant inverse association between depressive symptoms in men and Folate intake, while this significant correlation was not observed in female participants. Penckofer et al. also reported that people with higher risks for vitamin D deficiency are at greater risks for depression [16-18].

5. Conclusion

The results delineate the high prevalence of Folate and vitamin D deficiency among elderly nursing home residents of Tehran. This finding shows the importance of screening for vitamins deficiency, early diagnosis, and treatment of this high-risk and vulnerable population. Findings of the present survey also showed that there were no significant correlations between depression and these nutritional factors. Further studies considering other risk factors and more nutritional micronutrients are suggested.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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