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Relationship between Nutritional Status and Cognitive Functioning in the Elderly; a Case Study of Amol, Iran

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ABSTRACT

Aims The current study aimed to determine the relationship between nutritional status and cognitive functioning of the elderly.

Instrument & Methods This Descriptive-analytical study was performed in 2019 in health centers in Amol. This study was performed on 260 elderly people, covered by health centers in Amol, Iran in 2019. Participants were selected by cluster sampling method. Data were collected using the Mini Nutritional Assessment questionnaire, Psychometric Evaluation of the Cognitive State Test, Geriatric Depression Scale, Instrumental Activities of Daily Living Scale, and Geriatric Oral Health Assessment Index. Statistical analysis was conducted using descriptive and inferential tests in SPSS version 20.

Findings The mean age of the elderly was 67.3±6.65 years. Overall, 87.7% of the participants had a cognitive score above 25.5. The results of Spearman's correlation test showed a significant positive relationship between the nutritional status and cognitive functioning of the elderly; this relationship was also significant in the regression model.

Conclusion There is a relationship between nutritional status and cognitive functioning of the elderly covered by health centers in Amol, Iran.

Keywords Nutritional Status; Cognitive Functioning; Elderly

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Introduction

Iran's population is aging and it is predicted that by 2050, more than 21% of Iran's population will be 60 years and older [1]. Cognitive disorder is one of the most serious problems of the elderly, which can have significant adverse effects on their quality of life. According to previous studies, about 5% of the elderly, aged 65 years, have overt cognitive disorders, which is more than 40% of the population aged 80 years or above [2]. It is known that cognitive functions, including the processing speed, short-term memory, working memory, and long-term memory, decline with age [3]. Although some of these changes may be due to natural age-related changes, they become more important when they negatively affect the elderly's daily functioning or quality of life [4].

To date, no effective solution has been proposed for the prevention or treatment of cognitive disorders; therefore, identification of potential protective factors for the prevention of mild cognitive impairment (MCI) is essential [5, 6]. Many studies have shown that demographic characteristics, lifestyle, functional status, and chronic diseases (e.g., hypertension, cardiovascular disease, and diabetes) are associated with cognitive impairment [7, 8]. On the other hand, one of the most important issues in the health of the elderly is proper nutrition because proper nutrition has a great impact on physical and mental function [9]. the risk of malnutrition is higher in old age due to physical limitations [10] Some common problems among the elderly include changes in taste and smell, difficulty chewing and swallowing, xerostomia, chronic diseases, frequent hospitalizations, use of medications, mental and psychological disorders [11, 12].

Two-thirds of all deaths in the United States are due to diet-related diseases and poor eating habits [13]. The prevalence of malnutrition is estimated to be 9.2% among elderly living at home and 21.6% among elderly residents of nursing homes in Iran [14]. There is little information about the nutritional status of the elderly population in Iran [15]. Early intervention or rapid improvement of malnutrition, besides proper nutritional assessment and management, may delay the onset of dementia in the elderly [16].

The relationship between nutritional intake and cognitive disorder is complex, as more than one single factor is usually involved [17]. Some studies have shown that high consumption of fruits, vegetables, fish, nuts, legumes, and grains, besides the reduced consumption of meat, high-fat dairy products, sweets, and salt, is associated with the reduced risk of cognitive disorders and Alzheimer's disease [17]. Unlike some previous studies [5, 8-21], a significant relationship was found between nutrition and cognitive impairment in some surveys [3, 6, 17, 22-24]. Many previous studies in the field of screening and prevention of malnutrition in Iran have focused more on the elderly with disabilities or living in institutions, so healthy elderly were somewhat ignored.

Given the high prevalence of nutritional problems in the elderly and its importance in the health of this population, besides the controversial results of previous research, this study was designed to determine the relationship between nutritional status and cognitive functioning of the elderly, covered by health centers.

Instrument and Methods

This descriptive-analytical study was conducted on 10291 elderly people over 60 years, covered by health centers in Amol, Iran in 2019. A cluster random sampling was performed among 18 health centers in Amol, Iran from September 2019 to November 2019. From seven random centers, located in the north, south, east, west, and center of the city, the number of the elderly in each center was calculated relative to the total elderly population. In each center, the participants were randomly selected, based on the output of rand between functions in Microsoft Excel software. The sample size was determined, according to the results of a study by El-Zoghbi *et al*. [17], which indicated a Pearson's correlation coefficient of 0.208. The sample size was estimated at 236 people at 95% confidence interval (CI) and 90% power, based on the sample size formula in previous correlation studies [17]. However, considering a 10% attrition rate, a sample size of 260 was considered in this study.

The inclusion criteria were no use of psychiatric drugs, willingness to participate in the study, and having an accessible medical file in the health center. On the other hand, the exclusion criteria were having a history of stroke, treatment with a special diet, dementia (COST score<20), symptoms of major depression (GDS score≥12), and diseases such as heart failure and chronic liver or kidney disease.

Data were collected using the following questionnaires:

-The demographic questionnaire examined the subjects' demographic information, including age, sex, marital status, level of education, income status, occupation, underlying diseases, type of underlying disease, number of underlying diseases, number of medications used, multivitamin use, life companions, daily physical activity, body mass index (BMI), and smoking.

-The MNA is a standard questionnaire, recommended by the European Society for Clinical Nutrition and Metabolism (ESPEN) for assessing the nutritional status of the elderly. It consists of 18 questions in four sections, including anthropometric measurements (BMI, arm circumference, calf circumference, and weight loss), global assessment

(lifestyle, medication use, and mobility), dietary intake (number of meals, fluid intake, and appetite), and self-assessment (self-perception of nutrition and health status) [12]. This scale is also divided into screening and supplementary sections. The screening section contains six questions, which are answered by all individuals. The respondent is considered to have a normal nutritional status if he/she scores ≥12, while a score of ≤11 indicates the risk of malnutrition. On the other hand, the supplementary section (questions 7-18) is only completed for the elderly, who obtain scores of ≤11 in the screening section [11]. A score of ≤17 represents malnutrition or lack of energy intake; a score of 17-23.5 represents the risk of malnutrition, and a score ≥24 represents a good nutritional status; the maximum score of this section is 30. The validity and reliability of this tool have been confirmed in various studies [17, 25-27]. In a study by Mathew *et al.*, the reliability of this instrument was confirmed with a Cronbach's alpha coefficient of 0.80 in the elderly [25]. Moreover, to determine the validity of MNA, Masomy *et al.* performed a content validity analysis and calculated its test-retest reliability to be 98% [11, 28]. In the present study, the reliability of this tool was approved by a Cronbach's alpha of 74.4.

-The COST was designed by Babakan *et al.* [29]. This test takes a short time to complete (about five minutes) and can be used by literate and illiterate people [29]. Unlike other tools that only examine the cognitive domain, this test assesses all aspects of dementia. It contains 19 questions, with scores ranging from 0 to 30 [30, 31]. It evaluates the areas of awareness (4 points), memorization (3 points), attention (5 points), recall (3 points), abstract thinking (2 points), speech fluidity (1 point), remote memory (3 points), language (5 points), inability to recognize objects (1 point), inability to perform purposeful movements (2 points), and spatial memory (1 point) [31]. Babakan *et al.* observed a significant positive relationship between the COST questionnaire and the Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA) scales and found its reliability to be good (0.86) [29]. The validity of this test in Iran was examined by Lotfi *et al.* [30], and Cronbach's alpha coefficient of the instrument was calculated to be 0.82. Also, to determine its reliability, Spearman's correlation coefficient was measured to be 0.95, and its intra-class correlation coefficient was 0.88. The sensitivity and specificity of this tool at the cut-off point of 25.5 were 94% and 86%, respectively, although higher scores indicate a better cognitive status [30, 31]. The reliability of this tool in the present study was 70.4%, based on Cronbach's alpha.

-The symptoms of depression were assessed using the GDS instrument. Elderly people with a GDS score of less than 12 (severe depression) were not included in the study. To evaluate the elderly's performance status, the IADL scale was used. The oral health of the elderly was assessed with the GOHAI instrument. Overall, the questionnaires were completed orally, face to face, and individually by the researcher in the health centers, and the elderly were assured that their information in the questionnaires would remain completely confidential.

This article was approved by the Mazandaran University of Medical Sciences and Health Services. To persuade the elderly, the research and its importance were first explained. Also, educational content related to the study was provided to the elderly orally. Questionnaires were completed in health centers and the interview with each elderly person lasted about 30 minutes. The whole process of sampling and completing the questionnaires took three months. The height, arm circumference, and leg circumference of the elderly were measured using a sewing tape, and weight was calculated with the least possible clothing (for men, with pants and a shirt and women, with a coat and pants) without shoes, using a digital scale (Ofogh company; Iran) with an accuracy of ±50g.

Data analysis was performed in SPSS 20. We analyzed the results of the demographic questionnaire, MNA, COST, GDS, GOHAI, and IADL scales, using descriptive (frequency distribution table, mean, and standard deviation) and inferential tests (Spearman's correlation coefficient, multiple logistic regression, Chi-square, and Fisher's test). Spearman correlation coefficient test was used to examine the correlation between nutritional status and cognitive status of the elderly. Multiple logistic regression was used to analyze the factors related to the cognitive status of the elderly. Chi-square and Fisher tests were used to compare the demographic information of the elderly by nutritional status and also by their univariate demographic status.

Findings

Of 260 samples studied, 131 (50.4%) were male. The majority of the elderly (43.5%) were 65-74 years old, and their mean age was 67.3±6.65 years. Also, the majority of the elderly (76.5%) were married. Overall, 66.2% of the participants reported their income to be less than their living expenses. Also, 41.5% were retired. The most common underlying disease was hypertension. Moreover, 74.2% of the participants claimed that they had daily physical activity, and 87.7% stated that they did not smoke (Table 1).

After classifying the MNA score, it was found that 190 patients (73.1%) had a normal nutritional status, 63 patients (24.2%) were at risk of malnutrition, and 7 patients (2.7%) were malnourished. Also, after dividing the cognitive functioning score according to the cut-off point (25.5), 32 people (12.3%) had a cognitive score of less than 25.5, and 228 people (87.7%) had a cognitive score of more than 25.5.

The results of the COST test showed that the most frequent correct response was related to the person's ability to recognize objects (100%) and memorization (99.6%), while the least frequent correct response was related to the dimension of recall (61%).

The mean and standard deviation of the nutritional status components in the elderly showed in Table 2.

The results of Spearman's correlation coefficient test showed a significant positive relationship between nutritional status and cognitive functioning in the elderly covered by health centers in Amol (r=0.46, p=0.001).

Comparison of the demographic information of the elderly covered by health centers in Amol concerning nutritional status (univariate) showed that gender (p=0.045), life companions (p=0.001), education (p=0.044), occupation (p=0.025), BMI (p=0.001), marital status (p=0.001), having an underlying disease (p=0.033), cardiac diseases (p=0.003), gastrointestinal diseases (p=0.048), musculoskeletal disorders (p=0.001), number of medications used (p=0.001), number of underlying diseases (p=0.001), physical activity (p=0.001), and depression (p=0.001) had significant relationships with the nutritional status of the elderly.

According to Table 3, nutritional status had significant relationships with the cognitive functioning of the elderly (p=0.001).

The results of multivariate logistic regression analysis for factors related to cognitive functioning showed that the variables of education, occupation, physical activity, and use of multivitamins were significantly associated with cognitive functioning. Also, the results showed that people with a normal nutritional status had better cognitive functioning than those exposed to malnutrition or malnourished (Table 4).

Table 1) Results of demographic data of the elderly covered by Amol health centers (n=260)

Variables		Number (%)
Gender	Female	129 (49.6)
	Male	131 (50.4)
Age (years)	60-64	107 (41.2)
	65-74	113 (43.5)
	≥75	40 (15.4)
Marital status	Married	199 (76.5)
	Single/widowed/divorced	61 (23.5)
Education level	Illiterate	105 (40.4)
	School dropout	105 (40.4)
	Diploma	26 (10)
	University education	24 (9.2)
Income status	Less than living expenses	172 (66.2)
	Equal to living expenses	82 (31.5)
	More than living expenses	6 (2.3)
Occupational status	Retired	108 (41.5)
	Self-employed	28 (10.8)
	Employee/worker	12 (4.6)
	Housewife	112 (43.1)
Underlying disease	Yes	226 (86.9)
	No	34 (13.1)
Type of underlying disease	Respiratory diseases	20 (7.7)
	Renal diseases	16 (6.2)
	Cardiac diseases	67 (25.8)
	Hypertension	147 (56.5)
	Gastrointestinal diseases	48 (18.5)
	Musculoskeletal disorders	126 (48.5)
Number of underlying diseases	1-2	148 (56.9)
	>2	78 (30)
	None	34 (13.1)
Number of medications used	≤5	160 (61.5)
	>5	100 (38.5)
Multivitamin intake	Yes	120 (46.2)
	No	140 (53.8)
Life companions	Spouse	195 (75)
	Children	30 (11.5)
	Alone	35 (13.5)
Daily physical activity	Yes	193 (74.2)
	No	67 (25.8)
BMI (kg/m²)	21>	20 (7.7)
	21-25	71 (27.3)
	25<	169 (65)
Smoking	Yes	32 (12.3)
	No	228 (87.7)

Table 2) The mean±SD results of the nutritional status components in the elderly understudy supported by Amol health centers

Dimensions	Normal	At the risk of malnutrition	Malnourished	Total
Anthropometric measurements	7.60±0.74	6.87±1.16	4.30±2.24	7.34±1.09
Global assessment	7.98±0.97	6.05±1.36	5.00±1.15	7.43±1.41
Dietary intake	8.06±0.76	7.10±0.94	5.35±1.28	7.76±1.00
Self-assessment of nutritional health	3.17±0.74	2.20±0.90	1.28±0.69	2.8±0.92

Table 3) Comparison of the demographic information of the elderly covered by health centers in Amol based on cognitive functioning and nutritional status (univariate analysis)

Variables		Cognitive functioning			Nutritional status			
		>25.5	<25.5	p-value	Normal	At risk of malnutrition	malnourished	p-value
Age (years)	60-64	8 (7.5)	99 (92.5)	0.001[a]	80 (74.8)	23 (21.5)	4 (3.7)	0.51[a]
	65-74	12 (10.6)	101 (89.4)		72.6 (82)	30 (26.5)	1 (0.9)	
	≥75	12 (30)	28 (70)		70(28)	10(25)	2 (5)	
Gender	Female	20 (15.5)	109 (84.5)	0.12[a]	87 (67.4)	36 (27.9)	6 (4.7)	0.045[a]
	Male	12 (9.2)	119 (90.8)		103 (87.6)	27 (20.6)	1 (0.8)	
Life companions	Spouse	15 (7.7)	180 (92.3)	0.001[a]	158 (81)	35 (17.9)	2 (1)	0.001[a]
	Children	9 (30)	21 (70)		15 (50)	11 (36.7)	4 (13.3)	
	Alone	8 (22.9)	27 (77.1)		17 (48.6)	17 (48.6)	1 (2.9)	
Education level	Illiterate	30 (28.6)	75 (71.4)	0.001[b]	68 (64.8)	32 (30.5)	5 (4.8)	0.044[b]
	School dropout	2 (1.9)	103 (98.1)		77 (73.3)	26 (24.8)	2 (1.9)	
	Diploma	0	26 (100)		22 (84.6)	4 (15.4)	0	
	University student	0	24 (100)		23 (95.8)	1 (4.2)	0	
Occupational status	Retired	12 (11.1)	96 (88.9)	0.064[b]	89 (82.4)	18 (16.7)	1 (0.9)	0.025[b]
	Self-employed	0	28 (100)		21 (75)	7 (25)	0	
	Employee	1 (8.3)	11 (91.7)		6 (50)	6 (50)	0	
	Housewife	19 (17)	93 (83)		74 (66.1)	32 (28.6)	6 (5.4)	
Income status	Less than living expenses	25 (14.5)	147 (85.5)	0.35[b]	116 (67.4)	50 (29.1)	6 (3.5)	0.055b
	Equal to living expenses	7 (8.5)	75 (91.5)		68 (82.9)	13 (15.9)	1 (1.2)	
	More than living expenses	0	6 (100)		6 (100)	0	0	
BMI	21>	4 (20)	16 (80)	0.28[b]	10 (50)	7 (35)	3 (15)	0.001b
	21-25	9 (12.7)	62 (87.3)		47 (66.2)	22 (31)	2 (2.8)	
	25<	19 (11.2)	150 (87.7)		133 (78.7)	34 (20.1)	2 (1.2)	
Marital status	Married	15 (7.5)	184 (92.5)	0.001[a]	58 (79.4)	38 (19.1)	3 (1.5)	0.001a
	Single	17 (27.9)	184 (72.1)		32 (52.5)	25 (41)	4 (6.6)	
Underlying diseases	Yes	28 (12.4)	198 (87.6)	0.918[a]	59 (70.4)	60 (26.5)	7 (3.1)	0.033a
Chronic diseases	Cardiac diseases	9 (13.4)	58 (86.6)	0.74[a]	39 (58.2)	24 (35.8)	4 (6)	0.003[a]
	Respiratory diseases	1 (5)	19 (95)	0.3[a]	14 (70)	5 (25)	1 (5)	0.79[a]
	Gastrointestinal diseases	6 (12.5)	42 (87.5)	0.96[a]	29 (60.4)	16 (33.3)	3 (6.2)	0.048[a]
	Musculoskeletal disorders	19 (15.1)	107 (84.9)	0.187[a]	79 (62.7)	43 (34.1)	4 (3.2)	0.001[a]
	Diabetes	11 (12.4)	78 (87.6)	0.98[a]	61 (68.5)	25 (28.1)	3 (3.4)	0.48[a]
	Hypertension	22 (15)	125 (85)	0.137[a]	100 (68)	42 (28.6)	5 (3.4)	0.109[a]
	Renal diseases	2 (12.5)	14 (87.5)	0.98[a]	11 (68.8)	5 (31.2)	0	0.65[b]
Number of underlying diseases	<2	16 (10.8)	132 (89.2)	0.001[a]	116 (78.4)	29 (19.6)	3 (2)	0.001[a]
	>2	12 (15.4)	66 (84.6)		43 (55.1)	31 (39.7)	4 (5.1)	
Number of medications used	5>	18 (11.2)	142 (88.8)	0.51[a]	131 (81.9)	27 (16.9)	2 (1.2)	0.001[a]
	5<	14 (14)	86 (86)		59 (59)	36 (36)	5 (5)	
Vitamin intake	Yes	9 (7.5)	111 (92.5)	0.02[a]	84 (70)	33 (27.5)	3 (2.5)	0.535[a]
Physical activity	Yes	16 (8.3)	177 (91.7)	0.001[a]	155 (80.3)	35 (18.1)	3 (1.6)	0.001[a]
Smoking	Yes	2 (6.2)	30 (93.8)	0.26[a]	25 (78.1)	7 (21.9)	0	0.79[b]
Depression symptoms	Lack of depression	7 (5)	133 (95)	0.001[a]	132 (94.3)	7 (5)	1 (0.7)	0.001[a]
	Mild depression	18 (20.7)	69 (79.3)		48 (55.2)	38 (43.7)	1 (1.1)	
	Moderate depression	7 (21.2)	26 (78.8)		10 (30.3)	18 (54.5)	5 (15.2)	
Nutritional status	Normal nutrition	9 (7.4)	181 (3.95)	0.001[a]	-	-	-	-
	At the risk of malnutrition	19 (2.30)	44 (8.69)		-	-	-	
	Malnourished	4 (1.57)	3 (9.42)		-	-	-	

[a] Chi-square test; [b] Fisher's exact test

Table 4) The results of multivariate logistic regression analysis for factors related to the cognitive functioning of the elderly covered by Amol health centers

Variables		B	Confidence interval (95% CI)		Exp. (β)	p-value
			Lower limit	Upper limit	OR	
Age (years)	60-64	2.01	0.48	11.72	7.49	0.15
	65-74	2.28	0.77	12.3	9.82	0.07
Gender	Male/Female	-4.2	0.001	3.09	1.34	0.06
Education	Illiterate/literate (under high school diploma/diploma/above diploma)	-5.6	0.001	0.064	0.004	0.001
Marital status	Single/married	-3.85	0.001	39.2	0.021	0.31
Occupational status	Employed or retired	-5.34	0.001	0.41	0.005	0.019
	Housewife	0.11	0.016	76.14	1.12	0.95
	Self-employed					
Income status	Less/more than living expenses	0.003	0.16	6.14	1.003	0.99
Life companions	Spouse	-2.63	0.001	11.41	0.079	0.48
	Children	0.073	0.06	17.11	1.07	0.95
	Alone					
BMI (kg/m²)	21>	-0.48	0.054	7.011	0.61	0.69
	21-25	1.34	0.59	24.77	30.82	0.16
	25<					
Chronic Diseases	Respiratory diseases	-1.69	0.001	90.36	0.18	0.59
	Musculoskeletal disorders	0.69	0.31	12.5	1.99	0.46
	Hypertension	-0.22	0.12	5.24	0.8	0.81
Number of medications used	5>	-1.02	0.029	1.05	0.175	0.058
	5<					
Physical activity	Physical activity	2.27	1.32	71.04	9.71	0.025
Smoking	Yes/No	1.15	0.103	97.22	3.17	0.509
IADL	Score	0.21	0.66	2.28	1.23	0.5
Vitamin intake	Yes/No	2.27	1.32	71.04	9.71	0.025
Depression symptoms	No depression	-0.016	0.092	10.56	0.98	0.98
	Mild depression	-0.57	0.078	4.02	0.56	0.56
	Moderate depression					
Nutritional status	Normal	3.81	6.03	34.12	45.44	0.001
	At risk of malnutrition and malnourished					

Discussion

The results of the present study showed that most of the elderly (73.1%) had a normal nutritional status, 24.2% were at risk of malnutrition, and 2.7% were malnourished. In different studies, the nutritional status of the elderly varied in different situations (e.g., hospitalized elderly, residents of nursing homes, and elderly living in the community). In this regard, Azizi *et al.*, found that 26.7% of the elderly were at risk of malnutrition, and 2.5% were malnourished [15]. Moreover, in a study by Masomy *et al.*, 13.5% were at risk of malnutrition, and 5.8% were malnourished [11].

In another study by Talhaoui *et al.* on the relationship between malnutrition and cognitive disorder among 179 elderly in three nursing homes and a health center in Morocco, 5.2% of the subjects were malnourished, and 49.4% were at risk of malnutrition [32]. Some studies have even reported higher prevalence rates of malnutrition. In a study by Shawky *et al.* on 120 elderly living in the nursing homes of Cairo, Egypt, the prevalence of malnutrition was 10.8%, and 40.8% were at risk of malnutrition [33]. Moreover, El-Zoghbi *et al.* [17] investigated the relationship between cognitive function and nutritional status in 460 elderly over 65 years in three nursing homes of Beirut. The prevalence of malnutrition was estimated at 12.6%, and 48.7% of the elderly were at risk of malnutrition [17]. The differences in the prevalence of malnutrition in the elderly may be related to their cultural, social, and economic characteristics in different regions. Also, these differences can be explained by the fact that the hospitalized elderly or those living in nursing homes are at the highest risk of malnutrition [34].

In the present study, 3.7% of the elderly, aged 64-60 years, 0.9% of the elderly, aged 65-74 years, and 5% of the elderly, aged over 75 years, were malnourished, and there was no significant correlation between age and nutritional status. Similarly, in studies by Doostan *et al.* [35] and Masomy *et al.* [11], no relationship was observed between age and nutritional status, whereas in studies by Arsalani *et al.* [12] and Khater *et al.* [33], a significant correlation was observed. Moreover, the findings of the present study showed that the percentage of malnourished women was higher than men, and the relationship between nutritional status and gender was significant. This finding is in line with the results reported by Arsalani [12] and Doostan [35], whereas in the study by Khater [33], no significant correlation was found between gender and nutritional status of the elderly.

In the present study, the prevalence of malnutrition and the risk of malnutrition were lower in people with higher education levels, and the relationship between educational level and nutritional status was

significant, which is in line with the results reported by Arsalani *et al.* [12]. Generally, higher education may lead to more income and higher awareness about nutritional health and lifestyle, leading to better nutrition in the elderly. However, this relationship was not significant in the study by Khater *et al.* [33]. The findings of the present study showed that most of the elderly (87.7%) had a good cognitive status, and 12.3% obtained a low cognitive score. In the study by Sharifi *et al.* [36], the prevalence of dementia was 7.9%, and in the study by Wang *et al.* [3], 12.2% had moderate cognitive impairments. On the other hand, in the study by Talhaoui *et al.*, the percentage of elderly people with cognitive impairment was very high (69.8%) [32]. The discrepancy between the results can be attributed to differences in the tools used or differences in the cultural and social characteristics of the elderly.

In the present study, there was a significant relationship between age and cognitive status of the elderly, which is in line with the results reported by Sharifi *et al.* [36] and Khater *et al.* [33]. However, in the study by El-Zoghbi *et al.*, there was no significant relationship between age and cognitive status of the elderly [17]. Moreover, in the present study, no significant relationship was found between gender and cognitive status of the elderly. Similarly, in the study by Sharifi *et al.* [36], this relationship was not significant, whereas in the study by Talhaoui *et al.*, cognitive impairment was higher in women than men [32]. In the present study, there was a significant relationship between the level of education and cognitive functioning of the elderly, which is in line with several previous studies [17, 32, 33, 36]. The results of Spearman's correlation coefficient test showed a significant positive relationship between nutritional status and cognitive functioning of the elderly, covered by health centers in Amol, Iran; this relationship was also significant in the regression model. In other words, people with normal eating habits had better cognition than people with malnutrition. In studies by El-Zoghbi [17], Shanhai [22], and Khater [33], the nutritional status of the elderly was related to their cognitive functioning, which is in line with the results of the present study. However, the results of some studies, including studies by Sundsvold *et al.* [37] and Shatenstein *et al.* [20], are not in line with the present study.

This study was performed on the elderly living in the community. As the elderly living in nursing homes were not examined, it might have affected the estimates of the prevalence of nutritional and cognitive disorders.

Conclusion

The results of the present study showed that the majority of the elderly had a good nutritional status and cognitive functioning. The elderly's nutritional status, education, occupation, daily physical activity, and multivitamin use were influential factors in their cognitive functioning. There is a relationship between nutritional status and cognitive functioning of the elderly covered by health centers in Amol, Iran, and paying attention to the diet of the elderly and teaching proper nutrition to the elderly or their families can be useful to prevent cognitive disorders. It seems that in addition to attention to the dietary intake of the elderly, educational interventions, regular exercise programs, and the use of multivitamins can be useful in preventing cognitive disorders.

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