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Investigation of cognition, nutrition, independence and swallowing difficulty, relationship with quality of life, and effect levels in elderly people with Alzheimer's disease living with their families

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Abstract

Background & Objective: The aim of this study is to determine the deteriorations in nutrition, swallowing, cognition, and independence among geriatric people with Alzheimer's disease who are living with their families (PWADLF), to examine how these conditions relate to and how much they affect the patients' qualities of life. *Methods:* Standardized Mini-Mental Examination (SMMSE), Barthel Index (BI), Bedside Water Swallow Test (BWST), The Mini Nutritional Assessment (MNA), and Nottingham Health Profile (NHP) were determined. *Results:* According to the BWST results, 31.1% of patients had dysphagia. It was observed that 49.6% of the patients were at risk of malnutrition, and 30.3% were malnourished; 16% were highly dependent, 58.8% were moderately dependent, and only 1.7% were completely independent. It was observed that the SMMSE, MNA, and BI variables had a significant impact on the NHP variable.
Conclusions: It was found in this study that elderly PWADLF are at risk for dysphagia and malnutrition. As the stage of patients progressed, it was observed that the risk of dysphagia and malnutrition increased, and their independence levels and quality of life decreased. It was found that quality of life is related to independence, nutrition, and cognitive level, and these conditions have a significant effect on the quality of life, respectively. Therefore, conditions such as malnutrition, which may decrease the quality of life in people with Alzheimer's disease, should be evaluated early, and necessary corrective measures taken.

Keywords: Alzheimer disease, quality of life, nutrition, independence, swallowing, elderly, relationship, effect, dementia

INTRODUCTION

Alzheimer's disease (AD) is a progressive neurodegenerative disease that causes a decline in cognitive functions, progressive deterioration in skills required for daily living, and changes in behavior.[1] As the disease progresses with cognitive deterioration in AD patients, it becomes difficult for them to perform the tasks necessary to take care of themselves, and their levels of dependency in daily living activities increases.[2]

The cognitive, psychological, and behavioral problems of individuals with AD and their dependency in daily living activities negatively affect the quality of life of both the patients and the caregivers.[3] Dysphagia and other feeding problems can also be seen in individuals with AD.[4] Changes in the body that result from underfeeding that is due to diseases are defined as malnutrition. The presence of malnutrition leads to secondary health problems such as memory loss, delayed wound healing, and pressure ulcers.[5] As AD progresses, dysphagia, which is defined as an obstruction in the passage of food from the mouth to the stomach, and difficulty in swallowing may be observed.[6,7] The prevalence of dysphagia was found to be 80% in patients with AD.[8] Feeding problems and swallowing difficulties can further affect the quality of life of patients.[9] Therefore,

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it is important to determine the factors the affect quality of life in this patient group.

There were previous studies that looked at cognitive status, malnutrition, independence levels, and quality of life in individuals with AD, examining each aspect separately or a few together.[10-12] However, most previous studies have only looked at the associations these conditions have with quality of life.[13-15] In addition, studies that examined how much other related factors affected geriatric individuals with AD are limited.[16, 17] No study has yet been done that looks at the effects of dysphagia on quality of life in geriatric patients who have dementia and are living with their families, had all these conditions evaluated together and comparing their effects on quality of life. Therefore, the objective of this study was to determine the deteriorations in nutrition, swallowing, cognition, and independence among geriatric AD patients who are living with their families, to be able to examine how these conditions relate to and how much they affect the patients' qualities of life.

METHODS

This cross-sectional study, which was approved by the hospital ethics committee (decision number: 66/15), was conducted with participants who came to the neurology clinic's dementia outpatient clinic. The study was explained to all participants and their relatives, and informed consent obtained.

Participants

The participants had all been diagnosed with AD in the neurology clinic, according to criteria of the DSM 5 (the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition) and the National Institutes of Neurological and Communicative Disorders and Stroke and Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA). These patients were then followed up in the clinic, and patients who were aged 65 years and over and living with their families were included in the study.

Exclusion criteria were that they had additional neurological problems (history of stroke, multiple sclerosis, Parkinson's disease), psychiatric disorders (delirium, major depressive disorder, schizophrenia), and other chronic diseases (heart disease, blood pressure, diabetes mellitus).

Procedure

The questions in the various scales were asked by clinicians. The neurologist first applied the Standardized Mini-Mental Examination (SMMSE) to the patients. The SMMSE and the Clinical Dementia Rating Scale (CDR) determined the stage of the disease as mild, moderate, or advanced. Another clinician who did not know the cognitive levels of these patients then evaluated their swallowing, nutrition, and independence, while another separate clinician evaluated the quality of life without knowing the results of the other evaluations.

Evaluation Tools

Cognitive status assessment: SMMSE has been validated and used in many countries. Indeed, it is the gold standard test throughout the world for screening for AD in the elderly by assessing cognitive status. The Turkish version had 11 items, and five subsections.[18] The assessment has five sub-dimensions: orientation (10 points), recording memory (3 points), attention and calculation (5 points), recall (3 points), and language (9 points). These were scored out of a total of 30 points.

Nutritional status assessment: The Mini Nutritional Assessment (MNA), which is viewed as the gold standard test for screening and evaluating malnutrition in the elderly and used in many studies, was used in this study.[19, 20] The patients were asked 18 questions, 15 of which were based on verbal inquiries and 3 on anthropometric measurements. The verbal questions in the MNA asked about the patients' general nutritional evaluations and dietary habits. The anthropometric measurements, including body mass index (BMI), upper arm circumference, and calf circumference were also determined. These results were scored out of 30 points. Based on the results, scores of 24-30 points were considered normal diets, those totaling 17.5-23.5 points indicated a risk of malnutrition, and those with scores of less than 17 were considered to be malnourished.

Swallowing difficulties assessment: The Bedside Water Swallow Test (BWST) was performed according to Smith *et al*. who recommended the simultaneous application of a 10 ml water swallow test and pulse oximetry.[21] In our previous study, we found BWST to be consistent with the instrumental evaluation in clinical practice in individuals with AD.[7] In BWST, six observations that may occur while drinking 10 milliliters (ml) of water and after drinking were evaluated. These observations were: (1) taking more than one swallow to finish the 10mL water (2) drooling of

water from the mouth, (3) absence of laryngeal movement while drinking the water and after 10 minutes, (4) a 2% and above decrease in oxygen saturation while drinking, (5) coughing after drinking the water (5), and (6) a change in voice. The presence of each of these six observations was given a score of 1, and the absence of it was given a 0. If the total score was between 0 and 2, it was interpreted as normal swallowing, and between 3 and 6 as having difficulty swallowing.

Independence levels assessment: Barthel Index (BI), which is frequently used in individuals with dementia, was used.[22] With BI, the functionality of the patients in activities of daily living was evaluated in 10 items (movement: transfer, ambulation/wheelchair use, going up and down stairs, personal hygiene and dressing: self-regulation, bathing, toilet use, nutrition, excretion: urine control, stool control) evaluated. Scoring between 0-100 was made in BI and the level of independence of the patients in functional activities was determined. The scores of 0-20 points was considered fully dependent; 21-61 points, highly dependent; 62-90 points, moderately dependent; 91-99 points, mildly dependent; 100 points, fully independent.

Quality of life assessment: The Nottingham Health Profile (NHP), a general health questionnaire, was used.[23] NHP is one of the commonly used generic scales in the assessment of quality of life in individuals with dementia, and internal consistency and test-retest results has been determined by applying it to individuals with mild to severe dementia with a mean SMMSE of 13.[24, 25] This scale was used in our study because it can be applied at every stage. With the NHP, a total of 38 questions in six categories were asked: pain, physical activity, energy, sleep, social isolation, and emotional reaction. The total score was calculated by adding the scores ranging from 0 to 100 for the questions answered as "Yes" or "No" in each subsection. The quality of life was worse with an increase in the total score.

Statistical analysis

Analyses were carried out using the IBM SPSS 25.0 program. Descriptive findings are given in numbers, percentages, mean, standard deviation, minimum and maximum values, median, and quarters. The conformity of the data to the normal distribution was examined with Kolmogorov–Smirnov tests, Shapiro–Wilk tests, and kurtosis/skewness values. It was determined that the skewness and kurtosis values were in the range of ±2, and the data were normally distributed.[26] An ANOVA test was performed to determine whether the research variables differed according to Alzheimer's stages. Bonferroni test findings were taken into account in the multiple comparison tests performed to determine between which stages the difference was. Relationships between variables were examined with the Pearson correlation test. The effects of the independent variable(s) on the dependent variable were evaluated by linear regression analysis. Multivariate regression analysis was performed to determine the effect of variables with significant effects on the dependent variable as a result of univariate regression analysis. The enter method was used in the analysis. The statistical significance level was $p < 0.05$. In addition, according to the results of the regression analysis, it was interpreted that the efficacy of the variables that were statistically significant increased as the β value increased.

RESULTS

A total of 119 patients (69 males; 50 females) between the ages of 65 and 97 (mean age 76.05 ± 9.25 years) who met the inclusion and exclusion criteria were recruited. (Table 1)

As for SMMSE, the mean score was 14.25 ± 5.27, with 16.8% being mild, 69.7% moderate, and 13.4% advanced. According to the BWST

Table 1: Patients' demographic characteristics

Variable		n	% mean ± SD
Age		119	76.05 ± 9.25
Gender	Female	69	58.0
	Male	50	42.0
Education	Illiterate	50	42.0
	Literate	69	58.0

Table 2: Patients' clinical findings

Variable		n	% mean ± SD
SMMSE		119	14.25 ± 5.27
BWST	Dysphagia Presence	37	31.1
	Dysphagia Absence	82	68.9
	Total	119	1.94 ± 1.33
MNA	Malnourished	36	30.3
	At risk of malnutrition	59	49.6
	Normal nutrition	24	20.2
	Total	119	18.97 ± 5.40
BI	Fully dependent	14	11.8
	Highly dependent	19	16.0
	Moderately dependent	70	58.8
	Mildly dependent	14	11.8
	Fully independent	2	1.7
	Total	119	67.65 ± 28.17
NHP		119	269.82 ± 110.42

Standardized Mini-Mental State Examination (SMMSE), Bedside Water Swallow Test (BWST) Mini Nutritional Assessment (MNA), Barthel Index (BI), Nottingham Health Profile (NHP)

results, 68.9% of the patients were normal, and 31.1% had dysphagia (Table 2).

It was determined that 49.6% of the patients, with a mean MNA of 18.97 ± 5.40, were at risk of malnutrition, and 30.3% were malnourished (Table 2)

For the BI, 16% of the patients were highly dependent, 58.8% were moderately dependent, and only 1.7% were completely independent.

The mean of NHP was 268.82 ± 110.42. Details of the SMMSE, BWST, MNA, BI, and NHP results are given in Table 2.

When the SMMSE, MNA, BWST, BI, and NHP at different stages of AD were compared, it was seen that all variables showed significant deterioration. While SMMSE, MNA, and BI scores decreased from mild to advanced stages, BWST and NHP scores increased (Table 3).

According to the correlation analysis findings, there was a significant ($p < .05$) correlation between NHP and the SMMSE, MNA, and BI variables (Table 4).

As a result of the univariate regression analysis to determine the effect of the variables on the NHP

Table 3: Comparison of variables according to Alzheimer's disease stages

	Alzheimer's disease stages			Test Statistics	
Variables	**mild (n=16) Mean ± SD**	**moderate (n=83) Mean ± SD**	**advanced (n=20) Mean ± SD**	**F**	**p**
SMMSE	22.06 ± 1.52	14.75 ± 2.81	5.95 ± 3.39	152.105	**<0.001**
MNA	22.15 ± 4.35	19.69 ± 4.74	13.40 ± 5.09	18.290	**<0.001**
BWST	1.13 ± 1.25	2.07 ± 1.38	2.05 ± 0.94	3.605	**0.03**
BI	86.88 ± 14.93	72.11 ± 21.79	33.75 ± 33.08	28.082	**<0.001**
NHP	201.76 ± 87.53	252.34 ± 89.87	390.84 ± 119.01	21.743	**<0.001**

Standardized Mini-Mental State Examination (SMMSE), Bedside Water Swallow Test (BWST) Mini Nutritional Assessment (MNA), Barthel Index (BI), Nottingham Health Profile (NHP)

Table 4: Correlation Analysis Findings Regarding NHP Variables

		NHP
Age	r	0.148
	p	0.109
Education	r	-0.164
	p	0.075
SMMSE	r	-0.583
	p	**<0.001**
BWST	r	0.158
	p	0.085
MNA	r	-0.606
	p	**<0.001**
BI	r	-0.641
	p	**<0.001**

Standardized Mini-Mental State Examination (SMMSE), Bedside Water Swallow Test (BWST) Mini Nutritional Assessment (MNA), Barthel Index (BI), Nottingham Health Profile (NHP)

variable, it was observed that the SMMSE, MNA, and BI variables had a significant impact. When multivariate regression analysis was performed to determine the effect of these variables on the NHP variable, the regression model was significant ($F = 36.293$; $p < 0.001$). Independent variables in the model were responsible for 47.3% of the total variance in NHP scores. SMMSE ($\beta = -0.258$; $p = 0.005$), MNA ($\beta = -0.261$; $p = 0.010$), and BI ($\beta = -0.278$; $p = 0.014$) variables were found to have a significant negative effect upon NHP. VIF values were an indication that there was no multicollinearity problem between independent variables (Table 5).

DISCUSSION

In this study, 31.1% of the patients had dysphagia as determined by BWST. In previous studies on patients with AD, the incidence of dysphagia has been reported at different rates.[8,27,28] Factors such as the evaluation method used, the stage of the patients, and comorbid conditions probably affect the dysphagia rate.[4,27] Our finding is similar to what was reported by Volicer *et al*.[29] The reason for this result may be that both studies performed an additional clinical evaluation for swallowing along with the water drinking test. Voicer *et al*. used cervical auscultation together with the water drinking test.[29] However, Takagi *et al.* found swallowing difficulties in only 7.32% (17/232) of the patients.[28] This may be due to the difference in the disease stage and the evaluation method used. In Takagi *et al*. study, 45.6% of the patients were in the very mild to mild phase, and 3 ml of water was used in the water-drinking test.[28] In our study, most of the patients were in the middle stage (69.7%) and clinical swallowing evaluation was performed with an oxygen saturation device to assess silent aspiration; moreover, a 10 ml water-drinking test was used. In addition, many studies on patients with dementia have shown that the likelihood of dysphagia increases as the disease stage progresses.[7,8,17,30] In the results of our study, similar to the literature, the incidence of dysphagia increased towards the advanced stage. This shows that as the disease progresses, not only cognitive functions, but also the swallowing deteriorated.

In our study, according to the MNA results, 49.6% of all patients were at risk of malnutrition, and 30.3% of them were malnourished. A number of studies have used MNA as the gold standard test for screening and assessment of malnutrition in the elderly.[31] Yıldız *et al*. evaluated individuals with dementia at all stages using MNA and found 32.89% of the patients had malnutrition and 48.68% were at risk of malnutrition. This results

Table 5: Regression analysis findings regarding the variable

Variables	B	SD	β	t	p	VIF
Fixed	520.535	28.448		18.298	<0.001	
SMMSE	-5.408	1.873	-0.258	-2.887	**0.005**	1.790
MNA	-5.325	2.038	-0.261	-2.613	**0.010**	2.229
BI	-1.088	0.437	-0.278	-2.491	**0.014**	2.782
R: 0.697	**R^2**: 0.486	**Adjusted R^2**: 0.473		**F**: 36.293	**p**: <0.001	
The dependent variable: NHP						

Standardized Mini-Mental State Examination (SMMSE), Bedside Water Swallow Test (BWST) Mini Nutritional Assessment (MNA), Barthel Index (BI), Nottingham Health Profile (NHP)

correspond to that of our study.[10] The visual and tactile agnosia, apraxia, and motor difficulties prevents the patients from feeding themselves. Chewing and swallowing difficulties, forgetting meal times, loss of appetite may also aggravate the disabilities.[9] Takagi *et al*. reported decreased muscle mass to be correlated with difficulties in swallowing.[28] With the increasing motor, sensory and cognitive difficulties as the disease progresses, there may be increase the probability of malnutrition, as shown in this study.[9]

The mean SMMSE of our patients was 14.25 ± 5.27, reflecting the stage of the disease. However, the mean BI of our patients with similar SMMSE means as in Sato *et al*.'s study was 67.65 ± 28. In the study of Sato *et al*., the mean BI of individuals with moderate and mild AD stage was 43.1 ± 31.5.[8] There was thus a higher mean BI in our study, which include advanced stage AD. One reason for the higher mean BI in our patients, may be that those with another chronic or neurogenic disease were excluded in the study. The additional disease condition may aggravate the independence level of the patients.

According to the correlation analysis in our patients, ıt was observed that the quality of life was associated with the level of independence, malnutrition, and cognitive status. We found that cognitive impairment was inversely proportional to the quality of life in people with AD, which is similar to that reported by Wetzels *et al*., and Mjørud *et al*.[32,33] Many studies in the literature also support these results. On the other hand, in our study, there was no relationship between quality of life and education level or age. This is similar to the report by Andersen *et al*., who failed to find a correlation between socio-demographic data and quality of life.[16] However, Li *et al*. and Marventano *et al*. found that quality of life was better with higher education levels.[34,35] Furthermore, Banerjee *et al*. found that the quality of life of people with dementia declines with increasing age.[15]

In the current study, quality of life was not found to have a significant correlation with dysphagia, which was determined by using both saturation measurement and water drinking test. One reason for this may be that patients were unaware of their dysphagia because many individuals with dementia only complained of dry mouth, not swallowing difficulties. Another reason may be that the dysphagia severity of the patients were not at a level that will affect their general health status and quality of life. Because the BWST average of all patients was 1.94, which was still in the 'normal' range. Nevertheless, the BWST of our patients was higher among the moderate (2.07) and advanced (2.05) stage as compared to mild (1.13) stage.

In this study, it was observed that the level of independence had a direct and first-rank effect on the quality of life. Although we expected cognitive status to be primary, our result showed that independence status was more important. This situation may be because the independence levels of the patients decrease further with the effect of all factors such as cognitive impairment, difficulty in swallowing, and malnutrition. Our result of independence being correlated with quality of life is similar to what was reported by Jink *et al*. studies. In a systematic review by Jink *et al*., the quality of life of older people with dementia was significantly affected by physical independence in performing daily living activities (e.g., dressing, mobility, and personal toilets), as observed here.[36]

In our study, malnutrition was found to be the second rank factor affecting the quality of life. This result is consistent with the results found in many studies conducted with geriatric populations. Mantzorou *et al*. and Kimura *et al*. found that, as malnutrition levels are increased in dementia patients, depression levels are also increased.[12, 14] Weight loss, as a result of malnutrition, is also common in individuals with dementia, increasing the risk of complications, such as decreased muscle mass, loss of autonomy and falls, decubitus ulceration, and increased risk of systemic infection. Therefore, all these may help to explain the impaired quality of life of AD patients.[13,37]

In our study, it was observed that the SMMSE level was the third most important variable affecting the quality of life. This is similar to the study by Marventano *et al*. who reported that the quality of life was affected by age, education, and recent health status, but the severity of dementia was the most critical factor in the deterioration of quality of life.[34]

It has also been shown in many studies that chronic health problems have a negative effect on the quality of life; better general health is associated with a higher quality of life among older people with dementia.[38,39] In this study, we have excluded those with chronic disease.

This study has a number of limitations. First, the religion of the patients, their financial factors, and the sociodemographic information of the caregivers in the family were not evaluated. We found the nutritional, swallowing, cognition, and independence states to constitute 47.3% of the factors affecting the quality of life. Therefore,

how the quality of life may be affected by other factors is unknown. Additionally, in this study, only the quality of life and the level of effect were examined. In future studies, the effects of all these factors on each other can also be examined, as well as other conditions that may affect the quality of life.

In conclusion, in this study, it was found that elderly patients with AD living with their families are at risk for dysphagia and malnutrition. As the stage of patients progressed, ıt was observed that the risk of dysphagia and malnutrition increased, and their independence levels and quality of life deteriorated. It was found that quality of life is related to independence, nutrition, and cognitive level. As malnutrition is remediable, therefore it should be evaluated early, and corrective measures taken.

DISCLOSURE

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Conflicts of interest: None

Availability of data and material: All data generated or analysed during this study are included in this article. Further enquiries can be directed to the corresponding author.

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