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RESEARCH ARTICLE

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The Relationship Between Depression and Anxiety in Older Adults and Memory Functionality: An Assessment Using Neuropsychological Tests

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Abstract

This research evaluates memory function, depression and anxiety symptoms in elderly individuals and examines the relationship between these variables. The Digit Span Test and the 10/36 Spatial Recall Test were used to evaluate memory function, and the Depression, Anxiety and Stress Scale-21 was used to evaluate mental health. Participants were reached through Healthy Ageing and Support Centres, Public Education Courses and an easily accessible sampling method. Participants were included in the research based on inclusion and exclusion criteria. The tests and questionnaires were administered by a clinical psychologist and a clinical neuropsychologist. The study sample consisted of 160 volunteer participants aged between 66 and 74. The average age of the participants was M= 68.00 (SD=2.31). The correlation analysis revealed that increasing levels of depression and anxiety were associated with decreasing memory performance. In gender comparisons, while there was no significant difference between female participants and male participants in terms of memory functionality, it was determined that female participants had higher levels of depression and anxiety than male participants. The findings of the research draw attention to the relationship between mental health and cognitive functionality. In conclusion, managing depression and anxiety in older adults is critical for preserving cognitive function. In this regard, multidisciplinary approaches are needed to develop strategies that support both the cognitive and mental health of older adults.

Keywords: *older adults, memory functioning, clinical neuropsychology/neuropsychological assessment, mental health*

Öz

Bu çalışma, yaşlı bireylerde bellek işlevselliği, depresyon ve anksiyete belirtilerini değerlendirmekte olup bu değişkenler arasındaki ilişkiyi incelemektedir. Çalışmada, bellek işlevselliğini değerlendirmek için Sayı Dizisi Testi ve 10/36 Uzamsal Geri Çağırma Testi, ruh sağlığını değerlendirmek için Depresyon, Anksiyete ve Stres Ölçeği-21 kullanılmıştır. Katılımcılara, Sağlıklı Yaş Alma ve Dayanışma Merkezleri, Halk Eğitim Kursları ve kolay ulaşılabilir örneklem yöntemi ile ulaşılmıştır. Dahil olma ve dışlama kriterleri dikkate alınarak bireyler çalışmaya dahil edilmiştir. Test ve anketler, klinik psikolog ve klinik nöropsikolog tarafından uygulanmıştır. Araştırmanın örneklemi, 66 ile 74 yaş arası 160 gönüllü katılımcıdır. Katılımcıların yaş ortalaması M= 68.00 (SS=2.31)'dir. Yapılan korelasyon analizi sonucu, artan depresyon ve anksiyete düzeylerinin azalan bellek performansı ile ilişkili olduğu bulunmuştur. Cinsiyetler arası karşılaştırmalarda, bellek işlevselliği açısından kadınlar ve erkekler arasında anlamlı bir fark bulunmazken, kadınların erkeklere kıyasla daha yüksek depresyon ve anksiyete düzeylerine sahip olduğu belirlenmiştir. Çalışmanın bulguları, ruh sağlığı ile bilişsel işlevsellik arasındaki ilişkiye dikkat çekmektedir. Sonuç olarak, yaşlılık döneminde depresyon ve anksiyetenin yönetilmesi, bilişsel işlevlerin korunması açısından kritik bir öneme sahiptir. Bu doğrultuda, multidisipliner yaklaşımlar ile yaşlı bireylerin hem bilişsel hem de ruhsal sağlıklarını destekleyici stratejiler geliştirilmesi gerekmektedir.

Anahtar Kelimeler: *yaşlı bireyler, bellek işlevselliği, klinik nöropsikoloji/nöropsikolojik değerlendirme, ruh sağlığı.*

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Introduction

Aging is a natural process that leads to various changes in an individual's physical, cognitive and mental processes. In this process, especially memory functionality is recognized as one of the most important cognitive abilities that directly affect the independence of individuals in daily life activities (Park & Reuter-Lorenz, 2009). Age-related cognitive changes may be manifested by various cognitive losses such as decreased information processing speed, decline in attention processes and weakening of working memory (Salthouse, 2010). However, it is suggested that these changes in memory functioning in older individuals may show individual differences and that various environmental, genetic and psychological factors may affect this process (Craik & Bialystok, 2006; Nyberg et al., 2012).

Age-related declines in memory functioning can reduce the individual's capacity to learn new information, cause difficulty in remembering old information, and ultimately result in a holistic weakening of cognitive abilities (Lindenberger, 2014). This process has a significant impact on working memory, executive functions and episodic memory (McDaniel et al., 2008). The decline in memory functionality with aging may result in the loss of independence in daily life skills, and this may lead to the emergence of psychological conditions such as depression, anxiety and stress in older individuals. It has been reported that depression and anxiety, especially in the elderly, negatively affect memory functioning, accelerate the deterioration in memory processes and increase the risk of cognitive decline (Ownby et al., 2006; Butters et al., 2004).

Cognitive functions are affected by many factors such as genetic factors, lifestyle, education level, nutrition and social environment during the aging process (Salthouse, 2010). Memory functioning is one of the most prominent components of cognitive aging, especially in older individuals, and may manifest itself with problems such as slowing of information processing speed, decreased working memory and decreased ability to recall information over time (Craik & Bialystok, 2006). Various neurobiological processes and environmental factors underlie changes in memory performance in old age. For example, significant decreases in the functioning of the prefrontal cortex and hippocampus have been observed with aging, revealing the effects on executive functions and episodic memory (Nyberg et al., 2012; Lindenberger, 2014).

These changes in memory functioning may affect the individual's capacity to lead an independent life and cause impairment in the ability to fulfill daily functions (McDaniel et al., 2008). However, studies show that physical activity, mental stimulation and social interaction are important in maintaining memory functioning in old age (Erickson et al., 2011; Hertzog et al., 2008). Physical exercise, especially aerobic activities, has been shown to support memory functioning by increasing hippocampus volume and slow cognitive decline due to aging (Colcombe & Kramer, 2003; Voss et al., 2013). In addition, regular physical exercise has been found to increase brain plasticity and positively support cognitive functions (Kramer et al., 2004).

Cognitive stimulation is also a critical factor in maintaining memory functioning in old age. Studies show that learning new skills, engaging in cognitive activities and mental exercises can improve memory performance in older adults (Valenzuela & Sachdev, 2009). In particular, activities that increase cognitive stimulation such as solving puzzles, learning a new language, and playing a musical instrument have been found to contribute to memory performance (Park et al., 2014). In addition, educational level is also an important determinant in terms of the development of cognitive reserve in old age, and it has been found that individuals with higher levels of education can maintain their cognitive functions for longer (Stern, 2009).

Social interaction is also of great importance for the protection of cognitive health in older individuals. It has been reported that loneliness and social isolation may cause impairment in memory functions and increase the risk of dementia (Cacioppo & Hawkley, 2009). It has been observed that cognitive functions are better preserved and age-related cognitive decline progresses more slowly in individuals with high levels of social interaction (Haslam et al., 2014). Therefore, elderly individuals' participation in social activities and keeping their

social ties strong are among the protective factors that support their memory performance.

On the other hand, mental health factors are among the factors that directly affect memory functioning in older adults. Depression can have significant negative effects on memory functions and contribute to the deterioration of cognitive functions in older adults (Geda et al., 2006). In addition to memory impairments, depression in the elderly may lead to a decrease in executive functions and attention processes (Butters et al., 2004). Especially late-onset depression has been found to be an important factor that increases the risk of developing dementia and is associated with Alzheimer's disease (Ownby et al., 2006). It has been suggested that the negative effects of depression on memory functioning are linked to neurobiological mechanisms such as hippocampal shrinkage, neuroinflammation and neurotransmitter imbalances (Sheline et al., 2003).

In addition to depression, anxiety disorders are also known to negatively affect memory functioning in older adults (Beaudreau & O'Hara, 2009). Anxiety may cause distraction and increase cognitive load, making it difficult for the individual to encode and recall information (Eysenck et al., 2007). Studies show that the negative effects of chronic anxiety on memory functions are more pronounced especially in older individuals and memory loss progresses faster in these individuals (Balash et al., 2013). Moreover, it is suggested that excessive cortisol release caused by anxiety may lead to cognitive decline in the long term due to its neurotoxic effects on the hippocampus (Sapolsky, 2000).

In the literature, there are various studies investigating the effects of depression and anxiety on memory functioning. For example, a longitudinal study by Yaffe et al. (2010) found that older individuals with depression had a higher risk of cognitive decline compared to their peers without depressive symptoms. Similarly, Gulpers et al. (2016) found that depression may increase the risk of developing dementia in older adults and is an important determinant of cognitive decline. Managing depression and anxiety may play a critical role in preserving memory functioning. Studies have shown that cognitive behavioral therapies (CBT), in addition to antidepressant and anxiolytic drug treatments, can provide supportive effects on cognitive functioning in older adults.

Therefore, research on the relationship between memory functioning and mental health in old age can contribute to the development of interventions that support the cognitive health of older adults. In this context, managing depression and anxiety is of great importance for older adults to maintain their cognitive functions for a longer period of time. In addition, developing multidisciplinary approaches to prevent cognitive decline in elderly individuals will be an important step towards the protection of mental health and memory functioning in old age at both individual and societal levels.

The objective of the present study is to evaluate memory functioning and mental health in old age. In this direction, it was purposed to evaluate the immediate and delayed memory functioning, depression and anxiety levels of individuals aged 65 years and older. A further objective of the study is to elucidate the correlation between memory function and levels of depression and anxiety. The study utilised a relational screening model with the objective of evaluating the relationships between variables.

The hypotheses of the study are as follows:

H1: There is a relationship between age and memory function in old age.

H2: There is a relationship between age and the level of mental disorder symptoms in old age.

H3: There is a relationship between memory function and the level of mental disorder symptoms in old age.

H4: In old age, when educational level is controlled for, the level of mental disorder symptoms is a significant predictor of memory function.

H5: There is a significant difference between genders in terms of memory function.

H6: There is a significant difference between genders in terms of mental disorder symptom level.

Method

Samples and Procedures

The ethics committee report of the study was obtained with the decision numbered 'E.975589' of the meeting held by Süleyman Demirel University Ethics Committee on 20/03/2025. Participants were reached through Healthy Ageing and Support Centres affiliated with municipalities, public education courses, and an easily accessible sampling method. Tests and surveys were administered by clinical psychologists and clinical neuropsychologists. Prior to the commencement of the research, the participants were provided with comprehensive information regarding the process. Following the approval of participants for the study, appointments were scheduled for the administration of tests. Cognitive assessments were conducted in a designated testing environment.

Individuals over the age of 65 who voluntarily agreed to participate in the study were included in the study. The exclusion criteria were being sleepless and tired at the time of the test, illiteracy, alcohol and substance abuse, diagnosis of psychosis, and use of medication that would affect cognitive test performance. The validity and reliability of cognitive tests depend on controlling external and internal factors that may affect an individual's cognitive capacity during the test. In this context, sleep deprivation and fatigue, literacy level, alcohol and substance use, psychotic disorders, and the use of certain medications are among the primary factors that can significantly affect test performance. Sleep deprivation can lead to impairments in attention, short-term memory, decision-making, and executive functions (Killgore, 2010). In particular, functions such as planning, cognitive flexibility, and inhibition have been shown to be significantly weakened in the absence of sleep. Fatigue similarly leads to the depletion of cognitive resources and a decline in performance during testing. In addition, it has been stated that the cognitive performance of individuals with low levels of education may result in low scores on tests, even if they are within normal limits (Manly et al., 1999). Research conducted in the context of Turkey similarly reveals that literacy levels have significant effects on attention and memory tests (Çökmüş & Atabek, 2007). Chronic use of alcohol and various substances has negative effects, particularly on frontal lobe functions, causing impairments in attention, decision-making, impulse control, and learning (Oscar-Berman & Marinkovic, 2007). In substance use disorders, there is a decrease in information processing speed, attention, and short-term memory performance (Verdejo-García et al., 2004). This situation threatens the validity of cognitive tests based on executive functions. In psychotic disorders such as schizophrenia, significant impairments are observed in numerous cognitive domains, including attention, working memory, abstraction, problem-solving, and cognitive flexibility, from the onset of the disorder (Mesholam-Gately et al., 2009). These impairments negatively affect not only clinical assessments but also the individual's daily functioning (Green et al., 2000). Therefore, the test performance of individuals with psychotic disorders is directly affected by disease-related neurocognitive deficits. Some psychoactive medications, particularly benzodiazepines, anticholinergics, and certain antipsychotics, can cause slowing in attention, memory, and processing speed. Barker and colleagues (2004) revealed that long-term benzodiazepine use has lasting negative effects on attention and memory. Similarly, it has been reported that drugs with a high anticholinergic load can cause cognitive impairment in older individuals (Campbell et al., 2009). Factors such as insomnia, illiteracy, alcohol and substance use, psychotic disorders, and the use of certain medications can significantly affect test performance, thereby increasing the margin of error in interpreting test results. Therefore, it is crucial to systematically assess such factors prior to cognitive evaluations. In consideration of the aforementioned criteria, the study was conducted with a total of 160 volunteer participants, 86 of whom were female and 74 of whom were male. The age range of the participants was between 66 and 74 years, with a mean age of M= 68.00 years (SD= 2.31). The sociodemographic information of the participants is presented in Table 1.

Table 1. Sociodemographic Information of the Participants

Variables		n	%
Sex	Female	86	53,75
	Male	74	46,25
Education Level	Primary School	25	15,63
	Secondary School	32	20,00
	High School	51	31,87
	University	52	32,50
Marital Status	Single	53	33,10
	Married	89	55,60
	Divorced	18	11,30
Total		160	%100

Data Analysis

Prior to the analyses related to the research questions, the research data were evaluated in terms of accuracy, missing values and normality assumptions. For descriptive statistics, number and percentage ratios were used for qualitative data, and mean and standard deviation were used for quantitative data. The relationships between variables were evaluated with correlation coefficients.

Data Collection Tool

Spatial Recall Test- SPART: During the test, individuals are asked to remember the location of 6 circles shown on a checkerboard shape with 36 squares (6X6). The test evaluates visual learning and memory. After 3 repetitions, a total learning score is obtained. To assess delayed memory, 15 minutes later, the person is asked to remember the location of the 6 circles without being shown the visual. In this trial, a delayed recall score is obtained (Boringa et al., 2001). It has high test-retest reliability among repeated applications, and the correlation coefficient is r = .79. The Cronbach Alpha value for internal consistency has not been reported. Since the test is a single-session measure designed to assess visual-spatial short-term memory. The correlation obtained from the Wechsler visual memory tests conducted to assess criterion validity is high (Benedict, 1997). The advantage of the test and the reason for its preference is primarily that it allows for the assessment of visual memory and short- and long-term memory performance related to visual memory. In addition, the test is quick to administer and independent of linguistic proficiency.

Digit Span Test – DST: Attention, short- and long-term memory, and working memory assessment tests consist of two parts: forward and backward number sequences. In the forward number sequence, the participant is asked to repeat the numbers read by the test administrator in the same order. In the backward number sequence, the participant is asked to count backwards the numbers read by the test administrator in a specific sequence. (Karakaş, Eski, & Başar, 1996). The test-retest correlation coefficients are r = .82 for the forward number sequence, r = .78 for the backward number sequence, and r = .87 for the total score (Wechsler, 2008). The advantages of the test and the reasons for its preference are that it is quick and standardised, can be applied to a wide age range, including children and adults, is powerful in measuring working memory capacity, and is relatively less affected by factors such as educational level and language skills (Lezak et al., 2012).

Depression, Anxiety and Stress Scale- 21: The Turkish reliability and validity study of the 21-item short form of the scale developed by Lovibond and Lovibond (1995) was conducted by Sarıçam (2018). As a result of the factor analysis, it was found that the scale had 3 sub-dimensions, and it was reported that these three factors had an excellent fit index value in the clinical sample and an acceptable fit index in the normal sample (Sarıçam, 2018). Cronbach's alpha internal consistency reliability coefficients for the depression, anxiety, and stress subscales were α=0.87, α=0.85, and α=0.81, respectively. The test-retest correlation coefficients are r = 0.68 for the depression subscale, r = 0.66 for the anxiety subscale, and r = 0.61 for the stress subscale (Sarıçam, 2018). Anxiety and depression subscales of the scale were used in the study.

Sociodemographic Information Form: The form created by the researchers aims to obtain information such as age, education level, marital status of the participants.

Findings

Before testing the hypotheses, the data were preanalyzed. Depending on the results of the preliminary analysis, parametric and non-parametric statistical methods were chosen. In the normality test analysis, skewness and kurtosis values were first checked. Skewness and kurtosis values were evaluated within the limit of ±1.5, taking into account the recommendation of Tabachnick and Fidell (2013).

Table 2. Descriptive, Reliability, Normality Analysis

	Mean	SD	α	ω	Skewness	Kurtosis
DST- Forward	12,77	4,35			,437	- ,342
DST-Backward	12,26	4,46			,679	,746
SPART- Immediate	15,95	5,59			,227	- ,550
SPART- Delayed	5,79	2,44			,155	- ,779
DASS-21- Anxiety	4,18	3,21	,821	,832	,849	,668
DASS-21- Depression	4,86	3,27	,814	,825	1,289	1,184

DST: Digit Span Test; **SPART**:10/36 Spatial Recall Test; **DASS-21**: Depression, Anxiety and Stress Scale- 21

As a result of the test, it was found that the skewness and kurtosis values in the data were within the limits of normality. Cronbach's Alpha (α) and McDonald's Omega (ω) method were adopted to test the reliability of the scales. The values of preliminary analyses are given in Table 2.

The second research question pertained to the investigation of whether there were significant changes in depression and anxiety symptoms with age. The findings of the correlation analysis demonstrated a decline in anxiety levels and an increase in depression levels with advancing age.

Table 3. Results of Correlation Analysis

Variables		DST- Forward	DST-Backward	SPART- Immediate	SPART- Delayed	DASS-21- Anxiety	DASS-21- Depression
DST- Forward	r	1	,581**	,310**	,316**	-,268**	-,267**
	Sig.		,000	,000	,000	,001	,001
DST-Backward	r	,581**	1	,398**	,356**	-,286**	-,211**
	Sig.	,000		,000	,000	,000	,007
SPART- Immediate	r	,310**	,398**	1	,739**	-,284**	-,259**
	Sig.	,000	,000		,000	,000	,001
SPART- Delayed	r	,316**	,356**	,739**	1	-,220**	-,225**
	Sig.	,000	,000	,000		,005	,004
DASS-21- Anxiety	r	-,268**	-,286**	-,284**	-,220**	1	,701**
	Sig.	,001	,000	,000	,005		,000
DASS-21- Depression	r	-,267**	-,211**	-,259**	-,225**	,701**	1
	Sig.	,001	,007	,001	,004	,000	
Age	r	-,338**	-,298**	-,383**	-,415**	-,034	,057
	Sig.	,000	,000	,000	,000	,762	,555

* p<0.05, **p<0.01

DST: Digit Span Test**; SPART:**10/36 Spatial Recall Test; **DASS-21:** Depression, Anxiety and Stress Scale- 21

Subsequent to the preliminary analyses, the research questions were subjected to evaluation. The primary research question that the study sought to address pertained to the investigation of changes in memory functioning with advancing age in the elderly. The findings of the present study indicate a negative correlation between age and the performance on the forward and backward Digit Span Test (DST), as well as on the immediate and delayed 10/36 Spatial Recall Test (SPART), in individuals over the age of 65. The results of the correlation analysis conducted in this direction demonstrate a statistically significant decrease in test scores with increasing age.

However, it is important to note that neither of these relationships were statistically significant.

The fundamental question that this research seeks to address is whether there is a significant relationship between memory functioning in old age and levels of symptoms of mental disorder. The relationship between the results obtained from the tests and depression and anxiety scores was tested by correlation analysis. The analysis yielded findings indicating a correlation between elevated anxiety and depression scores and diminished performance on the forward and backward DST, as well as on the immediate and delayed SPART. The values of all analyses are presented in Table 3.

The differences between genders of the variables addressed in the study were analysed. As a result of the analysis, it was seen that the difference between genders in memory functionality was not significant, but depression and anxiety levels were statistically significantly higher in female participants. The values obtained as a result of the Independent Samples T Test are shown in **Table 4.**

Table 4. Result of Comparison Analysis Between Groups

Variable	Female		Male			
	M	**SD**	**M**	**SD**	***t***	***p***
DST-Forward	12,48	4,33	13,32	4,36	-1,167	,245
DST-Backward	11,99	4,41	12,76	4,54	-1,052	,294
SPART- Immediate	15,70	5,58	16,41	5,62	- ,764	,446
SPART- Delayed	5,73	2,40	5,89	2,53	- ,381	,704
DASS-21-Anxiety	4,58	3,42	3,44	2,67	2,144	,034
DASS-21-Depression	5,34	4,30	4,00	3,13	2,249	,026

DST: Digit Span Test**; SPART:**10/36 Spatial Recall Test; **DASS-21:** Depression, Anxiety and Stress Scale- 21

Hierarchical regression analysis was applied in order to evaluate whether educational level, age, depression and anxiety level predicted memory functioning. In the first hierarchical regression analysis, age and education level variables were added to the model in the first step. The results of the analysis showed that the education level variable did not predict the SPART- Immediate scores at a significant level (B = 0.163, p = .295), while the age variable predicted the SPART- Immediate scores significantly and negatively (B = -0.317, p < .000). Values of the model, R^2 = .153 F (2,157) = 14.170, p = .000. In the second step, anxiety and depression variables were added to the model and it was found that the model improved significantly (R^2 = .290, F (2,155) = 15.852, p < .000). In this model, age predicted SPART- Immediate scores negatively and significantly (B = -0.322, p < .000), anxiety predicted negatively and significantly (B = -0.330, p < .000), and depression predicted negatively but not significantly (B = -0.119, p = .131). Education level was not a significant predictor (B = 0.190, p = .185).

In the second regression analysis, education level and age variables were added to the model in the first step. It was observed that the education variable did not predict SPART- Delayed scores at a significant level (B = 0.063, p = .632). The age variable was found to be a significant predictor (B = -0.191, p < .000). Values of the model, R^2 = .173, F (2,157) = 16.466, p = .000. In the second step, anxiety and depression variables were added to the model and it was found that the model improved significantly (R^2 = .390, F (2,155) = 24.769, p < .000). In this model, age predicted SPART-Delayed scores negatively and significantly (B = -0.287, p < .000), anxiety predicted negatively and significantly (B = -0.257, p < .000), and depression predicted negatively and significantly (B = -0.261, p < .000). Education level was not a significant predictor (B = 0.031, p = .788).

In the other regression analysis, age and education level variables were added to the model in the first step. It was observed that education level did not predict DST-Backward scores at a significant level (B = 0.048, p = .734). On the other hand, age was found to be a significant and negative predictor (B = -0.216, p < .000). Values of the model, R^2 = .089, F (2,157) = 7.678, p = .001. In the second step, anxiety and depression variables were added to the model and it was found that the model improved significantly (R^2 = .265, F (2,155) = 13.990, p < .000). In this model, age predicted DST-Backward scores negatively and significantly (B = -0.206, p < .000), depression predicted negatively but not significantly (B = -0.150, p = .061), and anxiety predicted negatively and significantly (B = -0.325, p < .000). Education level was not a significant predictor (B = 0.078, p = .544).

In the last regression model, age and education level variables were added to the model in the first step. It was observed that education level did not predict the DST-Forward scores at a significant level (B = 0.050, p = .731). On the other hand, age was found to be a significant and negative predictor (B = -0.258, p < .000). Values of the model, R^2 = .115, F (2,157) = 10.243, p < .000. In the second step, anxiety and depression variables were added to the model and it was found that the model improved significantly (R^2 = .295, F (2,155) = 16.180, p < .000). In this model, age predicted DST-Forward scores negatively and significantly (B = -0.258, p < .000), anxiety predicted negatively and significantly (B = -0.300, p < .000), and depression predicted negatively and significantly (B = -0.199, p = .006). Education level was not a significant predictor (B = 0.081, p = .537).

Conclusion and Discussion

This study examined the relationship between memory functioning and depression and anxiety in elderly individuals. The findings indicate a negative correlation between increasing age and memory function. According to the results of the Number Sequence Test and the 10/36 Spatial Memory Test, increasing age is negatively correlated with both forward and backward number sequence repetition capacity and immediate and delayed spatial memory skills. This supports the negative effect of aging on cognitive processes (Salthouse, 2010). Loss of synaptic plasticity, neurotransmitter changes and decreases in brain volume are thought to underlie these cognitive declines that occur during aging (Lindenberger, 2014).

When examining the relationship between memory function and mental health, a negative correlation has been found between depression and anxiety levels and memory performance. A negative correlation was found between depression and anxiety levels measured by DASS-21 and DST and SPART scores. Existing studies in the literature attempt to explain the relationship between depression and cognitive decline. According to these studies, there is a negative correlation between increased depression scores and the cognitive decline process, and this situation may negatively affect memory functions (Ownby et al., 2006). Similarly, studies explaining the relationship between anxiety and cognitive decline indicate that an increase in anxiety scores disrupts attention processes and shows a negative relationship with memory functionality (Eysenck et al., 2007). The findings of our current study are consistent with this literature.

In our study, no significant difference was found between genders in terms of cognitive function decline in elderly individuals. This finding is consistent with some studies in the literature and suggests that female and male may experience similar levels of decline in cognitive functions during the aging process (McCarrey et al., 2016). It has been suggested that cognitive decline may be gender-independent and that brain aging and neurodegenerative processes may depend on individual and environmental factors rather than biological sex (Ritchie et al., 2018). In particular, it is stated that factors such as education level, physical activity level and social interaction play a protective role in cognitive functions and that these factors may have different effects among individuals regardless of gender (Stern, 2009). Some studies suggest that female perform better in verbal memory tasks in old age, while male may have an advantage in spatial tasks (Asperholm et al., 2019). However, it has been observed that these differences gradually decrease in old age and that there is no significant gender difference in terms of general cognitive functions. The reason for this is thought to be that both female and male are affected by similar neurodegenerative processes during the aging process (Ferreira et al., 2017). The findings of our study reveal that the aging process generally affects cognitive functions in a similar way and that intervention strategies should be developed to protect the cognitive health of older individuals without gender discrimination. Again, when we examined the difference in depression and anxiety symptoms between genders in our study, it was found that female participant showed more symptoms compared to male participant. These results are consistent with previous studies showing that depression and anxiety are more common in female participant (McLean et al., 2011). This finding can be explained by female participants having different coping mechanisms than

male participants in terms of anxiety and emotional processing (Bangasser & Valentino, 2014).

An interesting finding in our study was that no correlational relationship was found between age and anxiety and depression. It is thought that this is because the sample consisted entirely of elderly participants. In order to determine the relationship between age and anxiety and depression, it is thought that it would be more accurate to compare the data of elderly participants with the data of participants in other developmental stages.

Again, within the scope of our study, the predictive effects of educational level, depression, and anxiety levels on different components of memory performance were examined. The findings indicate that educational level is not a significant predictor of any memory measure, whereas anxiety is a significant and negative predictor of all memory measures (SPART-Immediate, SPART-Delayed, DST-Backward, DST-Forward). However, when examining the effect of age on memory performance, it was found to have a significant and negative impact. Depression was found to predict delayed memory (SPART-Delayed) and forward number series (DST-Forward) in a significant and negative manner, but did not predict immediate memory (SPART-Immediate) and backward number series (DST-Backward) in a statistically significant manner. The lack of a significant relationship between educational level and memory performance is consistent with some studies. For example, Mascherek and colleagues (2020) reported that educational level did not significantly predict subjective memory performance when the effects of depression and anxiety were controlled for. Similarly, McLaren and colleagues (2015) also found that educational level did not moderate memory performance in a sample of subclinical depression. One reason for this finding in our study is that the measurement tools used were not affected by educational levels. The use of tools that are more affected by educational levels could change this finding. The negative effect of anxiety is the most consistent aspect of our findings. Beaudreau and O'Hara (2009) showed that high anxiety levels are associated with significant declines in both working memory and episodic memory performance. The negative effect of depression on memory performance is particularly evident in delayed recall and advanced number sequence performance. Sheline and colleagues (2006) noted that as the severity of depression increases, working memory and processing speed decrease, which negatively affects episodic memory performance. Nebes and colleagues (2000) also found that declines in working memory and processing speed significantly mediated cognitive impairment in elderly depressed individuals.

Based on the findings of our study, the importance of interventions to protect memory performance in older individuals can be discussed. In particular, factors such as physical exercise, cognitive stimulation and social interaction can be said to have a protective effect on cognitive functions (Erickson et al., 2011; Haslam et al., 2014). Especially aerobic exercises are known to improve memory performance by increasing hippocampus volume (Colcombe & Kramer, 2003). In this context, elderly individuals should adopt an active lifestyle and their access to psychosocial support mechanisms should be increased. In addition, individuals' participation in activities that provide mental stimulation (e.g., learning a new language, playing a musical instrument) may increase their cognitive reserves and slow down aging-related cognitive losses (Valenzuela & Sachdev, 2009).

This study has some limitations. The fact that the sample group consisted only of individuals between the ages of 65-74 may limit generalizability due to the exclusion of older individuals. Again, the sample size of the study is considered too small to examine the effects of aging. Future studies should be conducted with larger samples. In addition, since it is a cross-sectional study, the causal relationship between the variables cannot be determined with certainty. It is suggested that future studies should more comprehensively examine the interactions between depression, anxiety and memory functioning using longitudinal designs. However, directly examining the effect of depression on cognitive decline through studies using biomarkers will allow us to better understand the neurobiological mechanisms (Sapolsky, 2000). Another limitation is the use of self-reported data on depression and anxiety. Furthermore, the fact that

the internal consistency Cronbach's alpha value of the SPART inventory is not reported can be considered a limitation in terms of reliability. It would be beneficial for future studies to be revised in this regard.

In conclusion, multidisciplinary approaches are required to maintain memory functionality and reduce depression and anxiety levels in elderly individuals. Supporting mental health is critical for individuals to maintain their cognitive functions. The findings of this study may provide guidance to health professionals and caregivers working with elderly individuals and may contribute to the development of strategies to protect cognitive health in old age.

Declarations

Funding: *No funding was received for conducting this study.*

Conflicts of Interest: *The authors declare no conflict of interest.*

Ethical Approval: *This study was approved by the Ethics Committee of Süleyman Demirel University (Decision No: E.975589, dated March 20, 2025).*

Informed Consent: *Informed consent was obtained from all participants prior to data collection. Participation was voluntary, and confidentiality and anonymity were strictly maintained.*

Data Availability: *The datasets generated and analyzed during the study are not publicly available due to privacy and confidentiality restrictions but are available from the authors on reasonable request.*

Authors' Contributions: *Both authors contributed to the design, implementation, data analysis, and writing of the study. All authors have read and approved the final version of the manuscript.*

AI Disclosure: *No artificial intelligence–based tools or applications were used in the preparation of this study. All content of the study was produced by the authors in accordance with scientific research methods and academic ethical principles.*

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