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A Linguistic Profile of Narrative Speech in Early and Late-Onset Alzheimer's Disease

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ABSTRACT

Objective. *Alzheimer's Dementia is defined as multiple impairments in cognitive functions and language impairment is one of the observed problems in this disease. In order to analyse these problems, narrative speech transcriptions of Turkish patients with early and late-onset Alzheimer's Disease (AD) and an age/education-matched control group were examined.*

Materials & Methods. *By using different language tests, the sentence production of Turkish patients with early (n: 23) and late-onset (n: 39) was examined and the results*

were compared within groups and within language tests. Our aim was to reveal the differences in sentence processing of Turkish Alzheimer patients.

Results. *According to the results, Turkish Alzheimer patients use short and simple sentences composed of fewer words in their speech. It was determined that these patients performed better in Picnic Picture Description test, which is thought to be easy to describe. In Cookie Theft Picture Description test, which is a complex one, and in the Subject-based Narration test, it was found that the speech amounts of AD patients were less. It was revealed that early-onset AD patients used shorter sentences including fewer words compared to late-onset AD patients.*

Conclusions. *In the light of the data obtained, it can be said that AD patients have different sentence processing than normal individuals because of the problems in the language and memory areas of the disease. The fact that sentence processing is different means that these patients do not prefer the types of sentences that normal individuals prefer in their speeches, and use less words and simpler sentences.*

Key words: *linguistic profile, narrative speech, sentence types, Alzheimer's dementia, early-onset, late-onset.*

Introduction

Aging is a very complicated process in which all functions from cells to organs are gradually declining. Aging is the sum of the regressions that have taken place over time in the growth and development of the living organism, and the reduction of functional abilities. Aging is a process, starts with birth and never stops (Özkayar & Arıoğul, 2007). Biological aging causes many changes in individuals. These changes can be observed in many areas such as physical, mental, psychological, cognitive, etc. These observed changes explain the process called "normal aging". However, with aging, some mental and cognitive diseases arise. One of these diseases is *dementia*. The forgetfulness, observed in normal aging, causes some problems about the separation of dementia from normal aging (Fjell et al., 2014).

There are different types of dementia. The most common of them is the Alzheimer's Disease (AD). AD is defined as multiple impairments in cognitive functions. The symptoms of AD are thought to be a direct reflection of the loss of function of multiple brain systems for memory, executive function, visuospatial function, language, praxis, and other abilities (Bakkaur et al., 2013).

There is a decrease in the performance of the episodic memory in the age-related normal cognitive decline. This cognitive disorder that

manifests itself after the age of 70 is evident in the AD. The episodic memory includes certain events that have a specific time and place. Semantic memory is the recognition and remembering of stored encyclopedic information for a long time. Semantic memory is a cognitive process involving recognizing objects, understanding the meaning of the words that are recorded, and putting the learned knowledge into words. The semantic memory performance is improved by giving clues.

In normal aging, other cognitive functions, including less severe than episodic memory, also manifest disorders. These disorders appear not only in verbal fluency, naming and word finding difficulties, but also appear in visual-spatial abilities and impairments in executive functions (such as designing, organizing, sequencing, abstraction) especially after the age of 80. However, implicit memory and reading ability are preserved. Those with a high level of education are resistant to long-term memory impairment and deterioration of fluency. Education has no effect on attention and visual-spatial skills (Eker, 2008).

Low education level increases the possibility of catching AD. It is not known which mechanism has a protective effect on AD in terms of the high level of education. There is no question that diagnostic tests used in the diagnosis of dementia are influenced by the level of education and therefore it is not difficult to diagnose dementia in highly educated individuals. The high level of education facilitated the development of strategies to compensate for the possible effects of cognitive impairment in the early stages of the dementia (Yazıcı & Şahin, 2010).

The most important feature of the AD is the progressive forgetfulness observed from the beginning. Loss of cognitive ability, such as attention, language, speech, and perception of what they see are problems encountered in AD. In the light of this information it is possible to define AD as a dementia type in which the forgetfulness is in the forefront. Another important symptom seen in dementia is visual-spatial processing skills that are degenerated in the early stages of the disease. Assessment scales such as face recognition and line orientation test can easily identify such problems in the early stages of the disease (Maviş & Özbabalık, 2006).

Linguistic problems are one of the most important problems seen in individuals with AD. Word finding difficulties, problems in phonetic and syntactic use, writing disorders etc. are linguistic problems observed in patients with AD. These problems can differentiate in relation to the stages of AD. Patients with AD who have word finding difficulties,

verbal fluency problems, comprehension difficulties in written and spoken language in the early stage of the disease, then have severe problems about verbal fluency, comprehension problems and difficulties in repetition especially in the moderate and severe AD. In the last phase of the AD, word-repetition problems are observed at a serious level and language problems go as far as mutism (Ferris & Farlow, 2013).

Looking at the rate of changes on the language, that is the second most important feature after forgetfulness, it is seen that 73.0% of forgetfulness and 15.0% of language problems are among the complaints reported by the patients. Language problems are initially manifested by the problems of naming in spontaneus speech. Other than naming problems, word finding difficulties, mixing words, using meaningless words etc. linguistic problems are problems faced by AD patients. As the disease progresses, AD patients begin to experience problems at the semantic level. In other words, as the stage of disease changes, the perception level of the patients decreases. Although phonological and syntactic processing are early-preserved features, it can be argued that the sentences made by these patients are less complex. There is a similar situation in terms of perception of the complex sentences. Simple sentences can be understood by the patients with AD. However, there are still problems in the perception of complex sentences (Beeckman, 2009; Altmann & McClung, 2008). Especially, the meaning and pragmatics, dominated by thought and intelligence, are the language components that are vulnerable in patients with AD. In addition, phonetic and syntactic usages are not very conscious in these patients. When the patient's speech or writing is carefully examined, the format errors (especially reduction of morphemes or adding inappropriate morphemes) are noticed (Maviş & Özbabalık, 2006)

There are two types of AD. Early-onset AD (EAD) affects people younger than age 65, late onset AD (LAD) affects people older than age 65. In EAD, the starting age can be as early as twenty (Saka, 2010). Most of these individuals have a distinct family story and a known genetic mutation can be found. 3 gene deficiency is known to cause early-onset AD in families: presenilin 1 on chromosome 14, presenilin 2 on chromosome 1, and amyloid-b protein precursor on chromosome 21 (Yener, 1994). EAD is a clinical problem. It causes not only psychological destruction due to the early-onset, but also make the patients try hard to live with this disease in their most productive ages and these patients are experiencing economic difficulties in terms of

their treatment (Mendez, 2012). The onset of LAD is after 65 and the E4 allele of apolipoprotein E (Apo-E4), a cholesterol-carrying enzyme encoded on the 19 chromosome, is the only proven single gene to be associated with LAD (Altın, 2006). It can be said that the difference between EAD and LAD is related to the neurochemical characteristics, the rate of progression of the disease and the degree of linguistic impairment (Kensinger, 1996) and linguistic problems are more clearly observed in EAD cases (Van der Flier et al., 2011). In addition to this, it is revealed in many studies that language impairment is more distinctive in EAD whereas memory problems are more distinctive in LAD (Multani et al., 2016; Joubert et al., 2016). Language problems in EAD and LAD have been investigated in various studies. However, the difference in language could not be revealed due to the insufficient statistics, incorrect measurement techniques, uncontrollable variables, etc. It was not clear due to the reasons (Imamura et al., 1998). According to the main conclusion of the limited number of studies, the linguistic performance of individuals with EAD is lower than those with LAD. However, this result is not the same in all linguistic fields (Kensinger, 1996).

The aim of this study was to investigate the simple and complex sentence structures used in the speech of EAD and LAD patients who have mild and moderate impairment and compare the data within the groups as well as the control group. Before this research was conducted, permission was obtained from the Non-Interventional Ethics Committee in Dokuz Eylül University, Faculty of Medicine. Taking into account the results obtained from the literature, two hypotheses have been raised regarding the syntactic properties observed in the speech of Turkish AD patients:

(1). The speech of Turkish AD patients is syntactically different from normal individuals.

(2). The speech of Turkish EAD patients are more affected compared to the LAD patients.

Methods

Participants

A total of 4 research groups were included in the study: Alzheimer's Group (AD) (a total of 62 patients with EAD and LAD), EAD Group

(23 patients), LAD Group (39 patients) and Control Group (CG) (a group of 26 individuals who do not have neurological disabilities).

Age and education were regarded as the most significant variables in the choice of subjects. The diagnosis age of all subjects in EAD group is between 45 and 64 years. 45–64 are the diagnosis ages of the patients, not the age at which they were included in the study. The diagnosis age of all subjects in LAD group is 65 years or older. The ages of the subjects at the time of test implementation may vary. Since the age of the subjects is 45 years and over, the same age range is used for the control group. The average age of EAD group is 59,8 and the average age of LAD group is 78,5. All patients had at least a secondary school diploma. Gender variation was not considered in our study. For this reason, the number of male and female participants is not equal. In EAD group, 10 of the subjects were male, 13 were females. In LAD group, 16 were male and 23 were female.

Table 1
Comparison of EAD, LAD and CG in terms of variables

	AGE	GENDER	EDUCATION	MMSE
EAD-CG	0.292	0.331	0.390	-
LAD-CG	0.150	0.223	0.126	-
EAD-LAD	0.707	0.529	0.710	0.203

There was no statistically significant difference in terms of age, gender, education level and MMSE between patients and healthy subjects according to the results in table 1 ($p>0.005$).

Ethical Standards

The authors ensure that the study has been carried out in accordance with the Non-Interventional Ethics Committee in Dokuz Eylül University, Faculty of Medicine. Written informed consent was obtained from all participants.

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Materials and Procedure

Four different language tests were used to describe the linguistic profile of EAD and LAD patients. These tests are: Picnic Picture Description Test (from Western Aphasia Battery, Revised: Kertesz, 2007), Cookie Theft Picture Description Test (from Boston Diagnostic Examination of Aphasia: Goodglass & Kaplan, 1983), Story Picture Sequencing Test, Subject-based Narration Test. The reason why we used picture description tests in our research is that these tests are the most sensitive tests to measure the language skills of individuals who have AD. Bayles, Kaszniak and Tomoeda (1987) stated that Cookie Theft Picture Description Test was among these tests, and had played an important role in eliciting the linguistic profile of AD patients. La Rue (1992) mentioned picture description tests and their functions in his book "Aging and Neuropsychological Assessment", and stated that these tests were useful for AD patients. Shimada et al. (1998) also mentioned the importance of picture description tests in their studies about the verbal skills of AD patients. Forbes et al. (2001) and Thomas et al. (2005) stated that picture description tests could be used to reveal cognitive impairments observed in AD patients and to resolve the spontaneous speech of them. The third test used in our research was "Picture Story Sequencing Test". This test, which was prepared for the ability of patients to connect different pictures and create a story, was drawn by Abdulkadir Gurol, who was working in visual design department in Ministry of National Education. A pilot study with normal subjects was conducted before this test was applied to the patients and it was revealed that the test was an applicable test. There are some views of various researchers regarding the use of story picture sequencing to reveal the linguistic profile of AD patients. According to these views, picture sequencing allows AD patients to describe the events in the picture, both temporally and logically. Thus, lots of linguistic data are obtained by using their narrative skills (Duong & Ska, 2001; Lira et al., 2011).

The last test that is applied to the AD patients was "Subject-based Narration Test". In this test, the examiner asked if they could tell him/her the happiest or most depressing moment of their lives. It was expected that they would tell their memories via logical sequence of events. By the help of this test, the patients were made to feel more

comfortable without visual data and without any restrictions, so that the narrative skills of these patients were revealed more clearly.

The data collection process was carried out in the Department of Neurology at Dokuz Eylül University, Faculty of Medicine. All patients were interviewed seperately by the examiner in a silent room. Four language tests were performed one after the other. In order to receive equal data from all patients, the interviews were limited to 2 minutes. Patient's speech was recorded via a voice recorder. The recorded speeches were also transcribed based on the symbols identified by DuBois et al. (1993). All language tests were also performed to the CG.

Data Analysis

The data obtained from EAD and LAD and the control group were analyzed by focusing on the sentence structure. In this analysis, the sentences that were formed by all individuals included in the study were examined by looking at whether they were grammatically acceptable. As a result of this examination, 9.56% of the sentences formed by the EAD group, 6.81% of the sentences formed by the LAD group and 8.11% of the sentences formed by the control group were excluded as they were grammatically unacceptable sentences. All sentences except the unacceptable ones were analysed based on simple or complex sentence structures. The mean sentence length of the patients were determined firstly. This determination was examined by taking into account the total number of sentences the subjects established in each test and the number of words in each sentence. The mean sentence length was calculated by dividing the total number of words by the number of sentences. The same procedure was applied separately for all individuals and all tests included in the study. After determining the mean sentence length, the total number of sentences was examined in order to find out in which test participants used more sentences and therefore the amount of speech was more.

The data obtained from the syntactic analysis were interpreted by appropriate statistical analysis. The t-test was used for the mean sentence length, the Friedman test and the Wilcoxon test were used to compare the dependent groups. In the general evaluation of the sentence types Chi square test was used to determine the effect of Alzheimer's disease on the ability to establish sentence. However, due to the symmetrical data set, sufficient scale and sample size Mann-Whitney test was

used while comparing simple sentence structures within groups. And Chi-Square test was used to determine the relationship between content and test. Median test was used to determine whether there were any differences between groups in terms of sentence types.

Results

The data underlying this article are available in Mendeley Data Search (Can & Kuruoğlu, 2021b).

Sentence Length

All groups (EAD, LAD, AD and CG) were compared separately in terms of mean sentence length. According to the results of the analysis of Picnic Picture description test, Cookie Theft description test, Story Picture Sequencing test and Subject-based Narration test, statistically significant difference was found with confidence with 95.0% in all tests in terms of mean sentence length between EAD-CG, LAD-CG and AD-CG ($p<0.01$).

According to the averages EAD, LAD and AD groups used shorter sentences compared to the control group. The comparison of EAD-LAD group revealed that only statistically significant difference was found with 95.0% confidence in the Cookie Theft description test ($p<0.01$). No significant difference was found in other language tests ($p<0.01$). In terms of averages, the EAD group performed worse compared to the LAD group and formed shorter sentences.

Table 2
Comparison of the mean length of all sentences in all groups

TESTS	N	Group	Mean	Standard Deviation	Standard Error	p value
PICNIC PICTURE DESCRIPTION TEST	26	Control	6.484	1.909	1.909	0.001
	23	EAD	4.586	1.658	1.658	
	26	Control	6.484	1.909	0.374	0.000
	39	GBA	4.768	1.230	0.197	
	23	EAD	4.586	1.658	0.345	0.624
	39	LAD	4.768	1.230	0.197	
	26	Control	6.484	1.909	0.374	
	62	Alzheimer	4.700	1.393	0.177	0.000

COOKIE THEFT DESCRIPTION TEST	26	Control	8.529	3.515	3.515	0.000
	23	EAD	4.576	1.459	1.459	
	26	Control	8.529	3.515	0.689	0.000
	39	LAD	5.473	1.620	0.259	
	23	EAD	4.576	1.459	0.304	0.033
	39	LAD	5.473	1.620	0.259	
	26	Control	8.529	3.515	0.689	
	62	Alzheimer	5.140	1.610	0.204	0.000
STORY PICTURE SEQUENCING TEST	26	Control	8.417	2.760	0.541	0.000
	23	EAD	5.094	2.309	0.481	
	26	Control	8.417	2.760	0.541	0,000
	39	LAD	5.222	1.526	0.244	
	23	EAD	5.094	2.309	0.481	0.794
	39	LAD	5.222	1.526	0.244	
	26	Control	8.417	2.760	0.541	
	62	Alzheimer	5.175	1.838	0.233	0.000
SUBJECT-BASED NARRATION TEST	26	Control	8.550	3.505	3.705	0.000
	23	EAD	5.298	2.020	2.020	
	26	Control	8.550	3.505	0.626	0.000
	39	LAD	5.448	1.677	0.249	
	23	EAD	5.298	2.020	0.421	0.114
	39	LAD	6.948	4.677	0.749	
	26	Control	8.550	3.505	0.726	
	62	Alzheimer	5.336	1.968	0.504	0.000

N = Number of participants

Sentence Production

The analysis about the number of the sentences was performed by using chi-square homogeneity test. By this test, it was found that the groups included in the study were heterogeneous groups and the data obtained from these groups differed in terms of the groups and the tests.

According to the results seen in table 3, there was a statistically significant difference with 95.0% confidence in EAD, LAD and control groups ($p<0.01$). Accordingly, in all tests the LAD group used more sentences than EAD and the control group. The minimum number of sentences belongs to the EAD group.

The data of the EAD, LAD, AD and control group subjects were evaluated by using the Wilcoxon test and Friedman test. According to the results seen in table 4, the sentences of all groups differ according to the tests and this is statistically significant ($p<0.01$) (CG), $p<0.01$ (EAD), $p<0.01$ (LAD), $p<0.01$ (AD)). When the number of sentences

was examined, it was seen that the EAD group spoke most in the Subject-based Narration test and least in the Picnic Picture description test. LAD group was talked most in the Picnic Picture description test and least the Subject-based Narration test. The control group was mostly spoke in the Subject-based Narration test and Picnic Picture description test while they spoke least in the Cookie Theft picture description test.

Table 3
Comparisons of all groups in terms of number of the sentences

GROUP	SENTENCES	TESTS				p value
		PICNIC PICTURE DESCRIPTION TEST	COOKIE THEFT DESCRIPTION TEST	STORY PICTURE SEQUENCING TEST	SUBJECT-BASED NARRATION TEST	
EAD	Total Number	88	177	214	188	0.000
	%	9.8	22.4	22.6	23.7	
LAD	Total Number	543	383	441	360	
	%	60.6	48.5	46.5	45.4	
CONTROL	Total Number	265	230	293	245	
	%	29.6	29.1	30.9	30.9	
TOTAL		896	790	948	793	
(%)		100	100	100	100	

Table 4
Distribution of sentence numbers of all groups in all tests

TESTS	N	Group	Mean Rank	p value
PICNIC PICTURE DESCRIPTION TEST	26	Control	3.10	0.022
	23	EAD	3.26	0.005
	39	LAD	3.27	0.000
	62	AD	3.27	0.000
COOKIE THEFT DESCRIPTION TEST	26	Control	2.08	0.022
	23	EAD	2.09	0.005
	39	LAD	2.28	0.000
	62	AD	2.21	0.000
STORY PICTURE SEQUENCING TEST	26	Control	2.31	0.022
	23	EAD	2.52	0.005
	39	LAD	2.55	0.000
	62	AD	2.54	0.000
SUBJECT-BASED NARRATION TEST	26	Control	2.52	0.022
	23	EAD	2.13	0.005
	39	LAD	1.90	0.000
	62	AD	1.98	0.000

After revealing the results about the distibution of sentence numbers of all groups in all tests, EAD, LAD, AD and control group subjects' performance on sentence production was analysed. In this analysis, basic sentence structures and complex sentence structures were included. The results about the distribution of basic and complex sentence structures in all tests and groups were shown in table 5.

Table 5
Distribution of basic and complex sentence structures in all tests and groups

TESTS	GROUP	Sentence Types								
		Simple Sentences			Noun Clauses		Adjective Clauses		Adverbial Clauses	
		Mean	Std Deviation	p value	f (%)	p value	f (%)	p value	f (%)	p value
PICNIC PICTURE DESCRIPTION TEST	EAD	9.391	4.812	0.872	8.7	0.016	26.1	0.086	17.4	0.559
	Control	9.615	4.833		61.5		50		11.5	
	LAD	10.871	8.915	0.514	15.4	0.034	41	0.476	15.4	0.660
	Control	9.615	4.833		38.5		50		11.5	
	EAD	9.391	4.812	0.466	8.7	0.448	26.1	0.235	17.4	0.836
	LAD	10.871	8.915		15.4		41		15.4	
	AD	10.322	7.641	0.664	12.9	0.007	35.5	0.204	16.1	0.508
	Control	9.615	4.833		38.5		50		11.5	
COOKIE THEFT DESCRIPTION TEST	EAD	5.521	3.328	0.748	34.8	0.109	21.7	0.001	21.7	0.125
	Control	5.846	3.662		57.7		69.2		42.3	
	LAD	6.666	4.618	0.450	33.6	0.042	41	0.026	30.8	0.341
	Control	5.846	3.662		57.7		69.2		42.3	
	EAD	5.521	3.328	0.303	34.8	0.907	21.7	0.121	21.7	0.441
	LAD	6.666	4.618		33.3		41		30.8	
	AD	6.241	4.194	0.677	33.9	0.038	33.9	0.002	27.4	0.171
	Control	5.846	3.662		57.7		69.2		42.3	
STORY PICTURE SEQUENCING TEST	EAD	6.956	4.986	0.314	21.7	0.000	26.1	0.001	21.7	0.000
	Control	5.615	4.233		73.1		73.1		73.1	
	LAD	7.512	6.468	0.192	38.5	0.006	38.5	0.006	28.2	0.000
	Control	5.615	4.233		73.1		73.1		73.1	
	EAD	6.956	4.986	0.724	21.7	0.174	26.1	0.320	21.7	0.574
	LAD	7.512	6.468		38.5		38.5		28.2	
	AD	7.306	5.924	0.191	32.3	0.000	33.9	0.001	25.8	0.000
	Control	5.615	4.233		73.1		73.1		73.1	
SUBJECT-BASED NARRATION TEST	EAD	5.304	3.036	0.000	17.4	0.001	39.1	0.035	17.4	0.103
	Control	2.653	1.547		65.4		69.2		38.5	
	LAD	5.179	3.992	0.003	17.9	0.000	61.5	0.525	30.8	0.521
	Control	2.653	1.547		65.4		69.2		38.5	
	EAD	5.304	3.036	0.897	17.4	0.956	39.1	0.088	17.4	0.245
	LAD	5.179	3.992		17.9		61.5		30.8	
	AD	5.225	3.641	0.001	17.7	0.000	53.2	0.165	25.8	0.235
	Control	2.653	1.547		65.4		69.2		38.5	

Basic Sentence Structures

According to the results seen in table 5, of the simple sentence structures, only a statistically significant difference was found between the groups of EAD-Control, LAD-Control and AD-Control in terms of simple sentence use with 95.0% confidence in the Subject-based Narration test ($p<0.01$). This shows us that the EAD, LAD and AD groups use more simple sentences than the control group. However, there was no statistically significant difference between the EAD and LAD groups in terms of simple sentence use ($p=0.897$).

For the other three language tests, no statistically significant difference was found between the groups in terms of simple sentence usage ($p<0.01$). According to the data, the EAD, LAD and AD groups produced more simple sentences than the control group in the Story Picture Sequencıng test and Subject-based Narration test. LAD group used more simple sentences than the EAD group in the Picnic Picture, Cookie Theft picture description test and Story Picture Sequencing test. When the EAD-LAD and AD-Control group comparisons were examined it is understood that the LAD and AD group tended to form more simple sentences in the Picnic Picture description test. However, these data were not found statistically significant.

Complex Sentence Structures

In this sentence type, noun clauses, adjective clauses and adverb clauses were analysed. According to the results of noun clauses seen in table 5, there was a statistically significant difference with 95.0% confidence among all groups except for EAD-LAD group in terms of the use of noun clauses ($p<0.01$). In Cookie Theft description test, there was a statistically significant difference with 95.0% confidence in terms of the use of noun clauses between LAD-Control and AD-Control group ($p<0.01$). There was a statistically significant difference with 95.0% confidence in the use of noun clauses among all groups except for EAD-LAD group in Story Picture Sequencing test and Subject-based Narration test (p values<0.05). In terms of percentages, it was seen that the control group produced more noun clauses than the experimental group. In terms of EAD-LAD comparison, LAD group produced more noun clauses in all tests except for the Cookie Theft description test.

According to the results of adjective clauses seen in table 5, there was a statistically significant difference with 95.0% confidence between

EAD-Control, LAD-Control and AD-Control groups in Cookie Theft description test and Story Picture Sequencing test ($p<0.01$). However, in the same tests, there was no statistically significant difference between the EAD-LAD group in terms of the use of adjective clauses ($p=0.121$/ $p=0.320$). There was no statistically significant difference between the subject groups in terms of the use of adjective clauses in Picnic Picture description test. Only in Subject-based Narration test there was a statistically significant difference between EAD-Control group ($p<0.01$). Examined the variation in terms of percentages within groups, it was revealed that the control group produced more adjective clauses than the subject groups. In terms of the comparison of EAD-LAD, LAD group produced more adjective clauses than EAD group in all tests.

The other findings were about the adverbial clauses. No statistically significant difference was found in the use of adverbial clauses in any of the groups except for the Story Picture Sequencing test ($p<0.01$). A statistically significant difference was found between the EAD-Control, LAD-Control and AD-Control groups in terms of the use of adverbial clauses in Story Picture Sequencing test ($p<0.01$). In the same test, no statistically significant difference was found between the EAD-LAD group ($p=0.574$). In terms of percentages, it was observed that the control group produced more adverbial clauses than the other groups in Cookie Theft description test, Story Picture Sequencing test and Subject-based Narration test. However, in the Picnic Picture description test, the EAD group used more adverbial clauses than the control group. In terms of EAD-LAD comparison, LAD group produced a more adverbial clauses than the EAD group in all tests except for the Picnic Picture description test.

Comparison of Language Tests

In this comparison, the data about simple sentence structures, noun clauses, adjective clauses and adverbial clauses was compared within the tests and the results were shown in table 6. Chi-Square test was used to reveal the relationship between content and tests. It was revealed that there was a statistically significant difference between simple and complex sentence types in four language tests with 95.0% confidence ($p<0.01$). This result shows that the simple and complex sentence structures produced by all groups differ according to the four tests.

Table 6
Comparison of all sentence types within groups and tests

SENTENCE TYPES	GROUP	PICNIC PICTURE DESCRIPTION TEST f (%)	COOKIE THEFT DESCRIPTION TEST f (%)	STORY PICTURE SEQUENCING TEST f (%)	SUBJECT-BASED NARRATION TEST f (%)	p value
SIMPLE SENTENCES	Control	40.5	24.6	23.7	11.2	0.000
	EAD	34.6	20.3	25.6	19.5	0.001
	LAD	36	22.1	24.9	17.1	0.000
	AD	35.5	21.5	25.1	18	0.000
NOUN CLAUSES	Control	13.6	22.3	34	30.1	0.000
	EAD	8.3	41.7	33.3	16.7	0.001
	LAD	15.4	30.8	32.7	21.2	0.000
	AD	13.2	34.2	32.9	19.7	0.000
ADJECTIVE CLAUSES	Control	21.2	24.2	26.1	28.5	0.000
	EAD	17.9	17.9	17.9	46.2	0.001
	LAD	22	17.4	23.5	37.1	0.000
	AD	21.1	17.5	22.2	39.2	0.000
ADVERBIAL CLAUSES	Control	6.1	24.2	48.5	21.2	0.000
	EAD	17.4	34.8	21.7	26.1	0.001
	LAD	15.1	30.2	30.2	24.5	0.000
	AD	15.8	31.6	27.6	25	0.000

Picnic Picture Description Test

According to the table 6, a statistically significant difference was found in terms of simple and complex sentence use of all groups in Picnic Picture description test ($p<0.01$). Accordingly, all groups used simple sentences more in the Picnic Picture description test.

Cookie Theft Picture Description Test

All groups showed a difference in terms of simple and complex sentence use in Cookie Theft picture description test ($p<0.01$) as seen in table 6. In this test, control group used simple sentences more, EAD group used noun clauses more and LAD group used adverbial clauses more. AD group used noun clauses and adverbial clauses in similar numbers.

Story Picture Sequencing test

The use of simple and complex sentence structures used in Story Picture Sequencing test was different within groups ($p<0.01$). Accordingly, the control group used noun clauses and adverbial clauses

more. AD and EAD group used noun clauses more, while LAD group used noun clauses and adverbial clauses more.

Subject-based Narration Test

In this test, there was a difference within groups in terms of simple and complex sentences use ($p<0.01$) as shown in table 6. Accordingly, all groups used adjective clauses more in Subject-based Narration test.

Discussions and Conclusions

In this study, all groups were primarily compared in accordance to their mean length of sentences. According to that, EAD group produced shorter sentences than the control group. LAD group on the other side had shorter sentences than the control group. Compared with the EAD group, the LAD group produced longer sentences in the test of Cookie Theft Picture description. However, no differences could be found within EAD, LAD an AD groups in regards to the tests of Picnic Picture description, Story Picture Sequencing and Subject-based Narration tests. This shows that the length of the produced sentences are similar for those two groups. These findings are parallel to the literature. The random speech which is obtained by the Picture description of the AD patients were examined in a study and it is seen that the results were similar to our study. According to this, AD patients produce shorter sentences compared to the control group (Blanken, 1987). Hier et al. (1985) and Croisile et al. (1996) also stated in their studies that AD patients, due to their diseases, produced fewer number of words and therefore had different sentence length than their coevals who do not have any diseases. It is also seen that similar conclusions were obtained in the literature in regards to EAD and LAD results. Sevush et al. (1993) observed the fluency and syntactic spesifications of the random speeches belonging to EAD and LAD patients. One of the results of these studies are related to the length of the sentences. According to that, the mean length of the sentences of LAD patients was more than EAD patients. In other words, LAD group produced longer sentences than EAD group. Similarly, Can and Kuruoglu (2017, 2018) found out that the sentence length of Turkish speaking LAD patients was higher compared to EAD patients. In other words, speech amount of AD patients varied in relation to Alzheimer's type. Turkish speaking LAD

patients used more simple sentence structures compared to the control group due to the problems about syntactic processing in a study done by Can, Kuruoglu and Özsoy (2018).

Kemper et. al. (1993) revealed that the phase of the disease strongly affected the mean length of the sentences. In their study of examining AD patients' sentences by both content and length. Another study which revealed that the mean sentence length of the AD patients was shorter than the control group was done by Ehrlich et al. (1997). In that study, similar to ours, more than one picture were shown to the AD patients and they were asked to describe what they saw. The speech of the patients were recorded and then transcribed. Similar to our study, the obtained results revealed that the AD patients produced shorter sentences compared to the control group. In another study which observed the random speech has also stated that the AD patients and the control group had serious differences in terms of the mean length of the sentences (Bucks et al., 2000). In their study of description of the Italian and English speaking bilingual AD patients' linguistic abilities, Bencini et al. (2011) have also observed the mean length of the sentences and revealed that AD patients' sentence length was affected more compared to the control group. Almor et al. (2001) compared the AD patients with the control group and revealed that the AD patients' mean length of sentence was shorter than the control group. Kemper and Mitzner (2001) who described the linguistic spesifications of the AD patients in accordence to a variety of research results, also stated that many syntactic differences occured due to the phase of the illness and mentioned that those patients' mean length of sentences was differentiated. In a similar way, Kemper and Lions (1994) stated that the mean length of sentences decreased due to the demantia degree of the AD patients in their study of describing the effects of AD on language and communication. Ahmed et al. (2012), in their study of observation of the AD patients' speech, evaluated the sentences produced by those patients and compared the results to the control group. According to the results, the mean length of sentences of the AD patients were shorter than the control group. In other words, the AD patients tended to produce shorter sentences. Also Boye et al. (2013), in their study which compared the AD patients and the control group in regards to the linguistic, applied picture description tests to AD patients and the

control group and revealed that the mean sentence length of AD patients were shorter than the control group.

In conclusion, our study and the other studies in the literature revealed that, the sentence length of the AD patients were shorter than the control group. In the literature, observations were mostly done on the Alzheimer patients who were not native speakers of Turkish. Our study prooves that the Turkish speaking Alzheimer patients produced shorter sentences in comparison with the control group. Also this research revealed that this fact which was observed in the AD patients was mainly related to the phase of the disease. Even though similar results were obtained in the early phase, syntactic mistakes of the AD patients increase as the phase of the disease progresses.

Within EAD, LAD, Alzheimer and control groups, it was determined that a significant difference occured only in Subject-based Narration test for two groups in regards to the basic sentence. According to that, EAD and LAD groups used more sentences compared to the control group in the test of Subject-based Narration Test. This can be related to the control group's ability of strong usage of other sentence types. In regards to the basic sentence, it was determined that no meaningful differences occured in any tests within EAD and LAD groups. However, due to the averages, EAD group used more sentences compared to LAD in all tests. In regards to the sentences containing noun clauses, EAD and the control group had a meaningful difference in all tests except for the Cookie Theft picture description test. It was also seen that the sentences containing noun clauses were similar to each other in Cookie Theft picture description test. Observing LAD and AD groups, it was seen that the number of sentences containing noun clauses were less than the control group. Regarding to the EAD and LAD groups, it was determined that no meaningful differences occured within the two groups in any of the tests. However, according to the averages, the average sentence number of LAD group was more than EAD group. In regards to the sentences containing adjective clauses, it was determined that EAD group and the control group had a meaningful difference in all the tests except for the Picnic Picture description test. In the tests of Cookies Theft picture description and Story Picture Sequencing tests, it was determined that the two groups of AD and LAD had a meaningful difference. It was determined that EAD and LAD groups had a meaningful difference in the tests of Cookies Theft picture

description and Story Picture Sequencing tests. In other words, the number of sentences containing adjective clauses belonging to the LAD group was more than EAD group. In regards to the sentences containing adverbial clauses, it was determined that no meaningful differences occured within AD, LAD, EAD and control groups in any of the tests except for the Story Picture Sequencing test. In other words, AD group had a fewer number of sentences containing adverbial clauses compared to the control group. According to the comparison of EAD and LAD groups, it was determined that no meaningful differences occured within those two groups in any of the tests. However, according to the averages, LAD group had a higher number of sentences containing adverbial clauses than EAD group. These stated results had parallelism with the literature. Hier et al. (1985) examined the results of the picture description tests and determined that the AD patients used less complex sentences compared to the control group. In their study, Kempler et al. (1987) observed the syntactic structure of AD patients and examined their random speech. In the comparison of the control group and AD group, it was revealed that those two groups had similar mistakes. In addition, they stated that there were similarities between the two groups in terms of their ability to produce complex sentences. There are several studies comparing early and late-onset Alzheimer's disease as well as evaluating AD patients in general. Some argue that the linguistic difference between the two types is clear, while others argue that there is no such difference. For example, Seines et al. (1988) examined the linguistic characteristics of the patients with EAD and LAD and found that there was no difference between the two groups. Only early onset group had problems due to attention and concentration problems during the test implementation but still it did not make any difference in terms of performance between the two groups.

Studies comparing the linguistic characteristics of patients with EAD and LAD have been reported to be worse in linguistic deterioration in patients with EAD (Seltzer & Sherwin, 1983; Sevush et al., 1993; Binetti et al., 1993; Goldblum et al., 1994; Becker et al., 1988; Chui et al., 1985; Filley et al., 1986). Similarly, Can et al. (2016, 2021) stated in their studies that Turkish speaking EAD patients' syntactic performance was worse. In contrast to these studies, Bayles (1991, 1992, 1993) found that linguistic deterioration was more prominent in LAD patients. Swearer et al (1992) suggested that there was a clear

difference in terms of linguistic skills other than neurological differences in their study about EAD and LAD patients. Contrary to these findings, studies revealing that there is a difference between the two types in terms of language skills are also included in the literature. Sevush et al. (1993) evaluated the spontaneous speech of EAD and LAD patients syntactically and stated that there was a difference between the two groups. Accordingly, the ability of LAD patients to spontaneous speech is worse. In contrast to this study, Romero and Kurz (1996) have again found that linguistic deterioration is faster and greater in those diagnosed with EAD. Similarly, Koss et al. (1996) compared the speech of EAD and LAD patients as naming, repeating etc. and found that they showed a similar performance in terms of linguistic characteristics. Kempler (1995) revealed the linguistic changes in patients with AD and tried to describe the language of AD patients as semantically, pragmatically and syntactically.

According to Kempler (1995), syntactic features are partially preserved features in AD patients. Kempler (1995) found that there was a difference in terms of sentence production and sentence perception in patients with AD. While sentence production is a partially preserved feature, there was no clear result about sentence perceptio. Croisile et al. (1996) found that patients with AD tended to use more simple sentences by using the Cookie Theft picture description test in their study, which aimed to measure the oral and written language skills of the patients with AD. This result was also revealed in our study. Caramelli et al. (1998) reported that syntactic structures were protected features in patients with AD. Especially in the early or middle stage, it was reported that their performance was syntactically correct. Caplan and Waters (1999) examined the process of sentence processing in detail and found that the performance of AD patients decreased as the type of sentence became more complex. Ehrlich et al. (1997) evaluated the speech of AD patients syntactically and found that patients with moderate or severe AD could not maintain the ability to establish sentences containing complex sentence structures. Emery (2000) in his study on the discovery of linguistic disorders in patients with AD revealed that there was a parallelism between the progression of the disease and the deterioration of linguistic features, and that linguistic distortion was first seen in complex structures. There are many studies on the effect of age factor on sentence production. For example, Kemper, Thompson, and Marquis

(2001) found that older dementia patients preferred sentences with less words and also simple sentences. Kemper et al. (2001) emphasized in their study that aging would cause differences in linguistic aspects on individuals. In the study, it was stated that there was a similar change for the production of the sentences. It was suggested that complex sentence production decreases with age and individuals tended to use simple structures. Burke (2002) stated in his study that, there was disease-related deterioration in many patients with AD. Burke (2002) argued that a great problem, especially in the production of complex syntactic structures, was observed in terms of linguistic skills in patients with AD. He also stated that the problems in syntactic features and in complex sentences increased due to problems in working memory especially with increasing age. Kemper, Herman and Lian (2003) tried to reveal the relationship between age factor and sentence production and asserted that older individuals tended to have simpler and shorter sentences compared to younger individuals. Waters and Caplan (2002) reported that, under running memory and syntactic processing, patients with AD did not perform much differently from the control group in terms of complex sentences, even if they had working memory problems. Thus, they also supported the idea that syntactic features were protected features in patients with AD as advocated by other researchers. Kav'e and Levy (2003) compared patients with moderate to severe AD in terms of sentences that they produced by using picture description tests and revealed that patients with AD used less complex sentences compared to the control group. Kertesz (2004) stated that syntactic structures were protected in the early stages of AD disease, and in later stages, they they experienced problems in the production of sentences. Kertesz (2004) also stated that syntactic disorders were more related to EAD patients. In their study, Visch-Brink et al. (2009) compared the individuals who had no problems with AD patients in terms of the sentences that they produced. Only complex sentences were taken into consideration. As a result of the study, it was found that there was a significant difference between the AD patients and the control group in terms of complex sentence use and the control group used these sentences more. Similarly, in our study, it was found out that there was a difference between Alzheimer's and control group in terms of complex sentences. Lira et al. (2011) examined the types of sentences and compared the data of the AD patients and the control group that

was taken from Story-Picture Sequencing test. As a result of the study, it was found that patients with AD rarely used coordinated and compound sentences more frequently than the control group. In the compound sentences, there was no clear distinction between the two groups. When the results were evaluated in general, it was found that patients with AD preferred syntactically simpler structures more. A similar study was done by Can and Kuruoglu (2018). According to the results, cognitive deficits made EAD patients performed worse in different language tests. It is revealed that there was no tendency to use coordinated and compound sentences in their speeches. A similar finding was found by Waters and Caplan (1997). According to the analysis, the patients with AD had more difficulty in complex sentences. Therefore, AD patients used simple sentences more frequently. This finding was also emphasized in the studies of Waters and Caplan in 1999 and 2001 and it was stated that AD patients used less complicated sentences compared to the control group. Gayraud and Barkat-Defradas (2013) compared the AD patients and the control group in terms of complex sentences using Cookie Theft description test and revealed that AD patients used less coordinated and compound sentences compared to the control group. Caloi (2017) examined the sentence perception of patients with AD in terms of noun clauses, adjective clauses and adverbial clauses. As a result of this study, it was stated that AD patients experienced problems in all types of sentences, but the highest difficulty was encountered in the adjective clauses. Tsantali et al. (2013), who conducted a similar study on early-stage patients, found that syntactic structures were protected features in early-stage AD patients. Orimaye et al. (2014) examined the sentences of the patients with AD and examined the sentences containing the complex sentences (coordinated and compound sentences). In the same study, it was emphasized that syntactic and lexical analysis were of great importance for the diagnosis of AD. Sung (2015) evaluated AD patients in terms of age factor and sentence types and revealed that increasing age caused a decrease in the rate of producing complex sentences.

In this study, the sentences produced by EAD and LAD patients in four different language tests were examined in terms of mean sentence length, number of sentences and simple or complex sentence types. All the data were compared to normal individuals without any health problems. According to the findings, the sentence structures in the speech of AD patients differ from normal individuals in terms

of both types and length. This difference can be explained by the neurological deterioration of AD. Particularly deterioration in brain and memory which are important areas in terms of the linguistic functions leads to a difference in the structure of the sentence. Working memory enables the selection of appropriate behaviors to encode, stimulate and use the various stimuli from the environment during our daily life. These processes, which take place in a very complex but fast way, have an active role in the processing skills of language, especially by providing mental organization of verbal and non-verbal information from different sources (Akoğlu & Acar, 2014). Working memory is a cognitive structure that is associated with the provision of grammatical knowledge in sentence processing (Sung et al., 2013). It is known that there are working memory problems in patients with AD due to damage in the neural connections between the posterior linguistic areas and the frontal areas supporting the working memory. These problems observed in patients cause problems in sentence production and perception (Altmann & McClung, 2008). Various studies on sentence processing indicate that left temporo-frontal networks are important for syntactic processing and bilateral temporo-frontal networks are also important for semantic processing (Lukic et al., 2013). In the light of the data obtained, it can be said that AD patients have different sentence processing than normal individuals because of the problems in the language and memory areas of the disease. The fact that sentence processing is different means that these patients do not prefer the types of sentences that normal individuals prefer in their speeches, and use less words and simpler sentences.

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АНОТАЦІЯ

Мета. *Хвороба Альцгеймера визначається як множинні порушення когнітивних функцій, а порушення мовлення (як одного з когнітивних процесів) є однією з проблем, що спостерігаються при цьому захворюванні. Щоб проаналізувати ці проблеми були досліджені розповыдны мовленнэвы транскрипції турецьких пацієнтів з хворобою Альцгеймера (ХА) з раннім та пізнім початком та контрольної групи людей,вік та освіта яких відповідають віку та освіті людей з хворобою Альцгеймера.*

Методи та матеріали. *За допомогою різних мовленнєвих тестів були вивчені особливості побудови речень у турецьких пацієнтів з раннім (n: 23) та пізнім (n: 39) початком хвороби Альцгеймера. Результати порівнювалися як усередині груп, так і за мовленнєвиими тестами. Нашою метою було виявити відмінності в обробці речень турецьких пацієнтів із хворобою Альцгеймера.*

Результати. *Згідно з результатами дослідження, турецькі пацієнти з хворобою Альцгеймера у своєму мовленні використовують короткі та прості речення, що складаються з меншої кількості слів. Було встановлено, що ці пацієнти краще впоралися із тестом "Опис картинки пікніка", який, як вважається, легко зробити. У тесті "Розповідь про зображення крадіжки файлів cookie", який є складним, і в тесті "Розповідь про сприйнятий предмет" було виявлено, що пацієнти з ХА були малоговірливі. Встановлено, що пацієнти з раннім початком хвороби альцгеймера використовували короткі речення, що включають менше слів, порівняно з пацієнтами з пізнім початком ХА.*

Висновки. *У світлі отриманих даних можна зробити висновок про те, що у пацієнтів з хворобою Альцгеймера обробка речень відрізняється від людей у нормі через проблеми з мовленням та пам'яттю, пов'язаними з цим захворюванням. Той факт, що обробка речень відрізняється, означає, що пацієнти з хворобою Альцгеймера не використовують у своєму мовленні ті типи речень, які використовують люди в нормі, і використовують менше слів і простіші речення.*

Ключові слова: *лінгвістичний профіль, розповідне мовлення, типи речень, хвороба Альцгеймера, ранній початок хвороби, пізній початок хвороби.*

Джан Эда & Куруоглу Гюльмира. Лингвистический профиль повествовательной речи пациентов при раннем и позднем начале болезни Альцгеймера

Цель. *Болезнь Альцгеймера определяется как множественные нарушения когнитивных функций, а нарушение речи (как одного из когнитивных процессов) является одной из наблюдаемых проблем при этом заболевании. Чтобы проанализировать эти проблемы были исследованы повествовательные речевые транскрипции турецких пациентов с болезнью Альцгеймера (БА) с ранним и поздним началом и контрольной группы, соответствующей возрасту и образованию.*

Методы и материалы. *С помощью различных языковых тестов были изучены особенности построения предложений у турецких пациентов с ранним (n: 23) и*

поздним (n: 39) началом БА. Результаты сравнивались как внутри групп, так и в рамках языковых тестов. Нашей целью было выявить различия в обработке предложений турецких пациентов с болезнью Альцгеймера.

Результаты. *Согласно результатам, турецкие пациенты с болезнью Альцгеймера в своей речи используют короткие и простые предложения, состоящие из меньшего количества слов. Было установлено, что эти пациенты лучше справились с тестом Picnic Picture Description, который, как считается, легко описать. В тесте "Описание изображения кражи файлов cookie", который является сложным, и в тесте "Повествование на основе воспринимаемого предмета" было обнаружено, что пациенты с БА были малоразговорчивые. Было обнаружено, что пациенты с ранним началом БА использовали более короткие предложения, включающие меньше слов, по сравнению с пациентами с поздним началом БА.*

Выводы. *В свете полученных данных можно сделать вывод о том, что у пациентов с БА обработка предложений отличается от людей в норме из-за проблем в области языка и памяти, связанных с этим заболеванием. Тот факт, что обработка предложений отличается, означает, что пациенты с БА не используют в своей речи те типы предложений, которые используют нормальные люди, и используют меньше слов и более простые предложения.*

Ключевые слова: *лингвистический профиль, разговорная речь, типы предложений, болезнь Альцгеймера, раннее начало, позднее начало.*