Year (Yıl) : 2019
Volume (Cilt) : 6
Issue Number (Sayı) : 3
Doi : 10.5455/JNBS.1560860171

Received/Geliş 18.06.2019
Accepted/Kabul 01.10.2019
JNBS, 2019, 6(3):197-205

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THE PREDICTOR EFFECT OF DEMOGRAPHIC VARIABLES IN ASSESSING SEMANTIC FLUENCY TEST FOR HEALTHY ADULTS AGED 50 AND ABOVE

50 YAŞ VE ÜSTÜ SAĞLIKLI YETİŞKİNLER İÇİN SEMANTİK AKICILIK TESTİNİN DEĞERLENDİRİLMESİNDE DEMOGRAFİK DEĞİŞKENLERİN YORDAYICI ETKİSİ

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Öz

Semantik akıcılık testleri, bilişsel işlevleri değerlendirmek amacıyla hem klinik hem de deneysel çalışmalarda sıklıkla kullanılmaktadır. Demografik değişkenlerin bilişsel işlevler üzerinde bir etkisi olduğu için bu çalışma, demografik değişkenlerin semantik akıcılık puanları üzerindeki yordayıcı gücünü araştırmayı amaçlamaktadır. Çalışmaya, yaşları 50 ile 84 arasında değişen, aldıkları eğitim süreleri en fazla 24 yıl olan, 389 sağlıklı yetişkin katılmıştır. Katılımcıların semantik akıcılığını değerlendirmek amacıyla İsim-Hayvan testi uygulanmıştır. Bu testte katılımcılardan bir dakika içinde mümkün olduğunca çok isim üretmeleri istenmiştir. Sonuçlar değerlendirildiğinde, eğitim süresi arttıkça, ürettikleri kelime sayısının da arttığı görülmüştür. Ayrıca katılımcıların yaşları artarken, ürettikleri kelime sayısının azaldığı gözlenmiştir. Bu çalışmadan elde edilen bulgular, eğitim ve yaşın bu testler üzerinde açıklayıcı bir etkisi olduğunu göstermiştir. Bu nedenle, kliniklerde sıklıkla kullanılan bu testlerin doğru bilişsel değerlendirme amacıyla yapılabilmesi açısından, bu değişkenlerin dikkate alınması önemlidir.

Anahtar Kelimeler: sözel akıcılık, semantik akıcılık, nöropsikolojik test, biliş, demografik değişkenler

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Abstract

Semantic fluency tests are frequently used both in clinical and experimental studies with the purpose of assessing cognitive functions. Since demographic variables have quite an explanatory effect on cognitive functions, this study aims to investigate the predictor power of the demographic variables on semantic fluency scores. 389 healthy adults aged between 50and84 who had education up to24years participated in the study. The participants were asked to produce as many names as possible in one minute. When the results are examined, it has been observed that as the education increased, so did the number of words. Also as age increased, the number of words decreased. The education has been found to be effective on categorical error. The findings that have been acquired from this study demonstrate that education and age have an explanatory effect on these tests. Therefore, it will be important to take these variables into consideration when these tests, which are frequently used in clinics, are carried out for an accurate cognitive assessment.

Keywords: *verbal fluency, semantic fluency, neuropsychological test, cognition, demographic variables.*

1. Introduction

Semantic fluency tests are frequently used both in clinical practices and in experimental studies and they can be assessed in two different manners, namely, semantic and phonemic fluency. Because they are highly sensitive to cognitive decline and are easy to use, they are widely used in clinical practice. The tasks of semantic fluency, which is also known as category fluency, rely on the (Benton, 1968) idea of producing as many words as possible from a certain category (names of people, animals, fruits or vegetables) in one minute. These tests provide quite important information regarding verbal abilities, access to semantic information (Shao, Janse, Visser, & Meyer, 2014). Also this type of measurement is about executive processes that require both the ability to make an effective organization during recall and retrieval, and to check oneself so as to follow the appropriateness of the given answer (Henry, Crawford, & Phillips, 2004), Moreover, executive processes require effortful self-initiation, inhibition ability, and the ability to switch from one category or group of words to the other one in terms of executive function control and working memory (Abwender, Swan, Bowerman, & Connolly, 2001; Henry et al., 2004; Hirshorn, & Thompson-Schill, 2006). Hence, this measurement presents important information with regards to the functions that are mentioned in terms of many neurological and psychiatric illnesses, such as attention-deficit/hyperactivity disorder (Andreou & Trott, 2013), and cognitive impairment in persons with neurodegenerative diseases, such as Alzheimer's disease (Henry et al., 2004; Hart, Kwentus, Taylor, & Hamer, 1988) or Parkinson's disease, and depression (Hart et al., 1988; St-Hilaire et al., 2016).

In many studies, the semantic fluency test scores have decreased in people with neurodegenerative diseases such as Dementia of Alzheimer Type (Henry et al., 2004; Hart et al., 1988) or Parkinson Disease Dementia (Hart et al., 1988; St-Hilaire et al., 2016) when compared to healthy controls. At the same time, it was found that semantic fluency scores of individuals who were thought to have subjective cognitive decline (Nicholai et al., 2017) or mild cognitive impairment were lower than normal controls (Wajman, Cecchini, Bertolucci & Mansur, 2018), and the scores from this task were significant predictors of regression (Pakhomov, Hemmy & Lim, 2012; Vaughan, Coen, Kenny, & Lawlor, 2018).

The high degree of clinical discrimination of the semantic fluency tests as well as the fact that it is easy to apply to untutored and low education groups increases the importance of this test in clinical practice. Because, although 12-year compulsory education was made compulsory in our country in 1997, today there is still a large number of untutored or 5 year or less educated people in age groups. Therefore, there is still a great need for psychometrically valid and reliable instruments to distinguish whether these groups have dementia. One of the most important variables affecting the cognitive performance of a person is demographic characteristics such as education and age. Especially the low level of education has a negative impact on the semantic fluency test performance (Lezak, Howieson, Loring, & Fischer, 2004).

It is now commonly accepted that one's cognitive performance is significantly affected by one's demographic characteristics. In particular, as the level of education decreases, the test performance is negatively affected (Lezak et al., 2004). When the studies that have been conducted with healthy groups are examined, it has been observed that in the Spanish sample (53 participants aged between 20 and 49), among the variables of age, the duration of education, and gender, only the duration of education has been found to be a predictor variable for semantic fluency (Villodre et al., 2006); in the Greek sample (300 participants aged between 18 and 79), it has been found that the level of education and age are predictor variables for semantic and phonemic word production (Kosmidis, Vlahou, Panagiotaki, & Kiosseoglou, 2004); in the study conducted by Stricks et al. (1998), which was composed of 995 elderly adults (USA), it has been found that there is a strong interaction between age and education regarding the names of animal, food and clothing categories; in the Mexican sample (Ostrosky-Solis, Ardila, & Rosselli, 1999) (800 participants aged between 16 and 85, within a range of 0 to 24 years of education), it has been found that the effect of education is strong especially regarding producing animal names and letter fluency (letter F), and the predictor effect of age is lower than education; in the study conducted by Troyer (2000), when the verbal fluency test performances of 411 adults, who are aged between 18 and 91 and within a range of 5 to 21 years of education, it has been found that education has an effect on the fluency performance both separately and together with age.

Ardila et al. (1994) has found that when a group of 70 years old adults and a group of 50 years old adults are compared regardless of education, the semantic fluency performance shows a %50 decrease. In a study that Acevedo et al. (2000) conducted with 702 participants above 50 years of age and 8 to 17 years of education, they have found that as age increases, a decrease is observed in all the verbal fluency (animal, fruit and vegetable naming) tests, and women receive a lower score than men, and the low level of education is correlated with the high scores. Diaz et al. (2000) indicates that the decrease that is observed in semantic fluency in accordance with age is due to the fact that making a search within a big set creates vulnerability because of a slowdown in search processes. Studies have shown that the duration of education is effective in word production (Villodre et al., 2006; Kosmidis et al., 2004; Stricks et al. 1998; Troyer, 2000), and the interaction between age and education is quite strong (Ostrosky-Solis, Ardila, & Rosselli, 1999).

Assessment of memory for everyday items in the elderly population is an essential aspect in the evaluation of cognitive functions in clinical settings. The present study has aimed to provide normative data of one of the most frequently used test in the elderly population. Although semantic fluency tests have often been used in our country, there is no normative study to show the effects of age, education and gender on test scores. Even in prominent clinics, semantic fluency test was used as part of the clinical evaluations without age, gender and education related corrections. In the continuing absence of any normative data, the recent data will make useful explanatory tool for clinical judgments to identify patient groups. In other words, the availability of normative data which also take demographic variables into account will allow a more reliable use of the fluency test for clinical assessment as well as for research purposes in Turkish speaking population.

This study investigates how the semantic fluency tests, which are frequently used in our country, are affected by demographic variables such as age, gender, and education and examines the predictor effect of these variables on the data. Investigation of the demographic variables has an important role in identifying patient groups. For example, healthy individuals with a lower level of education may receive lower scores compared to individuals with a higher level of education, even if those highly educated individuals also have a mild cognitive disorder. Therefore, if these tests are carried out and interpreted without taking the demographic variables into consideration, it becomes possible to categorize cognitively normal people as "defective" (Lucas et al., 1998). Furthermore, understanding the extent to which the cognitive changes that are age-dependent affect the performances of these tasks will prove helpful in distinguishing age-dependent cognitive disorders and other mild cognitive disorders (Brooks, Iverson, & White, 2007).

2. Materials and Method

The sample of the study consists of a total of 389 healthy adults who are aged above 50. The cut-off points of 50 was chosen for consistency and comparability with many other studies on the elderly (Shao et al., 2014; Acevedo et al., 2000; Palmer, Boone, Lesser, & Wohl, 1998).

All participants were selected in accordance with the following criteria: 1) Participants were able to read and write. 2) They had scores on the Standardized Mini Mental State Examination (SMMSE) (Molloy, & Standish, 1997; Güngen, Ertan, Eker, & Engin, 1999) that were greater than 23 for more than five years of primary education and greater than 16 for less than five years of primary education (Ertan et al., 1999). 3) Geriatric Depression Scale (GDS, Brink et al., 1982; Ertan, Eker, & Şar, 1997) score lower than 14. 4) Participants had no prior history of stroke, dementia, cerebrovascular anomalies, Parkinson's disease, multiple sclerosis, psychiatric conditions, or chronic medical conditions such as lung, liver, or kidney failures. 5) Participants used no medication that might affect test performance, such as antidepressants, antipsychotics, anxiolytics, or antiepileptics for the treatment of neurological or psychiatric illnesses. Criterias for number 4 and 5 were collected based on participants' self reports. All participants were native speakers of Turkish language.

389 Turkish volunteers were recruited at random from 9 different cities in Turkey. Participants were recruited from metropolitan cities-Ankara and İstanbul-and from 7 other cities that are provincial centers of the western, eastern, and southeastern regions of Turkey, including Adana, Hatay, Mersin, Diyarbakır, Mardin, Manisa, and Eskişehir with snowball sampling method. The participants were 389 healthy adults aged between 50 and 84 ($\bar{X}$=57.83; Ss.=6.91) whose level of education varied between being literate and 24 years of education ($\bar{X}$=9.17; Ss.=4.43), 164 of which are female and 225 of which are male. As data collection tools, Personal Information Form, SMMSE, GDS that included information on individuals' demographic characteristics and health status were filled out so as to meet the required criteria to be a part of the study. Semantic Fluency test data were collected as part of a larger neuropsychological battery that included other tests, such as Three Words-Three Shapes test (Weintraub & Mesulam, 1985), Number Digit Sequence, Semantic Fluency and Wechsler Memory Scale-R Logical Memory Test (Wechsler, 1987). All these tests have been carried out in that order. In addition, informant consent form was collected from the participants.

Semantic fluency tasks: Semantic fluency has been assessed with 3 tasks. In the first task, the participants were asked to produce as many names as possible in one minute (semantic fluency names of people – SFnp). In the second task, they were asked to produce as many animal names as possible in one minute again (semantic fluency names of animals – SFna). Only names of people and names of animals were used because they are the most frequently used categories in clinical practice in Turkey. The total score is acquired in accordance with the number of words that was produced. The words that were repeated were not included in the score;

they were calculated separately. In the third task, the participants were asked to produce a name of a people and then a name of an animal in one minute. This task requires the participant to switch category in one minute (Categorical Switch people-animal naming – CSpan) and each word pair is calculated as 1 point. For example, in a sequence that proceeds like people (1)-animal (1)-people (2)-animal (2)-people (3)… the pair people (1)-animal (1) is one point, animal (1)-people (2) pair is one point, people (2)-animal (2) is one point; so the total number of points is three. Repetition and categorical error were calculated separately from the total score. Categorical error is to produce names in people-animal-animal-people sequence instead of people-animal-people-animal. When this happens, a point is taken and it is also calculated as a categorical switch error.

Because age, education and gender are critical concerns in evaluating semantic fluency test performances of the patients, Regression Analyses were used to estimate the effect of the demographic variables. Linear Regression Analyses were conducted to determine the effects of age, education and gender on the dependent measures SFnp, SFna, CSpan and repetition and categorical error.

3. Results

In order to examine the relative contribution of education, age and gender in predicting fluency scores, a stepwise regression analysis was performed with the each subscale scores as dependent variables. There was a linear relationship between the outcome variable and the independent variables, the independent variables were not highly correlated with each other and the variance of error terms were similar across the values of the independent variables.

According to the regression analyses, age, education and gender all predict the SFnp subscale. As shown in Table 1, both age and education explained sizeable and significant portion of variances on most of the subscale test scores. The effect of gender was significant only on the SFnp subscale. As education increased and age decreased, participants produced more people names; female participants produced more people names than the male participants and repeating decreased (F(3,385)=16.59, p<.001). Education also explained sizeable and significant portions of the variance for the SFna subscale (F(1,387)=20.30, p<.001). As education increased, participants produced more animal names. For thee CSpan subscale, age accounted for the largest proportion of the variance (F(1,387)=33.04, p<.001). As age increased, participants scored less on the CSpan scale and repeating increased. In addition, as education increased, participants made fewer categorical errors.

Table 1. Linear Regression Analyses Results for Semantic Fluency Subscales

	Level	B	SH	B	R^2	Adj. R^2	P
	Education	.390	.070	.273	.050	.047	.000
SFnp	Gender	-2.383	.639	-.185	.092	.087	.000
	Age	-.141	.045	-.153	.114	.108	.002
SFnp repat	Education	-.024	.012	-.101	.010	.008	.048
SFna	Education	.260	.058	.223	.050	.047	.000
CSpan	Age	-.206	.036	-.280	.079	.076	.000
CSpan Repeat Number	Age	.025	.008	.159	.025	.023	.002
CSpan Categorical Error	Education	-.020	.010	-.106	.011	.009	.040

SFnp: Semantic fluency- names of people, SFna: Semantic fluency animal naming, CSpan: Categorical switch people animal naming.

In the second set of regression analyses, a hierarchical regression procedure was used. Education entered in the first step, age entered in the next and then gender followed. Using the enter method it was found that for the 50-59 age group, age, education and gender explain a significant amount of the variance in SFnp, SFna, CSpan subscales. The analysis shows that gender and education level did significantly predict SFnp subscale (F(3,243)=10.547, p<.001). As education increased, participants produced more people names; female participants produced more people names than the male participants. Education level did also significantly predict SFna subscale (F(3,243)=8.772, p<.001). As education increased, participants produced more animal names. As age decreased, participants scored higher on the CSpan subscale scores. For the 60 and above age group significant variations were found for SFnp (F(3,138)=4.230, p<.01) and CSpan (F(3,138)=2.863, p<.05) subscales and categorical error (F(1,134)=4.926, p<.05) in the CSpan subscale. As age decreased and education level increased, participants produced more people names. When their age increased, they scored less on the CSpan subscale scores. And as education level decreased, participant made higher categorical error in the CSpan subscale (Table 2).

As preliminary analyses, Multivariate Analysis of Variance (MANOVA) was conducted to find a distinct distribution for age and education, with education, age and gender as the between-factors and each semantic fluency subscales as the dependent variable. The divisions of continuous variables such as education and age into discrete categories may, at first, appear inherently arbitrary, but the criteria used here were chosen to be consistent with and comparable to other research. MANOVA revealed that the comparison of age groups based on age and education categories resulted in significant differences on semantic fluency subscale test scores.

We examined the incremental contributions of these demographic variables and their two-way interactions by entering education, age, gender, and the set of interaction terms sequentially into the regression model. Each independent variable first were centered and then their

Table 2. Hierarchical multiple regression analysis of Semantic Fluency subscales scores and demographic predictors

	Step	Predictors	Final beta	R^2	R^2 Change	Sig. F
Age: 59 and under						
SFnp	1	Education	.308	.073	.073***	.000
	2	Age	-.023	.075	.002	.440
	3	Gender	-.204	.115	.040**	.001
SFnp Repeat	1	Education	-.094	.007	.007	.191
	2	Age	.006	.007	.000	.849
	3	Gender	.055	.010	.003	.405
SFnp Categorical Error	1	Education	-.070	.004	.004	.356
	2	Age	.073	.010	.007	.212
	3	Gender	.066	.014	.004	.318
SFna	1	Education	.313	.097	.097***	.000
	2	Age	-.019	.098	.000	.739
	3	Gender	-.007	.098	.000	.913
SFna Repeat	1	Education	-.071	.005	.005	.260
	2	Age	.057	.009	.003	.375
	3	Gender	.000	.009	.000	.999
SFna Categorical Error	1	Education	-.070	.004	.004	.356
	2	Age	.073	.010	.007	.212
	3	Gender	.066	.014	.004	.318
CSpan	1	Education	.080	.010	.010	.126
	2	Age	-.156	.031	.022*	.020
	3	Gender	.067	.036	.004	.301
CSpan Repeat	1	Education	-.034	.001	.001	.633
	2	Age	-.062	.005	.004	.344
	3	Gender	.009	.005	.000	.897
CSpan Categorical Error	1	Education	-.071	.002	.002	.453
	2	Age	-.097	.010	.007	.191
	3	Gender	.112	.022	.012	.090

interaction term computed. The interaction for education X age, education X gender and age X gender was found to be significant in the SFnp, SFna and CSpan subscales of the regression analyses for the 50-59 age group. For the 60 and above age group, significant variations were found for the SFnp and CSpan subscales.

A Univariate Analysis of Variance for each subscale was conducted as follow-up analysis (Table 3). According to ANOVAs, two distinct age groups (aged between 50 and 59 and aged above 60) were found to differ significantly on most of the subscale scores. In addition, two distinct education groups (low education (LE): 1-8 years and high education; (HE): 9 years and above) were found to differ significantly on most of the tests. Two age groups were separated into two education (LE and HE) subgroups.

For the SFnp subscale, there are significant main effects of age ($F(1,385)=8.06$, $p=.005$, partial $\eta 2 =.05$), and education ($F (1,385) =22.01$, $p=.000$, partial $\eta 2 =.02$). Participants who are aged between 50 and 59 years old produced more names than the ones between 60 and above. Participants with HE ($\bar{X}=25.25$) produced more names than LE ($\bar{X}=22.23$) group. For SFnp repetition scores, there are significant main effects of education ($F (1,382) =3.82$, $p=.051$, partial $\eta 2 =.01$). Participants with HE ($\bar{X}=.55$) repeated less compared to the participants with LE ($\bar{X}=.77$) (Table 3).

For SFan, age does not have a significant main

Table 2. Hierarchical multiple regression analysis of Semantic Fluency subscales scores and demographic predictors (Continued) .

	Step	Predictors	Final beta	R^2	R^2 Change	Sig. F
Age: 60 and over						
SFnp	1	Education	.224	.032	.032*	.032
	2	Age	-.164	.061	.028*	.043
	3	Gender	-.159	.084	.024	.061
SFnp Repeat	1	Education	-.105	.016	.016	.139
	2	Age	-.022	.016	.001	.775
	3	Gender	-.082	.023	.006	.352
SFnp Categorical Error	1	Education	.080	.010	.010	.241
	2	Age	.137	.030	.019	.104
	3	Gender	.045	.032	.002	.607
SFna	1	Education	.111	.011	.011	.225
	2	Age	-.133	.028	.018	.114
	3	Gender	-.016	.028	.000	.850
SFna Repeat	1	Education	.120	.016	.016	.145
	2	Age	.110	.027	.012	.204
	3	Gender	-.016	.028	.000	.851
SFna Categorical Error	1	Education	-.057	.008	.008	.308
	2	Age	-.076	.014	.007	.343
	3	Gender	-.111	.026	.012	.208

*p<.05; **p<.01; ***p<.001

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effect. There is a significant main effect of education (F(1,385)=15.25, p=.000, partial η2 =.04). Participants with HE ($\bar{X}$=21.05) produced more names than the ones with LE ($\bar{X}$=18.98) (Table 3).

For the CSpan subscale, there is a significant main effect of age (F(1,385)=19.94, p=.000, partial η2 =.05), Participants who are aged between 50 and 59 ($\bar{X}$=14.51) produced more names than the ones between 60 and above ($\bar{X}$=12.18). There is not a significant main effect of education. For CSpan repetition scores, there is a significant main effect of age (F (1,377) =5.64, p=.018, partial η2 =.02). Participants who are aged between 50 and 59 years old ($\bar{X}$=.32) made less repetition than the ones aged between 60 and above ($\bar{X}$=.59). For CSpan categorical error scores, there is a significant main effect of education (F (1,376) =4.57, p=.033, partial η2 =.01). Participants with HE ($\bar{X}$=.28) made less mistakes than the ones with LE ($\bar{X}$=.47) (Table 3). For all subscale age x education interaction effect was not significant.

Pearson Correlation Analyses were conducted between fluency scores and education level and age using age and education as continuous variables. Scores from the two fluency tests were significantly and positively correlated. In addition, all measures of fluency performance were negatively correlated with age and positively correlated with education (Table 4).

Table 3. Means and standard deviations for semantic fluency subscales

	Education duration					
	8 and below		9 and above		Total	
	$\bar{X}$	Ss.	$\bar{X}$	Ss.	$\bar{X}$	Ss.
Age: 59 and below						
N	131		116		247	
Education	5.31	1.493	13	2.359	8.92	4.311
Age	53.57	2.729	53.43	2.860	53.51	2.786
SFnp	22.85	6.16	26.47	5.66	24.55	6.19
SFnp repeat number	.80	1.153	.59	.994	.70	1.084
SFna	18.68	4.55	21.47	4.78	19.99	4.85
SFna repeat number	.68	1.126	.52	.971	.60	1.056
CSpan	13.99	4.84	15.03	4.95	14.48	4.91
CSpan Repeat	.35	.635	.31	.551	.33	.595
CSpan categorical error	.41	.848	.30	.667	.36	.769
Age: 60 and above						
N	70		72		142	
Education	5.36	1.362	13.74	2.368	9.61	4.623
Age	65.51	5.545	65.21	5.007	65.36	5.262
SFnp	21.61	6.41	24.04	6.43	22.84	6.51
SFnp Repeat	.74	1.017	.51	.888	.62	.956
SFna	19.27	5.91	20.64	5.41	19.96	5.68
SFna Repeat	.41	.701	.63	.926	.52	.830
CSpan	12.60	4.86	11.75	5.28	12.17	5.078
CSpan Repeat	.52	.731	.66	2.02	.60	1.541
CSpan categorical error	.52	.937	.25	.890	.38	.919

SFnp: Semantic fluency- names of people, SFna: Semantic fluency animal naming, CSpan: Categorical switch people animal naming

Table 4. Pearson correlation between semantic fluency subscale and demographic variables

	1	2	3	4	5	6	7	8	9	10	11
1. Education	-										
2. Age	.06	-									
3. Gender	.22*	.17*	-								
4. SFnp	.22*	-.17*	-.15*	-							
5. SFna	.22*	-.05	.03	.55*	-						
6. CSpan	.01	-.28*	.01	.40*	.43*	-					
7. SFnp Repeat	-.10*	-.03	-.01	.09	.05	.00	-				
8. SFnp Categorical Error	-.00	.07	.07	-.11*	-.14*	-.08	.24*	-			
9. SFna Repeat	-.01	.01	-.01	.10*	-.05	.04	.42*	.31*	-		
10. SFna Categorical Error	-.07	.01	-.02	-.07	-.08	-.11*	.26*	.52*	.12*	-	
11. CSpan Repeat	.03	.16*	.05	.02	.03	.05	.22*	.41*	.30*	.00	-
12. CSpan Categorical Error	-.11*	-.03	.06	-.05	.05	-.12*	-.00	.01	-.07	.02	-.05

*p<.05

4. Discussion

Semantic fluency tests allow us to have information regarding executive function control, functioning of the working and semantic memory (Shao et al., 2014; Henry et al., 2004; Abwender et al., 2001). These sorts of tasks are quite sensitive to demographic variables such as education and age, since they require the ability of effortful self-initiation, inhibition and switching from one category or group of words to the other one, and also the ability to make an effective organization while remembering and the ability to check oneself so as to follow the appropriateness of a given answer. These processes are affected mostly in patients with neurodegenerative diseases such as Alzheimer, Parkinson and Depression. These problems are more common for people over the age of 60. In addition, published studies of these tests involve predominantly younger people.

The findings of this study indicate that the variables of education, age, and gender all have a significant effect on SFnp. As education increased and age decreased, participants produced more people names and repeating decreased. It was found that there was a significant negative correlation between people-naming (SFnp) and age. Based on that, we would guess that people-naming is even easier than animal-naming (SFna) because participants generate names from within well-established subgroups within their semantic memory (e.g., family members, neighbors, co-workers, characters on a favorite television show, etc.). If people's social networks shrink as they age, this might help explain why age is the best predictor of declining people-naming ability. Actually, it might be interesting in a future study to ask participants after the test to explain how they came up with the people's names. It is all the more striking that age accounted for a significant percentage of CSpan variance among participants with such a restricted age range (50-59). This suggests that fully developed norms for CSpan ought to be provided for 5-year age increments (e.g., 50-54, 55-59, 60-64, etc.), because it appears that performance might change a lot as people age. However, in this study, we did not find significant differences between 5-year age increments on subscales.

In the literature, the task of naming people in semantic fluency tests is quite rare. Generally, categories including different subgroups are used. However, one needs to be careful in terms of diagnostic judgments in the cognitive evaluation of the uneducated groups in our country. Therefore, it is of importance to generate findings regarding such a task so as to form an accurate diagnosis. When Sáez-Zea et al. (2008) examined the effect of age, gender, education, and cognitive status both on the scores of naming people and naming animals, the scores of the names of animal task were associated with age, sex, gender, educational level and cognitive status of the subject. On the contrary, the scores of the names of people task depended only on the cognitive status. In our study, as well, it has been found that the only variable that has a predictor effect on SFna score is education. As the level of education of the participants increased, they produced more words. These findings are thought provoking, because SFna is a task that requires finding words from a larger category that involves different subgroups (such as wild animals, domestic animals, fish, and birds). In this regard, this task is more difficult than SFnp. Because SFnp task does not have any limited subgroups for female names, male names, names of familiar people and names of people one doesn't know. However, our findings demonstrate that this task is sensitive to demographic variables such as age, education, and gender.

The findings that illustrate the effect of education on SFna are consistent with the results of different studies. Fluency for animals was also found to be affected by education and age in a sample of normal Hispanic, Chinese, and Vietnamese elderly people who were tested in their native language (Kempler, Teng, Dick, Taussig, & Davis, 1998). In a Portuguese sample (Da Silva, Petersson, Faísca, Ingvar, & Reis, 2004), when a group who had education for 10 years and more animal naming (X□: 12.4) was compared with a group who received education for less than 10 years (animal naming mean:16.7), it was observed that the more educated group had a better score in semantic word production and they also produced more words within the sub-categories of a certain category. The authors of this study indicated that the more educated group was able to do more active strategic search among the sub-categories and they also emphasized that formal education, apart from pointing to a capacity with regard to how to acquire information, was also in close connection with how to use this information in an abstract and systematic order. On the other hand there are also counter-findings in this regard in the literature. An Israeli sample (Kavé, 2005), which consisted of 369 participants aged between 18 and 89, demonstrated that age is a predictor variable whereas education is not as effective as it has been expected. However, it should be kept in mind that the level of education for this sample was higher than ours; the lowest level of education was 8 years.

On the other hand, our findings in terms of mean SFna scores show similarity to the other study results. In a Netherlands sample, which consisted of 82 participants with a mean age of 71.8 and most of whom high education, Shao et al. (2014) found the mean for semantic fluency (animal naming) to be 22.0. In the same Israeli sample (Kavé, 2005) the mean was 20.5 for the group with 8 to 12 years of education and 22.3 for the group with 13 to 24 years of education. In a Greek sample (Kosmidis et al., 2004) the mean for the low education group was 14.7, it was 16.8 for the medium-level education group, and 18.8 for the high education group; in the Mexican sample (Stricks et al., 1998) the mean score for semantic fluency (animal naming) for the uneducated group aged above 65 was 13.1, it was 15.6 for the group with 1 to 4 years of education, 16.6 for the group with 5 to 9 years of education and 18.4 for the group with more than 9 years of education. The numbers in our study are quite close to the findings of those other studies. The mean score for HE-50-59 age group was 21.47; the average score for LE-50-59 age group was 18.68; it was 19.27 for LE-60 and above age group and 20.64 for HE-60 and above age group.

The CSpan task also requires mental flexibility that allows one to access semantic information and switch from one category to the other. Even though education is considered as an important factor in terms of executive function control and mental flexibility (Kosmidis et al., 2004), for the healthy elderly people in our sample, the age turned out to be a more important factor. It has been observed that the only explanatory variable in the CSpan task was age; as age increased, it has ben observed that the number of words that the participants needed to produce by shifting between categories decreased. In the CSpan task, it has been observed that the categorical error is related to education. As the level of education increased, the probability of error decreased. Repetition and categorical errors are important, if these types of errors would be under-reported in patient populations in which perseverations are frequent (Troyer, 2000).

Even though semantic fluency tests are frequently used in our country, the number of studies that has been conducted on these tests is quite limited (Dinc, 2014; Evlice, 2016). Hence, these findings are considered to provide information to clinicians during neuropsychological evaluation.

The need for language-specific norms may be less apparent when talking about something like semantic fluency test as similar conceptual categories exist in all languages. However, raw scores from different languages vary (Kavé, 2005). Additionally, education, age and gender corrected norms could give more accurate results to be used with elderly in clinical settings. Semantic Fluency Test can be considered as fast and simple bedside diagnosis tool. It is relatively brief and easy test that can be easily adapted to variety of clinical settings. Therefore, these tests can easily be used for elderly people. The results of the study show that subscale tests of the Semantic Fluency can differentiate two distinct age and education groups. Based on these results Semantic Fluency Test can provide information about the grouping of elderly patients about executive functions. Given the limitation of the existing study, it should be kept in mind that the semantic fluency tasks were given in a set consisting of memory and learning tests and therefore this may have caused a certain amount of exhaustion in the participants. On the other hand, the measurement of semantic fluency tests through tasks involving different categories and the formation of normative data through studies with larger samples will contribute to the accuracy of the cognitive measurements in our country. In the study snowball method has been used; however, this is considered the limitation of the study.

Patient informed consent: There is no need for patient informed consent.

Ethics committee approval: The ethics committee approval has been obtained from Mersin University with Ethics committee report number of 78017789-050.01.04-521126 (17 August 2017).

Conflict of interest: There is no conflicts of interest to declare.

Financial support: No funding was received.

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JNBS 2019 Published by Üsküdar University / 2019 Üsküdar Üniversitesi tarafından yayımlanmaktadır www.jnbs.org