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Semantic verbal fluency analysis in highly educated older adults

Análise da fluência verbal semântica em idosos altamente escolarizados

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ABSTRACT

Purpose: to compare the performance of a group of highly educated, healthy older adults in the quantitative and qualitative analysis of the Semantic Verbal Fluency (SVF) test in the Animals and Fruits categories, the performance of the subgroups of participants (with high [HE] and very high [VHE] educational level) in both categories, as well as the performance between men and women. **Methods**: The study included 31 older adults (> 60 years old), with eight years or more of formal education, from the Federal District (DF-Brazil). All performed the 60-second test in both categories. The following items were analyzed: total words, clustering, switching, intersection, return, test time, and errors, considering demographic variables such as gender and educational level (HE: 8 to 16 years; VHE: 17 to 25 years). **Results**: Participants with VHE had a better performance in both categories, with a greater total number of words evoked for "animals" and a greater number of switches ($p<0.05$) for "fruits". In relation to gender, men obtained a better performance for "animals" with the highest total number of evoked words and in the different time blocks ($p<0.05$) and greater number of clusters and intersections ($p<0.001$). **Conclusion**: The performance of healthy older adults with a high educational level is influenced by demographic variables such as years of formal education and gender, suggesting that the application of the SVF should consider the impact of these variables, with a cautious interpretation of the results.

Keywords: Aging; Cognition; Language; Education; Neuropsychological test

RESUMO

Objetivo: comparar o desempenho de idosos saudáveis com alta escolaridade nas análises quantitativas e qualitativas do Teste de Fluência Verbal Semântica, nas categorias "animais" e "frutas", comparar o desempenho de subgrupos de participantes (com escolaridade alta e muito alta) em ambas as categorias, assim como o desempenho entre homens e mulheres. **Métodos**: participaram do estudo 31 idosos, (>60 anos), com oito anos ou mais de escolaridade, procedentes do Distrito Federal (DF-Brasil). Todos realizaram o teste de 60 segundos, nas duas categorias. Foram analisados: total de palavras, clustering, switching, intersecção, retorno, tempo de teste e erros, atendendo às variáveis demográficas, como gênero e escolaridade (escolaridade alta: oito a 16 anos de estudo; escolaridade muito alta: 17 a 25 anos de estudo). **Resultados**: participantes com escolaridade muito alta obtiveram melhor desempenho em ambas as categorias, com maior número total de palavras evocadas na categoria "animais" e maior quantidade de switches ($p<0,05$) em "frutas". Quanto ao gênero, os homens obtiveram melhor desempenho na categoria "animais", com maior número total de palavras evocadas e nos diferentes blocos de tempo ($p<0,05$), e maior quantidade de clusters e interseções ($p<0,001$). **Conclusão**: o desempenho de idosos saudáveis com alta escolaridade foi influenciado por variáveis demográficas como anos de estudo e gênero, sugerindo que a aplicação do Teste de Fluência Verbal Semântica deve considerar o impacto dessas variáveis e realizar uma interpretação cautelosa dos resultados.

Palavras-chave: Envelhecimento; Cognição; Linguagem; Educação; Teste neuropsicológico

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INTRODUCTION

The Verbal Fluency Test is an instrument widely used in the neuropsychological assessment of aging[1] and in the screening of cognitive changes[2]. According to data from the 2018 Demographic Census of the *Instituto Brasileiro de Geografia e Estatistica*[3] (IBGE, Brazilian Institute of Geography and Statistics), the elderly population is expected to increase in the coming decades. It is estimated that 1/4 of Brazilian citizens will be elderly by 2043. Therefore, it is necessary to study these individuals and the cognitive changes resulting from the passage of time. Charchat-Fichman et al.[4], when studying the cognitive decline in the aging process, state that the cognitive trajectory is divided into two groups: stable and benign and in an incipient/transition stage to dementia. Some researchers state that clinical characterization is fundamental and highlight that demographic, cultural, environmental, genetic, and lifestyle variables, influence neuropsychological performance and contribute to the cognitive heterogeneity of the aging process[5]. To assess cognitive changes in aging, several neuropsychological instruments have been developed. Martins et al.[6], in a review study, describe that the Verbal Fluency Test has been the second most used instrument over the last five years with older adults in Brazil. Thus, in addition to its simplicity and speed, it assesses the spontaneous production of words under restricted conditions, involving linguistic, memory (semantic memory), and cognitive processes specific to executive functions (sustained attention, working memory, search strategies, initiation, inhibition of inappropriate responses, planning, and speed of information processing)[7], as well as vocabulary size and general knowledge[2].

According to the literature, among its different versions, the Semantic Verbal Fluency Test (SVF) requires the production of words of predetermined categories, such as, for example, "animals" or "fruits", in an established time of 60 seconds[7], and losses in performance would be related mainly to brain changes, specifically lesions in the left hemisphere and requiring greater activation of the temporal lobe regions[7]. In addition to being an ecological instrument and of rapid application, it presents a high sensitivity in the discrimination of the normal aging process, early stages of cognitive decline, and dementia[1]. However, as with most neuropsychological tests, studies have shown that SVF performance can be influenced by sociodemographic variables, such as age, academic level, gender, among others[8,9]. However, in the SVF performance analysis, in samples of healthy older adults with a high educational level, studies have found different results. In the study by Brucki and Rocha[8], using quantitative and qualitative analyses, there were no statistically significant differences between two groups of participants with high educational levels (nine to 11 years of formal education and 11 years or more), as well as the study by Acevedo et al.[9] who reported no impact regarding the years of formal education on the performance of the groups of participants (eight to 12 years; 13 to 16 years; and over 17 years). However, Fichman et al.[10] found differences in the quantitative performance of older adults with 12 years or more of formal education, compared to older adults with lower educational levels. For their part, Souza et al.[11] highlighted the relevance of the task in detecting differences between samples with a higher educational level.

Regarding the relationship between gender and test performance, most studies reported the absence of statistically significant differences between groups of older adults in the "animals"[8,9,12-15] SVF category, except in the studies developed by Castro-Costa et al.[16] and Silva et al.[17], in which men had a better performance. In turn, some studies have highlighted that women have a better performance in the "fruits" and "vegetables" categories[9,18].

It is worth pointing out that few studies[8,19-21] included qualitative analyses, such as clusters, categories, and switches of the words generated in the SVF in healthy populations of older adults, being highly relevant in understanding the participants' cognitive performance, considering the possible influence of sociodemographic variables on the normal aging process. In a complementary way, it is important to know the cognitive profile of older adults with a high educational level, especially in rapid and sensitive tests to identify neuropsychological changes, considering the greater access to Education, which provides an increase in the educational level, and the lack of qualitative data, in Brazil, regarding the performance of older adults and samples with high educational levels in SVF tasks.

Finally, regarding the type of category, studies carried out in other countries have shown that, in the "animals" category, the SVF presented a better validity criterion than in the "fruits" category, with less influence from cultural and educational level[22], while the performance in this test was influenced by sociodemographic variables in a different way in relation to the "animals" and "fruits" categories in several Spanish-speaking countries[23]. Thus, the objectives of the present study were: to compare the performance of a group of healthy older adults with high educational level in the quantitative and qualitative SVF analyses in the "animal" and "fruit" categories; comparing the performance of two groups of older adults with different educational levels (high and very high) in the SVF, in the "animal" and "fruit" categories; to compare the performance in the SVF between men and women. It was expected that the participants with higher educational levels would have a better performance in the "animals" category, aiming at contributing to a better analysis of SVF performance for Brazilian older adults with high educational levels, especially regarding the strategies used in each category.

METHODS

Ethical aspects

This study was approved by the Research Ethics Committee of the Faculty of Health Sciences of the *Universidade de Brasília* (UnB, University of Brasília), CAAE: 36747614.5.0000.0030. All participants signed the Informed Consent Term, which was also approved by the Committee.

Participants

This study involved 31 older adults (22 women and 9 men), aged 60 or over, with a mean age of 69.25 years (standard deviation of 4.64), and with eight or more years of formal education, with a mean of 16.75 years (standard deviation of 4.39), recruited from the community and selected for convenience.

The 31 older adults were selected from the 45 participants of a project involving a cognitive training program. Older

adults aged 60 or over were included; with more than eight years of formal education; native speakers of Brazilian Portuguese; who reported having good health conditions, no history of drug or alcohol abuse, or psychiatric or neurological disorders, having normal or corrected hearing and vision, not using psychotropic medication; who did not present cognitive impairment (with a score equal to or greater than 24 points in the Montreal Cognitive Assessment [MoCA][24]); individuals who did not have symptomatology suggestive of anxiety (scores below 7 points on the Beck's Anxiety Inventory - BAI)[25] or depression (score below 13 points on the Beck's Depression Inventory - BDI-II)[26].

Instruments

For screening the participants, the following were applied: a general assessment questionnaire, a self-administered instrument that contains the participant's identification, sociodemographic, and clinical data; the MoCA (Brazilian version) proposed by Cesar et al.[24]; the BAI (Brazilian version) proposed by Cunha[25]; and the BDI-II (Brazilian version) proposed by Gorenstein et al.[26].

For the analysis of the SVF, the categories chosen for the present study were "animals" and "fruits". The participants were instructed on the invalidity of words belonging to the error groups, so that they would not emit words that fit those groups. They received the following guidelines: (1) "Now, I would like you to tell me as many names of animals of any species as possible (land or sea animals, four-legged, birds, fish, insects). You have a minute, the more animals you say, the better". (2) "Now, I would like you to tell me as many fruit names as you can remember. They can be from fruit trees you have in the backyard, wild fruits, any fruit. You have a minute, the more you say, the better ". The total number of words evoked and the number of words in the time intervals (in seconds) were analyzed: from 0 to 15, 16 to 30, 31 to 45, and 46 to 60. Error analysis and qualitative analysis were performed, such as the order of the words emitted. The inclusion of qualitative analyses suggests relevant information regarding the strategies used, formation of clusters, and change of subcategories when the previous one is over[27]. The errors considered were: intrusion (words that are not of the requested category), repetition (words spoken more than once), continuous repetition/perseveration (repetition of the same item continuously, persistence in the same word, uttered twice or more), paraphasia (phonological, semantic, or other changes) and derivation (words that vary in number, size, gender, and verbal conjugations), based on the authors Machado et al.[28] and Fichman et al.[10].

For the study of clustering, switching, intersection, and return, the following groupings were considered for each semantic category: - Animals: first letter, environment (aquatic, farm, Brazilian *cerrado*, domestic, rainforest, savannah, jungle, and zoo animals) and class (bird, mammal, fish, amphibian, insect, crustacean, and reptile); - Fruits: first letter, flavor (acid, bitter, bittersweet, sweet, and neutral) and climate (tropical, temperate, subtropical, equatorial). Clustering (refers to the subcategories generated by the participants) was calculated based on the study by Wajman[21], from the second word of the cluster, therefore, a single word had a size of 0, a group of two words had a size of 1, a group of three words had a size of 2, and so on. For switching (changes in subcategories and groupings), the number of changes between the subcategories was calculated. Regarding intersection (using the word of a stimulus group to start the next one), the calculation was made by the number of strategies performed. Return is a reversion to the previous subcategory, calculating the switching and the intersection, as described by Pereira et al.[20]. The performance of the participants in this study was also analyzed by the time used in the test, with divisions in blocks of 15 seconds.

Procedure

The instruments were applied individually by researchers, who were trained for the task at the UnB and took place in a well-lit room, with noise control. As part of a broader study, at first, the older adults were asked about their identification, sociodemographic data, and information regarding their current and past health condition, presence of emotional and cognitive symptoms, list of medications in use, and complementary studies performed. Those who met the inclusion criteria were invited to participate in the study. In a second meeting, half of the group performed the "animals" SVF category and the other half, the "fruits" category, with the subsequent application of other neuropsychological tests from the broader study. After two months, the participants returned to reapply the SVF, using a different category than the one previously performed. Their tests were recorded and later digitized for analysis.

Statistical analysis

To characterize the sample regarding the demographic variables of interest, descriptive analyses were used, using mean and standard deviation. The t-test of independent samples was used to compare the demographic and mental status of the participants in the subgroups by educational level: high (HE) and very high (VHE). To analyze the performance of the participants in the SVF, the GLM test (General Linear Model) was used, for unrelated samples, using the Bonferroni post-hoc test and partial eta squared (ηp2) as a measure of the effect size. The dependent variables were: total words, total words in time intervals in seconds (0 to 15, 15 to 30, 30 to 45 and 45 to 60), total clustering, switching, intersections, returns to the first letter, environment and class, total intrusions, repetitions/perseveration, continuous repetition, paraphasias, and derivations. The independent variables were educational level and gender. The statistical program IBM SPSS Statistics, version 25, was used and the level of significance considered was $p \leq 0.05$.

RESULTS

The sample involved 31 older adults, with a mean age of 69.25 years (standard deviation of 4.64) and with 16.75 years of formal education (standard deviation of 4.39), 22 of which were female. The comparison of the subgroups of participants, considering the educational levels - HE (from 8 to 16 years of study) and VHE (from 17 years to 25 years of study) - did not show any statistically significant differences by age (p=0.963), global cognition (MoCA, p=0.370), and presence of symptoms of anxiety (BAI, p=0.466) and depression (BDI, p=0.442) (Table 1).

As for the words evoked in the SVF, it was observed that the total mean was significantly higher (p<0.001) in the "animals" semantic category, with the same occurring for all time blocks, however, with utterance values decreasing every 15 seconds (0-15s> 15-30s> 30-45s> 45-60s). It was noted that there was a statistically significant difference in the total first letter (p<0.001) and class (p=0.013) switches, between categories, obtaining higher means in the "animals" category. There were significant differences in the total first letter returns (p<0.001) and environment and class clusters (p<0.001), as well as in the total environment and class intersections (p<0.001). There were also significant differences in the total paraphasia errors (p=0.003) and total derivations (p=0.012), between the two categories studied, presenting a higher occurrence in the mean of the "animals" category, however, with values close to 1 word uttered. The analysis of the comparison of the different time intervals showed significant differences between the categories, with those being first letter switches and class and environment and class clusters (p<0.05). Table 2 compares the SVF performance of the participants in the "animal" and "fruit" categories and presents the mean (standard deviation) and the significance value of the comparison between them (p value).

Regarding the comparison of the performance of the HE and VHE groups in the "animal" and "fruit" categories, the results of the analysis of the "animal" category indicated a significant difference in the total number of words (p=0.044), with a greater number of words in the VHE group (24.85 ± 6.02) in comparison to the HE group (20.75 ± 4.42). There was a statistically significant difference in the total words during the first 15 seconds of the test (p=0.023), with a greater number of words in the VHE group (10.92 ± 2.46) than in the HE group (8.56 ± 2.75). The results also indicated that the VHE group performed a greater number of switches, in relation to the first letter of the word (p=0.039) and in the time interval between 0 and 15 seconds (p=0.024). Significant differences were observed between groups for the environment cluster (30-45s) (p=0.007) and class cluster (0-15s) variables (p=0.025). For the "fruit" category, there was no difference in relation to

Table 1. Demographic and clinical characterization of the sample

Variable	Total	Educational level		p-value*
		High	Very high	
Sample size	31	17	14	-
Percentage of women	70.96%	82.35%	57.14%	-
Age years)	69.25 ± 4.64	69.29 ± 5.05	69.21 ± 4.26	0.963
Educational level (years)	16.75 ± 4.39	13.50 ± 2.39	20.71 ± 2.61	0.001
MoCA	27.03 ± 1.40	26.82 ± 1.50	27.28 ± 1.26	0.370
BAI	5.16 ± 5.20	4.52 ± 3.84	5.92 ± 6.56	0.466
BDI-II	6.87 ± 4.68	7.47 ± 5.25	6.14 ± 3.95	0.442

T test for independent samples; *Statistically significant value (p≤0.05)
Subtitle: n = number of subjects; % = percentage; MoCA=Montreal Cognitive Assessment; BAI=Beck's Anxiety Inventory; BDI-II=Beck's Depression Inventory II

Table 2. Comparison of the performance of participants in the Semantic Verbal Fluency test

Variables	Category type		p-value
	Animals	Fruits	
	Mean (SD)	Mean (SD)	
Total words	22.59 (5.50)	16.44 (4.42)	**0.001***
Total words (0-15s)	9.62 (2.84)	8.11 (2.11)	**0.029***
Total words (15-30s)	5.00 (1.98)	3.74 (1.53)	**0.011***
Total words (30-45s)	4.31 (1.96)	2.56 (1.57)	**0.001***
Total words (45-60s)	3.66 (1.83)	2.04 (1.95)	**0.002***
Total cluster (first letter)	2.34 (1.83)	3.15 (2.44)	0.168
Total switching (first letter)	18.86 (5.45)	12.33 (4.51)	**0.001***
Total intersections (first letter)	2.34 (1.83)	3.15 (2.44)	0.168
Total returns (first letter)	9.17 (3.78)	5.04 (3.28)	**0.001***
Total clusters (environment)	14.86 (4.43)	9.07 (2.99)	**0.001***
Total switching (environment)	6.76 (2.66)	6.19 (2.54)	0.415
Total intersections (environment)	14.86 (4.43)	9.07 (2.99)	**0.001***
Total returns (environment)	4.69 (2.36)	4.15 (2.17)	0.378
Total clusters (class)	13.52 (4.76)	9.26 (3.44)	**0.001***
Total switching (class)	7.93 (2.54)	6.04 (2.98)	**0.013***
Total intersections (class)	13.52 (4.76)	9.26 (3.44)	**0.001***
Total returns (class)	4.52 (1.59)	4.52 (2.66)	0.998
Total intrusions	0.007 (0.25)	0.19 (0.62)	0.359
Total repetitions/perseverance	1.14 (1.24)	0.85 (1.19)	0.386
Total continuous repetition	0.00 (0.00)	0.00 (0.00)	-
Total paraphasias	1.24 (1.30)	0.41 (0.57)	**0.003***
Total leads	0.41 (0.82)	0.00 (0.00)	**0.012***

General Linear Model (GLM); *Statistically significant values (p≤0.05)
Subtitle: s = seconds; SD = standard deviation

the total number of words, errors, and fruit climate, between both groups. However, there was a statistically significant difference in the total number of words in the (45-60s) interval (p=0.019) and in the total first letter returns (p=0.036), as well as greater production of fruit flavor and climate switches at different intervals of time, especially in the final 15 seconds (flavor p=0.013 and climate p=0.024). Table 3 shows the comparison of the performance of the HE and VHE groups in the "animal" and "fruit" categories.

Regarding the performance comparison between genders for the two SVF categories, it was observed that, in the "animals" category, there was a significant difference in the total of words (p<0.001), with better performances being linked to men (27.75 ± 6.47), when compared to women (20.60 ± 3.61). There was a significant difference in the time blocks from 0 to 15 seconds (p=0.038), 30 to 45 seconds (p=0.012), and 45 to 60 seconds (p=0.012). Regarding animal environment, the male group showed a higher occurrence of clustering (p<0.001) in the time intervals from 0 to 15 seconds (p=0.033) and 30 to 45 seconds (p=0.041), intersection (p< 0.001), and switching, from 30 to 45 seconds (p=0.048). They performed a greater number of first letter clusters in the interval between 30 and 45 seconds (p=0.048) and switching in the last 30 seconds of the test (p=0.040). There was also a greater number of clusters of the animal class in the time interval from 0 to 15 seconds (p<0.001), with the male group always obtaining higher scores. For the "fruit" category, the results indicated the absence of statistically significant differences between the groups. Table 4 shows the total SVF performance in the two semantic categories between men and women.

DISCUSSION

The objectives of the present study were to compare the performance of a group of healthy older adults with a high educational level in the quantitative and qualitative analyses of the SVF in the "animals" and "fruits" categories, to compare the performance of older adults with different educational levels, high and very high, in the SVF, in the "animal" and "fruit" categories, and to compare the performance between men and women in the SVF, based on the analysis of quantitative variables (performance by test run time) and qualitative variables, such as clustering, switching, intersection, and return.

In the "animals" category, the performance of older adults with a high educational level was better than in the "fruits" category, both in quantitative and qualitative analyses. A better performance in the "animals" category, compared to other categories, has already been described in previous studies[9,18,29]. The smaller number of responses in the "fruit" category may justify the lower occurrence of errors such as paraphasias and derivations. The significant differences in the occurrence of paraphasia and derivation, with higher values in the "animals" category, can also be justified by the possibility of conjugations regarding gender, in this category (for example, lion/lioness), which does not occur in "fruits". However, as expected, the values were low, as it was a group of healthy participants. It is also worth considering that no studies comparing errors between the "animals" and "fruits" categories were found.

The performance analysis of the SVF in the "animals" category, in the different educational level groups, revealed

Table 3. Comparison of the participants' performance in the two categories of the Semantic Verbal Fluency Test considering their educational level

Variables	Animals		p-value	Fruits		p-value
	HE	VHE		HE	VHE	
	n=16	n=13		n=15	n=12	
	Mean (SD)	Mean (SD)		Mean (SD)	Mean (SD)	
Total words	20.7 (4.41)	24.8 (6.02)	**0.044***	15.20 (3.07)	18.00 (5.42)	0.103
Total words (0-15s)	8.56 (2.75)	10.9 (2.46)	**0.023***	8.33 (1.67)	7.83 (2.62)	0.553
Total words (15-30s)	4.75 (1.77)	5.30 (2.25)	0.461	3.46 (1.45)	4.08 (1.62)	0.309
Total words (30-45s)	3.81 (1.72)	4.92 (2.13)	0.133	2.13 (1.24)	3.08 (1.83)	0.122
Total words (45-60s)	3.62 (2.09)	3.69 (1.54)	0.924	1.26 (1.66)	3.00 (1.90)	**0.019***
Total cluster (first letter)	2.12 (1.92)	2.61 (1.75)	0.485	3.46 (2.64)	2.75 (2.22)	0.460
Total switching (first letter)	17 (5.24)	21.1 (4.98)	**0.039***	10.70 (3.08)	14.3 (5.31)	**0.037***
Total intersections (first letter)	2.12 (1.92)	2.61 (1.75)	0.485	3.46 (2.64)	2.75 (2.22)	0.460
Total returns (first letter)	8.12 (3.11)	10.4 (4.23)	0.098	3.86 (2.32)	6.50 (3.80)	**0.036***
Total clusters (environment)	13.5 (3.65)	16.5 (4.85)	0.065	8.53 (2.41)	9.75 (3.59)	0.304
Total switching (environment)	6.31 (2.08)	7.30 (3.25)	0.327	5.33 (1.98)	7.25 (2.83)	**0.049***
Total intersections (environment)	13.5 (3.65)	16.5 (4.85)	0.065	8.53 (2.41)	9.75 (3.59)	0.304
Total returns (environment)	4.43 (1.86)	5 (2.91)	0.533	3.46 (1.40)	5.00 (2.69)	0.068
Total clusters (class)	12.4 (4.93)	14.8 (4.35)	0.180	8.53 (1.95)	10.10 (4.64)	0.228
Total switching (class)	7.12 (2.33)	8.92 (2.53)	0.057	5.40 (2.94)	6.83 (2.94)	0.221
Total intersections (class)	12.4 (4.93)	14.8 (4.35)	0.180	8.53 (1.95)	10.10 (4.64)	0.228
Total returns (class)	4.06 (1.48)	5.07 (1.60)	0.089	4.00 (2.50)	5.16 (2.82)	0.267
Total intrusions	0.06 (0.25)	0.07 (0.27)	0.884	0.26 (0.79)	0.08 (0.28)	0.458
Total repetitions/perseverance	1.37 (1.25)	0.84 (1.21)	0.263	0.86 (1.24)	0.83 (1.19)	0.944
Total continuous repetition	0.00 (0)	0.00 (0)	-	0.00 (0)	0.00 (0)	-
Total paraphasias	1.12 (1.40)	1.38 (1.19)	0.602	0.26 (0.45)	0.58 (0.66)	0.157
Total leads	0.56 (0.96)	0.23 (0.59)	0.289	0.00 (0)	0.00 (0)	-

General Linear Model (GLM); *Statistically significant values (p≤0.05)
Subtitle: n = number of subjects; s = seconds; SD = standard deviation

Table 4. Comparison of performance in the two categories of the Semantic Verbal Fluency Test considering the gender of the participants

Variables	Animals		p-value	Fruits		p-value
	Women	Men		Women	Men	
	n=21	n=8		n=18	n=9	
	Mean (SD)	Mean (SD)		Mean (SD)	Mean (SD)	
Total words	20.60 (3.61)	27.7 (6.47)	**0.001***	16.60 (3.94)	16.10 (5.51)	0.788
Total words (0-15s)	8.95 (2.65)	11.30 (2.72)	**0.038***	8.61 (1.53)	7.11 (2.80)	0.083
Total words (15-30s)	4.76 (1.57)	5.62 (2.82)	0.303	3.44 (1.50)	4.33 (1.5)	0.160
Total words (30-45s)	3.76 (1.64)	5.75 (2.12)	**0.012***	2.83 (1.68)	2.00 (1.22)	0.201
Total words (45-60s)	3.14 (1.87)	5.00 (0.75)	**0.012***	1.72 (1.93)	2.66 (1.93)	0.243
Total cluster (first letter)	1.95 (1.39)	3.37 (2.50)	0.061	2.83 (1.38)	3.77 (3.83)	0.354
Total switching (first letter)	17.6 (4.05)	22.00 (7.52)	0.054	12.90 (4.13)	11.10 (5.23)	0.330
Total intersections (first letter)	1.95 (1.39)	3.37 (2.50)	0.061	2.83 (1.38)	3.77 (3.83)	0.354
Total returns (first letter)	8.04 (2.94)	12.1 (4.32)	**0.007***	5.61 (3.22)	3.88 (3.29)	0.205
Total clusters (environment)	13.3 (2.97)	18.8 (5.27)	**0.001***	9.27 (2.78)	8.66 (3.53)	0.627
Total switching (environment)	6.38 (2.24)	7.75 (3.53)	0.223	6.27 (2.39)	6.00 (2.95)	0.795
Total intersections (environment)	13.3 (2.97)	18.8 (5.27)	**0.001***	9.27 (2.78)	8.66 (3.53)	0.627
Total returns (environment)	4.52 (2.01)	5.12 (3.22)	0.550	4.05 (1.73)	4.33 (3.00)	0.762
Total clusters (class)	11.7 (3.28)	18.2 (4.94)	**0.001***	9.55 (3.31)	8.66 (3.84)	0.538
Total switching (class)	7.80 (2.33)	8.25 (3.19)	0.685	6.00 (3.34)	6.11 (2.26)	0.929
Total intersections (class)	11.7 (3.28)	18.2 (4.94)	**0.001***	9.55 (3.31)	8.66 (3.84)	0.538
Total returns (class)	4.66 (1.59)	4.12 (1.64)	0.424	4.61 (2.97)	4.33 (2.06)	0.804
Total intrusions	0.04 (0.21)	0.12 (0.35)	0.480	0.11 (0.32)	0.33 (1.00)	0.392
Total repetitions/perseverance	1.19 (1.24)	1.00 (1.30)	0.720	0.94 (1.16)	0.66 (1.32)	0.581
Total continuous repetition	0.00 (0.00)	0.00 (0.00)	1.000	0.00 (0.00)	0.00 (0.00)	1.000
Total paraphasias	1.04 (0.97)	1.75 (1.90)	0.199	0.33 (0.48)	0.55 (0.72)	0.352
Total leads	0.28 (0.64)	0.75 (1.16)	0.180	0.00 (0.00)	0.00 (0.00)	1.000

General Linear Model (GLM), *Statistically significant values (p≤0.05)
Subtitle: n = number of subjects; s = seconds; SD=standard deviation

that the group of older adults with VHE obtained higher scores than those of the HE group, in the total of words (including 0 to 15 seconds), clustering (class and 0 to 15 seconds), switching (first letter, first letter [0 to 15 seconds], and class), and intersection (class). For the "fruit" category, this variable had significant effects on the production of first letter switching, first letter in the last 30 seconds, flavor and climate from 45 to 60 seconds, and return to the first letter of the word.

In both categories, it was noted that the VHE group made more switches, compared to individuals in the HE group. Thus, the results suggest the influence of the years of study on performance, which is in line with the data obtained in the study by Pereira et al.[20], in which the group with the highest educational level obtained more numbers of switches, compared to the lower educational level group. It is worth noting, in the analyses of this study, that the switching strategy was better for the VHE group and Table 3 shows several comparisons that showed greater use of this strategy for the "fruits" category, which seems to require greater complexity of cognitive activation, according to the comparison of the results between the two categories. The evocation of words within a group (clustering) and change of groups (switching) are abilities dependent on cognitive flexibility, cognitive function, and lexical organization, which are directly related to educational level. Thus, it is expected that individuals with more years of education will obtain a greater number of words, making greater use of this type of strategies[19]. According to Pereira et al.[20], the return strategy requires mnemonic skills, such as episodic and working memory, to remember the previously mentioned subcategory, as well as mental flexibility to search for other words within the same category.

The gender variable had an influence on the SVF in a particular way for each category studied. Men achieved better results in the "animals" category, compared to women, like in previous studies[16,17]. It is noteworthy that the study developed by Castro-Costa et al.[16] also assessed a sample of participants from the Midwestern region of Brazil. In the "fruit" category, women had a slightly higher mean in the total of words, however, the difference had no statistical significance, whereas in the study by Acevedo[9], a better performance was found in the total number of words within the same category.

According to the literature, gender-related differences in SVF performance are mainly derived from the test category and would be related mainly to social roles[30], culturally inherited, and associated with masculinity and femininity archetypes, in which men are seen as providers, working outside home, and women are seen as a caregivers, working at home. Additionally, it is important to emphasize the importance of early childhood in the development of cognitive skills, since men are more stimulated early on the names of animals, an activity that is historically considered more masculine, and women are stimulated with activities that involve motherhood and activities domestic. About the names of fruits, in early childhood, children of both genders are encouraged to eat them, which provides greater equity in the comparison between genders. Studies report that a better performance on the test would be associated with a more stimulating environment, a broader vocabulary, as well as with the greater development of reading and writing skills, among other factors[30].

Regarding the analysis by time blocks, several studies propose that, during the execution of the test, the number of emissions gradually decreases[19,29]. As observed in the present

research, the values referring to the total of words decrease every 15 seconds of testing, especially in the second time block, in both categories.

Regarding the identification of the use of strategies, the older adults in this study did not rely on the first letter of a word as a method to produce the greatest possible number of utterances within a category. No studies were found that analyzed the first letter strategy in the semantic type of the test and offered a unique contribution to this research. A plausible assumption is the number of letters in the alphabet, which allows for a greater variety of responses.

The present study had some limitations. First, the sample size was small. Secondly, it was observed that there was a prevalence of female participants and, thirdly, complementary analyses of vocabulary, as well as performance in reading and writing tasks were not included.

CONCLUSION

There were quantitative and qualitative differences in the performance of healthy older adults with a high educational level in the "animal" and "fruit" categories. When comparing the HE and VHE groups, there was a better performance of the VHE group in both categories, however, there were no differences between them for the "fruit" category. Regarding gender, men performed better in the "animals" category. Thus, the application of the SVF, whether in the clinical or research context, must consider the impact of demographic variables on the quantitative and qualitative performance and value a cautious qualitative analysis of the results.

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