

## Research Article



# Investigating Noun and Verb Naming in Behavioral Variant of Frontotemporal Dementia and Non-Patients Persian-Speaking

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## ABSTRACT

**Introduction:** Due to the prevalence of cognitive disorders, such as the behavioral variant of frontotemporal dementia (bvFTD) and the consequences that these disorders follow, early diagnosis and awareness of the deficiencies of these people in the cognitive and language areas is essential. Given that language is dependent on culture, examining the linguistic characteristics of such patients in different languages can provide valuable findings. Therefore, this study compares noun and verb naming abilities in individuals with bvFTD and non-patients Persian-speaking.

**Materials and Methods:** In this cross-sectional study, 3 cognitive tests, including frontal assessment battery (FAB), Montreal cognitive assessment, and mini-mental state examination (MMSE), along with 2 noun naming and verb naming tests were performed on 15 patients with bvFTD and 30 homogeneous non-patient individuals.

**Results:** The bvFTD group had significantly different scores for both noun and verb naming compared to the non-patient group ( $P < 0.05$ ). Meanwhile, the bvFTD group was more impaired in naming verbs than nouns, with the largest difference between groups in the verb naming task.

**Conclusion:** the results showed that bvFTD patients have poorer noun and verb naming abilities than non-patients. In particular, in verb naming, they showed more deficits than nouns. One possible explanation is that the processing of verbs is more complicated than nouns and involves a more complex neural system and cognitive processes than noun processing. Another possibility is that verbs rely more heavily on frontal and temporal regions of the brain, which are typically affected by bvFTD.

### Keywords:

Dementia; Behavioral variant of frontotemporal dementia (bvFTD); Cognition; Naming

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## Introduction

**D**ementia is the most common cognitive disorder that has a significant prevalence among elderly people [1]. Frontotemporal dementia (FTD) is used to describe a spectrum of progressive dementia conditions associated with focal atrophy of the frontal lobes and or temporal lobes, which is now considered the second most common cause of young-onset dementia after Alzheimer disease [2]. Clinically, FTD can be divided into two variants, namely the behavioral variant (bvFTD) and the language variant. The latter is also known as the primary progressive aphasia (PPA). PPA is typically classified into a nonfluent/agrammatic, logopenic, and semantic variant. Meanwhile, the latter is also referred to as semantic dementia.

Among the clinical types of FTD, bvFTD is the most common. Behavioral-type dementia accounts for approximately 60% of FTD cases and the other 40% comprises the linguistic type of FTD [3]. No study was found in Iran regarding the prevalence of this disease.

bvFTD is a neurodegenerative disease that causes profound changes in a patient's behavior and personality, associated with progressive frontal and anterior temporal lobe atrophy [4]. Behavioral changes may include disinhibiting, social inappropriateness, and compulsions, loss of insight, loss of empathy, excessive jocularity, and gluttonous overeating. These changes appear in the earlier stages of the disease, usually preceding the onset of cognitive deficits, and tend to be best recognized by the patient's closest relatives, friends, and colleagues [5]. This disease is more common in men and tends to start in the middle or late fifth decade of life [3].

Although PPA is known to dominant language problems, there are also some language problems in bvFTD [6]. Deficits in confrontation naming [7], comprehension of single words, and sentences, in addition to more generalized semantic and language impairment have been described in bvFTD [8]. The results of a study showed that bvFTD patients overall showed impairments in noun naming, verb naming, and concrete single-word comprehension. In addition, contrary to previous evidence patients with bvFTD did not show deficits in abstract single-word comprehension, sentence comprehension, or any other language domains [9].

Based on previous research, we concluded that patients with bvFTD have deficits particularly affecting language functions, such as naming, sentence comprehension, and

production that are likely to engage executive and semantic processes. Accordingly, this study compares the differences between noun and verb naming in individuals with bvFTD and non-patients who speak Persian. Through a series of experiments and analyses, we expect to find new results in this field.

## Materials and Methods

This is a cross-sectional study. A total of 15 patients with bvFTD who were referred to the Neurology Clinic of [Roozbeh Hospital](#) in Tehran City, Iran, participated in the study. At first, the neurologist diagnosed the type of dementia then, the patients were included based on the inclusion criteria. The inclusion criteria were no medical disorders other than dementia, age over 50 years, having dementia for over one year, being monolingual in Persian or case of bilingualism, having proficiency in both languages (obtaining a score of 3 or more in the self-rating questionnaire), and having minimum literacy (having at least primary education). The control group consisted of 30 non-patient subjects who were selected from public places such as libraries, parks, and gyms. The two groups were matched for age, gender, and education. The sampling was carried out in one or two days depending on the cooperation of the people. Also, the tests were performed in a quiet environment. The average performance was one hour and a half for each person.

All participants and or their caregivers gave informed consent, and ethical approval for the study was granted by the [Tehran University of Medical Sciences](#). Demographic information of the participants was extracted through individual questionnaires ([Table 1](#)). After this, language and cognitive tests were implemented randomly.

### Naming assessment

In this research, naming tests administered to participants examined the lexical retrieval (noun naming, verb naming). In naming tests, the stimuli were black-and-white pictures that represented objects and actions. Each participant (patients and controls) was asked to name each test stimulus as it was presented on screen. Noun naming test [10] includes 115 images of Persian nouns (109 main images and 6 practice images). Its 109 main images include names with one to four syllables. These names were classified into three levels high, medium, and low frequency in terms of usage in the Persian language. Verb naming test [11] included 90 pictures of Persian verbs. The participants had 10 s to name each picture of a noun or verb. The participants' responses were recorded for further analysis.

### Cognition assessment

The neuropsychological tests that were used in this research included the frontal assessment battery (FAB), the Persian version of the mini-mental state examination (MMSE), and the Montreal cognitive assessment (MOCA). FAB consists of six subtests that assess several specific cognitive functions, including mental flexibility, motor programming, sensitivity to interference, inhibitory control, and environmental autonomy. The cut-off point for this test is 12 [12]. Also, the MMSE consists of a series of questions and tasks that are designed to evaluate an individual's cognitive abilities, such as orientation, concentration, attention, verbal memory, naming, and visuospatial skills. The cutoff point for this test is 22 [13]. Similar to the MMSE, the MOCA assesses short-term memory recall (5 points), visuospatial abilities through clock drawing (3 points), cube copy (1 point), and orientation (6 points). The cutoff point for the MOCA test is 24 [14]. The cognitive and executive function of bvFTD and normal individuals were examined with these three neuropsychological tests.

### Statistical analysis

Statistical analyses of language and cognitive variables were conducted using SPSS software, version 25. Meanwhile, demographic data and cognitive and language tests were compared between the bvFTD and normal groups. Before analysis, the variables were checked for normality by the Kolmogorov–Smirnov test. To compare the mean score of FAB, MOCA, noun and verb naming, test, the Mann–Whitney test was used; however, to compare the mean score of MMSE, we employed the independent t-test between bvFTD and the control group.

### Results

In this research, 15 bvFTD and 30 non-patient subjects who were over 50 years old participated. The partici-

pants with different educational levels were involved. In both groups, the highest frequency of educational level is diploma (37%) and the lowest frequency belongs to people with a Bachelor's degree (7%) which shows that the two groups were matched in terms of education. In both groups of patients and non-patient individuals, the number of males was more than in females which based on the conducted study suggests that this disorder is more prevalent in males than females [15]. These people named 109 nouns and 90 verbs and were examined by three cognitive tests. According to the results, the mean scores of naming and cognitive tests in bvFTD groups were significantly lower than in the non-patients group.

### Cognitive test

As shown in Table 2, a significant difference was observed between the median score of FAB and the mean score of MMSE in the bvFTD and non-patient group ( $P=0.000$ ) by the Mann–Whitney test. Also, the results differed considerably between the mean score of the MOCA test in the bvFTD and the non-patient group ( $P=0.000$ ) by the independent t-test. Therefore, the bvFTD patients scored lower than normal subjects in the cognitive tests.

### Verb and noun naming

The mean scores on the naming of nouns and verbs for both groups of patients and non-patient individuals are summarized in Table 3. These data revealed that the patients, on average, scored 58 and 79, respectively, in the verb and noun naming test which is lower than the score of the non-patient group with 71.5 and 95.5, respectively. Accordingly, both groups of patients and non-patient individuals earned lower scores on the verb naming test compared to the noun naming test ( $P=0.000$ ).

**Table 1.** Demographic data and MMSE, MOCA, and FAB scores of bvFTD and non-patient individuals

Participants	Gender (F/M), No.	Mean±SD			
		Age (Y)	MOCA	MMSE	FAB
bvFTD patient (n=15)	7/8	62.5±10.7	13.20±5	20.935±2.84	7.93±194
Non-patients (n=30)	13/17	63.2±9.4.	22.07±3.59	25.83±3.04	16.97±0.92

**JMR**

Abbreviations: F: Female; M: Male; MOCA: Montreal cognitive assessment; MMSE: Mini-mental state examination; FAB: Frontal assessment battery; bvFTD: Behavioral variant of frontotemporal dementia; SD: Standard deviation.

**Table 2.** Comparing the cognitive test in the bvFTD and non-patient individuals

Variables	Participants	Median/Mean±SD	P
FAB	bvFTD	9.00*	0.000
	Non-patient	17.00	
MOCA	bvFTD	13.20±5**	0.000
	Non-patient	22.07±3.5	
MMSE	bvFTD	21***	0.000
	Non-patient	26	

JMR

Abbreviations: MOCA: Montreal cognitive assessment; MMSE: Mini-mental state examination; FAB: Frontal assessment battery; bvFTD: Behavioral variant of frontotemporal dementia; SD: Standard deviation.

\*FAB cut-off=12, \*\*MOCA cut-off=24, \*\*\*MMSE cut-off=2

### Discussion

This study compared noun and verb naming in bvFTD patients and non-patient individuals. The mean age of patients and non-patient individuals was the same which is in line with previous studies [15, 16].

In this study, patients earned a lower score on the noun naming test compared to non-patient speakers. These findings are in line with the other studies. This is because bvFTD primarily affects the frontal and temporal lobes of the brain, which are responsible for language and communication skills. When these brain regions are damaged or degenerate, the ability to retrieve and generate words is affected. Patients with bvFTD may struggle to find the right words to describe objects, people, or places [17]. This can manifest itself as difficulty in naming common objects, such as a pen or a pencil, or more complex concepts that require a combination of words. In contrast, non-patient people typically have a greater ability to spontaneously generate and recall specific names for various objects, people, or concepts. However, as with bvFTD patients, the ease of naming may vary between different individuals based on factors such

as age, level of education, and other cognitive abilities [18, 19]. Accordingly, individual naming abilities can be influenced by a variety of factors, and it is essential to consider these factors when comparing naming nouns between bvFTD patients and non-patient individuals.

As in previous studies, the findings of this research have shown that bvFTD patients obtained a lower score on the verb naming test compared to non-patient groups. Studies suggest that verb processing is critically dependent on the left frontal lobe, whereas noun processing is more widely distributed in the brain [9]. In bvFTD, the left frontal lobe is one of the earliest regions to degenerate, resulting in a selective impairment of verb processing. Additionally, verbs are more complex than nouns and require more processing steps to access their meaning. The impairment of verb processing in bvFTD patients may also be related to their more general cognitive deficits, which can impair the processing of complex linguistic information [17]. Overall, the selective impairment of verb processing in bvFTD patients is related to the specific pattern of brain atrophy in this condition, which affects the left frontal lobe and impairs the processing of complex linguistic information.

**Table 3.** Comparing the noun and verb naming in bvFTD and non-patient individuals

Variables	Participants	Median	P
Noun naming	bvFTD	79.00	0.01
	Non-patient	95.00	
Verb naming	bvFTD	58.00	0.000
	Non-patient	71.00	

bvFTD: Behavioral variant of frontotemporal dementia.

JMR

These findings suggest that individuals with bvFTD may have specific language impairments related to the processing of verbs. This is consistent with previous research indicating that the frontal and temporal regions, which are primarily affected in bvFTD, are important for the processing of action-related words. The development of more sensitive clinical assessments that target verb processing may help with the early identification of language impairments in bvFTD, leading to earlier interventions and better management of language deficits in this patient population. Future research may use these findings to develop more sensitive clinical assessments and interventions that target verb processing in individuals with bvFTD.

## Conclusion

In conclusion, this study compared noun and verb naming abilities in individuals with bvFTD and non-patient Persian speakers. Our findings revealed significant differences between these two groups; the bvFTD patients showed poorer cognitive skills and noun and verb naming abilities than non-patients. The results indicated that verb naming was more impaired in bvFTD patients compared to noun naming. Overall, our study contributes to the growing body of literature on language processing in neurodegenerative disorders and emphasizes the importance of examining both noun and verb processing in individuals with bvFTD.

## Study limitations and suggestions

The limitations of this study include the relatively small sample size; meanwhile, this study just used picture-naming tasks as a measure of noun and verb processing. Future studies could examine noun and verb processing using other tasks, such as sentence completion or sentence generation tasks. Additionally, the use of other types of stimuli beyond pictures may also be beneficial for addressing the ecological validity of our findings. Another limitation is that did not examine the specific types of verbs that might be particularly sensitive to the effects of bvFTD. Future studies could investigate the nature of verb processing deficits in bvFTD by exploring whether certain types of verbs, such as action-related versus non-action-related verbs, are more impaired in this patient population.

In terms of suggestions, future research could investigate the neural mechanisms underlying noun and verb processing deficits in bvFTD using various neuroimaging techniques such as functional magnetic resonance imaging or electroencephalogram. This could provide

more precise information on how the frontal and temporal regions are involved in noun and verb processing and could help to explain why verb naming is more impaired in individuals with bvFTD.

## Ethical Considerations

### Compliance with ethical guidelines

The Ethics Committee of [Tehran University of Medical Sciences](#) approved this study (Code: IR.TUMS.FNM.REC.1400.122).

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The present study was extracted from master's thesis of Atefeh Ahmadi, approved by the Department of Speech Therapy, School of Rehabilitation, [Tehran University of Medical Sciences](#), Tehran, Iran.

### Authors' contributions

Conceptualization, study design and project administration: Atefeh Ahmadi and Azar Mehri; Data acquisition, analysis and interpretation: Atefeh Ahmadi and Shohreh Jalaei; Drafting of the manuscript: All authors; Supervision: Azar Mehri and Shohreh Jalaei and Vajihah Aghamollaii.

### Conflict of interest

The authors declared no conflict of interest.

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## References

- [1] León-Carrión J, Giannini M. Behavioral neurology in the elderly. Boca Raton: CRC Press; 2001. [DOI:10.1201/b14249]
- [2] Harciarek M, Cosentino S. Language, executive function and social cognition in the diagnosis of frontotemporal dementia syndromes. *International Review of Psychiatry*. 2013; 25(2):178-96. [DOI:10.3109/09540261.2013.763340] [PMID]
- [3] Rascovsky K, Hodges JR, Knopman D, Mendez MF, Kramer JH, Neuhaus J, et al. Sensitivity of revised diagnostic criteria for the behavioral variant of frontotemporal dementia. *Brain*. 2011; 134(9):2456-77. [DOI:10.1093/brain/awr179] [PMID]
- [4] Baez S, Pinasco C, Roca M, Ferrari J, Couto B, García-Cordero I, et al. Brain structural correlates of executive and social cognition profiles in behavioral variant frontotemporal dementia and elderly bipolar disorder. *Neuropsychologia*. 2019; 126:159-69. [DOI:10.1016/j.neuropsychologia.2017.02.012] [PMID]
- [5] Hornberger M, Piguet O, Kipps C, Hodges JR. Executive function in progressive and nonprogressive behavioral variant frontotemporal dementia. *Neurology*. 2008; 71(19):1481-8. [DOI:10.1212/01.wnl.0000334299.72023.c8] [PMID]
- [6] Ash S, Nevler N, Phillips J, Irwin DJ, McMillan CT, Rascovsky K, et al. A longitudinal study of speech production in primary progressive aphasia and behavioral variant frontotemporal dementia. *Brain and Language*. 2019; 194:46-57. [DOI:10.1016/j.bandl.2019.04.006] [PMID]
- [7] Silveri MC, Salvigni BL, Cappa A, Della Vedova C, Puopolo M. Impairment of verb processing in frontal variant-frontotemporal dementia: A dysexecutive symptom. *Dementia and Geriatric Cognitive Disorders*. 2003; 16(4):296-300. [DOI:10.1159/000072816] [PMID]
- [8] Grossman M, Rhee J, Moore P. Sentence processing in frontotemporal dementia. *Cortex*. 2005; 41(6):764-77. [DOI:10.1016/S0010-9452(08)70295-8] [PMID]
- [9] Hardy CJ, Buckley AH, Downey LE, Lehmann M, Zimmerer VC, Varley RA, et al. The language profile of behavioral variant frontotemporal dementia. *Journal of Alzheimer's Disease*. 2016; 50(2):359-71. [DOI:10.3233/JAD-150806] [PMID]
- [10] Tahanzadeh B, Soleymani Z, Jalaie S. Parallel picture-naming tests: Development and psychometric properties for Farsi-speaking adults. *Applied Neuropsychology: Adult*. 2017; 24(2):100-7. [DOI:10.1080/23279095.2015.1107562] [PMID]
- [11] Namdar Khatibani M, Mehri A, Jalaie S, Dastjerdi Kazemi M. Developing Verb Picture Naming Test for Persian adults and determining its psychometric properties. *Applied Neuropsychology: Adult*. 2022; 29(3):373-82. [DOI:10.1080/23279095.2020.1762085] [PMID]
- [12] Asaadi S, Ashrafi F, Nasiri Z, Lotfinia M, Lotfinia AA. [The correlation between frontal assessment battery and unified Parkinson's Disease Rating Scale in the early stages of Parkinson's Disease (Persian)]. *The Neuroscience Journal of Shefaye Khatam*. 2015; 3(4):24-30. [DOI:10.18869/acadpub.shefa.3.4.24]
- [13] Ruiz-Garcia R, Yu S, Richardson L, Roberts A, Pasternak S, Stewart C, et al. Comparison of behavior-related features in the MMSE sentence in behavioral variant frontotemporal dementia and Alzheimer's Disease. *Frontiers in Aging Neuroscience*. 2021; 13:733153. [DOI:10.3389/fnagi.2021.733153] [PMID]
- [14] Arab Ahmadi M, Ashrafi F, Behnam B. Comparison of Montreal Cognitive Assessment test and Mini Mental State Examination in detecting cognitive impairment in relapsing-remitting multiple sclerosis patients. *International Clinical Neuroscience Journal*. 2016; 2(4):137-41. [DOI:10.22037/icnj.v2i4.11665]
- [15] Wilson SM, Henry ML, Besbris M, Ogar JM, Dronkers NF, Jarrold W, et al. Connected speech production in three variants of primary progressive aphasia. *Brain*. 2010; 133(7):2069-88. [DOI:10.1093/brain/awq129] [PMID]
- [16] Borroni B, Grassi M, Premi E, Gazzina S, Alberici A, Cosseddu M, et al. Neuroanatomical correlates of behavioural phenotypes in behavioural variant of frontotemporal dementia. *Behavioural Brain Research*. 2012; 235(2):124-9. [DOI:10.1016/j.bbr.2012.08.003] [PMID]
- [17] Cotelli M, Borroni B, Manenti R, Alberici A, Calabria M, Agosti C, et al. Action and object naming in frontotemporal dementia, progressive supranuclear palsy, and corticobasal degeneration. *Neuropsychology*. 2006; 20(5):558-65. [DOI:10.1037/0894-4105.20.5.558] [PMID]
- [18] Snowden JS, Harris JM, Saxon JA, Thompson JC, Richardson AM, Jones M, et al. Naming and conceptual understanding in frontotemporal dementia. *Cortex*. 2019; 120:22-35. [DOI:10.1016/j.cortex.2019.04.027] [PMID]
- [19] Garibotto V, Borroni B, Kalbe E, Herholz K, Salmon E, Holtorf V, et al. Education and occupation as proxies for reserve in aMCI converters and AD: FDG-PET evidence. *Neurology*. 2008; 71(17):1342-9. [DOI:10.1212/01.wnl.0000327670.62378.c0] [PMID]