

A Comparative Study of Phonemic and Semantic Verbal Fluency in Children and Adolescents with Developmental Stuttering

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Article information	Abstract
<p>Article history: Received: 31 May 2011 Accepted: 29 June 2011 Available online: 3 June 2013 ZJRMS 2014; 16 (5): 41-44</p> <p>Keywords: Developmental stuttering Verbal fluency Speech</p> <p>*Corresponding author at: Department of Clinical Psychology, Shahid Beheshti University, Tehran, Iran. E-mail: nejati@sbu.ac.ir</p>	<p>Background: Stuttering is a common disorder among children and adolescents. The purpose of this study is to draw semantic and phonemic verbal fluency comparison between children and adolescents with developmental stuttering, and their normal peers.</p> <p>Materials and Methods: This is a cross-sectional comparison study in which 30 students with developmental stuttering and 30 students, as normal peers, were selected from the schools within Shahriar, using convenience sampling method and getting help from an expert speech therapist in making diagnosis. The subjects completed semantic and phonemic verbal fluency tests. In these tests, in a given time interval, the subject should mention words that phonemically begin with a certain phoneme or semantically belong to a certain group. All gathered data were analyzed using <i>t</i>-test.</p> <p>Results: The findings showed a significant difference between the two groups in terms of phonemic-verbal fluency, but not regarding verbal-semantic fluency.</p> <p>Conclusion: Due to the dependence of verbal fluency task on cognitive functions, the research findings suggest inclusion of stutterers' cognitive deficits in their treatment programs.</p> <p>Copyright © 2014 Zahedan University of Medical Sciences. All rights reserved.</p>

Introduction

Stuttering is an extremely complex psychomotor phenomenon that occurs in the normal speech process of an individual, and is determined with verbal expression disturbance (involuntary repetitions, pauses, and prolongations of sounds, syllables, or words). Developmental stuttering is one the most common form of stuttering. It usually begins in pre-school years, among children of 2 to 5 years old, for different reasons. Stuttering is affecting around 5 percent of individuals globally, of which 70-80% is cured without administering specific formal treatment, and 20% converts to permanent stuttering [1]. Verbal fluency evaluation is an important part of neuropsychological assessments carrying out in phonemic and semantic domains. In the phonemic and semantic types, the subject, in a given time interval generates the words beginning with a specific phoneme, and the words that semantically belong to a specific group, respectively [2]. Verbal fluency performance along with language competencies requires other high-level cognitive processes, as well [3]. Performing verbal fluency task not only depends on language skills relevant to phonemic and semantic knowledge, but also requires engagement with significant cognitive abilities including executive functions (the cognitive processes that control and integrate other cognitive activities) and working memory (temporary storage of information in the mind for immediate accessibility) [4]. Despite considerable attention to stuttering disorder among other speech and language impairments, its etiology has not yet been precisely understood, and is sometimes referred to as

idiopathic disorder of unknown origin [5]. Since the creation, development, and effective use of language functions depend on cognitive functions [6], so investigating the cognitive deficits in this group is of crucial importance. On the other hand, verbal fluency test is an appropriate instrument to evaluate the performance of language and executive functions [7]. Therefore, investigating verbal fluency would lead to understanding the role of cognitive functions (including executive functions and working memory) in language difficulties of the children with language impairments. The purpose of the present study is to make semantic and phonemic verbal fluency comparison between children and adolescents with developmental stuttering, and their normal peers. The main research question is: whether semantic and phonemic verbal fluency of the children and adolescents with developmental stuttering significantly differ from that of their normal peers.

Materials and Methods

The present research is a cross-sectional comparison study. Its population includes the students of all school grades within Shahriar. Of the mentioned population, 60 cases (30 as normal group and 30 as patient group) were selected using convenience sampling. In addition, the children and adolescents with developmental stuttering were given this diagnosis with the help of an expert speech therapist. In order to diagnose stuttering disorder, following DSM-IV-TR criteria were used:

Disturbance in the normal fluency and time patterning of speech that is inappropriate for the individual's age, characterized by frequent occurrence of the following: Sound and syllable repetitions; sound prolongations; interjections; broken words (e.g., pauses within a word); audible or silent blocking (filled or unfilled pauses in speech); circumlocutions; words produced with an excess of physical tension; monosyllabic whole-word repetitions [8]. Inclusion criteria were onset of stuttering in pre-school ages (between 2 to 5 years old), the absence of history of head injury, tumor, epilepsy, stroke and other neurological injuries, and without history of other psychiatric disorders. The subjects were introduced by the schools' personnel and were given stuttering diagnosis by the help of a speech therapist. To diagnose the early stuttering in children, a free interview were carried out between the researcher and the child in different areas (e.g., talking about skills, interests, recent journeys, etc). After obtaining consent of and cooperation from the subjects and their parents, as well as completion of demographic information (including age, sex, and school grade), semantic and phonemic verbal fluency questionnaire was given to the subject and completed.

The instrument used in this study was semantic and phonemic verbal fluency test. This test was introduced by Thurstone for the first time. Emi and Takashi [2] in a study investigated the psychometric properties of the test and found internal consistency of the both parts of the test satisfactory with Cronbach's alpha coefficient of 81%. In addition, in this study, finding significant correlation between this test and the Stroop tests, and recalling sentences supported the validity of the test. To study the semantic verbal fluency two subtests including the names of animals and fruits are used. Doing so, the subjects are asked to recall as many animal's names in one minute and as many fruit's names in one minute. Finally, the number of recalled names would be recorded as the test grade. In the phonemic verbal fluency section, the subjects are asked to generate the words beginning with Persian phonemes "ف: F" and "ج: J" in two separate time intervals of 60 seconds. In this part, the number of pronounced words is recorded as the test grade [10].

The independent and dependent variables in the present study include the group and verbal fluency, respectively. Of confounding variables, intelligence can be cited. For participation in the sessions, written permission of the participants and their parents was gained, and their personal information was kept confidential. In order to perform statistical analysis, independent t-test was carried out using SPSS-18. The significance level was considered as $p \leq 0.05$.

Results

In data analysis, descriptive statistics was first used to examine the demographic characteristics of the subjects. The descriptive findings of the subjects under study are presented in table 1. The subjects included 60 students categorized into two groups of stutterers (30 persons) and non-stutterers (30 persons). Additionally, the groups were

matched in terms of age, sex, and educational level. To draw semantic and phonemic verbal fluency between the two groups, independent t-test was used. The results are presented in table 2.

Table 1. Demographic characteristics of the two groups (stutterers and normal)

	Stuttering group	Healthy group
Age (year)	12.27±0.37	12.27±0.37
Education		
Elementary School	14	14
Middle School	8	8
High School	8	8
Sex		
Male	17	17
Female	13	13

Table 2. Independent t-test to make verbal fluency comparison between the two groups (stutterers and normal)

Verbal Fluency subscales	Stuttering group Mean±SD	Healthy group Mean±SD	p-Value
Phonemic	11.4±4.95	18.36±6.29	0.01
Semantic	21.7±6.66	22.83±4	0.43

Discussion

The findings showed that, in contrast to semantic verbal fluency, there is a significant difference between two groups of stuttering and normal children and adolescents regarding phonemic verbal fluency. These findings are consistent with that of Gillam and Hoffman [11], arguing that clustering and switching are two aspects of verbal fluency that are not directly related to language knowledge. Clustering means generation of the words that are grouped into the same category (semantic verbal fluency); while, switching refers to changing to new group (phonemic verbal fluency) [11]. On the other hand, anatomical origin of the executive functions has representation in the frontal lobe of the brain. Executive functions regulate behavior outcomes and typically include planning, organization, cognitive flexibility, controlling all aspects of attention (switching, selective, and sustained), irrelevant response inhibition, and working memory [6]. On this basis, it can be said that the children with developmental stuttering have deficit in executive functions including working memory, control, and cognitive flexibility [12]. Therefore, deficit in executive functions is of the reasons for poor performance in phonemic verbal fluency in this group. In consistent with this finding, Nejati and Rahimzade [13] in a meta-analytic study demonstrated that healthy elderly adults show significant age-related decline in phonemic verbal fluency task, during their lifetime, since the frontal lobe of the brain (which is involved in executive functions) in elderly adults deteriorates further than other regions of the brain [13]. In addition, efficient use of lexical search skills and memory retrieval mechanisms is a requirement for success in the verbal fluency task. Meaning-based word searching and retrieval (semantic fluency) requires acquiring semantic knowledge; while, searching and retrieval of words beginning with same initial phonemes

(phonemic fluency) require phonological awareness from the phonological memory inventory [12- 14]. Phonological memory is a core component of working memory [15]. A number of studies have shown impaired performance of the children with specific language impairment in phonological memory tasks [16, 17]. Since the ability in rapid retrieval of words beginning with same initial phoneme is considered as a form of phonological analysis and immediate storage of phonological materials, thus phonological memory deficit in such children may result in impaired phonemic verbal fluency, in contrast to semantic verbal fluency [17, 18]. In the present study, difference in semantic verbal fluency test between the two groups was not significant. As noted earlier, clustering potentiality is an aspect of verbal fluency. Cluster sizes are related to memory storage capacity and retrieval [19]. Parallel to the present study, Stuss, Alexander, Winocur, Moscovitch, and Troyer found that the subjects with specific language impairments generate cluster size equal to that of their normal peers. Therefore, they reckoned that such children possess normal retrieval ability. In addition, this issue has representation in the brain. As pathological studies of brain have shown, semantic verbal fluency and phonemic verbal fluency are in turn associated with temporal cortex and frontal cortex [7]. Today, there is a general agreement on the issue that the frontal lobe involves in executive functions [20, 21]. Based on this explanation it can be said that the children and adolescents with developmental stuttering are impaired in executive functions associated with frontal cortex. Baldo et al. [22] studied verbal fluency in the patients with frontal lobe injury. Their findings demonstrated phonemic verbal fluency impairment in this group to their normal peers, supporting the results of the present research. In general, the outcomes of this study revealed that, in contrast to semantic verbal fluency, phonemic verbal fluency performance in the children with developmental stuttering is poorer than in their normal

peers. Regarding the dependence of phonemic verbal fluency performance on executive functions and working memory (cognitive functions) [23, 24-26], impairment in this task indicates impairment in executive functions and its various aspects. In the studies associated with language disorders, the relationship between the language and cognitive areas are ignored and this disorder is taken only as a type of motor disorder [6, 27, 29], while neglecting cognitive limitation in the children with language deficits causes poor outcome from purely language interventions [14, 30, 31]. Consequently, pointing out the significant deficits in cognitive aspects in the children with developmental stuttering is the study's innovation that can provide guidance in carrying out cognitive interventions in the mentioned group to wipe out language deficits. Of the present research limitations are the lack of subjects segregation on the basis of single-linguality and multi-linguality criteria, and developmental stuttering type (i.e., tonic and clonic) [32-34]. It is recommended for further study to consider the noted limitations in investigating the distinctive aspects of deficits and various executive functions in different groups with language and verbal impairments.

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Authors' Contributions

All authors had equal role in design, work, statistical analysis and manuscript writing.

Conflict of Interest

The authors declare no conflict of interest.

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