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Original Research Article

Word Fluency in Typically Developing Malayalam Speaking Children

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ABSTRACT

Word fluency or verbal fluency is the ability to form and express words that are attuned with the required criteria. The test of word fluency assesses verbal functioning using two tasks i.e., category fluency or semantic fluency task (SF) and letter fluency or phonemic fluency task (PF). The performance of these tasks is related to vocabulary size and speed of lexical access which are directly related to the learning process. The present study aimed at assessing the word fluency in 5-14 year old typically developing Malayalam speaking children and the objectives were (1). To assess the word fluency in terms of semantic fluency and phonemic fluency in typically developing Malayalam speaking children across age and gender. (2).To compare the performance of typically developing Malayalam speaking children in both semantic fluency and phonemic fluency tasks across the age and the gender. The study included 600 typically developing children in the age range of 5-14 years. A cross-sectional research design was used to assess the semantic fluency and phonemic fluency. The results of the study revealed that there were distinct patterns of continuous and linear developmental trend in word fluency. The outcome of the study has also revealed a positive influence of age and gender on the word fluency.

Keywords: *Word Fluency, Semantic Fluency, Phonemic Fluency.*

INTRODUCTION

Language is one of the most mysterious products of the human mind. It is a means of communication and socialization as well as a vehicle for thought. The ability to speak is unique to humans which makes them distinct from other animals. Spoken word production is influenced by the ability to generate words with speed and accuracy. Word fluency or verbal fluency is the ability to form and express words that are attuned with the required criteria. Verbal fluency or word fluency assesses the verbal ability including lexical knowledge and lexical retrieval ability. [1-4] Verbal fluency is necessary for optimal communication and for normal social and occupational functioning. The information obtained from word fluency has been used to understand the vocabulary size, lexical knowledge, speed of lexical access in both healthy and disordered adults and children. [5-11]

The test of word fluency has been used to assess verbal functioning, [12] using two tasks i.e., category fluency task or semantic fluency task [13] and letter fluency task or phonemic fluency task. [14] Semantic fluency test requires the generation of words corresponding to a specific semantic category such as animals, fruits, vegetables, etc. in the specified time. Generally, the number of words produced in one minute is counted. The literature review has shown that various categories have been used for semantic fluency assessment such as animals, fruits, vegetables, types of transportation, kitchen items, foods, drinks,

parts of the body, clothing, colours, birds, flowers, trees, and others. [6,8,9,15-17] However, the category of animals has been the most frequently used item. [18-20] Ardila,O strosky-Solı´s and Bernal [18] had reported that there have been advantages in using animal category i.e., (1). 'Animal category' has been reported to be a clear semantic category across the languages and cultures; (2).It is a relatively easy semantic category with only minor differences among people living in different countries and generations; and (3). It is easy-to-administer and commonly used in different neuropsychological test batteries such as Boston Diagnostic Aphasia Examination, [21] CERAD neuropsychological test battery. [22] The results of various studies have revealed that a normal person has been reported to produce about 16 words in a given category within one minute. [16]

Phonemic fluency or letter fluency task assesses the ability to produce as many words as possible beginning with a specific letter within a fixed timeframe. The time used commonly is one minute and the number of correct words produced without errors such as repetitions or words not starting with the specified letter are counted. Researchers have used different letters for the phonemic fluency task. The frequently used letters for phonemic fluency tasks are "F", "A" and "S", [13] "C", "F" & "L" and "P", "R" and "W", [23] all the English alphabets except "X" and "Z", [24] "P" and "K". [5] It has been reported that a normal individual can generate about 12-14 words starting with a specific letter whereas children aged 6 years old generate fewer than 5 words. [16,11]

The literature search revealed that word fluency or verbal fluency has been widely used to investigate the neuro-typical adults and geriatric, focusing on aging and neurological diseases, such as Dementia. [25-27] However, there is a dearth of data on word fluency among typically developing children. It is widely accepted that vocabulary differs across the culture, language, ethnicity, age, and gender. The studies on word fluency in children speaking Indian languages, particularly Malayalamare limited. [5,6,19] The present study was an attempt to investigate the word fluency in typically developing children speaking Malayalam, in the age range of 5-14 years.

Aim of the study

The present study aimed at assessing the word fluency in 5-14-year-old typically developing Malayalam speaking children and the objectives were to 1. Assess the word fluency in terms of semantic fluency and phonemic fluency in typically developing Malayalam speaking children of both the genders across the age groups and 2. Compare the performance of semantic fluency and phonemic fluency in typically developing Malayalam speaking children across the gender and the age groups.

METHOD

The present study was designed to assess the word fluency in typically developing Malayalam speaking children in the age range of 5-14 years

Participants

The study included 600 typically developing children in the age range of 5-14 years. The typically developing children were selected randomly from Malayalam medium schools at Shoranur, a semi-urban area in Palakkad district, Kerala, India. All the children had Malayalam as their mother tongue and medium of communication at home and school. All the participants had normal hearing sensitivity and normal visual acuity with normal motor, speech-language and cognitive skills. Only, children with Average/good academic performance as reported by teachers and school records were included in the study. 10 groups of participants in the age range5-14 years with 30 males and 30 females in each group were included in the study. Thus a cross-sectional study was carried out to assess the semantic fluency and phonemic fluency in the present study.

Procedure

The word fluency was assessed using the phonemic fluency and semantic fluency tasks. The testing was carried out in a quiet room in the school. For assessing the phonemic fluency, the participants were instructed, in Malayalam, to produce as many words as possible starting with the sound "k" as soon as the investigator said start and to stop as soon as the investigator said stop. One minute time was given for the task and the investigator monitored the time using a stop watch. The participant was also instructed to avoid repetition of the same words and the names of people and places. Whenever it was felt that the participant had not understood the instructions, then the investigator demonstrated the procedure by using the sound 'p'. The participant who could not follow the instructions even after that was dropped from the study. The responses were recorded using Sony digital voice recorder ICD-UX560F for offline analysis and the researcher also noted down the correct responses.

Similarly, to assess the semantic fluency, the procedure that was adopted for assessing the phonemic fluency was used except that the participants were asked to name as many animals as possible in one minute. The participant was instructed, in Malayalam, to name as many animals as possible as soon as the investigator said start and to stop as soon as the investigator said stop. One minute time was given for the task. Repetition of the same words and words from different categories were excluded from the analysis. Whenever it was felt by the investigator that the participant had not understood the instructions, then the investigator demonstrated the procedure by using another item like furniture. The participant who could not follow the instructions even after that was dropped from the study. The responses were recorded using Sony digital voice recorder ICD-UX560F for offline analysis and the researcher also noted down the correct responses. The task was to elicit maximum number of names in the given class in one minute and the number of correct names produced in one minute was counted.

Thus, using these procedures, both the phonemic fluency and semantic fluency were assessed in each of the participant of all the age groups and both the genders i.e., all the 600 participants performed the tasks and scores of each participants in terms of phonemic fluency and semantic fluency were analyzed.

Statistical analysis

The data obtained were subjected to descriptive statistical analysis to obtain the mean scores and the standard deviation values and Multivariate analysis of variance (MANOVA) was carried out, using Statistical Package for Social Sciences (SPSS) to find out the effect of age and gender on semantic fluency and phonemic fluency tasks. The Post hoc analysis was done using Tukey test.

RESULTS

The performances on semantic fluency and phonemic fluency were investigated as the total number of correct words/ names produced in one minute. The mean and standard deviation (SD)values for each age group were presented in Table 1

Table 1: Mean and Std. Deviation (SD) across age, gender and task.

	SEMANTIC FLUENCY			PHONEMIC FLUENCY		
	Males	Females	Total	Males	Females	Total
Age Group	Mean(SD)	Mean (SD)	Mean(SD)	Mean (SD)	Mean(SD)	Mean(SD)
>5- <6	3.93(0.98)	4.93(1.14)	4.43(1.17)	2.93(0.64)	3.67(0.76)	3.30(0.79)
>6- <7	6.00(0.95)	6.93(1.17)	6.47(1.16)	4.43(0.77)	5.53(1.25)	4.98(1.17)
>7- <8	8.10(1.35)	10.60(1.67)	9.35(1.96)	6.10(1.18)	8.63(1.22)	7.37(1.75)
>8- <9	10.40(1.10)	12.00(1.08)	11.20(1.3)	7.60(1.07)	9.57(0.82)	8.58(1.37)
>9- <10	12.37(0.96)	13.20(1.06)	12.78(1.09)	9.40(0.93)	10.87(1.01)	10.13(1.21)
>10- <11	13.80(1.06)	14.00(1.08)	13.90(1.07)	10.90(0.99)	11.77(1.07)	11.33(1.11)
>11- <12	14.00(1.23)	14.17(0.99)	14.08(1.11)	11.30(0.92)	11.77(0.90)	11.53(0.93)
>12- <13	14.33(0.99)	14.40(1.13)	14.37(1.06)	11.73(0.98)	11.90(0.99)	11.82(0.98)
>13- <14	14.57(1.36)	14.67(1.37)	14.62(1.35)	12.00(1.39)	12.20(0.96)	12.10(1.19)
>14- <15	14.93(1.66)	15.07(1.51)	15.00(1.57)	12.30(0.99)	12.33(1.15)	12.32(1.07)

As given in Table 1, an increase in mean values for both semantic fluency and phonemic fluency with increase in age in both males and females, was noticed. The performance was lowest in the age group >5 years - <6 years with a mean of 4.43 (SD=1.17) and 3.30 (SD=0.79) and highest in the age group >14 years - <15 years with a mean of 15 (SD=1.57) and 12.32 (SD=1.07) for semantic fluency and phonemic fluency respectively. The results also revealed that the females were having higher scores than the males in both semantic fluency and phonemic fluency tasks. The differences between the males and the females were observed in all the age groups. The differences were also noticed in all the age groups between semantic fluency and phonemic fluency, semantic fluency having higher scores than phonemic fluency. The differences between the males and the females were also noticed in both semantic fluency and phonemic fluency.

MANOVA was carried outto understand the significance of variation across age and gender. The multivariate analysis revealed that there was significant effect of age on word fluency, F (18, 1158) = 160.770, p < 0.0001; Wilk's Lambda = .082;ηp^2 = .714; power =1.The effect of gender on word fluency task was also found to be statistically significant, F (2, 579) = 65.967, p < .0001; Wilk's Lambda = .814; ηp^2 =0.186; power =1. Similarly there was significant interaction between age and gender on word fluency task, F (18, 1156) = 5.655, p < 0.0001; Wilk's Lambda = 0.845; ηp^2 = 0.081, power = 1. Post hoc comparison was done using Tukey test and the results indicated that the difference in mean scores were statistically significant at 0.05 level at younger age groups i.e., upto the age group of >9- <10 years. The difference in mean scores were not statistically significant in the higher age groups, above >10- <11 years.

DISCUSSION

The present study examined the effect of age, gender and task on word fluency among typically developing Malayalam speaking children in the age range of 5-14 years. The results of the study have revealed that there was a distinct pattern of a continuous and linear developmental trend in word fluency. The outcome of the study has also indicated a positive influence of age and gender on word fluency. However, the increase in word fluency across the age and the gender was negligible in higher age groups i.e., age groups above 10 years. The results of the study has also unveiled that the performance was relatively better in the semantic fluency task compared to the phonemic fluency task across the age and the gender.

Effect of age on word fluency

The findings of the present study have indicated statistically significant effect of age on word fluency i.e., for both semantic fluency and phonemic fluency. These results were found to be similar to reports of the earlier studies. [5-7,19,28,29] In the present study, children in the age range of >5 years - <6 years produced approximately 2-8 words in one minute on semantic fluency task and 2-6 words on phonemic fluency task, whereas children in the higher age group, i.e.,>14years - <15 years produced approximately 12-19 words on semantic fluency task and 9-15 words on phonemic fluency task. This increase in word fluency across age was similar to the findings by Halperin et al [28] among English speaking children. They had reported that children by six years of age retrieved 10 items which increased to 18 by twelve years of age on semantic fluency task. A similar increase in semantic fluency and phonemic fluency task among typically developing Malayalam speaking children have been reported by John and Rajasekhar, [19] and by John, Rajasekhar and Guddattu [5] respectively. The present study also revealed that the increase in word fluency in the higher age groups i.e., above 10 years of age were not statistically significant. These findings of the present study have been similar to the reports by Anderson et al, [30] Anderson, [31] and Regard et al. [32] They had

reported that the executive functions such as verbal fluency reach maturity by around 12 years of age.

The increase in the production of correct words may be ascribed to the expansion of mental lexicon with the advancement in schooling and environmental exposure with age. Nelson, [33] and Sauzeon et al, [34] have reported that there was an increase in semantic network activation which had helped in faster exploration, better organization and quicker retrieval of words from the semantic store with the advancement in age.

Effect of gender on word fluency:

The study also revealed that gender had statistically significant effect on the word fluency with females having better scores than males. The difference in scores was observed in all the age groups in both semantic fluency and phonemic fluency, though the difference in mean scores was not statistically significant among higher age groups. Burton et al, [35] Capitani et al, [36] Filippetti and Allegri, [37] Munro et al, [38] and Halari et al [39] have reported a female advantage in word fluency. This may be attributed to the female advantage in verbal tasks. However the results of the current study were not in agreement with the study conducted by John and Rajasekhar, [19] and John, Rajasekhar and Guddattu [5] according to which the gender had no significant influence on word fluency.

Effects of tasks on word fluency:

The results of the study had revealed that the participants had performed better on semantic fluency tasks compared to phonemic fluency tasks across the age and the gender. Similar findings have been reported by Crowe, [40] Monsch et al [41] and Ratcliff et al. [26] The advantage of semantic fluency over phonemic fluency may be attributed to the search strategies employed in the two tasks. Semantic cues have been reported to be more effective and faster than phonemic cues.

Thus the findings of the study may be summarized as follows:

1. Word fluency (semantic fluency and Phonemic fluency) had increased with age and the this increase in Word fluency (semantic fluency and Phonemic fluency) was statistically significant in lower age groups i.e below 10 years of age and not above 10 years of age.
2. Both semantic fluency and phonemic fluency were better in females than in males.
3. The semantic fluency was better than the phonemic fluency in all the age groups and in both the genders.

CONCLUSIONS

The present study on word fluency has shown a distinct pattern of development in word fluency, both in terms of semantic fluency and phonemic fluency. The study analyzed word fluency by using simple and short tasks, which can be easily administered to a school-aged population. The results of the study have indicated that there were positive influences of age on both semantic fluency and phonemic fluency. In both semantic fluency and phonemic fluency the females had shown an advantage over males in all the age groups. The results of the present study have also revealed that the semantic fluency was better than the phonemic fluency in all age groups and in both the genders. The outcomes of the study may serve as a baseline while testing the performance in disordered population and it may be used as a therapeutic tool as vocabulary size and lexical access speed are directly related to communication, social and occupational functioning, learning process and academic performance. It may also be noted that the word fluency varies across different categories in semantic fluency and the phonemic fluency in different phonemes. Therefore research on semantic fluency with different categories and phonemic fluency with different phonemes may be tried. Future research on the clinical population is also warranted.

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