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Original Article

Hindi and English Letter Cancellation Tasks : Does language have an effect on performance?

Abhinav Dixit* and Ankit Kumar Rai

Department of Physiology,
All India Institute of Medical Sciences,
Jodhpur – 342 005, Rajasthan (India)

Abstract

Letter Cancellation Tasks (LCTs) are paper-pencil based psychomotor tasks that are commonly used to assess cognitive functions of healthy volunteers and patients.

The performance on LCTs can be affected by the proficiency in the language used for the tasks. This is of importance in a country like India where most of the population is not fluent in English. Since most of the cognitive tests are in English, the population that can be recruited for cognitive studies gets limited.

It is therefore essential to develop tests in Indian languages like Hindi and compare the results obtained with tests in English.

The present study evaluated the effect of Hindi and English language on performance of one, two and three letter cancellation tasks.

The study was conducted on 50 healthy volunteers after taking written, informed consent. Subjects were asked to cancel out letters in One, Two and Three LCTs in Hindi and English language.

The total time taken to complete each test and number of errors were statistically analyzed by unpaired t-test.

The results revealed that a significantly longer time was taken to complete Hindi LCTs than English LCTs. The error rates in the Hindi LCTs were more than that in English with the difference in One Letter Cancellation Task being significant. This is probably because of the complex script for Hindi requiring more time and neural resources for processing.

***Corresponding author :**

Dr. Abhinav Dixit, Associate Professor,Department of Physiology, All India Institute of Medical Sciences, Jodhpur-342005, Rajasthan (India); Email: abhinavdr@gmail.com

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Introduction

Letter Cancellation Tasks (LCT) are a group of psychomotor performance tests that are used to study cognitive functions (1). Performance of a subject on

letter cancellation task depends upon vigilance and hence these tests are considered as reliable measures of sustained attention, concentration, visual scanning, response activation and inhibition (2). The Letter cancellation tasks are used for cognitive testing in various disorders like Alzheimer's disease, hemispatial neglect and traumatic brain injury (3-5).

Factors such as age and level of education affect the performance with increasing age leading to a slower and inaccurate performance (6). More the number of years of education, the lesser the time taken on LCT (7). Poor literacy in the language in which LCT is being performed leads to erroneous results thereby reducing the reliability of LCT.

Language is known to effect performance on cognitive tests. An example of this being the effect on Stroop task, which is believed to be one of the best measures of attention (8). Chinese language is known to produce greater interference effects on Stroop task than English (9). Fluency of language also effects performance. Mägiste studied the effect of fluency of language using German and Swedish and reported that change in language brought about a change in interference (10, 11).

Studies have shown that different areas of brain are activated by different languages. Coderre et al evaluated the effect of Kana (syllabic symbols) and Kanji (logographic writing system) scripts of Japanese and found that Kana activated left inferior parietal lobule and Kanji activated left inferior frontal gyrus thereby providing evidence that scripts activated different brain areas (12).

A study by Jaiswal et al used a Gujarati version of the Six Letter Cancellation Task to study cognition in hypertensive patients (13). However there was no comparison with the English version and no validation vis a vis the English or any report of the difference due to use of different language. Another study by Jaykaran et al used Hindi, English and Gujarati versions of Six Letter Cancellation Tasks but no comparison between the three was done (14).

The Indian subcontinent has people speaking different languages. Since most of the cognitive tests are in English, it greatly limits the population sample that can be used for cognitive testing. The processing of language by the brain itself may bring about changes in performance with the script of the language being a factor.

In line with the viewpoint of developing cognitive tests for the Indian population, Ganguli et al developed the Hindi Mini Mental State Examination (MMSE) (15). MMSE gives an indication of global cognitive functions. However a proper assessment of cognition involves testing of specific domains of cognition with the need to understand the effect of language on cognition and further develop tests in vernacular languages.

Though a number of studies have used vernacular LCTs, there has been little work to evaluate the effect of language on performance. This is important because in order to test a large population of Hindi and English speaking the two tests need to be compared.

The present study evaluated the effect of Hindi and English language on performance of one, two and three letter cancellation task with the aim to standardize the Hindi LCT.

Materials and Methods

Subjects: The study was done in Department of Physiology, All India Institute of Medical Sciences, Jodhpur and was approved by the Institute Ethics Committee. Since it was a pilot study to be done in 2 months time as per ICMR STS guidelines, 50 healthy male volunteers between the age group of 18-40 years were recruited for the study after taking written, informed consent. Menstrual cycle is known to effect cognitive functions and considering the time limitation, only males were recruited. Purposive sampling was done for the study. The study was explained to the residents of the campus and those who volunteered were recruited for the study.

The subjects with History of neuropsychological illness, stroke, or serious mental illness such as depression or schizophrenia; History of drug intake like alcohol, cocaine, heroine etc. and less than 5

years of schooling in Hindi and English were excluded from the study.

The testing was done in a quiet room during the morning hours.

Subjects were asked to cancel out letters in three versions of letter cancellation tasks: One, Two and Three letter cancellations in Hindi and English language. Each LCT consisted of 960 letters with 25% as target letters. The size of the letters was kept same in Hindi and English versions. The LCTs used were the ones that have been used in our previous studies (16).

The total time taken to complete each test along with the number of errors and omissions was noted and analyzed statistically using SPSS by unpaired t test. The level of significance was kept at 0.05.

Results

The present study evaluated the effect of language on performance using one, two and three letter cancellation tasks of Hindi and English. The results are summarized in Table I. The mean age of the subjects was 24.23±2.38 years.

The results reveal a significant difference between Hindi and English in the time taken to complete the LCTs. The error rates were significantly more in Hindi one Letter Cancellation Task as compared to English One Letter Cancellation Task. The error rates in two and three letter cancellation tasks in Hindi were more than in English but the difference was not significant.

Discussion

The present study evaluated the effect of language on Letter cancellation tasks. The results revealed a significantly longer time to complete the Hindi LCTs as compared to English LCTs. The error rates were more in Hindi LCTs but the difference was significant only for One LCT thereby indicating that increasing mental load had similar effects irrespective of the language of the test.

The findings of the present study indicate that the performance on cognitive tests is affected by language. Previous studies have used LCTs in Hindi and Gujarati. However they have not evaluated the difference in performance between the tests in these languages and English (13, 14).

Studies have been done to evaluate different areas of brain activated by Hindi and English. English is considered as a linear language involving sequential arrangement of vowels and consonants. Hindi is more complex with non linear writing script. Kumar et al showed that Hindi activated superior temporal gyrus, temporal pole and caudate nucleus in right hemisphere and suggested that comprehension of Hindi involved increased visuo-spatial processing (17). Another study by Das et al showed that different areas of brain were activated by low frequency words of Hindi and English with different reading pathways (18). However similar areas were activated by high frequency words of both languages.

The findings of longer time taken to complete Hindi tasks as compared to English can be explained by the fact that Hindi is a more complex writing script

Table I: Time in minutes (Mean±SD) and Errors Mean ± SD) on Hindi and English Letter Cancellation Tasks.

Test	*Time (min)*		*p value*	*Error*		*p value*
	Hindi	*English*		*Hindi*	*English*	
1 LCT	4.59±1.0	3.72±0.84	< 0.001	4.98±4.71	3.01±2.94	0.017
2 LCT	5.61±0.96	4.34±0.97	< 0.001	8.92±6.55	6.44±6.22	0.055
3 LCT	6.39±1.19	5.31±1.0	< 0.001	14.14±11.1	12.5±8.78	0.417

1LCT- One Letter Cancellation Task
2LCT- Two Letter Cancellation Task
3LCT- Three Letter Cancellation Task

requiring more neural resources and time for processing. This leads to a longer time for completing LCTs. Also the areas of brain where processing of Hindi occurs are different from those of English.

The present study indicated that the processing of Hindi script required more attentional resources than English thereby leading to a longer time for completing the LCTs. Also as the mental load increased, there was no significant difference in error rates, thereby showing that mental load acts independent of the language of the test and has similar effects.

Since the Indian population is not fluent in English, tests in vernacular languages are required to increase the population base for cognitive studies. However the results that are obtained with vernacular languages need to be analyzed with respect to English language to draw proper conclusions due to difference in language processing. The limitation of the present study was the number of subjects being only 50. Studies with larger number of subjects can further help in standardizing the Hindi LCTs vis a vis the English LCTs for use in general population.

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