

Comparison of stroop colour-word test among male and female students in a medical college of Nepal

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Abstract

Background: The Stroop Colour-Word Test is a widely used neuropsychological test. This test is designed to assess impaired concentration and the struggle to stay focused despite of distractions. There are conflicting data on the gender difference in Stroop test.

Objectives: To make a gender comparison of the reaction time by Stroop Colour-Word Test in young healthy medical students.

Methods: This was a cross-sectional analytical study conducted at the Department of Physiology, Kathmandu University School of Medical Sciences from 2022 August to 2022 October. Stroop Color Word test was done in healthy medical students with three different cards, a control card (colour word written in black color), congruent card (colour word written in same color as written word) and incongruent card (colour word written in different colour then word written). The number of errors made and reaction time was noted. Paired t-test was applied. Gender comparison was made and independent sample t-test was done.

Results: Out of total 130 participants, 68 were females and 62 were males. The number of errors made was 0,0 and 12.8 ± 2 and the reaction time was 38.3 ± 2.3, 37.2 ± 2.8 ,72.5 ± 5.6 seconds for control, congruent and incongruent card respectively which was statistically significant for incongruent card. There was no significant difference between males and females.

Conclusion: Reaction time by Stroop Colour-Word Test is longer for incongruent words. There is no gender difference in errors made or reaction time in Stroop Colour-Word Test.

Key words: Medical students; Reaction time; Stroop colour-word test.

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INTRODUCTION

Originally developed in 1935, the Stroop Colour-Word Test (SCWT) is widely used neuropsychological test.^{1,2} In this test, subject is given a card with colour names written in incongruent ink colour; and subject says the name of the ink colour, instead of the written word.¹ Test is designed to assess impaired concentration and the struggle to stay focused despite of distractions to assess a person's ability to inhibit automatic and interfering responses.³ Numerous researchers have been investigating the potential gender differences between males and females in the Stroop task. According to MacLeod's review of the Stroop task, no significant gender differences were observed.⁴ Similar findings have been reported by several other studies.^{5,6} However, a few researchers have found that females tend to have shorter reaction times compared to males on the Stroop task.⁷ Consequently, the results obtained thus far do not provide a clear and definitive conclusion regarding gender differences in Stroop task performance. The

present study found only one literature regarding SCWT from Nepal where they investigated the reaction time but gender comparison was not made.⁸ So, the aim of this study is to make a gender comparison of the reaction time by SCWT in young healthy medical students.

METHODOLOGY

This was an analytical cross-sectional study. It was conducted at the Department of Physiology, Kathmandu University School of Medical Sciences (KUSMS) from 2022 August to 2022 October. Ethical clearance was taken from Institutional review committee (IRC) of KUSMS (Ref. 07/22). Convenience sampling was done. Sample size was calculated using formula, Sample size $n = Z^2 p q / e^2$; where $Z = 1.96$ at 95% confidence interval; $p = 0.95$, $q = 0.05$; $e = 0.04$ (4% margin of error). Healthy students with normal eyesight or corrected eyesight with lenses, aged between 18 to 24 years were included in the study. Students who self reported to have colour blindness were excluded from the study. A total of 130 students participated in the study. Their demographic profile was recorded. Participants were informed about the study and the procedure in group. Students were called individually and given a card where five different colours (Red, Green, Blue, Purple and Brown) is printed in five columns and 10 rows format in black ink with white background. They were asked to read it out and the investigator who also had exactly the same card checked if they read it correctly. At the same time, the investigator recorded the time taken to read by using Digital Stop watch (100 MIN ELECTRONIC TIMER, Made in China).

Similarly, the same student were given a congruent card that is colours were then printed in same colour as the word written (for example: Red in red colour, blue in blue colour) in same format. The investigator noted if it is correctly read and the time taken to read. Next the same student was given the incongruent card that is colours were then printed in different than the word written (for example: Red in blue colour, blue in brown colour) in same format. Now they had to speak out the colour and ignore the word written. The investigator noted if it was correctly spoken out and the time taken to read. The number of error made while speaking out and the reaction time was noted in all three tasks.

Data were analysed using IBM SPSS Statistics for Windows, version 21 (IBM Corp., Armonk, N.Y., USA). Paired t-test and independent sample t-test was applied to compare the performance in different task card and gender difference respectively. The level of significance was taken as $p < 0.05$.

RESULTS

Out of total 130 participants 68 were females and 62 were males. The mean age was 19.2 ± 0.4 years in male and 19.5 ± 0.6 years in female (Table 1). The number of errors made was 0,0 and 12.8 ± 2 and the reaction time was 38.3 ± 2.3 , 37.2 ± 2.8 , 72.5 ± 5.6 seconds for control, congruent and incongruent card respectively which was statistically significant for incongruent card (Table 2). There was no significant difference between males and females (Table 3).

RED	BLUE	GREEN	PURPLE	BROWN
GREEN	PURPLE	RED	BROWN	BLUE
BLUE	RED	BROWN	GREEN	PURPLE
PURPLE	BROWN	BLUE	RED	GREEN
RED	BLUE	GREEN	BROWN	PURPLE
BROWN	GREEN	BLUE	PURPLE	RED
PURPLE	RED	GREEN	BLUE	BROWN
BROWN	BLUE	RED	PURPLE	GREEN
BLUE	GREEN	PURPLE	RED	BROWN
GREEN	PURPLE	BLUE	BROWN	RED

Figure 1: Control card

RED	BLUE	GREEN	PURPLE	BROWN
GREEN	PURPLE	RED	BROWN	BLUE
BLUE	RED	BROWN	GREEN	PURPLE
PURPLE	BROWN	BLUE	RED	GREEN
RED	BLUE	GREEN	BROWN	PURPLE
BROWN	GREEN	BLUE	PURPLE	RED
PURPLE	RED	GREEN	BLUE	BROWN
BROWN	BLUE	RED	PURPLE	GREEN
BLUE	GREEN	PURPLE	RED	BROWN
GREEN	PURPLE	BLUE	BROWN	RED

Figure 2: Congruent card

RED	BLUE	GREEN	PURPLE	BROWN
GREEN	PURPLE	RED	BROWN	BLUE
BLUE	RED	BROWN	GREEN	PURPLE
PURPLE	BROWN	BLUE	RED	GREEN
RED	BLUE	GREEN	BROWN	PURPLE
BROWN	GREEN	BLUE	PURPLE	RED
PURPLE	RED	GREEN	BLUE	BROWN
BROWN	BLUE	RED	PURPLE	GREEN
BLUE	GREEN	PURPLE	RED	BROWN
GREEN	PURPLE	BLUE	BROWN	RED

Figure 3: Incongruent card

Table 1: General characteristic features of the participants and gender comparison

	Male	Female	p - value
Age (years)	19.2 ± 0.4	19.5 ± 0.6	0.864
Weight (kg)	62.5 ± 3.4	58.2 ± 4.2	0.494
With lenses (number)	23	28	0.712
Without lenses (number)	39	40	0.984

Table 2: Comparison of number of errors and reaction time between control card, congruent card, incongruent card

	Number of errors	Reaction time (seconds)
Control card	0	38.3 ± 2.3
Congruent card	0	37.2 ± 2.8
Difference	0	1.1 ± 0.5
p- value	1.0	0.794
Control card	0	38.3 ± 2.3
Incongruent card	12.8 ± 2.4	72.5 ± 5.6
Difference	12.8 ± 2.4	34.8 ± 3.3
p- value	0.001	0.003
Congruent card	0	37.2 ± 2.8
Incongruent card	12.8 ± 2.4	72.5 ± 5.6
Difference	12.8 ± 2.4	35.3 ± 2.8
p- value	0.001	0.002

Table 3: Comparison of number of errors and reaction time with gender

	Number of errors	Reaction time
Control card		
Male	0	38.8 ± 2.4
Female	0	37.9 ± 2.6
Difference	0	0.9 ± 0.2
p- value	1.0	0.843
Congruent card		
Male	0	37.6 ± 3.1
Females	0	36.9 ± 3.2
Difference	0	0.7 ± 0.1
p- value	1.0	0.634
Incongruent card		
Male	13.3 ± 2.7	74.2 ± 6.2
Female	12.2 ± 3.1	71.4 ± 4.2
Difference	1.1 ± 0.4	2.8 ± 2.2
p- value	0.456	0.389

DISCUSSION

The Stroop-Colour word test which was originally designed in 1935 is widely used for neuropsychological test. The SCWT was performed on healthy young medical students and it was found that there was significant difference in reading between congruent card and incongruent card in terms of number of errors (12.8 ± 2.4) and reaction time difference (34.8 ± 3.3 seconds). Reaction time was almost double for incongruent card. However, there was no difference between male and female. A study done in Nepal by Ghimire et al. found the significant number of error and prolonged reaction time while reading the incongruent card.⁸ This has similarity with current study though the difference is much larger in their study. They did not look at the gender difference unlike this study.

A study done by Sarmany et al. in 1977 found that women were better in at SCWT because they had better ability to name the colours in comparison to males.⁹ However, a study done by Macleod et in 1991 reviewed more than 400 literatures published over 50 years and asserted that there was no difference in sex related to SCWT though incongruent card reading took longer time in both sex.⁴ Mekarski et al found that men were slower than women though there was no difference in error made.⁷ They thought that the difference was due to greater verbal and fine motor abilities of women. This contradicts the findings of the present study as it did not find significant difference in male and females neither in error made

or reaction time. However, common finding in all these studies including the current study is that reaction time is longer for incongruent card.

A recent study by Datta et al in India found that females had significantly shorter reaction time compared to males in both English and Hindi version of the Stroop test.¹⁰ There was no difference in reaction time across languages. They thought biological factors such as smaller head size and larger areas like callosum and planum temporale were reason for the difference. However, this contradicts the finding in the current study as it did not report significant difference between male and female. In the present study Stroop test was performed in English language only. A study by Baroun et al in Kuwait also found the gender difference in SCWT which contradicts the result of this study.¹¹ Sjoberg et al. found that the there was no difference in SCWT for men and women in 74%, female had less reaction time in 22% and male had less reaction time in 4% .¹² Therefore they concluded that there was no gender difference in SCWT and suggested that if there is any difference then it could be due superior color naming ability of women. This aligns with the present study.

Many studies have similar to the findings of this study, suggesting that there is no gender difference in Stroop test.^{4,6,12} However some studies show that female have shorter reaction time in comparison to males.^{7,9-11} Almost all studies suggest that reaction time is longer for incongruent words. The physiological basis of which

could be due to semantic interference.¹³ In the study by Rezaei et al, it suggests that there are situations where it is necessary to disregard or override the usual processes of our language system when responding. And if a person fails to override these processes, they may either respond at length or not respond at all.¹³

CONCLUSION

From this study it can be concluded that reaction time is longer for incongruent words. There is no gender difference in errors made or reaction time in SCWT.

Conflict of interest: None

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