Hand Dominance and WAIS-R Block Design performance

Authors:

Fardaus Ara Begum[1], Tahamina Begum[2]* Faruque Reza[2].

Affiliation:

1. Department of Public Health, State University of Bangladesh, 77 Satmasjid Road, Dhanmondi, Dhaka.

2. Department of Neurosciences, School of Medical Sciences, Universiti Sains Malaysia, 16150 Kubang Kerian, Kota Bharu, Kelantan, Malaysia.

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Address Correspondence and reprint request to:

*Tahamina Begum

Department of Neurosciences, School of Medical Sciences, Universiti Sains Malaysia, Kubang Kerian, Kota Bharu, Kelantan, Malaysia.

Email: tahaminabegum70@hotmail.com, tahamina676@gmail.com

ABSTRACT

Background

Several studies have examined various factors that affect block design test performance, yet none has examined the effect of hand dominance. Block design performance is used as a measure of visuospatial functioning. It is important, therefore, to assess whether handedness influences performance because the results could affect the treatment and management of different patient groups. Therefore, we aimed to detect whether right- and left-handed groups perform differently on the block design test, which could improve the management of patients.

Method

Twenty normal healthy subjects were recruited, with an equal number of right- (RH) and left-handed (LH) subjects (n=10 in each group). Age and education were matched between the groups. All participants completed the block design test to assess their visuospatial functioning. Mediana, minimum (min) and maximum (max) scores were calculated and compared between the two groups. A non-parametric Mann-Whitney test was done using SPSS 22 to find mean Rank, Sum of Rank and significance values between these two groups.

Results

There was no significant difference between the mean block design test scores of the two groups. The right-handed group scored slightly higher than the left-handed group.

Conclusion

Right- and left-handed people have similar visuospatial memory performance, but those who are right-handed may perform slightly better. A larger sample size is needed to ensure the reliability of the results.

Keywords *Block design test; hand dominance; WAIS-R; visuospatial memory*

1. INTRODUCTION

The block design (BD) test is included as a subtest in many IQ batteries [1, 2]. The BD test is a sensitive measure used in the assessment of intelligence [1], neuropsychological functions [3] and central nervous system dysfunction [3]. The test requires the subject to reorganize the blocks by hand to match specific patterns of colored blocks. Therefore, the BD test is considered an accurate test to assess spatial visualization ability and motor skills [4] which are the parts of the cognitive function. Many factors can affect performance on the BD test, including older age [5, 6] and low education [7]. BD test performance is also influenced by sex, with men showing non-significant [8] and significant [9, 10] advantages. However, no study has examined the effect of handedness on BD performance.

Hemispheric lateralization was explained in [11], which mentioned specific functions for each hemisphere. For example, left hemisphere has specific functions for language, fine motor skills, performing analysis, logical decision making etc [12]. These hemispheric functions are directly related to hand dominance tasks. Left-handed people may be more likely to develop Alzheimer's disease than right-handed people [13]. Right-handed people have a larger premotor cortex in the left hemisphere, and vice versa [14]. As the two hemispheres work differently, hand dominance is an important issue that may help to explain score differences on neuropsychological tests. A hand dominance effect has been documented for various tests [15], but has not yet been examined in the BD test. Therefore, in this study we investigated the effect of hand dominance on block design test performance. The important contribution of this study is that it will determine whether patient management should differ among right- and left-handed people, as different types of cognitive function varies between these two groups.

2. METHODOLOGY

We received permission to carry out the study with human participants from the ethical committee of Universiti Sains Malaysia (USM). Twenty normal healthy subjects were recruited, with an equal number of right- and left-handed (n=10 in each group). The groups were matched on age and education (Table 1). Written informed consent was obtained from all subjects before the experiment.

EXPERIMENTAL PROCEDURE:

The BD test was administered by an expert neuropsychologist at Hospital Universiti Sains Malaysia (HUSM). We used the WAIS-R block design test to evaluate the visuospatial function of right- and left-handed groups. Participants had to organize the colored blocks to match the designs presented by the neuropsychologist within a limited time. The designs gradually became more complicated. The scores were calculated according to the correct matching of colors and designs within the time limit. No extra time was calculated.

DATA ANALYSIS:

A non-parametric Mann-Whitney test was used to test whether there was a significant difference between the two groups using SPSS 22 software. The significance level was set at $p \leq 0.05$.

3. RESULTS

The demographic data and mediana, minimum (min), and maximum (max) BD test scores are shown in Table 1 and Figure 1. Higher (68.00) and lower (32.00) BD performing subjects are observed in the left handed group. In case of the right-handed group these values are 66.00 and 43.00, respectively (Table 1, Figure 1). Figure 1 shows individual BD scores in both groups. There was no significant difference (p=0.124) between the mean BD scores of the two groups (Figure 1, Table 1). We observed only a tendency toward mean higher scores in the right-

handed than in the left-handed group. Table 2 shows the detailed statistical results of Mann-Whitney test where Mean Rank for the RH (10.95) and LH (10.50) groups are very close. In case of the sum of Ranks, those values have little difference and those are 109.50 and 100.50, respectively.

4. DISCUSSION

We aimed to determine whether visuospatial function, measured by the BD test, differs between right- and left-handed people, as this information might be helpful for improving the management of right- and left-handed patient groups. We found no significant difference in mean BD scores, but the right-handed group performed slightly better than the left-handed group.

Various neuropsychology tests have been used to examine differences in performance between right- and left-handed individuals. Left-handed people have been shown to be more attentive and have better memory, and most of them have a visual learning style [15]. The main connecting fiber tract of the corpus callosum is 11% larger in left-handed than in right-handed people [16, 17]. Greater development of anatomical connectivity between the anterior temporal and inferior temporal lobe has also been documented in left-handers [18, 19]. Researchers [18, 19] believe that these differences are the main reason left-handed people shower better attention and memory performance. In this study we found no significant difference between the right- and left-handed groups. Our left handed group did not perform significantly better in the case of spatial visualization ability and motor skills, which contradicts the findings of a previous study where left handed individuals were significantly better in the case of attention and memory [15]. Based on these results, it is difficult to draw a conclusion about potential differences in visuospatial memory, because our sample size may have been too small.

5. CONCLUSION

We conclude that there is no difference in visuospatial memory between right- and left-handed people, although a tendency to better performance in the right-handed group is observed.

6. LIMITATION

The main limitation of our study was the small sample size. A larger sample size may provide more reliable results.

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COMPETING INTERESTS

The authors declare that they have no competing interests.

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Table 1: Demographic data for right- and left-handed groups and their block design (BD) scores.

Groups	**Age (years) Mediana, min, max**	**Education (years) Mediana, min, max**	**Score of Block Design Mediana, min, max**

Right handed	29.83, 22.20, 48.00	13.40, 11.00, 17.00	56.80, 43.00, 66.00
Left handed	29.93, 21.40, 49.10	14.00, 11.00, 18.00	49.70, 32.00, 68.00

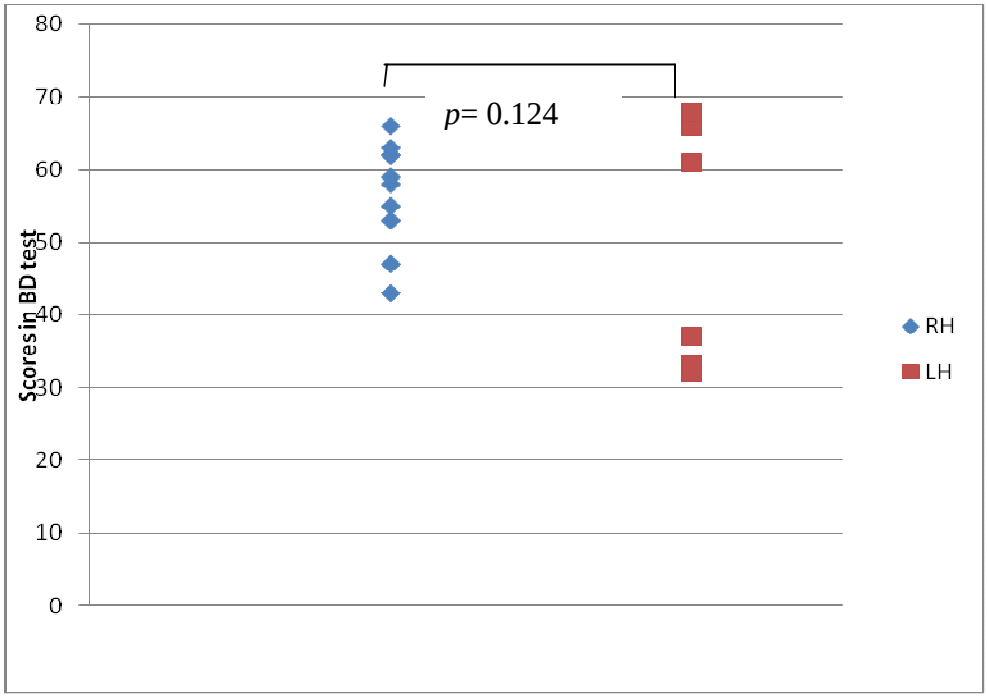

Figure 1: Individual BD scores for right-handed (RH, rhombs, n=10) and for left-handed (LH, squares, n=10) subjects. No significant between-group difference was found by Mann-Whitney U-test (p=0.124).

Table 2: Details of the between-group comparison for BD scores by Mann-Whitney U-test

groups	Mean Rank	Sum of Ranks
RH	10.95	109.50
LH	10.50	100.50