Research Article

Association between the Pseudoneglect and Depression Symptoms in Young Adults

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Abstract

Pseudoneglect – the tendency to bias visual attention to the left visual half-field, is attributed to the activity of the right brain hemisphere. At the same time, research data suggest that depression is related to the imbalance between the activity of brain hemispheres affecting the right hemisphere more prominently. However, little is known about the association between the pseudoneglect and depression. To extend this data, we studied the association between scores in Beck Depression Inventory (BDI-II) and the bias of attention to the left versus right visual half-field in the Star cancellation task performance in young adult participants. Of the total of 54 university students, of both sexes, mean age 22.65, left-to-right readers in their native language, 40 participants (74,1%) initially started to cancel the stars from the left side and the mean number of stars cancelled on the left was M = 11.45 (SD = 7.44). The range of scores in BDI-II was 1 to 25. The rest of 14 participants (25,9%) started cancelation from the right and cancelled more targets on the right side (M = 6.10, SD = 6.49). The range of scores in BDI-II was 0 to 23. Spearman's rank-order correlation was conducted to examine the association between depressive symptoms (BDI-II scores) and performance on the Star Cancellation Test, as indexed by the number of stars cancelled on the left and right sides. A statistically significant, moderate positive correlation was found between BDI-II scores and the number of stars cancelled on the right side, r = .385; p = .006, indicating that higher levels of depressive symptoms were associated with a greater number of right-sided cancellations. In contrast, the correlation between BDI-II scores and the number of stars cancelled on the left side was negative and did not reach statistical significance. Findings suggest that depressive symptom severity is more strongly and significantly related to the bias of visual attention to the right visual half-field.

In conclusion, the bias of visual attention to the visual half-field expressed in target cancellation task performance is associated with the depressive symptoms, measured by BDI-II. As compared to the leftward visual bias, the bias of visual attention to the right visual half-field is associated with higher level of depressive symptoms.

Keywords: Pseudoneglect; Depression; Right hemisphere; Beck Inventory; Star cancellation

Background

Pseudoneglect – the tendency of most healthy people to pay more attention to the left visual half-field [3] is altered in learning and psychic disorders, in healthy people with a depressive mood and under the influence of a stressogenic environment. In contrast to healthy mates, dyslexic children do not show a preference to either the left or right visual half-field [1,20] or display bias to the right visual half-field [13,22]. Bias to the left visual half-field is less pronounced in the case of autism spectrum disorder [8] and ADHD [5] and, presumably, in schizophrenia [15,16]. Research data with respect to the latter, however, are contradictory [4]. Pseudoneglect is found increased in a stressogenic environment [21].

Here we are focused on the association between depression and pseudoneglect. On the one hand, pseudoneglect is attributed to the dominance of the right brain hemisphere in visual-spatial attention [9]. Neurovisualization and EEG studies in healthy adults confirm the association of the right hemispheric regions with pseudoneglect [6,7,19]. On the other hand, research data suggest that depression is related to the imbalance between the activity of brain hemispheres affecting the right hemisphere more prominently (see for review [11]). Therefore, the study of the association between pseudoneglect (a phenomenon mediated by the right hemisphere) and depression (associated with the right hemisphere malfunctioning) is of particular interest. Using a side-by-side simple response task, authors [11] found left visual field response impaired in healthy people with a depressive mood and in mild unipolar depressive patients. In a more recent study [18], the authors did not reveal statistically significant alterations of pseudoneglect in visuospatial neglect task performance in study participants diagnosed with major depressive episode. However, comparing scores of omissions in the left and right visual half-field in participants with depression and healthy controls, the authors noted higher values in the depression group, suggesting a bias to the right visual field. No difference in the allocation of attention toward the left and right visual half-field between study participants diagnosed with depression and controls was found in the Posner cueing task performance [14]. Thus, the issue concerning the association between depression and pseudoneglect needs further clarification. To contribute to the issue, we studied the association between the scores in Beck Depression Inventory (BDI-II) and the expression of pseudoneglect in the Star cancellation task (SCT)

performance in young adult participants. The hypothesis was that higher BDI scores would be associated with less expressed bias to the left visual half-field in cancellation task performance.

Material and Methods

Study participants were volunteer students recruited from Ilia State University. None of the study participants had been diagnosed with clinical depression. All participants signed the written consent to participate in the study. In total, 63 individuals with an average age of 22 (M = 22,65; SD = 3,97), right-handers of both sexes, with normal or corrected to normal vision participated in the study. All of them were left-to-right readers in their native language. Participants were asked to fulfil the BDI-II translated into their native language. BDI-II is used for measuring characteristic attitudes and symptoms of depression. It consists of 21 groups of statements [2]. Participants were instructed to read each group of statements carefully, to pick out the one statement in each group that best described the way they have been feeling during the past two weeks and circle the number (score) beside the statement they have picked. Total scores were calculated by the instructor. The paper-and-pencil version of the SCT was used to study the bias to the visual half-field. The side of first cancelation in SCT (left versus right) and the total number of stars cancelled in the left versus right side demonstrate the bias of visual attention to the left and right visual half-field respectively (see for example, [12,17,21]). Test sample consisted of 52 large stars interspersed with 56 smaller stars evenly distributed on the left and the right sides of a sample. Study participant was seated at the table. The instructor demonstrated the task sample at a distance of 1 -2 meters from the participant and said: "Here you can see the big and smaller stars interspersed with each other. When I put the sample on the table, you have to cancel as many as possible smaller stars for 10 seconds. Start cancellation immediately after I put the sample on the table". After that, the sample was placed on the table, along the participant's body midline and the participant started cancellation. The sidedness, left or right, of the first cancellation was registered. The number of stars cancelled on the left and right sides was calculated. The data collected from each participant consisted of 4 parameters: 1. scores in BDI-II, 2. side of the first cancellation, 3. The total number of targets cancelled on the left side of a sample and 4. The total number of targets cancelled on the right side of a sample.

Descriptive statistics, Spearman's rank-order correlation and the nonparametric independent-samples Mann–Whitney U test was used for data analysis.

Results and Discussion

Initially there were 63 participants under examination. Of these individuals, 6 participants cancelled first target on the left, however cancelled more stars in total on the right. Their score in BDI was 14.6 (M = 14,67; SD = 8,017). Only 3 participants cancelled first target on the right, however cancelled more stars on the left. Their BDI score was 7.6 (M = 7,67; SD = 5,859) (Table 1).
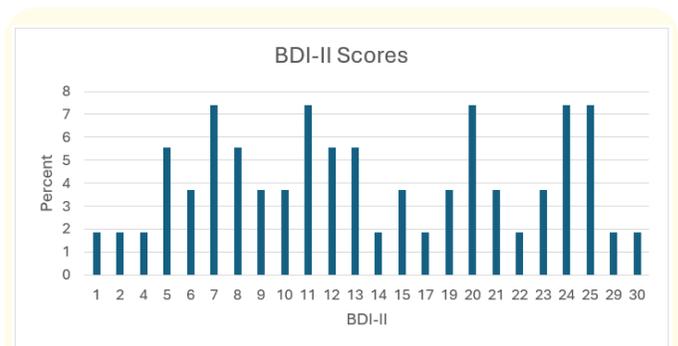
	Side_Change	N	Mean	Std. Deviation consideration	Std. Error Mean
BDI-II	Switched from the Left to the Right	6	14.67	8.017	3.273
	Switched from the Right to the Left	3	7.67	5.859	3.383

Table 1: Results of the study of 9 participants.

The range of scores in BDI-II was 0-30. Data statistical processing was impossible because of a very small number of participants (9 in total).

Two alternatives of SCT performance - the "Left Cancellation" and the "Right Cancellation" was revealed in the study of the rest 54 participants. In case of the Left Cancellation, 40 participants (74,1%) initially started to cancel the stars from the left side, and cancelled more stars on the left side of the sample. The mean number of stars cancelled on the left was M = 11.45 (SD = 7.44). The range of scores in BDI-II was 1 to 25. In case of the Right Cancellation 14 participants (25,9%) started from the right side and cancelled more stars on the right side (M = 6.10, SD = 6.49). The range of scores in BDI-II was 0 to 23 (Table 2).

		Total of Left Cancellations	Total of Right Cancellations
N	Valid	53	50
	Missing	1	4
Mean		11.45	6.10
Std. Deviation		7.438	6.488
		BDI -II scores	
Minimum in BDI II		1	0
Maximum in BDI II		25	23

Table 2: Statistical analysis of STC performance data and BDI-II scores.

Descriptive statistics were calculated for depressive symptoms as measured by the Beck Depression Inventory–II (BDI-II). The mean BDI-II score was M = 14.57 (SD = 7.64), with scores ranging from 1 to 30 (including the scores of all the 64 participants), indicating a wide variability in the severity of depressive symptoms within the sample (see Figure1 and Table 3).

Figure 1

| N	Valid	54
	Missing	0
Mean		14.57
Std. Deviation		7.644
Minimum in BDI-II		1
Maximum in BDI-II		30

Table 3

To examine differences in depressive symptom severity between participants with Left and Right Cancellation, a nonparametric independent-samples Mann–Whitney U test was conducted. The use of a nonparametric test was deemed appropriate due to the sample size and the distributional characteristics of the data.

Participants with the Left and Right Cancellation did not differ significantly in their BDI-II scores, U = 371.00, z = 1.80, p = .072. However, participants with the Left Cancellation had lower mean rank BDI-II scores (25,23) compared to participants with the Right Cancellation (34,00). This pattern suggests that individuals demonstrating predominantly left-sided cancellations had lower levels of depressive symptoms as compared to those who demonstrated predominantly right-sided cancellations.

Spearman's rank-order correlation was conducted to examine the association between depressive symptoms (BDI-II scores) and performance on the Star Cancellation Test, as indexed by the number of stars cancelled on the left and right sides (Table 4 and Figure 2). A statistically significant, moderate positive correlation was found between BDI-II scores and the number of stars cancelled on the right side, r = .385; p = .006, indicating that higher levels of depressive symptoms were associated with a greater number of right-sided cancellations. In contrast, the correlation between BDI-II scores and the number of stars cancelled on the left side was negative and did not reach statistical significance. Findings suggest that depressive symptoms' severity is more strongly and significantly related to the Right Cancellation than to the Left Cancellation.

			BDI-II	Total_Left Cancellations	Total_Right Cancellations
Spearman's rho	BDI-II	Correlation Coefficient	1.000	-.245	.385**
		Sig. (2-tailed)	.	.077	.006
		N	54	53	50
	Total_Left Cancellations	Correlation Coefficient	-.245	1.000	-.650**
		Sig. (2-tailed)	.077	.	.000
		N	53	53	49
	Total_Right Cancellations	Correlation Coefficient	.385**	-.650**	1.000
		Sig. (2-tailed)	.006	.000	.
		N	50	49	50
**. Correlation is significant at the 0.01 level (2-tailed).					

Table 4: Spearman's rank-order correlation.
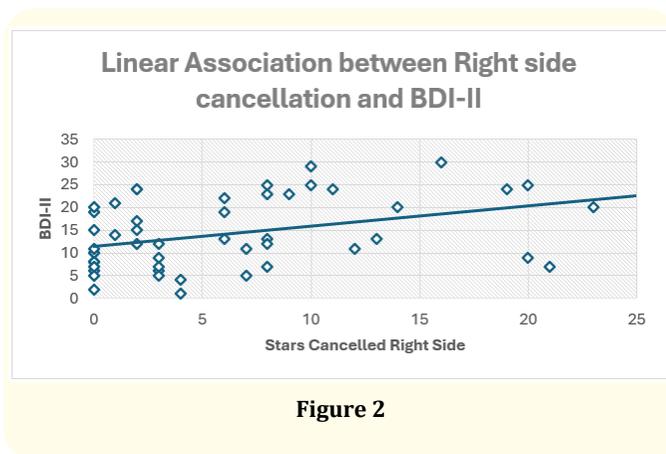
Figure 2

Data obtained confirm the suggestion, that most people express pseudoneglect – the bias to allocate visual attention to the left visual half-field [3]. It should be noted, however, that this is true for left-to-right readers in their native language, while for right-to-left readers the percentage of right-sided bias is much higher due to the influence of reading habits [12]. The discussion and conclusions in our study refer to left-to-right readers only. The data obtained show that in parallel to the consistent Left and Right Cancellation task performers, there are some (9 in total), expressing „mixed cancellation": they cancel either the first target on the left but in total, cancel more targets on the right, or cancel first target on the right but cancel more stars on the left. Study of these mixed

versions is interesting and encourage for further research with the recruitment of a large number of participants with mixed cancellation types of SCT performance.

Conclusions

The bias of visual attention to the visual half-field expressed in target cancellation task performance is associated to the depressive symptoms, measured by BDI-II. As compared to the leftward visual bias, the bias of visual attention to the right visual half-field is associated to higher level of depressive symptoms.

Limitations

One of the important limitations of the study is the variability of BDI-II total scores among participants, which reflects the high heterogeneity of depressive symptoms in the research sample. This factor may reduce the statistical power and complicate the interpretation of the obtained associations. In particular, in conditions of wide variation, the risk of the influence of extreme values (outliers) increases, which may distort the final results.

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