PRACTICE in CLINICAL PSYCHOLOGY

July 2023, Volume 11, Number 3

Research Paper

Investigating Cognitive Control and Repetitive Thinking in Clinical Groups With Major Depressive Disorder and Generalized Anxiety Disorder

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Citation Vosoughi Motlagh, A., Mohammadi, N., Taghavi, M.R., & Goodarzi, M.A. (2023). Investigating Cognitive Control and Repetitive Thinking in Clinical Groups With Major Depressive Disorder and Generalized Anxiety Disorder. *Journal of Practice in Clinical Psychology, 11*(3), 259-266. https://doi.org/10.32598/jpcp.11.3.856.2

https://doi.org/10.32598/jpcp.11.3.856.2

Article info:
Received: 01 Feb 2023
Accepted: 13 Mar 2023
Available Online: 01 Jul 2023

Keywords:
Major depressive disorder, Generalized anxiety disorder, Cognitive control, Rumination, Worry

ABSTRACT

Objective: Some theories state that a deficiency in cognitive control makes people more vulnerable to the occurrence of repetitive negative thoughts. The present study is aimed to investigate the association between cognitive control and repetitive thinking in major depressive disorder (MDD) and generalized anxiety disorder (GAD).

Methods: Thirty people with major depressive disorder and 30 people with generalized anxiety disorder were selected by purposive sampling method from counseling and psychiatry centers in Shiraz City. Then, the Stroop and Wisconsin tests were performed and the questionnaires on rumination, worry, depression, and anxiety were completed. The obtained results were analyzed by Pearson's correlation coefficient and multivariate analysis of variance (MANOVA).

Results: The results showed that there was a negative and significant relationship between cognitive control and rumination in the depression group and worry in the generalized anxiety group. The level of cognitive control, rumination, and worry was not significantly different in cases with major depressive disorder and generalized anxiety disorder.

Conclusion: Based on the results of this study, reducing attention control is considered a risk factor for repetitive thinking, including rumination and worry. The lack of significant difference in cognitive control, rumination, and worry can indicate common unified transdiagnostic components in these disorders.

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Highlights

• There was a negative relationship between cognitive control and rumination in the depression group.

• There was a negative relationship between cognitive control and worry in the generalized anxiety group.

• In both groups of major depressive disorder (MDD) and generalized anxiety disorder (GAD), the level of cognitive control, rumination, and worry was not significantly different.

Plain Language Summary

In general, deficiency in cognitive control is associated with an increase in repetitive thinking. The aim of this study was to investigate the relationship between cognitive control and repetitive thinking of rumination and worry in people with depression and anxiety disorders. We assessed how much a person's ability to ignore irrelevant stimuli and purposeful search can be related to repetitive thinking. The results showed that weakness in cognitive control is related to increased rumination in the depression group and weakness in cognitive control is also related to increased worry in the anxiety group. This demonstrates the important role of unified transdiagnostic processes in the development and continuation of anxiety and depression disorders because they can be effective in the treatment of comorbidities.

1. Introduction

Generalized anxiety disorder (GAD) and depression are among the common emotional disorders, with several harmful effects on a person's life. Therefore, it is better to pay special attention to ongoing research. These disorders include behavioral, cognitive, and emotional dimensions, of which the cognitive dimension has been more considered. There is a diversity in cognitive components of depression and anxiety disorders. One of these components, which has been very prominent recently, is persistent negative cognitions, which seem to play a significant role in the etiology and persistence of these disorders (De Lissnyder et al., 2012; De Lissnyder et al., 2010). Besides, the intensification of a conflict with repeated and continuous thoughts about oneself in relation to the social environment can affect the way of dealing with stressful events or affect a person's emotional state (De Lissnyder et al., 2012, De Lissnyder et al., 2010). Previous studies have emphasized rumination as one of the negative cognitions in depressed people and tried to understand the underlying mechanisms of rumination. In other words, they have tried to explain rumination through the individual's information processing system (Koster et al., 2011). The ability of cognitive control is considered a vital factor in information processing. It means that a defect in the information processing system causes ruminating tendencies in the individual, and since cognitive control and stopping negative thoughts are considered significant factors in processing information (Koster et al., 2011), cognitive control deficits may lead to higher levels of rumination while an individual deal with stress (Watkins, 2008). Cognitive control is defined as the ability of a person to ignore prepotent responses and inhibit the processing of irrelevant or related information belonging to the past (De Lissnyder et al., 2012), and its relationship with repetitive thinking can be measured as one of the underlying mechanisms. Many studies have investigated the relationship between cognitive control and rumination in depressed people and concluded that the deficiency in the process of cognitive control leads to the increment of rumination tendencies (Watkins, 2008; Mennies et al., 2021; Tylor & Synder, 2021; Zareian et al., 2021). As mentioned above, worry and rumination are similar in terms of recurrence and both are considered to be transdiagnostic components of emotional disorders (Roelofs et al., 2008; Cheminski & Zimmerman, 2003) and considering the relationship between cognitive control and rumination (Watkins, 2008), there is a possibility that this cognitive control mechanism be also related to worry. Furthermore, there is a possibility that repetitive negative thinking and cognitive control differ in GAD and major depressive disorder (MDD). In other words, there may be a specific relationship between each of these cognitive dimensions and GAD and MDD. The present research has two purposes. Its first goal was to investigate the relationship between cognitive control and repetitive thoughts of rumination and worry in people with GAD and MDD. The second goal of the present study was to compare the cognitive control, worry, and rumination between the GAD and MDD groups.

2. Materials and Methods

The current research was conducted using a retrospective (causal-comparative) method. The statistical population was all people with MDD and GAD who had been referred to the medical centers of Shiraz in 2012. In this research, a purposive sampling method was established and 30 people with MDD and 30 with GAD were selected according to the described method. In addition, people suffering from psychotic disorders, bipolar disorder, drug use, attention deficit/hyperactivity disorder, mental retardation, cognitive disorders, epilepsy, users of antipsychotic and antiepileptic drugs, and GAD patients who had low scores in the depression questionnaire and higher than the cut-off point (a score higher than 24) and MDD patients who scored higher than the cut-off point (a score higher than 24) on the Beck's anxiety scale were excluded from this study. Also, the target groups were equal in terms of age, gender, and education. Pearson's correlation method was used to investigate the hypothesis of the research, i.e. set-shifting and inhibition-based cognitive control have a negative relationship with rumination and worry in patients with MDD and GAD. Multivariate analysis of variance (MANOVA) was used to compare set-shifting and inhibition-based cognitive control, worry, and rumination between the GAD and MDD groups.

Questionnaires

Beck depression inventory (BDI)

This questionnaire was introduced for the first time in 1961 by Beck and his colleagues and revised in 1971 (Beck et al., 1988). This questionnaire has 21 items scored from 0 (sign of mental health) to 3 (sign of acute and deep depression). The psychometric characteristics of this tool in Iran are as follows: α coefficient=0.91, correlation coefficient between the two halves=0.89, re-test coefficient with an interval of one week=0.94, its correlation with the first edition of Beck depression inventory was 0.93 (Fata et al., 2013). The reliability of the Beck inventory was reported in another study using internal consistency determination and re-testing method as 0.73-0.92 (Khosravi et al., 2008).

Beck anxiety inventory (BAI)

This questionnaire contains 21 items with four answers (0-3) that express their severity. The range of scores is 0 to 63. Beck et al. (1988) reported the internal consistency of this scale as 0.93 and its re-test reliability as 0.75. This questionnaire has been standardized in Iran (Kaviani & Mousavi, 2008) and its psychometric properties have been reported as follows: Internal consistency=0.92 using Cronbach's α, its test re-test reliability =0.83, and validity=0.83 using intraclass correlation.

Neuropsychological tests

The Stroop color and word test: This test was first introduced by Ridley Stroop in 1935 (Stroop, 1935) and since then, has been considered as one of the most important neuropsychological tests carried out by researchers in different countries. In its original form, it has four stages (Lezak et al., 2004), but in its new versions, it has three stages, which include color recognition, congruent efforts, incongruent efforts, and interference, respectively. In this research, the Stroop test is used to measure the inhibition component of cognitive control. The reliability coefficient was calculated by the test re-test method in an Iranian sample with a two-week break as 0.71. Its face validity has also been confirmed by two clinical psychologists and a neurologist (Alilou et al., 2011).

Wisconsin card sorting test (WCST)

This test evaluates the ability to invent and change cognitive strategies in response to changing environmental feedbacks and requires planning, organized search, and the ability to use environmental feedbacks for cognitive switching (Cavallaro et al., 2003). This test was prepared by Grant and Berg for the first time in 1948 (Lezak et al., 2004). This test has been used to evaluate the cognitive control switching intervention. This test consists of 64 different cards with different shapes (triangle, star, cross and circle) and different colors. What is measured in this test contains:

The number of obtained classes: The classes refer to the number of correct categories and fluctuate from zero to six

Total number of errors: Total number of cards that do not match the pattern card correctly.

The validity of this test for measuring cognitive deficits after brain injuries is above 0.86 (Lezak et al., 2004). The validity of this test is also reported as 0.83 based on the contingency coefficient of the evaluators in the study of Spreen and Strauss, (1991). Ghorbani et al., (2007) has estimated Cronbach's α coefficients of this test in the Iranian population as 0.85. In this research, this tool has been used to measure the function of switching.

Table 1. Descriptive data of research variables (n=30)

Test	Group	Mean±SD
Rumination	Depression	51.70±6.75
	Generalized anxiety	49.80±6.71
Worry	Depression	60.93±10.59
	Generalized anxiety	63±10.61
Incongruent effort error (Stroop)	Depression	8.03±4.91
	Generalized anxiety	7.75±4.56
Incongruent effort time (Stroop)	Depression	90.81±22.91
	Generalized anxiety	95.49±26.64
Number of classes (WCST)	Depression	1.90±1.18
	Generalized anxiety	1.47±1.10
Repetition error (WCST)	Depression	23.70±9.79
	Generalized anxiety	27±12.57
Total error (WCST)	Depression	27.7±8.82
	Generalized anxiety	30.27±11.43

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Revised rumination-reflection questionnaire (RRQ)

This questionnaire, which was created by Terpenel and Campbell in 1999, has 24 questions and includes two subscales of self-rumination and self-reflection, each subscale has 12 questions, by which the rumination subscale is used in this research.

Scoring is based on a 5-point Likert scale, Khorsandi (2010) calculated the reliability of the dimensions of this questionnaire using Cronbach's α method and reported it as 0.90 for rumination and 0.89 for two subscales, and the range of internal correlation for rumination was 0.24 to 0.62. The re-test reliability of this scale was reported as 0.9 in general.

Penn state worry questionnaire (PSWQ)

This questionnaire was created by Meyer et al., 1990. It is a 16-item self-report scale that measures severe, excessive, and uncontrollable worry. This questionnaire is used as a screening tool for GAD. The characteristics of the original version of the questionnaire are as follows: The internal consistency coefficient for GAD is 0.86 and the re-test reliability is reported as 0.77 with a four-week interval. Concurrent validity was tested by the BDI and reported as favorable (0.49). The psychometric characteristics of the Iranian version are as follows: Internal consistency coefficient=0.88 and re-test coefficient=0.79. The correlation of the total score of the questionnaire with the score of the trait-state inventory is 0.68 and the total score of the BDI is 0.49, which indicates a good convergent validity (Dehshiri et al., 2009).

3. Results

Descriptive data of the research variables are presented in Table 1. The participants included 34 females (57%; 18 MDD and 16 GAD) and 26 males (43%; 12 MDD and 14 GAD) referring to the Shiraz psychiatric clinics. The number of participants in each group was 30. The Mean±SD age of the MDD group was 31.93±7.93) and that of the GAD group was 32.20±9.01).

Relationship between cognitive control, rumination, and worry

Pearson's correlation coefficient was used to investigate the hypothesis of the research that set-shifting and inhibition-based cognitive control have a negative relationship with rumination and worry in patients with MDD and GAD. The results indicated a negative and

Table 2. Correlation matrix of variables

Group	Variables	Rumination	Number of Classes	Repetition Error	Total Error
MDD (Wisconsin test)	Rumination	-	-	-	-
	Number of classes	-0.36*	-	-	-
	Repetition error	0.56*	-0.88***	-	-
	Total error	0.55**	-0.86***	0.89***	-

Group	Variables	Rumination	Incongruent Effort Error (Stroop)	Incongruent Effort Time (Stroop)
MDD (Stroop test)	Rumination	-	-	-
	Incongruent effort error	0.45*	-	-
	Incongruent effort time	0.48**	0.68***	-

Group	Variables	Worry	Number of Classes	Re-test Error	Total Error
(Wisconsin test) GAD	Worry	-	-	-	-
	Number of classes	-0.48**	-	-	-
	Repetition error	0.47**	-0.90***	-	-
	Total error	0.49**	-0.91***	-0.89***	-

Group	Variables	Worry	Incongruent Effort Error (Stroop)	Incongruent Effort Time (Stroop)
(Stroop test) GAD	Worry	-	-	-
	Incongruent effort error	0.58**	-	-
	Incongruent effort time	0.43*	0.55**	-

*P<0.01, **P<0.001, ***P<0.0001.

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significant relationship between the number of WCST classes and rumination (r=-0.36, P<0.04). Also, there was a positive and significant relationship between WCST repetition error and rumination (r=0.56, P<0.001) and a positive and significant relationship between WCST total error and rumination (r=0.55, P<0.001) (Table 2). Furthermore, there was a positive and significant relationship between inhibition based on the number of errors and rumination (r=0.45, P<0.01). Also, the relationship between inhibition based on time and rumination was positive and significant (r=0.48, P<0.007) (Table 2).

There was also a negative relationship between the number of WCST classes and worry in the GAD group (r=-0.48, P<0.006). Also, the results showed a positive and significant relationship between WCST repetition error and worry (r=0.47, P<0.008). In addition, WCST total error and worry in the GAD group had a positive relationship (r=0.49, P<0.006) (Table 2). The results of the correlation between Stroop test components and worry in GAD illustrated that there was a positive relationship between time-based inhibition and worry in GAD patients (r=0.43, P<0.01). Also, inhibition based on the number of errors had a positive relationship with anxiety in these patients (r=0.58, P<0.001). Therefore, the higher the level of worry in GAD patients, the more time spent on the incongruent effort of the Stroop test and the number of errors committed by these patients in the test (Table 2).

Comparing cognitive control, worry, and rumination between the GAD and MDD groups

The mean score of all three components of classes, repetition error, and total error of the Wisconsin test, both

time and error related to the incongruent effort components of the Stroop test, rumination, and worry were not significantly different in the MDD and GAD groups.

4. Discussion

The purpose of the present research was to investigate the relationship between cognitive control and repetitive thoughts of rumination and worry in people with MDD and GAD and compare the cognitive control, worry, and rumination between the GAD and MDD groups.

The results revealed that there was a significant negative relationship between cognitive control and rumination in depressed patients, which is consistent with the studies by De Lissnyder et al. (2012), Zareian et al. (2021), Taylor and Synder (2021), Hallard et al. (2021), Burdette et al. (2021), Pont et al. (2019), Mennies et al. (2021) and inconsistent with the study by Armstrong et al. (2011) who found this relationship in the obsessive-compulsive disorder and GAD groups.

Also, the obtained results which revealed a significant negative relationship between cognitive control and worry in generalized anxiety patients are in line with the research conducted by Matinfar et al. (2019).

In order to explain this relationship, two different studies and theoretical paths can be pointed out. On the one hand, it is stated that the ruminative thinking style continuously focuses on negative thoughts and causes disruption in the cognitive resources needed by a person to solve problems in assignments (Koster et al., 2012). On the other hand, it has been suggested that defects in the information processing process led to ruminating tendencies in people (De Raedt & Koster, 2010). The second axis of the research states that repetitive thinking, such as rumination and worry, are unpleasant states that are caused by unrelated processes, that is, by cognitive vulnerabilities, such as cognitive vulnerability to attention deficit. It means that reducing attention control is considered a risk factor for repetitive thinking, including rumination because with reduced attention control, a person's ability to manage their cognitive resources to prevent unwanted negative thoughts decreases (Levens et al., 2009). These negative cognitions may exacerbate deficits in attentional control, whereby negative thoughts are allowed to re-enter the individual's working memory cycle despite his/her suppression (Rosen & Engle, 1998). This cycle is aggravated by weakness in the shift function (weakness in attention shifting) (Armstrong et al., 2011).

Therefore, attention control plays an important role both in the initiation of this repetitive thinking and in the form of the person's coping strategies with these negative cognitions (Armstrong et al., 2011).

Koster et al., 2011 have also stated that Maladjusted Schemas, as a characteristic of emotional disorders, have an important influence on the way information is processed and leads to the interpretation, attention, and memory to the negative experiences related to itself.

Also, the findings of this research are in line with the theory of recapture of attention by Koster et al. (2011), which examines the underlying mechanisms of rumination in depressed patients. This theory states that a person experiences rumination when dealing with stressful situations in life, and in this situation, they feel a cognitive conflict, and this cognitive conflict is followed by freeing attention from negative thoughts in most people. However, in people with depressed moods, rumination or negative schemas about themselves leads to a reduction in the recall of cognitive conflict, which also reduces the resources of attention allocated to this cognitive conflict. As a result, this decrease in attention causes defects in problem-solving, poor performance in assignments, and negative emotions in the individual. According to this theory, when rumination reduces cognitive conflict recall and thus reduces attention control, rumination, attention control, and depression can have mutual relations.

However, despite the research conducted in this field, it is still not possible to express the cause-and-effect relationship between these two variables. In other words, the problem remains that either the rumination causes defects in attention control or the defects in controlling attention create and maintain rumination. But the most important factor is the mutual relations of these two variables, which helps in understanding rumination and its underlying factors so that the therapists better do their best via a broader and more comprehensive view of the treatment path in the treatment of emotional disorders.

The results revealed that the level of cognitive control, rumination, and worry was not significantly different in both groups of MDD and GAD. Defects in the cognitive control of this group of patients can indicate common mechanisms in the development and continuation of emotional disorders (Zainal & Newman, 2022). This dysfunction in cognitive control can make a person more vulnerable to repetitive thoughts of rumination and worry (Bartholomay et al., 2022).

On the other hand, rumination and worry are both part of the unified transdiagnostic components of emotional disorders. The basic premise of the unified transdiagnostic approach is that emotional disorders are related to the core of psychological processes. Therefore, the lack of significant difference between these variables in this group of disorders can be explained (Zarghami et al., 2020). Considering the limitations of this study, it should be mentioned that the number of samples was limited because many patients were reluctant to cooperate, which made it difficult to access people who were suffering from MDD and GAD. Besides, the current study was correlational. Therefore, the causal relationship must not be obtained. It is suggested to use Stroop versions with emotional content in future studies. Furthermore, repeating the study with other tools increases the generalizability of the results. Future studies should examine the causal relationship between research variables.

5. Conclusion

The results showed that there was a negative and significant relationship between cognitive control and rumination in the MDD and GAD groups. The level of cognitive control, rumination, and worry was not significantly different in the MDD and GAD groups. Defects in information processing us related to repetitive thinking tendencies in people. It means that reducing attention control is considered a risk factor for repetitive thinking because, with reduced attention control, a person's ability to manage his/her cognitive resources to prevent unwanted negative thoughts decreases.

Ethical Considerations

Compliance with ethical guidelines

All ethical principles were considered in this article. The participants were informed of the purpose of the research. They were also assured about the confidentiality of their information, and if desired, the research results would be available to them.

Funding

The paper was extracted from the Master's thesis of Afsaneh Vosoughi Motlagh, approved by the Department of Clinical Psychology, Shiraz University.

Authors' contributions

Afsaneh Vosoughi Motlagh and Nourallah Mohammadi equally contributed to preparing this article and Mohammad Reza Taghavi and Mohammad Ali Goudarzi did the editing

Conflict of interest

The authors declared no conflict of interests.

Acknowledgments

We thank all the participants who contributed to the study.

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