

Comparison of Working Memory in Individuals with Obsessive-Compulsive Disorder, Major Depression, Panic Disorder and Healthy Individuals

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ABSTRACT

Objective: Given the relatively high prevalence of panic disorder, little research has been conducted on this disorder. The current study aimed to compare working memory among individuals with obsessive-compulsive disorder, major depression, panic disorder, and healthy individuals.

Materials and Methods: The method of the present study was causal-comparative. The statistical population included all individuals referring to psychiatric and neurological clinics in Qom city during 2021-2022. In this study, a total of 200 individuals were selected as samples (50 individuals with obsessive-compulsive disorder, 50 with major depressive disorder, 50 with panic disorder, and 50 healthy individuals) using a convenient sampling method. The research tool included the Daneman and Carpenter Working Memory (1980). The research data were also analyzed using a multivariate analysis of variance test and statistical software (SPSS-24).

Findings: The results of the analysis showed that working memory in individuals with obsessive-compulsive disorder, major depression, panic disorder, and healthy individuals was different ($P < 0.05$). The working memory in obsessive-compulsive disorder was higher than in major depressive disorder and panic disorder individuals and was lower compared to healthy individuals ($P < 0.05$).

Conclusion: It can be concluded that working memory differs among individuals with obsessive-compulsive disorder, major depression, panic disorder, and healthy individuals.

Keywords: Working memory, Obsessive-compulsive disorder, Major depression, Panic disorder.

1. Introduction

In epidemiological studies, the lifetime prevalence of panic disorder has been reported to be 1 to 4 percent, with a six-month prevalence of 0.5 to 1 percent. Women are two to three times more likely than men to be affected. Panic disorder most commonly occurs in youth, with the average age of onset around 25 years (Barlow & Craske, 2006; Walsh et al., 2022). Given the relatively high prevalence of panic disorder, limited research has been conducted on this condition. Additionally, individuals with panic disorder often perceive their symptoms as physiological and frequently present themselves to emergency departments, leading to a neglect of psychological research in this area. To date, various cognitive, behavioral, metacognitive, and emotional models have been introduced concerning the etiology of anxiety disorders. Other participants in the current research include healthy individuals who are family members of people with the three disorder groups and accompany them to the clinic (Hahn et al., 2003; Hsieh et al., 2022).

Among the disorders involved in the current research on attendees of psychiatric clinics is Obsessive-Compulsive Disorder (OCD), a chronic psychological disorder that severely impacts the mental, emotional, and social health of affected individuals. Characterized by persistent, intrusive thoughts and repetitive behaviors accompanied by anxiety, most individuals with OCD have both cognitive and behavioral symptoms. The compulsive thoughts and actions resulting from OCD are not pleasurable or voluntary (Cludius et al., 2021; Menzies et al., 2021). They occur involuntarily and usually cause worry and anxiety in individuals (Fajnerova et al., 2020; Reid et al., 2021). Due to its debilitating nature, OCD can significantly affect various developmental aspects of children and adolescents, thereby seriously impairing their overall functioning. Symptoms of OCD may include obsessions, checking, ordering or arranging, washing, hoarding, and neutralization (Di Nicola et al., 2015; Menzies et al., 2021; Pozza et al., 2021; Rahimzadegan & Atadokht, 2020).

Active memory plays a role in individuals with Obsessive-Compulsive Disorder, Major Depression, Panic Disorder, and healthy individuals. Maintaining information in active memory is crucial for cognitive functions such as reasoning, perception, and learning (Bayrami et al., 2021; Taghizadeh et al., 2018). Active memory is a system involved when recalling complex mental functions like reasoning, understanding, and learning (Bryant et al., 2021;

Gan et al., 2022; Oka et al., 2021). It is foundational for thinking and learning. Active memory is significantly important as it guides the intelligent behavior of humans and even non-human primates when task-related stimuli are not present (Ashori & Tajvar Rostami, 2020; Doebel, 2020). It acts as a temporary store between past sensations and future behavior. Therefore, understanding it is vital not only because active memory encodes and retains sensory information, but more so as it deals with how one plans for future use (Taghizadeh et al., 2018).

Another disorder of focus in the attendees of the psychiatric clinics in the current study is Panic Disorder, characterized by recurrent and unexpected panic attacks. A panic attack is a sudden onset of intense fear or discomfort that peaks within minutes, accompanied by at least four of thirteen physical and cognitive symptoms. Physical symptoms include heart palpitations, sweating, trembling, shortness of breath, feelings of choking, chest pain, nausea, dizziness, heat sensations, paresthesia, and derealization. Cognitive symptoms include the fear of losing control or going insane and fear of dying. Additionally, individuals with panic disorder often experience ongoing worry or preoccupation with having another attack or its consequences and an adaptive behavioral change to avoid future attacks (American Psychiatric Association, 2022).

Therefore, the current research aims to investigate whether active memory differs among individuals with Obsessive-Compulsive Disorder, Major Depression, Panic Disorder, and healthy individuals.

2. Methods and Materials

2.1. Study Design and Participants

The method of the present research was causal-comparative. The population consisted of all individuals visiting psychiatric and neurological clinics in Qom city from December 2021 to December 2022. For sampling from the targeted population, 200 individuals were selected using a convenient sampling method, with 50 individuals each from groups with obsessive-compulsive disorder, major depressive disorder, panic disorder, and 50 healthy individuals (who were family members of individuals with the three disorders and accompanied them to the clinic). The minimum sample size to detect differences between homogeneous groups with an effect size of 0.35, statistical power of 0.95, and alpha error of 0.05 was 50 individuals per group.

Ethical considerations in this research were such that participation was entirely voluntary. Before starting the project, participants were familiarized with the details of the plan and its regulations. Individual beliefs and attitudes were respected. Moreover, all documents, questionnaires, and records were confidential and accessible only to the researchers. Informed written consent was obtained from all volunteers.

2.2. Measures

2.2.1. Working Memory

The Working Memory Capacity assessment, designed by Daneman and Carpenter (1980), consists of 27 sentences divided and classified into six sections, ranging from two-sentence to seven-sentence sections. The main feature of this test is the simultaneous assessment of two aspects of working memory (processing and storage) while performing a mental activity. Test subjects are asked to listen carefully to a series of different and relatively difficult sentences read to them, then perform two mental tasks simultaneously as follows: a) correctly identify the meaning and concept of the stated sentences, b) remember the last word stated in the sentences. The test also comes in other versions. Throughout the test, subjects reflect their mental activity on a special answer sheet provided to them. For example, in the first stage, subjects pay close attention to the two-sentence section and only after the two sentences are read do they proceed to mark and write the last word. This process continues through the final stage, i.e., the six-sentence section, with more time allocated as the number of sentences increases. Each sentence in the test is valued equally, and each correct answer receives one point, while wrong or blank

answers receive no points. Thus, each subject receives two scores per sentence: one processing score for correctly identifying the sentences read and one storage score for correctly writing the last word heard. Overall, as the test contains 27 sentences and each question is valued equally, each subject's score in both processing and storage is calculated out of 27, and the active memory score of each subject is derived from the average of the two scores, expressed as a percentage (Daneman & Carpenter, 1980). The validity and reliability of this test have been approved in many studies (Chevalère et al., 2023; Taghizadeh et al., 2018).

2.3. Data Analysis

In addition to calculating descriptive indices (including frequency distribution tables, percentages, central tendency measures like mean and variance, etc.) in data analysis, inferential indices were calculated. For inferential data analysis, the multivariate analysis of variance (MANOVA) method was utilized using the SPSS-24 statistical software.

3. Findings and Results

In terms of demographic characteristics, 45.62% of the sample were men and 54.38% were women. The frequency distribution of the duration of illness as per the table indicated that 52.0% of the sample had been ill for less than 5 years, 43.5% had been ill for 5-10 years, and 4.5% had been ill for more than 10 years. The age distribution showed that 8.5% of the sample were aged between 20-30 years, the least number, and 39.5% were aged between 40-50 years, the majority.

Table 1

Mean and Standard Deviation Results for Components of Active Memory

Components	Obsessive-Compulsive Disorder Group	Major Depression Disorder Group	Panic Disorder Group	Healthy Individuals Group
	Mean	Standard Deviation	Mean	Standard Deviation
Processing	10.32	3.98	8.58	1.81
Storage	11.28	3.84	9.66	1.84

As show in Table 1, it is evident that there is a difference between the mean components of active memory variables examined in the groups with obsessive-compulsive disorder, major depressive disorder, panic disorder, and healthy individuals in dependent variables. Wilks' Lambda test was

used to determine the significance of the group effect on the components of active memory variables examined in the groups with obsessive-compulsive disorder, major depressive disorder, panic disorder, and healthy individuals.

Table 2

Analysis Result from Multivariate Analysis of Variance for Active Memory Variables

Source	SS	Df	MS	F	P	Effect Size
Group Variable (Active Memory)	32016.095	3	10672.032	305.795	0.0005	0.824
Error	6840.260	196	34.899			

The results of the Wilks' Lambda test indicated that there is a significant difference between the four groups in at least one of the components of active memory variables ($F(9, 472.296) = 44.835, P < 0.01$). Furthermore, the results of the

effect size 0.618 indicate that the group variable explains 61.8% of the variance of the dependent variables of active memory.

Table 3

Analysis Result from Scheffé Post-Hoc Test for Active Memory Variables in Obsessive-Compulsive Disorder, Major Depressive Disorder, Panic Disorder, and Healthy Individuals

Groups	Mean	Standard Deviation	p-value
Major Depressive Disorder	3.36	1.18	0.047
Panic Disorder	5.44	1.18	0.0005
Healthy Individuals	-25.90	1.18	0.0005

Results from [Table 3](#) show that there is a significant difference in the average amount of active memory variable among individuals with obsessive-compulsive disorder, major depressive disorder, panic disorder, and healthy individuals. Specifically, there is a significant difference in the active memory variable among the four groups of obsessive-compulsive disorder, major depressive disorder, panic disorder, and healthy individuals ($F_{(3,196)} = 305.795, P < 0.01$), explaining 82.4% of the variance in active memory. A Scheffé Post-Hoc test comparison of the means of the active memory variable among these four groups revealed that active memory in individuals with obsessive-compulsive disorder is higher than those with major depressive disorder and panic disorder, and lower compared to healthy individuals.

groups showed that the processing of healthy individuals is greater than those with panic disorder, obsessive-compulsive disorder, and major depressive disorder. It was also demonstrated that there is a significant difference among obsessive-compulsive disorder, major depressive disorder, panic disorder, and healthy individuals in the average amount of storage variable and that the storage of healthy individuals is greater than those with obsessive-compulsive disorder, major depressive disorder, and panic disorder. These findings are consistent with previous research ([Barlow & Craske, 2006](#); [Dajani et al., 2016](#); [Hasani et al., 2020](#); [Sanagaoi Moharrar & Mir Shekari, 2019](#)).

4. Discussion and Conclusion

The objective of the present research was to investigate the comparison of active memory among individuals with obsessive-compulsive disorder, major depression, panic disorder, and healthy individuals. The research findings indicated that individuals with obsessive-compulsive disorder, major depressive disorder, panic disorder, and healthy individuals differ significantly in the average amount of processing variable. Furthermore, a comparison of the means of the processing variable among these four

Active memory or working memory is a type of memory that is used during task performance or problem-solving and assists in learning and temporary retention of information. This memory is crucial for performing complex and difficult tasks and has a limited capacity. Active memory can be divided into two types: storage and processing. Storage in active memory refers to the ability to pay attention to incoming information and maintain it in active memory for a short duration. In other words, this type of memory is sensitive to the information entering the mind and retains it briefly for processing. Processing in active memory, on the other hand, refers to the ability to use temporary information in active memory to perform an activity or solve a problem. This type of memory allows you to combine information and

engage in a singular activity for problem-solving (Sweller, 2020).

In explaining the above findings related to active memory in individuals with obsessive-compulsive disorder, it can be said that according to studies, it has been shown that in individuals with obsessive-compulsive disorder, their active memory is less than that of healthy individuals. One reason that may cause a weakness in active memory in individuals with obsessive-compulsive disorder is that their minds are preoccupied with thinking and focusing on issues related to their obsessions, which prevents their active memory from being sufficiently engaged for other tasks (Bryant et al., 2021; Puma & Tricot, 2019; Zaremba et al., 2019). Active memory refers to a set of cognitive processes used for mental tasks such as problem-solving, decision-making, planning, and prioritizing. In obsessive-compulsive disorder, an individual might experience difficulties in their active memory. For instance, the individual might lose the ability to select and retain information in their active memory, thereby failing to make proper decisions or respond to problems. Individuals with obsessive-compulsive disorder are less efficient in their active memory performance compared to healthy individuals (Roselló et al., 2020; Sweller, 2020). Thus, research indicates that individuals with obsessive-compulsive disorder might be inefficient in their active memory performance and that treatment with antidepressants and antioxidants can expedite the improvement of active memory performance in these individuals.

Individuals with obsessive-compulsive disorder typically face difficulties in controlling their thoughts and functions and may have problems in their processing active memory. While some research has shown that processing active memory in individuals with obsessive-compulsive disorder is less than that of healthy individuals. Studies demonstrated that the performance of processing active memory in individuals with obsessive-compulsive disorder is reduced compared to healthy individuals, and their capacity for processing active memory is less, requiring more time for memory tasks (Ashori & Tajvar Rostami, 2020; Puma & Tricot, 2019). Similarly, Abramovitch et al. (2017) reported similar results regarding the inefficiency of processing active memory in individuals with obsessive-compulsive disorder, pointing to cognitive, personality, and obsessive-compulsive-related factors as reasons for the inefficiency. Regarding storage active memory, studies shown that individuals with obsessive-compulsive disorder perform

poorly in storage memory tasks (Taghizadeh et al., 2018; Wang & Shah, 2014).

In relation to active memory in individuals with major depression, it can be said that individuals with major depression are less efficient in their active memory performance and have a reduced capacity for active memory. In other words, individuals with major depression are less efficient in performing active memory tasks, and their memory performance is less compared to healthy individuals. Major depression may be associated with reduced active memory performance and can have negative effects on an individual's cognitive performance. Therefore, attention to diagnosing and treating major depression and improving an individual's cognitive performance is very important (Ashori & Tajvar Rostami, 2020; Sisakhti et al., 2021). It can also be said that processing active memory in individuals with major depression differs from that of individuals with normal conditions such that the performance of processing active memory in individuals with major depression is reduced compared to the control group (Bayrami et al., 2021; Roselló et al., 2020). Processing active memory is one type of working memory that deals with the storage and processing of information in memory during a task. Additionally, confirming these findings, the use of electroencephalography (EEG) has shown that potentials related to processing active memory in two groups of individuals with major depression and normal individuals indicate that the performance of processing active memory in individuals with major depression is reduced compared to the control group. This means that individuals with major depression are less efficient in performing tasks related to processing active memory, indicating a type of disability in processing information during tasks related to processing active memory in individuals with major depression (Covey et al., 2011; Cristofori et al., 2019). Therefore, it can be concluded that a disorder in processing active memory performance can be one of the cognitive characteristics of individuals with major depression.

Regarding storage active memory in individuals with major depression, it can be stated that this memory is reduced in both groups: individuals with major depression and normal individuals. Studies have shown that the test of storage active memory indicates less efficient performance in storage active memory in both groups of individuals with major depression and the control group (Chen et al., 2017; Cristofori et al., 2019). Thus, a disorder in storage active memory performance can be one of the cognitive characteristics of individuals with major depression.

In relation to the difference in processing active memory in individuals with panic disorder compared to other groups in the current study, it can be stated that using electroencephalography (EEG), potentials related to processing active memory in both groups of individuals with panic disorder and normal individuals differ, and a decrease is shown in individuals with the disorder. Specifically, individuals with panic disorder are less efficient in performing tasks related to processing active memory and demonstrate a certain inability in processing information during tasks related to processing active memory (Gan et al., 2022; Ricker & Vergauwe, 2022; Swart & Janeke, 2022). Therefore, a disorder in processing active memory performance can be one of the cognitive characteristics of individuals with panic disorder. Similarly, in relation to storage active memory in individuals with panic disorder, storage active memory differs between groups of individuals with panic disorder and normal individuals, and performance of storage active memory in individuals with panic disorder is reduced. This means that individuals with panic disorder are less efficient in performing tasks related to storage active memory, demonstrating a certain inability in processing information during tasks related to storage active memory. Thus, a disorder in storage active memory performance can be one of the cognitive characteristics of individuals with panic disorder.

Finally, active memory in healthy individuals typically can process around 5 to 9 units of information. For example, when you memorize a person's telephone number as individual digits, you can only remember about 5 to 9 digits. Other studies have shown that the capacity for storage active memory in healthy individuals increases with age, education, and experience. For instance, individuals who have spent more extended periods in fields such as music or sports have a greater capacity for storage active memory (Cowan, 2010). Additionally, individuals with greater capacity for storage active memory are better at stimulating and monitoring their task goals and also better at controlling attention. In other words, individuals with greater storage active memory are better at paying attention to complex tasks and reduce their attention to unnecessary items. Indeed, storage active memory is one of the important factors in controlling and monitoring attention and executing complex tasks (Oka et al., 2021; Sweller, 2020).

In general explanation of this hypothesis, it can be mentioned that according to the findings, the performance of active memory in individuals with various mental disorders, including obsessive-compulsive disorder, depression, and

panic disorder, is reduced and, in general, appears to be lower compared to healthy individuals. For example, individuals with obsessive-compulsive disorder do not perform better in tasks requiring the use of active memory. This may be due to the fact that individuals with obsessive-compulsive disorder are preoccupied with thinking and recognizing issues related to their obsessions, which prevents their active memory from being sufficiently engaged for other tasks. In the case of individuals with panic disorder, the situation might be somewhat different from other disorders, meaning that in these individuals, there may be more awareness and distraction, which causes their active memory to function with more precision and speed. In the case of individuals with major depression, due to reduced brain activity in these individuals, there might be a reduction in brain activity in areas related to cognition and memory, and this leads to reduced performance of active memory in these individuals.

5. Limitations & Suggestions

The main limitation of this research is related to external validity; since the statistical population of this research was a specific group of society, namely all individuals visiting psychiatric and neurological clinics in Qom city during 2021-2022, hence the possibility of generalizing the results to the entire population is limited. The method of the current research was descriptive-cross-sectional and of a retrospective type, which itself is one of the limitations of the current research because it is not as valid and definite as experimental researches and reduces the generalizability of the research findings. Data collection in this research was based on self-report scales, therefore, another limitation of this research relates to the measurement tool; as these reports are prone to distortion due to unconscious defenses and bias in response. Since this research has been conducted on all individuals visiting psychiatric and neurological clinics in Qom, it is suggested that it be conducted in other communities as well to increase the generalizability of the research data. Given that the present research is of a retrospective type, it is suggested that researchers in future studies use an experimental or longitudinal study to more accurately determine the role of these active memory variables in obsessive-compulsive disorder, major depression, panic disorder, and healthy individuals. Considering that one of the limitations of this research is the use of self-report scales, it is suggested that future research uses a qualitative study based on interviews. It is

recommended that this study be conducted with the participation of the entire population if conditions allow. It is suggested that training workshops be implemented. For this purpose, use of programs and training workshops related to active memory compared to obsessive-compulsive disorder, major depression, panic disorder, and healthy individuals visiting psychiatric and neurological clinics should be implemented. It is recommended that psychological consultants control the use of active memory in individuals visiting psychiatric and neurological clinics. It is suggested that by visiting a consultant, and receiving programs based on controlling active memory as well as reducing obsessive-compulsive disorders, major depression, and panic disorders be used. It is suggested that brochures and books in simple language be provided for all members of society so that they can gain the necessary and sufficient familiarity with issues of the impact of active memory variables. It is suggested that workshops and educational seminars aimed at examining the comparison of active memory in individuals with obsessive-compulsive disorder, major depression, panic disorder, and healthy individuals be regularly organized. Efforts should be made to organize conferences and scientific deliberations to strengthen active memory in all members of society. On the one hand, to reduce obsessive-compulsive disorders, major depression, and panic disorders, a scientific movement must take place, and one should study and research as much as possible and find answers to their questions by referring to books written on this topic or by asking consultants, psychologists, and physicians, to clarify any doubts and ambiguities that arise in their mind.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

Authors' Contributions

Zahra Sabokbar contributed to the study's conception, design, data collection, and analysis, as well as manuscript drafting and revision. Shahnam Abolghasemi played a pivotal role in conceiving and designing the study, conducting data analysis, providing research supervision, and contributing to manuscript drafting and revision. Abdolhassan Farhangi contributed to the study's conception and design, carried out data collection and analysis, and participated in manuscript drafting and revision.

All authors made substantial contributions to the research process, covering various aspects from study design to data handling and manuscript preparation.

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