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Neuropsychological profile of obsessive-compulsive disorder: findings from structural equation modeling

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ABSTRACT

Background and Aim: Obsessive compulsive disorder has a wide prevalence in human society. Based on this, it is very important to know the cognitive, behavioral and neurological backgrounds of these patients and the effective methods of therapeutic interventions to improve their conditions. The aim of the current research was to compare the cognitive, emotional and neurological profiles of people with obsessive-compulsive symptoms with normal people. **Method:** The present study was a correlational descriptive study. The statistical population consisted of all people with symptoms of obsessive-compulsive disorder in the second half of 1400 in Mashhad, who entered the research through an invitation. After conducting the screening interview and checking the criteria for entering the research, 80 people were selected as the research sample. The research tools included Stroop color word test, Wisconsin cards, anxiety sensitivity, ambiguous scenarios, Googlen behavioral disorders questionnaire, Yale Brown obsessive compulsive disorder questionnaire and uncertainty intolerance scale. In order to analyze the data, partial least squares (PLS) approach was used due to the exploratory nature of the model, small sample size and non-normal distribution of variables. Analyzes were performed with SPSS.25 and SmartPLS.3.3.2 software. **Results:** The results showed that the trajectory of predicting obsessive-compulsive symptoms by five indicators was significant in all dimensions. Based on this, it was found that from the cognitive indicators, congruent reactions ($P < 0.01$), incongruent reactions ($P < 0.01$) and ambiguous scenarios ($P < 0.01$), among the neurological indicators ($P < 0.01$) $P < 0.01$) and completion of classes ($P < 0.01$), among the emotional indices of anxiety sensitivity ($P < 0.01$) and intolerance of uncertainty ($P < 0.01$) and among the behavioral indices of behavioral tendencies Consistency ($P<0.01$) and impulsive behavior tendencies ($P<0.01$) were significant predictors for OCD symptoms. **Conclusion:** These results indicate that in explaining the psychological profile of obsessive-compulsive sufferers, the need to pay attention to cognitive, behavioral, emotional and neurological indicators has an important place. Also, based on these findings, it was found that emotional indicators have the highest level of predictability and behavioral indicators have the lowest level of predictability among the investigated indicators.

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Introduction

Obsessive-compulsive disorder is a common psychiatric illness characterized by obsessions or compulsions that affect most aspects of a person's life (American Psychiatric Association, 2016). This disorder is one of the psychiatric diseases that have many complications. The vast differences among observed symptoms in OCD have been an important factor in the heterogeneity of OCD research. Assessment of symptom differences is the most common approach to examining condition heterogeneity (Dams et al., 2020). In this regard, neuropsychological studies have shown that patients with obsessive-compulsive disorder probably show significant disorders in executive actions (Morin et al., 2014); Meta-analyses show that people with symptoms of the obsessive-compulsive disorder have a much weaker performance in the neurological field. Abramovich et al. (2013) have pointed out that people with symptoms of obsessive-compulsive disorder have weaker performance than the non-clinical sample (norm people) in many indicators. Neurocognitive, including attention, memory, planning, response inhibition, flexibility, verbal and non-verbal memory, and spatial working memory (Abramovitch, Abramowitz, and Mittelman, 2013).

Existing explanatory models regarding obsessive-compulsive disorder consider how to interpret intrusive and obsessive thoughts in terms of personal threats as a key factor in the occurrence and exacerbation of this disorder (Ekman & Hiltunen, 2018). This process is considered a fusion of thought, equating thoughts with actions and deeds. In other words, they believe that by thinking about an event, bad things will happen next (Clark, 2015). In other words, in this process, it is possible to explain how an initial experience or a critical life event can activate a general presumption of liability for damage. In this regard, Salek Ebrahimi et al. (2017) found that in patients with obsessive-compulsive disorder, the highest average cognitive error is related to catastrophic error and isolation. Misir et al. (2018) also found that patients with obsessive-compulsive disorder have a higher average in neurological deficits, cognitive factors, and level of insight than normal people. Individuals with obsessive-compulsive disorder are increasingly and inflexibly concerned with exerting control over all the details of issues and believe that all details should be logically ordered (Francis, 2018). Accordingly, one of the major problems in these patients is the existence of inefficiency in internal and external processes, which are defined in the form of reviewing, evaluating, and adjusting emotional indicators (McCann, 2009). During research conducted on various patients, including obsessive-compulsive patients, defects in factors based on emotions, including anxiety sensitivity, have been reported as one of their major problems (Zahiruddin et al., 2013). Studies have supported the association between the cognitive concerns subscale of anxiety sensitivity and obsessive-compulsive symptoms (Bazol et al., 2013; Timpano et al., 2016). Studies show that there is a significant relationship between anxiety sensitivity subscales and different dimensions of obsessive symptoms (Robinson & Friston, 2014). In other words, the higher the level of anxiety sensitivity, the greater the intensity of obsessive symptoms in clinical and non-clinical groups (Laposa et al., 2015).

One of the most basic concepts in people with OCD are obsessions and compulsions that reduce distress, and these emotional arousals are usually known as fear or anxiety (Blakey et al., 2017), which is sometimes seen as a feeling of guilt (Melli, Carraresi, Poli, Marazitti, & Pinto, 2017). People with symptoms of obsessive-compulsive disorder are associated with a feeling of disgust towards the aggravation of symptoms, which is more evident in sensitivities related to pollution (Wheaton et al., 2021). In this regard, Pirkhafi et al. (2016) found no significant difference between obsessive people, people with depression, and people with general anxiety symptoms in terms of perceptual stability. But in terms of visual memory, there is a significant difference between obsessive patients and the other two groups. On the other hand, dysfunctional attributions and suppressed emotions are significantly more in the family members of obsessive-compulsive patients compared to normal people, and these attributions show themselves in the form of attributing problems to uncontrollable factors (Renshaw et al., 2017).

In addition to the cognitive, emotional and behavioral indicators, the neurocognitive structures of the patterned nature of OCD symptoms regarding chronicity and prevalence

highlight the role of neuropsychological characteristics (Khosravi et al., 2015). The research conducted by neuroimaging studies shows significant differences between people with obsessive-compulsive syndrome and non-clinical samples, which indicates the presence of high activity in the prefrontal cortex, anterior cingulate cortex, and caudate nucleus, which is hypothesized as the cortico-striato-thalamo-cortical neurobiological model (Hazari et al., 2019). Also, brain imaging findings of children and adolescents show neuropsychological changes related to age-related changes in obsessive-compulsive disorder (Boedhoe et al., 2019). The challenge of this research is whether people with obsessive-compulsive disorder have a specific structure of cognitive, emotional, behavioral, and neurological dimensions that can help therapists develop a specific and comprehensive treatment field based on a comprehensive perspective. Based on this, the main goal of this research is to examine the neurological profile of people with obsessive-compulsive symptoms and to conceptualize the disorder based on neurological, cognitive (cognitive bias, executive functions), behavioral and emotional (uncertainty tolerance and anxiety sensitivity) indicators.

Method

The current research was a correlational descriptive method in which structural equations were used. The statistical population was all people suffering from obsessive-compulsive syndrome in the first half of 2022 in Mashhad. By using the purposeful sampling method, in the first study, in the first step, 150 people, who were familiar with the research process through the research call, were examined and screened. Finally, 80 people were selected as the final sample. The sample members were invited to attend one of the counseling centers that are easier for the members to access to complete the questionnaires. First, the informed consent form was seen and approved by the volunteer to participate in the research. For those who could not complete the questionnaire for any reason, the researcher completed the questionnaire. Due to the existing conditions and the impossibility of completing the questionnaires at once, this process was carried out in 4 to 5 consecutive days. Ethical considerations include: coordinating and obtaining permission to enter the environment, explaining the purpose of the research and the method of completing the questionnaires and the right of the participants to participate in the study or their refusal, assuring the participants about the confidentiality of personal information and obtaining informed consent to participate in the study.

Tools

1. Ambiguous scenarios test: This test was created by Berna et al. (2011) to measure interpretation bias in depressed people. This scale has 24 ambiguous scenarios. In this questionnaire, the participants are asked to read each scenario and make mental images; imagine that those scenarios have happened to them. After mental imagery, they should rate the pleasantness of each scenario based on a 9-point Likert scale, from 1 (very unpleasant) to 9 (very pleasant). A higher pleasantness score indicates a positive interpretation bias and a lower score indicates a negative interpretation bias. In the research of Barna et al. (2011), Cronbach's alpha of this test was 0.82, which indicates good internal consistency. In Iran, Nikbakht et al. (2019) found the reliability of this instrument to be 0.78 in the sample of students.

2. Obsession Scale - Gabriel Yale Brown: This scale was prepared and compiled in 1989 by Goodman et al. This scale has 10 items, each graded from 0 to 4. Data related to the reliability of this scale show that the reliability coefficient of different evaluators in 40 patients was 0.98, and the internal consistency coefficient through Cronbach's alpha was 0.89. The correlation coefficient of this scale with the revised Obsessive-compulsive Questionnaire was reported as 0.45 and with the Brown Beliefs Scale as 0.34, which indicates a good and high validity of this scale. In Iran, the reliability coefficient of this scale was reported as 0.84 through test-retest and re-implementation after two weeks, and experts confirmed the content validity of this test.

3. Uncertainty Intolerance Scale: This scale was designed by Friston and colleagues in 1994. This test has 27 questions related to the unacceptability of indecision and ambiguity and usually leads to failure, stress, and inability to act. This test is answered with a five-point Likert scale (never, rarely, sometimes, often, and always). Each item is scored 1, 2, 3, 4, and 5, respectively. In the initial French version, internal consistency (0.91) and a relatively good retest reliability coefficient with an interval of 4 weeks (0.78) has been obtained. The reliability coefficient of this test has been reported as significant and satisfactory (Freeston, 1994). Cronbach's alpha and retest reliability coefficient

(after 5 weeks) of the revised scale were reported as 0.94 and 0.74, respectively. The correlation coefficient of this scale with Beck's anxiety questionnaire (r=0.59) has been significant (Baher and Dugas, 2004).

4. Anxiety Sensitivity Scale: This scale is a self-report questionnaire with 16 items on a five-point Likert scale (very low = 0 to very high = 4). Each item reflects the belief that anxious feelings are experienced unpleasantly and have the potential to lead to a traumatic outcome. Higher scores determine the degree of experience of fear of anxiety symptoms. The scores range is between 0 and 64 (Floyd, Garfield, and Marcus, 2005). The structure of this questionnaire consists of three factors; Fear consists of physical concerns (8 items), fear of lack of cognitive control (4 items), and fear of being observed by others (4 items) (Zinberg, Barlow, & Brown, 1997). Examining the psychometric properties of this scale has shown its high internal stability (alpha between 0.80 and 0.90). The test-retest reliability was 0.75 after 2 weeks and 0.71 for three years, indicating that the ASIR is a stable personality construct (Rees, Patterson, Garsky, & McNally, 1986). Its validity in the Iranian sample was calculated based on three methods of internal homogeneity, retesting, and classification, which obtained the validity coefficients of 0.93, 0.95, and 0.97 for the whole scale, respectively.

5. Wisconsin Card Sorting Test: This test was compiled by Grant and Berg in 1948 and was prepared for abstract behavior, set change and executive functions. The Wisconsin Card Sorting Test is one of the most well-known neuropsychological tests measuring the prefrontal lobe functions such as abstract reasoning, cognitive flexibility, retention, problem-solving, concept formation, change of tone, and the ability to test hypotheses and use error feedback. It measures the strategy of starting and stopping action and maintaining attention. This test is considered one of the most sensitive tests related to the prefrontal and dorsolateral cortex. Lezak (1995) mentioned the validity of this test to measure cognitive deficits after brain injuries above 0.86. The reliability of this test is also reported as 0.83 based on the agreement coefficient of the evaluators in the study of Spreen and Strauss (1991). Naderi (1996) mentioned this test in Iranian population with 0.85 retesting method coefficient.

6. Color-Word Stroop Test: A computerized Stroop test was used to measure response inhibition in this research. The (color-word) Stroop test was first developed in 1935 by Ridley Stroop to measure selective attention and cognitive flexibility. The Stroop test is one of the most important tests used by researchers to measure response inhibition. The reliability of this test is reported as 0.88 for the first and second cards and 0.80 for the third and fourth cards (Danny et al., 2005; quoted by Narimani et al., 2012).

7. Guglen Behavioral Disorders Questionnaire: The scale for measuring the type of behavioral disorders was introduced by Michel Guglen. This scale has 41 items and allows a person to estimate the type of disorder both in terms of the physical structure and psychological characteristics. In this questionnaire, 5 axes have been predicted for diagnosing mental and behavioral disorders, and in the present study, two axes, 4 and 5, have been investigated. If column IV has more than 4 positive answers, the subject is classified as having manic-depressive psychosis. Suppose column V has more than 13 positive answers. In that case, it indicates that the person will be prone to manic nature, in the psychiatric sense of the word. The professors of the university have confirmed the content validity of the questionnaire. Also, the reliability of the questionnaire is mentioned with Cronbach's alpha above 80%.

Results

Among the 80 participants with OCD, 34 (42.50%) were men, and 46 (57.50%) were women. In the total sample, 15 people (18.75%) had a bachelor's degree, 43 people (53.75%) had a bachelor's degree, and 22 people (27.50%) had a master's degree or higher. In screening the data, the box plot of the results showed no univariate outlier. Mahalanobis statistic also showed no multivariate outlier in the data ($P>0.01$). Examining the assumption of normality with the Kalmogorov-Smirnov test showed that the distribution of variables is not normal ($P<0.05$). In examining the non-collinearity of the predictor variables of the model, the tolerance index was greater than 0.41 and the variance inflation index (VIF) was less than 2.46, which indicated multiple non-collinearity among the predictor variables. Durbin-Watson's statistic was equal to 2.12, indicating errors' independence. After the assumptions were fulfilled, the conceptual model of the research was evaluated using Smart PLS software. The results show that anxiety sensitivity has the highest correlation and consonant reaction has the lowest correlation

with compulsive obsession (-0.72 against -0.34). Cognitive, nervous, and emotional indicators have a negative correlation and behavioral indicators have a positive and significant correlation with compulsive obsession (P<0.001).

The bootstrap method estimated standard error and model reproduction with 5000 repetitions. Index reliability, convergent validity, and divergent validity were used to evaluate measurement models. Examining the factor loadings of each reflective indicator on its corresponding structure shows the reliability of the measurement models. Suitable coefficients for this index include values of 0.40 and above. Coefficients higher than 0.70 for Cronbach's alpha and composite reliability (CR) indicate the internal consistency of the constructs. Fornell and Larcker (1981) recommended a coefficient of 0.50 and greater for the measure of average variance extracted (AVE) for the convergent validity of constructs. Fornell and Larcker's (1981) method was also used in the divergent validity analysis. Based on this method, the average square root of the extracted variance (AVE) should be greater than the correlation of indicators of each construct. Table 2 shows that all constructs have adequate reliability and convergent validity. Divergent validity has also been achieved for all constructs

The t coefficients for the factor loadings were also greater than 1.96 and significant (P<0.01). The standardized coefficients in the measurement models show that ambiguous scenarios have the highest factor load in the cognitive indicators measurement model. In the measurement model of neurological indicators, it has a higher factor load. In the model for measuring emotional indicators, anxiety sensitivity, and in the model for measuring behavioral indicators, impulsive behavior tendencies have a higher factor load.

Next, the explanatory coefficient (R2) and predictor suitability criterion (Q2) were examined to fit the model's structural part. The explanatory coefficient (R2) values of 0.19, 0.33, and 0.67 are weak, medium, and strong criteria for this index. Three values of 0.02, 0.15, and 0.35 for the predictive fit criterion (Q2) indicate weak, moderate, and strong power (Hair et al., 2019). The results showed that the explanatory coefficient is equal to R2=0.75, the adjusted explanatory coefficient is equal to R2adjusted=0.74, and the predictive fit criterion is equal to Q2=0.71. These values indicate a strong fit for the model. The standardized structural coefficients show that emotional indices have the highest path coefficient on algebraic obsession (β=0.29). Other results show that cognitive, nervous, and emotional indicators have a negative path coefficient and behavioral indicators have a positive and significant path coefficient on algebraic obsession (P<0.01).

The results show that among the structures, emotional, neurological, cognitive and behavioral indicators have the highest priority for intervention, respectively. The importance of emotional indicators is more than other indicators. However, all indicators have below-average performance. Accordingly, they need intervention. Other results regarding the indicators show that anxiety sensitivity is the most important and its performance is low. After that, there are immobility and unstable behavior tendencies, uncertainty intolerance, class completion, incongruent reaction, congruent reaction, ambiguous scenarios, and impulsive behavior tendencies.

Conclusion

The current research aimed to study the cognitive, emotional, neurological, and behavioral dimensions in the occurrence of obsessive-compulsive disorder symptoms. The findings obtained from the data analysis showed that the structures evaluated in the multidimensional model had significant paths in explaining obsessive-compulsive disorder. In explaining this finding, it can be said that obsessive-compulsive disorder is a multifaceted and debilitating disorder, and various cognitive factors are involved in its etiology and persistence. Anxiety sensitivity is one of the factors proposed in this field that can help to understand the symptoms of obsessive-compulsive disorder as well as improve explanatory models and treatment processes. OCD patients have been found to often suppress their emotions instead of using more beneficial reappraisal strategies (Yazici & Yazici, 2019). Continued use of suppression has the opposite effect, leading to more distress and intrusive thoughts (Webb et al., 2012). Because cognitive reappraisal involves changing the initial experience of emotional stimuli, there are usually two main strategies: reinterpreting the stimulus to achieve a more pleasant meaning and distancing and visualizing the stimulus from the perspective of an unrelated observer or an unreal situation .

On the other hand, neurological indicators were also significant explanations for obsessive-compulsive disorder. In the explanation of this finding, it can also be said that as it has been mentioned about the distress related to the attitudes regarding obsessive thoughts, in obsessive-compulsive disorder, especially in the type of cleanliness obsession, high distress is associated with activation in the prefrontal cortex, the visual communication cortex and the primary somatosensory area. It was found that the involvement of these areas during symptom stimulation indicates ineffective emotional processing (Maia et al., 2008). Therefore, people with obsessive-compulsive disorder have significant differences from normal people in cognitive, emotional, and neuropsychological characteristics, and the profile the researcher assumes can be considered applicable to these patients. In this regard, the researches conducted in the field of attention deficit in patients with obsessive-compulsive disorder, while confirming this problem, emphasize that people with this disorder suffer from cognitive defects and inefficiency in information processing, as well as defects in behavioral control. It is among them. In explaining the problem of behavioral control in people with obsessive-compulsive disorder, it can be said that in accordance with the behavioral theory, given that obsessive compulsive disorder is a response to stimuli that provoke obsessive thoughts, the balance in the goal-oriented attention system and the stimulus attention system disappears. As a result, due to a defect in behavioral control, the performance of the patient suffers from a defect in performing behavioral tasks (Den Ouden et al., 2020). Among the limitations of the present research, we can mention the limited generalization of the results due to the selection of the research sample from Mashhad city and a large number of research tools. It is suggested that researchers interested in the field of obsessive-compulsive disorder should investigate this profile in patients with comorbid disorders with obsessive-compulsive disorder.

Conflict of Interest

According to the authors, this article has no financial sponsor or conflict of interest.

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