# **Cognitive Flexibility and Decision-Making Under Ambiguity in OCD Regarding the Disorder Duration**

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# Abstract

Introduction: Obsessive-compulsive disorder (OCD) is a complex disorder. According to the previous findings, OCD patients suffer from neuropsychological impairments. The aim of the present research is to study the executive function impairments in OCD. Method: 30 OCD patients and 30 healthy controls were selected using convenience sampling method. OCD patients and the controls were matched regarding their gender, age, and IQ. The study method was causal-comparative. Research tools were Yale-Brown Obsessive Compulsive Scale (Y-BOCS), Iowa Gambling Task (IGT), Wisconsin Card Sorting Test (WCST) and Raven's Progressive Matrices. Data were analyzed using MANOVA and independent t-test. Results: Results showed that individuals with OCD had a significantly weaker performance in cognitive flexibility (WSCT) in comparison with the healthy control group. However, there was no significant difference between two groups in performing decision- making under ambiguity. Moreover, it can be mentioned that OCD patients who had the disorder for a shorter period of time, had a significantly weaker cognitive flexibility. Conclusion: The results of this study have concluded that OCD patients have a weaker cognitive flexibility compared to the healthy individuals, also, OCD duration affects patients' cognitive flexibility.

**Keywords:** Obsessive compulsive disorder, executive functions, cognitive flexibility, decision - making

# Introduction

Obsessive-compulsive disorder (OCD) is a heterogeneous psychiatric disorder characterized by clinically significant

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recurrent, intrusive and disturbing thoughts (obsessions) as well as repetitive stereotypic behaviors which are usually associated with anxiety or dread (compulsions) (Wang, Cui, Wang, Fan, Xu, et al., 2011). Obsessions and compulsions encompass the entire range of human thoughts and behaviors and are unique to the affected individual. It can be mentioned that the clinical expressions of obsessions and compulsions are broad (Pauls, Abramovitch, Rauch, Geller, 2014).

During the past two decades, due to the increasing interest towards the neuropsychological functions of the OCD, a growing body of knowledge emerged to assess the neurobiological aspects of the OCD. This body of knowledge led to the cortico-striatothalamocortical model of OCD which assumes the fronto-striatal pathobiology (Milad & Rauch, 2012). Furthermore, a substantial body of literature investigated neuropsychological test performance in OCD has resulted in inconsistent findings. Unfortunately, the accumulation of neuropsychological research in this field has not yet been successful to draw conclusions about a neuropsychological profile of OCD (Abramovitch & Cooperman, 2015). The OCD patients have a weaker function in performing the activities which need response adjustment related to changing reward's feedback (Gillan, Papmeyer, Morein, 2011). The numerous findings are available about executive functioning deficits in OCD (Del Casale, Rapinesi, Kotzalidis, De Rossi, Curto, et al., 2015). Different subsets of the executive functioning such as response inhibition, working memory, and cognitive flexibility, are mostly related to the obsessive-compulsive disorder (Snyder, Kaiser, Warren, Heller, 2015).

Cognitive flexibility is a psychological construct which is known as one of the characteristics of the proper executive functions. Some of the executive functions subsets coherently lead to the cognitive flexibility. In a changing environment, individuals must recognize the process of the changes that occur in the environment by directing their attention to the changing elements. When an individual confirms that the previous strategy is not effective in a new environment, he must inhibit the previous response and form a new strategy based on the changing environment. Individuals receive information and manipulate them in order to use proper flexible responses in different conditions. Cognitive flexibility includes displacement or reforming respond subset towards a new goal. Lack of cognitive flexibility is one of the executive function deficits reported in OCD patients (Dajani & Uddin, 2015).

Decision-making ability is one of the most important domains of an individual cognitive function. It is a daily activity of all the humans (Banca, Vestergaard, Rankov, Back, Mitchell, et al., 2014). Decision-making ability is a process derived from reasoning and emotion and is performed by the prefrontal area of the brain (Bouyssou, Dubois, Pirlot, Prade, 2009). Several studies reported that OCD patients showed impairments in decisionmaking ability under ambiguity as they were compared to the healthy control group (Martoni, Brombin, Nonis, Salgari, Buongiorno, et al, 2015; Zhang, Dong, Ji, Zhu, Yu, et al, 2015; Pushkarskaya, Tolin, Ruderman, Kirshenbaum, Kelly, et al., 2015; Kim, Kang, Namkoong, Jhung, Ha, et al., 2015).

Regarding the fact that a valid diagnosis is the first step towards a successful treatment, it can be said that a comprehensive and accurate understanding of a disorder may contribute to a favored diagnosis. OCD is one of the most considerable and complicated psychiatric disorders. Different treatment approaches may face some onerous challenges while treating the OCD patients and sometimes these challenges have stemmed from disregarding the effective factors in shaping and persistence of the disorder. Therefore, considering the importance of fundamental and comprehensive understanding of OCD which may actually lead to successful therapeutic results, the aim of the current study was to assess the effective neuropsychological deficits of OCD patients. Although there are several researches regarding the assessment of cognitive flexibility and decision-making in individuals with OCD, to the best of our knowledge, there are only a few articles which examined the effect of OCD duration. In addition, we did not find any similar research which evaluated the effect of OCD duration on cognitive flexibility and decision-making which are the two most assessed domains of executive functions in OCD patients. In correspondence with the above-mentioned studies, the following hypotheses and a question were made: 1) compared to the healthy control group, the OCD patients were expected to perform worse in the decision-making ability under ambiguity task, 2) compared to the healthy control group, OCD patients were expected to have weaker cognitive flexibility, 3) does the OCD duration affect the OCD patients' performance in cognitive flexibility and decision-making under ambiguity?

#### Method

The research design is causal-comparative since it attempts to determine the neuropsychological causes and differences which already exist between the OCD and control groups. Independent variables in this study are a group of OCD patients and a healthy control group, while decision-making ability under ambiguity and cognitive flexibility are considered as the dependent variables.

This study was carried out from May to November 2016. The participants comprised 30 patients diagnosed with OCD and had visited psychiatric clinics in Shiraz as well as 30 healthy participants matched for age, IQ, and gender and were chosen from the staffs of psychiatric clinics. The age range of the participants was between 18 - 55 years old. It is worth mentioning that, the group of OCD patients was diagnosed by a psychiatrist and the Structured Clinical Interview for DSM-V (First, Williams, Karg, Spitzer, 2015) was used to determine both any psychiatric disorders among healthy participants and confirm the OCD. Accordingly, based on the psychiatrist diagnosis and the structured clinical interview, participants were assigned to either OCD or control group. Participants had the minimum level of education (read and write). Regarding patients' medical history, those who suffered from comorbid disorders (according to DSM-V) were excluded from the OCD group. Moreover, those in the control group diagnosed with OCD or other psychiatric diseases or participants suffered from physical deficits, visual, audible and speech difficulties were excluded as well. After a clinical interview, participants were presented randomly based on the chosen tests and tasks.

# Instruments

1. Yale-Brown Obsessive-Compulsive Scale (Y-BOCS): Y-BOCS (Goodman et al., 1989) was made in order to determine the severity and supervise the recuperation of OCD. This scale included a semi-structured interview and the scales show symptoms and the severity of symptoms. It consists of 10 items on a Likert – type scale (0-4) to assess symptoms' severity based on disorders' current condition. The Y-BOCS has acceptable interrater reliability (r = 0.86 to 0.98) and internal consistency (r = 0.88 to 0.91), and the total score for the Y-BOCS has been shown to be significantly correlated with other measures of OCD severity (i.e., NIMH-OC, r = 0.67; CGI-OCS, r = 0.74) (Goodman et al., 1989a, 1989b). In this study, the Persian version of Y-BOCS validated by Rajezi Esfahani, Motaghipour, Kamkari, Zahiredin, & Janbozorgi (2012) was used for symptom recognition and symptoms severity assessment of each patient.

2. Iowa Gambling Task (IGT): It was made to measure decisionmaking (Bechara, A.R., Damasio, Damasio, & Anderson, 1994). In the current study, decision making under ambiguity was measured using the Persian computerized version of the IGT (Khodadadi, Saed, Amani, 2014). In the task, participants were asked to select one card from four decks of cards, deck A, B, C or D. After each selection, they were awarded a specified amount of points. However, on a fixed but unpredictable schedule, they may lose a specific amount of points. The subjects were informed to gain as more points as possible with a starting capital in 100 trials. The selection of a card from deck A or B produced high immediate gains but even higher losses that occurred unpredictably at certain times. The card selection from deck C and D was followed by small immediate gains but even smaller losses. In contrast, decks A and B were considered to be disadvantageous resulted in a negative outcome in the long run. However, decks C and D were deemed to be advantageous decks which led to a positive outcome in the long run. The subjects were told that some decks are more advantageous than other decks and that they can switch between the four decks. The gain or loss and the changed amount of money were shown on the screen after each selection. For the analysis of the IGT performance, we calculated the net gain by subtracting the frequency of disadvantageous selections from the frequency of advantageous selections. The 100 trials were divided into 5 blocks of 20 card selections, and the net score of each block was calculated to investigate whether decision making changed over time.

3. Wisconsin Card-Sorting Test (WCST-64): The WCST-64 is a standardized short-form of WCST. WCST is a well-established test traditionally used to measure executive functioning and is used widely by neuropsychologists for diagnostic and research purposes for individuals aged 5 to 89 years old (Baron, 2004; Greve, Strickle, Love, Bianchini, & Standford, 2005). Berg (1948) developed the WCST for use in adults to assess abstract reasoning and the ability to display cognitive flexibility in the face of changing environmental feedback (Heaton, Chelune, Talley, Kay, & Curtiss, 1993). The WCST (Grant & Berg, 1948) involves presenting participants with a pack of cards and participants are instructed to sort the cards on the basis of some rule which, once the rule has been acquired, continues to change until all the cards have been sorted (Strauss, Sherman, & Spreen, 2006). For each participant, the following is scored and has been considered a measure of executive function; number of correct categories (number of categories sorted with 10 consecutive correct responses), perseverative errors (all incorrect responses that contained a match to the preceding sorting category), and perseveration of the preceding response (exact repetitions of the directly preceding incorrect response) (Stuss et al., 2000). The validity of this task in measuring cognitive deficits followed by brain injuries is more than 0.86 (Lezak, Howieson, Bigler & Tranel, 2012). The WCST-64 normed for Iranian populations was used and the psychometric properties have been reported to be good in Iranian samples (Pirzadeh, 2008).

4. Raven's Standardized Progressive Matrices (RPM): Participants' intelligence was assessed using RPM (Raven, 2000), in which each test item consists of a matrix of geometric patterns with one missing cell, and the task for the participant is to select the best completion of the missing cell from a set of alternatives. This is a 60-item, timed (maximum 20 min allowed) fluid intelligence test of nonverbal abstract reasoning. The choice of RPM was based on its psychometric properties and reliance on nonverbal abstract reasoning. The RPM test manual describes studies from a wide age range and on different cultural groups from clinical and normal populations, and attest to the reliability (alpha coefficient = 0.91) and validity of the measure (Raven, 2000). Internal consistency studies have shown reliability estimates ranging from 0.60 to 0.98, with a median of 0.90 for the total score. Investigations of the factorial structure underlying RSPM scores, along with other cognitive measures, have reported factor loadings higher than 0.75 on a general factor. Concurrent validity studies have documented the presence of important correlates between the RSPM test scores and the Stanford-Binet and Wechsler scales, which have ranged from the lowest (0.54) to

the highest (0.88), with the bulk of correlations between 0.70 and 0.80 (Arce-Ferrer & Guzmán, 2009).

#### Procedure

Sampling procedure took place at Shiraz University Clinic of Counseling and Psychotherapy. Participants were given a complete oral and written description of the study and written informed consent was collected. Following informed consent, participants first completed the clinical interview and then neuropsychological assessment started. The participants were assessed by an expert psychologist.

#### **Statistics**

The Statistical Package for the Social Sciences (SPSS, Version 16) was used to analyze the data. ANOVA was conducted in order to check group differences concerning demographical characteristics. Moreover, independent sample t- test was used to check group matching concerning age and IQ. We also used MANOVA for evaluating the hypotheses and question of the study.

# Results

The OCD and healthy control groups were both included, 15 women and 15 men. Participants in each group were equal concerning their genders. The independent sample t-test was used in order to check group matching considering age and IQ. The age mean and standard deviation of the OCD group were 26.03 and 7.16, while the age means and standard deviation of the control group were equal to 25.06 and 6.50. Also, Leven's test result approved the equality of the variances (P=0.77, F=0.081). Therefore, the independent sample t-test did not show any significant differences between OCD and control group considering the participant's age (t=0.54, P=0.58). Mean and standard deviation of OCD group, measuring the participants' IQ, were equal to 116.23 and 12.37. While IQ means for the control group was 118.37 and the standard deviation was equal to 10.49. According to the Leven's test result, the equality of the variances was approved (F=0.44, P=0.50). Eventually, the independent sample t-test indicated that OCD and control group had no significant differences regarding the participants' IQ (t= -0.72, P=0.47).

The following tables show the descriptive indicators and MANOVA results of cognitive flexibility and decision-making ability subscales. Means and the standard deviations are shown in table 1.

Table 1- Mean and standard deviation of OCD and control groups in cognitive flexibility (WCST) and decision-making (IGT) subscales

Variables	Groups	Ν	Mean	SD	Cohen's d
Categories	OCD	30	0.86	0.93	0.70
Completed	Control	30	1.70	1.20	-0.78

Preservative	OCD	30	11.63	8.14	0.56
Errors	Control	30	7.03	8.28	0.50
Total Wrong	OCD	30	29.66	9.98	0.73
Responses	Control	30	21.83	11.23	0.75
Net Gain	OCD	30	1660.8	648.29	0.08
Net Galli	Control	30	1597.5	874.45	0.08
Total Time	OCD	30	199.50	245.33	0.43
Total Time	Control	30	123.88	30.76	0.45

Table 1 indicated that OCD group had lower performance in the categories subscale (M= 0.86, SD= 0.93) in comparison with the control group (M=1.70, SD= 1.20) which means that OCD patients made fewer sets than the control participants (Cohen's d= -0.78). Also occurred preservation errors of the OCD patients (M=11.63, SD=8.14) compared to the healthy control subjects (M=7.03, SD=8.28), were higher (Cohen's d= 0.56); OCD patients' performance in "total wrong responses" subscale (M= 29.66, SD= 9.98) was worse than the control group (M=21.83, SD=11.23) which expressed that OCD patients had more wrong responses than the healthy participants (Cohen's d= 0.73).

In order to evaluate the first hypothesis, MANOVA was used. The "Categories Completed", "Preservative Errors", and "Total Wrong Responses" subscales were considered as the dependent variables and the group type (OCD patients and control group) as the independent variable. Assessment of the Pillaie indicator illustrated significant differences between OCD patients and the healthy control subjects based on WCST (F=3.07, P=0.016,  $\eta_p^2=0.16$ ). As table 2 shows, there were significant differences between OCD patients and healthy control subjects' performances in all three subscales of the WCST. This result indicated that OCD patients made fewer categories with large effect size (F  $_{(1, 58)}$  =8.915, p=0.004,  $\eta_p^2$ =0.13) in comparison with the healthy control subjects and they had more preservative errors with medium size effect (F (1, 58) =4.70, p<0.034,  $\eta_p^2$ =0.075) than the control group. Also, there was a significant difference with large size effect observed in the "Total Wrong Responses" subscale (F  $_{(1, 58)}$  =8.14, p<0.006,  $\eta_p^2$ =0.12) made by individuals with OCD. Eventually, regarding the MANOVA results, it can be concluded that OCD patients had a weaker performance in cognitive flexibility in comparison with the healthy subjects.

Table 2- Analysis of variance for OCD and control group in cognitive flexibility's subscales (WCST)

	Variables	Sum of Squares	df	Mean Square	F	Р	Partial Eta Square
	Categories Completed	10.41	1	10.41	8.915	0.004	0.13
Groups	Preservative Errors	317.40	1	317.40	4.70	0.034	0.075
	Totral Wrong Responses	920.41	1	920.41	8.14	0.006	0.12
	Categories Completed	67.76	58	1.16	-	-	-
Error	Preservative Errors	3913.93	58	67.48	-	-	-
	Totral Wrong Responses	6550.83	58	112.94	-	-	-

The second hypothesis compares the groups taking into account their decision-making under ambiguity's subscales of the Iowa gambling task. Means and the standard deviation are shown in table 3. In order to assess the hypothesis, MANOVA was used. The "Net Gain", and "Total Time" subscales were deemed as the dependent variables and the group type (OCD patients and control group) as the independent variables. The Pillaie indicator depicted that there was no significant difference between OCD patients and the healthy control subjects regarding the Iowa gambling task's subscales (F <sub>(2,57)</sub> =1.38, p=0.25,  $\eta_p^2$ =0.046).

The main question of this study attempted to assess the effects of OCD duration on patients' cognitive flexibility and decisionmaking under ambiguity. Determining the disorder duration was based on psychiatric diagnosis, patients' clinical files and their own declaration about the period that they had dealt recurrently with OC symptoms in the clinical interview. Accordingly, based on the stated data, statistical analysis of SPSS was used to determine cut off points for the duration of the disorder. Hence, the two groups were defined based on the duration of the disorder. First, group or the "Moderate Duration" was considered for the OCD patients whose symptoms ranged from the minimum of one month to 4 years (less than 5 years), second, group entitled "Long-term Duration" contained OCD patients who suffered from the OC symptoms for 5 years to 9 years (more than 5 years). For evaluating the first question, the means and standard deviations of cognitive flexibility and decision-making based on the OCD duration were examined. In table 3, means and standard deviations of OCD duration in cognitive flexibility and decisionmaking under ambiguity subscales have been shown.

Table 3- Means and standard deviations for OCD duration in cognitive flexibility (WCST) and decision-making (IGT) subscales

Variables	Duration	N	Mean	SD	Cohen's d	
Catagorias Completed	Moderate	11	0.45	0.68	-0.76	
Categories Completed	Long-term	19	1.10	0.99		
Democratica Error	Moderate	11	9.81	5.52	-0.37	
Ferseverative Errors	Long-term	19	12.68	9.30		
Total Wrong Responses	Moderate	11	31.27	9.77	0.25	
	Long-term	19	28.73	10.24	0.23	
Net Gain	Moderate	11	1784.1	568.80	0.30	

	Long-term	19	1589.5	694.78	
Total Time	Moderate	11	276.51	401.74	0.42
Total Time	Long-term	19	154.91	39.79	0.42

Table 3 illustrated that OCD group who suffered from OC symptoms for a medium duration made fewer categories (M= 0.45, SD= 0.68) in comparison with the individuals who suffered from OCD for a long-term (M=1.10, SD= 0.99) (Cohen's d= -0.76). Moreover, regarding the preservative errors, it can be mentioned that the moderate group's errors (M=9.81, SD=5.52) were fewer compared to the long-term group (M=12.68, SD=9.30) (Cohen's d= -0.37); Eventually, moderate group's performance in "total wrong responses" subscale (M= 31.27, SD= 9.77) were higher than the long-term group (M=28.73, SD=10.24) which expressed that OCD patients had more wrong responses than the healthy participants (Cohen's d= 0.25).

In order to examine the question of this study, MANOVA was used. We considered the "categories completed", "preservative errors", and "total wrong responses" subscales as the dependent variables and the OCD duration as the independent variable. The Pillaie indicator was assessed (F  $_{(6, 112)}$  =2.61, P=0.021,

 $\eta_p^2=0.12$ ; results suggested that duration of OCD has a significant effect on cognitive flexibility subscales. As table 4 demonstrates, disorder duration has significant effects on patients' performances in "Categories Completed" and "Total Wrong Responses". The result indicated that OCD patients with moderate duration of disorder made fewer categories compared to patients who suffered from OCD for a long time with large effect size (F<sub>(2, 57)</sub> =5.87, p=0.005,  $\eta_p^2$ =0.17). Furthermore, there was a significant difference with medium effect size observed in the "Total Wrong Responses" (F (2, 57) =4.22, p<0.019, np<sup>2</sup>=0.12) subscales made by individuals with OCD. In contrast, there was no significant effect of OCD duration on making perseverative (F  $_{(2, 57)}$  =2.76, p<0.071,  $\eta_p^2$ =0.08). Eventually, according to the MANOVA results, it can be concluded that individuals with OCD who suffered from OC symptoms for less than 5 years had weaker performance in completing categories and finding the right answers in comparison with OCD patients who dealt with the symptoms for more than 5 years.

Table 4- Analysis of variance for OCD duration in cognitive flexibility's subscales (WCST)

	Variables	Sum of Squares	df	Mean Square	F	Р	Partial Eta Square
Duration	Categories Completed	13.36	2	6.68	5.87	0.005	0.17
	Preservative Errors	374.62	2	187.31	2.76	0.071	0.089
	Totral Wrong Responses	965.21	2	482.60	4.22	0.019	0.12
	Categories Completed	64.81	57	1.13	-	-	-
Error	Preservative Errors	3856.70	57	67.66	-	-	-
	Totral Wrong Responses	6506.03	57	114.14	-	-	-

For examining the question, MANOVA was used. The "Net Gain", and "Total Time" subscales were considered as the dependent variables and the OCD duration as the independent variable. For using MANOVA, the Pillaie indicator was evaluated (F <sub>(4, 114)</sub> =1.58, p=0.18,  $\eta_p^2$ =0.053); these numbers indicated that OCD duration has no significant effect on OCD patients' decision-making ability.

# Discussion

The main purposes of this study were assessing OCD patients' performance in two subdomains of executive function including cognitive flexibility and decision-making under ambiguity comparing with healthy control subjects and evaluating the effect of OCD duration on patients' cognitive flexibility and decision-making under ambiguity. Obtaining the results of the study, it was noticed that there were significant differences between OCD patients and healthy control subjects considering their cognitive flexibility while, no significant differences were observed between subjects performance of the two mentioned groups in decision-making ability. Effect size analysis demonstrated that the largest effect observed was when we assessed the differences between OCD and control group regarding their performance in two subscales of cognitive flexibility including the "Categories Completed" and "Wrong Responses", while the effect size for

"Perseverative Errors" was small. However, the Cohen's d for the "Net Gain" subscale was considerably low, the "Total Time" subscale depicted a moderate effect size. Moreover, the results of this study indicated that OCD duration has significant effects on cognitive flexibility of the individuals with OCD and patients who suffered from OC symptoms for less than 5 years had weaker performance in making categories (with large effect size) and finding the correct response (with moderate effect size) for the task compared to the patients who had OCD for more than 5 years. However, there was no significant difference between OCD patients regarding their perseverative errors. Additionally, statistical results showed that duration of disorder had no significant effect on OCD patients' decision-making ability in the subscales of "Net Gain" and "Total Time" with medium effect size.

The first part of the findings of this study showed significant differences between OCD patients and the control group considering their cognitive flexibility. It is consistent with the results of the study by Francazio & Flessner (2015) and Lewin et al. (2014). Statistical results showed that OCD patients had weaker performance in "Categories" subscale comparing with healthy control subjects; this finding revealed OCD patients' weakness in the first subscale of WCST. Regarding the higher mean of OCD group in "Preservation Error", it can be concluded

that OCD patients make more preservative errors than healthy subjects. Moreover, "Wrong Responses" subscale's mean of the two groups was compared and the results showed that the wrong responses of the OCD patients were more than the healthy control subjects. According to the described effect size which ranged from small to moderate, it can be concluded that the cognitive flexibility differences between OCD and healthy subjects were significant.

According to the above-mentioned finding, OCD patients have weaker performance in cognitive flexibility comparing to the healthy control subjects. It can be explained that OCD patients have some issues and problems in adjusting to the changing world and variables around them. Cognitive flexibility can be considered as a part of obsessive-compulsive's symptomology. Regarding the fact that cognitive flexibility is one of the executive function's sub-domains which takes place in frontal areas of the brain and considering the finding cited that OCD patients have some problems in cognitive flexibility, it can be concluded that cognitive flexibility problems in OCD patients may stem from performance disorder of OCD patients' frontal lobe.

The second part of the findings of the current study declared no significant differences between OCD patients and healthy control subjects in decision-making under ambiguity. The results reported by Zhang et al (2015) and Martoni et al (2015) were in contrast with the current finding of this study. Decision-making ability was assessed as the two subscales of Iowa gambling task. Statistical findings showed no significant differences between OCD patients and healthy control subjects in the subscales of the task. This can be explained referring to symptoms severity heterogeneity. In the other words, most of the OCD patients who participated in this study suffered from moderate symptom's severity and it can be possible that the performance of the patients who suffered from moderate severity of the symptoms is less disturbed in decision-making compared to the patients with severe symptoms.

As the conclusion which is based on the findings of the current study, it can be stated that OCD patients may experience some problems in one of the executive functions of their brain, which is known as cognitive flexibility, that helps the individuals adjust to the changing environment. The above - mentioned problem may stem from their frontal lobe. In contrast, OCD patients' ability in decision-making under ambiguity did not differ from healthy control subjects. This finding, however, may result from the moderate symptoms' severity of the patients who participated in the current study. According to the very small effect size of Cohen's d in the "Net Gain" subscale, it can be mentioned that the differences between the OCD and control group were not significant enough to reach a conclusion. In contrast, although "Total Time" subscale illustrated a moderate effect size, there were no statistical differences between the groups regarding their performance in this subscale.

The third part of the findings of this study demonstrated a significant effect of OCD duration on patients' cognitive flexibility. It can be noticed that patients who suffered from OCD for less than 5 years had weaker performance in comparison with the patients who had OCD for a longer period of time (more than 5 years). Moreover, the effect size analysis of the stated subscales of cognitive flexibility ranged from moderate to large indicating that OCD duration effect is overwhelmingly significant. In contrast, it can be mentioned that statistical results of the study did not illustrate any significant duration effect on the decisionmaking ability of the patients. Regarding the Cohen's d interpretation, we had medium effect size for the two subscales of decision-making. To the best of our knowledge, there is not enough literature regarding the effects of OCD duration on patients' executive functions (including cognitive flexibility and decision-making under ambiguity). A research conducted by Nakao and his colleagues (2009) was one of the slightly similar research to our work which assessed the duration effect of OCD on cognitive functions including attention and memory. The findings of this study demonstrated that the OCD duration resulted in weaker cognitive flexibility in patients who had OCD for less than 5 years. Taking into account the result obtained, it can be stated that as the disorder lasts for longer period of time, patients may learn to use some compensatory methods and as a result, their performance gets slightly better than those patients who suffer from the disorder for a shorter period of time.

The findings of the current study can contribute to the therapeutic procedure of obsessive-compulsive disorder. Based on the considerable findings of this study indicating that cognitive inflexibility in OCD patients may result from frontal lobe dysfunctions, one may notice that the main purpose of psychotherapy, regardless of the psychological approach, must be focusing on using a variety of effective therapeutic techniques in order to develop new learning loop in the patients' cortex. Additionally, it can be mentioned that the theoretical background of a psychotherapist and his ability to perform the approach related therapeutic techniques, are more important than the disputation that occurs among different users of the approaches trying to prove their techniques have had better efficacy in comparison with the other approaches. While psychotherapists focus on providing effective techniques and concentrate on developing a new cortical learning loop, we can expect transpicuous and perceptible changes in patients' daily life and functions.

This study had some limitations which will be mentioned in the following lines. According to the moderate symptoms severity of the participated OCD patients, generalizing results to the patients suffering from severe symptoms must be considered carefully. In addition, since the convenient sampling method was used in the current study, any generalizations must be considered cautiously. Considering the fact that different OCD types were not assessed in the present study, it is also suggested that article audiences notice this limitation for further generalizations.

Eventually, it can be mentioned that the symptom severity of the patients who were evaluated by Yale-Brown obsessivecompulsive scale could be lower than actual severity, therefore, it is suggested that psychologists focus on their observations and clinical interview findings instead of self-report tests.

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