



Personality and Mental Disorders: Examination and Comparison of Reinforcement Sensitivity Theory of Personality in Obsessive-Compulsive Disorder and Anxiety Disorders

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Abstract

Background: Reinforcement sensitivity theory is a neurocognitive theory of personality that strives to explain the underlying structure of personality.

Aim: The present study aimed to address this issue by assessing the behavioral systems of revised-RST, i.e., BIS, BAS, fight, flight, and freeze among four populations.

Methods: Participants included 235 out-patients, of these, 54 met the DSM-5 criteria for OCD, 65 for GAD, 72 for SAD, and 44 for PD. Further, 82 healthy controls were recruited and matched on education and age. Then, participants completed demographic information and several questionnaires in Persian. The Kolmogorov-Smirnov, Chi-squared analyses, the independent t-tests, and MANCOVA was used to compare demographics and clinical variables in five groups.

Results: The mean score of GAD in r-BAS was higher than the other abnormal groups, but the mean score of r-BIS was higher for the OCD group. In addition, the PD group experienced the highest Fight as well as Flight mean score. Also, the GAD group experienced the highest mean score of Freeze. The greatest effect size was for r-BAS, whereas the effect size of the groups for Flight and Freeze was lower than the other scales.

Conclusions: More nuanced knowledge from RST may be helpful in the diagnosis, etiology, and continuation of common mental disorders. The results may help us understand better the personality-related psychopathology underlying OCD as well as anxiety disorders.

Keywords: Personality; Obsessive-Compulsive Disorder; Anxiety Disorders

Introduction

Mental disorder is a syndrome characterized by significant disruption of cognition, emotional or behavioral regulation, which itself is a reflection of the distortion of biological, psychological, or developmental processes underlying mental function [1]. The most common mental disorders are anxiety disorders and obses-

sive-compulsive disorder (OCD). There are many similarities between anxiety disorders and OCD, the most important of which are loss of cognitive control, negative cognition, and anxiety, but there are also differences between the two disorders in terms of spontaneous thoughts, anxiety intensity, evaluation, emotional response, and personality [2,3]. Numerous studies have shown that anxiety,

OCD, and depression are closely related to each other in terms of brain systems and genetic bases. For example, reactivation of the behavioral inhibition system in response to negative stimuli and events is found in both anxiety disorders and depression [4]. Also, depression is one of the most common disorders associated with anxiety disorders and OCD [5].

Personality aspects have been implicated in the development and continuation of psychiatric disorders. Some studies have examined the relevance of various personality theories for obsessive-compulsive disorders (OCD), generalized anxiety disorder (GAD), social anxiety disorder (SAD), and panic disorder (PD) [6]. For instance, according to Eysenck's arousal theory, introverts are prone to suffer from anxiety because they easily develop emotional responses; this makes the introverted neurotic prone to anxiety disorders [7]. Neuroticism has been related to negative emotions, namely anxiety, anger, and depression. Also, Cloninger's personality theory explained OCD and anxiety disorders; ambition and perfectionistic are correlated with anxiety disorders [8]. Each of the anxiety disorders is associated with certain personality traits. For example, SAD has been positively correlated with neuroticism and perfectionism [9,10]. GAD has been positively correlated with neuroticism and harm avoidance [11,12]. PD has been correlated with introversion and neuroticism [13]. In the present study, we assessed personality differences among OCD, GAD, PD, and SAD.

One of the theories that explain the differences and similarities of these disorders well is the Reinforcement Sensitivity Theory (RST) of personality. Consideration of theoretical concepts of RST draws new perspectives in the field of the psychopathology of anxiety disorders and OCD [7]. RST is a new neurological theory of personality developed by Jeffrey Gray [14,15]. Contrary to Eisenhower's three-dimensional theory, Gary proposed two basic motivational systems based on two personality dimensions: anxiety and impulsivity. This theory includes three emotional and neurological systems: Behavior Activation System (BAS), Behavior Inhibition System (BIS), and Fight-Flight System (FFS). Gray hypothesized that the dimensions of RST are controlled by distinct brain structures and respond to different environmental stimuli [4,16].

Differences between individuals reflect differences in BAS and BIS sensitivity. People with strong BAS are reward-sensitive, more likely to engage in high-risk behaviors, and exhibit more impulsive behaviors [17]. BAS is also responsible for controlling positive

emotions. Excessive activity of BAS leads to close and impulsive behavior. A person engages in behaviors that are likely to lead to rewards without paying much attention to the potential for negative consequences. BAS is controlled by the dopaminergic pathway as well as the limbic system and its components such as the amygdala. Despite this, people with strong BIS are more likely to be inhibited.

The activity of BIS leads to feelings of anxiety and fear, and the person notices signs that warn of danger. The BIS system is responsible for controlling negative emotions. High sensitivity to punishment is due to high BIS activity [17]. BIS is controlled by the hippocampal septum and the serotonergic pathway. Gary later added a third system to his theory, which was FFS. The FFS is based on the amygdala and hypothalamus. The amygdala has an inhibitory effect on the middle hypothalamus, and this part of the hypothalamus itself has an inhibitory effect on the final output between the brain [4]. While BIS responds to conditionally annoying stimuli, FFS responds to unconditionally annoying stimuli. whereas BIS responses are manifested through stopping, staring, listening, and preparing for activity, FFS responses appear in the form of unconditional defensive aggression or avoidant behavior [17].

RST was revised in 2000 by Gary and McNaughton (r-RST) [18]. The main revision of the foundation theory is at the psychological and conceptual levels, still involving three fixed systems but activated by different stimuli. r-BAS is responsible for responding to stimuli, both conditional and unconditional. Fight-Flight-Freeze System (FFFS) mediates the response to all annoying stimuli, both conditional and unconditional, while in the RST, the BIS was responsible for responding to (conditional) punishment. FFFS, like the previous version of the theory, is responsible not only for the fight-or-flight response but also for the freeze response to the inevitable threatening stimulus. r-BIS is responsible for resolving target conflict and resolves conflicts by changing the stimulus attraction rather than behavioral resolution (distance or proximity to one of the stimuli). Both r-BAS and FFFS will be activated when the situation includes both threat and reward situations [4]. According to Eysenck's theory, neurotic people experience negative emotions (fight-or-flight) [7]. Regarding anxiety, Gray and McNaughton (2000) proposed that individual differences in reactivity of the BIS not only underlie the normal personality dimension of trait anxiety/neuroticism but also underlies vulnerability to the anxiety disorders [18]. The BIS generates anxiety, comprising the

engagement of risk assessment processes and the inhibition of conflicting behaviors. High levels of BIS led to the risk of aversions like anxiety disorders as well as OCD that increases under conditions of conflict and create pain or the threat of death [7]. BIS is also one of the indicators of SAD [19]. Furthermore, harm avoidance and self-directedness are closely associated with SAD [20]. PD is also correlated with specific personality traits. For instance, PD has been correlated with introversion and neuroticism [13].

Some studies have shown that extraversion and conscientiousness are higher in patients with OCD than in normal individuals. Patients with neuroticism and its four subscales of anxiety, depression, shyness, and vulnerability also score higher than the general population [21]. To date, no research has examined r-RST in OCD patients. In this study, we not only examined OCD patients for r-RST, but also compared them with anxiety disorders (GAD, SAD, and PD). The present study aimed to address this issue by assessing the behavioral systems of r-RST, i.e., BIS, BAS, fight, flight, and freeze among four populations. The results may help us under-

stand better the personality-related psychopathology underlying OCD as well as anxiety disorders.

Methods

Participants

Participants included 235 out-patients, of these, 54 met the DSM-5 criteria for OCD, 65 for GAD, 72 for SAD, and 44 for PD. The highest comorbidity was belonged to GAD (64.82%). Further, 82 healthy controls were recruited and matched on education and age because these two items might affect test results. The clinical cohort was recruited from three sites: The Psychiatric Institute of Mental Health (Kermanshah, Iran), The Special Clinic for Clinical Psychology Researches (Kashan, Iran), and The Clinical Psychology and Psychotherapy Clinic (Isfahan, Iran). The control group was recruited from healthy individuals on the basis of the absence of current axis I disorders of DSM-5 and confirmed by mental assessment. The demographic and clinical characteristics of the groups are shown in table 1.

Characteristics	OCD (N = 54)	GAD (N = 65)	SAD (N = 72)	PD (N = 44)	HC (N = 82)
Average age (years)	27.02 (4.58)	28.34 (3.45)	29.14 (4.12)	28.52 (3.04)	28.30 (4.18)
Gender (M/F)	20/34	21/44	41/31	17/27	35/47
Years of education	10.15 (2.42)	10.87 (2.01)	11.23 (2.14)	10.42 (2.08)	11.48 (3.22)
First diagnostic age (years)	22.45 (3.94)	23.64 (3.06)	21.12 (4.37)	22.10 (2.32)	
Number of hospitalizations	0.23 (0.04)	0.43 (0.11)	0.09 (0.23)	1.08 (0.84)	
Comorbidity	%32.48	%44.82	%26.62	%29.35	

Table 1:

Demographic and clinical characteristics of subjects.

Procedure

Ethical approval for this study was obtained. Participants were given information about the study and provided informed consent. Then, participants completed demographic information and several questionnaires in Persian. Furthermore, patient inclusion criteria were the presence of OCD, GAD, SAD, and PD, and an educational level higher than eighth grade – to understand personality questionnaires. The only exclusion criteria for the clinical groups was a current psychotic episode. Patients' r-RST scores were com-

pared with 82 matched healthy controls selected basis on the absence of current axis I disorders of DSM-5 and confirmed by mental assessment. Data were collected between February 2021 and January 2022.

Measures

Structured clinical interview for DSM-IV Axis I disorders (SCID-I)

The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) comprises 24 items evaluating symptomology for Axis I

disorders [22,23]. Diagnostic agreements between test and retest SCID-I administration were good for most diagnostic categories in the Iranian population. Overall weighted kappa was 0.55 for lifetime diagnoses and 0.52 for current diagnoses. Moreover, specificity values for most psychiatric disorders were high (> 0.85) [3,24].

Jackson-5 questionnaire

The 30-item questionnaire consists of five subscales: Behavioral Activation System (BAS), Behavioral Inhibition System (BIS), Fight, Flight, and Freeze system. Response is based on a 5-point Likert scale (1 = 'always' and 5 = 'never'). The Cronbach's alpha was reported to be: r -BAS = 0.81; r -BIS = 0.88; Fight = 0.74; Flight = 0.72; and Freeze = 0.77 in an Iranian society. The questionnaire showed acceptable reliability in the present study for all five subscales (Cronbach's α .68 to .87) [25,26].

Yale-brown scale(Y-BOCS)

This 10-item scale was developed by Goodman, *et al.* (1989), 5 items focus on obsessions and 5 others on compulsion. Each obsession and compulsion is estimated in five dimensions: confusion, frequency, interference, resistance, and symptom control. The highest score is 40 [27]. The reliability among the interviewers ($r = 0.98$), its internal consistency coefficient ($r = 0.89$), and its reliability coefficient by retesting method at two-week intervals ($r = 0.89$) have been reported in an Iranian community. Furthermore, its diagnostic validity was obtained with Beck Depression Inventory and Hamilton Anxiety Rating Scale ($r = 0.64$ and $r = 0.59$, respectively) [28]. In a healthy Persian population, Cronbach's alpha was reported 0.95, Validity of two halves was 0.89, and retest validity was 0.99 [29].

Generalized anxiety disorder questionnaire (GAD-7)

This 7-items questionnaire was developed by Spitzer, *et al.* (2006), each of which addresses the psychological problems in the past two weeks. Scores range from zero to 21. Furthermore, Spitzer, *et al.* (2006) reported the Cronbach's alpha coefficient and the retest coefficient of this scale of 0.92 and 0.83, respectively. The correlation coefficient of the anxiety scale with Beck anxiety inventory was 0.77 and 0.74 with the psychological checklist of 90 questions. The Cronbach's alpha coefficient was 0.85 in the present study, indicating the reliability of this scale [30,31].

Social phobia questionnaire (SPIN)

The self-assessment and 17-items questionnaire measures social phobia, including three levels of avoidance, fear, and physiological discomfort. Each item is scored on a Likert scale (from 0 to 5). In an Iranian community, Cronbach's alpha for the first half of the measure was 0/82, the second half of the measure was 0/76, and ultimately, the correlation of these two was 0/84. In an Iranian community, Cronbach's alpha for avoidance, fear, and physiological discomfort subscales respectively were 0/75, 0/74, and 0/75 [32].

Panic and Agoraphobia Scale (P and A)

The 13-item questionnaire is scored on a 0-4-point Likert scale, comprising five subscales: (1) Panic Attacks, (2) Agoraphobia, (3) Anticipatory Anxiety, (4) Disability, and (5) Worries about Health. Some studies showed satisfactory values for internal consistency (Cronbach's α), test-retest reliability, inter-rater reliability, internal validity, and correlation with other anxiety scales. The external validity of the scale was indicated significant [33].

Data analyses

SPSS 21 was exerted to determine basic statistics for all variables of interest and to perform the Kolmogorov-Smirnov, Chi-squared analyses, the independent t-tests, and MANCOVA to compare demographics and clinical variables in five groups. A MANCOVA, as well as Chi-squared analyses, were used to assess group equivalency at baseline.

Results

Descriptive statistics

The number of women was higher than men in OCD, GAD, PD, and, HC groups, whereas it was higher for men in the SAD group. However, this difference was not statistically significant. The level of education of the HC group and the mean age of the SAD group was higher than the other groups. The age of the first diagnostic was lower in the SAD group. The mean of hospitalization was significantly higher for the PD group. Additionally, comorbidity with other disorders was substantially higher for the GAD group.

r-RST results

The results of MANCOVA showed a significant difference between-group differences on Jackson-5 scales ($F = 23.18$; $p = 0.001$). The mean score of GAD in r -BAS was higher than the other abnor-

mal groups but lower than healthy control. The mean score of r-BIS was higher for the OCD group, but the lowest mean score of r-BIS belonged to the PD group.

In addition, the PD group experienced the highest Fight as well as Flight mean score. However, the lowest mean score of Fight and

Flight was belonged to GAD and OCD, respectively. Also, the GAD group experienced the highest mean score of Freeze. And finally, results indicated the lowest score of Freeze of PD (Table 2). The greatest effect size was for r-BAS, whereas the effect size of the groups for Flight and Freeze was lower than the other scales.

Variables	OCD(N = 54)		GAD(N = 65)		SAD(N = 72)		PD(N = 44)		HC(N = 82)		P	η ²	Games-Howell
	M	SD	M	SD	M	SD	M	SD	M	SD			
r-BAS	20.84	3.18	21.22	4.03	20.17	4.07	19.24	2.56	21.92	3.62	0.001	0.356	***HC > GAD > OCD > SAD > PD
r-BIS	23.52	3.48	22.46	3.28	22.08	3.44	18.88	2.07	19.04	3.74	0.001	0.246	**OCD > GAD > SAD > HC > PD
Fight	22.22	4.74	17.44	3.08	18.27	3.27	24.46	2.84	18.34	3.60	0.003	0.232	***PD > OCD > HC > SAD > GAD
Flight	11.28	3.84	19.48	3.14	19.14	3.38	22.24	2.18	14.05	3.75	0.001	0.042	**PD > GAD > SAD > HC > OCD
Freeze	14.68	3.54	17.87	3.78	15.24	3.42	14.28	2.26	14.89	3.33	0.002	0.074	*GAD > SAD > HC > OCD > PD

Table 2

* Tend to significance ** P < 0.05 *** P < 0.01.

Discussion and Conclusion

The present study aimed to examine and compare the reinforcement sensitivity theory of personality in OCD and anxiety disorders (GAD, SAD, and PD) for the first time. Research evidence shows that the natural tendencies of the behavioral inhibition system and the behavioral activation system, which manifest themselves as emotional styles, are important risk factors for emotional disorders. The abnormal sensitivity of these systems indicates readiness and susceptibility to various forms of psychopathology; In a way, the behavioral activation system and the behavioral inhibition system can explain a wide range of disorders. The personality tests of diagnosed OCD were compared against healthy controls to show the difference between OCD patients and healthy people in the brain systems of the personality. In fact, higher or lower scores were determined according to the score of healthy controls.

The results showed that the mean score of GAD in r-BAS was higher than the other abnormal groups but lower than the healthy control. A high BAS indicates higher levels of extraversion-impulsivity and a tendency to reward and avoid punishment. In his theory, Gary states that the BAS or reward sensitivity is psychologically related to impulsivity. Explaining this finding, we can explain that GAD patients prefer immediate reward to long-term reward. This means that GAD patients need shorter-range amplifiers than normal people. Therefore, these people cannot regulate their behaviors. This finding is consistent with previous findings regarding the presence of emotional dysregulation in GAD patients [34]. Behavior inhibition represents sensitivity to aversive stimuli. Also, Behavior inhibition can prohibit patients from trying activities and interaction in social interactions. It makes them prone to desire to escape from relationships [35]. The finding in the present study

likely is related to the construct validity of r-BIS in Jackson-5; GAD patients are more tendencies to social comparison due to their symptoms [1].

The findings showed that the highest mean score of r-BIS belonged to the OCD group. Avoidance in the BIS unlike avoidance in the BAS is passive and causes behaviors to stop and restrain. According to RST, high sensitivity to punishment is associated with anxiety. Thus, in case of punishment or elimination of pleasurable stimuli, the organism becomes anxious and leads to passive withdrawal, causing the person to stop non-rewarding behaviors [36]; Hence, sensitivity to punishment leads to inactivity, behavioral inhibition, and withdrawal, and indicates problems with emotional self-regulation, arousal, tinnitus, and mental confusion, which are also present in OCD.

In addition, studies have shown that the BIS is correlated with disgust. Researchers believe that the feeling of disgust along with the high BIS score may be considered a warning sign of punishment. In other words, disgust is considered a negative and annoying event that the BIS uses to respond and regulate future behaviors and motivations. The interaction of the BIS and disgust in the formation of OCD can be interpreted as an attempt to eliminate the feeling, which on the one hand is the result of a disorder and on the other hand, arises from the inability to inhibit or suppress the initial process. If one considers the interactive effect of the BIS and disgust on OCD, complex effects become apparent, in which case disgust mediates an important part of the relationship between the BIS and OCD [37]. In the process chain leading to the symptoms of OCD, the BIS seems to take precedence over disgust. Then, the BIS integrates the inputs received from disgust, which ultimately leads to direct behavior or motivational behavior. Following that, large amounts of BIS and their association with disgusting warnings form OCD, especially obsessive symptoms. Furthermore, behavioral inhibition is one of the important factors in the psychopathology and treatment of OCD [37]. behavioral inhibition has direct implications for understanding the nature of emotional disorders since it has a substantial correlation with negative emotional [38].

The results also showed that the PD group experienced the highest Fight as well as Flight mean score. However, the lowest mean score of Fight and Flight was belonged to GAD and OCD, respectively. Also, the GAD group experienced the highest mean score of

Freeze. And finally, results indicated the lowest score of Freeze for the PD group. The defensive fight is an alternative adaptive reaction against danger, which happens when the flight is not possible, but this strategy is associated with rage rather than PD. PD is also responsible for vigorous flight reactions evoked by very close danger like proximal danger [39]. Moreover, PD is manifesting itself primarily as flight behavior [40]. The freezing behavior occurs in the cases in which the actual threat stimuli are unavoidable while the avoidable ones induce anger-related fight or fear-related flight [7]. Increased freezing in GAD in the present study is in line with previous investigations of the high prevalence of depression in this disorder [1]. FFFS in r-RST is associated with anxiety, depression, restrictive anorexia nervosa, schizophrenia, and cluster C personality disorders [41].

The results of the present study are of value for future research which has the aim of (1) examining RST in mental disorders; (2) grasping the role of personality vulnerabilities in mental health; and (3) using the findings to improve treatment of OCD as well as anxiety disorders. Such research will throw new light onto the etiology and development of the continuation of common psychiatric disorders.

Finally, our results have some implications. In diagnosis, Jackson's 5 scales can be applied to differentiate anxiety disorders. In psychotherapy, behavioral inhibition treatment is appropriate to improve mental disorders as a recent study has shown [42-44]. It inhibits behaviors that increase connection with environmental contingency reinforcements. Indeed, emotion regulation-focused psychotherapies such as dialectical behavior therapy possibly are more appropriate for anxiety disorders that had higher r-BAS and r-BIS sensitivity.

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