



Investigation of Behavioral Inhibition System, Behavioral Activation System, and Personality Factors in Type 2 Diabetic Patients Compared to Healthy Individuals

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ARTICLE INFO	ABSTRACT
<p>Article History: Received 15 January 2020 Received in revised form 2 April 2020 Accepted 4 June 2020 Available online 12 June 2020</p>	<p>Objective: One of the significant topics that has attracted researchers in the field of health psychology is the examination of personality factors in individuals with diabetes. In this regard, the present study aims to compare the behavioral control/activation systems and personality factors in patients with type 2 diabetes and healthy individuals.</p> <p>Methods: This research is a comparative descriptive study. The statistical population consisted of all diabetic patients referring to the Diabetes Education Center at Imam Khomeini Hospital in Tehran in the year 2017, where 40 diabetic patients were compared with 40 healthy individuals. The behavioral control/activation systems data were collected using the NEO Personality Inventory questionnaire.</p> <p>Results: The psychological distress scores in diabetic individuals were higher than those in non-diabetic individuals. The behavioral control system in diabetic patients was significantly higher than in healthy individuals, but the sensitivity of the behavioral activation system in diabetic individuals was lower. Psychological distress played a facilitating role in the behavioral activation system, and the high sensitivity of the behavioral inhibition system.</p> <p>Conclusion: Psychological distress is associated with the occurrence of diabetes, and based on these characteristics, the occurrence or non-occurrence of diabetes can be relatively predicted alongside other influential factors.</p>
<p>Keywords: Personality Factors, Diabetes, Behavioral Activation System, Behavioral Control System.</p>	

1. INTRODUCTION

Diabetes is the most prevalent metabolic disorder, characterized by elevated blood glucose levels and impaired metabolism of carbohydrates, fats, and proteins, resulting in defects in insulin secretion and/or function [1]. This disease has drawn significant attention from healthcare systems due to multiple factors, including its high prevalence, associated complications such as blindness, lower-limb amputation, neurological and cardiovascular

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problems, disease-related mortality, and substantial healthcare costs [2]. Type 2 diabetes, as one of the primary forms of the disease, accounts for approximately 90–95% of all diabetes cases [3].

Due to its severe long-term complications, diabetes has increasingly attracted global attention, exhibiting widespread prevalence worldwide with no signs of decline [4]. Currently, more than 400 million individuals are living with diabetes globally, and this number is projected to exceed 640 million by 2035 [5]. Similarly, in Iran, approximately 11% of the population over the age of 25 suffers from diabetes, with the majority affected by type 2 diabetes rather than type 1 [6]. Among these statistics, 10% are men and 11.5% are women [6]. Such high prevalence has increasingly drawn the focus of healthcare professionals and health psychologists toward the disease [7].

Evidence suggests that individuals exhibit unique behavioral and emotional responses to stressful events based on their personality traits and structures [8]. The manner in which these emotions are expressed during stressful encounters not only influences susceptibility to mental health disorders but also affects the onset and progression of physical illnesses [9]. Over the past decades, the psychological aspects of diabetes have garnered considerable attention from researchers [10]. Ample evidence indicates that personality dimensions, particularly introversion–extraversion and neuroticism, serve as predictors of health outcomes [11]. Research has shown that neuroticism is positively associated with negative affect, whereas extraversion is linked with positive affect [12]. Indeed, alterations in psychological factors can influence immune function and increase the risk of infectious diseases, allergies, cancer, diabetes, and even mortality [13].

According to Eysenck’s theory, human personality comprises three major temperamental dimensions (the three-factor personality model): extraversion, neuroticism, and psychoticism [14]. Among personality traits, neuroticism—particularly its components of anxiety, depression, anger, and hostility—has been shown to predict glucose levels in patients with type 2 diabetes [15–16]. In a study by Gordon, Fisher, and Wilson (2003), extraversion was positively associated with blood glucose levels.

Gray, offering a different perspective from Eysenck, proposed three distinct behavioral brain systems based on differential reward and punishment mechanisms in the brain and individual differences in sensitivity to various stimuli. These systems provide a foundation for understanding personality differences [17]. According to this theory, the three brain systems that regulate behavior and emotions are the Behavioral Approach System (BAS), the Behavioral Inhibition System (BIS), and the Fight–Flight–Freeze System (FFFS). Although these systems operate independently, they interact with one another [18].

Lee and Gomez (2014), examining the relationship between these behavioral brain systems, stress, and social interaction, found that both forms of stress were positively associated with sensitivity to punishment and the BIS but negatively correlated with the BAS [19]. Warr et al. (2010) confirmed that clinical stress is associated with heightened activity in the BAS [20]. In their study, BIS scores were higher in individuals experiencing stress compared to those without stress. In addition, Kanis, Radmarker, and Geejues (2013) demonstrated that BAS is positively related to reward dependence in Cloninger’s model. BAS correlates with positive affect, whereas psychoticism and BAS are associated with negative emotions, and FFFS is closely linked to negative emotional states [21]. Overlaps have also been observed between BIS and FFFS, with BIS mediating passive avoidance, leading to feelings of worry, guilt, and inhibition of responses.

Given the high prevalence of type 2 diabetes and the evidence above, the present study investigates the behavioral inhibition system, behavioral activation system, and personality traits in patients with type 2 diabetes compared to healthy individuals.

2. METHOD:

The present study is a descriptive–comparative research. The statistical population included all patients with type 2 diabetes referred to the Diabetes Education Center at Imam Khomeini Hospital, Tehran, in 2017. Inclusion criteria were: absence of any comorbid medical conditions, at least one year since diagnosis, and an age around 30 years, reflecting the prevalence of type 2 diabetes in middle adulthood. From this population, 40 participants were selected using Cochran’s formula.

2.1. Instruments

NEO Five-Factor Inventory (NEO-FFI): The NEO Personality Inventory is a widely recognized psychological instrument for assessing personality factors, either alone or in combination with other variables. Originally developed by Costa and McCrae in 1985, the NEO-PI consisted of 181 items measuring the five major personality dimensions. Following revisions, the 1992 version included 240 items covering five broad factors, each with six facets. Due to the complexity and length of the full NEO-PI-R, as well as the need for rapid screening in clinical and research settings, the short form, NEO-FFI, was developed. The NEO-FFI contains 60 items, with 12 items per factor selected for their highest factor loadings. Responses are scored on a 5-point Likert scale (strongly disagree to strongly agree), assessing five major dimensions:

Neuroticism (N): Tendency to experience anxiety, tension, sympathy, hostility, impulsivity, depression, and low self-esteem.

Extraversion (E): Inclination toward positivity, assertiveness, and high energy.

Openness (O): Curiosity, appreciation of art, creativity, flexibility, and intellectual engagement.

Agreeableness (A): Compassion, kindness, generosity, empathy, cooperativeness, altruism, and trust.

Conscientiousness (C): Organization, efficiency, reliability, self-discipline, goal orientation, rationality, and calmness.

Gray–Wilson Personality Scale: This instrument assesses the activity of behavioral brain systems and their components, developed by Wilson, Bart, and Gray. The questionnaire comprises 120 items, with 40 items dedicated to each system: BIS, BAS, and FFFS. For BIS, 20 items measure passive avoidance and 20 measure suppression. For BAS, 20 items assess approach behavior and 20 assess active avoidance. For FFFS, 20 items measure fight and 20 measure flight components.

3. RESULTS

The results presented in Table 1 indicate that the significance levels for all variables exceeded 0.05. According to the Kolmogorov–Smirnov test, if the significance level is less than 0.05, the test is considered significant and nonparametric methods should be applied. In this study, since all significance levels were greater than 0.05, it can be concluded that the distributions of the study variables are normal or approximately normal, allowing the use of parametric tests.

Table 1. Kolmogorov–Smirnov Test for Normality of Variables

Variable	Statistic	Significance (p)
Behavioral Activation System (BAS)	1.32	0.062
Behavioral Inhibition System (BIS)	1.31	0.065
Fight–Flight System (FFS)	1.15	0.141
Neuropsychological (Brain–Behavioral) Activities	1.20	0.114
Neuroticism	1.28	0.074
Extraversion	1.29	0.070
Openness	1.26	0.084
Agreeableness	1.30	0.069
Conscientiousness	1.26	0.084
Five-Factor Personality	1.27	0.079

Table 2 presents the means and standard deviations of personality traits and behavioral activation/inhibition system scores for diabetic and healthy participants. As shown, differences exist between the two groups in both personality traits and behavioral system activity.

Table 2. Means and Standard Deviations of Behavioral Activation/Inhibition Systems and Personality Traits in Diabetic and Healthy Groups

Dimension	Group	Mean	SD
N (Neuroticism)	Healthy	10.44	2.54
	Diabetic	13.42	3.70
E (Extraversion)	Healthy	14.41	2.78
	Diabetic	11.45	2.98
BIS	Healthy	13.22	4.73
	Diabetic	20.20	2.61
BAS	Healthy	33.95	4.45
	Diabetic	27.35	4.72
D (Drive)	Healthy	11.37	2.12
	Diabetic	8.67	2.71
F (Fun Seeking)	Healthy	10.80	2.72
	Diabetic	9.250	3.80
R (Reward Responsiveness)	Healthy	11.93	2.29
	Diabetic	9.47	2.21

To compare personality traits and behavioral system activity between diabetic and healthy groups, multivariate analysis of variance (MANOVA) was employed. Assumptions of the analysis, including homogeneity of variance, were evaluated using Wilks’ Lambda. Results indicated that significant differences existed between the two groups in at least one variable, supporting the reliability of subsequent analyses. Table 3 presents the MANOVA results.

Table 3. MANOVA Results for Behavioral Activation/Inhibition Systems and Personality Traits in Diabetic and Non-Diabetic Groups

Dimension	Sum of Squares	df	Mean Square	F	p	Effect Size (η^2)
N (Neuroticism)	182.015	1	182.015	39.60	0.001	0.337
E (Extraversion)	171.112	1	171.112	29.17	0.001	0.274
BIS	973.014	1	973.014	66.49	0.001	0.460
BAS	872.300	1	872.300	41.30	0.001	0.346
D (Drive)	146.760	1	146.760	39.95	0.001	0.334
F (Fun Seeking)	48.600	1	48.600	8.96	0.001	0.103
R (Reward Responsiveness)	123.512	1	123.512	23.96	0.064	0.230

The results indicate significant differences between diabetic and non-diabetic groups in the behavioral inhibition and activation systems, as well as in the subcomponents of Drive and Fun Seeking. Additionally, significant differences were observed in the personality traits of neuroticism and extraversion.

4. DISCUSSION

The present study aimed to comparatively examine behavioral inhibition/activation systems and personality traits in patients with type 2 diabetes and healthy non-diabetic individuals. The results indicate a significant difference between the two groups in the personality dimension of neuroticism, with diabetic patients exhibiting higher levels. This finding may be attributed to the chronic stressors and daily psychological pressures associated with living with diabetes.

A significant difference was also observed in extraversion, with diabetic individuals scoring lower. This may reflect a lifestyle shaped by the disease, leading to social withdrawal, isolation, and reduced interpersonal interactions [22]. Emotional responses to stress can trigger the release of hormones that adversely affect fat and glucose metabolism, ultimately impairing immune function.

Furthermore, the study revealed that diabetic patients exhibited higher activity in the behavioral inhibition system (BIS) and lower activity in the behavioral activation system (BAS) compared to healthy individuals. In other words, diabetic patients possess a strong BIS and a weak BAS. This finding aligns with those of Corr and Gray (2002), who reported that the BIS is associated with neuroticism and negative affect, while the BAS is linked to extraversion and positive affect [23].

The differential functioning of this behavioral brain systems in diabetic individuals may alter optimal immune system performance, thereby increasing disease susceptibility. Specifically, individuals with heightened BIS activity experience greater anxiety and distress. They are not only more susceptible to negative stressors but also less effective at coping with stress. Repeated exposure to stress can disrupt hypothalamic regulatory mechanisms and hormone feedback, leading to functional changes at cellular, organ, and systemic levels, ultimately contributing to various diseases. Diabetes can represent both a consequence and a component of the chronic stress cycle associated with the disease.

Research by Pourmohammadzadeh Tajrishi and Mirzamani Bafghi (2007) similarly found that strong BIS activity and weak BAS activity are associated with depression [24]. Numerous studies have reported elevated levels of depression among diabetic patients [25–28], suggesting that depression in these patients is not merely a consequence of chronic illness but may also be influenced by behavioral brain system activity, which affects immune function and contributes to disease susceptibility.

In the present study, diabetic patients scored lower on BAS subscales, including Fun Seeking and Drive (D), as well as Reward Responsiveness. This indicates heightened sensitivity to situations perceived as threatening or potentially punitive, and reduced responsiveness to rewarding stimuli. In other words, diabetic patients are more sensitive to both reward and punishment cues. This may reflect a decreased orientation toward reward-related activities and reduced hopefulness due to the psychological and social challenges associated with chronic illness, often manifested as depression and anxiety.

5. CONCLUSION

Overall, the findings of this study not only help identify and clarify the factors involved in the onset of type 2 diabetes but also emphasize the importance of understanding individual differences in sensitivity to psychological constructs and stress vulnerability. Such understanding can inform the design of innovative therapeutic strategies for diabetes management. Future research is recommended to compare diabetic and healthy groups across additional psychological and behavioral variables. Additionally, developing targeted intervention and educational programs aimed at improving quality of life for diabetic patients is strongly advised.

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Transparency Statement

The data supporting this study are available upon reasonable request to the corresponding author, subject to ethical and confidentiality considerations.

Declaration of Interest

The authors declare that they have no competing interests.

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