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# Investigating Behavioral Control System, Behavioral Activation System, and Personality Factors in Type 2 Diabetic Patients and Healthy People

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***ABSTRACT***

*Objective: One of the important issues that has occupied the minds of researchers in the field of health psychology is the study of personality traits of people with diabetes. In this regard, the present research compared the behavioral control / activation systems and personality factors in patients with type 2 diabetes and healthy individuals. Materials and Methods: The present research was a comparative descriptive study. The statistical population consisted of all diabetic patients referred to the Diabetes Training Center at Imam Khomeini Hospital in Tehran (2017), in which 40 diabetic patients were compared with 40 healthy individuals. The scale of information behavior control / activation systems was collected through the NEO personality questionnaire. Results: The neuroticism score was higher in diabetics than in non-diabetics. Behavioral control systems in diabetic patients were significantly higher than in healthy individuals, but the sensitivity of the behavioral activation system was lower in diabetics. Neuroticism played a facilitating role in the behavioral activation system and the high sensitivity of the behavioral inhibition system. Conclusion: neuroticism is associated with the incidence of diabetes and therefore based on these characteristics, the occurrence and non-occurrence of diabetes can be predicted relatively along with other effective factors.*

***Keywords:*** *personality factors, diabetes, behavioral activation system, behavioral Control system*

## I. INTRODUCTION

Diabetes is the most common metabolic disease, characterized by high blood sugar, impaired carbohydrate, fat, and protein metabolism, resulting in impaired insulin secretion or insulin function (World Health Organization (WHO), 2015). The disease has attracted the attention of healthcare systems for a variety of reasons, including the prevalence of the disease, the rate of complications, such as blindness, amputation, neurological and cardiovascular problems, morbidity and mortality. Type 2 diabetes accounts for 90 to 95 percent of all types of diabetes [1]. Due to the late and dangerous complications, diabetes has attracted more and more attention; it has a widespread dispersion throughout the world, and there is currently no sign of stopping it [2].

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There are currently more than 400 million diabetics in the world, which is predicted to reach more than 640 million by 2035. In Iran, 11% of the population over the age of 25 have diabetes, with the number of people with type 2 diabetes being much more significant than those with type 1 diabetes. Its 10 percent constitute men and 11.5 percent women. These high statistics have attracted the attention of health professionals and psychologists to this disease more than before. Evidence has shown that each individual exhibits specific behaviors and emotions when faced with stressful events, depending on their personality traits and personality structure. How these emotions are triggered when faced with stressful events not only paves the way for mental illness, but also affects the course of physical diseases [3]. Over the past decades, the psychological aspects of diabetes have attracted the attention of many experts. There is ample evidence that the personality dimensions of introversion-extroversion and neuroticism predict health [4]. Researches have shown that neuroticism is directly related to negative mood and extroversion is directly related to positive mood. In fact, changing psychological factors by altering the immune system increases the risk of infectious diseases, allergies, cancer, diabetes, and even death [5].

According to Eysenck's theory, human personality has three important temperament factors (three factors of personality), extroversion, neuroticism and mental psychoticism [6]. Among personality traits, psychoticism, especially the traits of anxiety, depression, anger, and hostility, predict glucose levels in patients with type 2 diabetes [7, 8]. In the study of Gordon, Fisher, and Wilson [9], the personality trait of extroversion was positively related to blood glucose. With a different view of Eysenck's theory, Gary describes three distinct behavioral brain systems according to different mechanisms of reward and punishment in the brain and the problem of individual differences in sensitivity to different stimuli that underlie personality differences. According to this theory, the three brain systems that control behaviors and emotions are the behavioral approach system (BAS), the behavioral inhibition system (BIS), and the Fight-Flight-Freeze System (FFFS). These systems interact with each other despite being independent [10].

Ly & Gomez [11] examined the relationship between behavioral brain systems and stress of observation and social interaction and showed that both forms of stress are positively related to sensitivity to punishment and behavioral inhibition system but negatively related to behavioral activation system. The results of a study done by Vervoort et al. [12] confirmed the hypothesis that clinical stress is associated with high activity of the behavioral activating system. In this study, the scores of the behavioral inhibition system of the group with stress were higher than the stress-free group. Kennis, Rademaker & Geuze [13] showed in their research that BAS is positively related to reward dependence in the Cloninger model. BAS is associated with positive emotions. BAS is associated with negative emotions and feelings in psychosis. FFFS is closely related to negative emotions. Coexistence was found between BIS and FFFS. BIS is responsible for inactive avoidance, so the control system may cause anxiety, guilt, and controlling response. According to the background and high prevalence of type 2 diabetes, this article examined the behavioral control system, behavioral activation system and personality factors in patients with type 2 diabetes compared to healthy people.

## II. Methods

The present research is a descriptive-comparative study. The statistical population of the present research consisted of all patients with type 2 diabetes who referred to the Diabetes Training Center at Imam Khomeini Hospital in Tehran (2017). The inclusion criteria were that people with diabetes had no other disease, at least one year had passed since their diagnosis, and that they were 30 years old and middle-aged due to the prevalence of type 2 diabetes. We selected 40 people from among the statistical population using Cochran's formula. The research tools were**:**

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Five Factors of Personality Questionnaire: The Neo Personality Questionnaire has been considered in international research; it is one of the important psychological tools used for researches whose purpose is to study personality factors alone or in combination with other variables. Historically, the tool was first developed by Costa and McCray in 1985 and included 181 items to investigate five major personality factors. After several developments in 1992, a revised version of the Neo Personality Questionnaire was prepared and published. It consisted of 240 expression, providing a general measurement of the five major factors, each of which includes six dimensions, that is, elements of the trait that converge to describe the whole. NEO-PI-R is complex and long; it has small and multiple dimensions in each of the five major personality traits and needs for rapid sifting when necessary; most importantly due to the reluctance of subjects to respond to a long tool in Clinical and research situations, a short version of NEO-PI-R was designed as a five-factor questionnaire (NEO-FFI) 1. The questionnaire consists of 60 items obtained based on a factor analysis of the NEP-PI scores that were conducted in 1986. In this questionnaire, there are 12 items for each factor, and these items have been selected according to having the highest number of factor loads related to the desired trait. It is possible to respond to these items in the form of a 5-point Likert scale (I disagree completely, I disagree, it is indifferent for me, I agree, I agree fully). We can consider five major dimensions in this questionnaire. Nervousness (N) indicates a person's tendency to experience anxiety, stress, pity, hostility, stress, depression, and low self-esteem. While extroversion (E) refers to a person's desire to be positive, bold, energetic. Openness (O) refers to a person's desire for curiosity, love of art, artistry, flexibility, and rationality, while acceptance (A) refers to a person's desire for forgiveness, kindness, generosity, empathy, altruism and trust. Finally, conscientiousness (C) shows a person's tendency to be orderly, efficient, trustworthy and self-regulated, self-disciplined, progressive, rational, and calm.

Gary-Wilson's Personality Scale: Wilson, Bart, and Gary designed this scale, which assesses the activity of behavioral brain systems and their components. The questionnaire consists of 120 items; 40 items are considered to evaluate the activities of each of the behavioral inhibition system, behavioral activation system and fight and flight. Of the 40 items related to the behavioral inhibition system, 20 items are dedicated to the passive avoidance component and 20 items are related to the silence component. Of the 40 items related to Behavioral Activation System, 20 items are for the Approach component and 20 items are for the Active Avoidance Component. Of the 40 items on the fight / flight system, 20 are dedicated to the fight component and 20 to the flight component**.**

## III. Findings

In this table, the results showed that the significance level obtained for all variables is greater than 0.05. In the Kolmogorov-Smirnov test, if the significance level is less than 5%, it means that the test is significant and we should use non-parametric tests. In this table, considering that the significance level is greater than 0.05, we can state that the distribution of research variables is normal or close to normal and parametric tests can be used**.**

**Table 1**. Kolmogorov-Smirnov test values to assess the normality of variables

| Variable | Statistic | Significance level |
|---|---|---|
| Behavioral Activation System (BAS) | 1/32 | ***./062*** |

| | | |
|---|---|---|
| Behavioral Inhibition System (BIS) | 1/31 | ***./065*** |
| Fight-flight system (FFS) | 1/15 | ***./141*** |
| Neuropsychological (cerebral-behavioral) activities | 1/20 | ***./114*** |
| Neuroticism | 1/28 | ***./074*** |
| Extroversion | 1/29 | ***./070*** |
| Accepting experience | 1/26 | ***./084*** |
| Agreement | 1/30 | ***./069*** |
| Conscientiousness | 1/26 | ***./084*** |
| Five factors of personality | 1/27 | ***./079*** |

Table 2 compares the mean and standard deviation of personality traits scores and behavioral inhibition / activation systems in the two groups of diabetics and healthy individuals. According to this table, there is a difference between diabetic and healthy individuals in personality traits and behavioral activation and inhibition systems**.**

**Table 2**. Average and standard deviation of groups' scores in the behavioral activation and inhibition system and personality traits

| Dimensions | Groups | Mean | Standard deviation |
|---|---|---|---|
| N (neuroticism) | Healthy | 10/44 | 2/54 |
| | Diabetic | 13/42 | 3/70 |
| E (extroversion-introversion) | 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 | 4/54 |
| | Diabetic | 27/35 | 4/74 |
| D (drive) | Healthy | 11/37 | 2/12 |

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| | | | |
|---|---|---|---|
| F (Fun-seeking) | Diabetic | 8/67 | 2/71 |
| | Healthy | 10/80 | 2/72 |
| R (responding to reward) | Diabetic | 9/250 | 3/80 |
| | Healthy | 11/93 | 2/29 |
| | Diabetic | 9/47 | 2/21 |

Multivariate analysis of variance was used to compare personality traits and behavioral activation and inhibition systems in two groups of diabetic patients and healthy individuals. For this purpose, first, using Wilkes' lambda test, we examined the assumptions of the above statistical method and determining the homogeneity of variances through significance test of group effect on research variables. The results of the Wilkes Lambda test showed that there was at least one significant difference between the two groups in one of the variables. The findings show the reliability of subsequent results. Based on the results of the mentioned tests, we examined the analysis related to the effects between the subjects. We listed the data for this analysis in Table 3**.**

**Table 3**. Results of multivariate analysis of variance in behavioral inhibition and activation systems and personality traits among diabetic and non-diabetic groups

| Dimension | Total squares | df | Mean squares | F | P | Coefficient of effects (eta) |
|---|---|---|---|---|---|---|
| N (neuroticism) | 182/015 | ***1*** | 182/015 | 39/60 | 0/001 | 0/337 |
| E (extroversion) | 171/112 | ***1*** | 171/112 | 29/17 | 0/001 | 0/274 |
| behavioral inhibition systems | 973/014 | ***1*** | 973/014 | 66/49 | 0/001 | 0/460 |
| behavioral activation systems | 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 (responding to reward) | 123/512 | ***1*** | 123/512 | 23/96 | 0/064 | 0/230 |

The results showed that the two diabetic and non-diabetic groups in the behavioral inhibition system and the behavioral activation system as well as under the components of the stimulus and the search for entertainment are significantly different from each other. In addition, neuroticism and extraversion are different in personality traits**.**

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## IV. Discussion

The aim of this research was to perform a comparative study of behavioral inhibition / activation systems and personality factors in two groups of patients with type 2 diabetes and non-diabetic healthy individuals. The results of the present research indicate that there is a significant difference in personality traits in the neuroticism dimension between the two groups, so that diabetic patients have higher levels in the neuroticism dimension.

In explaining this finding, we can mention the stressful events and daily psychological pressures in the lives of diabetic patients. In terms of extroversion, there was a significant difference between the two groups. People with diabetes had lower scores on this dimension. In fact, the dissatisfied lifestyle of diabetic patients affected by their illness can affect their social isolation and reduce their social relationships [4].

Emotional reactions to stress can trigger the release of hormones that adversely affect fat and glucose metabolism, leading to a weakened immune system. The present research also found that the activity of the behavioral inhibition system in diabetic patients was higher than that of non-diabetic healthy individuals and that the activity of the behavioral activation system was lower in non-diabetic individuals; it means that diabetic patients had stronger behavioral inhibition system and weak behavior activation system. This finding is consistent with the findings of Corr [14] who believe that the behavioral inhibition system is associated with neuroticism and negative emotion and the behavioral activating system is associated with extraversion and positive emotion [14]. Different functions of brain / behavioral systems in diabetic individuals provide the basis for the disease by altering the optimal function of the immune system. In other words, people with higher behavioral inhibition systems experience more distress and anxiety. Not only are these people easily affected by negative stress, but they also cope poorly with stress. Repetition of stress can cause a defect in the hypothalamic regulatory phenomenon and effective hormonal control through feedback. This leads to several functional changes at different cellular, organ, and systemic levels, and ultimately to various diseases. Diabetes can be a consequence of the diabetic stress cycle. Research done by Pour Mohammad Reza Tajrishi and Mirzamani Bafghi [15] also showed that behavioral inhibition system is strongly and behavioral activation system is poorly associated with depression. On the other hand, many researches show high levels of depression in diabetic patients [16, 17, 18 and 19]. We can conclude that depression in diabetic patients is not only the result of a chronic disease, but also the activity of the behavioral cerebral system can affect the immune system and provide the basis for the disease. In the present research, diabetic patients had lower scores than healthy people in the subscales of the fun-seeking behavioral activation system (D), ie in the subscales of the stimulus and responding to the reward. In fact, diabetics are more sensitive to threatening situations that may result in punishment or to stop being rewarded; in other words, diabetics are more sensitive to the signs of reward and punishment. In explaining this finding, we can say that diabetics are less prone to rewarding situations due to their chronic illness and have less hope for life due to psychological and social issues that often manifest themselves in the form of depression and anxiety.

Overall, the results of this research implicitly lead not only to the identification and specification of various factors in the development of diabetes; also they refer to the fact that understanding individual differences in the sensitivity of different psychological structures and different vulnerabilities of the individuals in the face of stress, new therapies and strategies for diabetes can be developed. Finally, we suggest that two healthy and diabetic groups be compared in other variables due to the influence of different factors on the incidence of diabetes. We also recommend that intervention and training programs be developed to improve the quality of life of these patients.

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