

Structural Relationship Model of Type D Personality and Depression with the Mediating Role of Cognitive Distortions and Family Functioning: A Multi-Group Analysis

Tayebeh Gogheri

Hormozgan University

Abdolwahab Samavi (✉ wahab.samavi@gmail.com)

Hormozgan University <https://orcid.org/0000-0002-8660-6622>

Samaneh Najarpourian

Hormozgan University

Original Article

Keywords: Type D personality, Depression, Cognitive Distortions, Family functioning, Irritable Bowel Syndrome, Multi-group analysis

Posted Date: February 5th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-157026/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Version of Record: A version of this preprint was published at Current Psychology on April 23rd, 2021. See the published version at <https://doi.org/10.1007/s12144-021-01755-y>.

Abstract

Irritable bowel syndrome (IBS) is one of the most common gastrointestinal disorders with symptoms of chronic abdominal pain and changes in bowel movements. Although the cause of this disorder is not known, psychological factors have been reported among the most important causes of IBS. This research was conducted to test and compare the structural relationship model of type D personality and depression with the mediating role of cognitive distortions and family functioning in patients with IBS and healthy people. Furthermore, we compared the mediational model across levels of grouping variable (IBS and healthy groups). The research method was descriptive correlational and the sample included 236 healthy citizens aged 20–60 years old (130 females and 100 males) whom selected by stratified random sampling method and 236 citizens with IBS aged 20–60 years old (177 females and 59 males), which selected by purposeful sampling method. The research participants answered the Beck Depression Inventory-short form (BDI-13), Type D Personality Scale (DS-14), Interpersonal Cognitive Distortion Scale (ICDS), Family Functioning Assessment Device (FAD), and IBS Symptom Index questionnaire based on ROME III criterion. The obtained data were analyzed using structural equation modeling (SEM). The results revealed that the model proposed in this research has an acceptable fit in both groups. Also, according to the results, cognitive distortion and family functioning play a mediating role in the relationship between type D personality and depression. In the case of comparing the mediational model across levels of grouping variable (IBS and healthy groups), we concluded that all paths are not different across the two models. In general, the results of this work can be specifically applied by counselors and psychotherapists.

Introduction

Functional gastrointestinal disorders (FGID) are a group of unknown gastrointestinal diseases in which one experiences long unpredictable periods of discomfort and difficulty. Out of 25 functional gastrointestinal disorders, Irritable Bowel Syndrome (IBS) is the most common disorder (De Bortoli et al., 2018). Changes in bowel movements, pain, or abdominal discomfort without structural disorder are among the most important symptoms of IBS (Ng et al., 2018). Based on the predominant stool pattern, it includes three classes: IBS with diarrhea (IBS-D), IBS with constipation (IBS-C), and mixed IBS (IBS-M) (Kibune-Nagasako et al., 2016). The prevalence of this syndrome is 1.10 to 25% among the Iranian sample (Jahangiri et al., 2012), in Western countries range from 10 to 20% (Saito et al., 2002) and about 11% in the world's population (Kibune-Nagasako et al., 2016). Also, this disorder is diagnosed in women 2 to 3 times more than men, and up to 80% of them experience severe IBS (Adeyemo et al., 2010). The causes of IBS have not yet been identified. However, significant hypotheses have been proposed in this regard. For example, one hypothesis states disorder in the brain and gastrointestinal tract interaction is involved in this disorder, suggesting the major role of the brain in the pathophysiology of this syndrome (Qi et al., 2016). Also, psychiatric disorders are highly associated with IBS and depression is the most important of them (Lee et al., 2017). Many patients with IBS experience major emotional disorders, particularly depression (Qi et al., 2016).

In 2015, the number of depressed people in the world was estimated at 4.4% and the total number of depressed people increased by 18.4% from 2005 to 2015, suggesting a general increase in the prevalence of this disorder (World Health Organization, 2015). Based on Diagnostic and Statistical Manual of Mental Disorders-Version Five (DSM-5), if a person has the following five symptoms, he/she will be diagnosed as a depressed person: 1) lack of interest or enjoyment in normal activities, 2) weight loss or changes in appetite, 3) feeling guilty or worthless, 4) problems related to concentration or thought disorder, and 5) thoughts of death and suicide during at least two weeks, with significant clinical distress and disorder in social, occupational or other important activities (Alwhaibi, 2016).

Chronic diseases and a combination of genetic, biological, psychological, social, and environmental factors have been proposed in the etiology of depression (Mooney & El-Sayed, 2016). Moreover, personality types are a special and important factor in the formation of abnormal reactions and mental disorders (Al-Qezweny et al., 2016). One of the

personality types associated with depression is the type D personality, which includes the two major components negative affectivity (NA) and social inhibition (SI)". In a negative affect trait, the person tends to experience increasingly negative emotions such as anxiety, depression, and hostility. In social inhibition trait, the person is unwilling to express emotions due to fear of being rejected and low self-esteem (Yilmaz et al., 2016). Type D personality was introduced by Denollet et al. (1995) as a disturbed and anxious personality type. Based on early estimates, this personality type is common in 20% of the general population (Allen et al., 2019; Denollet, 2005). Type D personality is identified when people score above a predetermined cut-off on both the NA and SI subscales of the DS14. (Lambertus et al., 2018). Type D displays special traits that negatively influence people's health (Williams et al., 2016). Also, according to the existing studies, this type predicts poor physical health and poor public health (Allen et al., 2019; Kupper & Denollet, 2018) and is considered a risk factor for mental disorders, especially depression (Lambertus et al., 2018). People with this personality type show a higher level of harmful behavior and perception than others (Cheng et al., 2018).

Although, trait psychological features are supposed to be stable over time, but in the case of Type D, there are some evidence to conclude the poor temporal stability over time of it. Ossola et al. (2015) suggested that NA and depression are overlapping constructs, and DS14 measures depressed features, rather than a personality disposition. Based on Ossola et al. (2015) results and following the Lodder (2020), it can be considered that SI or NA separately can produce Type D personality effects even if only one of them (NA or SI) is related to the outcome.

In a one-year follow-up study of heart failure patients, these patients displayed distinctive personality trait D that was independently associated with the severity of depression symptoms (Burkauskas et al., 2015). Also, previous studies have shown that higher levels of negative affectivity and social inhibition are associated with more depressive symptoms (Gupta & Basak, 2013; van Dooren et al., 2016). Moreover, type D personality affects a construct called cognitive distortion. In this construct, the information processing activity of individuals is disrupted or inactivated, and then, misconceptions guide the person's behaviors (Ota et al., 2020). So, in response to environmental events, people display behaviors and emotions that are a result of spontaneous and automatic thoughts (Rnic et al., 2016). These thoughts include dichotomous thinking, fortune telling, over-generalization, mind reading, discounting positive aspects, emotional reasoning, labeling, personalization, magnification or minimization, blaming, should statements, and jumping to conclusions, what if, selective abstraction, and an unfair comparison.

Early studies on cognitive distortion have focused on depression so that cognitive distortions are more common in depressed people than in healthy ones according to the studies. Cognitive distortions are considered one of the features of depression disorder (MacLaren et al., 2015). When one's major negative beliefs initiate to work and spontaneous negative thoughts appear, a natural, negative, neutral, or even positive event can affect negative affect (a type D dimension) and abnormal behaviors. Therefore, type D personality can be associated with depression due to cognitive distortion.

Moreover, cognitive distortions are formed in the context of interpersonal relationships, which is a part of social interactions, depending on the role of family and its function. According to the World Health Organization (WHO), the family is the primary social factor that brings health and well-being for people. When families are threatened, they experience imbalance due to morbid behaviors. Family functioning, which is the joint effort of the members to maintain balance in the family, is of crucial value in this regard. If people's communication and tendencies are based on intimacy, understanding, and affection, all members will be less harmed by the pressures of illness and life (Song et al., 2019). Based on different studies, the family functioning of depressed patients has defects and abnormalities that play a role in the occurrence of this disorder and affect the treatment outcomes. Wiegand-Grefe et al. (2019) found that family functioning is an important mediator in the development of mental disorders in parents, which in turn affects the development of the children. On the other hand, some studies addressed the association between type D personality and family functioning. For instance, Spek et al. (2018), revealed that Participants with Type D and participants with high NA tend to experience less social support and less relationship adjustment (the variables related to family functioning).

Likewise, they reported an association between Type D personality and more loneliness, lower social support and relationship adjustment in people with diabetes. Other studies also provided some evidence linking Type D personality with less social support in individuals with coronary heart disease and patients with type 2 diabetes mellitus (Ginting et al., 2016; Shao et al., 2017).

Several studies have been conducted on the role of personality traits in IBS. Rafezi et al. (2018) conducted a cross-sectional analytical study on 100 healthy and IBS people. They compared the personality traits of 50 individuals, diagnosed as IBS patients and 50 healthy individuals. According to their results, people with IBS had higher neuroticism and lower extraversion than healthy people, both of which are associated with type D characteristics (De Fruyt & Denollet, 2002). Hence, some personality traits can predispose people to IBS. Thus, the incidence of IBS in a person is predictable based on personality type. Sibelli et al. (2016) showed a significant relationship between anxiety and depression and an increased risk of IBS. Therefore, the role of depression as a risk factor for IBS can also be significant. Based on previous studies, the present study aims to examine the structural relation between type D personality and depression with a mediating role of cognitive distortions and family functioning both in people with IBS and health people. Furthermore, we compared the both mediation models across levels of grouping variable (IBS and healthy groups).

Methodology

Method

The method of this study was descriptive correlational approach. its population included healthy people and people with IBS in Bandar Abbas, Iran. The study population included the citizens of Bandar Abbas, Iran. A total of 472 people participated in this study, of which 177 (75.2%) female and 59 (24.8%) male samples were included in the IBS group and 130 (55.2%) female and 106 (44.8%) male samples were included in the healthy people. The total group also included 307 females (65%) and 165 males (35%). The 236 healthy citizens selected by stratified random sampling method. Their age rang was 20–60 years old (38.37 ± 2.54) and the 236 citizens with IBS, which selected by purposeful sampling method. Their age rang was 20–60 years old (39.62 ± 2.39). To determine the patients with IBS, the IBS Symptom Index Questionnaire was used based on the ROME III criterion. ROME III criterion used to detect the presence of IBS was lower abdominal pain or discomfort in association with an alteration in bowel habit, and no organic GI disease. People who had symptoms of the disorder and a history of visiting a physician for the mentioned problem according to this questionnaire were diagnosed as IBS cases. After selecting the participants, the participants were provided with a brief explanation of the research objectives and were ensured about their right to leave the study at any stage. Informed consent was obtained from all individual participants included in the study. Once the participants filled the consent forms, they were asked to complete the questionnaires.

Research tools

A) Beck Depression Inventory-short Form (bdi-13)

This questionnaire has 13 items, which includes two subscales i.e. the negative affect (items 1, 2, 3, 4, 5, 6, 7, and 10) and anhedonia (items 7, 8, 9, 11, 12, and 13). The goal of this questionnaire is to assess one's depression and a high score indicates severe depression. Luty and O'Gara (2006) reported Cronbach's alpha of this scale at 0.88, and its concurrent validity (correlational coefficient) compared with the Montgomery Asberg Depression Rating Scale, was 0.76. In this study, the reliability of the negative affect and anhedonia sub scales by Cronbach's alpha method was estimated at 0.79 and 0.78 respectively.

B) Type D Personality Scale (ds-14)

This scale was developed by Denollet (2005) to identify people with type D personality. It has two subscales of negative affect (items 2, 4, 5, 7, 9, 12, and 13) and social inhibition (items 1, 3, 6, 8, 10, 11, and 14). The Type D Personality

Questionnaire consists of fourteen 5-point Likert questions (incorrect, somewhat incorrect, no idea, somewhat correct, and correct), with a score above the cutoff (≥ 10) on both measures indicating a type D personality. The reliability of this scale in Belgium was reported at 0.81 and its validity was reported at the desired level. So, the negative affect subscale was correlated with the Neuroticism subscale of the Big Five Factors Scale (at a significance level of 0.001). Factor analysis of Persian version of DS14 yielded the two-factor structure in MI patients and test–retest stability of the NA and the SI subscales were 0.86 and 0.77 respectively over a 2-month period (Bagherian & Ehsan, 2011). Social inhibition subscale is negatively correlated with extraversion (-0.61) and level of consciousness (-0.40) and positively correlated with neuroticism (Denollet, 1998). In Iran, based on the calculation of Cronbach's alpha, the reliability of this tool was estimated at 0.86 (Fakhari et al., 2015). Moreover, the reliability of the NA and the SI subscales in the present study was estimated at 0.81 and 0.81 respectively.

C) Interpersonal Cognitive Distortions Scale

The purpose of this scale was to assess the level of cognitive distortion in people. It was designed by Hamamci and Büyüköztürk (2004). This 19-item scale includes three subscales of rejection in interpersonal relationships, unrealistic expectations in interpersonal relationships, and misperceptions in interpersonal relationships, scored on a five-point Likert scale. They are scored with numbers 1, 2, 3, 4, and 5, respectively. A high score indicates high cognitive distortion in the person and a low score indicates low cognitive distortion. The reliability of the questionnaire through internal consistency by Cronbach's alpha and test-retest with a two-week interval for the whole scale was obtained at 0.67 and 0.74, respectively (Hamamci & Büyüköztürk, 2004). They also calculated these factors at 0.73 and 0.70 for the subscale of rejection in interpersonal relationships, 0.66 and 0.76 for unrealistic expectations in interpersonal relationships, and 0.73 and 0.70 for misperception in interpersonal relationships, respectively.

Its validity was calculated at 0.45, 0.53, and 0.53, respectively, through correlation with the scale of irrational beliefs, the scale of automatic thoughts, and the scale of the tendency to conflict in interpersonal relationships (Hamamci & Büyüköztürk, 2004). In Iran, the construct validity of the questionnaire and the existence of three factors of rejection in interpersonal relationships, unrealistic expectations in interpersonal relationships, and misperception in interpersonal relationships were confirmed. Cronbach's alpha for the subscale of rejection in interpersonal relationships, unrealistic expectations in interpersonal relationships, and misperception of interpersonal relationships was obtained at 0.79, 0.82, and 0.81, respectively (Esmaelpoor et al., 2015). In the present study, Cronbach's alpha for the subscale of rejection in interpersonal relationships, unrealistic expectations in interpersonal relationships, and misperception of interpersonal relationships was estimated at 0.78, 0.81, and 0.81, respectively.

D) Family functioning Assessment Device (FAD)

The purpose of this scale is to assess family functioning. It was designed based on the McMaster model of family functioning. It has seven components including problem-solving, communication, roles, affective involvement, affective responsiveness, behavior control, and general family functioning. In this study, to assess family functioning, the general family functioning components (questions 7, 14, 21, 28, 35, 36, 39, 43, 47, 50, 52, and 53) were used. A high score indicates the desirable general family functioning and a low score indicates poor functioning. According to Epstein et al. (1983) the minimum alpha coefficient of scales was 0.75. In Iran, Yoosefi (2012) identified three structures in this test by factor analysis, which included family roles, problem-solving, and expression of affections. In the present study, the reliability of this scale with Cronbach's alpha method was estimated at 0.75.

E) IBS symptoms index scale based on ROME III criteria

The purpose of this scale is to diagnose people with IBS based on ROME III diagnostic criteria. This scale includes 10 questions regarding the severity and frequency of IBS symptoms. This scale is completed by a specialist physician. The

reliability coefficient of this scale using Cronbach's alpha was estimated at 0.63 (Kanazawa et al., 2015) and its Cronbach's alpha was estimated at 0.73 in the present study.

Statistical analysis

Statistical analysis was performed using the SPSS (version 26) and AMOS (version 24). The models were analyzed using structural equation modelling, *Maximum Likelihood Estimates* method. The criteria for evaluating model fit include Chi-square divided by the degrees of freedom (χ^2/df), Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA). The χ^2/df was recommended with values of 5 or less (Hu & Bentler, 1999), for both the TLI and CFI, we considered the values above 0.90 to indicate adequate fit (Hu & Bentler, 1999), and for the RMSEA, the values above 0.10 were considered as unacceptable and values below 0.06 as good model fit (Chen et al., 2008).

Also, we conducted multivariate normality test in AMOS, by the calculation of *Mardia's* coefficient, which is a multivariate measure of kurtosis. Since, this test is highly sensitive to sample size, with larger sample sizes being more likely to produce significant (non-normal) results. Therefore, according to Stevens (2012), we used it, in conjunction with the kurtosis values for individual variables. Kurtosis values above 3 (in magnitude) may designate that a variable is not normally distributed (Westfall & Henning, 2013).

Since the Type D personality is hypothesized to constitute a statistical interaction between the construct's two subcomponents (NA and SI), in line with recommendations by (Lodder et al., 2019), we used the matched product indicator (Matched PI) as the interaction method and run the model. Accordingly, we tested five models as following:

1. A SEM with NA and SI as exogenous (independent) latent variables, cognitive distortion and family function as mediators and depression as criterion (dependent) variable.
2. A SEM with NA, SI and NA*SI (interaction effect) as exogenous (independent) latent variables, cognitive distortion and family function as mediators and depression as criterion (dependent) variable.
3. A SEM NA*SI (interaction effect) and NA effect as exogenous (independent) latent variables, cognitive distortion and family function as mediators and depression as criterion (dependent) variable.
4. A SEM NA*SI (interaction effect) and SI effect as exogenous (independent) latent variables, cognitive distortion and family function as mediators and depression as criterion (dependent) variable.
5. A SEM with only NA*SI (interaction effect) as exogenous (independent) latent variable, cognitive distortion and family function as mediators and depression as criterion (dependent) variable.

For multi-group analysis, we used the manage groups function in the AMOS software to compare path coefficients in both IBS and healthy models. For this purpose, each path was named twice with different labels for both groups. We selected Critical ratios for differences in the Analysis Properties, to compare coefficients for the specified paths in both groups in the output. It yields a z-test for the difference between coefficients from IBS Model to Healthy Model, and for a two-tailed test, if this value is greater than |1.96| (absolute value of 1.96) for the difference between paths to be statistically significant at $p < .05$. This method produces only one set of fit statistics for overall model fit.

Results

Table 1 shows the mean and standard deviation of the research variables in the IBS and healthy groups.

Table 1

Results of descriptive indices of research variables in the IBS and healthy groups

| Variable | Component | Group | N | Mean | SD |
|------------------------------------|------------------------------------|---------|-----|-------|------|
| Depression | depression | IBS | 236 | 12.16 | 9.15 |
| | | healthy | 236 | 11.04 | 9.43 |
| Type-D personality | social inhibition | IBS | 236 | 13.58 | 4.08 |
| | | healthy | 236 | 12.63 | 4.35 |
| | negative affects | IBS | 236 | 10.98 | 5.82 |
| | | healthy | 236 | 8.68 | 5.48 |
| | NA*SI interaction | IBS | 236 | 23.18 | 7.48 |
| | | healthy | 236 | 17.95 | 5.21 |
| Interpersonal cognitive distortion | Interpersonal cognitive distortion | IBS | 236 | 22.96 | 4.54 |
| | | healthy | 236 | 21.43 | 5.10 |
| Family functioning | Family functioning | IBS | 236 | 32.75 | 6.59 |
| | | healthy | 236 | 35.15 | 5.77 |

The multivariate normality of the scores of the research variables in the IBS and healthy groups was examined through multivariate measures of skewness and kurtosis and the results confirmed the data normality. The result of normality test was provided as supplementary file. As mentioned earlier, we tested five models and reported the model fit indices related to each model, unstandardized and standardized direct effects for both groups in table 2.

Table 2

Model fit indices and structural regression coefficients for each of the five models in IBS and healthy groups

| No | Model | χ^2/df | CFI | TLI | RMSEA | Fitting status | Group | Path | Coefficient | | p-value |
|----------------------------------|-----------------|-------------|--------|------|-------|----------------|---------|-------------------------------------|-------------|---------|---------|
| | | | | | | | | | B | β | |
| 1 | NA + SI | 1.86 | 0.95 | 0.94 | 0.043 | Fitted | IBS | NA effect on depression | 3.91 | 0.38 | 0.001** |
| | | | | | | | | NA effect on cognitive distortions | 2.64 | 0.24 | 0.009* |
| | | | | | | | | NA effect on family functioning | -3.20 | -0.43 | 0.001** |
| | | | | | | | | SI effect on depression | 3.70 | 0.20 | 0.013* |
| | | | | | | | | SI effect on cognitive distortions | 5.42 | 0.24 | 0.006* |
| | | | | | | | | SI effect on family functioning | -4.37 | -0.43 | 0.001** |
| | | | | | | | | Cognitive distortions on depression | 0.20 | 0.22 | 0.001** |
| | | | | | | | | Family functioning on depression | -0.20 | -0.15 | 0.018* |
| | | | | | | | healthy | NA effect on depression | 3.08 | 0.25 | 0.001** |
| | | | | | | | | NA effect on cognitive distortions | 2.88 | 0.22 | 0.013* |
| | | | | | | | | NA effect on family functioning | -2.68 | -0.35 | 0.001** |
| | | | | | | | | SI effect on depression | 3.50 | 0.19 | 0.008* |
| | | | | | | | | SI effect on cognitive distortions | 4.95 | 0.26 | 0.004* |
| | | | | | | | | SI effect on family functioning | -2.37 | -0.21 | 0.011* |
| | | | | | | | | Cognitive distortions on depression | 0.28 | 0.30 | 0.001** |
| Family functioning on depression | -0.28 | -0.18 | 0.002* | | | | | | | | |
| 2 | NA*SI + NA + SI | 11.65 | 0.59 | 0.53 | 0.151 | Not fitted | IBS | NA effect on depression | 0.68 | 0.06 | 0.639 |
| | | | | | | | | NA effect on cognitive distortions | 0.09 | 0.009 | 0.963 |

| | | | | | | | | | | | | |
|-------------------------------------|---------------|-------|---------|------|-------|------------|-----|--------------------------------------|-------------------------|--------|---------|--------|
| 3 | NA*SI + NA | 11.04 | 0.72 | 0.67 | 0.146 | Not fitted | IBS | on depression | | | | |
| | | | | | | | | NA effect on depression | 1.48 | 0.14 | 0.687 | |
| | | | | | | | | NA effect on cognitive distortions | -2.93 | -0.26 | 0.596 | |
| | | | | | | | | NA effect on family functioning | -0.178 | -0.02 | 0.954 | |
| | | | | | | | | NASI effect on depression | 1.20 | 0.34 | 0.349 | |
| | | | | | | | | NASI effect on cognitive distortions | 2.65 | 0.70 | 0.156 | |
| | | | | | | | | NASI effect on family functioning | -1.62 | -0.64 | 0.119 | |
| | | | | | | | | Cognitive distortions on depression | 0.22 | 0.24 | 0.001** | |
| | | | | | | | | Family functioning on depression | -0.26 | -0.19 | 0.001** | |
| | | | | | | | | healthy | NA effect on depression | 7.95 | 0.64 | 0.008* |
| | | | | | | | | NA effect on cognitive distortions | 4.99 | 0.37 | 0.164 | |
| | | | | | | | | NA effect on family functioning | 2.36 | 0.31 | 0.289 | |
| | | | | | | | | NASI effect on depression | -1.25 | -0.27 | 0.257 | |
| | | | | | | | | NASI effect on cognitive distortions | -0.04 | -0.009 | 0.975 | |
| | | | | | | | | NASI effect on family functioning | -2.18 | -0.77 | 0.009* | |
| Cognitive distortions on depression | 0.32 | 0.35 | 0.001** | | | | | | | | | |
| Family functioning on depression | -0.28 | -0.18 | 0.003* | | | | | | | | | |
| 4 | NA*SI+ SI | 8.48 | 0.71 | 0.66 | 0.126 | Not fitted | IBS | SI effect on depression | -1.63 | -0.08 | 0.626 | |
| | | | | | | | | SI effect on | 2.001 | 0.09 | 0.681 | |

| | | | | | | | | | | | |
|---|-------|------|------|------|-------|--------------------------------|---------|--------------------------------------|-------|-------|---------|
| | | | | | | | | cognitive distortions | | | |
| | | | | | | | | SI effect on family functioning | -0.70 | -0.05 | 0.800 |
| | | | | | | | | NASI effect on depression | 1.95 | 0.56 | 0.003* |
| | | | | | | | | NASI effect on cognitive distortions | 1.36 | 0.36 | 0.112 |
| | | | | | | | | NASI effect on family functioning | -1.57 | -0.62 | 0.001** |
| | | | | | | | | Cognitive distortions on depression | 0.224 | 0.24 | 0.001** |
| | | | | | | | | Family functioning on depression | -0.27 | -0.19 | 0.001** |
| | | | | | | | healthy | SI effect on depression | 1.73 | 0.10 | 0.285 |
| | | | | | | | | SI effect on cognitive distortions | 5.08 | 0.27 | 0.021* |
| | | | | | | | | SI effect on family functioning | -2.25 | -0.21 | 0.063 |
| | | | | | | | | NASI effect on depression | 1.48 | 0.32 | 0.001** |
| | | | | | | | | NASI effect on cognitive distortions | 0.81 | 0.16 | 0.150 |
| | | | | | | | | NASI effect on family functioning | -0.85 | -0.30 | 0.007* |
| | | | | | | | | Cognitive distortions on depression | 0.29 | 0.32 | 0.001** |
| | | | | | | | | Family functioning on depression | -0.31 | -0.19 | 0.001** |
| 5 | NA*SI | 2.13 | 0.98 | 0.97 | 0.049 | Fitted (With one modification) | IBS | NASI effect on depression | 1.69 | 0.49 | 0.001** |
| | | | | | | | | NASI effect on cognitive distortions | 1.65 | 0.45 | 0.001** |
| | | | | | | | | NASI effect on family functioning | -1.64 | -0.66 | 0.001** |
| | | | | | | | | Cognitive distortions | 0.22 | 0.24 | 0.001** |

| | | | | | | | | | | |
|--|--|--|--|--|--|---------|--------------------------------------|-------|-------|---------|
| | | | | | | | on depression | | | |
| | | | | | | | Family functioning on depression | -0.26 | -0.19 | 0.001** |
| | | | | | | healthy | NASI effect on depression | 1.86 | 0.40 | 0.001** |
| | | | | | | | NASI effect on cognitive distortions | 1.89 | 0.38 | 0.001** |
| | | | | | | | NASI effect on family functioning | -1.31 | -0.46 | 0.001** |
| | | | | | | | Cognitive distortions on depression | 0.30 | 0.32 | 0.001** |
| | | | | | | | Family functioning on depression | -0.31 | -0.20 | 0.001** |

SI= social inhibition, NA= negative affectivity, NASI = NA and SI interaction

** $p < .001$.

* $p < .01$.

Table 2 shows model fit indices and structural regression coefficients for each of the five models in IBS and healthy groups. According to the results, from five models, the models 1 and 5 were well-fitted in both groups. Both models resulted in a χ^2/df values lower than 5, a sign of good model fit. According to the RMSEA, CFI and TLI, the models fitted the data best. Both Models 1 and 5, showed RMSEA 95% confidence intervals lower than 0.06. According to both the CFI and TLI, models 1 and 5 showed good fit with values of approximately 0.90.

The results of the *Hayes PROCESS macro for mediation method* in IBS model indicated the indirect path coefficient between type D personality and depression through cognitive distortions was significant (indirect coefficient = 0.11, 95% CL = [0.12, 0.26]) and the indirect path coefficient between type D personality and depression through family functioning was statistically significant (indirect coefficient =0.08, 95% CL = [0.03, 0.13]). Furthermore, the results of the mediation analyses in healthy model indicated the indirect path coefficient between type D personality and depression through cognitive distortions was significant (indirect coefficient = 0.13, 95% CL = [0.07, 0.20]) and the indirect path coefficient between type D personality and depression through family functioning was statistically significant (indirect coefficient =0.13, 95% CL = [0.007, 0.21]). Considering all these results, the relationships between type D personality and depression was significantly mediated by the cognitive distortions and family functioning in two groups.

One of the purposes of the present study was to compare path coefficients in both IBS and healthy models. In addition, model coefficients were compared using multi-group analysis in AMOS software. The results showed that all path coefficients were not different in the two models. According to the results, the z-value for all comparisons was not exceeding the critical value of |1.96|. In this regard, we have no evidence to suggest that these paths are unequal across the two models.

Discussion

The first aim of this study was to test the fit of the structural model of personality type D and depression mediated by cognitive distortions and family functioning in two IBS and healthy groups. Lodder (2020) provided the first empirical support to show there are Type D personality effects even if only one of the personality traits (NA or SI) is related to the outcome. Accordingly, the last decade, in some studies, Type D personality effects were estimated based on the main and interaction effects of the continuous NA and SI scores. Following the Lodder (2020) and in line with Ossola et al. (2015), we analyzed five models to test main and interaction effects of the continuous NA and SI scores. Results revealed from five models, the models 1 and 5 were well-fitted. In model 1, we tested the structural relationship of NA and SI as independent variables with depression as dependent variable mediated by cognitive distortion and family function as mediators. In model 5, we tested the structural relationship of only NA*SI (interaction effect) as independent variable with depression as dependent variable mediated by cognitive distortion and family function as mediators as well. The findings demonstrated a significant relationship between type D and depression in addition to cognitive distortions and family functioning, on the one hand, and cognitive distortions and family functioning with depression on the other hand in both of the fitted models.

The present study further aimed at comparing path coefficients in IBS and healthy models and we have no evidence to suggest that these paths are unequal across the two models. Model fit indices represented that the proposed models has a good fit in both healthy and IBS groups, which is consistent with the results of previous research (Al-Qezweny et al., 2016; Gupta & Basak, 2013; Kibune-Nagasako et al., 2016; Lee et al., 2017). Individuals with type D personality tend to experience negative emotions and avoid being in the community and expressing their feelings and are more prone to mental health problems and disorders such as depression and psychosomatic illnesses (Williams et al., 2016).

Further, those with type D personality experience depression and low general health, along with disrupted interpersonal relationships due to the combined effects of negative excitement and social inhibition (van Dooren et al., 2016). It seems that type D personality can lead to cognitive distortions in people due to disturbing their emotions and creating a negative attitude toward themselves, and these cognitive distortions, in turn, can cause depression.

Our findings suggest that family functioning may mediate the relationship between personality type D and depression. Depression is a disorder that may stem from problems with emotional regulations (Gilbert, 2012; Pereira et al., 2015; Sheeber et al., 2009). Furthermore, people with type D personality have probably no proper emotional regulation due to poor family functioning, which can lead to depression in these people. Moreover, they may hide their feelings and emotions because of difficulties in expressing love due to the lack of appropriate words, friendly attitudes, and physical contact. Additionally, the negative emotion and social restraint of type D personality can increase depression given that families do not allow their children to express their thoughts and feelings, disagreements between family members are not considered normal, and negotiations for resolving disputes are not conducted by agreement. Similarly, improper family functioning can contribute to stress and thus depression. According to previous researches, interactions between biological, personality, and stressful life events may increase the likelihood of experiencing depression (McLeod et al., 2007; Pereira et al., 2015). In addition, various family factors are associated with the risk of depression. For example, parental psychological pathology, parental cognitive style, family emotional climate, parenting style, attachment, and parental conflicts are among the factors that may be possible mechanisms for experiencing depression. However, no study has so far thoroughly elucidated the mechanism by which dysfunctional family interactions may increase a person's vulnerability to depression.

The evidence indicates that psychosomatic illnesses can both act as an antecedent to mental disorders and occasionally as a consequence of these disorders. Therefore, people with IBS, similar to other psychosomatic illnesses, are prone to develop more cognitive distortions, and stronger cognitive distortions may result in longer depression. On the other hand, these individuals have a more disproportionate family function compared to normal people. According to studies, poor family functioning can lead to more depressive experiences (Ghamari, 2012; Pereira et al., 2015).

In general, the results of the present study demonstrated that type D personality has a positive and significant relationship with depression under the influence of irritable bowel syndrome, and cognitive distortion and family functioning mediate this relationship. However, the correlational nature of our study prevents us from reaching a causal conclusion. The correlation coefficients are significant despite their small size. It can be one of the limitations of the study and we suggest to include more relevant variables in the model in future studies.

Based on the findings, the relationship between personality type D and depression through cognitive distortion and family functioning confirmed the need for paying more attention to personality traits and family climate in order to prevent mental disorders. Furthermore, the interaction of these variables with psychosomatic disorders is considered as an important factor that should be considered in disorders such as depression.

Despite the above-mentioned findings, this study has several limitations that should be considered in generalizing the findings. As it was mentioned earlier, the lack of causal conclusion due to the correlational type of the research and the lack of examining the interaction between the subjects' gender, occupation, level of education, and socioeconomic status with the studied variables are the most important limitations of the present study. Thus, it is suggested that future studies test the proposed model on other populations of psychiatric patients by considering the mediating or moderating effects of demographic variables. It is further suggested that educational programs for IBS patients pay special attention to these individuals' disease and control it through designing and using psychological therapies, and in general, non-pharmacological and cultural strategies in order to help patients and inform them about their disorder.

Declarations

Competing interests: The authors declare no competing interests.

Ethics: Once the participants filled the consent forms, they were asked to complete the questionnaires. This project was approved by the ethics committee at Hormozgan university of medical sciences (Ethics ID IR.HUMS.REC.1399.349).

References

Adeyemo, M., Spiegel, B., & Chang, L. (2010). Meta-analysis: do irritable bowel syndrome symptoms vary between men and women? *Alimentary pharmacology & therapeutics*, *32*(6), 738-755.

Al-Quezweny, M. N., Utens, E., Dulfer, K., Hazemeijer, B., van Geuns, R. J., Daemen, J., & van Domburg, R. (2016). The association between type D personality, and depression and anxiety ten years after PCI. *Netherlands Heart Journal*, *24*(9), 538-543.

Allen, S. F., Wetherell, M. A., & Smith, M. A. (2019). A one-year prospective investigation of Type D personality and self-reported physical health. *Psychology & health*, *34*(7), 773-795.

Alwhaibi, M. M. (2016). *Risk of Newly-diagnosed Depression, Treatment and its Economic Outcomes among Elderly Medicare Beneficiaries with Incident Breast, Colorectal or Prostate Cancer* [Dissertation, West Virginia University]. West Virginia

Bagherian, R., & Ehsan, H. B. (2011). Psychometric properties of the Persian version of type D personality scale (DS14). *Iranian journal of psychiatry and behavioral sciences*, *5*(2), 12.

Burkauskas, J., Staniūtė, M., Brožaitienė, J., Kažukauskienė, N., Mickuvienė, N., & Bunevičius, R. (2015). Health-related quality of life and type d personality in coronary artery disease patients with heart failure: A longitudinal observational study. 12th World Congress of Biological Psychiatry; the World Federation of Societies of Biological Psychiatry (WFSBP):

Athens, Greece, June 14th-18th, 2015/World Federation of Societies of Biological Psychiatry. Athens: World Federation of Societies of Biological Psychiatry, 2015,

- Chen, F., Curran, P. J., Bollen, K. A., Kirby, J., & Paxton, P. (2008). An empirical evaluation of the use of fixed cutoff points in RMSEA test statistic in structural equation models. *Sociological methods & research*, *36*(4), 462-494.
- Cheng, F., Lin, P., Wang, Y., Liu, G., Li, L., Yu, H., Yu, B., Zhao, Z., & Gao, X. (2018). Type D personality and coronary atherosclerotic plaque vulnerability: the potential mediating effect of health behavior. *Journal of psychosomatic research*, *108*, 54-60.
- De Bortoli, N., Tolone, S., Frazzoni, M., Martinucci, I., Sgherri, G., Albano, E., Ceccarelli, L., Stasi, C., Bellini, M., & Savarino, V. (2018). Gastroesophageal reflux disease, functional dyspepsia and irritable bowel syndrome: common overlapping gastrointestinal disorders. *Annals of gastroenterology*, *31*(6), 639.
- De Fruyt, F., & Denollet, J. (2002). Type D personality: A five-factor model perspective. *Psychology and Health*, *17*(5), 671-683.
- Denollet, J. (1998). Personality and coronary heart disease: the type-D scale-16 (DS16). *Annals of Behavioral Medicine*, *20*(3), 209-215.
- Denollet, J. (2005). DS14: standard assessment of negative affectivity, social inhibition, and Type D personality. *Psychosomatic medicine*, *67*(1), 89-97.
- Denollet, J., Sys, S. U., & Brutsaert, D. L. (1995). Personality and mortality after myocardial infarction. *Psychosomatic medicine*, *57*(6), 582-591.
- Epstein, N. B., Baldwin, L. M., & Bishop, D. S. (1983). The McMaster family assessment device. *Journal of marital and family therapy*, *9*(2), 171-180.
- Esmaeelpoor, K., Bakhshipour, A., & Mohammadzadegan, R. (2015). Determining the factor structure, validity and reliability of interpersonal cognitive distortions scale among students of Tabriz University. *Bi-Quarterly Journal of Cognitive Strategies in Learning*, *2*(3), 53-72.
- Fakhari, A., Norouzi, S., & Pezeshki, M. Z. (2015). Reliability and validity of type D personality questionnaires (ds14 Persian version) in coronary artery patients. *Medical Journal of Tabriz University of Medical Sciences and Health Services*, *36*(4), 78-85.
- Ghamari, M. (2012). Family function and depression, anxiety, and somatization among college students. *International journal of academic research in business and social sciences*, *2*(5), 101-105.
- Gilbert, K. E. (2012). The neglected role of positive emotion in adolescent psychopathology. *Clinical psychology review*, *32*(6), 467-481.
- Ginting, H., van de Ven, M., Becker, E. S., & Näring, G. (2016). Type D personality is associated with health behaviors and perceived social support in individuals with coronary heart disease. *Journal of health psychology*, *21*(5), 727-737.
- Gupta, S., & Basak, P. (2013). Depression and type D personality among undergraduate medical students. *Indian journal of psychiatry*, *55*(3), 287.
- Hamamci, Z., & Büyüköztürk, Ş. (2004). The interpersonal cognitive distortions scale: development and psychometric characteristics. *Psychological reports*, *95*(1), 291-303.

- Hu, L. t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary journal*, 6(1), 1-55.
- Jahangiri, P., Jazi, M. S. H., Keshteli, A. H., Sadeghpour, S., Amini, E., & Adibi, P. (2012). Irritable bowel syndrome in Iran: SEPAHAN systematic review No. 1. *International journal of preventive medicine*, 3(Suppl1), S1.
- Kanazawa, M., Nakajima, S., Oshima, T., Whitehead, W. E., Sperber, A. D., Palsson, O. S., Drossman, D. A., Miwa, H., & Fukudo, S. (2015). Validity and reliability of the Japanese version of the Rome III diagnostic questionnaire for irritable bowel syndrome and functional dyspepsia. *Journal of neurogastroenterology and motility*, 21(4), 537-544.
- Kibune-Nagasako, C., García-Montes, C., Silva-Lorena, S. L., & Aparecida-Mesquita, M. (2016). Irritable bowel syndrome subtypes: Clinical and psychological features, body mass index and comorbidities. *Revista Española de Enfermedades Digestivas*, 108(2), 59-64.
- Kupper, N., & Denollet, J. (2018). Type D personality as a risk factor in coronary heart disease: a review of current evidence. *Current cardiology reports*, 20(11), 104.
- Lambertus, F., Herrmann-Lingen, C., Fritzsche, K., Hamacher, S., Hellmich, M., Jünger, J., Ladwig, K.-H., Michal, M., Ronel, J., & Schultz, J.-H. (2018). Prevalence of mental disorders among depressed coronary patients with and without Type D personality. Results of the multi-center SPIRR-CAD trial. *General hospital psychiatry*, 50, 69-75.
- Lee, C., Doo, E., Choi, J. M., Jang, S.-h., Ryu, H.-S., Lee, J. Y., Oh, J. H., Park, J. H., & Kim, Y. S. (2017). The increased level of depression and anxiety in irritable bowel syndrome patients compared with healthy controls: systematic review and meta-analysis. *Journal of neurogastroenterology and motility*, 23(3), 349.
- Lodder, P. (2020). A re-evaluation of the Type D personality effect. *Personality and Individual Differences*, 167, 110254.
- Lodder, P., Denollet, J., Emons, W. H., Nefs, G., Pouwer, F., Speight, J., & Wicherts, J. M. (2019). Modeling interactions between latent variables in research on Type D personality: A Monte Carlo simulation and clinical study of depression and anxiety. *Multivariate behavioral research*, 54(5), 637-665.
- Luty, J., & O'Gara, C. (2006). Validation of the 13-Item Beck Depression Inventory in alcohol-dependent people. *International Journal of Psychiatry in Clinical Practice*, 10(1), 45-51.
- MacLaren, V., Ellery, M., & Knoll, T. (2015). Personality, gambling motives and cognitive distortions in electronic gambling machine players. *Personality and Individual Differences*, 73, 24-28.
- McLeod, B. D., Weisz, J. R., & Wood, J. J. (2007). Examining the association between parenting and childhood depression: A meta-analysis. *Clinical psychology review*, 27(8), 986-1003.
- Mooney, S. J., & El-Sayed, A. M. (2016). Stigma and the etiology of depression among the obese: an agent-based exploration. *Social science & medicine*, 148, 1-7.
- Ng, Q. X., Soh, A. Y. S., Loke, W., Lim, D. Y., & Yeo, W.-S. (2018). The role of inflammation in irritable bowel syndrome (IBS). *Journal of inflammation research*, 11, 345.
- Ossola, P., De Panfilis, C., Tonna, M., Ardissino, D., & Marchesi, C. (2015). DS 14 is more likely to measure depression rather than a personality disposition in patients with acute coronary syndrome. *Scandinavian Journal of Psychology*, 56(6), 685-692.

- Ota, M., Takeda, S., Pu, S., Matsumura, H., Araki, T., Hosoda, N., Yamamoto, Y., Sakakihara, A., & Kaneko, K. (2020). The relationship between cognitive distortion, depressive symptoms, and social adaptation: A survey in Japan. *Journal of affective disorders, 265*, 453-459.
- Pereira, M. L., Ferraz, M. P. d. T., Peçanha, D. L. N., Mesquita, M. E., Finazzi, M. E. P., & Bordin, I. A. S. (2015). Family functioning in adolescents with major depressive disorder: A comparative study. *Estudos de Psicologia (Campinas), 32*(4), 641-652.
- Qi, R., Liu, C., Ke, J., Xu, Q., Zhong, J., Wang, F., Zhang, L. J., & Lu, G. M. (2016). Intrinsic brain abnormalities in irritable bowel syndrome and effect of anxiety and depression. *Brain imaging and behavior, 10*(4), 1127-1134.
- Rafezi, Z., Asghari, M., & Mashayekh, M. (2018). Comparison of Personality Traits of Irritable Bowel Syndrome Patients and Healthy Individuals: Five -Factor Model [Research]. *Yafte, 19*(5), 34-42. <http://yafte.lums.ac.ir/article-1-2422-fa.html>
- Rnic, K., Dozois, D. J., & Martin, R. A. (2016). Cognitive distortions, humor styles, and depression. *Europe's journal of psychology, 12*(3), 348.
- Saito, Y. A., Schoenfeld, P., & Locke III, G. R. (2002). The epidemiology of irritable bowel syndrome in North America: a systematic review. *The American journal of gastroenterology, 97*(8), 1910-1915.
- Shao, Y., Yin, H., & Wan, C. (2017). Type D personality as a predictor of self-efficacy and social support in patients with type 2 diabetes mellitus. *Neuropsychiatric disease and treatment, 13*, 855.
- Sheeber, L. B., Allen, N. B., Leve, C., Davis, B., Shortt, J. W., & Katz, L. F. (2009). Dynamics of affective experience and behavior in depressed adolescents. *Journal of Child Psychology and Psychiatry, 50*(11), 1419-1427.
- Sibelli, A., Chalder, T., Everitt, H., Workman, P., Windgassen, S., & Moss-Morris, R. (2016). A systematic review with meta-analysis of the role of anxiety and depression in irritable bowel syndrome onset. *Psychological medicine, 1*-16.
- Song, J., Chen, H., & Liang, T. (2019). Family functioning and 1-year prognosis of first-episode major depressive disorder. *Psychiatry Research, 273*, 192-196.
- Spek, V., Nefs, G., Mommersteeg, P. M., Speight, J., Pouwer, F., & Denollet, J. (2018). Type D personality and social relations in adults with diabetes: results from diabetes MILES–The Netherlands. *Psychology & health, 33*(12), 1456-1471.
- Stevens, J. P. (2012). *Applied multivariate statistics for the social sciences*. Routledge.
- van Dooren, F. E., Verhey, F. R., Pouwer, F., Schalkwijk, C. G., Sep, S. J., Stehouwer, C. D., Henry, R. M., Dagnelie, P. C., Schaper, N. C., & van der Kallen, C. J. (2016). Association of Type D personality with increased vulnerability to depression: Is there a role for inflammation or endothelial dysfunction?–The Maastricht Study. *Journal of affective disorders, 189*, 118-125.
- Westfall, P., & Henning, K. S. (2013). *Understanding advanced statistical methods*. CRC Press.
- Wiegand-Grefe, S., Sell, M., Filter, B., & Plass-Christl, A. (2019). Family functioning and psychological health of children with mentally ill parents. *International journal of environmental research and public health, 16*(7), 1278.
- Williams, L., Abbott, C., & Kerr, R. (2016). Health behaviour mediates the relationship between Type D personality and subjective health in the general population. *Journal of health psychology, 21*(10), 2148-2155.
- World Health Organization, W. (2015). *Tracking universal health coverage: first global monitoring report*. World Health Organization.

Yilmaz, B., Canan, F., Sengül, E., Özkurt, F., Tuna, S., & Yildirim, H. (2016). Type D personality, anxiety, depression and personality traits in patients with isolated itching of the external auditory canal. *The Journal of laryngology and otology*, 130(1), 50.

Yoosefi, N. (2012). An investigation of the psychometric properties of the McMaster clinical rating scale. *Educational Measurement*, 3(7), 83-112. <https://www.sid.ir/fa/journal/ViewPaper.aspx?id=169447>

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [RegressionWeights.docx](#)
- [normalitytestresults.docx](#)