Original Research

Evaluation of Temperament and Character Traits and Their Subscale Dimensions Associated with Major Depressive Disorder

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Abstract

Objectives: The relationship between major depressive disorder (MDD) and, especially harm avoidance, self-directedness, and cooperativeness has been determined based on Cloninger's psychobiological personality model; there are not enough studies in the literature on the role of the subdimensions. Therefore, the aim of this study was to compare the patients with MDD and healthy controls in terms of temperament and character traits and especially subdimensions and thus to determine the role and predictive value of temperament and character subdimensions in major depression patients.

Methods: The sample of this cross-sectional study consisted of 105 participants, 65 of whom were MDD patients, and 40 healthy controls, who voluntarily agreed to participate in the study. Sociodemographic data form, temperament and character inventory, and Hamilton depression rating scale were administered to the participants.

Results: Compared with healthy controls, patients with MDD had lower self-directedness (p<0.001), cooperativeness (p=0.017), persistence (p<0.001), self-transcendence (p=0.001), and higher harm avoidance (p<0.001) scores. While there was no significant difference in novelty seeking (p=0.774); it was determined that MDD patients got higher scores in "Impulsiveness" (p=0.013) and lower scores in "Exploratory excitability" (p=0.001) subscales. Reward dependence has been identified as the only personality trait that there was no significant difference between major depression patients and healthy controls (p=0.511). As a result of the logistic regression analysis performed to determine the predictors of temperament and character subdimensions in major depression patients, only three temperament and character traits "Fatigability, Purposefulness, and Spiritual Acceptance" were determined as significant predictors (p<0.001). Fatigability was determined to be a serious risk factor, increasing the probability of MDD 3.6 times (p<0.001); purposefulness and spiritual acceptance were found to be protective personality traits that together reduced the probability of MDD by 0.8 times (p<0.001).

Conclusion: This study shows that the risk of developing MDD is increased in individuals with low self-directedness, cooperativeness, persistence, and self-transcendence profiles, and whereas with prominent Harm avoidance personality traits. Therapeutic interventions, especially considering the temperament and character traits of "Fatigability, Purposefulness, and Spiritual Acceptance" determined in our study, may contribute positively to MDD treatment.

Keywords: Character, major depressive disorder, temperament, personality

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Major depressive disorder (MDD) is a mood disorder characterized by depressed mood or anhedonia lasting for a minimum of 2 weeks.[1] MDD reduces quality of life and seriously limits social and professional functioning. MDD is cited as the third leading contributor to the global burden of disease and is predicted to be the top contributor in 2030.[2] Despite the effectiveness of current treatments, only half of patients with major depression respond to treatment; approximately 70% fail to achieve full remission.[3]

The relationship between personality traits and MDD is complicated. Personality traits may make an individual prone to MDD or change the clinical manifestation of MDD, or MDD can cause changes in personality traits.[4] Cloninger developed a dimensional model for the assessment of personality traits, defining the dimensions of temperament and character as the two primary components of personality.[5] Cloninger's psychobiological model is among the most commonly used models in the current psychiatric literature for defining individual differences in psychopathological behavior.[6]

Human temperament is largely genetic and forms in early childhood.[7] Temperament is considered to be the emotional core of personality and is assessed in four dimensions in the psychobiological model: Harm avoidance, novelty seeking, reward dependence, and persistence. These dimensions are associated with neurotransmitter circuits in the central nervous system: Novelty seeking with dopamine, harm avoidance with serotonin, reward dependence, and persistence with noradrenaline.[5,8] According to Cloninger, the subdimensions of temperament are genetically independent and constant for a lifetime; that is, they are unchanging against sociocultural influences.[5] Character, defined as the individual differences in the concept of ego (self) with a lifelong development in response to sociocultural influences, is assessed according to three dimensions in the psychobiological model: Self-directedness, cooperativeness, and self-transcendence. Self-directedness is defined as having willpower and determination and is associated with an individual's self-acceptance. Cooperativeness, identified as individual differences in tolerance and empathy, is linked to the individual's acceptance of others. Self-transcendence is defined as individual differences in spirituality and is associated with an individual's feeling of being an integral part of nature and the universe.[8,9]

Cloninger's psychobiological personality model has been applied extensively to individuals affected by mood disorders and found that MDD patients were positively correlated with the temperament dimension of harm avoidance,[10-17] and negatively correlated with the character

dimensions of self-directedness and cooperativeness.[7,11,14,15,17,18] The role of novelty seeking, reward dependence, persistence temperament dimensions, and self-transcendence character dimension in MDD could not be clarified because the results of various studies were inconsistent.[3,13,15,19,20] Most studies are highly heterogeneous in sample size, assessment methods, and selection of participants; therefore, different results may have been obtained.[21]

The relationship between MDD and, especially harm avoidance, self-directedness, and cooperativeness has been determined based on Cloninger's psychobiological personality model, there are not enough studies in the literature on the role of the subdimensions. Therefore, the aim of this study was to compare patients with MDD and healthy controls in terms of temperament and character traits and especially subdimensions and thus to determine the role and predictive value of temperament and character subdimensions in major depression patients.

Methods

Sampling

This study was designed as a cross-sectional study to include patients within the age range of 18–65 years who attended the psychiatry polyclinic of our hospital between July 1, 2020, and January 1, 2021. Patient participants were diagnosed with MDD according to the DSM-V of the American Psychiatric Association; they provided written consent for participation. All MDD patients were drug naive and in their first depressive episode. Exclusion criteria were meeting the criteria of any psychiatric disorder other than MDD in the psychiatric evaluation, according to DSM-V diagnostic criteria; alcohol or substance use disorder; any neurological or physical disease; and cognitive disability that would be problematic in understanding the study directives and completing the study tools' scale items.

The study's healthy control group consisted of individuals aged 18–65 years who applied to the medical board of our hospital during the same period. These participants were not diagnosed with any physical disease in the medical board's examination, did not meet the criteria for any psychiatric disorder according to the diagnostic criteria of DSM-V, and had no cognitive disabilities that would be problematic in understanding the study directives and completing the study tools' scale items. Three of 68 MDD patients and three of 43 healthy controls who accepted to participate in the study were not included in the study because they filled the temperament and character inventory (TCI) incompletely. A total of 105 voluntary participants, 65 patients with MDD and 40 healthy controls, constituted the study sample.

Evaluation Instruments

Sociodemographic Data Form

A form was prepared by the researchers to collect participant data, including age, gender, marital status, education level, and employment status.

TCI

TCI is a self-report scale consisting of 240 true/false items.[22] The validity and reliability of the Turkish version of the scale were confirmed in a study by Köse et al.; that study found Cronbach alpha values between 0.60 and 0.85 in the temperament dimension and 0.82 and 0.83 in the character dimension.[23] The scale was further tested by Arkar et al. who found Cronbach alpha values between 0.55 and 0.84 in the temperament dimension and 0.80 and 0.84 in the character dimension.[24]

Hamilton Depression Rating Scale (HDRS)

HDRS is among the most common depression assessment scales used by researchers and clinicians.[25] The validity and reliability of the Turkish version of the scale were confirmed in a study by Akdemir et al.[26]

Process

This study was approved by the Ethics Committee for Non-Invasive Clinical Research, the Faculty of Medicine of Alanya Alaaddin Keykubat University on June 5, 2020, under decision no. 19-20. With approval obtained from the ethics committee, the participant volunteers who attended either the psychiatry polyclinic between July 1, 2020, and January 1, 2021, and satisfied the inclusion criteria constituted the study sample. Participants were provided information about the study; their informed consent was received in writing. The sociodemographic data form, temperament and character inventory, and HDRS were then administered to participants.

Statistical Analysis

In the study's statistical analysis and results, numeric variables were shown as mean and standard deviation values; categorical variables were reflected as numbers and percentages. Any differences between the groups in terms of categorical variables were studied using the Chi-square test. For numeric variables, a one-way analysis of variance was applied to compare variables that created more than 2 independent groups. With any statistically significant differences, paired comparisons were made using Tukey's post hoc test. For the comparison of variables forming two independent groups in terms of numeric variables, the independent group's t-test was used. Logistic regression analysis was applied to determine the predictability of the subscale dimensions of temperament and character in MDD prediction. Participant status as a patient with MDD or healthy control was a binary dependent variable; age, gender, and temperament and character subscale dimensions determined to be risk factors for MDD were the independent variables. The Box-Tidwell method was used to control whether the independent variables of the model had linear relationships with the logit and was introduced into the model in the right scale. In the final stage of the statistical analysis, the interactions of the independent variables of the model were evaluated and the interaction terms were determined. The data were assessed using the SPSS (Statistical Package for the Social Sciences) 22.0 statistics program, and the statistical significance level was set as $P \leq 0.05$.[27]

Results

Sociodemographic and Clinical Characteristic of the Participants

The sociodemographic data of 65 patients with MDD with an average age of 27.86±8.83 years and consisting of 51 females and 14 males with a mean HDRS score of 18.48±4.58 are shown in Table 1. Among the patients with MDD, 30.7% were married, 46.1% were high school graduates, and 40% were in the workforce. According to their HDRS scores, 12.3% were diagnosed with mild MDD, 44.6% with moderate MDD, 23% with severe MDD, and 20% with very severe MDD. The patients were divided into groups according to age (p=0.305), gender (p=0.681), marital status (p=0.304), education level (p=0.991), and employment status (p=0.745). No statistically significant differences were found with HDRS scores (Table 1). The MDD patient group was compared with 40 healthy controls consisting of 27 females and 13 males with an average age of 30.53±9.73 years. Age and gender comparisons were made; no differences between the two groups were found in terms of age (p=0.152) and gender (p=0.212). Table 2 presents the comparison of the two groups in terms of TCI – temperament traits; Table 3 presents the comparison in terms of TCI – character traits.

Comparison of MDD Patient Group and Healthy Control Group in Terms of Temperament and Character Inventory – Temperament Traits

Although no correlation was found between novelty seeking and MDD (p=0.774), assessment of the subscale dimensions revealed that, compared with healthy controls, patients with MDD had higher scores in the impulsiveness subscale dimension (p=0.013) and lower scores in the exploratory excitability subscale dimension (p=0.001). It was

Table 1. Comparison of sociodemographic characteristics and Hamilton depression rating scale scores of major depressive disorder patient group in terms of sociodemographic variables

	N/Mean	%/SD	HDRS score		Mean Diff./F	95% CI		P
			Mean	SD		Lower limit	Upper limit	
N: 65	27.86	8.83	18.48	4.58				
Age								
18–30	41	63.07	18.93	4.74	1.218	−1.134	3.571	0.305
31 and above	24	36.93	17.71	4.27				
Gender								
Female	51	78.46	18.35	4.88	−0.576	−3.357	2.206	0.681
Male	14	21.54	18.93	3.36				
Marital status								
Married	20	30.76	18.15	3.92	1.215	16.31	19.99	0.304
Single	39	60.00	19.03	4.77		17.48	20.57	
Divorced	6	9.23	16.00	5.17		10.57	21.43	
Marital status								
Married	20	30.76	18.15	3.92	−0.472	−2.950	2.006	0.705
Unmarried	45	69.23	18.62	4.88				
Education level								
Primary sch.	19	29.23	18.58	5.13	0.009	16.10	21.05	0.991
High school	30	46.15	18.40	4.25		16.81	19.99	
University	16	24.62	18.50	4.78		15.95	21.05	
Employment status								
Employed	26	40.00	18.62	4.67	0.412	16.73	20.50	0.745
Housewife	13	20.00	17.38	3.90		15.02	19.74	
Student	18	27.69	18.56	4.00		16.56	20.55	
Unemployed	8	12.31	19.63	6.71		14.01	25.04	
Employment status								
Employed	26	40.00	18.62	4.67	0.231	−2.106	2.567	0.844
Unemployed	39	60.00	18.38	4.58				
HDRS score								
8–13	8	12.31	12.25	1.03	175.36	11.38	13.12	<0.001
14–18	29	44.62	15.90	1.49		15.33	16.47	
19–22	15	23.07	20.80	0.94		20.28	21.32	
23 and above	13	20.00	25.38	2.18		24.07	26.70	
HDRS score								
18 and below	37	56.92	15.11	2.06	−7.82	−9.033	−6.608	<0.001
19 and above	28	43.08	22.93	2.82				

HDRS: Hamilton depression rating scale, Diff: Difference, SD: Standard deviation, CI: Confidence interval, P: Statistical significance P≤0.05, independent groups t-test and ANOVA test.

determined that, compared with healthy controls, patients with major depression had higher scores in the harm avoidance temperament dimension (p<0.001) and all subscales anticipatory worry (p<0.001), fear of uncertainty (p=0.001), shyness (p<0.001), and fatigability (p<0.001). Reward dependence, including its subscale dimensions, was determined to be the only personality trait that was not correlated with MDD (p=0.511). In the temperament dimension of persistence, patients with major depression had lower scores compared with healthy controls (p<0.001) (Table 2).

Comparison of MDD Patient Group and Healthy Control Group in Terms of Temperament and Character Inventory – Character Traits

Compared with patients with major depression, healthy controls had higher scores in the self-directedness character dimension (p<0.001) and all of its subscales responsibility (p<0.001), purposefulness (p<0.001), resourcefulness (p<0.001), self-acceptance (p=0.009), and enlightened second nature (p<0.001); in the cooperativeness character

Table 2. Comparison of MDD patient group and HC group in terms of TCI – temperament traits

	N	TCI temperament score		Mean difference	95% confidence interval		P
		Mean	SD		Lower limit	Upper LIMIT	
Exploratory excitability							
MDD	65	4.83	2.27	−1.319	−2.147	−0.492	0.001
HC	40	6.15	1.70				
Impulsiveness							
MDD	65	4.83	1.97	0.956	0.209	1.702	0.013
HC	40	3.88	1.69				
Extravagance							
MDD	65	4.86	2.56	0.312	−0.516	1.139	0.457
HC	40	4.55	1.70				
Disorderliness							
MDD	65	4.60	1.69	0.300	−0.418	1.018	0.409
HC	40	4.30	1.96				
Novelty seeking TS							
MDD	65	19.12	5.11	0.248	−1.465	1.961	0.774
HC	40	18.88	3.70				
Anticipatory worry							
MDD	65	8.80	1.77	3.750	2.820	4.680	<0.001
HC	40	5.05	2.59				
Fear of uncertainty							
MDD	65	5.18	1.43	1.310	0.580	2.039	0.001
HC	40	3.88	2.01				
Shyness							
MDD	65	5.25	2.20	2.021	1.130	2.912	<0.001
HC	40	3.23	2.28				
Fatigability							
MDD	65	7.06	1.56	3.762	3.088	4.435	0.001
HC	40	3.30	1.88				
Harm avoidance TS							
MDD	65	26.29	4.70	10.842	8.439	13.245	<0.001
HC	40	15.45	6.64				
Sentimentalit							
MDD	65	7.12	1.89	−0.502	−1.266	0.262	0.195
HC	40	7.63	1.95				
Attachment							
MDD	65	3.68	2.11	−0.173	−0.926	0.580	0.649
HC	40	3.85	1.73				
Dependence							
MDD	65	2.57	1.64	0.169	−0.414	0.753	0.566
HC	40	2.40	1.33				
Reward depend. TS							
MDD	65	13.37	3.93	−0.506	−2.026	1.015	0.511
HC	40	13.88	3.60				
Persistence							
MDD	65	3.88	1.94	−1.848	−2.607	−1.090	<0.001
HC	40	5.73	1.84				

MDD: Major depressive disorder, HC: Healthy control, N: Sample number, TCI: Temperament and character inventory, TS: Total score, Depend: Dependence, SD: Standard deviation, P: Statistical significance, P≤0.05, independent groups t-test.

Table 3. Comparison of MDD patient group and HC group in terms of TCI – character traits

	N	TCI character score		Mean Diff.	95% confidence interval		P
		Mean	**SD**		**Lower limit**	**Upper limit**	
Responsibility							
MDD	65	2.83	1.97	−2.069	−2.857	−1.281	<0.001
HC	40	4.90	1.98				
Purposefulness							
MDD	65	3.11	1.63	−2.767	−3.406	−2.128	<0.001
HC	40	5.88	1.55				
Resourcefulness							
MDD	65	1.77	1.22	−1.556	−2.074	−1.037	<0.001
HC	40	3.33	1.42				
Self-acceptance							
MDD	65	4.71	2.28	−1.467	−2.552	−0.383	0.009
HC	40	6.18	2.93				
Enlightened second nature							
MDD	65	6.40	2.17	−2.825	−3.666	−1.984	<0.001
HC	40	9.23	2.00				
Self-directedness TS							
MDD	65	18.82	6.00	−10.685	−13.232	−8.137	<0.001
HC	40	29.50	6.97				
Social acceptance							
MDD	65	5.35	1.94	−1.021	−1.756	−0.286	0.007
HC	40	6.38	1.67				
Empathy							
MDD	65	3.83	1.47	−0.594	−1.188	0.000	0.050
HC	40	4.43	1.51				
Helpfulness							
MDD	65	3.95	1.54	−0.546	−1.130	0.037	0.066
HC	40	4.50	1.32				
Compassion							
MDD	65	6.14	3.31	−0.337	−1.672	0.999	0.618
HC	40	6.48	3.41				
Pure-hearted conscience							
MDD	65	6.20	1.62	−0.825	−1.453	−0.197	0.010
HC	40	7.03	1.49				
Cooperativeness TS							
MDD	65	25.48	7.19	−3.323	−6.043	−0.603	0.017
HC	40	28.80	6.16				
Self-forgetfulness							
MDD	65	6.42	2.21	−0.185	−1.071	0.702	0.680
HC	40	6.60	2.24				
Transpersonal identification							
MDD	65	4.18	2.33	−1.465	−2.330	−0.601	0.001
HC	40	5.65	1.86				
Spiritual acceptance							
MDD	65	6.66	2.75	−1.763	−2.822	−0.705	0.001
HC	40	8.43	2.49				
Self-trans. TS							
MDD	65	17.26	5.80	−3.413	−5.445	−1.382	0.001
HC	40	20.68	4.59				

MDD: Major depressive disorder, HC: Healthy control, N: Sample number, TCI: Temperament and character inventory, Diff: Difference, SD: Standard deviation, Trans: Transcendence, TS: Total score, P: Statistical significance, P≤0.05, independent groups t-test.

dimension (p=0.017) and its social acceptance (p=0.007), empathy (p=0.050), and pure hearted conscience (p=0.010) subscales; and in the self-transcendence character dimension (p=0.001) and its transpersonal identification (p=0.001), and spiritual acceptance (p=0.001) subscales (Table 3).

Logistic Regression Analysis Performed to Determine the Predictors of Temperament and Character Subdimensions in MDD

From the comparison of temperament and character subscale dimensions in patients with MDD and healthy controls, 17 temperament and character traits were determined to be risk factors for MDD: "Exploratory excitability, impulsiveness, anticipatory worry, fear of uncertainty, shyness, fatigability, persistence, responsibility, purposefulness, resourcefulness, self-acceptance, enlightened second nature, social acceptance, empathy, pure hearted conscience, transpersonal identification, and spiritual acceptance" (Tables 2 and 3). Table 4 shows the results of logistic regression analysis of the temperament and character variables considered to be associated with MDD or not (dependent variable). Due to the multiple connections determined, the total scores of harm avoidance, self-directedness, cooperativeness, and self-transcendence were not included in the model. The most suitable logistic regression model was formed with fatigability (p<0.001), purposefulness (p=0.001), and spiritual acceptance (p=0.013) among the independent variables (Table 4, Model 1).

Table 4 shows the most suitable logistic regression model formed by determining the interaction between the variables of purposefulness and spiritual acceptance and introducing the interaction term "purposefulness*spiritual acceptance" into the model (Table 4, Model 2).

When the interaction term was introduced into the model, the independent variables of purposefulness (p=0.075) and spiritual acceptance (p=0.076) lost their statistical significance. By adding the interaction term and removing the independent variables that lost their statistical significance, a final model was formed. The final model

Table 4. Logistic regression analysis performed to determine the predictors of temperament and character subdimensions in MDD

	β	SE	Wald	P	Odds ratio	95% CI for odds ratio	
						Lower limit	Upper limit
Model 1 independent variable							
Fatigability	1.047	0.267	15.404	<0.001	2.849	1.689	4.805
Purposefulness	−1.088	0.314	12.000	0.001	0.337	0.182	0.623
Spiritual acceptance	−0.522	0.211	6.148	0.013	0.593	0.392	0.896
Constant	3.803	2.441	2.427	0.119	44.842		
Model 2 independent variable							
Fatigability	1.682	0.478	12.371	<0.001	5.375	2.106	13.722
Purposefulness	1.689	0.947	3.180	0.075	5.416	0.846	34.680
Spiritual acceptance	0.930	0.524	3.148	0.076	2.535	0.907	7.082
Purposefulness* Spiritual acceptance	−0.371	0.142	6.763	0.009	0.690	0.522	0.913
Constant	−10.883	5.583	3.799	0.051	0.000		
Model 3 independent variable							
Fatigability	1.282	0.319	16.130	<0.001	3.603	1.927	6.734
Purposefulness* spiritual acceptance	−0.150	0.041	13.531	<0.001	0.861	0.794	0.932
Constant	−1.312	1.431	0.841	0.359	0.269		

*Interaction term, β: Independent variable coefficient, SE: Standard error, CI: Confidence interval, MDD: Major depressive disorder, P: Statistical significance, P≤0.05. The likelihood-ratio Chi-squared test statistics of the model: 96.346 (P<0.001). Model-2 log likelihood: 43.205, Cox-Snell R-squared: 0.601, Nagelkerke R-squared: 0.817. The Hosmer and Lemeshow goodness-of-fit test Chi-squared value: 10.606 (P=0.157) (Table 4, Model 1). The likelihood-ratio Chi-squared test statistics of the model: 104.847 (P<0.001). Model-2 log likelihood: 34.704, Cox-Snell R-squared: 0.632, Nagelkerke R-squared: 0.859. The Hosmer and Lemeshow goodness-of-fit test Chi-squared: 2.545 (P=0.924) (Table 4, Model 2). The likelihood-ratio Chi-squared test statistics of the model: 101.646 (P<0.001). Model-2 log likelihood: 37.905, Cox-Snell R-squared: 0.620, Nagelkerke R-squared: 0.843. The Hosmer and Lemeshow goodness-of-fit test Chi-squared: 4.915 (P=0.767) (Table 4, Model 3).

included fatigability (p<0.001) and the interaction term of "purposefulness*spiritual acceptance" (p<0.001), (Table 4, Model 3).

Discussion

In this study, patients with major depression were compared with healthy controls in terms of temperament and character traits, according to Cloninger's psychobiological personality model. Individuals with low self-directedness, cooperativeness, persistence, and self-transcendence profiles and with prominent harm avoidance personality traits were found to be at higher risk of developing MDD. To the bets of our knowledge, this study is the first in Turkey to investigate the predictability of the subscale dimensions of temperament and character traits in MDD prediction based on Cloninger's psychobiological personality model. The most significant result of this study is that "Fatigability, Purposefulness, and Spiritual Acceptance" were the temperament and character subdimensions that predict MDD. Therapeutic interventions, especially considering these personality traits determined in our study, may contribute positively to the treatment of MDD.

Cloninger et al. found that patients with MDD scored lower in the character dimensions of self-directedness and cooperativeness and higher in the temperament dimension of harm avoidance, defined as inhibition of behavior as a response to signals of punishment.[7,18] Cloninger suggested that these dimensions of personality might predict a personality disorder associated with MDD and that the character dimensions of self-directedness and cooperativeness might be protective factors against MDD.[7] Individuals demonstrating high harm avoidance and low self-directedness traits also have reduced tolerance for stressful life events. Serotonin receptor sensitivity, which is well known for its association with MDD, is positively correlated with harm avoidance and negatively correlated with self-directedness.[11] Paralleling the results of Cloninger et al., our study also found low self-directedness and cooperativeness scores and high harm avoidance scores in patients with major depression. Consistent with the existent literature, the results of our study show that low self-directedness and cooperativeness character dimensions and a high harm avoidance temperament dimension may be personality traits associated with MDD. As this study does not involve patients with MDD in remission, we were unable to deduce or determine accurately if personality traits are circumstantial factors or independent risk factors in MDD.

Studies report that the temperament dimensions of reward dependence and novelty seeking are not influenced by the clinical conditions of patients with MDD.[28] Therefore, it is important to identify the relationship between these temperament dimensions and MDD, as novelty seeking and reward dependence may remain unchanged with respect to mood. Our study found reward dependence to be the only personality trait that could not be associated with MDD. There is little evidence of correlation between reward dependence and MDD, unlike correlations seen with the personality traits of harm avoidance and self-directedness.[16] No correlation between reward dependence and MDD was also found in studies by Balestri et al. and Arkar.[3,20] This study did not find any significant difference between patients with MDD and healthy controls in the temperament dimension of novelty seeking; however, an assessment of the subscale dimensions revealed that, in comparison to healthy controls, patients with MDD had higher scores in the impulsiveness subscale dimension and lower scores in the exploratory excitability subscale dimension, like Arkar's study.[20] The low scores observed with exploratory excitability may facilitate an understanding of the difficulties patients with MDD experience initiating new behavior and actively exploring their environments. These difficulties may be consequences of depression becoming chronic rather than causes of depression.[29] The high scores observed for the impulsivity subscale may be a warning for clinicians in terms of comorbid personality disorders. In a prospective study conducted by Joyce et al., it was reported that patients with MDD who were found to have high scores for the novelty seeking impulsiveness subscale were a depressive subgroup that also demonstrated borderline personality disorder.[30] Our study has highlighted the importance of evaluating the novelty seeking subscale dimensions, rather than simply making a dimensional assessment.

In the original version of Cloninger's psychobiological model, persistence was a subscale dimension for the temperament dimension of reward dependence; the model was later revised to convert persistence to an independent temperament dimension. Cloninger et al. found higher persistence scores in patients with MDD.[19] According to Cloninger, individuals with high persistence scores are hardworking, eager, and perfectionistic.[7] These traits may lead individuals to be excessively hard on themselves in the name of success, thus affecting the development of depression.[31] Balestri et al., in contrast to Cloninger, found lower persistence scores in patients with MDD, similar to our results.[3] Individuals with low persistence levels may be silent, passive, and prone to depression when faced with disappointments or when rewards are rare or take a long time to emerge. Indecisiveness and a tendency to quit in individuals with low persistence are similar to depressive mood.[22,32]

Self-transcendence was found to be correlated with MDD in some studies,[30] but not in others.[20] In our study, pa-

tients with MDD scored lower than healthy controls in the self-transcendence character dimension, similar to the results for the character dimensions of self-directedness and cooperativeness. High self-transcendence is considered an adaptive personality trait and is associated with creativity in combination with high self-directedness and cooperativeness. Cloninger et al. suggested that absent the combination, schizotypal personality disorder may occur.[7] Therefore, rather than evaluating self-transcendence specifically, it would be more appropriate to make an assessment that considers that the relationship between self-transcendence has with other character dimensions. The previous studies have shown that rather than the isolated effect of self-transcendence, the relationship it has with other character and temperament dimensions influences depression.[33,34]

Although the correlations between MDD and the temperament and character dimensions of Cloninger's psychobiological personality model have been well documented, there are few studies on the correlation of MDD with temperament and character subscale dimensions. Our study found differences between patients with MDD and healthy controls in 17 of the 25 temperament and character subscales. Yet, the logistic regression analysis conducted to determine the predictability of temperament and character subscale dimensions in patients with MDD found only three temperament and character traits to be significant predictors: Fatigability, purposefulness, and spiritual acceptance.

Loss of energy, weakness, and exhaustion are listed among the diagnostic criteria for MDD according to the American Psychiatric Association's DSM-V.[1] Individuals with depression often complain about loss of energy, including exhaustion and fatigue, and an unexplained feeling of fatigue may be an onset symptom of depression. A study from Elovainio et al. also determined fatigability, part of the temperament dimension of harm avoidance, to be a predictor of MDD.[35] Our study confirmed fatigability as a serious risk factor, increasing the likelihood of MDD by 3.6 times. Individuals scoring high on the fatigability subscale appear asthenic and have lower energy than the majority of the population. They often require naps or longer rest times. Characteristically, these individuals recover more slowly from minor diseases or stress.[5,22,36] According to the results of the discriminant analysis conducted by Arkar et al. in a Turkish validity reliability study of the TCI using 25 subscales with regard to the predictability of belonging in psychiatric patient or healthy normal groups, the fatigability subscale revealed the strongest correlation with discriminant function.[24] Fatigability can also be considered a personality trait that predicts not only MDD but psychiatric diseases in general.

In a study conducted by Elovainio et al., other significant predictors of MDD, in addition to fatigability, were shyness, sentimentality, and persistence.[35] All of the significant predictors found by the aforementioned study belong to the temperament dimension. Our study determined that the combination of purposefulness and spiritual acceptance was a personality trait that protected against MDD, decreasing the likelihood of developing MDD by 0.8 times. Purposefulness is part of the self-directedness character dimension while spiritual acceptance is part of the self-transcendence character dimension. Cloninger stated that character dimensions may better handle psychopathology and personality pathology.[5] Character traits may change and develop over a lifetime in response to learning and life experiences; thus, they may be included in therapeutic intervention objectives. Individuals scoring high on the subscale of purposefulness are generally identified as goal driven. Their lives have clear and distinct meaning, direction, and goals. Their actions are directed by long-term goals and values. Conversely, individuals scoring low on the subscale of purposefulness strive to find direction, aim, and meaning in their lives. They are indecisive about long-term goals. They feel that their lives are empty and have little or no meaning.[7,22,36] Our study found purposefulness to be a protective personality trait against MDD. Our results suggest that individuals who have a hard time choosing goals and personal values are at higher risk of developing MDD.

Individuals scoring low in spiritual acceptance experience coping difficulties when faced with the inevitability of death, disease, or unfair punishment if there is no possibility of evaluation through rational objective means.[7,22,36] Spiritual acceptance is observed as a character trait that facilitates individuals' coping skills in situations where there is lack of control. Our study found spiritual acceptance to be a protective personality trait against MDD, together with purposefulness. In Cloninger's original study, women scored higher on spiritual acceptance.[22] In our study, four-fifths of the MDD patient group and two-thirds of the healthy control group consisted of women. In the MDD patient group, there were more women than the healthy control group, which may have influenced our results. Therefore, our results in regard to the subscale dimensions should be considered with caution and must be tested in future studies.

Our study has some limitations that require further investigation. The study's deficiencies include the number of depressive episodes, disease onset age, and duration, which may have influenced the results. The plan is for our next study to include this data. In this study, temperament and character traits and MDD severity were assessed cross-sectionally, and for 1 time only, therefore, no causality re-

lationship was established. Another limitation is that this study involved only patients with MDD with active depressive symptoms; patients with MDD in remission were not included. As this was not a prospective study and the study was conducted with a relatively small sample, any type II statistical errors that may occur should be considered. Hence, study results should not be considered definitive; future studies should be conducted with larger patient samples.

Conclusion

This study demonstrates that individuals with low self-directedness, cooperativeness, persistence, and self-transcendence profiles and with prominent harm avoidance personality traits have a higher risk of developing MDD based on a dimensional evaluation of Cloninger's psychobiological personality model. Although our results must be supported by future studies, they suggest that depressive symptoms are correlated with the temperament and character subdimensions fatigability, purposefulness, and spiritual acceptance. As character traits can be changed and developed, therapeutic interventions should consider the personality traits of purposefulness and spiritual acceptance, and in this way, positive contributions can be made to the treatment of MDD.

Disclosures

Ethics Committee Approval: This study was approved by the Ethics Committee for NonInvasive Clinical Research, the Faculty of Medicine of Alanya Alaaddin Keykubat University on June 5, 2020, under decision no. 19-20.

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