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Mental Health Risks and Protective Personality Traits among Multinational Seafarers

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Abstract

The maritime profession is characterized by high psychosocial stress and isolation, posing significant risks to the mental health of seafarers. This study investigated the prevalence and predictors of psychological symptoms among a large multinational sample of seafarers using the Symptom Checklist-90-Revised scale. Personality traits were measured with the Big Five Inventory, and statistical analyses, including exploratory factor analysis, confirmatory factor analysis, and structural equation modeling, were employed to examine the factor structure and relationships with symptoms. Based on these analyses, a population-specific two-factor personality model—Ideal Personality and Balanced Social Personality (BSP)—was identified, with BSP showing a strong protective effect across all symptom domains. In addition to assessing common symptoms such as depression (27.2%), anxiety (15.8%), Obsessive-Compulsive disorders (33.1%), and Paranoid Ideation (32.3%), it was found that Turkish and Generation Z participants reported higher symptom levels, while better onboard social and nutritional facilities, positive onboard relationships, were associated with lower symptoms and higher BSP scores. These findings underscore that seafarers' mental health is shaped by demographic, occupational, and personality factors, suggesting that interventions should address both environmental conditions and individual differences to enhance resilience. By providing empirical evidence on both risk and protective factors, this study informs the development of targeted mental health policies and support mechanisms within the maritime sector.

Keywords: Seafarer, mental health, SCL-90-R, personality traits, confirmatory factor analysis

1. Introduction

It is known that the maritime industry has a history of various maritime accidents throughout its development. Despite advancements in maritime technologies, revisions in maritime regulations, and the implementation of long-standing safety measures, maritime accidents have continued to occur and have not been reduced to the anticipated extent [1]. One of the primary causes of these accidents is human error, and among the significant contributors to such errors are the adverse mental states experienced by seafarers [2]. Maritime accidents are also known to be related to the onboard safety culture and the seafarers' psychological state [3]. Indeed, most maritime accidents are associated with the human factor, which is irrefutable. For this reason, it is thought that there is a link between the psychological state of seafarers and maritime accidents [2]. Seafarers' work environments are considered dangerous both physically and psychosocially due to prolonged isolation, watchkeeping-based systems, uncertainties, and high workloads [4,5]. Therefore, it is acknowledged that such factors inherent in the nature of the maritime profession adversely affect the mental health and overall well-being of seafarers [6].

Maritime industry working conditions, characterized by long watchkeeping, variable working hours, and high job demands [7], have been associated with chronic fatigue, sleep problems, impaired circadian rhythms, and stress-related psychosomatic disorders [4]; these challenges are further compounded in multinational and multicultural environments, where language and cultural barriers emerge as

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significant sources of psychological strain for seafarers [8,9]. Sleep patterns, in particular, play a critical role in seafarers' health, as long working hours and irregular watchkeeping can negatively affect sleep quality [10]. Furthermore, chronic sleep deprivation and insomnia can cause not only fatigue and poor quality of life for seafarers, but also depression (DEP) and anxiety (ANX) [11]. Approximately 1.5 million seafarers in the world both work and live under adverse physical and mental conditions, often in dangerous conditions [12-14]. Therefore, the maritime profession is at a point where it cannot be compared to jobs ashore due to mental, psychosocial, and physical stress factors [12]. While some studies show that the mental health of seafarers is worse than other occupational groups [15], further research is needed to explore contributing factors. The fundamental needs and expectations of seafarers, as with other employees, are to lead a healthy and fulfilling lives. This aligns with the growing attention given to seafarers' well-being by organizations such as the International Maritime Organization and the International Labour Organization. In particular, the Maritime Labour Convention has established the protection of seafarers' physical and mental health as a legal obligation. This necessity is explicitly recognized at the international level in the preamble of the convention, which states that "seafarers need special protection" [16]. For example, one study reported that transient mental disorders among seafarers increased between 2011 and 2016, and that 37% of active seafarers in 2016 experienced a recent decline in their mental health. Compared to the general population, this figure indicates poorer mental health status, as highlighted in several studies [17]. In another study, the incidence of seafarers' mental health abnormalities was determined to be 49.9%, which is well above the normal population average [15]. Awareness of seafarers' mental health has also increased in the last 20 years [18]. Studies have shown that certain mental health problems, such as DEP and ANX, are associated with loneliness and psychological strain [19,20]. In addition to these general findings, recent evidence indicates that Turkish seafarers may be particularly vulnerable to mental health problems compared to their counterparts from other nationalities. Sivri [21] reported that Turkish seafarers scored significantly higher on ANX measures, while Kinali et al. [22] found depressive symptoms in 33.2% of participants. Sana et al. [23] further showed that family-related reasons were the most frequent cause for leaving the profession, which may reflect the strong cultural emphasis on close family ties in Türkiye. These findings suggest that Turkish seafarers' elevated DEP and ANX scores may stem not only from occupational stressors but also from cultural factors, particularly limited tolerance for prolonged isolation and family separation. While family separation emerges as a central challenge, onboard peer support has been shown to play a significant role in reducing mental health problems and fatigue, as well as in coping with anxieties and work-related pressures [24]. In addition, it is widely recognized that seafarers are more fatigued than workers in other industries due to demanding working conditions, and the resulting strain and accumulated exhaustion can pose risks not only to their own health but also to the safety of their colleagues [25]. As noted by Ma and Liao [26], fatigue is not only an individual issue; positive interpersonal and workplace relationships also play a significant role in alleviating seafarers' fatigue. Therefore, the mental health of seafarers should be considered not merely an individual issue but a critical concern for the sustainability and safety of the maritime industry.

In addition to these findings regarding the mental health of seafarers, it is well recognized that individual differences may also play a decisive role in this process. Among these individual differences, personality traits stand out as a primary factor. Personality refers to relatively stable individual differences in the ways people think, feel, and behave [27]. These differences are shaped by factors such as individuals' cultural environments, developmental experiences, and genetic makeup. Indeed, having diverse backgrounds leads to variation in individuals' attitudes, values, and norms, which in turn lays the foundation for the development of different personality structures [28]. Personality traits exhibit relative stability over time, primarily shaped by genetic factors [29] and early life experiences [30], as supported by longitudinal evidence [31]. One of the most widely used personality theories in the psychology literature is the Five Factor Model (FFM). This model conceptualizes personality along five core dimensions: extraversion, agreeableness, conscientiousness, openness to experience, and emotional stability (neuroticism, reverse-coded) [32,33]. FFM is widely used in personality research due to its cross-cultural validity and temporal stability [34]. Research has shown that personality dimensions are significantly associated with individuals' mental health. High levels of neuroticism are particularly associated with adverse psychological symptoms such as DEP and suicidal ideation [35]. In contrast, extraversion has been positively associated with psychological well-being [36]. Therefore, personality is considered an important and determining factor in understanding and explaining individuals' levels of psychological resilience and their coping styles with stress [37]. Some studies conducted specifically in the maritime context have demonstrated that personality traits are not only influential at the individual level but also play a significant role in work-related outcomes. For instance, Slišković et al. [38] reported that, within the framework of the FFM of personality, emotional stability, extraversion, and conscientiousness were positively associated with both general job satisfaction and maritime job-specific satisfaction among seafarers. Emotional stability was highlighted as the

most influential trait for job satisfaction and psychological adjustment, particularly given the high-stress nature of the maritime profession. This finding suggests that seafarers' mental health is closely linked not only to external conditions but also to individual temperament and personality profiles. Moreover, it was noted that situational factors—such as living conditions onboard, duration of service, and workload—can exert a stronger influence than personality traits.

Considering the complex and high-stress working environment in the maritime profession, this study examines both the psychological symptoms and the influence of personality traits on mental well-being among seafarers. Although research on seafarers' mental health has increased in recent years, studies combining large sample sizes, multinational scope, and broad assessment of psychological symptoms remain limited. Moreover, previous studies have predominantly focused on environmental and occupational stressors, while the role of individual factors—particularly personality traits—remains underexplored. By addressing these gaps, the present study provides comparative insights into the prevalence of psychological symptoms and the contribution of personality traits across a multinational, diverse, and sizable sample of seafarers. Using the Symptom Checklist-90-Revised (SCL-90-R) scale, this research identifies key psychological risk factors and highlights the protective role of specific personality traits. Notably, instead of the traditional FFM, Exploratory Factor Analysis (EFA) of the Big Five Inventory (BFI-10) revealed a two-factor structure specific to the seafarer population, labeled Ideal Personality (I-P) and Balanced Social Personality (BSP), reflecting their unique occupational context. By addressing significant gaps in comparative and personality-based assessments of seafarer mental health, this study contributes to the literature offering data-driven insights to inform maritime health policies and promote mental well-being among seafarers. This study hypothesizes that mental health symptom severity among seafarers is significantly influenced by a combination of socio-demographic, occupational, and personality-related factors.

2. Materials and Methods

2.1. Measuring Tools

2.1.1. SCL-90-R

The SCL-90-R, developed by Derogatis, is a commonly used scale for assessing psychological distress in both clinical and research settings [39]. The SCL-90-R, which is employed to differentiate individuals with psychological issues from healthy individuals, is not only used to evaluate the mental health and psychiatric symptoms of individuals, but also to assess and compare groups as a whole [40]. This scale is widely used in both clinical practice and academic research due to its established reliability. The questionnaire contains 90 items and takes approximately 12 to 15 minutes to complete all items [41]. The SCL-90-R comprises nine primary symptom dimensions as well as Additional Symptom (ADD) items. The item distribution across the subscales is as follows: Somatization (SOM)–12 items, Obsessive-Compulsive disorders (O-C)–10 items, Interpersonal Sensitivity (I-S)–9 items, DEP–13 items, ANX–10 items, Hostility–6 items, Phobic Anxiety–7 items, Paranoid Ideation (PAR)–6 items, and Psychoticism–10 items [40,42]. In addition, other minor symptoms, (e.g., sleep disturbances) are assessed using seven items. The instrument employs a five-point Likert-type scale ranging from 0 to 4, where 0= not at all, 1= a little bit, 2= moderately, 3= quite a bit, and 4= extremely. Higher scores indicate that symptoms are experienced more frequently or intensely. Furthermore, the Global Severity Index (GSI), calculated as the mean of responses to the 90 items, serves as a robust indicator of an individual's overall level of psychological distress [39,43]. A value ≥1 in the GSI or any specific subscale indicates psychopathology for the participants.

2.1.2. The BFI-10

Norman [44] refined the work of Tupes and Christal [45], shaping the modern structure of the FFM of personality. Building on this model, McCrae and Costa [46] further developed the framework, which became one of the most widely used approaches in personality theory. In 1992, they revised the theory and introduced the Revised NEO personality Inventory to provide a more comprehensive assessment of the five personality dimensions [47]. Due to the increasing demand for ultra-short scales, Rammstedt and John [48] abbreviated the original BFI-44 into a 10-item version, known as the BFI-10, and confirmed its reliability and structural validity. The BFI-10 consists of 10 items rated on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). It assesses personality traits across five broad dimensions: Extraversion, Agreeableness, Conscientiousness, Emotional Stability (Neuroticism, reverse-coded), and Openness to Experience. Although the BFI-10 typically assumes a five-factor structure, the EFA in this sample revealed a context-specific two-factor solution (I-P and BSP), which is further tested using the confirmatory factor analysis (CFA).

In this study, the SCL-90-R was selected as the primary instrument to comprehensively capture seafarers' mental health, given its established utility for both individual and group-level assessments. Its capacity to screen a wide range of psychological symptoms, along with its suitability for administration in occupational contexts by non-specialists [41], makes it particularly relevant to the maritime setting. Additionally, personality traits were measured using the

BFI-10, an ultra-short scale derived from the FFM, which is among the most robust and widely applied frameworks in personality psychology [46]. The brevity of the BFI-10 was especially advantageous for minimizing response burden in a large and diverse seafaring population while retaining reliable assessment of core personality dimensions. Collectively, these two instruments were employed not only for their strong psychometric properties but also for their appropriateness in evaluating psychological well-being and individual differences within high-stress, safety-critical occupational groups such as seafaring.

2.2. Data Collection

The population of this study consists of seafarers who are actively working worldwide. According to the latest available statistics, there are a total of 1.89 million seafarers in the global merchant fleet, with 857,000 serving as officers and 1,035,000 as ratings [49]. Considering this population, a minimum sample size of 384 participants is deemed sufficient [50]. The present study included 1,109 seafarers from different nationalities, who work in a large number of ship management organizations; this exceeds the minimum requirement and is considered adequate for robust statistical analyses. A non-probability sampling method, specifically convenience sampling, was employed to recruit seafarers from the Turkish fleet as well as from international fleets. Data collection was conducted electronically, and participants were provided with an information sheet explaining the purpose of the study and emphasizing voluntary participation. No personal identifying information was requested to ensure confidentiality, and individuals who did not wish to participate were not included.

The survey instrument consisted of three sections. The first section included socio-demographic questions (see Table 1). The second section assessed psychological symptoms using the SCL-90-R, and the third section measured personality traits using the BFI-10. Both scales are internationally validated and widely applied in mental health and personality research.

The information for this research was obtained from seafarers who were actively working on ships. Participation in this research was voluntary and anonymous. In addition, the study received approval from the Ethics Committee of the Science and Engineering Departments at Karadeniz Technical University. Data from the participants were collected between 21 June 2022 and 11 September 2022 with the online e-survey application. During the data collection process, 1,148 participants answered the questionnaires, and after removing the missing, incorrect, or inconsistent questionnaires, 1,109 forms were evaluated. The collected data were analyzed statistically using version 26.0 of the Statistical Package for the Social Sciences (SPSS). McDonald's omega, one of the reliability tests, was calculated using SPSS version 27.0, and Amos Package Program Version 21.0 was used for CFA.

3. Findings

3.1. Participants and Socio-demographics

The distribution of participants according to their socio-demographic characteristics is presented in Table 1. When the socio-demographic characteristics of the participants are examined, it is seen that 95% are male, 62.5% are married, 19.7% are watchkeeping officers, 28.9% have worked at sea for more than 15 years, and 65.5% have a bachelor's degree. 82.1% are working on worldwide voyages.

In this study, we divided the nationalities of the participants into groups. The groups consist of the following countries. The Turkish group consists of Turkish people; the Far East group consists of Filipinos and Vietnamese; the Asian group consists of Indians, Pakistanis, and Bangladeshi; the East Europe group consists of Russians, Georgians, Azerbaijanis, Ukrainians, Moldavians, Latvians, and Lithuanians; the Arab group includes Syrians, Lebanese, Jordanians, Saudi Arabians, and Egyptians; and the European group includes Bulgarians, Poles, Serbs, Montenegrins, Croatians, Romanians, and Greeks. The distribution of participants by nationality is as follows, with the two largest groups being Turkish (n=501, 45.2%) and Far Eastern (n=249, 22.5%) (Table 1).

It should be noted that the Turkish group is overrepresented in the sample (n=501, 45.2%), which may affect the generalizability of the findings to the global seafarer population. However, the inclusion of multiple international groups and the large overall sample size partially mitigate this limitation. Furthermore, following Coşkun et al. [51], subgroup analyses (e.g., by nationality, education, age, or position) were conducted only when each subgroup included at least 30 participants, ensuring statistical reliability. The largest generational group among participants was Generation Y (1981-1995), comprising 56.3% of the sample [52].

The other demographic structure of the participants in the study is examined; 56.8% work on tanker-type vessels, 26.9% state that they are in 2-4 months of their contract, 67.8% communicate with their families every day, 37.7% state the social facilities on board as good, 48.4% evaluate the nutrition facility on board as good, and 52.7% state the onboard relationship as good.

3.2. Testing of Validity and Reliability

The reliability of the subscales of the SCL-90-R and the BFI-10 scale used in this study was assessed using Cronbach's α and McDonald's omega coefficients. The Cronbach's α and

Table 1. *General profile*

Variable	Subtitle	n	%	Variable	Subtitle	n	%
Voyage type (Type of your voyage?)	Worldwide	910	82.1	Competency (What is your rank on the ship?)	Master	140	12.6
	Coastal	199	17.9		Chief. officer	104	9.4
Gender (Your gender?)	Male	1,054	95.0		Watchkeeping officer	218	19.7
	Female	55	5.0		Chief. engineer	88	7.9
Marital status (Your marital status?)	Married	693	62.5		First engineer	59	5.3
	Single	416	37.5		Watchkeeping engineer	86	7.8
Nationality group (Your nationality?)	Turkish group	501	45.2		Electrician	45	4.1
	East Europe group	78	7.0		Deck rating	176	15.9
	Europe group	56	5.0		Engine rating	72	6.5
	Arabic group	74	6.7		Cabin rating	22	2.0
	Far East group	249	22.5		Cadet	78	7.0
	Asia group	151	13.6		Other	21	1.9
Education level (Your education status?)	Primary education	20	1.8	Ship type (What type of vessel are you working on?)	Dry cargo	277	25.0
	High school	114	10.3		Container	66	6.0
	Associate degree college	178	16.0		Tanker	630	56.8
	Bachelor	726	65.5		Ro-Ro	128	11.5
	Postgraduate	71	6.4		Cruise	8	0.7
Generation (Year of your birth?)	Baby boomer <1961	18	1.6	Communication with family (How often do you communicate with your family while on board?)	Every day	752	67.8
	X generation 1961-1980	281	25.3		Every 2-3 days	252	22.7
	Y generation 1981-1995	624	56.3		Once a week	78	7.0
	Z generation 1996 -	186	16.8		Once every 2 weeks	19	1.7
Duration onboard (How long have you been on this vessel?)	0-2 months	226	20.4		Once in a month	8	0.7
	2-4 months	298	26.9	Socail facilities (How do you find the social facilities on board?)	Very good	214	19.3
	4-6 months	225	20.3		Good	418	37.7
	6-10 months	140	12.6		Average	336	30.3
	More than 10 months	41	3.7		Bad	106	9.6
	At vacation	179	16.1		Very bad	35	3.2
Sea experience (What is your total sea experience?)	0-2 years	184	16.6	Nutrition facilities (How do you find the nutrition opportunities on board?)	Very good	229	20.6
	2-5 years	182	16.4		Good	537	48.4
	5-10 years	203	18.3		Average	280	25.2
	10-15 years	219	19.7		Bad	48	4.3
	More than 15 years	321	28.9		Very bad	15	1.4

McDonald's omega values for the subscales of the SCL-90-R were found to be as follows: DEP: 0.925-0.930, ANX: 0.875-0.883, I-S: 0.887-0.894, O-C: 0.906-0.914, PAR: 0.851-0.863, and ADD: 0.809-0.829. For the BFI-10 scale, the corresponding values were calculated as 0.690 and 0.646, respectively. These results indicate a high level of reliability for the SCL-90-R subscales [53,54] and an acceptable level of reliability for the BFI-10 scale [55].

EFA is a method used to identify the underlying structure or relationships among observed and unobserved, (latent variables) [56]. This study aims to examine the relationship between observed variables (symptom levels and personality traits) and various demographic and occupational characteristics: some of which, such as perceptions of onboard conditions, may be considered latent in nature. These include gender, marital status, nationality, education

level, time spent on the vessel, sea experience, rank, vessel type, and perceived quality of social and nutritional facilities. Additionally, the impact of the frequency of communication with family members on DEP levels was evaluated. To obtain the conceptual structure of the scales, principal component analysis was conducted using Promax rotation with the criterion of eigenvalues ≥1.

Before using the EFA method for each of the scales used in the study, it is important to meet some prerequisites for this method to give accurate and reliable results. The Kaiser-Meyer-Olkin (KMO) test and Bartlett test, which are some of the prerequisites of EFA, are statistical tests that show suitability for factor structure. The KMO test measures the effect of correlations between variables. The Bartlett test, on the other hand, evaluates the significance of the relationships between the variables. The KMO index (KMO ≥0.6) and Bartlett's test ($p<0.05$) confirmed the adequacy of samples for this procedure [57]. As a result of the analysis for each of the subscales used in the study, the values are as follows: KMO >0.6; $p<0.05$. These values for each scale given in Table 2 are considered sufficient for the factor analysis.

An initial analysis was performed for each scale to obtain eigenvalues for each component extracted from the data. In this study, for each subscale of the SCL-90-R, a single-factor structure with eigenvalues greater than one was identified. Büyüköztürk [58] states that the variance explained for single-factor scales should be at least 30% of the total variance. The single-factor structure for each subscale in this study had eigenvalues over Kaiser's criterion of 1 and explained more than 30% of the total variance. According to the original structure of the BFI-10, it was expected that all five components would have eigenvalues greater than Kaiser's criterion of 1.0. However, in this study, only three components had eigenvalues greater than 1.0. Upon further examination of the three-factor solution, it was observed that Item 9 loaded on two factors simultaneously, with a difference in factor loadings of less than 0.15, indicating a cross-loading issue. Therefore, Item 9 was removed from the analysis and the procedure was repeated. In the revised analysis, only two components had eigenvalues exceeding Kaiser's criterion of 1.0, and consequently, the number of factors was finalized as two [59]. Therefore, in the remainder of the study, the Shortened BFI will be referred to as the "Personality Scale"; the first of the two identified factors will be labeled as "I-P", and the second as "BSP".

Highly correlated variables and perfectly correlated variables exhibit multicollinearity and can cause problems in factor analysis. Multicollinearity is indicated by |R|, and the determinant of the R matrix gives this value. The determinant of the R matrix must be greater than 0.00001 [57,60]. |R| values for each subscale are given in Table 2 (>0.00001) and are considered sufficient for factor analysis.

In EFA, factor loading values greater than 0.30 are considered sufficient [61]. Factor loading values in each item of the scales are higher than 0.30, and the results are presented in Table 2.

After the EFA addressing construct validity was completed, the assumption of normality was tested to evaluate the suitability of the dataset for subsequent analyses. The normality of the data collected from the participants was evaluated using Skewness and Kurtosis values. The Skewness and Kurtosis

Table 2. *Results of exploratory factor analysis & normality values*

	KMO*	χ^2	p**	|R| Determinant	Minimum factor load	Cronbach's α	McDonald's omegas	Eigenvalue	Total variance	Normality	
										Skewness	Kurtosis
DEP	0.964	$\chi^2(78)=7713.400$	0.000	0.001	0.506	0.925	0.930	6.969	53.6%	1.292	1.225
ANX	0.921	$\chi^2(45)=4449.791$	0.000	0.018	0.477	0.875	0.883	4.893	48.9%	1.653	2.701
I-S	0.933	$\chi^2(36)=4350.463$	0.000	0.019	0.329	0.887	0.894	4.805	53.4%	1.289	1.232
O-C	0.931	$\chi^2(45)=4853.862$	0.000	0.012	0.331	0.906	0.914	5.160	51.6%	0.986	0.699
PAR	0.880	$\chi^2(15)=2542.831$	0.000	0.100	0.655	0.851	0.863	3.465	57.8%	1.138	0.712
ADD	0.839	$\chi^2(21)=2381.463$	0.000	0.116	0.554	0.809	0.829	3.326	47.5%	0.939	0.160
BFI-10	0.782	$\chi^2(36)=2109.833$	0.000	0.148	0.513	0.678	0.667	2.849	51.5%	-0.218	-0.525
GSI	-	-	-	-	-	-	-	-	-	1.260	1.138

*Superb: KMO>0.9; Great: 0.8>KMO>0.9; Good: 0.8>KMO>0.7

**p<0.05

values for the scales used in this study are also presented in Table 2. As skewness and kurtosis values approach zero, the distribution is considered to approximate perfect normality [62]. The Skewness and Kurtosis values obtained in this study were found to meet the established criteria (Table 2) [63]. Upon examining the linearity values, significant linear relationships were observed between symptom levels, personality traits, and demographic variables ($p<0.05$). Since the dataset demonstrated a normal and linear distribution, a parametric test—specifically, the ANOVA test—was employed in the analysis. Additionally, a significance level of $p<0.05$ was adopted.

3.3. CFA: Testing Construct Validity of the Scales

Since the population used in the development of this scale and the population used in this study were different, the compatibility of the structural validity of the scales we used in the study should be tested. Therefore, CFA was carried out for each scale. The model structure for each scale, for which CFA was conducted using the Amos Package Program, Version 21, is presented as follows (Appendix Figures 1-7).

For the CFA model to accurately represent the data, there must be no mismatch between the observed values and the recommended fit criteria. In this study, it was determined that the t values indicating the relationships between the items and the latent variables were statistically significant at the $p<0.05$ level for each scale. To ensure the reliability of the measurement model, the Composite Reliability (CR) value for the latent variables should exceed 0.70 [22,64], and the Average Variance Extracted (AVE) value should be greater than 0.40 [22,65]. As shown in Table 3, AVE and CR values for all scales meet the prerequisites. Appendix Figures 1-7 show the models for all scales. For the model of each scale (Appendix Figures 1-7) to align with the data, there should be no discrepancy between the observed values and recommended fit criteria. Appendix Figures 2, 4, 6, and 7 were deemed appropriate for modifications to better meet recommended fit criteria. After completion of the modifications, the fit criteria for all scales from Appendix Figures 1-7 are aligned with the suggested values presented in Table 3. As a result, the data confirm that the relationships in the research model for each scale are consistent with the sample. Thus, it is also demonstrated that all scales of the model are valid.

3.4. Preliminary Data Analysis

Based on the scale scores presented in Table 4, 27.2% of the participants scored 1 or above on DEP, 15.8% on ANX, 24.6% on I-S, 33.1% on O-C, 31.8% on PAR, and 32.3% on ADD. This suggests that these individuals reported elevated symptom levels in the respective domains. Additionally, 19.2% of the participants had a GSI score of 1 or higher, indicating greater overall symptom severity [68]. Overall, 53% of the participants did not report elevated symptom levels on any of the scales.

To examine the effects of socio-demographic and occupational characteristics on psychological symptomatology, a series of One-Way ANOVA tests was conducted. Given the violation of homogeneity of variances, the Games-Howell post-hoc test was applied, and Bonferroni correction was used to identify group-level distinctions.

The analyses revealed statistically significant differences in all symptom domains (DEP, ANX, I-S, O-C, PAR, ADD, and GSI) based on nationality groups. The Turkish Group exhibited consistently higher mean scores across all psychological symptoms (DEP: $\bar{X}=1.08$, SD=0.73; ANX: $\bar{X}=0.66$, SD=0.55; I-S: $\bar{X}=0.96$, SD=0.70; O-C: $\bar{X}=1.18$, SD=0.66; PAR: $\bar{X}=1.17$, SD=0.79; ADD: $\bar{X}=1.10$, SD=0.67; GSI: $\bar{X}=0.86$, SD=0.55) relative to other nationality groups (Table 5). Furthermore, BSP scores were significantly lower among the Turkish Group

Table 3. *Recommended fit criterias and actual values of CFA*

	RMSEA	CFI	GFI	AGFI	SRMR	p	AVE	CR
DEP	0.048	0.978	0.968	0.955	0.0235	***	0.54	0.94
ANX	0.057	0.984	0.983	0.964	0.0241	***	0.61	0.92
I-S	0.056	0.978	0.976	0.960	0.0268	***	0.53	0.91
O-C	0.058	0.975	0.974	0.956	0.0277	***	0.52	0.91
PAR	0.045	0.993	0.992	0.980	0.0163	***	0.58	0.89
ADD	0.059	0.980	0.985	0.966	0.0285	***	0.48	0.86
BFI-10	0.075	0.925	0.965	0.936	0.0557	***	0.44[c]	0.75[c]
Recommended fit criteria	<0.08[a]	≥0.90[a]	≥0.85[a]	≥0.85[a]	≤0.08[b]		≥0.40	≥0.70

***p<0.05

[a]From [66], [b]From [67], [c]Minimum value across the two subscales of BFI-10

SRMR: Standardized root mean squared residual, RMSEA: Root mean square of approximation error, GFI: Goodness-of-fit index, AGFI: Adjusted goodness-of-fit index, CFI: Comparative goodness-of-fit index, AVE: Average variance extracted, CR: Composite reliability

Table 4. *Symptom rates*

	Elevated symptom level	
	f	%
DEP	320	27.2
ANX	175	15.8
I-S	273	24.6
O-C	367	33.1
PAR	353	31.8
ADD	358	32.3
GSI	213	19.2

DEP: Depression, ANX: Anxiety, I-S: Interpersonal Sensitivity, O-C: Obsessive-Compulsive disorders, PAR: Paranoid Ideation, ADD: Additional Symptom, GSI: Global Severity Index

($\bar{X}$=2.48, SD=0.78), suggesting a potential vulnerability linked to social personality traits in this subgroup.

According to Table 5, statistically significant differences were identified among Generational Groups in relation to their scores on multiple psychological symptom dimensions, such as DEP, ANX, I-S, O-C, PAR, ADD, and GSI. Participants classified as members of Generation Z reported the highest mean scores across all symptom domains (DEP: $\bar{X}$=1.01, SD=0.76; ANX: $\bar{X}$=0.60, SD=0.56; I-S: $\bar{X}$=0.96, SD=0.77; O-C: $\bar{X}$=1.09, SD=0.72; PAR: $\bar{X}$=1.20, SD=0.86; ADD: $\bar{X}$=0.97, SD=0.68; GSI: $\bar{X}$=0.82, SD=0.58), indicating greater psychological distress relative to participants from other generational groups.

Similarly, significant group differences were observed in relation to participants' evaluations of Onboard Social Facilities. Individuals who rated these facilities as "very good" exhibited significantly lower mean scores on all symptom domains (DEP: $\bar{X}$=0.29, SD=0.41; ANX: $\bar{X}$=0.16, SD=0.29; I-S: $\bar{X}$=0.28, SD=0.45; O-C: $\bar{X}$=0.38, SD=0.46; PAR: $\bar{X}$=0.32, SD=0.48; ADD: $\bar{X}$=0.32, SD=0.46; GSI: $\bar{X}$=0.23, SD=0.31), suggesting a protective association between perceived social support and psychological well-being. Furthermore, participants in the "very good" group also reported significantly higher scores on the BSP trait (BSP: $\bar{X}$=3.17, SD=0.79) compared to all other groups.

In addition, statistically significant differences were found between participants' evaluations of Onboard Nutrition Facilities and their symptom scores on DEP, I-S, O-C, ADD, and GSI. Those who rated the Onboard Nutrition Facilities as "very good" reported lower symptom levels across all related domains (DEP: $\bar{X}$=0.39, SD=0.53; I-S: $\bar{X}$=0.37, SD=0.56; O-C: $\bar{X}$=0.49, SD=0.55; ADD: $\bar{X}$=0.46, SD=0.55; GSI: $\bar{X}$=0.33, SD=0.41), highlighting the potential impact of nutritional quality on mental health.

Moreover, participants perceived the Onboard Relationships group as yielding statistically significant differences in psychological symptomatology. Those who rated their relationships as "very good" demonstrated the lowest mean scores across all symptom domains (DEP: $\bar{X}$=0.33, SD=0.47; ANX: $\bar{X}$=0.18, SD=0.32; I-S: $\bar{X}$=0.27, SD=0.40; O-C: $\bar{X}$=0.43, SD=0.51; PAR: $\bar{X}$=0.33, SD=0.50; ADD: $\bar{X}$=0.39, SD=0.51; GSI: $\bar{X}$=0.26, SD=0.36) compared to those reporting their onboard relationships as "good," "average," or "poor". Additionally, these participants scored significantly higher on the BSP trait (BSP: $\bar{X}$=3.13, SD=0.79), suggesting a link between positive interpersonal dynamics and socially adaptive personality characteristics.

Table 5. *ANOVA table*

	DEP		ANX		I-S		O-C		PAR		ADD		GSI		I-P		BSP	
	f	p	f	p	f	p	f	p	f	p	f	p	f	p	f	p	f	p
Nationality of group	93.6	<0.05	53.1	<0.05	80.5	<0.05	96.4	<0.05	85.5	<0.05	85.1	<0.05	94.6	<0.05	17.2	<0.05	30.8	<0.05
Generations	26.4	<0.05	16.3	<0.05	31.6	<0.05	25.7	<0.05	38.2	<0.05	19.0	<0.05	29.1	<0.05	0.8	>0.05	8.9	<0.05
Onboard social facilities	84.4	<0.05	57.6	<0.05	66.7	<0.05	78.7	<0.05	77.9	<0.05	75.3	<0.05	85.1	<0.05	7.8	<0.05	29.0	<0.05
Onboard nutrition facilities	27.5	<0.05	19.9	<0.05	18.7	<0.05	24.4	<0.05	24.3	<0.05	28.8	<0.05	27.8	<0.05	4.5	<0.05	12.3	<0.05
Onboard relationship	77.0	<0.05	54.1	<0.05	71.1	<0.05	63.4	<0.05	79.0	<0.05	54.3	<0.05	76.8	<0.05	5.7	<0.05	23.0	<0.05
Total sea experience	16.4	<0.05	9.5	<0.05	22.7	<0.05	17.4	<0.05	27.0	<0.05	9.0	<0.05	18.5	<0.05	3.9	<0.05	8.1	<0.05

DEP: Depression, ANX: Anxiety, I-S: Interpersonal Sensitivity, O-C: Obsessive-Compulsive disorders, PAR: Paranoid Ideation, ADD: Additional Symptom, GSI: Global Severity Index, I-P: Ideal Personality, BSP: Balanced Social Personality

As reported in Table 5, statistically significant differences were observed between Total Sea Experience groups in the scores of I-S, PAR, ADD, and GSI. Participants with 0-2 years of total sea experience exhibited higher scores in I-S ($\bar{X}$=0.97, SS=0.78), PAR ($\bar{X}$=1.18, SS=0.89), ADD ($\bar{X}$=0.97, SS=0.72), and GSI ($\bar{X}$=0.81, SS=0.61) compared to participants with longer total sea experience.

3.5. Structural Model Analyses

In this section, a structural model was developed and tested to examine the relationships between personality traits and psychopathological symptoms. Within the model, the associations between I-P and BSP traits and various symptom dimensions were evaluated (Table 6). The goodness-of-fit indices for the tested model are presented in Table 7.

The analysis results presented in Table 7 indicate that there is no statistically significant relationship between I-P traits and the symptom dimensions of PAR and ADD. Conversely, both I-P and BSP traits were found to have significant associations with other psychopathological symptom dimensions.

In Figure 1, there is a significant negative relationship between the personality traits of I-P (p=0.000, r=-0.120) and BSP (p=0.000, r=-0.751), and the symptom of DEP. Furthermore, the model was found to exhibit good fit indices.

In Figure 2, a significant negative relationship was found with the personality traits of I-P (p=0.000, r=-0.136) and BSP (p=0.000, r=-0.696) the symptom of ANX. In addition, the model was found to demonstrate a good fit.

In Figure 3, a significant negative relationship was found between the personality traits of I-P (p=0.001, r=-0.108) and BSP (p=0.000, r=-0.741) with the symptom of I-S. In addition, the model was found to exhibit good fit indices.

In Figure 4, a significant negative relationship was found between the personality traits of I-P (p=0.000, r=-0.112) and BSP (p=0.000, r=-0.789), and the symptom of O-C. In addition, the model was found to exhibit good fit indices.

Figure 5 shows that there is no statistically significant relationship between the I-P traits and the PAR symptom (p=0.321, r=-0.034). In contrast, a significant negative relationship was identified between the BSP traits and the PAR symptom (p=0.000, r=-0.740). Moreover, the model was found to exhibit a set of good fit indices.

Figure 6 shows that there is no statistically significant relationship between the I-P traits and the ADD symptom (p=0.372, r=-0.031). In contrast, a significant negative relationship was identified between the BSP trait and the ADD symptom (p=0.000, r=-0.677). Moreover, the model was found to exhibit good fit indices.

Table 6. *Relationship between personality traits and symptoms*

Symptoms	Ideal personality		Balanced social personality	
	p	r	p	r
DEP	0.000	-0.120	0.000	-0.751
ANX	0.000	-0.136	0.000	-0.696
I-S	0.001	-0.108	0.000	-0.741
O-C	0.000	-0.112	0.000	-0.789
PAR	0.321	-0.034	0.000	-0.740
ADD	0.372	-0.031	0.000	-0.677

DEP: Depression, ANX: Anxiety, I-S: Interpersonal Sensitivity, O-C: Obsessive-Compulsive disorders, PAR: Paranoid Ideation, ADD: Additional Symptom

Table 7. *Results of models established between personality traits and symptoms*

Symptoms	C_{min}	DF	RMSEA	SRMR	GFI	AGFI	CFI
DEP	731,993	205	0.048	0.0543	0.941	0.927	0.949
ANX	812,896	147	0.064	0.0600	0.926	0.904	0.906
I-S	631,352	131	0.059	0.0633	0.937	0.917	0.929
O-C	724,475	147	0.060	0.0596	0.934	0.915	0.924
PAR	368,121	86	0.054	0.0531	0.958	0.941	0.944
ADD	460,257	99	0.057	0.0563	0.952	0.934	0.926

DEP: Depression, ANX: Anxiety, I-S: Interpersonal Sensitivity, O-C: Obsessive-Compulsive disorders, PAR: Paranoid Ideation, ADD: Additional Symptom, SRMR: Standardized root mean squared residual, DF: Degree of freedom, RMSEA: Root mean square of approximation error, GFI: Goodness-of-fit index, AGFI: Adjusted goodness-of-fit index, CFI: Comparative goodness-of-fit index

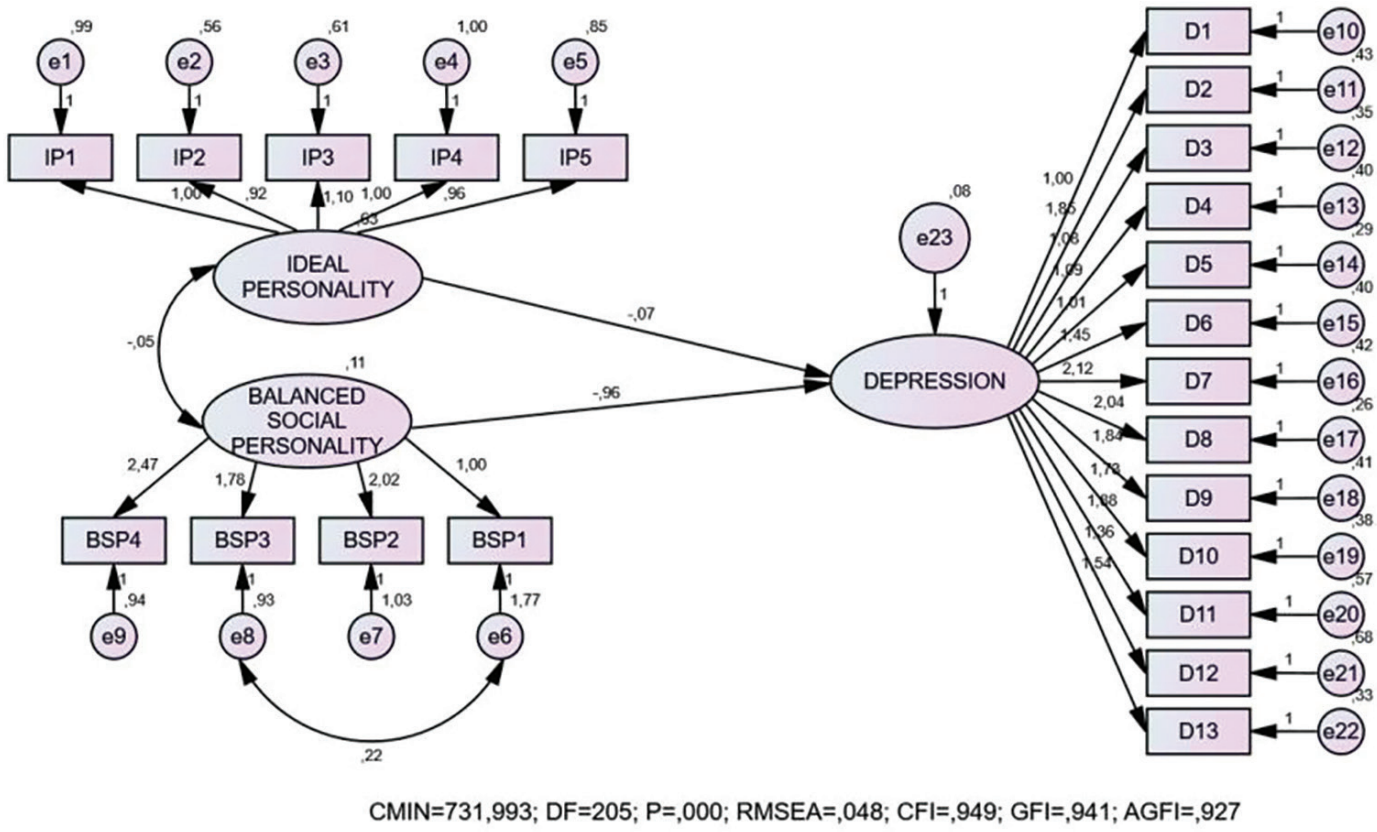


Figure 1. *Model of the relationship between personality traits and DEP symptoms*

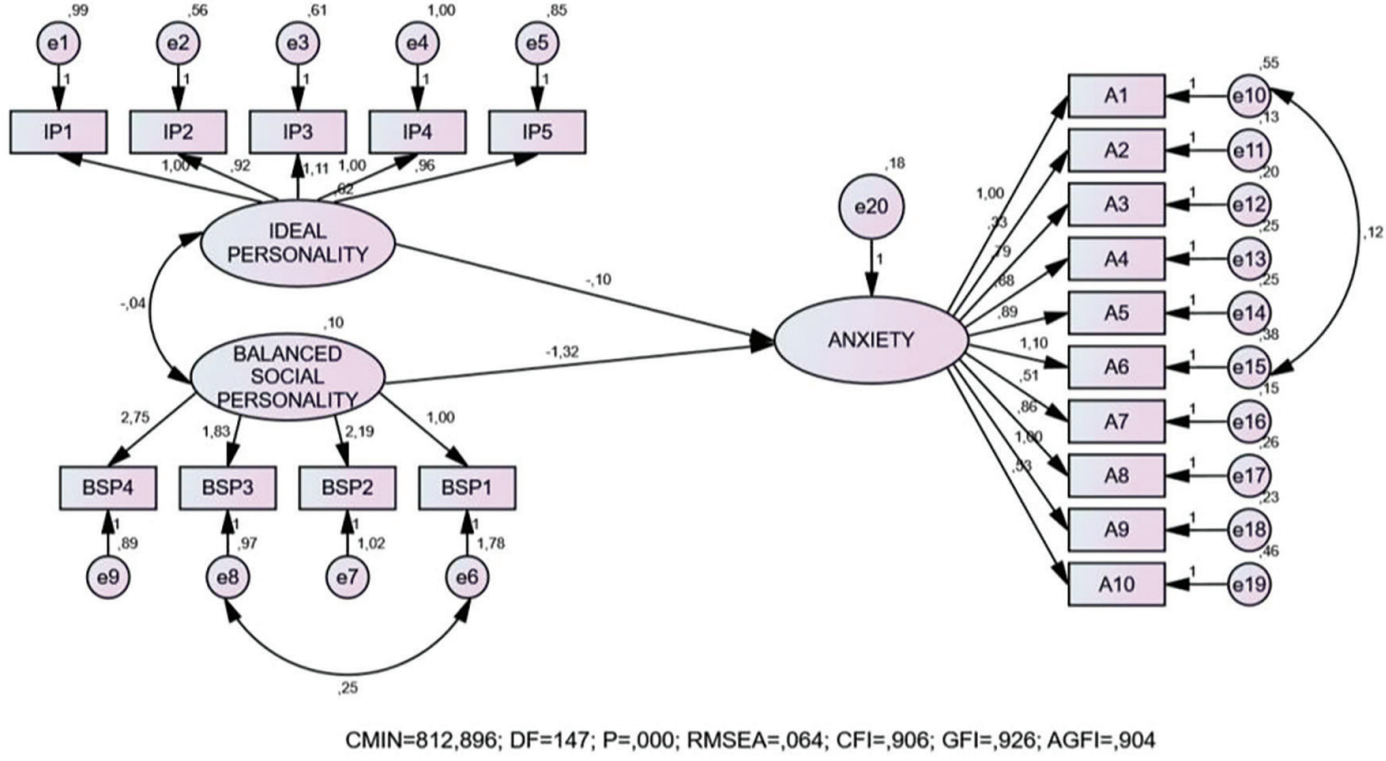


Figure 2. *Model of the relationship between personality traits and ANX symptoms*

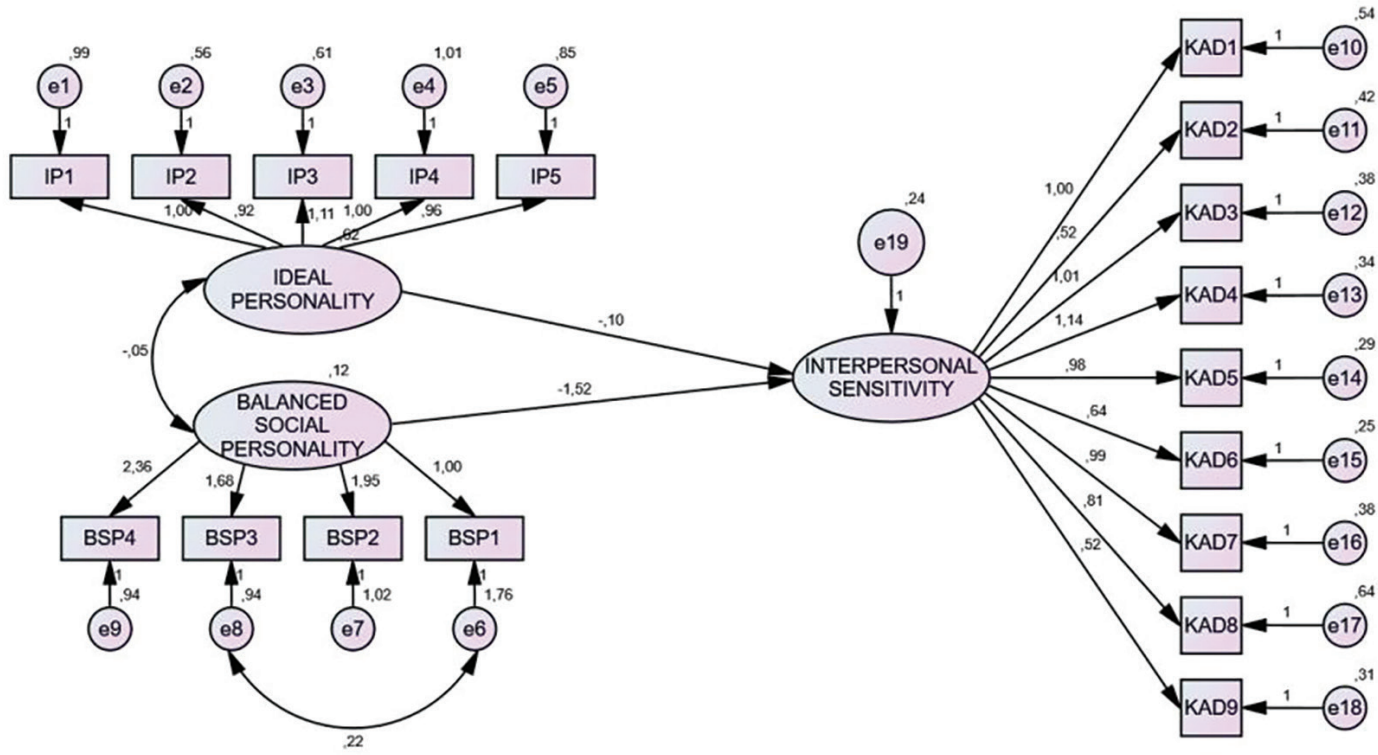


Figure 3. *Model of the relationship between personality traits and I-S symptoms*

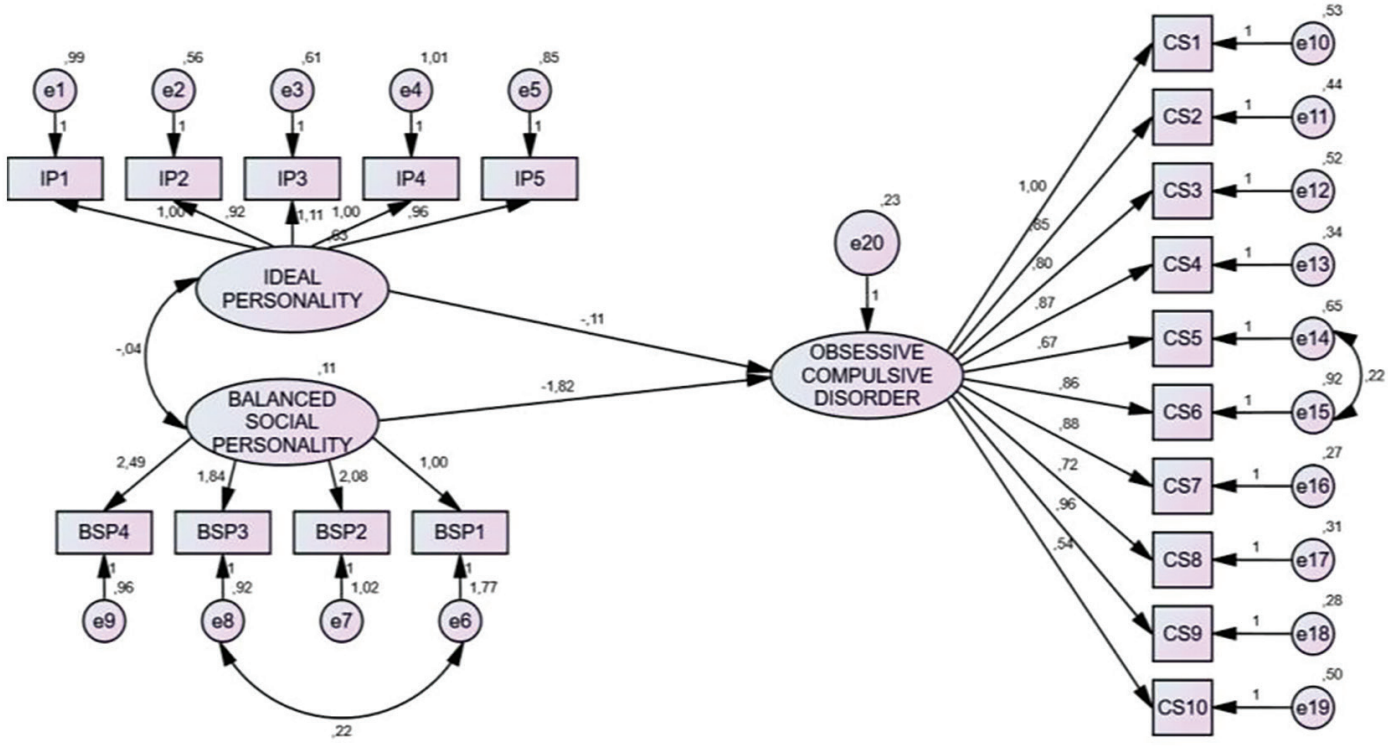


Figure 4. *Model of the relationship between personality traits and O-C symptoms*

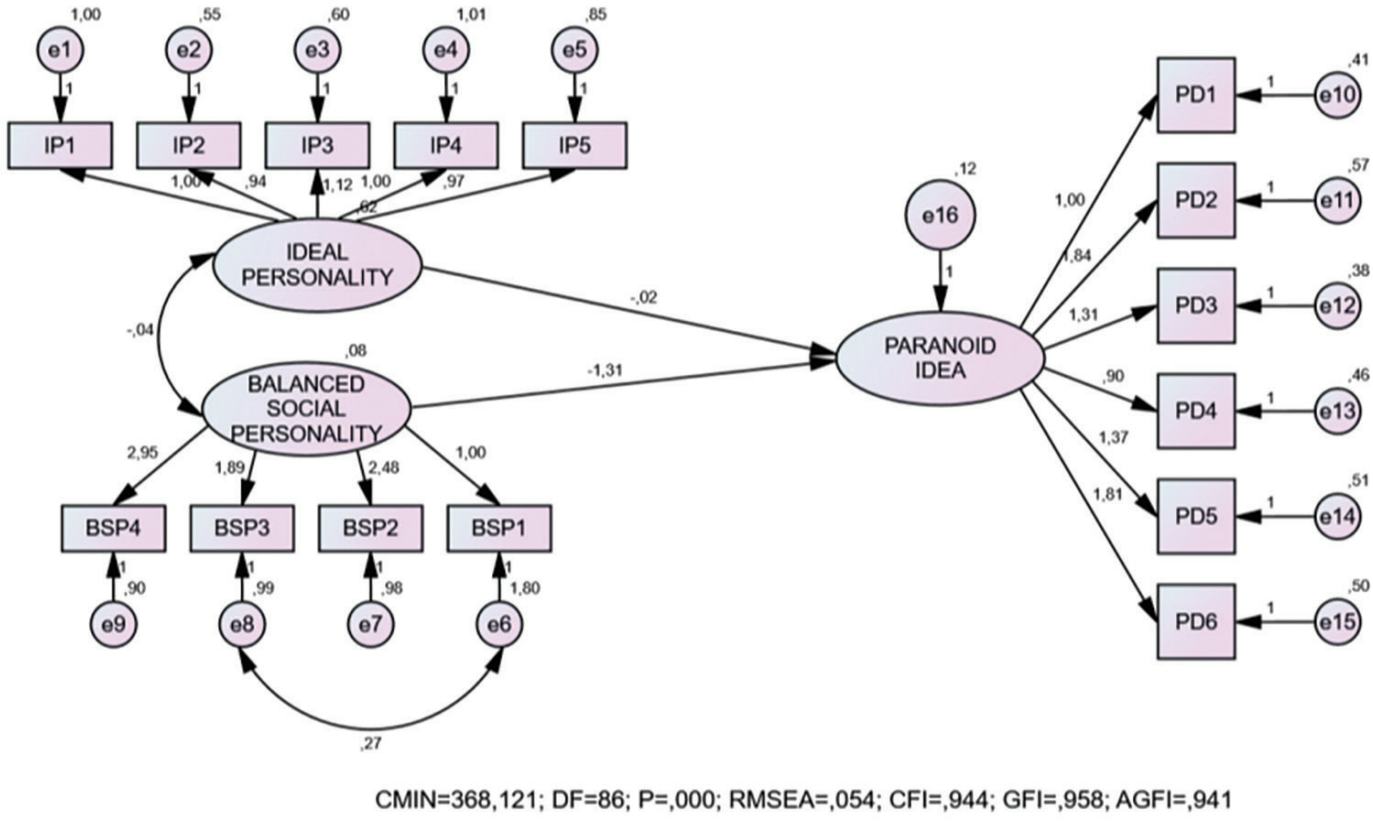


Figure 5. *Model of the relationship between personality traits and PAR symptoms*

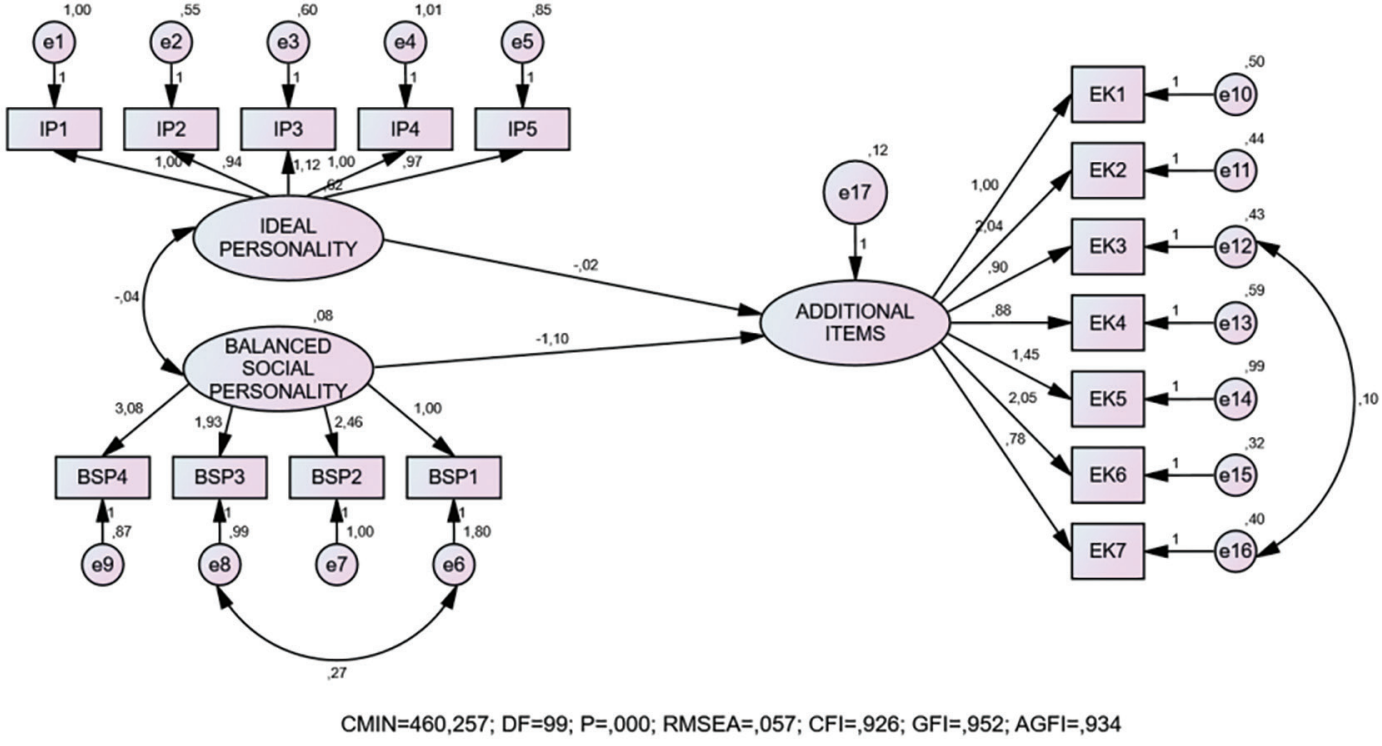


Figure 6. *Model of the relationship between personality traits and ADD symptoms*

4. Results and Discussion

The maritime profession involves numerous factors that can adversely affect mental health. In this study, Turkish seafarers were found to exhibit high levels of depressive and ANX symptoms. Similarly, Sivri [21] reported that Turkish seafarers scored significantly higher on ANX measures, while Kinali et al. [22] found that 33.2% of seafarers experienced depressive symptoms. These findings suggest that the factors influencing the mental health of seafarers may vary depending on nationality and cultural differences. Additionally, mental health problems appear to be relatively common among Turkish seafarers, highlighting the need for further research to better understand their underlying causes and risk factors.

Moreover, it has been observed that DEP and ANX levels are higher among Generation Z compared to Generations X and Y. This observation is consistent with the findings of Zamora et al. [69] regarding ANX rates across different age groups. The duration of sea experience is a significant factor influencing the mental health of seafarers. Higher levels of DEP and ANX have been observed among seafarers with shorter sea experience. Zamora et al. [69] reported that these rates are more pronounced in seafarers with less than 10 years of experience, supporting this finding. Another study states that cadets with less sea experience have lower quality of life in terms of mental health compared to captains, and chief engineers with more sea experience [70]. This suggests that as experience increases, seafarers may develop better coping skills to manage stress, thereby protecting their mental health. Some studies in the literature indicate that younger seafarers are at a higher risk in terms of mental health [69,71].

Social facilities and onboard relationships play a crucial role in the mental health of seafarers. In the present study, lower levels of DEP and ANX were observed when social facilities were adequate and onboard relationships were strong. These results align with previous research, which identifies insufficient social facilities [71] and lack of peer support [22] as contributing factors to mental health deterioration. Notably, the DEP and ANX levels recorded in this study exceed global prevalence rates among adults [72,73], underscoring their potential impact on both individual well-being and operational productivity in the maritime industry. Consistent with these findings, other studies [74,75] suggest that enhancing social facilities, fostering positive onboard relationships, and strengthening psychological support services—such as providing 24/7 access via secure communication platforms accessible through ship internet connections (e.g., instant messaging or video call applications like WhatsApp)—are effective strategies to promote mental well-being.

Comparisons with the general population reveal that mental health issues are more prevalent among seafarers. For instance, a study conducted among Chinese seafarers found that the rates of O-C, I-S, DEP, and ANX were higher than those in the general population [76]. O-C symptoms, which showed the highest mean score, were observed in a greater proportion of participants compared to other symptoms, based on scores exceeding the threshold value used in this study. These findings are consistent with previous studies in which O-C symptoms were identified as the most frequently observed symptoms [76,77]. Additionally, a study conducted by Zhi et al. [78] in 2008 involving 259 seafarers identified the primary psychological issues as O-C symptoms, I-S, DEP, and PAR.

In this study, negative associations were identified between the I-P and BSP traits and levels of psychopathological symptoms. While the BSP trait was found to have a strong effect on symptom levels, the effect of the I-P trait was relatively weak. The study indicates that there is a item-level difference between the I-P and BSP traits, particularly regarding the dimension representing openness to experience. Accordingly, it was concluded that openness to experience weakens the negative association between personality traits and symptoms, leading to a less negative relationship between openness to experience and symptom levels. Given the well-established positive association between stress levels and psychopathological symptoms, this finding is consistent with the result reported by Mitra [79], which also demonstrated a positive relationship between openness to experience and stress levels. Similarly, the studies conducted by Yu et al. [80] and Evcin [81] found negative associations between personality traits and symptom levels. In line with these studies, the present research also identified a negative, albeit weak, relationship between the I-P trait and psychopathological symptoms, thus supporting the findings of previous literature.

5. Conclusion

This study demonstrates that seafarers' mental health is influenced by a multidimensional set of factors, including demographic and occupational variables such as sea experience, access to social facilities, onboard relationships, age, and nationality, as well as individual personality traits. In particular, the traits of Ideal Personality (I-P) and BSP appear to play a protective role against psychopathological symptoms, whereas openness to experience showed a positive association with symptom levels. These findings highlight the importance of designing mental health interventions that not only improve working conditions but also account for individual personality differences.

The study contributes to the literature by revealing a higher-than-expected prevalence of O-C and PAR symptoms among seafarers: areas that have been underexplored compared to DEP and ANX. Moreover, by including participants from diverse nationalities, this study addresses a notable gap in comparative analyses across different cultural backgrounds.

The originality of this research lies in its integrated examination of seafarers' mental health through both psychopathological symptoms and personality traits, offering a broader perspective on the determinants of psychological well-being in maritime contexts.

Nevertheless, this study is not without limitations. Despite a sufficient sample size, the findings are based on self-reported measures, which may be subject to response bias. Furthermore, cross-sectional data restricts the ability to establish causal relationships. Future research should therefore adopt longitudinal designs and explore cultural and occupational differences in greater depth to enhance understanding of the psychological dynamics shaping seafarers' mental health.

In addition to regular physical health checks documented by the Medical Examination Certificate, the continuous monitoring of seafarers' mental health during long contract periods at sea is essential. Stressful and traumatic experiences can rapidly undermine psychological well-being, even in individuals initially certified as healthy. Regular mental health assessments—through surveys or access to psychological support either face-to-face in ports or online via secure shipboard internet platforms (e.g., instant messaging or video call applications like WhatsApp)—could help prevent future problems and provide timely support.

Moreover, seafarers may face acute psychological crises triggered by shock, trauma, or intense stress, which often require professional intervention beyond the support of peers. To address this need, organizations could establish dedicated online mental health services, available 24/7 via secure communication channels through ship internet connections (e.g., instant messaging or video call applications such as WhatsApp). Such services would ensure immediate access to qualified professionals, mitigating the short-term impact of crises while also reducing potential risks to safety and operations.

Ethics

Ethics Committee Approval: Ethical approval was gained from the Ethics Committee of the Science and Engineering Departments at Karadeniz Technical University (approval no.: E-26014373-050.01.04-242513, date: 16.05.2022).

Footnotes

Authorship Contributions

Concept design: F. Sana, and E. Başar, Data Collection or Processing: F. Sana, and E. Başar, Analysis or Interpretation: F. Sana, and E. Başar, Literature Review: F. Sana, and E. Başar, Writing, Reviewing and Editing: F. Sana, and E. Başar.

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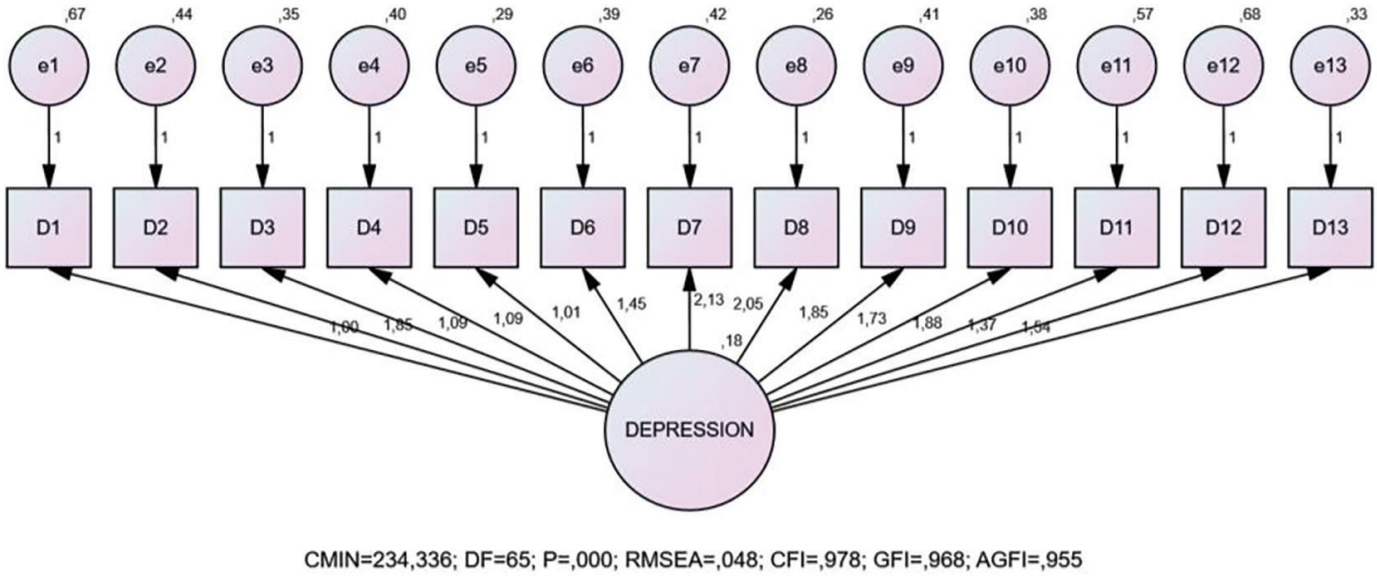
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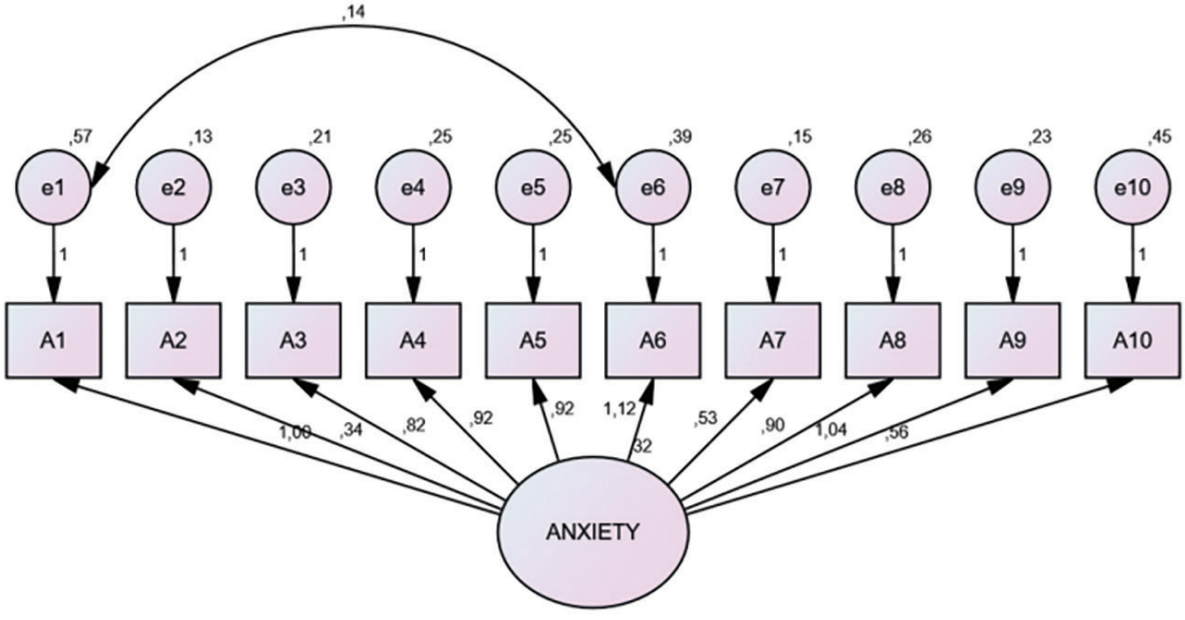
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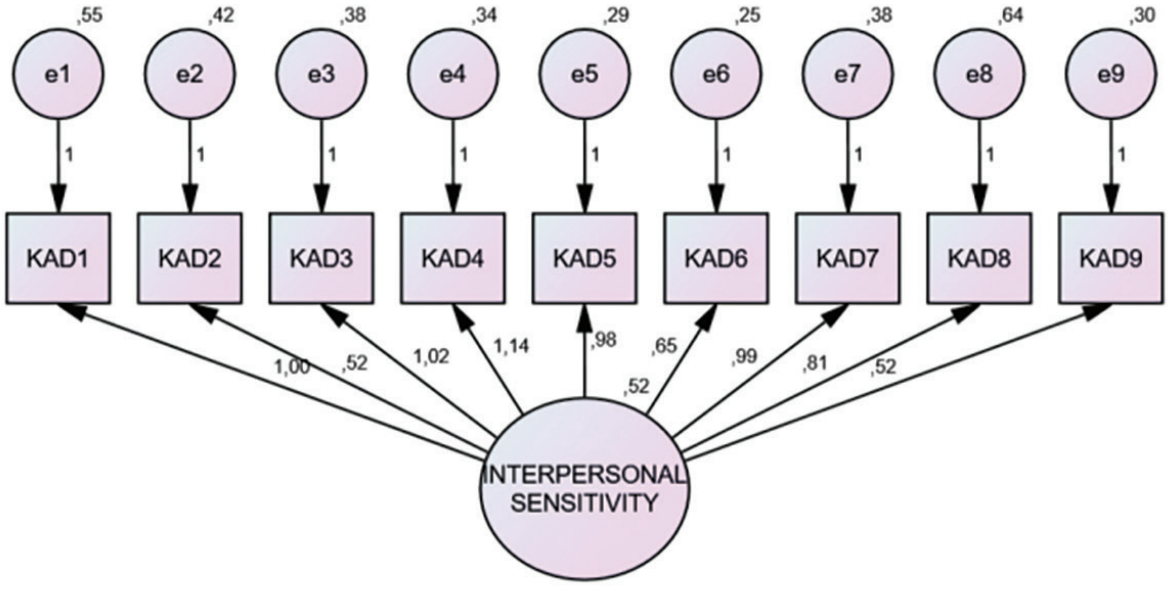
Appendix Figure 1. *CFA for the DEP scale*

CMIN: Minimum value of discrepancy function, DF: Degree of freedom, RMSEA: Root mean square of approximation error, CFI: Comparative goodness-of-fit index, GFI: Goodness-of-fit index, AGFI: Adjusted goodness-of-fit index, e: Residual-error variance, D: Items of the DEP scale



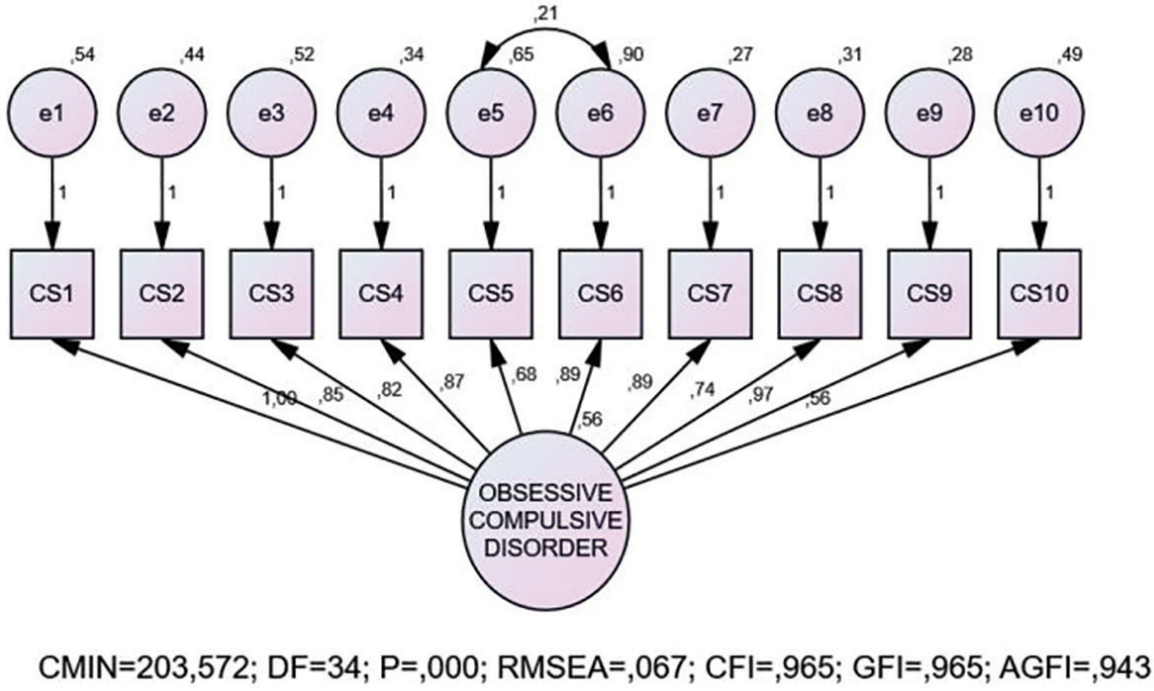
Appendix Figure 2. *CFA for the ANX scale*

A: Items of the ANX scale



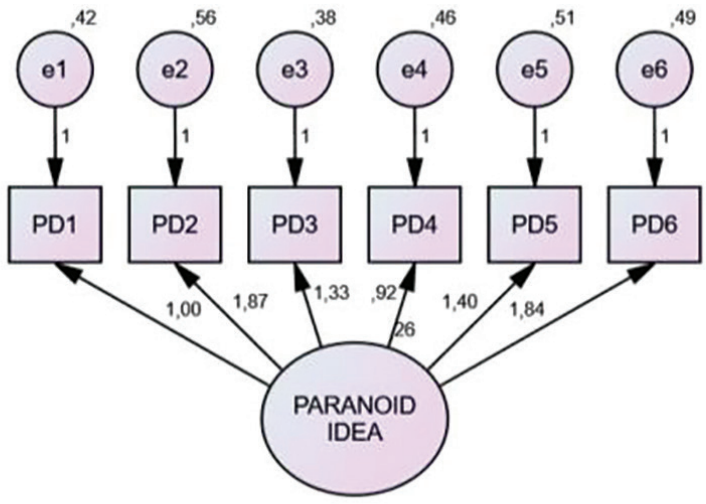
Appendix Figure 3. *CFA for the I-S scale*

KAD: Items of the I-S scale



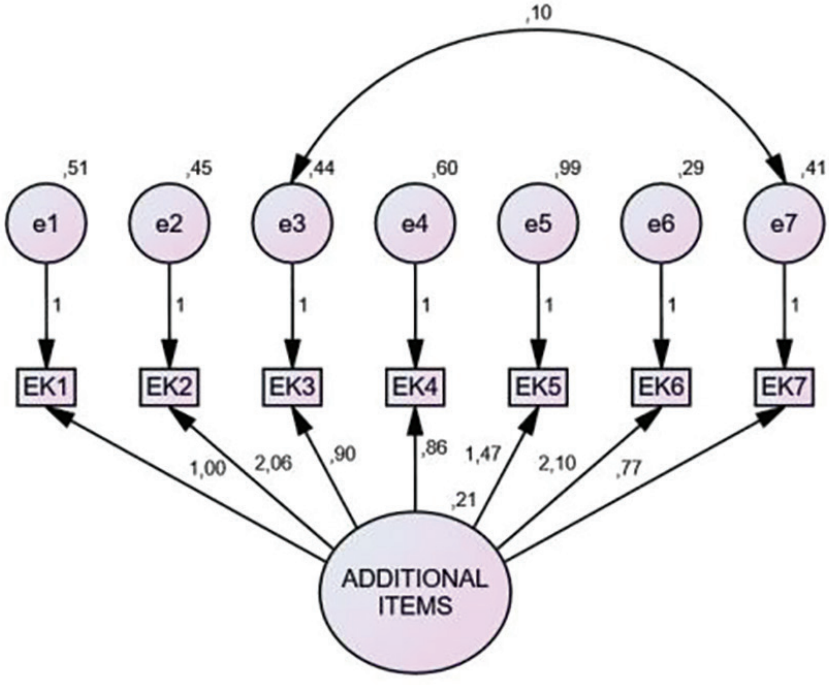
Appendix Figure 4. *CFA for the O-C scale*

CS: Items of the O-C scale



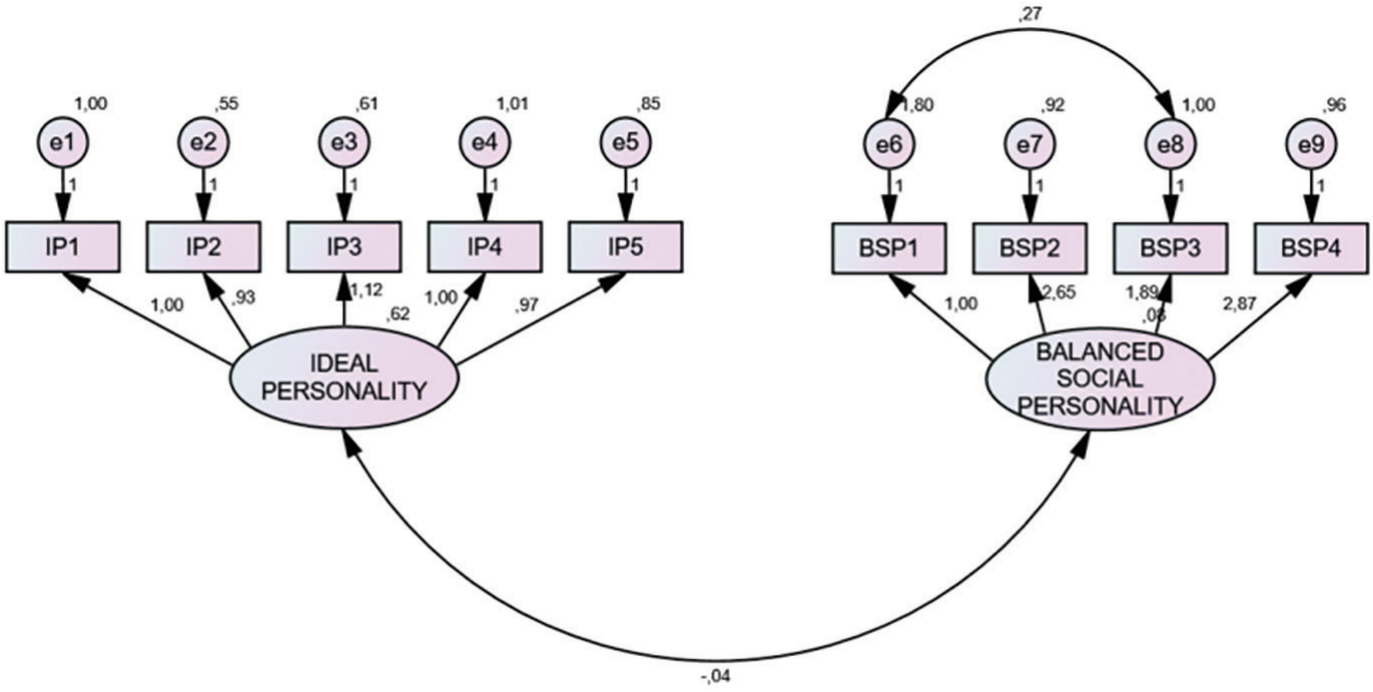
Appendix Figure 5. *CFA for the PAR scale*

PD: Items of the PAR scale



Appendix Figure 6. *CFA for the ADD scale*

EK: Items of the ADD scale



Appendix Figure 7. *CFA for the BFI-10 scale*

IP: Items of the I-P scale, BSP: Items of the BSP scale