

Personality traits in post-COVID syndrome

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Abstract

Background. We aimed to evaluate personality traits in patients with post-COVID syndrome, as well as the association with neuropsychiatric symptoms present in this disorder.

Methods. The Big Five Structure Inventory was administered to 93 consecutive patients with a diagnosis of post-COVID syndrome and to matched controls. We also performed a comprehensive evaluation of depression, anxiety, fatigue, sleep quality, cognitive function, and olfactory function.

Results. Patients with post-COVID syndrome scored lower for emotional stability, equanimity, positive mood, and self-control. Extraversion, emotional stability, and openness correlated negatively with anxiety and depression levels. Conscientiousness correlated negatively with anxiety. No statistically significant correlations were observed between personality traits and cognitive function, sleep quality, olfactory function, or fatigue. Personality scores explained 36.3% and 41% of the variance in scores on the anxiety and depression scales, respectively. Two personality profiles with lower levels of emotional stability were associated with depression and anxiety.

Limitations. This study has a cross-sectional design, and personality was evaluated during post-COVID syndrome and not before the onset of the disease.

Conclusions. Our study shows higher levels of neuroticism in patients with post-COVID syndrome. Personality traits were predictive of the presence of depression and anxiety, but not cognitive function, sleep quality, or fatigue, in the context of post-COVID syndrome. These findings may have implications for the detection of patients at risk of depression and anxiety in post-COVID syndrome, and for the development of preventive and therapeutic interventions.

Introduction

The WHO has recently defined post-COVID-19 condition or post-COVID syndrome as a disorder occurring in patients with a history of SARS-CoV-2 infection who present symptoms that cannot be explained by an alternative diagnosis (World Health Organization, 2021). These symptoms usually present 3 months after the onset of COVID-19 and last at least 2 months. According to the WHO, the most common symptoms include fatigue, shortness of breath, and cognitive dysfunction. Other common symptoms include depression, anxiety, headache, joint and muscle pain, sleep problems, and smell or taste disorders.

The pathogenesis of post-COVID syndrome remains unknown. Several mechanisms have been suggested, including prolonged inflammation, vascular injury and endothelial dysfunction, sequelae of organ damage, and the effects of hospitalisation (Maltezou et al., 2021). Due to the heterogeneity of clinical symptoms, multiple mechanisms may be involved. Other explanations, such as viral induction of a neurodegenerative process, are under investigation (Gómez-Pinedo et al., 2020; Matias-Guiu et al., 2021).

Personality traits are stable characteristics that reveal patterns of behaviour, values, habits, feelings, and thoughts. Several models have been developed to describe and assess personality. Among them, the most widely used is the Big Five Structure Inventory (BFSI), which categorises the main personality traits into openness, conscientiousness, extraversion, agreeableness, and neuroticism (Ka et al., 2021).

Some studies have examined the relationship between personality traits and engagement with containment measures during the COVID-19 pandemic (Carvalho et al., 2020; Airaksinen et al., 2021), the risk of depression and anxiety (Nikcevic et al., 2021; Proto and Zhang, 2021), and the psychological impact of the pandemic (Gori et al., 2021).

Furthermore, previous research has linked personality factors with certain diseases and clinical characteristics. Specifically, neuroticism, positive emotion in extraversion, and competence and self-discipline in conscientiousness were associated with anxiety and depression (Ka et al., 2021). Patients with different forms of pain may exhibit certain personality traits or be more prone to chronic pain or developing reactive depression (Naylor et al. 2017; García-Fontanals et al., 2017; Ibrahim et al., 2020). In addition, personality traits have been linked to subjective cognitive perception (Steinberg et al., 2013; Bell et al., 2020). However, to our knowledge, no study has evaluated the role of personality traits in post-COVID syndrome. The study of personality in the context of patients with post-COVID syndrome may be of interest for developing therapeutic strategies in case of maladaptive coping mechanisms. Investigating personality traits may also improve our understanding of the mechanisms of neurological and psychiatric symptoms in post-COVID syndrome.

In this study, we evaluated the role of personality traits in patients with post-COVID syndrome. Firstly, we aimed to compare the personality traits of a cohort of patients with post-COVID syndrome and a group of controls, according to the BFSI. Secondly, we evaluated the correlation between the main personality traits and the neuropsychiatric features of post-COVID syndrome. Thirdly, we examined the association between personality profiles and the clinical characteristics of post-COVID syndrome.

Methods

Participants and procedure

This study included 93 consecutive patients with post-COVID syndrome attended at our centre's neurology department due to cognitive issues. Patients met the current criteria for post-COVID syndrome proposed by the WHO (World Health Organization, 2021). Patients with other diagnosis previous to the onset of COVID-19 and potentially associated with symptoms (e.g. neurological or psychiatric disorders) were excluded. The mean age was 50.39 ± 11.26 years; 66 patients (71%) were women. Mean time from COVID-19 onset to assessment was 11.20 ± 4.29 months. The main clinical characteristics are presented in **Supplementary Table 1**. A group of healthy controls with no history of COVID-19 was also included. Patients and controls were matched 1:1 for age (< 6 years) and sex.

Personality was assessed using the BFSI, a multi-dimensional questionnaire based on 5 personality factors: emotional stability (inverse scores of neuroticism), extraversion, openness, conscientiousness, and agreeableness. Each factor is calculated from the parameters of 6 subscales (for instance, emotional stability is calculated from the carefreeness, equanimity, positive mood, social confidence, self-control, and emotional robustness subscales). For each item, the participant is asked to rate the accuracy of a statement using a four-point scale. The questionnaire was self-administered using the standard form of the test included in the Vienna Test System® (Schuhfried GmbH; Mödling, Austria), and we ensured that all participants received the same information about the test, with no external influences. Raw scores were converted to percentiles, taking into account sex, education, and age.

Depression was assessed using the Beck Depression Inventory-II (BDI-II; Beck et al., 1996), and anxiety using the State-Trait Anxiety Inventory (STAI). Sleep quality was examined with the Pittsburgh Sleep Quality Inventory. The Modified Fatigue Impact Scale (Kos et al., 2005) was administered to assess fatigue. The Brief Smell Identification test was used to assess olfactory function. Patients also underwent cognitive assessment with a comprehensive neuropsychological protocol (**Supplementary Table 2**), described elsewhere (Delgado-Alonso et al., 2021).

All assessments were performed in person by a trained neuropsychologist.

Statistical analysis

Statistical analysis was performed using SPSS Statistics 24.0 and R package version 3.6.3. Descriptive data are shown as mean \pm standard deviation or median (interquartile range). The chi-square test was used to compare categorical variables. The two-sample *t* test and ANOVA with Tukey post-hoc test were used to examine intergroup differences in continuous variables. P values < 0.05 were considered statistically significant. To compare personality factors and subfactors (35 variables), we applied a false discovery rate correction for multiple comparisons (Benjamini and Hochberg, 1995).

The two-tailed Pearson coefficient was used to evaluate correlations between quantitative variables. Correlations were regarded as weak (< 0.30), moderate (0.30-0.49), or strong (> 0.49), according to the correlation coefficient. Statistical significance was set at P < 0.01 to reduce the risk of multiple comparisons.

Automatic linear modelling (LINEAR) was performed to identify the personality traits that predict depression and anxiety. All factors and subfactors of BFSI were introduced in the model as predictors, and BDI-II and STAI state anxiety (STAI-S) scores were regarded as the independent variables. Only variables with P values < 0.05 were retained as predictors.

We used Ward's linkage algorithm (Ward, 1963), an unsupervised method of agglomerative hierarchical clustering, to identify subtypes of patients according to the 5 main personality traits. This analysis was performed using data from both patients and controls.

Results

Comparison between patients with post-COVID syndrome and controls

Patients with post-COVID syndrome scored lower for emotional stability (Table 1). When examining all subfactors of the BFSI, patients with post-COVID syndrome presented lower scores for equanimity, positive mood, and self-control (**Supplementary Table 3**).

Correlation analysis

Conscientiousness showed negative correlations with STAI-S ($r = -0.364$, $P < 0.001$) and STAI trait anxiety (STAI-T) scores ($r = -0.347$, $P = 0.001$). Extraversion showed negative correlations with BDI-II ($r = -0.326$, $P = 0.002$), STAI-S ($r = -0.374$, $P < 0.001$), and STAI-T scores ($r = -0.495$, $P < 0.001$). Emotional stability was also negatively correlated with BDI-II ($r = -0.360$, $P < 0.001$), STAI-S ($r = -0.342$, $P = 0.001$), and STAI-T scores ($r = -0.612$, $P < 0.001$). Openness also showed negative correlations with BDI-II ($r = -0.314$, $P = 0.002$), STAI-S ($r = -0.283$, $P = 0.006$), and STAI-T scores ($r = -0.297$, $P = 0.004$). Agreeableness did not show a significant correlation with scores on any neuropsychological instrument.

No statistically significant correlations were identified between the 5 personality factors and fatigue, sleep quality, olfactory function, or objective cognitive testing. Neither did we observe any correlation with months from symptom onset to consultation. All correlations with BFSI factors and subfactors are shown in **Figure 1** and **Supplementary Figures 1 and 2**, respectively.

Personality-related predictors of depression and anxiety

The results of automatic linear modelling are shown in **Supplementary Table 4**. Regarding depression (BDI-II), linear modelling identified openness to ideas, obligingness, dynamism, and openness to feelings as significant predictors, and the model explained 36.3% of variance. For anxiety (STAI-S), the model identified openness to actions, caution, love of order, competence, cheerfulness, social confidence, adventurousness, discipline, assertiveness, and openness to aesthetics as predictors, and explained 41% of variance.

Cluster analysis

The optimal cluster analysis solution was found at 4 clusters (**Supplementary Figure 3**). The mean values of personality traits for each group are shown in **Supplementary Figure 4**. Cluster 1 showed higher levels of depression than clusters 2 and 3. Regarding anxiety, STAI-S scores were higher in clusters 1 and 4 than in cluster 2. No statistically significant differences were observed in fatigue or sleep quality (**Supplementary Table 5**).

Discussion

In this study, we used the BFSI to evaluate personality traits in patients with post-COVID syndrome. We aimed to disentangle the personality characteristics of these patients and to clarify the association between certain personality traits and the neuropsychiatric symptoms of post-COVID syndrome. To our knowledge, this is the first study to address these questions.

Patients with post-COVID syndrome showed lower levels of emotional stability (higher neuroticism). In addition, the analysis of subfactors revealed lower scores for equanimity, positive mood, and self-control, all of which belong to the neuroticism/emotional stability factor. Accordingly, this trait would suggest greater tendencies to stress, worries, or anxiety. In this regard, the neuroticism factor showed strong and moderate correlations with STAI-T and STAI-S scores, respectively. Lower levels of conscientiousness and extraversion showed moderate negative correlations with anxiety and depression. Regarding the automatic linear analysis, the models identified several subfactors (eg, openness to ideas, feelings, and actions; love of order; competence; etc) that have previously been associated with affective disorders (Ka et al., 2021). Overall, these findings suggest that personality traits at least partially explain the development of depressive and anxiety symptoms in the context of post-COVID-19 syndrome.

Interestingly, no statistically significant correlations were observed between personality traits and cognition, sleep quality, olfactory function, or fatigue. This finding is noteworthy because it suggests that these symptoms are independent of personality traits.

The analysis of the distribution of patients in 4 clusters suggests the following profiles: a first group, with reduced levels of the main personality traits, especially extraversion, emotional stability, and openness; a second group, which may be identified as the resilient type according to the ARC typology (Gerlach et al., 2018); a third group, with average levels but lower openness and higher emotional stability, which may be classified as reserved; and a fourth group, with lower emotional stability, which could be identified as the overcontrolled group. Groups 1 and 4, both with lower levels of emotional stability, presented higher scores in BDI-II and STAI, confirming the vulnerability of these personality profiles to depression and anxiety in the context of the post-COVID syndrome.

Our study presents some limitations. Firstly, our controls had no history of COVID-19. A control group including patients affected by COVID-19 but without post-COVID syndrome would be of interest. Secondly, the personality assessment was performed at the time of assessment. Although evidence shows that personality traits are quite stable over time (Roberts and DelVecchio, 2000), we cannot exclude the possibility that diagnosis of COVID-19, the impact of the pandemic, or individual circumstances may induce changes.

In conclusion, our study shows higher levels of neuroticism in patients with post-COVID syndrome. Several personality traits were predictive of the presence of depression and anxiety. This supports the role of personality traits in coping behaviours during chronic disorders. Conversely, cognitive function, sleep quality, olfactory function, and fatigue were not associated with personality characteristics. These findings may have implications for the detection of patients at risk of depression and anxiety in the context of post-COVID syndrome, and for the development of preventive and therapeutic interventions.

Declarations

CREDIT Roles:

- Conceptualization and design of the study: MY, JMG, JAMG.
- Data curation: CDA, MVS, ADA, NGR, CP, AM, MJG.
- Formal analysis: CDA, JAMG
- Funding acquisition: JMG, JAMG
- Investigation: VP, MNM, ADA, MY, MTC, TMR, JLC, JAMG.
- Methodology: MY, JAMG
- Supervision: MY, JAMG, JMG
- Writing original draft: JAMG
- Writing review and editing: CDA, MVS, ADA, NGR, MY, CP, AM, MJG, JMG, JAMG.

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Availability of data and material: The datasets generated and analysed are available from the corresponding author on reasonable request.

Ethics approval: This study was approved by our centre’s Ethics and Research Committee (code 20/633-E).

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Conflicts of interest: The authors declare that they have no conflicts of interest.

Abbreviations

Abbreviations: ANOVA: analysis of variance; BDI-II: Beck Depression Inventory II; BFI: Big Five Structure Inventory; BSIT: Brief Smell Identification Test; COVID-19: coronavirus disease 2019; PSQI: Pittsburgh Sleep Quality Index; STAI: State-Trait Anxiety Inventory; VTS: Vienna Test System; WAF: Perception and Attention Functions test; WHO: World Health Organization.

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Table 1

Table 1. Comparison of Big Five personality traits between patients with post-COVID syndrome and controls.

	Post-COVID syndrome	Healthy controls	t (P value)
Agreeableness	47.94 ± 22.47	55.66 ± 22.40	2.34 (0.020)
Conscientiousness	50.33 ± 29.05	58.38 ± 26.82	1.96 (0.051)
Extraversion	45.04 ± 30.79	56.38 ± 29.78	2.55 (0.012)
Emotional stability	34.15 ± 27.00	45.24 ± 27.00	2.79 (0.006)
Openness	40.02 ± 31.45	48.62 ± 28.09	1.96 (0.051)

Statistically significant P values after false discovery rate correction for multiple comparisons are shown in bold.

Figures



Figure 1

Heatmap of Pearson correlation coefficients between personality factors and scales assessing depression, anxiety, fatigue, sleep quality, and olfactory function.

Supplementary Files

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- [SupplementaryFigure2.tiff](#)
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