

THE ASSOCIATION OF SLEEP QUALITY WITH DECISION MAKING AND EXECUTIVE FUNCTIONS IN PATIENTS WITH PANIC DISORDER FOLLOWED FOR THREE MONTHS

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BACKGROUND AND AIM: Panic disorder (PD) is an anxiety disorder characterized by sudden and unexpected panic attacks that manifest with both physical and cognitive symptoms. These attacks can be debilitating, leading to increased distress and avoidance behaviors. Sleep disturbances frequently accompany PD, negatively impacting quality of life and exacerbating anxiety symptoms. Studies indicate that PD patients often report difficulty falling and staying asleep, as well as experiencing fragmented sleep patterns, which contribute to heightened emotional distress and cognitive impairment. Additionally, chronic sleep disturbances may lead to greater emotional instability, increased stress sensitivity, and long-term neurocognitive deficits. Executive functions are complex cognitive processes that enable goal-directed behavior, including planning, working memory, inhibition control, cognitive flexibility, reasoning, and problem-solving. Impairments in sleep quality have been associated with deficits in these cognitive abilities. Sleep deprivation or poor sleep quality may reduce the brain's ability to regulate emotions and make adaptive decisions. Studies indicate that individuals with PD experience impairments in visuospatial memory, verbal memory, short-term memory, working memory, and executive functioning. These cognitive impairments not only affect daily functioning but may also contribute to the persistence of anxiety symptoms and hinder effective coping mechanisms. PD is not limited to anxiety symptoms but is closely related to neurocognitive dysfunctions and sleep disturbances, which can significantly impact overall functionality. This study aims to evaluate the relationship between sleep quality and cognitive function impairments in PD patients. Additionally, it investigates whether cognitive deficits persist despite symptomatic improvement after treatment and whether functional recovery occurs alongside symptom resolution. The findings may contribute to an improved understanding of cognitive impairments in PD and highlight the importance of sleep management in the treatment of anxiety disorders.

METHODS: The ethical approval for the study was obtained from the Non-Interventional Clinical Research Ethics Committee of Balıkesir University Rectorate, Republic of Turkey, on August 15, 2023, with decision number 2023/75. The study included 81 volunteer patients diagnosed with PD and 81 healthy control. To be included in the patient group, individuals had to be between 18-65 years old and voluntarily participate in the study. They were required to meet the DSM-5 diagnostic criteria for panic

disorder, not have used psychotropic medication for at least one month before the study, and possess adequate physical and mental capacity to complete the assessments. The treatment process of the patients was monitored in accordance with the routine procedures of the psychiatry outpatient clinic at our hospital. No modifications or interventions were made to the treatment protocols within the scope of this study. At the initial assessment, patients were administered the Sociodemographic Data Form, Pittsburgh Sleep Quality Index (PSQI), Panic Disorder Severity Scale (PDSS), Montgomery-Asberg Depression Rating Scale (MADRS), Wisconsin Card Sorting Test (WCST), and Iowa Gambling Task (IGT). Over the three-month psychiatric treatment and follow-up period, 43 patients discontinued participation for various reasons. Consequently, PSQI, PDSS, MADRS, WCST, and IGT were re-administered to the remaining 38 PD patients who continued treatment and follow-up.

RESULTS: Correlation analyses revealed a significant positive correlation between PSQI and MADRS and between MADRS and PDSS ($p < 0.001$). However, no statistically significant correlation was found between PSQI and PDSS scores ($p = 0.079$). PDSS scores showed a significant negative correlation with WCST parameters, including total correct responses, total categories completed, and conceptual level response percentage ($p < 0.05$). In contrast, PDSS was positively correlated with total errors, perseverative responses, perseverative errors, and perseverative error percentage ($p < 0.05$). After treatment, WCST results showed an increase in total correct responses and a significant decrease in total errors and perseverative errors ($p < 0.001$). However, no significant changes were observed in the number of trials to complete the first category, failure to maintain set, or learning-to-learn scores ($p > 0.05$). Post-treatment IGT scores increased significantly. A significant positive correlation was found between post-treatment PSQI and MADRS scores and between PSQI and PDSS scores ($p < 0.001$). Generalized Estimating Equations (GEE) modeling indicated that PSQI significantly affected IGT performance, with each one-point decrease in PSQI associated with a 0.156-point increase in IGT score ($p = 0.013$).

CONCLUSIONS: Comparison of WCST results between PD patients and healthy controls revealed that the patient group exhibited lower performance in executive functions, including cognitive flexibility, problem-solving, and abstract thinking. PD patients demonstrated impaired decision-making abilities,

favoring disadvantageous choices and struggling to avoid long-term negative outcomes. Additionally, PD severity was found to significantly impact cognitive functioning, with increased PD severity associated with diminished executive functions, particularly cognitive flexibility, set-shifting, abstraction, and inhibition. Poor sleep quality was associated with increased depression severity, which in turn exacerbated PD severity. Post-treatment assessments indicated improvements in sleep quality, depressive symptoms, and PD severity. Patients demonstrated enhanced problem-solving skills, cognitive flexibility, and adaptation to new rules. Improved abstraction skills and rule-following success suggested increased conceptual thinking and overall cognitive understanding. The observed reduction in perseverative errors indicated enhanced attention and executive function organization. Post-treatment, a decrease in risky decision-making tendencies and an improvement in long-term gain-focused decision-making were noted. A one-point decrease in PSQI score corresponded to an average increase of 0.156 points in IGT score. GEE analysis confirmed that the effect of sleep quality on IGT scores was independent of other variables.

Failure to recognize and treat sleep disorders not only negatively affects cognitive functions and decision-making but also leads to a decline in overall functioning. However, the absence of direct acknowledgment of sleep disturbances in the DSM-5 diagnostic criteria for PD may cause this critical issue to be overlooked in clinical practice. Greater awareness and structured interventions targeting sleep disturbances in PD may enhance overall treatment outcomes and long-term cognitive stability. Regular assessment and management of sleep quality in outpatient and inpatient settings are essential for improving the quality of life and cognitive processes in individuals with PD. This study highlights the significance of treating sleep disturbances not only for managing PD symptoms but also for enhancing cognitive performance and decision-making processes. Addressing sleep disorders in PD patients may contribute to a broader approach in clinical psychiatry, promoting better patient outcomes and reducing the long-term functional impairments associated with cognitive decline.

Keywords: Cognitive functions, depression, decision-making, panic disorder, sleep quality