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Exploring Work-Related Stress, Burnout, Poor Sleep Quality and Mindfulness as Predictors for Psychosomatic Symptoms

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ABSTRACT

Psychosomatic symptoms refer to the medically unexplained physical disturbances that are commonly associated with psychological distress and have been observed within occupational settings impacting employee well-being. The current study investigates whether work-related stress, burnout, poor sleep quality, and mindfulness can significantly predict the manifestation of psychosomatic symptoms in a sample of employed Greek adults. A total of 209 individuals with a mean age of M= 33.68 years (SD= 8.68) participated in the survey, completing demographic information followed by five separate validated self-report questionnaires, including the Workplace Stress Scale (WSS), Oldenburg Burnout Inventory (OLBI), Short Pittsburgh Sleep Quality Index (Short-PSQI), Five Facet Mindfulness Questionnaire – 15 (FFMQ-15) and the Psychosomatic Screening Questionnaire - 29 (PSSQ-29). The standard multiple linear regression analysis indicated significance of the model, F (6, 202) = 38.78, p< .001, adjusted R^2= .521, indicating a large effect size, thus 52.1% of the variance of psychosomatic symptoms could be explained by the predictors combined. Specifically, work-related stress (B= 1.86, p< .001), burnout (B= 1.86, p= .006), poor sleep quality (B= 4.20, p<.001), and mindfulness (B= 3.04, p< .001), revealed a significant positive association with the outcome, while gender and low income (< €10.000), also contributed significantly to psychosomatic symptoms scores. Contrary to the initial hypothesis and prior research, mindfulness was found to be positively correlated with psychosomatic symptoms, indicating a more complex relationship. These findings contribute to the growing body of research on psychosomatic symptoms in occupational settings and highlight the importance of further investigation. Future research should consider biological, psychological and individual difference factors while adopting longitudinal designs to more accurately assess causality and understand the mechanisms of these associations, ultimately forming strategies to support and improve employee well-being.

Keywords: Psychosomatic Symptoms, Work-Related Stress, Burnout, Sleep Quality, Mindfulness

INTRODUCTION

Psychosomatic Symptoms

As the modern workplace becomes increasingly competitive, employees strive to manage the rapidly growing responsibilities while maintaining their positions, which can sometimes lead to adverse effects on their physical and psychological well-being (Dlouhy & Casper, 2021; Cottini& Lucifora, 2013). Employees may experience somatic manifestations of symptoms that are strongly connected and derived from the psychological distress experienced in their workplace. These symptoms, usually known as psychosomatic symptoms, are defined as physical or physiological changes resulting from emotional or psychological distress that interfere with normal biological function (Nisar & Srivastava, 2017). More specifically, these symptoms may include fatigue, gastrointestinal issues, headaches, insomnia, and muscular tension, making it challenging for the individuals to engage in their everyday activities (Stanisławska-Kubiak et al., 2023). Notably, literature supports that especially medical professions are considered the most possible to give employees psychosomatic symptoms (Busch et al., 2021; Polyakova & Bonkalo, 2020). More precisely, in a research study conducted on healthcare workers during the COVID-19 outbreak, it was reported that 60.7% of participants were experiencing psychosomatic symptoms due to the massively demanding working conditions, which led them to being less productive and more prone to mistakes (Jiang et al., 2023; Lees & Lal, 2017). Similarly, a study conducted on 9,137 health workers in Japan also concluded that healthcare workers exhibited 10% more psychosomatic symptoms than the average population, highlighting that women experienced more psychosomatic symptoms than men (Ito et al., 2014). Congruent to this was the meta-analytic study of Grasshoff et al. (2025), who investigated the differences in psychosomatic symptoms between the two genders in the workplace. Notably, they discovered that women exhibited higher levels of psychosomatic symptoms than men due to the pay gap, actual and perceived unfair treatment and inadequate compensation (European Commission. Statistical Office of the European Union, 2022; Grasshoff et al., 2025). Another factor contributing to the higher percentage of psychosomatic symptoms in women was also the disproportionate caregiving responsibilities and societal expectations while maintaining a stable job position (Destatis, 2022).

In all occupational contexts, the psychosomatic symptoms not only affect the employees themselves but may also lead to increased organizational costs (Ramos-Galarza & Acosta-Rodas, 2019). This concept underscores the need to investigate and understand the primary causes behind the manifestation of psychosomatic symptoms, which could subsequently lead to the development of potential management strategies.

Work-related Stress

Several factors may also contribute to the manifestation of psychosomatic symptoms in the workplace. Literature suggests that factors such as work-related stress are strongly associated with increased psychosomatic symptoms. According to the Demand-Control model developed by Karasek (1979), high job demands combined with low job control create highly stressful work conditions which are referred to in the literature as high strain jobs (Fila, 2016). Individuals that are employed in high-strain jobs experience high levels of work-related stress (Fila, 2016).

From a biological perspective, the stressful conditions activate the 'Hypothalamic-Pituitary-Adrenal' (HPA) axis, releasing cortisol into the system (Russell& Lightman, 2019). Prolonged activation of this system may result in increased levels of cortisol in the organism, which over time can lead to immune system deregulation, increased inflammatory risk, metabolic disruptions and cardiovascular conditions

(Kivimäki & Steptoe, 2018; McEwen & McEwen, 2017; McEwen et al., 2012).

Jaradat et al. (2016), in a study conducted on 430 Palestinian nurses, found that high levels of work-related stress harmed physical and psychological well-being, giving high scores on a psychosomatic symptoms checklist that the researchers used for the assessment. Similarly, in a sample of 2,889 nurses, it was concluded that high levels of occupational stress were associated with increased psychosomatic symptoms, affecting also their sleep and causing them anxiety and depression (Gu et al., 2019). Furthermore, Jiang et al. (2023), while studying the physical and psychological impact of the COVID-19 outbreak (from 2020 to 2023) on healthcare workers, found that the perceived stress and psychosomatic symptoms among the participants had increased dramatically between the first quarter of the pandemic and the last.

Burnout

According to Galanakis et al. (2020), work-related stress has a significant relationship with burnout. Occupational burnout, as defined by Maslach & Jackson (1986), refers to the psychological syndrome of emotional exhaustion, depersonalization, and diminished personal achievement that occurs among individuals working under high-pressure environments. Empirical evidence further enhances this association, specifically in a study conducted on a European population, it was demonstrated that individuals experiencing higher levels of work-related stress were significantly more likely to report symptoms of burnout (Chiciro, 2016). Similarly, Ptacek et al. (2017), investigating a sample of Czech citizens, concluded that job stress and burnout were positively correlated, with burnout symptoms intensifying alongside increases in stress levels.

Notably, burnout not only produces psychological strain, but it also causes physiological dysfunctions. According to Van Den Bergh et al. (2017), chronic exposure to stress, which leads to burnout, has been associated with dysregulation of the HPA axis, potentially contributing to the development of psychosomatic symptoms. Burnout is also linked to systematic inflammation, which can disrupt normal gut and bowel functioning that are characteristic manifestations often observed among individuals with psychosomatic complaints (Adebayo et al., 2023). Hammarström et al. (2023) support the notion that burnout is positively associated with the manifestation of psychosomatic symptoms, based on their investigation of a Swedish adult population. Similarly, Von Känel et al. (2020) found that occupational burnout was strongly correlated with the presence of somatic symptoms, suggesting that higher severity burnout increased the likelihood of somatic reactions.

Sleep Quality

In the same context, Deng et al. (2020) and Metlaine et al. (2018) argued that burnout can not only lead to somatic disturbances but may also negatively impact sleep quality. Sleep disturbances are considered responsible for both physical and mental health issues (Deng et al., 2020; Metlaine et al., 2018). Sleep is an important aspect of the human life cycle, as it has a key role in maintaining and shaping crucial functions of the body and the mind (Worley, 2018). During sleep, the body follows a series of restorative processes, including tissue repair, regulation of immune function and metabolism, consolidation of memories and emotional regulation (Worley, 2018). Sleep occurs through repeated cycles of 'Non-Rapid Eye-Movement' (NREM) and 'Rapid-Eye-Movement' (REM) sleep (Patel et al., 2025). Specifically, NREM, which is the longest in duration stage, is divided into three distinct sub-stages, which are N1, N2 and N3, corresponding to light sleep, light sleep but slightly deeper than in N1, and deep sleep, which is considered the most significant one and is associated with physical restoration and immune function regulations (Patel et al., 2025). REM, which

is the last stage of the sleep cycle, is also important, as it is linked with emotional processes and memory integration (Patel et al., 2025). Most organisms have evolved to follow a specific sleep schedule. This is possible through an internal biological clock, known as the circadian rhythm, which is located in the suprachiasmatic nucleus (SCN) of the hypothalamus (Reddy et al., 2025). This system regulates the twenty-four-hour cycle that humans follow, based on the conditions of light and darkness in the environment, promoting wakefulness during the daytime and sleepiness once it gets dark at night (Reddy et al., 2025). Disturbances in this cycle due to an abnormal sleep programme, working in shifts or exposure to light during nighttime may impact sleep quality (Reddy et al., 2025). Similarly, conditions such as burnout may also disrupt circadian rhythms, causing irregular sleep patterns and a decline in overall sleep quality, depriving the organism of the restorative processes that normally happen during sleep. Simultaneously, these sleep disturbances intensify burnout symptoms, creating a self-reinforcing cycle that can result in progressively severe health consequences (Stewart & Arora, 2019).

Literature suggests that poor sleep quality and sleep deprivation inhibit the restorative processes of the body and are related with numerous negative consequences (Irwin, 2015). Specifically, insufficient sleep can lead to increased activation of the HPA axis, raised cortisol levels, amplified activity in the sympathetic nervous system, systematic inflammation and diminished immune responses (Irwin, 2015). These biochemical disruptions are fundamental pathways connecting sleep disorders to physical health issues. Chronic sleep abnormalities are significantly associated with the emergence and progression of psychosomatic symptoms, such as headaches, gastrointestinal disorders, chronic fatigue, musculoskeletal pain, and cardiovascular complications (Nordin et al., 2021). This notion aligned with the findings of Pilcher and Morris's (2020) review, which concluded that poor sleep quality among employees could severely impact their physical and psychological health. Likewise, the systematic literature review of Mao et al. (2023) examining sleep quality in thirty-eight studies mainly using the 'Pittsburgh-Sleep-Quality-Index'(PSQI) found that poor sleep was positively associated with high occupational stress and adverse somatic effects (Mao et al., 2023).

Mindfulness

Nevertheless, literature suggests that individuals could alleviate the psychosomatic symptoms caused by stress and/ or burnout though mindfulness techniques (Zargar et al., 2021). Mindfulness originates from the Buddhist psychology tradition which refers to the ability to retain an object in mind while at the same time paying attention to the present moment, including emotions, thoughts, and body sensations (Guendelman et al., 2017). Contemporary psychology has utilised the bases of Buddhist techniques of mindfulness to create a more Western approach that could benefit individuals in clinical settings. Specifically, Jon Kabat-Zinn (2005) in the seventies was the first to develop a mindfulness-based stress reduction program, which was proven to be extremely valuable in reducing symptoms of stress and negative emotions, as well as physiological complaints of individuals suffering from chronic pain and diseases (Guendelman et al., 2017). In the years that follow, many variations and applications of this model have arisen. Mindfulness-based therapies focus on training body awareness with techniques such as body scan, which is paying attention to all body parts, mindful breathing, which is focusing on the breath and yoga, which is paying attention to the movements of the body (De Jong et al., 2016). Body awareness in the context of mindfulness refers to the conscious perception of the internal body sensations such as emotion, pain and breath, which is influenced by the individual's attitudes and

beliefs (De Jong et al., 2016). Studies support that higher levels of mindfulness, thus enhanced body awareness, are associated with reduction of cortisol levels and pro-inflammatory cytokines (Garland et al., 2017). More precisely, individuals become able to recognise and modulate their stress responses while regulating their emotions. In this way the activation of the HPA axis and sympathetic nervous system is reduced, lowering the effects of stress and stopping it from becoming chronic or impacting any other systems (Garland et al., 2017). Research findings support the effectiveness of mindfulness in reducing psychological distress and psychosomatic symptoms. Specifically, Pascoe et al. (2017), in their meta-analysis of forty-five studies, indicated that mindfulness meditation reduced blood pressure, cortisol levels and inflammation-related proteins across multiple populations. Additionally, in the research study of Sayyar Khesmakhi et al. (2019), it was concluded that mindfulness helped individuals improve their body awareness by recognising how their emotions and thoughts enhanced their somatic health. In this way mindfulness may reduce the severity of psychosomatic symptoms and has a positive outcome for the overall quality of life (Zargar et al., 2021).

Rational

Building on the existing literature, which has examined work-related stress, burnout, sleep quality, mindfulness, and psychosomatic symptoms separately, the current study is the first to investigate the relationship between these variables simultaneously within a Greek population using validated and standardized psychometric instruments. In this context, the researcher expects that higher scores in work-related stress, burnout and poor sleep quality will significantly predict increased scores in psychosomatic symptoms, while higher mindfulness will be associated with decreased psychosomatic symptoms.

MATERIALS & METHODS

Design

This research study followed a quantitative, cross-sectional, correlational design with a goal of investigating the predictive value of work-related stress, burnout, sleep quality and mindfulness for psychosomatic symptoms in the employed adult Greek population. Additionally, several demographic factors, including age, gender, level of education, marital status, number of children, occupation, income and residence area, were taken into consideration. The quantitative approach allowed for the collection of scaled data through validated questionnaires and for the statistical analysis of the relationships between the selected variables (Field, 2018). Data collection took place within a defined time frame, from week 50 of 2024 to week 10 of 2025, thereby giving the study a cross-sectional structure (Wang & Cheng, 2020). Furthermore, a correlational design was considered appropriate, as the study focused on exploring the associations between variables, rather than searching for causality (Field, 2018). Multiple linear regression was utilised to simultaneously examine the extent to which the predictor variables (work-related stress, burnout, sleep quality and mindfulness) could predict the outcome (psychosomatic symptoms; Field, 2018). The research design met the key assumptions for regression analysis, including linearity, homoscedasticity, normality, and independence of predictors (Schmidt & Finan, 2018). Furthermore, both the outcome (psychosomatic symptoms) and the predictors (work-related stress, burnout, sleep quality and mindfulness) were measured using scaled data. Moreover, a correlational relationship was confirmed among and between the predictors and the outcome, further strengthening the suitability of this method of analysis (Schmidt & Finan, 2018).

Participants

A total of two hundred and twenty-three individuals were invited to participate in the

study. The final sample consisted of two hundred and nine healthy, employed Greek adults, ages 19 to 63 (M= 33.68, SD= 8.68) yielding a participation rate of 93.72%. Of those, 68% were female (M= 33.5, SD= 8.97) and 32% were male (M= 34.1, SD= 8.09). This sample size exceeded the minimum size as suggested by G*power software which indicated that one hundred and eighty-four individuals were needed to have a medium effect size, a 5% significance level (a= 0.05) and a power of 95%, expressing the likelihood of a true effect being detected.

The participants were approached using a combination of convenience and snowball sampling. In the former approach, the researcher engages participants within their social circles, while in the latter, the researcher connects with participants via online social platforms such as Facebook, Instagram, and LinkedIn, requests individuals to participate in the survey, and encourages those who have completed it to share it with their acquaintances for further participation (Lavrakas, 2008; Parker et al., 2020).

The inclusion criteria required participants to be over 18 years old and free from any diagnosed mental health condition or related medication use. Additionally, they needed to have a good understanding of the English language since all questionnaires were in English and be familiar with the use of computers, laptops, tablets and/or smartphones to respond to the online survey via Google Forms. The exclusion criteria included being unemployed, of non-Greek nationality (to avoid any cultural biases) or having a diagnosed mental health condition. It is important to point out that no payments or rewards were offered to the participants.

MATERIALS

Demographics Questionnaire. The participants, after they had been invited to the study and gave their consent to participate, were asked to complete a demographic questionnaire developed for this research, which included questions about age, gender, marital status, number of children, level of education, occupation, income, and area of residence. The questionnaire gathered information on demographics that may be potentially relevant to sociodemographic influences on psychosomatic symptoms and psychological predictors (Huurre et al., 2005; Pilafas et al., 2024).

Workplace Stress Scale (WSS). Work-related stress was measured using the 'Workplace-Stress-Scale' (WSS), which was developed by The Marlin Company in conjunction with the American Institute of Stress (1978). The WSS consists of eight items rated on a 5-point Likert scale (1= Never, 2= Rarely, 3= Sometimes, 4= Often, 5= Very Often), resulting in a score range from 8 to 40 (Jebb et al., 2021). A total combined score is interpreted as follows: Scores of 15 or less indicate a relatively calm state with a low level of stress; scores between 16 and 20 are fairly low levels of stress, scores from 21 to 25 suggest a moderate level of stress, scores from 26 to 30 present a severe level of stress and scores from 31 to 40 reflect a possibly dangerous level of stress, where intervention may be warranted, particularly if stress is affecting their health or well-being (The Marlin Company &The American Institute of Stress, 1978). This scale is regularly administered in occupational health research and practice to screen for harmful levels of work-related stress and initiate early intervention plans (The Marlin Company & The American Institute of Stress,1978).

Oldenburg Burnout Inventory (OLBI). Burnout was evaluated using the 'Oldenburg-Burnout-Inventory' (OLBI; Halbesleben & Demerouti, 2005; Demerouti, 1999). The OLBI contains 16 items related to two principles of burnout, exhaustion and disengagement from work. Items are rated on a 4-point Likert scale (1= Strongly Agree, 2= Agree, 3= Disagree, 4= Strongly Disagree), and some items are reverse scored (Jebb et al.,2021). The total

scores range from 16 to 64, with higher scores indicating increasing levels of burnout. The OLBI is widely employed in occupational health and psychological literature because it assesses emotional fatigue as well as psychological withdrawal from one's work, offering a dual-dimensional perspective (Halbesleben & Demerouti, 2005; Demerouti, 1999).

Short Pittsburgh Sleep Quality Index (Short-PSQI). The short form of the 'Pittsburgh-Sleep-Quality-Index' (PSQI) was used to assess sleep quality, patterns and disturbances during the period of the past month (Sancho-Domingo et al., 2021). The measure uses a mixture of open-ended items (e.g., sleep duration and sleep latency) and items that evaluate frequency of sleep habits and are rated based on a 4-point Likert scale (0= Not during the past month, 1= Less than once a week, 2= Once or twice a week, 3= Three or more times a week; Jebb et al., 2021). Five component scores were calculated for sleep latency, sleep duration, sleep efficiency, sleep disturbances, and daytime dysfunction. The five component scores are summed to calculate a global sleep quality score ranging from 0 to 15. A score greater than 4 is indicative for clinically significant poor sleep quality. The PSQI has been previously validated and is widely used in clinical settings and community-based studies assessing sleep behaviour (Sancho-Domingo et al., 2021).

Five Facet Mindfulness Questionnaire - 15 (FFMQ-15). Mindfulness was assessed utilizing the 'Five-Facet-Mindfulness-Questionnaire' (FFMQ-15; Baer et al., 2012). This evaluates five elements of mindfulness that include observing, describing, acting with awareness, non-judging of inner experience, and non-reactivity to inner experience. Each item was rated on a Likert scale from '1= Never or very rarely true' to '5= Very often or always true' and there were several items with reverse scores (Jebb et al., 2021). Total scores are summed, with higher total scores indicative of higher levels of mindfulness. The FFMQ-15 is an established measure of dispositional mindfulness and has demonstrated excellent psychometric reliability with clinical and non-clinical samples (Baer et al., 2012).

Psychosomatic Screening Questionnaire - 29 (PSSQ-29). Psychosomatic symptoms were the primary outcome variable of the study and were measured using the 'Psychosomatic-Screening-Questionnaire-29'(PSSQ-29), created and validated by Pilafas et al. (2021, 2024). The PSSQ-29 has 29 items measuring the frequency and intensity of various physical and emotional symptoms experienced during the past two weeks. Each item was scored using an 11-point Likert scale ranging from '0= Not at all' to '10= Very often', with the total score indicating more severe and more frequent psychosomatic symptomatology (Jebb et al., 2021). The questionnaire measures various domains of psychosomatic symptomatology that include sleep problems, GI problems, cardiovascular issues, and affective dysregulation (Pilafas et al., 2021; Pilafas et al., 2024). The PSSQ-29 has been validated in the standard Greek population and displays excellent internal consistency and is appropriate for use in clinical screening for psychosomatic symptoms and in epidemiological studies that no one else could access (Pilafas et al., 2021; Pilafas et al., 2024).

Technological Tools and Software. The study materials were created and delivered on Google Forms so that participants could access and finish the survey from anywhere, as long as they had their own electronic device, including computers, tablets, and smartphones. Participant responses were automatically logged and saved to the researcher's Google Drive account. For the design of the study, G*power software was utilised and for the analysis, the dataset was exported to Microsoft Excel for summary purposes and then was analysed using IBM

SPSS Statistics (version 29; IBM Corp., 2017; Kang, 2021). All aspects of managing the data, conducting statistical analysis, and writing the thesis were completed on the researcher's personal laptop.

PROCEDURE

Shortly after receiving ethical approval from the University of Derby, the study was initiated following the ethical guidelines of the British Psychological Society (BPS, 2021) by uploading all necessary documents and questionnaires to the Google Forms platform. These materials included the invitation to the study, consent form, debriefing sheet, and participation information sheet, followed by the demographic questions and the five psychometric questionnaires. Once everything was inserted in Google Forms, a link and a QR code directing participants to the online survey were created and distributed via social media or through direct scanning of the QR code.

Upon entering the survey, they were informed about the anonymity of their responses and were asked to give their consent before proceeding. Then they completed the demographic questions, followed by the five psychometric questionnaires. The participants were free to withdraw at any point from the study by closing the survey. After submitting their answers, participants were given a two-week period to request withdrawal by contacting the researcher on the provided details and giving their personal code. The sampling procedure lasted approximately 12 weeks, from December 2024 to February 2025. Upon completion, the anonymous responses were selected, downloaded and securely saved in order to proceed to their analysis.

Analytic Strategy

All analyses were performed using IBM SPSS Statistics version 29 (IBM Corp., 2017). The dataset was first screened for missing values, outliers, and violations of normality. Descriptive statistics (means, standard deviations and ranges) were calculated for all the study variables.

Independent samples t-tests were used to compare demographic differences between two levelled variables, such as the gender of participants, and where applicable, one-way ANOVAs were utilized to compare demographic differences between variables with more than two levels, such as the education level, with Bonferroni post hoc analysis as needed (Field, 2018). Bivariate relationships between all predictor variables and the outcome variable of psychosomatic symptoms were analysed using Pearson's correlation coefficients (Schober et al., 2018). A correlation matrix was assessed for any high correlations among the predictors (i.e., r> .90), which could indicate overlaps and multicollinearity (Schober et al., 2018). If overlapping predictors were found, they would be evaluated for removal from the regression analysis in order to maintain accuracy of the model. Multicollinearity was also examined by the Variance Inflation Factor (VIF), and factors below 10 were considered accepted (Schober et al., 2018). After these preliminary steps were completed, a standard multiple linear regression analysis was used to explore the unique and combined predictive power of work-related stress, burnout, sleep quality, and mindfulness on psychosomatic symptoms (Field, 2018). All key assumptions of regression (i.e., linearity, homoscedasticity, normality of residuals, and independence of errors) were tested and satisfied before interpreting the results (Schmidt & Finan, 2018).

RESULTS

A total of 209 participants met the eligibility criteria and participated in the study. Psychosomatic symptom scores corresponded to a mean of M= 120.84 (SD= 52.05), with a range from 30 to 259. The mean age of participants was found to be M= 33.68 (SD= 8.68), with a range from 19 to 63. Among the predictor variables, participants provided mean scores of M=22.00 (SD=6.14) for work-related stress,

M= 41.92 (SD= 4.23) for burnout, M= 4.49 (SD= 2.35) for sleep quality, and M= 29.11 (SD= 4.29) for mindfulness. Then, an independent samples t-test was conducted and found a statistically significant difference between females (M= 129.96, SD= 52.94) and males (M= 101.49, SD= 44.63) in psychosomatic symptoms, t (207) = -3.81, p< .001, with a medium effect size (Cohen's d= -0.56). Following, a one-way analysis of variance (ANOVA) was performed in order to explore differences across the remaining demographic categories. There were no significant differences in psychosomatic symptoms between the levels of education (p= .105), marital status (p= .141), occupation (p= .692), or area of residence (p= .711). In addition, the effect sizes were also minimal, with η^2 ranging between .006 and .023. On the contrary, psychosomatic symptoms were significantly associated with the levels of income, F (3, 205) = 4.44, p= .005, presenting a small to medium effect size, η^2= .061. The Post-hoc Bonferroni tests revealed that the lowest income group (< €10,000) reported significantly higher psychosomatic symptoms than the individuals in the €10,001 - 20,000 (p= .003) and > €30,000 income groups (p= .039). The scores for the < €10,000 group and the €20,001- €30,000 group (p= .543) were not statistically different.

A correlational analysis followed, and the Pearson r coefficients were calculated to look for associations between the main study variables. Psychosomatic symptoms were significantly positively correlated with work-related stress (r= .575, p< .001), burnout (r= .444, p< .001), poor sleep quality (r= .426, p< .001), and mindfulness (r= .495, p< .001). Moreover, there was a significant negative correlation with psychosomatic symptoms and income (< €10,000 pseudo variable) (r= -.241, p< .001). These results suggested that the aforementioned variables could be included in the regression model.

Notably, all assumptions of linear regression were assessed and met. The normality of the residuals was examined both visually in the Q-Q plot and histogram of standardized residuals, whose distributions showed approximately normal distributions. The residuals were also distributed almost evenly around zero, suggesting that the homoscedasticity assumptions were met. When checking for multicollinearity was found that none of the predictors had problematic correlations and that all the Variance Inflation Factor (VIF) values were < 1.4 and tolerance values > .70, within the acceptable limits. The Durbin-Watson test gave a 2.091 value, which indicated there was no autocorrelation among the residuals.

Then the standard multiple linear regression analysis was conducted to examine the contribution of gender, income (< €10,000), work-related stress, burnout, sleep quality, and mindfulness in predicting psychosomatic symptoms. The model was statistically significant, F (6, 202) = 38.78, p< .001, explaining 53.5% of the variability in psychosomatic symptoms (R^2 adjusted= .521). All the predictor variables significantly contribute to the model, and more precisely, work-related stress (B= 2.95, p< .001), burnout (B= 1.86, p= .006), poor sleep quality (B= 4.20, p< .001), and mindfulness (B= 3.04, p< .001) had strong positive predictive relationships with psychosomatic symptoms. On the other hand, income (< €10,000) had a negative association with psychosomatic symptoms (B= -16.66, p= .007), suggesting that lower income may predict higher psychosomatic symptoms. Gender was also significant (B= 13.25, p= .018) but the contribution to the model was relatively modest compared to the rest predictors.

The regression analysis indicated that work-related stress, burnout, poor sleep quality and mindfulness were significant predictors of psychosomatic symptoms. All four predictor variables showed positive associations with the outcome, indicating that the higher levels of these variables were associated with higher psychosomatic symptom scores. Furthermore, from the demographic factors, income and gender

were also associated with the outcome, indicating that female individuals and individuals with an annual income of less than €10.000 had higher scores in psychosomatic symptoms, however their relationship was weaker than the one of the predictor variables.

DISCUSSION

The aim of the current study was to investigate the relationship between work-related stress, burnout, poor sleep quality and mindfulness and psychosomatic symptoms in a population of employed Greek adults. Following a quantitative design and multiple regression analysis, the results confirmed that all the predictor variables contributed significantly to the model. Demographic factors, particularly gender and income, were also associated with the outcome, with females and individuals earning less than €10.000 annually reporting higher psychosomatic symptoms.

The research findings aligned with the majority of the hypotheses initially set. Specifically, work-related stress, burnout, and poor sleep quality all were proven to be statistically significant predictors of psychosomatic symptoms, with higher scores of these variables predicting higher scores of the symptoms. It was also observed that all of the predicted associations were present, as work-related stress, burnout and poor sleep quality all showed positive correlations with psychosomatic symptoms. However, the final hypothesis that higher levels of mindfulness would predict lower levels of psychosomatic symptoms could not be supported. Contrary to expectations, mindfulness was found to have a positive relationship with psychosomatic symptoms. This finding suggests a more complex or context-specific relationship that may require further investigation.

Focusing on the demographic associations explored in this study, it became apparent that female individuals reported higher levels of psychosomatic symptoms than male participants. These findings aligned with the prior literature, indicating that women may be more vulnerable to psychosomatic complaints than men (Torrubia-Pérez et al., 2022). This could be due to the social expectations and dual burden of caregiving roles and professional responsibilities that have been found to increase psychological distress among women (Destatis, 2022). Further to this, systematic workplace inequalities, such as the pay gap amongst male and female employees, could have contributed to the manifestation of the somatic symptoms (European Commission. Statistical Office of the European Union, 2022; Grasshoff et al., 2025). However, other factors, such as the biological background and hormonal differences between the two genders, might have contributed to these disparities, though this area may require further investigation (Kim et al., 2023).

Income also arose as a significant factor, with individuals in the lowest income stating the highest levels of psychosomatic symptoms. These findings could probably be explained through the lens of the Effort Reward Imbalance (ERI) model proposed by Siegrist (1996). ERI posits that stress arises when individuals put in high effort in an occupation and receive lower than expected rewards in terms of salary, recognition of their value or work security. Experiencing these imbalances for long periods has been linked to adverse health outcomes, including increased psychosomatic symptoms (Van Vegchel et al., 2005).

Furthermore, work-related stress appeared to be positively associated with psychosomatic symptoms among employed Greek adults. This finding is consistent with the existing literature suggesting that high work-related stress can lead to various somatic complaints, including gastrointestinal issues, fatigue, headaches and other somatic disturbances (Kivimäki & Steptoe, 2018; McEwen & McEwen, 2017). This relationship is particularly evident in healthcare or other high-demanding

professions, where chronic stress has been associated with adverse health effects (Gu et al., 2019; Jaradat et al., 2016; Jiang et al., 2023). Nevertheless, it may be important to consider additional factors, such as personality traits, that may influence the relationship between work-related stress and psychosomatic symptoms (Abdolkarimi et al., 2024). In a cross-sectional study conducted on nurses, it was found that personality traits of hardiness and perfectionism could influence the levels of stress, and as a result, the manifestation of psychosomatic symptoms. More specifically, individuals with high levels of hardiness were less vulnerable to stress than those who had perfectionist tendencies (Abdolkarimi et al., 2024). Additionally, literature suggests that psychological resilience could also influence the experience of stress and the manifestation of psychosomatic symptoms (Karampas et al., 2016). More precisely, Karampas et al. (2016), in their research conducted on Greek army forces, concluded that participants with high psychological resilience and positive emotions reported fewer psychosomatic complaints, regardless of being in an eminently stressful environment. These insights highlight the need for taking into consideration personality traits and psychological resilience when examining the implications of work-related stress in individual health.

Regarding burnout, this study identified a significant positive association with psychosomatic symptoms among the population. This aligns with the findings of prior research suggesting that burnout, possibly deriving from excessive stress and prolonged exposure, can harm health, manifesting in psychosomatic symptoms (Adebayo et al., 2023; Hammarström et al., 2023; Von Känel et al., 2020). Although literature suggests that burnout is commonly linked with occupational stress, evidence supports that personality traits may also play a crucial role (Bianchi, 2018). In a recent large-scale study conducted on 1,759 participants, it was found that burnout was more closely associated with neuroticism than with work-related factors (Bianchi, 2018). Similarly, Zhang et al. (2024) underscored neuroticism as an important personality trait that could not only contribute to burnout but also to a range of health issues, including psychosomatic symptoms.

Moreover, Figueiredo-Ferraz et al. (2021), when examining the relationship between burnout and psychosomatic symptoms, not only confirmed their strong correlation, but also identified that feelings of guilt could act as a moderator between the two (Figueiredo-Ferraz et al., 2021). More specifically, they discovered that individuals with high guilt were more prone to experiencing burnout and for it to develop into increased anxiety, depression, and somatizations (Figueiredo-Ferraz et al., 2021). In addition, although burnout may result in psychosomatic symptoms, it can also affect other aspects of human well-being, such as sleep quality (Stewart & Arora, 2019). According to Stewart & Arora, (2019) burnout can lead to the disruption of circadian rhythms, causing irregular sleep patterns and a decline in overall sleep quality. In turn, these sleep disturbances may intensify burnout symptoms, creating a self-reinforcing cycle that can result in progressively severe health consequences (Stewart & Arora, 2019).

Poor sleep quality was found to have a positive correlation with psychosomatic symptoms in this study. This finding was consistent with the literature suggesting that disrupted or inadequate sleep plays a significant role in the manifestation of psychosomatic symptoms (Irwin, 2015; Nordin et al., 2021). Even though literature offers a wide range of information on the physiological effects caused by poor sleep, it is worth noting that more complex interactions linked with psychosomatic symptoms may also exist. For instance, from a cognitive neuroscience perspective, sleep deprivation has been linked with emotion regulation difficulties, attentional biases towards negative stimuli, the

propensity to ruminate and decreased cognitive performance (Khan et al., 2023; Palmer & Alfano, 2017). All these factors may intensify somatic concerns and bodily distress, leading to the conclusion that poor sleep may not only impact the actual bodily functioning but could also influence the way that individuals perceive and respond to the bodily sensations, amplifying psychosomatic symptoms (Krause et al., 2017). Moreover, research supports that perceived sleep quality might be more predictive of psychosomatic symptoms than actual sleep measurements (Lenneis et al., 2024; Zhang et al., 2022). This underscores the significance of one's subjective experience, implying that this might be a result of maladaptive sleep beliefs (Lenneis et al., 2024; Zhang et al., 2022).

Taken together, the findings of this study support a robust body of evidence that demonstrates the overlapping and interconnected nature of work-related stress, burnout, poor sleep quality and psychosomatic symptoms, suggesting that they mutually influence and exacerbate one another. In support of this notion, Busch et al.'s (2021) metanalysis on 86 studies (N= 75,991) found that perceived work stress, burnout, sleep disturbances and psychosomatic symptoms were closely interconnected and may have profound consequences for the physical and psychological well-being as well as negatively affect work performance and social relationships. Finally, they highlighted the importance of structured intervention plans for the support of employees under stressful working environments (Busch et al., 2021). Mindfulness-based interventions have been proven to be extremely beneficial when it comes to psychosomatic symptom management (Aktaş et al., 2019; Van Ravesteijn et al., 2014).

Contrary to the initial hypothesis, mindfulness was found to be positively associated with psychosomatic symptoms, meaning that the higher the mindfulness the participants demonstrated, the more the psychosomatic symptoms increased. This finding is incongruent with most of the existing literature which suggests that mindfulness may work as an alleviating factor for psychosomatic disturbances (Garland et al., 2017; Guendelman et al., 2017; Pascoe et al., 2017; Zargar et al., 2021). This unexpected positive correlation may indicate a more nuanced relationship between mindfulness and psychosomatic complaints. One possible explanation could be that individuals who are mindful may be more attuned to their body senses and therefore more likely to notice and report subtle physical alterations. This may be due to the enhanced body awareness that mindful individuals might exhibit, allowing them consciously to perceive and acknowledge the physiological changes, attributing them to everyday stressors rather than ignoring them as random bodily occurrences (Hölzel et al., 2011). This ability to perceive and integrate internal physiological changes is also known as interoceptive perception or interoception and is strongly connected with mindfulness (Gibson, 2019). More specifically, Gibson (2019) argues that mindfulness practices can increase interoception, thus sensitivity to bodily signals, while these are interpreted in a calm and nonjudgmental resulting in improved emotional regulation and reduced stress. Notably, mindfulness changes the brain's structure, enhancing the activity of interoceptive regions like the insular cortex (Farb et al., 2023). In this system, mindfulness and interoception support one another, leading to enhanced body awareness (Gibson, 2019). It would also be important considering that prior research supporting the protective nature of mindfulness is largely based on outcomes from mindfulness-based interventions. However, the current study evaluated participants' dispositional mindfulness using a self-reported questionnaire that measured total mindfulness based on faucets, rather than examining the effects of mindfulness-based training, which is particularly designed to reduced stress and

psychosomatic symptoms, and not to increase mindfulness traits (Guendelman et al., 2017). This means that mindfulness may relate differently to psychosomatics as a trait than it does as a trained skill (Guendelman et al., 2017). This distinction, could partially explain the discrepancy between the current study findings and prior research, underscoring the need for further investigation on how the various aspects of mindfulness interact with somatic symptoms.

LIMITATIONS

While the present study offers unique and important contributions to the understanding of the relationship between work-related stress, burnout, sleep quality and mindfulness and psychosomatic symptoms, there are several limitations that need to be addressed.

Notably, the findings of this study do not have impact on clinical populations, because PSSQ-29 questionnaire does not have a clinical cut-off line, since it has not been validated for clinical settings (Pilafas et al., 2021; Pilafas et al., 2024). Moreover, since this is the first study to examine these variables in the Greek population, there is no existing evidence to compare with the present findings, thus future replication studies are needed (Plucker & Makel, 2021). Also, the literature review on the psychosomatic symptoms was mainly based on studies employing tools that mainly evaluated somatic symptoms, rather than a combination of psychological and somatic manifestations, highlighting the gap the PSSQ-29 was designed to fill (Pilafas et al., 2021). The convenience and snowball sampling procedures employed in this study indicate that generalizability might be limited (Andrade, 2021). In addition, the sample was comprised of Greek adults and the questionnaires were administered in English indicating that there might be potential misinterpretations affecting the responses provided (Cruchinho et al., 2024). The cultural and linguistic factors could probably limit the applicability of the results to non-Greek populations (Cruchinho et al., 2024). Also, the study employed self-reported questionnaires that are subject to biases, while the length of the psychometric tools used might have caused participant fatigue (Durmaz et al., 2020; Jeong et al., 2023). Furthermore, while the sample included participants of varying ages and occupational backgrounds, the fact that the current research did not target any specific occupational group might have introduced variability in job-related stressors that could not be controlled or influenced the responses in ways that cannot be adequately understood (Johnson et al., 2005). Finally, the cross-sectional design did not allow for causality to be examined.

Despite the limitations, the study also identified several strengths that need to be acknowledged. The adjusted R^2 (= .521) was larger than 0.26 which is the benchmark for a large effect size, indicating that the model has a high explanatory power (Cohen, 1988 as cited by Field et al., 2012). Additionally, it is evident that mindfulness remains an under-researched topic in Greek literature, and this is the first study to examine its relationship with psychosomatic symptoms in a Greek sample. Moreover, the relatively large sample size, although comprised of various ages and employment backgrounds which reduced homogeneity, provided a more diverse and realistic representation of the working adult population in Greece (Andrade, 2020; Faber & Fonseca, 2014). Furthermore, the study was based on validated and standardised psychometric instruments which increased reliability and contributed to the literature with solid findings (Vetter & Cubbin, 2019). Finally, the low dropout rate and the generally positive feedback of the participants suggest that the online survey was well accepted and completed (Hoerger, 2010).

Suggestions for Future Research

Future studies should employ longitudinal or experimental designs to better examine the directionality and causality of the relationships investigated in the current

study (Wang & Cheng, 2020). In addition, more focus should be given to the biological, hormonal and neurological disparities that might influence the manifestation of psychosomatic symptoms, as well as to individual differences, such as personality traits and psychological resilience, which could moderate the effects of stress on physical health. Particularly, the investigation of alexithymia should be considered, as it has been associated with increased vulnerability to somatic complaints, indicating that it might mediate in the relationship between stress and psychosomatic symptoms (Nakao & Takeuchi, 2018; Panayiotou, 2018).

Moreover, the unexpected positive relationship between mindfulness and psychosomatic symptoms underscores the necessity for more focused research on how these two variables interact. A great way to approach this could be the use N-of-1 studies, which would allow to assess the relationships of mindfulness and psychosomatic symptoms at the individual level (Fu et al., 2023). This could also have practical applications, including the development of personalised health apps or AI-monitored interventions that could adapt to the user's data inputs, to plan personalised and more effective strategies for stress and psychosomatic symptoms management (Fu et al., 2023).

Finally, the separate analysis of the five faucets of the FFMQ questionnaire, could be beneficial for future studies. This would provide more in-depth insights into which specific components of mindfulness are most relevant psychosomatic symptoms (Baer et al., 2006).

CONCLUSION

Overall, the current study examined the predictive power of work-related stress, burnout, poor sleep quality and mindfulness on the manifestation of psychosomatic symptoms among employed Greek adults. High scores in work-related stress, burnout, and poor sleep quality were found to be significantly associated with psychosomatic symptoms, consistent with previous research. Although these findings correspond with psychological theories of stress-related somatic functioning, the unforeseen positive correlation between mindfulness and psychosomatic symptoms indicates a necessity for further investigation into the underlying cause of this relationship. The researchers also identified that demographic differences, especially gender and income, played a significant role in symptom expression and highlighted important socioeconomic factors to consider in occupational health. The study offered valuable insights into the interplay between various psychological and demographic factors and their influence on physical health, contributing to the growing body of research on psychosomatic symptoms in occupational settings. It also emphasizes the importance of considering a range of contributing factors to better understand and manage psychosomatic symptoms in the workplace and ensure employee well-being.

Declaration by Authors

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