Dispositional mindfulness and fatigue in Chinese nurses during the COVID-19 pandemic: a possible mediating role of sleep quality

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Abstract

**Purpose:** During the COVID-19 epidemic in China, clinical nurses are at an elevated risk of suffering fatigue. This research sought to investigate the correlation between dispositional mindfulness and fatigue among nurses, as well as the potential mediation role of sleep quality in this relationship.

**Methods:** This online cross-sectional survey of nurses was performed from August to September 2022 after the re-emergence of COVID-19 in China. The Mindful Attention Awareness Scale (MAAS), 14-item Fatigue Scale (FS-14), and Pittsburgh Sleep Quality Index (PSQI) were employed to assess the levels of dispositional mindfulness, fatigue, and sleep quality, respectively. The significance of the mediation effect was determined through a bootstrap approach with SPSS PROCESS macro.

**Results:** A total of 2143 nurses completed the survey. Higher levels of dispositional mindfulness were significantly negatively related to fatigue ($r = -0.518, P < 0.001$) and sleep disturbance ($r = -0.344, P < 0.001$). Besides, there was a positive relationship between insufficient sleep and fatigue ($r = 0.547, P < 0.001$). Analyses of mediation revealed that sleep quality partly mediated the correlation between dispositional mindfulness and fatigue ($\beta = -0.551, 95\% \text{ Confidence Interval} = [-0.630, -0.474]$).

**Conclusions:** Chinese nurses' dispositional awareness was related to the reduction of fatigue during the COVID-19 pandemic, and this relationship indirectly operates through sleep quality. Intervention strategies and measures should be adapted to improve dispositional mindfulness and sleep quality to reduce fatigue in nurses during the pandemic.

Introduction

The COVID-19 pandemic enters its third year, and China is currently in the stage of normalized epidemic prevention. The psychological state of the public has been eased with the effective prevention and control of the epidemic, while there are still some sporadic outbreaks that would cause more serious psychological problems (Li et al., 2022). Faced with the re-emergence of the epidemic, stressful working environments, and extra epidemic prevention work, medical staff still suffer from physical fatigue and psychological burden (Q. Wu et al., 2022).

As the largest workforce within healthcare systems, nurses are essential in the fight against the COVID-19 epidemic (Fernandez et al., 2020). In the face of the challenges such as overwhelming workload, extreme stress, and severe lack of sleep quality, feelings of fatigue have been common among the nurse (Labrague, 2021; Y. Liu et al., 2022; Sagherian et al., 2022; Sikaras et al., 2021). Fatigue is described as the subjective sensation of being tired or lacking energy, including both physical and mental fatigue. Previous studies have shown that the prevalence of moderate-to-high fatigue levels ranged from 35.06–72.2% during the COVID-19 pandemic (Labrague, 2021; Zhan et al., 2020). Nurses’ fatigue could cause various physical symptoms and negative emotions, further affecting their health and work performance (Wang et al., 2022). Thus, it is critical to relieve nurses’ fatigue to improve healthcare quality.
Mindfulness was defined as “the awareness that arises from paying attention on purpose, in the present moment, non-judgmentally” (Kabat-Zinn & Hanh, 2009). Not only described as a construct that can be induced via practice but mindfulness has also been conceptualized as a state or as a trait, playing a significant role in fatigue (Bodhi, 2013; Heshmati & Caltabiano, 2020; Pagnini et al., 2019; Whitaker et al., 2019). A plethora of previous research has shown that mindfulness-based interventions (MBIs) could promote psychological health, and alleviate suffering from fatigue (Cao et al., 2022; Ngo, Revue des effets de la méditation de pleine conscience sur la santé mentale et physique et sur ses mécanismes d’action./2013). Mindfulness has been considered a protective factor against the unprecedented psychological impact caused by the COVID-19 pandemic (Dailey et al., 2022). A person’s psychological state was shown to be less negatively impacted by COVID-19 when they had higher levels of dispositional mindfulness (Wen et al., 2022). Additionally, the previous study has revealed the association between mindfulness and nurses’ quality of professional life during the outbreak of COVID-19 (Zakeri et al., 2022). However, there are few studies examining whether mindfulness (dispositional mindfulness) could be a protective factor against fatigue among nurses during the COVID-19 pandemic. Therefore, we hypothesized that nurses with higher levels of mindfulness (dispositional mindfulness) are less likely to suffer fatigue.

Furthermore, the previous study has found a connection between sleep and fatigue in nurses, indicating that poor sleep quality was a contributing factor to fatigue (Çelik et al., 2017; Kryssie Kunert & Services, 2007). During the post-epidemic of the anti-COVID-19 era, clinical nurses demonstrated worse sleep, which would cause various adverse outcomes, including higher mental workload, and more fatigue (Y. Liu et al., 2022; Sagherian et al., 2022). According to the current study, the overall prevalence of sleep disturbances was 44.0% during the pandemic (Marvaldi et al., 2021). There has also been a positive correlation reported between mindfulness and the sleep quality of nurses, and the nurses in the COVID-19 care units could benefit from the implementation of the mindfulness-based stress reduction program in enhancing their sleep (Fang et al., 2019; Nourian et al., 2021). In summary, we speculated that sleep quality may be a possible pathway for mindfulness to impact the fatigue of nurses during the COVID-19 pandemic.

The main objective of the current research was to investigate the association between mindfulness and fatigue among nurses during COVID-19, with sleep quality serving as a mediator. The results might help develop better intervention programs to relieve fatigue and improve the sleeping habits of nurses. Two hypotheses were proposed: (1) Mindfulness would have a significant direct effect on fatigue. (2) Sleep quality would play a mediating effect between mindfulness and fatigue.

**Materials and Methods**

**Study Design and Participants**

This cross-sectional web-based study was implemented from August 2022 to September 2022 corresponding to the period after COVID-19 flared up again in Jinhua, Zhejiang Province. Nurses from 11
hospitals in Jinhua voluntarily answered the self-administered Chinese anonymous questionnaires via an online platform (www.wjx.com).

The study obtained the approval of the Research Ethics Committee in Jinhua Municipal Central Hospital (No. 20222220101) and was performed in accordance with the ethical guidelines of the 1975 Declaration of Helsinki. All study participants provided oral informed consent before the online survey, and they could withdraw at any time or from any item of their own desire.

Measures

In addition to collecting demographic data such as age, gender, marital status, education, professional title, and years of nursing experience, we utilized the Chinese versions of validated psychometric tools to evaluate the fatigue, mindfulness, and sleep quality of the participants.

The Mindful Attention Awareness Scale (MAAS) was used to assess dispositional mindfulness (Brown & Ryan, 2003), which contains 15 items (E.g. It seems I am “running on automatic,” without much awareness of what I’m doing). Each item is answered on a 6-point Likert-type scale ranging from 1 (“almost always”) to 6 (“almost never”), with higher total scores indicating a higher tendency to be mindful in daily life. The Chinese version of MAAS has demonstrated good psychometric properties and is used widely (Chen et al., 2012; Fang et al., 2019; Y. Wu et al., 2022). The Cronbach's alpha coefficient of the MAAS in the current study was 0.929.

The 14-item Fatigue Scale (FS-14) was employed to evaluate fatigue (Chalder et al., 1993). Responses are structured as 2-point Likert scales (from 0 (“no fatigue-related problem”) and 1 (“have a fatigue-related problem”)), and a high score signifies more severe fatigue. The scale could also reflect fatigue from different perspectives, with items 1–8 representing physical fatigue and items 9–14 representing mental fatigue. The previous study demonstrated that the Chinese version of the FS-14 was applicable to Chinese people (L. Liu et al., 2018; Wong & Fielding, 2010). In the present study, Cronbach's alpha coefficient of the FS-14 was 0.840.

Pittsburgh Sleep Quality Index (PSQI) measures the quality of sleep over the previous month (Buysse et al., 1989). It consists of 19 self-assessed items classified into seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Total scores were weighted from 0 to 21 with higher scores indicating increasingly poor sleep quality. A global PSQI score > 5 had been recommended to screen for sleep disturbance (Buysse et al., 1989). In the present study, Cronbach's alpha coefficient of the PSQI was 0.790.

Statistical analyses

Descriptive analyses were performed on demographic characteristics, with means and standard deviations reported for continuous variables and frequencies and percentages reported for categorical data. The scale's reliability was assessed using Cronbach's alpha test of internal consistency. To
investigate the possible connection between each variable, Pearson's correlation analysis was conducted. As for data validity, we examined the common method bias by the Harman single-factor test (Podsakoff et al., 2003).

The mediation model was tested using bootstrapping analyses (5,000 resamples) through the PROCESS macro version 4.1 (www.processmacro.org/index.html) (Model 4) (Hayes et al., 2021), with a significant effect indicated by a 95% confidence interval (CI) excluding zero. The mediation analysis was also controlled for age, gender, and education level. All the research data were analyzed by the IBM SPSS statistics 23.0, and two-tailed P-values < 0.05 were considered statistically significant.

Results

Common method bias testing

Since the study data were gathered through self-report questionnaires, which might result in common method deviations, the Harman single-factor analysis was performed to screen for the deviations. The findings demonstrated that 6 factors with eigenvalues more than 1 and the interpretation rate of the first factor was 29.589%, which was less than 40% critical standard, indicating that there was no serious common method bias in this study.

Demographic characteristics and preliminary correlation analyses

As shown in Table 1, a total of 2143 nurses participated in and effectively completed the questionnaire. Of the total sample, 2075 females (96.8%) were female, 1059 (49.4%) were married, 1343 (62.7%) had a college degree or above, and 1031 (48.1%) obtained a junior technical title. The mean age of participants was 30.15 years (SD = 7.70) and the mean year of nursing was 9.17 (SD = 8.36).
Table 1
Characteristics of all investigated variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>n (%)</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>30.15</td>
<td>7.70</td>
<td></td>
</tr>
<tr>
<td>Years of nursing</td>
<td>9.17</td>
<td>8.36</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>2075 (96.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>68 (3.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational Level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junior college</td>
<td>757 (37.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undergraduate</td>
<td>1334 (62.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate or above</td>
<td>9 (0.4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unmarried</td>
<td>1046 (48.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>1059 (49.4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>38 (1.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional Title</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junior</td>
<td>1031 (48.1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate</td>
<td>868 (40.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior</td>
<td>244 (11.4%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: SD, Standard deviation

The mean, standard deviation, and correlation coefficient of key variables were represented in Table 2. Mindfulness was significantly negatively related to fatigue \(r = -0.518, P < 0.001\) and sleep disturbance \(r = 0.547, P < 0.001\). There was also a significant association between mindfulness and different perspectives of fatigue (physical fatigue: \(r = -0.448, P < 0.001\); mental fatigue: \(r = -0.469, P < 0.001\)). Additionally, a significant relationship was found between mindfulness and sleep disturbance \(r = -0.344, P < 0.001\).
Table 2
Correlations between key study variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean (SD)</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mindfulness (MAAS)</td>
<td>4.19 (0.92)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Fatigue (FS-14)</td>
<td>8.17 (3.70)</td>
<td>-0.518***</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3. Sleep Quality (PSQI)</td>
<td>7.59 (3.53)</td>
<td>-0.344***</td>
<td>0.547***</td>
<td>1</td>
</tr>
</tbody>
</table>

***P < 0.001.

Abbreviations: SD, Standard deviation; MAAS, The Mindful Attention Awareness Scale; PSQI, Pittsburgh Sleep Quality Index; FS-14, The 14-item Fatigue Scale.

Mediating effect analysis

Following examining the preliminary results and correlations, Model 4 in PROCESS was adopted to examine the effect of sleep quality in mediating the association between mindfulness and fatigue. Age, gender, and education level were set as covariates. As shown in Fig. 1, mindfulness had a significant direct effect on nurses’ fatigue and sleep quality (all p values < 0.001). The total effect was statistically significant (all p values < 0.001). This indicated that sleep quality partially mediated the relationship between mindfulness and fatigue. The partial mediation effect of sleep quality was also observed when fatigue was divided into two aspects (all p values < 0.001) (Fig. 2). By checking the bootstrapped 95% confidence interval, the significant indirect effect of sleep quality was identified in Table 3. Besides, Fig. 3 demonstrated that the relationship between mindfulness and sleep quality could be reversed (all p values < 0.001).

Table 3
Bootstrapping indirect effects and 95% confidence intervals (CI) for the mediational model.

<table>
<thead>
<tr>
<th>Pathway</th>
<th>Effect</th>
<th>SE</th>
<th>Boot LLCI</th>
<th>Boot ULCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAAS→PSQI→FS-14</td>
<td>-0.551</td>
<td>0.040</td>
<td>-0.630</td>
<td>-0.474</td>
</tr>
<tr>
<td>MAAS→PSQI→FS-14 - Physical Fatigue</td>
<td>-0.344</td>
<td>0.026</td>
<td>-0.395</td>
<td>-0.293</td>
</tr>
<tr>
<td>MAAS→PSQI→FS-14 - Mental Fatigue</td>
<td>-0.208</td>
<td>0.017</td>
<td>-0.126</td>
<td>-0.093</td>
</tr>
</tbody>
</table>

Abbreviations: SE, standard error; MAAS, The Mindful Attention Awareness Scale; PSQI, Pittsburgh Sleep Quality Index; FS-14, The 14-item Fatigue Scale.

Discussion

In the present study, the relationship between dispositional mindfulness and fatigue was intensively investigated in a large sample of 2134 Chinese nurses. The findings revealed that mindfulness was considerably and inversely related to fatigue among nurses during the COVID-19 pandemic, and sleep quality played a mediating role when included in the association. Despite the high incidence of fatigue...
Among nurses during the COVID-19 outbreak and the apparent impact of mindfulness-based interventions on fatigue, to our knowledge, there were few studies on the association between nurses' dispositional mindfulness and fatigue during the COVID-19 pandemic.

According to our analysis, mindfulness was negatively associated with nurses' fatigue. The conclusion was in line with the studies which revealed that mindfulness was a protective factor against fatigue (Heshmati & Caltabiano, 2020; Pagnini et al., 2019; Whitaker et al., 2019), and we further discussed that sleep quality could act on the mindfulness-fatigue connection. Mindfulness is the capacity to stay in the present moment and accept one's experiences and emotions, which is related to enhanced psychological functioning and tolerance for unpleasant emotions and situations (Hofmann et al., 2010). The previous study has found that dispositional mindfulness could lessen fatigue through its effects on emotion regulation among nurses (Heshmati & Caltabiano, 2020). During the COVID-19 pandemic, higher levels of dispositional mindfulness could facilitate nonjudgmental awareness to increase the acceptance of COVID-19-related stressors, moderating the symptoms of anxiety and depression (Dailey et al., 2022). Thus, nurses with a higher level of mindfulness might be less likely to engage in fatigue when facing a stressful environment during the COVID-19 pandemic. The findings may guide nursing managers in formulating measures such as mindfulness-based interventions to reduce the occurrence or relieve the severity of fatigue both directly and indirectly in nurses during the epidemic period.

Consistent with the previous studies, the current results offered support for the correlation between fatigue and sleep quality in nurses during the COVID-19 pandemic (H. Lee & Choi, 2022; Y. Liu et al., 2022). Heavy workloads and exposure to extreme stress limited nurses' opportunity to adequately sleep after work hours, attributing to their feelings of fatigue and daytime dysfunction (Sagherian et al., 2022; Zou et al., 2021). In addition, the re-emergence of the epidemic would lead to the disruption of the recovered life, causing a negative psychological impact such as anxiety, depression, and insomnia on nurses, which would significantly influence their physical and mental fatigue (H. Lee & Choi, 2022; Stocchetti et al., 2021). Therefore, sleep quality-oriented intervention strategies and measures should be improved to effectively relieve fatigue among this population.

The study also found that mindfulness disposition was associated with better sleep quality in nurses after the re-emergence of the epidemic. Previous research has proved that mindfulness could protect nurses from sleep disturbance (Fang et al., 2019; Kemper et al., 2015). Due to the beneficial impact of mindfulness in reducing stress-reactivity and increasing emotional balance, nurses with high mindfulness may appear more likely to stay with psychological equanimity in stressful contexts during the COVID-19 pandemic, which could be beneficial for sleep-related functioning (Fang et al., 2019). Furthermore, it also has been demonstrated that the mindfulness-based stress reduction program could effectively enhance the sleep quality of nurses (Nourian et al., 2021). Further studies are still needed with more cases to explore the potential mechanisms of mindfulness on sleep quality and verify the validity of mindfulness-based interventions on nurses during the COVID-19 pandemic.
As the analysis was based on cross-sectional data, the results also indicated that the relationship between mindfulness and sleep quality could be reversed. This possible inverse hypothesis was also supported by another path analysis, which was similar to the previous study that nurses with satisfactory and sufficient sleep could predict next-day greater mindful attention (S. Lee et al., 2021). Thus, mindfulness also can be seen as a buffer with respect to the association between sleep quality and fatigue. Nevertheless, the significant role of sleep quality and mindfulness in the fatigue of nurses should be recognized in any situation.

Some limitations of this study should be considered. First, the causality between variables could not be concluded in the current study due to the cross-sectional design. Besides, the dynamic psychological status of nurses could not be precisely reflected in the present study. A longitudinal follow-up study is still needed in the future. Second, the study did not distinguish whether the symptom was pre-existing or new due to the COVID-19 pandemic since the status of nurses before the outbreak was not evaluated, which might be a confounding factor. Third, the clinical nurses enrolled in this study were from partial areas of Jinhua, limiting the generalization of the findings. Forth, the present research relied entirely on self-reporting, which would lead to bias and compromise the accuracy of the data, limiting the comprehensiveness of the current findings. Multi-informant approaches utilized to supplement the present findings are suggested in future research.

Conclusions

In conclusion, the results identified dispositional mindfulness as a protective factor against the fatigue of nurses during the COVID-19 pandemic and revealed that sleep quality partially mediated the relationship between mindfulness and fatigue. It is suggested that managers and nursing policymakers could provide and implement appropriate solutions to increase nurses’ mindfulness to directly or indirectly relieve their fatigue.

Declarations

CRediT authorship contribution statement


Declaration of Competing Interest

All authors declare that they have no conflicts of interest.

Acknowledgment
The authors thank all study participants who were involved and contributed to the procedure of data collection.

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**References**


Figures

Figure 1

Path analysis fitting results for direct and indirect association between dispositional mindfulness and fatigue.

Note c: total effect, c': direct effect; b: standardized regression coefficient, SE: standard error, CI: confidence interval.
Figure 2

Relational model of dispositional mindfulness, sleep quality and different perspectives of fatigue. (A) The model of sleep quality mediating the association between dispositional mindfulness and physical fatigue. (B) The model of sleep quality mediating the association between dispositional mindfulness and mental fatigue.

Note c: total effect, c': direct effect; b: standardized regression coefficient, SE: standard error, CI: confidence interval.
Figure 3

The model of dispositional mindfulness mediating the association between sleep quality and fatigue.

Note: c: total effect, c': direct effect; b: standardized regression coefficient, SE: standard error, CI: confidence interval.