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# Mindfulness, psychological distress, and somatic symptoms among women engaged in sex work in China

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## Abstract

Women engaged in sex work (WSW) in China encounter numerous disadvantages (e.g., exposure to violence) and have substantial risk for psychological distress and somatic symptoms. Intervention literature has attended to mindfulness, which is a protective factor for psychological outcomes, and its influences can further improve physical health. However, mindfulness has not been well studied in WSW. We aimed to examine the association among mindfulness, psychological distress, and somatic symptoms among Chinese WSW. Data were collected from 410 WSW in Guangxi, China, using an anonymous, self-administered survey evaluating demographics, mindfulness, psychological distress (i.e., depression, loneliness, and perceived stress), and somatic symptoms (i.e., pain, cardiopulmonary, and gastrointestinal/fatigue symptoms). Structural equation modeling was utilized for data analyses. Mindfulness was negatively associated with psychological distress and somatic symptoms. Psychological distress was positively associated with somatic symptoms. Psychological distress mediated the association between mindfulness

Cheuk Chi Tam and Yuejiao Zhou contributed equally to this work.

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and somatic symptoms. Mindfulness appears to be a protective factor for psychological distress among WSW, and such an effect is further influential to their somatic symptoms. Our findings add to the growing literature on mindfulness, suggesting that mindfulness-based interventions could be beneficial for WSW. Future research should explore other cognitive factors underlying the psychosomatic mechanism of mindfulness.

#### KEYWORDS

depression, loneliness, mindfulness, pain, perceived stress, psychological distress, somatic symptoms, women engaged in sex work

## INTRODUCTION

Along with open policies, rapid economic growth and internal immigration (floating population from rural to urban areas for better income and job opportunities) since 1980, commercial sex trade reoccurred and has flourished in mainland China for decades (Zhang et al., 2020). Women engaged in sex work (WSW) account for a substantial population in China (e.g., an estimation of 1.8 to 3.8 million in 2007) (Wang et al., 2009) and suffer from health threats from multiple aspects. Since commercial sex is viewed as immoral and illegal in China, WSW encounter numerous structural or social challenges, such as police harassment, exposure to violence (e.g., from clients and partners), stigma, poor living conditions, and unhealthy lifestyles (e.g., hazardous alcohol use) (Fang et al., 2007; Huang & Pan, 2014; Zhang et al., 2017). As a result, psychological and physical well-being among Chinese WSW is concerning. WSW has been a key population susceptible to sexual transmitted infections (STIs), including human immunodeficiency virus (HIV) infection (Zhang et al., 2020). Psychological distress is common among WSW with a high prevalence of depressive symptoms (22–63%) and loneliness (44–50%) (Chen et al., 2017; Hong et al., 2013; Zhang et al., 2014). Importantly, psychological distress can increase vulnerability to somatic symptoms in WSW. Systematic review and meta-analysis studies have revealed a robust association between psychological distress (e.g., depression and anxiety) and somatic symptoms (e.g., fatigue, pain, and musculoskeletal complaints) (Hassan & Ali, 2011; Henningsen et al., 2003). Unfortunately, most WSW apply maladaptive ways in coping with psychosocial stress and somatic symptoms. Previous research has found a high rate of prescription drug misuse (46.6%) among WSW in China, and a majority of WSW reported using drugs for managing somatic symptoms, such as “relieve pain symptoms” (69%) and “help me sleep” (27%) (Tam et al., 2021). Such multiple vulnerabilities of psychological distress, somatic symptoms, and substance abuse problems underlie the needs of effective health promotion interventions for WSW in China to promote positive coping and enhance psychosomatic outcomes.

Health promotion literature has paid increasing attention to mindfulness (Logsdon-Conradson, 2002). Mindfulness refers to the state of mind in which attention is focused on what

is taking place in the present (Brown & Ryan, 2003). Mindfulness researchers believe that such a present-oriented mindset could facilitate non-judgment and acceptance of moment-to-moment experiences, thus alleviating intensive emotion states (Keng et al., 2011; Spijkerman et al., 2016). Several mindfulness-based intervention approaches (e.g., body awareness meditation and mindful appreciation) are developed for health management and are found to be significantly beneficial to psychological health (Bluth & Eisenlohr-Moul, 2017; de Jong et al., 2016). Previous meta-analysis studies in various populations, including working adults, people with a clinical condition, and people living with HIV, found that mindfulness-based interventions had significant effects for psychological distress reduction at immediate post-intervention (small-to-medium effect sizes for working adults and medium-to-large effect sizes for people with a clinical condition or living with HIV), and such effects largely maintained at 5-month or longer follow-ups (Goyal et al., 2014; Scott-Sheldon et al., 2019; Virgili, 2015). Notably, the positive effects of mindfulness could be beyond psychological outcomes. Extant evidence has shown that mindfulness-based interventions have efficacy on alleviating somatic symptoms (e.g., pain and gastrointestinal symptoms) and improving immune indicators (e.g., C-reactive protein) among individuals with clinical conditions, including patients with chronic pain, rheumatoid arthritis patients, fibromyalgia patients, individuals at risk for diabetes, and people living with HIV (Creswell et al., 2019, 2009; Davis et al., 2015; Garland et al., 2014; Gonzalez-Garcia et al., 2014; Jedel et al., 2014; Malarkey et al., 2013; van Gordon et al., 2017). These robust findings imply that mindfulness would be an essential factor for psychosomatic health promotion.

In addition, mindfulness intervention literature postulates a psychological pathway linking mindfulness with physical health (Creswell et al., 2019). This model suggests that mindfulness can enhance cognitive skills, such as stress appraisal, and this can facilitate psychological distress management and, in turn, decrease physiological stress reactivity and alleviate physical symptoms (Creswell et al., 2019). Following this rationale, psychological and physical influences of mindfulness would be depicted by an indirect relationship, in which mindfulness would reduce psychological distress, and this would subsequently alleviate somatic symptoms. Indeed, a recent mindfulness-based intervention study among persons with multiple sclerosis has supported this indirect model, showing that the association between mindfulness and fatigue symptoms was mediated by depression (Sauder et al., 2021). Such an indirect model can contribute to scientific knowledge of a mindfulness-based intervention for promoting psychological and physical health in marginal populations suffering from multiple vulnerabilities, such as WSW in China.

Despite the potential psychosomatic benefits, no mindfulness-based interventions are available for WSW in China. This may be due to the lack of mindfulness studies among WSW. To our knowledge, there is only one WSW study that has examined psychological influences of mindfulness, showing that mindfulness is negatively associated with depression, anxiety, and perceived stigma among WSW living with HIV in Dominican Republic and Tanzania (Kerrigan et al., 2021). It is worth noting that, as suggested by the psychological pathway of mindfulness, mindfulness can contribute to adaptive coping skills (e.g., emotional regulation and self-compassion) (Garland et al., 2015), which have been the protective factors for stress management and health promotion among people engaged in sex work (Dalla et al., 2003; Mumei et al., 2021). However, a scarcity of empirical studies has examined the model of mindfulness on psychological and somatic outcomes among WSW in China. To fill this knowledge gap, guided by the psychological pathway model of mindfulness (Creswell et al., 2019), the present study aimed to examine a hypothesized model among mindfulness, psychological distress (i.e., depression, loneliness, and perceived stress), and somatic symptoms (i.e., pain, cardiopulmonary, and gastrointestinal symptoms) in WSW in China (see Figure 1). Specifically, it was

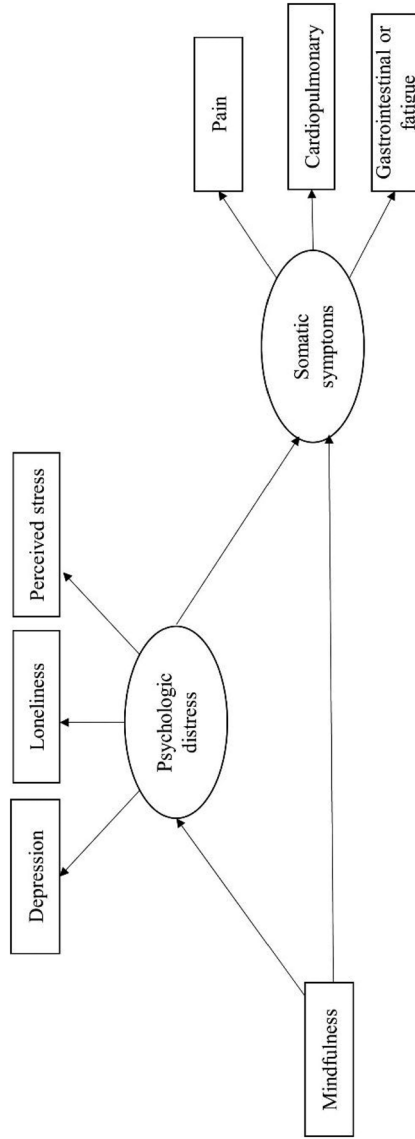


FIGURE 1 Hypothesized model among mindfulness, psychological distress, and somatic symptoms

hypothesized that (1) mindfulness would be negatively associated with psychological distress and somatic symptoms; (2) psychological distress would be positively associated with somatic symptoms; and (3) psychological distress would mediate the association between mindfulness and somatic symptoms.

## METHOD

### Participants and procedure

The present study utilized cross-sectional data collected from WSW from five regions (Guilin, Guigang, Beihai, Baise, and Hezhou) in Guangxi, China ( $n = 424$ ), between September 2019 to December 2019. Guangxi is located at the center of southwest China and has historically been an essential province for commerce, trade, and tourism in southern China and South East Asia. Increased tourism in Guangxi has contributed to a market for sex work. Guangxi Centers for Disease Prevention and Control (CDC) personnel who were responsible for outreach services with WSW approached participants in sex work venues and invited them to complete an anonymous, self-administered survey. The sex work venues covered different levels of commercial sex hierarchy according to their average payment per service, including the low-level venues (<50 RMB [China's currency, equivalent to 7.3 USD at the time of the survey]; e.g., streets and mini-hotels), middle-level venues (50–150 RMB; e.g., hairdressing rooms and massage parlors), and high-level venues (>150 RMB; e.g., karaoke and night clubs). A total of 106 (25%) WSW from the low-level venues, 162 (38%) from the middle-level venues, and 156 (37%) from the high-level venues participated in the present study. The eligibility criteria for participation included (1) women who provided commercial sex; (2) 18 years of age or older; and (3) able to independently complete the survey.

Before starting the survey, Guangxi CDC personnel provided informed consent form which showed information regarding voluntary nature, confidentiality, study purposes, and researchers' contact information. After signing the informed consent form, participants were invited to complete an anonymous and self-administered survey. Participants were allowed to withdraw from the study at any time. Upon completion of the survey, participants were provided with monetary incentives of 50 RMB. After removing respondents ( $n = 14$ ) with careless responses (e.g., 50% of missing values or more in the survey), the total sample size of the present study was 410. The study protocol was approved by the Guangxi CDC Institutional Review Board.

## Measures

### Demographics

Participants were asked to provide demographic information including age (years), ethnicity (i.e., Han, Zhuang, Yao, Miao, or other), marital status (i.e., unmarried, unmarried and cohabitation, married, married but separate, and divorce/widowed), and education (i.e., no formal education, some elementary school, some middle school, some high school or occupational school, and junior college and above). Han ethnicity accounts for the largest population in China, but Guangxi is inhabited by more residents in ethnic minority (Zhuang, Yao, and Miao; 37.52%) than the national average (8.89%) (Guangxi Zhuang Autonomous Region Bureau of

Statistics, 2021; National Bureau of Statistics of China, 2021). Participants also answered the number of working venues in the past year. Due to non-normality (kurtosis or skewness > 3.0) and small sizes in certain categories (<5% of  $n$ ), several variables (i.e., ethnicity, marital status, and education) were dichotomized for data analysis.

## Mindfulness

Participants completed a Chinese version of Mindfulness Attention Awareness Scale (MAAS) (Brown & Ryan, 2009; Deng et al., 2012). MAAS was composed of 15 items including both general (e.g., *I find it difficult to stay focused on what's happening in the present*) and situation-specific statements (e.g., *I snack without being aware that I'm eating*) about mindful states. Items were rated on a 5-point scale, ranging from *never* (1) to *very often* (5). A sum score was calculated, with a higher score indicating a greater level of mindfulness. MAAS had good internal consistency in the present study ( $\alpha = .96$ ).

## Psychological distress

### *Depression*

A Chinese version of the Center for Epidemiologic Studies Depression Scale Revised (CESD-R-10) (Cheung & Bagley, 1998; Radloff, 1977) was used to assess depression in WSW. This scale included 10 items asking if a particular depressive symptom occurred in the past week (e.g., *I was bothered by things that usually do not bother me*). Participants rate each item on a 4-option scale (0 = *less than 1 day* to 3 = *5–7 days*). A sum score was calculated, with a higher score showing a higher level of depression. Cronbach's alpha of this scale was .71 in the current study. In line with previous research (Andresen et al., 1994), a diagnostic cutoff score of 10 was utilized to indicate the presence of high depressive symptoms.

### *Loneliness*

A Chinese version of the short-form UCLA Loneliness scale (ULS-8) (Hays & DiMatteo, 1987; Wu & Yao, 2008) was utilized to evaluate loneliness among WSW. This scale was composed of eight items assessing whether a participant had scarcity of social contact compared to what was desired (e.g., *I feel isolation from others*). All items were rated on a 4-point scale ranging from 1 (*never*) to 4 (*always*). We deleted one item (*I am an outgoing person*) since it deteriorated internal consistency of the scale (Xu et al., 2018). A sum score was generated among remaining items, with a higher score indicating a greater level of loneliness. This scale was internally consistent in the current study ( $\alpha = .70$ ).

### *Perceived stress*

A Chinese version of the Perceived Stress Scale (PSS) (Cohen et al., 1994; Lu et al., 2017) was used to measure perceived stress level among WSW. The PSS had 10 items assessing the degree to which situations occurred in the past month were appraised as stressful (e.g., "How often have you been upset because something that happened unexpectedly?"). Participants replied on each item with five response options (1 = *never* to 5 = *very often*). A sum score was generated, with a higher score representing a greater level of perceived stress. Cronbach's alpha of this scale was .72 in the current study.



## Somatic symptoms

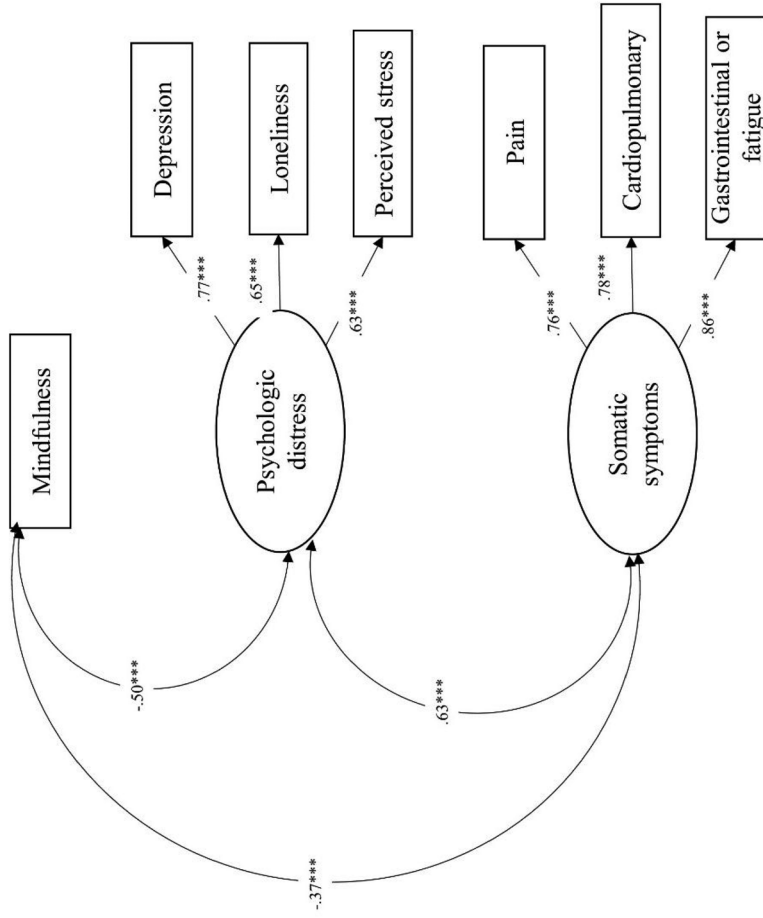
Participants completed a Chinese version of the Patient Health Questionnaire-15 (PHQ-15) (Kroenke et al., 2002; Zhang et al., 2016). This scale listed a total of 15 somatic symptoms and asked participants to rate these items on a three-option scale (0 = *not bothered at all*, 1 = *bothered a little*, and 2 = *bothered a lot*) for indicating whether they experienced any of 15 symptoms in the past 30 days. According to results of exploratory factor analysis (EFA), somatic symptoms were categorized into three types, including pain (e.g., *Back pain*), cardiopulmonary (e.g., *Dizziness*), and gastrointestinal or fatigue symptoms (e.g., *Nausea, gas, or indigestion* and *Feeling tired or having low energy*). The validation of this three-factor structure was tested using confirmatory factor analysis (CFA). Study sample was randomly split into two groups for factor analyses. Three sum scores were generated for pain, cardiopulmonary, and gastrointestinal or fatigue symptoms, with higher scores indicating higher levels of corresponding somatic symptoms. According to previous Chinese research (Zhang et al., 2016), a total score among 15 items was also calculated to indicate overall somatic symptom severity (0–4, *minimal*; 5–9, *mild*; 10–14, *moderate*; and 15–30, *severe*). We also dichotomized responses for each item (0 = *not bothered at all* and 1 = *bother a little or a lot*) to indicate prevalence of 15 individual symptoms.

## Data analysis

Prior to data analyses, data were screened in terms of missing, outliers (e.g.,  $z$  scores), and normality (i.e., skewness and kurtosis). Descriptive statistics were performed on demographic variables, mindfulness, psychological distress (i.e., depression, loneliness, and perceived stress), and somatic symptoms (i.e., pain, cardiopulmonary, and gastrointestinal or fatigue symptoms). We then used multiple statistical analysis approaches to analyze the hypothesized associations. First, Pearson's correlations were performed to examine the bivariate relationship among mindfulness, psychological distress, and somatic symptoms.

Second, we used structural equation modeling (SEM) to examine the hypothesized model. In line with Anderson and Gerbing (1988), the SEM analysis was performed by a two-step approach. In step one, confirmatory factor analysis (CFA) was utilized to evaluate a measurement model, in which two latent variables (i.e., psychological distress and somatic symptoms) and one manifest variable (i.e., mindfulness) were intercorrelated (Figure 2). Three psychological measures (i.e., depression, loneliness, and perceived stress) were entered as manifest variables, loading into a latent variable of psychological distress. Similarly, mean scores of three factors in PHQ-15 (i.e., pain, cardiopulmonary, and gastrointestinal or fatigue symptoms) were loaded into a latent variable of somatic symptoms. In step two, a SEM was performed to examine the hypothesized structural model (Figure 1), controlling for demographic factors and venue types (low-, middle-, or high-level). Standardized factor loadings were estimated for each manifest variables, and standardized regression coefficients were calculated for each prediction relationship between study constructs. The SEM analysis was tested using maximum likelihood (ML) estimation. As suggested by Hu and Bentler (1999), the goodness of model fit was examined using several indices (with their suggested cutoff values) including the *root mean square of approximation* (RMSEA; .06), the *comparative fit index* (CFI; .95), the *Tucker-Lewis index* (TLI; .95), and the *standardized root mean square residual* (SRMR; .05). The lower values of RMSEA





Model-fit indicator:  $Chi-square = 37.06, df = 12, p < .001; CFI = .98; TLI = .96; RMSEA = .07; SRMR = .03.$

FIGURE 2 Measurement model among mindfulness, psychological distress, and somatic symptoms ( $n = 410$ )

and *SRMR* or the higher values of *CFI* and *TLI* indicate a greater model fit to data. The quotient of *Chi-square value* and *degrees of freedom (df)* was also used, with the number lower than five indicating a good model fit.

Third, the indirect effect in the relationship among mindfulness, psychological distress, and somatic symptoms was examined using the *delta z* score (or Sobel test) (Muthén & Muthén, 2019; Sobel, 1982). This test uses the magnitude of an indirect effect, which is the product of two regression coefficients (i.e., the coefficient from mindfulness to psychological distress and the coefficient from psychological distress to somatic symptoms) and compares it to its estimated standard errors based on a *z* statistic (Sobel, 1982). A significant *delta z* score indicates a significant mediation relationship. The indirect effect analysis also identified a full or partial mediation. Full mediation means the direct effect between the independent variable (mindfulness) and criterion variable (somatic symptoms) reduces to zero (non-significant) after accounting for the mediation variable (psychological distress). Partial mediation occurs when a mediation variable reduces the direct effect, but it remains significant (Baron & Kenny, 1986). Bivariate analyses were employed in SPSS software version 28, while SEM analysis and the mediation test were performed in Mplus version 8.

In addition to the hypothesized model, we also ran an alternative model in which mindfulness mediated the linkage between psychological distress and somatic symptoms in consideration of the potentially bidirectional association between psychiatric symptoms and dispositional mindfulness (Gómez-Odrizola & Calvete, 2020). The evaluation of this alternative model followed the identical analytic procedures to these for the hypothesized model (i.e., SEM and indirect effect).

## RESULTS

### Descriptive statistics

As shown in Table 1, the average age of the study sample was 33.58 years ( $SD = 9.93$ ). The majority of WSW were Han ethnicity (59%), followed by Zhuang (27%), Yao (9%), and Miao (2%). Most WSW were married (43%), following by unmarried (35%), divorce/widowed (15%), and unmarried or cohabitating (2%). More than one in three WSW reported their education attainment was middle school (36%), followed by elementary school (24%), high school or occupational school (20%), no formal education (14%), and junior college or above (6%). WSW reported an average working venue number of 1.46 in the past year ( $SD = .88$ ).

In terms of psychological measures, the mean score was 76.63 ( $SD = 15.40$ ) for mindfulness, 4.18 ( $SD = 3.11$ ) for depression, 15.78 ( $SD = 3.37$ ) for loneliness, and 15.00 ( $SD = 5.67$ ) for perceived stress. Eight percent of WSW had high depressive symptoms. In terms of somatic symptoms, the mean scores were 1.74 ( $SD = 1.73$ ) for pain symptoms, 1.11 ( $SD = 1.88$ ) for cardiopulmonary symptoms, and 2.13 ( $SD = 2.22$ ) for gastrointestinal or fatigue symptoms. Nearly 60% of WSW had a minimal level of somatic symptoms, followed by a mild level (21%) and moderate (10%) or severe levels (10%). Most common somatic problems in WSW were pain symptoms (e.g., “stomach pain,” 46%; “headaches,” 41%), followed by fatigue symptoms (i.e., “feeling tired or having low energy,” 38%), gastrointestinal symptoms (e.g., “constipation, loose bowels or diarrhea,” 31%; “nausea, gas, or indigestion,” 28%), and cardiopulmonary symptoms (e.g., “feeling your heart pound or race,” 19%; “shortness of breath,” 16%).

TABLE 1 Descriptive statistics among Chinese women engaged in sex work ( $n = 410$ )

	Mean or $n$	SD or %
<b>Demographics</b>		
Age ( <i>mean, SD</i> )	33.58	9.94
Race/ethnicity ( $n, \%$ )		
Han	241	58.78%
Zhuang	110	26.83%
Miao	8	1.95%
Yao	38	9.27%
Other	13	3.17%
Marital status ( $n, \%$ )		
Unmarried	145	35.37%
Unmarried and cohabitation	10	2.44%
Married	178	43.42%
Married but separated	15	3.65%
Divorce/widowed	62	15.12%
Education ( $n, \%$ )		
No formal education	56	13.66%
Some elementary school	98	23.90%
Some middle school	148	36.10%
Some high school or occupational school	84	20.49%
Junior college and above	24	5.85%
Number of working venues in the past year ( <i>mean, SD</i> )	1.46	0.88
<b>Psychological and physical measures</b>		
Mindfulness ( <i>mean, SD</i> )	76.63	15.40
Psychological distress ( <i>mean, SD</i> )		
Depression	4.18	3.11
Loneliness	15.78	3.37
Perceived stress	25.00	5.67
Somatic symptoms ( <i>mean, SD</i> )		
Pain	1.74	1.73
Cardiopulmonary	1.11	1.88
Gastrointestinal or fatigue	2.13	2.22
Prevalence ( $n, \%$ )		
Psychological distress		
Depression (cutoff score = 10)	33	8.05%
Severity of somatic symptoms		
Minimal (scores = 0–4)	244	59.51%
Mild (scores = 5–9)	88	21.46%
Moderate (scores = 10–14)	39	9.51%
Severe (scores = 15–30)	39	9.51%

TABLE 1 (Continued)

	Mean or <i>n</i>	SD or %
Presence of individual somatic symptoms		
Stomach pain	187	45.61%
Trouble sleeping	128	45.61%
Menstrual cramps or other problems with your periods	139	44.63%
Headaches	183	41.22%
Feeling tired or having low energy	169	37.80%
Pain in your arms, legs, or joints	90	33.90%
Back pain	91	31.22%
Constipation, loose bowels, or diarrhea	40	30.73%
Nausea, gas, or indigestion	77	28.29%
Dizziness	64	22.20%
Chest pain	68	21.95%
Feeling your heart pound or race	126	18.78%
Pain or problems during sexual intercourse	116	16.59%
Shortness of breath	155	15.61%
Fainting spells	187	9.76%

Abbreviation: SD, standard deviation.

## Bivariate analyses

Results of correlation tests are present in Table 2. Mindfulness was negatively correlated with depression ( $r = -.39$ ), loneliness ( $r = -.31$ ), perceived stress ( $r = -.31$ ), pain symptoms ( $r = -.26$ ), cardiopulmonary symptoms ( $r = -.24$ ), and gastrointestinal or fatigue symptoms ( $r = -.36$ ). Depression was positive correlated with other two psychological distress measures (i.e., loneliness [ $r = .48$ ] and perceived stress [ $r = .45$ ]) and three somatic symptom factors (i.e., pain [ $r = .42$ ], cardiopulmonary [ $r = .39$ ], and gastrointestinal or fatigue symptoms [ $r = .50$ ]). Similarly, loneliness was positive correlated with perceived stress ( $r = .50$ ) and three somatic symptom factors (i.e., pain [ $r = .28$ ], cardiopulmonary [ $r = -.28$ ], and gastrointestinal or fatigue symptoms [ $r = .28$ ]). Perceived stress was positively correlated with pain ( $r = .24$ ), cardiopulmonary ( $r = .27$ ), and gastrointestinal or fatigue symptoms ( $r = .30$ ). Three somatic symptom factors were positively intercorrelated ( $r_s = .60-.68$ ). All correlation coefficients were statistically significant at the .001 level.

## Measurement model

Measurement model results among study variables were shown in Figure 2. All factor loadings of each manifest variable on corresponding latent variables were substantially and statistically significant ( $p < .001$ ). Mindfulness was significantly and negatively correlated with psychological distress ( $r = -.50$ ,  $p < .001$ ) and somatic symptoms ( $r = -.37$ ,  $p < .001$ ). Psychological distress was significantly and positively correlated with somatic symptoms ( $r = .63$ ,  $p < .001$ ). CFA

TABLE 2 Correlations among mindfulness, psychological distress, and somatic symptoms,  $n = 410$ 

	1	2	3	4	5	6	7
1. Mindfulness	1.00						
Psychological distress							
2. Depression	-.39***	1.00					
3. Loneliness	-.32***	.48***	1.00				
4. Perceived stress	-.31***	.45***	.50***	1.00			
Somatic symptoms							
5. Pain symptoms	-.26***	.42***	.28***	.24***	1.00		
6. Cardiopulmonary symptoms	-.24***	.39***	.28***	.27***	.60***	1.00	
7. Gastrointestinal or fatigue symptoms	-.36***	.50***	.28***	.30***	.66***	.68***	1.00

\*\*\*  $p < .001$ .

indicated a generally good fit to data with  $CFI = .98$ ,  $TLI = .96$ ,  $RMSEA = .07$ , and  $SRMR = .03$ . The *chi-square* value divided by *df* was 3.08. These results suggested that the latent constructs were adequately operationalized by their manifest variables.

## Structural model

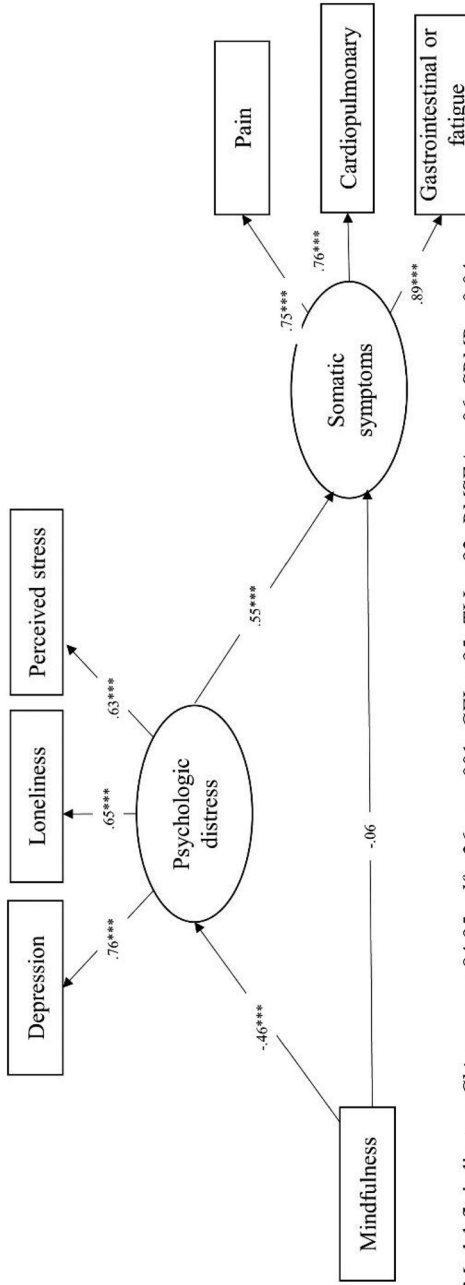
As presented in Figure 3, SEM results indicated a good model fit to data ( $Chi-square/df = 2.36$ ,  $CFI = .95$ ,  $TLI = .93$ ,  $RMSEA = .06$ ,  $SRMR = .04$ ). The structural model explained 44% of variances in somatic symptoms and 29% in psychological distress. Regression coefficients suggested that mindfulness was negatively and significantly associated with psychological distress ( $\beta = -.46$ ,  $p < .001$ ). Psychological distress was positively and significantly associated with somatic symptoms ( $\beta = .55$ ,  $p < .001$ ). The association between mindfulness and somatic symptoms was not statistically significant ( $\beta = -.06$ ,  $p = .32$ ).

## Indirect effects

The indirect effect in the hypothesized model is presented in Table 3. As hypothesized, results suggested a significant indirect effect ( $\beta = -.25$ ,  $delta z = -6.06$ ,  $p < .001$ ) in the association among mindfulness, psychological distress, and somatic symptoms. However, the direct effect of mindfulness on somatic symptoms was not statistically significant ( $\beta = -.06$ ,  $delta z = -.99$ ,  $p = .32$ ), after accounting for psychological distress. These results suggested that psychological distress fully mediated the association between mindfulness and somatic symptoms among WSW in China.

## Alternative model

An alternative model on the mediation of mindfulness in the association between psychological distress and somatic symptoms was also tested using SEM. Results suggested a generally good fit to data ( $Chi-square/df = 2.99$ ;  $CFI = .93$ ;  $TLI = .90$ ;  $SRMR = .07$ ;  $RMSEA = .07$ ).



Model-fit indicator:  $Chi-square = 84.95$ ,  $df = 36$ ,  $p < .001$ ;  $CFI = .95$ ;  $RMSEA = .06$ ;  $SRMR = 0.04$ .

The model controlled for age, ethnicity, education, marital status, number of working venues in the past year, and venue types

Explained variances: somatic symptoms (44%), psychological distress (29%)

FIGURE 3 SEM analysis of the indirect model among mindfulness, psychological distress, and somatic symptoms among WSW in China ( $n = 410$ )

TABLE 3 Indirect effects in hypothesized model

Effects	B	S.E.	Delta z	p value
From mindfulness to somatic symptoms				
Total effect	-.31	.05	-6.48	< .001
Total indirect	-.25	.04	-6.06	< .001
Specific indirect effect				
Mindfulness→psychological distress→somatic symptoms	-.25	.04	-6.06	< .001
Direct effect				
Mindfulness→somatic symptoms	-.06	.06	-.99	.32

Note: Delta  $z = -6.06$

Psychological distress was negatively and significantly associated with mindfulness ( $\beta = -.46$ ,  $p < .001$ ) and was positively and significantly associated with somatic symptoms ( $\beta = .54$ ,  $p < .001$ ). However, the regression coefficient between mindfulness and somatic symptoms did not reach the statistical significance ( $\beta = -.07$ ,  $p = .21$ ). Results did not suggest a significant indirect effect of mindfulness in the model ( $\beta = .03$ ,  $\text{delta } z = 1.27$ ,  $p = .20$ ).

## DISCUSSION

The present study examined somatic symptoms and psychological distress in WSW in China and investigated the role of mindfulness in these health outcomes. Our findings indicated mindfulness could have positive effects on somatic symptoms, and such effects seem to occur through psychological distress among WSW. To the best of our knowledge, the present study was one of the first attempt to examine mindfulness and its impacts on psychological and somatic health outcomes among WSW who are significantly vulnerable to psychosomatic problems.

Our findings suggested that about 40% of WSW in China reported mild to severe somatic symptoms. Such a high rate of physical illness is in line with previous WSW studies from multiple places, showing that 36% to 60% WSW in Israel (Cwikel et al., 2004) and 35% WSW in India (Pandiyan et al., 2012) suffered from somatic symptoms, and 43% WSW in the US reported fair or poor health (Varga & Surratt, 2014). In terms of individual symptoms, our results showed that majority of WSW suffered from pain symptoms (e.g., stomach pain or headaches), which is consistent with previous findings in Israeli WSW showing high prevalence of headaches (60%) and stomachache (53%) (Cwikel et al., 2004). The high prevalence of pain symptoms may be related to hazardous alcohol use. Drinking is encouraged in commercial sex venues since WSW's income are strongly dependent on liquor consumptions (Li et al., 2010; Wang et al., 2010). Therefore, WSW are at very high risk for harmful drinking, which could lead to hangover symptoms including headaches and stomach pain (National Institute on Alcohol Abuse and Alcoholism, 2021). As such, somatic symptoms appear to be a concern in Chinese WSW and interventions that promote physical health management in WSW are warranted.

Consistent with previous studies (Hassan & Ali, 2011; Henningsen et al., 2003), our results indicated that psychological distress was positively associated with somatic symptoms, suggesting that mental health problems can worsen physical symptoms among WSW in China. The negative influences of distress could be explained by maladaptive coping. According to transactional model of stress and coping (Lazarus & Folkman, 1984), individuals who are



situated in a threatening context and have limited coping resources would be likely to experience a high level of distress, and this could induce the adoption of maladaptive behaviors to cope, such as avoidance, self-blame, and substance use, which would lead to or worsen physical symptoms. Indeed, extant evidence has revealed that somatic symptoms are common for people who use maladaptive coping (Compas et al., 2006; Hassan & Ali, 2011; Mark & Smith, 2018). It is important to note that, as a marginal population who face numerous social challenges (e.g., stigma), WSW in China are at high risk for psychological distress but have limited interpersonal coping resources (e.g., social support) and, thus, they are likely to adopt maladaptive coping. Although mental health services could provide in-person psychological support and coping skill trainings, WSW are hesitant to utilize the services because of their concern on minority identity disclosure (She et al., 2021; Zehnder et al., 2019). As such, innovative mental health intervention strategies that address factors associated with coping and account for disclosure concern become important for health promotion among WSW in China.

Our findings regarding mindfulness add to literature on health promoting factors in WSW. Our results suggested that mindfulness was a protective factor for somatic symptoms, and such a positive association was indirectly influenced by psychological distress. This supported the psychological pathway model of mindfulness, indicating that WSW who exhibited higher mindfulness state experienced a lower burden of psychological distress, and this was associated with lower somatic symptoms. As suggested by the psychological pathway model, mindfulness is such a psychological factor contributing to adaptive coping process, enhancing cognitive qualities (e.g., emotional regulation, self-compassion, and positive appraisal of stress) beneficial to psychological and physical health management (Creswell et al., 2019; Garland et al., 2015). The cognitive benefits of mindfulness for marginal populations have been documented in a recent study among sexual minorities, which revealed that mindfulness was positively associated with positive reappraisal, and this was negatively associated with self-stigma and disempowerment (Chan & Leung, 2021). Building on our findings, future research would benefit from exploring cognitive factors associated with psychological mechanism of mindfulness and examining their influences on physical health among WSW in China.

The positive findings of mindfulness imply that health promotion interventions for WSW could benefit from using mindfulness enhancement strategies. In addition to its potential psychosomatic effects, it is noteworthy that mindfulness-based interventions are particularly favorable to hard-to-reach populations owing to its promising features. For example, mindfulness-based interventions have found to be easily adopted to online settings with strong privacy protection and flexible schedule (Spijkerman et al., 2016). This is important for WSW given their identity disclosure concern and unstable working patterns (e.g., different working schedule and daily routine compared to other occupation). The digitally delivered intervention with limited interaction between participants and the facilitators could also address the lack of intervention resources (e.g., facilitators, trainers, location, and appropriate settings) in low-and-middle-income countries. Future research should examine the potential role of mindfulness-based interventions in reducing psychological distress and somatic symptoms among WSW in China.

The current study had several methodological limitations. First, this study was based on a convenience sample of WSW in Guangxi. Our findings may be subject to selection bias and may not be generalized to other Chinese regions (e.g., a study sample with a relatively higher proportion of ethnic minority than the national average). Second, measures were all self-reported so that data may be affected by participants' response bias such as social desirability. Third, our findings would be confounded by other factors that were not measured in the present study,

such as the participation in a psychological intervention. Fourth, our mediation model was examined using cross-sectional data. The association between mindfulness, psychological distress, and somatic symptoms cannot draw conclusions about causality. Although our results did not support the alternative model, the causal relationships in the mediation model remained unclear without using longitudinal analyses. Future research using a stratified sampling and longitudinal design across different regions and employing advanced modeling methods (e.g., cross-lagged panel model) would be beneficial.

Despite these limitations, as one of the first attempt to explore the mindfulness influences among WSW in China, the current study offered valuable insights for health promotion interventions. We found that mindfulness appeared to be a protective factor for psychological distress, and such a positive effect could expand to somatic symptoms. This supported the psychological model of mindfulness, suggesting that mindfulness could promote physical health through the improvement of distress management, such as adaptive coping and positive reappraisal. Notably, our findings revealed that the psychological and physical benefits of mindfulness were applied to WSW in China, who suffer from multiple vulnerabilities of psychological distress and somatic symptoms. With flexibility of online delivery, mindfulness-based intervention may be an effective strategy to help marginal populations, such as WSW, promote their psychological and physical health outcomes.

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## CONFLICT OF INTEREST

The authors have no conflicts of interest to report.

## ETHICS STATEMENT

The study protocol was approved by the Institutional Review Board at the Guangxi Center for Diseases Prevention and Control.

## DATA AVAILABILITY STATEMENT

The datasets generated and/or analyzed in the current study are available from the corresponding author on reasonable request.

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