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Psychological resilience and post-traumatic stress disorder as chain mediators between personality traits and cognitive functioning in patients with breast cancer

Xinmiao Zhang¹, Junyue Lu², Zhangyi Ding¹, Gaoxiang Zhong¹, Yan Qiao¹, XiChen Li¹ and Huixia Cui^{3*}

Abstract

Background Personality is a unique behavioral trait; cognition is how an individual knows and understands things. It is essential for everyday daily living. In patients with breast cancer, despite the growing body of research on personality and cognitive functioning, exploration of the underlying mechanisms is still relatively scarce. Therefore, this study aimed to investigate the impact of Big Five personality traits on cognitive functioning and the mediating role of psychological resilience and post-traumatic stress disorder (PTSD) between personality traits and cognitive functioning in patients with breast cancer.

Methods Convenience sampling was used, and a cross-sectional survey of 288 patients clinically diagnosed with breast cancer was conducted in the Department of Breast Surgery of the First Hospital of Jinzhou Medical University. The general information questionnaire, the Ten-Item Personality Inventory in China, the 10-item Connor-Davidson Resilience Scale, the Post-traumatic Stress Disorder Checklist-Civilian Version, and the Montreal Cognitive Assessment were used to measure the patient's general condition, personality traits, psychological resilience, PTSD, and cognitive function, respectively. Descriptive and correlation analyses were performed using SPSS 26.0 software, and mediation effect tests using SPSS PROCESS macro 3.3 software.

Results (1) Psychological resilience, PTSD, Big Five personality traits, and cognitive functioning were significantly correlated. (2) The effects of the Big Five personality traits (extraversion, conscientiousness, agreeableness, emotional stability, and openness) on cognitive functioning can be mediated through three indirect pathways: the separate mediating effects of psychological resilience and PTSD and the chain mediating effects of psychological resilience and PTSD, with a chain mediation effect of 0.014, 0.018, 0.014, 0.018, and 0.014, respectively. None of the 95% CI contained 0.

Conclusion Personality traits can indirectly influence cognitive functioning in patients with breast cancer through the separate mediating roles of psychological resilience and PTSD and their chained mediating roles. This result suggests we pay more comprehensive attention to patients' cognitive function. Workers can be guided to assess patients' personality, psychological, and spiritual characteristics promptly in their work and adopt personalized care to safeguard good cognitive functioning.

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Keywords Breast cancer, Big Five personality traits, Cognitive function, Psychological resilience, Post-traumatic stress disorder

Introduction

Breast cancer is one of the most common cancers among women globally, with the highest incidence of malignant tumors among women, posing a significant challenge for both physical and mental health [1]. In recent years, with increasing research, it has been pointed out that the survival rate of patients with breast cancer has significantly improved. Still, complications related to altered cognitive functioning often occur during treatment [2]. Studies have shown that approximately 75% of cancer patients experience cognitive dysfunction during and after treatment [3]. Cognitive dysfunction includes impairments in memory, executive function, language, and spatial abilities due to various causes [4, 5]. For patients with breast cancer, changes in cognitive functioning due to cancer and its treatment may affect career and social goal achievement as well as patients' treatment decisions and quality of life [6]. Although some studies have focused on the factors influencing cognitive functioning in patients with breast cancer, the mechanisms by which the Big Five personality traits influence cognitive functioning have not been fully explored. Thus, further research is needed [7, 8].

According to the Five Factor Model (FFM), personality consists of five main areas: extraversion, conscientiousness, agreeableness, emotional stability, and openness, also known as the Big Five personality traits [9]. Personality reflects an individual's long-lasting and stable pattern of thoughts, emotions, and behaviors, but it can change with age and after adverse life events [10, 11]. Personality manifests itself in specific responses and behaviors in response to external events, and these traits can influence health habits, cognitive activity, and, thus, cognitive function [11]. Different personality traits affect cognitive functioning to varying degrees [12].

Psychological resilience is an individual's ability to cope with stress and adapt positively to adversity. It can help people to effectively cope with stress, anxiety, depression, and trauma in order to maintain mental health [13]. Therefore, developing a high level of psychological resilience in a rapidly changing life is essential [14]. Research has shown a significant correlation between psychological resilience and subjective cognitive functioning [15]. In addition, longitudinal studies have found that psychological resilience has a protective effect on cognitive function; that is, as the level of psychological resilience increases, the risk of cognitive dysfunction in patients decreases [16]. In addition, research on personality traits

and psychological resilience suggests that higher personality traits, such as responsibility, have a positive protective effect on psychological resilience [17]. Some studies have also explored the mediating role of psychological resilience in different personality traits; for example, Xue et al. found in their study that psychological resilience played a significant mediating role between certain personality traits and suicidal behavior [18]. Thus, personality traits influence patients' cognitive functioning through psychological resilience.

Post-traumatic stress disorder (PTSD) is a persistent and severe psychiatric disorder that occurs after an individual has experienced a severe traumatic event, with core manifestations that include a reenactment of the traumatic event, avoidance behaviors, and a persistent sense of cognitive and psychic crisis [19]. PTSD has a significant impact on mental health. According to self-regulation theory, an individual's capacity for self-initiated regulation is limited [20]. As a result, when faced with an event such as a sudden illness, the psychological condition is more likely to be affected, leading to the development of PTSD symptoms, which may lead to cognitive impairment in the case of inadequate regulation [21]. Studies have shown that the diagnosis of cognitive dysfunction is strongly associated with PTSD symptoms and that PTSD is a negative predictor of cognitive function [22, 23]. Also, previous studies have found that personality traits play a fundamental role in whether or not PTSD develops after experiencing a traumatic event; for example, neurotic personality plays a vital role in the development of PTSD symptoms [24, 25]. Thus, personality traits may affect patients' cognitive functioning through PTSD.

As mentioned earlier, psychological resilience and PTSD may have separate mediating roles between personality traits and cognitive functioning. Further, research has shown that there is a negative correlation between psychological resilience and PTSD symptoms, i.e., individuals with higher levels of psychological resilience have relatively less severe PTSD symptoms [26]. In addition, a COVID-19 period study found that psychological resilience negatively mediated the relationship between COVID-19-related effects and PTSD symptoms [27]. Thus, psychological resilience and PTSD may have a chain mediating role between personality traits and cognitive functioning.

Currently, research on the relationship between Big Five personality traits, psychological resilience, PTSD,

and cognitive functioning is still relatively limited, and the understanding of the interaction mechanisms of the factors influencing cognitive functioning in patients with breast cancer is impoverished. Therefore, four hypotheses are formulated, and a theoretical hypothesis model is constructed. The aim is to help healthcare professionals consider patients' cognitive function from multiple perspectives to minimize adverse effects on their daily activities and quality of life.

This study aimed to investigate the impact of Big Five personality traits on cognitive functioning in patients with breast cancer and whether psychological resilience and PTSD mediate the relationship between Big Five personality traits and cognitive functioning. The following four hypotheses are presented in this paper:

H1 Big Five personality traits significantly predict cognitive functioning (Big Five personality traits → cognitive functioning);

H2 Psychological resilience mediates the relationship between Big Five personality traits and cognitive functioning (Big Five personality traits → psychological resilience → cognitive functioning);

H3 PTSD mediates the relationship between Big Five personality traits and cognitive functioning (Big Five personality traits → PTSD → cognitive functioning);

H4 Psychological resilience and PTSD act as chain mediators in the relationship between Big Five personality traits and cognitive functioning (Big Five personality traits → psychological resilience → PTSD → cognitive functioning).

Methods

Study design and participants

This study used a descriptive cross-sectional study design. A convenience sampling method was used to select a sample of patients with breast cancer who were definitively diagnosed with clinical diagnosis in the Department of Breast Surgery of the First Hospital of Jinzhou Medical University from July 2023 to November 2023. The inclusion criteria were as follows: ① Age ≥ 18 years; ② Meet the diagnostic criteria of the Chinese Anti-Cancer Association's Breast Cancer Diagnostic and Treatment Guidelines and Criteria and the time of diagnosis > 1 month [28]; ③ Basic language comprehension and response skills; ④ Understand disease diagnosis; ⑤ Voluntarily participate in this study and sign the informed consent form. Exclusion Criteria: ① A history of neurological or psychiatric disorders; ② Those taking medications related to cognitive function; ③ Those with intracranial abnormalities and intracranial metastases on cranial MRI or CT; ④ Patients with terminal malignant

tumors; ⑤ Combination of serious heart, liver, kidney, brain, and hematopoietic system diseases.

Ethical approval and data collection

Ethical approval for this study was obtained from the Ethics Committee of Jinzhou Medical University (JZMULL2023078). Before the survey, members of the research team informed participants of the study's purpose and significance. All participants provided informed consent and volunteered to participate in the study. Confidentiality was strictly followed during the survey process, and questionnaires were distributed and collected one-on-one by uniformly trained team members on-site. For those who had difficulty reading and writing, the researcher dictated the questionnaire content and accurately recorded their responses, and the questionnaires were collected on the spot. According to Kendall's sample size estimation method [29], The sample size should be 5–10 times the number of variables, and the general demographic information for this study was five variables and 18 dimensions on four scales, for a total of 23 variables. Considering a sample attrition rate of 20%, the sample size was estimated to be 138–276 cases. 326 questionnaires were eventually distributed, and 288 valid responses were received, representing a valid response rate of 88.34%.

Survey instruments

General Information Questionnaire

The general information questionnaire had a researcher-designed questionnaire that included age, marital status, occupation, cancer stage, and treatment regimen.

Ten-Item Personality Inventory in China

Gosling originally developed the Ten-Item Personality Inventory in China (TIPI-C) [30], which was translated into Chinese by Li et al. The study showed good reliability and validity in the Chinese population [31]. The 10-item scale consists of five dimensions: extraversion (2 items), conscientiousness (2 items), agreeableness (2 items), emotional stability (2 items), and openness (2 items). Responses were scored on a 7-point Likert scale (absolutely disagree = 1, strongly disagree = 2, basically disagree = 3, unsure = 4, basically agree = 5, strongly agree = 6, and agree = 7), with 2, 4, 6, 8, and 10 being reverse scored items. Higher scores on a personality dimension indicate that the subject is more inclined towards that personality. The Cronbach's α coefficient for this scale in this study was 0.743.

10-item Connor-Davidson Resilience Scale

The Connor-Davidson Resilience Scale (CD-RISC) was developed by Connor et al. [32]. The 10-item

Connor-Davidson Resilience Scale (CD-RISC-10) applied in this study was simplified by Campbell-Sills et al., who extracted 10 entries from the CD-RISC [33]. Zhang et al. Revised to incorporate Chinese culture [34]. The scale consists of 10 entries and includes the dimensions of strength (5 entries) and resilience (5 entries). Responses were scored on a 5-point Likert scale (never=0, rarely=1, sometimes=2, often=3, all the time=4) with a total score of 0 to 40, with higher scores indicating higher levels of psychological resilience. The Cronbach's α coefficient for this scale in this study was 0.912.

Post-traumatic Stress Disorder Checklist-Civilian Version

The Post-traumatic Stress Disorder Checklist-Civilian Version is a self-evaluation questionnaire consisting of 17 entries [35]. The questionnaire has been translated into Chinese and tested for reliability in a Chinese population [36, 37]. Three dimensions were included: re-experiencing (5 entries), avoidance (7 entries), and increased alertness (5 entries). Responses were scored using a 5-point Likert scale (not at all=1, a little=2, moderately=3, quite a bit=4, and significantly=5), with a total score of 17 to 85, with higher scores representing a greater probability of PTSD occurring. The Cronbach's α coefficient for this scale in this study was 0.903.

Montreal Cognitive Assessment

The Montreal Cognitive Assessment (MoCA) scale was developed by Nasreddine et al. based on clinical empirical experience [38]. Our scholars, Wang et al., have applied it to Chinese populations [39]. The scale consists of 12 questions covering eight cognitive domains: memory functioning, visuospatial functioning, executive functioning, attention, numeracy, language functioning, time orientation, and place orientation. The total score was 0–30, ≥ 26 being cognitively normal, with a cut-off value of 25 if the number of years of education was ≤ 12 , and the lower the score, the worse the cognitive functioning. The Cronbach's α coefficient for this scale in this study was 0.706.

Data analysis

The study was analyzed using SPSS 26.0 software. Firstly, descriptive statistics of patients' general information and scores on the four scales were performed. Count data were described using frequencies and composition ratios (%), and non-normally distributed quantitative data were expressed using median and interquartile spacing $M(P25, P75)$. The data in this study did not conform to normal distribution, and the Mann–Whitney U and Kruskal–Wallis H tests were used to compare cognitive function scores across demographic characteristics. Second, Spearman's correlation analysis was used to explore the

correlation between Big Five personality traits, psychological resilience, post-traumatic stress disorder, and cognitive functioning in patients with breast cancer. Finally, SPSS PROCESS macro 3.3 software was used to test the mediating effects of psychological resilience and post-traumatic stress disorder on Big Five personality traits and cognitive functioning in patients with breast cancer. The 95% confidence intervals were estimated 5000 times using the bootstrap method, and the confidence intervals did not include 0, indicating a significant mediation effect. *P*-values less than 0.05 were considered statistically significant.

Results

Common method deviation test

Harman's one-way test was used to test for common method bias. The results show that the first factor has an explanatory rate of 24.115%, which is far below the critical criterion of 40%; in addition, 11 components have eigenvalues greater than 1, indicating no severe phenomenon of common method bias in this study.

General characteristics of participants

A total of 288 patients with breast cancer participated in this study. The prevalence of cognitive dysfunction was 20.1%. Age is predominantly 45–59 years (46.88%); In terms of marriage status, 90.63% were married; in terms of occupational activity, farmers accounted for a higher proportion of 31.60%; and there were more patients in stages I and II (70.49%) than in stages III and IV (29.52%); Regarding treatment program, more than half of the patients were undergoing chemotherapy (63.89%). Specific demographic characteristics, disease-related information, and cognitive function scores between subgroups are compared in Table 1.

The median psychological resilience, PTSD, and cognitive functioning scores were 25.00, 30.00, and 27.00, respectively. The median values for extraversion, conscientiousness, agreeableness, emotional stability, and openness were 9.00, 9.00, 10.00, 8.00, and 8.00, respectively. The results of the descriptive statistical analysis of the variable scores are shown in Table 2.

Correlation analysis of Big Five personality traits, psychological resilience, PTSD, and cognitive functioning

Table 3 shows the results of the correlation analysis between Big Five personality, psychological resilience, PTSD, and cognitive functioning. Correlation analyses showed that cognitive functioning was significantly positively correlated with extraversion, conscientiousness, agreeableness, emotional stability, openness, and psychological resilience and significantly negatively correlated with PTSD. Psychological resilience was significantly and

Table 1 Comparison of participants' general demographic characteristics and cognitive function scores in different subgroups ($N = 288$)

Variable	N (%)	Cognitive function score M(P25,P75)	Z	P
Age(years)				
18–44	73(25.35)	29.00(28.00,30.00)	74.667	< 0.001
45–59	135(46.88)	27.00(26.00,29.00)		
≥ 60	80(27.78)	26.00(24.00,27.00)		
Marriage status				
Unmarried	4(1.39)	28.00(27.25,29.50)	3.468	0.325
Married	261 (90.63)	27.00(26.00,29.00)		
Divorce	12(4.17)	26.50(26.00,28.75)		
Widowhood	11(3.82)	27.00(22.00,28.00)		
Careers				
Workless	19(6.60)	27.00(26.00,30.00)	59.197	< 0.001
Farmers	91(31.60)	26.00(23.00,28.00)		
Workers	51(17.71)	29.00(27.00,30.00)		
Individuals	29(10.07)	28.00(27.00,30.00)		
Officer	27(9.38)	29.00(28.00,30.00)		
Retired	71(24.65)	27.00(26.00,29.00)		
Disease Staging				
I	116(40.28)	28.00(27.00,29.00)	8.479	0.037
II	87(30.21)	27.00(26.00,29.00)		
III	44(15.28)	26.50(26.00,28.75)		
IV	41(14.24)	26.00(24.00,29.00)		
Treatment programme				
Chemotherapy	184(63.89)	27.00(26.00,29.00)	6.519	0.011
Non-chemo-therapy	104(36.11)	28.00(26.00,29.00)		

Table 2 Descriptive statistical analysis of variable scores

Variable	Scoring range	Total assessment M(P25,P75)
Extraversion	2 ~ 14	9.00(7.00,10.75)
Conscientiousness	2 ~ 14	9.00(7.00,10.00)
Agreeableness	2 ~ 14	10.00(8.00,11.00)
Emotional stability	2 ~ 14	8.00(6.00,10.00)
Openness	2 ~ 14	8.00(6.00, 10.00)
Psychological resilience	0 ~ 40	25.00(20.00,29.00)
Post-traumatic stress disorder	17 ~ 85	30.00(26.00,37.00)
Cognitive functioning	0 ~ 30	27.00(26.00,29.00)

positively correlated with extraversion, conscientiousness, agreeableness, emotional stability, and openness. PTSD was significantly and negatively correlated with extraversion, conscientiousness, agreeableness, emotional stability, and openness. Psychological resilience

was significantly negatively correlated with PTSD. All variables were significantly correlated and suitable for further testing of mediating effects.

Analysis of the mediating role of psychological resilience and PTSD

The present study was conducted to analyze the chain-mediated effects of psychological resilience and post-traumatic stress disorder between Big Five personality and cognitive functioning in patients with breast cancer by SPSS and SPSS PROCESS macro 3.3 software. The results of the specific analyses are shown in Table 4. After controlling for factors such as age and occupation, the results showed that the total effect of extraversion, conscientiousness, agreeableness, emotional stability, and openness on cognitive functioning were all significant. Extraversion, conscientiousness, emotional stability, and openness had significant direct and indirect effects on cognitive functioning. The direct effect of agreeableness on cognitive function was not significant. The direct effects of extraversion, conscientiousness, agreeableness, emotional stability, and openness on cognitive functioning were 0.147, 0.216, 0.073, 0.148, and 0.149, respectively.

Psychological resilience had a significant mediating effect between the Big Five personality traits (extraversion, conscientiousness, agreeableness, emotional stability, and openness) and cognitive functioning in patients with breast cancer, with mediating effect values of 0.040, 0.053, 0.036, 0.039, and 0.038, respectively. PTSD significantly mediated between the Big Five personality traits (extraversion, conscientiousness, agreeableness, emotional stability, and openness) and cognitive functioning in patients with breast cancer, with mediation effect values of 0.075, 0.113, 0.077, 0.038, and 0.079, respectively. In the relationship between the Big Five personality traits (extraversion, conscientiousness, agreeableness, emotional stability, and openness) and cognitive functioning, psychological resilience significantly predicted post-traumatic stress disorder ($\beta = -0.193$, $P < 0.01$; $\beta = -0.183$, $P < 0.01$; $\beta = -0.213$, $P < 0.01$; $\beta = -0.215$, $P < 0.01$; $\beta = -0.198$, $P < 0.01$). This shows that psychological resilience and post-traumatic stress disorder have a chain mediating effect between the Big Five personality traits (extraversion, conscientiousness, agreeableness, emotional stability, and openness) and cognitive functioning in patients with breast cancer, with effect values of 0.014, 0.018, 0.014, 0.018, and 0.014, respectively.

The overall mediating effects of psychological resilience and PTSD between the Big Five personalities (extraversion, conscientiousness, agreeableness, emotional stability, and openness) and cognitive functioning accounted for

Table 3 Correlation analysis of study variables

	1	2	3	4	5	6	7	8
1	1							
2	0.154**	1						
3	0.169**	0.206**	1					
4	0.018	0.206**	0.013	1				
5	0.473**	0.448**	0.257**	0.181**	1			
6	0.271**	0.253**	0.156**	0.178**	0.246**	1		
7	-0.299**	-0.365**	-0.295**	-0.148*	-0.331**	-0.271**	1	
8	0.317**	0.354**	0.170**	0.195**	0.449**	0.315**	-0.416**	1

1 to 8 are Extraversion, Conscientiousness, Agreeableness, Emotional stability, Openness, Psychological resilience, PTSD, and Cognitive functioning, respectively

* $P < 0.05$

** $P < 0.01$

Table 4 Analysis of the mediating effect of psychological resilience and PTSD

Affect	Pathway	Effect value	95%CI
Direct effect	①→⑧	0.147	0.046~0.249
	②→⑧	0.216	0.079~0.353
	③→⑧	0.073	-0.041~0.188
	④→⑧	0.148	0.054~0.241
	⑤→⑧	0.149	0.043~0.255
The mediating role of psychological resilience	①→⑥→⑧	0.040	0.009~0.080
	②→⑥→⑧	0.053	0.014~0.107
	③→⑥→⑧	0.036	0.008~0.074
	④→⑥→⑧	0.039	0.009~0.078
	⑤→⑥→⑧	0.038	0.010~0.077
The mediating role of post-traumatic stress disorder	①→⑦→⑧	0.075	0.037~0.123
	②→⑦→⑧	0.113	0.059~0.181
	③→⑦→⑧	0.077	0.034~0.128
	④→⑦→⑧	0.038	0.002~0.080
	⑤→⑦→⑧	0.079	0.033~0.133
Chain mediation	①→⑥→⑦→⑧	0.014	0.004~0.031
	②→⑥→⑦→⑧	0.018	0.005~0.040
	③→⑥→⑦→⑧	0.014	0.004~0.031
	④→⑥→⑦→⑧	0.018	0.005~0.037
	⑤→⑥→⑦→⑧	0.014	0.004~0.031

①Extraversion ②Conscientiousness ③Agreeableness ④Emotional stability
⑤Openness ⑥Psychological resilience ⑦PTSD ⑧Cognitive functioning

46.57%, 46.00%, 63.50%, 39.26%, and 46.98% of the total effect, respectively. The overall indirect effect pathways consisted of the following three approaches, respectively: personality→psychological resilience→cognitive functioning; personality→PTSD→cognitive functioning; and personality→psychological resilience→PTSD→cognitive functioning. See Fig. 1.

Discussion

Cognitive function in breast cancer patients has received widespread attention in recent years. In the present study, the prevalence of cognitive dysfunction in breast cancer patients was found to be 20.1%, which was slightly higher than the study by VEARNCOMBE et al. [40]. Consider the possible reasons for this, as the patients in this study were older and included other patients in addition to chemotherapy. Therefore, it is reasonable. In addition, we focus in this study on the effect of Big Five personality traits on cognitive functioning and whether psychological resilience and post-traumatic stress disorder have a mediating role between personality traits and cognitive functioning in patients with breast cancer. We found that personality traits were positively correlated with psychological resilience and cognitive functioning, which is consistent with previous studies [41, 42]. This suggests that the more positive personality traits such as extraversion and conscientiousness a patient favors, the better their psychological resilience and cognitive functioning. There is also further evidence of a significant negative correlation between personality traits and PTSD, as shown in the study by COHEN-LOUCK et al. [43]. Also, a mediation effect test found that psychological resilience mediated with PTSD. Therefore, the results of the current study can confirm the hypothetical questions we have posed.

The results indicate that Big Five personality traits have varying degrees of influence on cognitive functioning. Extraversion, conscientiousness, emotional stability, and openness positively predict cognitive functioning. Extraverted individuals are usually enthusiastic, gregarious, and actively seek out positive emotions, while open-minded individuals are imaginative, creative, and adaptable to change [9]. In these findings of Chinese patients with breast cancer, we found that extroverted and open individuals were more proactive in engaging

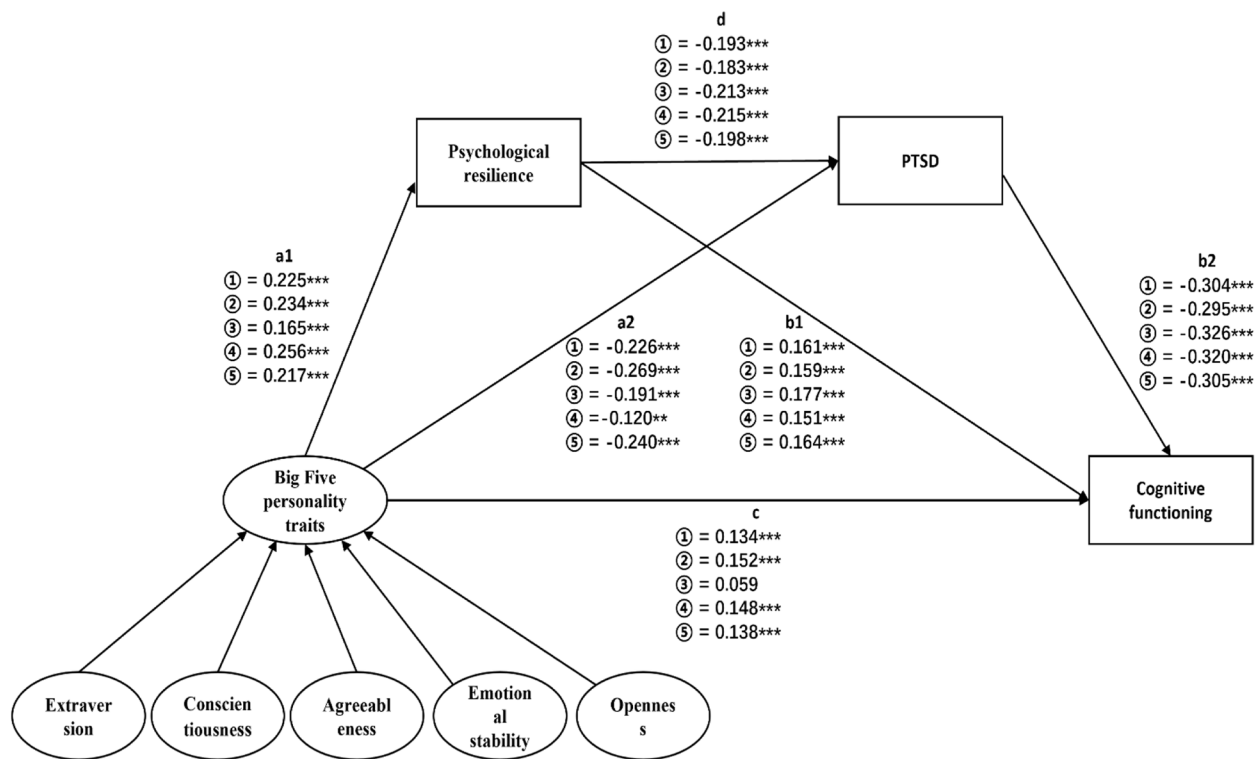


Fig. 1 Model of Chain Mediation Action. *** $P < 0.01$; ** $P < 0.05$

in social interactions and cognitive stimulation activities, thus maintaining better cognitive functioning [42]. Individuals with neurotic personalities are often more emotionally unstable and prone to negative emotions and coping styles; in contrast, emotional stability, the antithesis of neuroticism, reduces negative emotions and increases the chances of engaging in challenging activities, which, in turn, has a less negative impact on cognitive functioning [31, 42]. Conscientious individuals are dominated by traits such as planning and self-discipline. They can better organize their daily routines and maintain social contacts, thus increasing their cognitive reserve and maintaining good cognitive states [44]. In addition, the direct effect of agreeableness on cognitive functioning was found to be insignificant in this study, and agreeable individuals were predominantly characterized by submissiveness and gentleness—individuals with agreeable personalities predominated in the patients with breast cancer in this study. They may be more considerate of others than they can plan their own lives thoroughly. Qi et al.'s study also noted that although agreeable individuals tend to maintain stable social relationships, this does not equate to being socially active [44]; therefore, this study suggests that agreeableness may not directly impact cognitive functioning in patients with breast cancer.

The present study found that psychological resilience can act as a mediator of Big Five personality traits and influence cognitive functioning. Personality traits can improve cognitive functioning in patients with breast cancer through psychological resilience. Similar to previous findings, personality traits correlate significantly with psychological resilience [41]. On the other hand, personality traits are widely associated with various domains of cognitive functioning [45]. Stress coping theory states that when faced with stress, individuals assess their abilities and resources based on their abilities and resources and adopt appropriate strategies to adapt to the stress. A randomized controlled trial further supports the idea that a healthy psychological state improves cognitive functioning in patients [42]. This suggests that psychological resilience, as a protective factor, can alleviate negative emotions in patients and reduce the likelihood of altered cognitive functioning. It also means that psychological resilience can be combined with personality traits to weaken adverse effects on cognitive functioning [46]. Therefore, healthcare professionals should focus on developing patients' psychological resilience and maintaining good cognitive function by improving their psychological state.

In addition, the present study suggests that PTSD also has a mediating role in the relationship between

personality traits and cognitive functioning. Patients experiencing PTSD are more likely to suffer changes in cognitive function. In a study by HERMELINK et al., it was noted that PTSD affects and mediates cognitive functioning in patients with breast cancer [47]. More susceptible to mood swings and psychological stress in the face of change due to emotionally unstable personality traits [13]. As mentioned earlier, when stress is not regulated correctly, it can lead to other impairments, such as cognitive functioning [21]. Therefore, in the process of clinical care, more attention should be paid to patients' post-traumatic coping ability, and timely assessment and adjustment should be made to reduce the negative impact of PTSD.

Psychological resilience and PTSD have chain-mediated effects between Big Five personality traits and cognitive functioning in patients with breast cancer. That is, the Big Five personality traits reduce the effects of PTSD by increasing levels of psychological resilience, which in turn mitigates its effects on cognitive functioning. Psychological resilience, as a positive psychological trait, is critical to an individual's ability to cope when dealing with challenges and trauma [48]. Psychological Resilience Significantly Predicts PTSD, Study Shows [49]. For example, a prospective study conducted by MATHIEU et al. found that those with high psychological resilience had a lower incidence of PTSD compared to those with low psychological resilience [50]. Patients with breast cancer with positive personality traits are more proactive in accessing beneficial resources, increasing their level of psychological resilience and ability to cope with the disease, thus counteracting the effects of negative emotions such as post-traumatic stress disorder and maintaining a healthy psychological state. This positive psychological state helps to enhance patients' health-related quality of life [51]. This further explains that an upbeat personality can reduce the risk of PTSD in patients by increasing their psychological resilience, thereby improving cognitive function. In clinical practice, in addition to the preventive measures of timely assessment of the patient's psychological state, we should also actively take psychological intervention and physical exercise to help patients maintain a good psychological state and improve their cognitive function [52, 53].

In conclusion, this study deepens our understanding of the mechanisms at play between Big Five personality traits and cognitive functioning in patients with breast cancer. The results suggest that psychological resilience and PTSD play an essential role in this relationship. Therefore, a multifaceted focus on patients' cognitive function is essential, and this finding may guide clinical care and intervention for patients with breast cancer.

Limitations

Although our study revealed the chain-mediated role of psychological resilience and PTSD in the relationship between Big Five personality traits and cognitive functioning in patients with breast cancer, the following limitations remain. Firstly, our study used a cross-sectional research design, which did not allow us to determine the causal relationship between the variables. A longitudinal research design could be used in future studies to understand the relationship between these variables better. Secondly, this study used convenience sampling, and the sample was limited in its origin. Therefore, follow-up studies could expand the sample source and launch a multi-center study for further validation.

Conclusion

In summary, despite the shortcomings of this study, it still has important theoretical and practical implications. On the one hand, this study explored the relationship between Big Five personality traits and cognitive functioning in patients with breast cancer and its mechanisms. A chain mediation model was constructed, and psychological resilience and PTSD were found to mediate between personality traits and cognitive functioning. These findings emphasize the importance of psychological resilience and PTSD in preventing cognitive changes in patients. On the other hand, our findings guide personalized nursing interventions. Timely assessment of patients' personalities and psychological and spiritual characteristics guides patients to face the disease positively, improves psychological tolerance, reduces the occurrence of PTSD symptoms, and reduces the negative impact on cognitive function.

Abbreviations

TIPI-C	Ten-Item Personality Inventory in China
CD-RISC	Connor-Davidson Resilience Scale
CD-RISC-10	10-Item Connor-Davidson Resilience Scale
PTSD	Post-traumatic stress disorder
MoCA	Montreal Cognitive Assessment

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Authors' contributions

Xm Z was involved in research design, data compilation and analysis, and writing the original manuscript; Jy L was involved in interpreting the data and guiding the project; Zy D, Y Q, Xc L, and Gx Z were involved in data collection and presenting the results; and Hx C guided and supervised the process of research and revised the paper. All authors read and approved the final manuscript.

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Data availability

Due to the privacy of the participants involved in the study data, the datasets generated and/or analyzed in this study are currently not publicly available but can be obtained from the corresponding author of this study upon reasonable request.

Declarations

Ethics approval and consent to participate

The study was conducted by the Declaration of Helsinki and approved by the Ethics Committee of Jinzhou Medical University. The study followed the principle of voluntariness and risk minimization. The questionnaire was anonymous to protect the privacy of the participants. All participants provided informed consent. All methods were performed according to relevant guidelines and regulations.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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