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The role of depression in the relationship between cognitive decline and quality of life among breast cancer patients

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Abstract

Purpose Cancer patients who underwent chemotherapy experience cognitive decline, which, in turn, negatively impacts quality of life (QoL). Depression is considered a psychological factor that is negatively associated with the QoL of cancer patients. However, the relationships among cognitive functioning, depression, and QoL in breast cancer patients are under-researched in the literature. The aim of this cross-sectional study was to identify the role of depression in the relationship between cognitive functioning and QoL among breast cancer patients.
Methods One hundred thirty breast cancer patients who underwent primary treatment participated. Participants completed the Functional Assessment of Cancer Therapy-Cognitive Function version 3, the Montreal Cognitive Assessment, the Beck Depression Inventory-II, and the Functional Assessment of Cancer Therapy-Breast Scale. The data were analyzed using multiple regression according to Baron and Kenny's strategies and the Sobel test.
Results Subjective and objective cognitive functioning and depression were statistically significant predictors of QoL in breast cancer patients. Depression played a partial mediating role in the relationship between objective cognitive functioning and QoL and between subjective cognitive functioning and QoL. Additionally, the Sobel test demonstrated that depression had a significant partial mediating effect between subjective cognitive functioning and QoL ($Z = 4.91$, $p < 0.001$) and between objective cognitive functioning and QoL ($Z = 2.62$, $p = 0.009$).
Conclusions The findings indicated that depression could influence the association between cognitive functioning and QoL in breast cancer patients. Healthcare providers should develop an intervention focused on decreasing depression to evaluate the effectiveness of improving quality of life for breast cancer patients with cognitive dysfunction.

Keywords Cognition · Cognitive dysfunction · Quality of life · Depression · Breast neoplasms

Introduction

Breast cancer is the most common cancer among women worldwide [1]. Due to advances in diagnosis and treatment, there has been substantial improvement in the survival rates of breast cancer patients [1, 2]. As such, there is a need to understand the impact of late and long-term symptoms associated with cancer and its treatment on quality of life (QoL) in order to help breast cancer patients cope with cancer as a chronic disease [3, 4].

Cognitive impairment is one symptom often reported by breast cancer survivors [4], including problems with memory, attention, processing speed, and executive functioning [5–8]. These problems can persist up to 20 years or more after cancer treatment ends [9–11]. There is a growing body of research showing that the cognitive performance of breast cancer survivors was significantly worse than that of healthy age- and education-matched controls [4, 5, 7]. Cognitive impairment makes it difficult for survivors to resume normal daily activities such as focusing, word finding, reading, and driving and interferes with survivors' fulfillment of roles in the family, workplace, and society. Cognitive decline can have a significant effect on cancer survivors' QoL and may ultimately lead to long-term cognitive impairment [2, 6].

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Depression is another factor that must be considered in the context of QoL. It is one of the most common psychological problems among breast cancer survivors, with a prevalence rate of around 30% [2, 12]. Many studies have shown that depression and its symptoms are associated with functional impairment, lower treatment adherence, problems with interpersonal relationships and occupational performance, higher stress, and worse perceived health and physical symptoms [2, 13]. Naturally, depression may also have a negative impact on QoL in breast cancer patients [12, 13].

Besides QoL, depression is also linked with cognitive impairment. More specifically, although the nature of the association remains unclear, both subjective and objective cognitive impairment have been found to be associated with depression, which is modifiable, emotional/mood-related variable that are potential targets for intervention [2, 14]. For example, depression in patients who are receiving or have received chemotherapeutic treatment has been found to be related to objective cognitive impairment, which in turn may lead to more subjective complaints regarding these symptoms [3, 10, 15]. Potentially, depression influences individuals' perceptions of cognitive performance by interfering with attentional control during assessments of cognitive functioning [16]. Additionally, cancer patients who are experiencing cognitive impairment have been found to have more severe depressive symptoms and lower QoL compared to patients who do not develop cognitive impairment [17]. Several other studies found that cognitive impairment and depression were both significant factors associated with QoL in breast cancer patients [2, 6, 18]. Therefore, it is important to clarify whether depression plays a mediating role in the association of cognitive functioning and QoL in breast cancer survivors; indeed, assessing this mediating role can influence the design of strategies to promote QoL and prevent secondary health problems related to cognitive decline in breast cancer survivors.

Several studies have examined the relationship between two of these variables—such as cognitive functioning and depression [8, 10, 14], cognitive functioning and QoL [15, 19], or depression and QoL [20, 21]—but few studies have examined the relationship between all three. Only one study, which examined a Korean sample of colon cancer patients, examined whether depression mediated the association between cognitive functioning and QoL [18]. However, this previous study measured cognitive functioning using the Mini-Mental State Examination (MMSE), which assesses moderate and severe cognitive impairment [22], rather than mild cognitive impairment, which is more common in breast cancer patients.

Cognitive impairment has been documented among breast cancer patients using both objective neuropsychological tests and subjective reports. Objective cognitive function measured by neuropsychological tests is essentially the same as real-time imaging and is conducted in quiet and structured conditions, which create artificial settings that fail to reflect a real-life environment whereas self-reported subjective cognitive function can be used to examine cognitive decline over a certain period and in different setting [3, 6]. The majority of breast cancer survivors experience subtle cognitive changes that may not be detected by standard neuropsychological tests but nevertheless impede adaption [6]. Although assessments based on neuropsychological test batteries have revealed that cognitive impairment may be less prevalent than is revealed by self-reports, perceived cognitive decline is still a significant stressor for cancer survivors and has an even greater negative impact on QoL than do the results of objective neuropsychological tests [3, 6, 17]. Therefore, measures of both objective and subjective cognitive impairment should be employed to provide information relevant to the functioning of cancer survivors, despite the lack of agreement between measures of objective and perceived cognitive impairment [3].

In sum, understanding the effects of cognitive functioning and depression on QoL has the potential to promote patients' transition to survivorhood and achieve better outcomes. The current study aims to (a) describe levels of cognitive functioning, depression, and QoL and (b) determine whether depression mediates the relationship between cognitive functioning and QoL among breast cancer survivors in South Korea.

Methods

Design and participants

This study used a descriptive, cross-sectional, correlational design. A convenience sample of 130 women with breast cancer was recruited between April and October 2016 from the Department of Clinical Oncology at a University Hospital in Korea. The inclusion criteria for the participants were as follows: (1) > 19 years old, (2) had first diagnosis of breast cancer, (3) had completed active treatment (i.e., surgery, chemotherapy, and/or radiotherapy) within 1 year, and (4) able to read and understand the questionnaires. Patients who had been diagnosed with cancer previously, had a medical condition known to affect cognitive functioning, or had been diagnosed with a psychiatric disease and treated with medication were excluded. All patients were included in the final analysis.

Instruments

Subjective cognitive functioning

The FACT-Cog version 3 was used to assess subjective cognitive functioning. It is a 37-item questionnaire with four subscales: perceived cognitive impairment (CogPCI), perceived cognitive ability (CogPCA), noticeability (CogOth), and impact on quality of life (CogQoL) [23]. This study focused on

the cognitive functioning scale, comprising CogPCI and CogPCA, which assessed cognitive functions such as concentration, verbal fluency, memory, interference, mental acuity, and multitasking. All items were rated on a 5-point Likert scale. For each of the CogPCI subscales (range 0–72), the patients rated the frequency of occurrence in the last 7 days using a 5-point Likert scale (0 = "never" to 4 = "several times per day"). For each of the CogPCA subscales (range 0–28), the patients used a different 5-point Likert scale (0 = "not at all" to 4 = "very much"). Higher scores indicated better cognitive functioning. Cronbach's α for each subscale ranged between 0.83 and 0.90 in this study.

Objective cognitive functioning

The Montreal Cognitive Assessment (MoCA) was used to assess objective cognitive functioning. The MoCA was designed as a rapid screening instrument for mild cognitive dysfunction. Thirty items assessing multiple cognitive domains comprise the MoCA: short-term memory; visuospatial abilities via clock drawing and a cube copy task; executive functioning via an adaptation of Trail Making Test Part B, phonemic fluency, and verbal abstraction; attention, concentration, and working memory via target detection, serial subtraction, digits forward, and digits backward; language via confrontation naming with low-familiarity animals and repetition of complex sentences; and orientation to time and place [24]. The MoCA was administered for about 10 min. The MoCA is scored by obtaining an item total and scores range between 0 and 30. A score of 26 or more is considered to be normal [22, 24].

Depression

The Beck Depression Inventory Second Edition (BDI-II) was used to explore depressive symptoms. It is a 21-item self-report questionnaire for evaluating the severity of depression and is the most widely used instrument for detecting depression [25, 26]. Previous studies have indicated that the BDI-II has reported a good validity and reliability [25, 26]. All items were rated on a 4-point scale from 0 (symptom absent) to 3 (severe symptoms). The scores ranged from 0 to 63 points. High scores indicated severe depressive symptoms. Cronbach's α for the BDI-II in this study was 0.90.

Quality of life

QoL was assessed using the Functional Assessment of Cancer Therapy-Breast scale (FACT-B) [27]. The FACT-B includes 27 questions assessing the areas of physical, social, emotional, and functional well-being, which consisted of the same questions and subscales of the FACT-G, plus an additional nine questions for breast cancer. The FACT-B is a 35-item questionnaire and all items were rated on a 5-point Likert scale (0 = "not at all" to 4 = "very much") in terms of how true each statement had been in the past 7 days. The total FACT-B score is the sum of all subscales (range 0–144). The subscale scores are obtained by adding all the items of the questionnaire: physical (range 0–28), social (range 0–28), emotional (range 0–24), functional (range 0–28) well-being, and breast cancer subscale (range 0–36). Higher scores indicated better QoL. The Cronbach's alpha in this study was 0.86.

Data collection

The approval to conduct the study was obtained from the institutional review board before the collection of data. All potential participants were screened for eligibility based on medical records. The study staff contacted the potential patients to explain the purpose of the study and the right to withdraw from the study at any time and obtained a written informed consent at regular follow-up visits. The participants completed the MoCA and self-report questionnaires and responded to questions on demographic and clinical characteristics. The evaluation, including the MoCA, was conducted by a trained research assistant in a quiet and non-interference room. Clinical characteristics, such as pathology type, cancer stage, and type of treatments received (e.g., surgery, chemotherapy, radiotherapy, and hormone therapy), were extracted from the patients' medical records.

Data analysis

Descriptive statistics were used to present study variables and characteristics of the participants. Pearson's correlation coefficient was used to determine the relationship among cognitive functioning, depression, and QoL. To investigate the mediating effect of depression on the association between cognitive functioning and QoL, the causal step approach by Baron and Kenny [28] and the Sobel test [28, 29] were used, which are common methods of testing hypotheses using mediation analysis. Multiple regression analysis according to Baron and Kenny's method [28] included the following three steps: the independent variable must be shown to significantly influence the mediator in the first step, the independent variable must be shown to significantly influence the dependent variable in the second step, and the mediator must be shown to significantly influence the dependent variable in the third step, when the independent variable and mediator are entered as predictors. In the third step, complete mediation is present when the independent variable no longer influences the dependent variable after the mediator has been controlled. Partial mediation occurs when the independent variable's influence on the dependent variable is reduced after the mediator is controlled. In addition, the Sobel test [28, 29] was conducted for testing the mediation effect between cognitive functioning and QoL with

the help of depression. All analyses were completed using SPSS (version 23.0 for Windows; SPSS Korea Data Solution Inc.).

Results

Characteristics of study participants

The characteristics of the 130 patients are displayed in Table 1. The average age of the participants was 48 years ($M = 47.89$, $SD = 9.13$). Most patients were married and had more than a high school education. About 40% of patients were classified as having stage 2 breast cancer. Almost 80% of patients underwent partial mastectomy, radiotherapy, and hormone therapy.

Descriptive statistics and correlations between study variables

The mean scores for subjective cognitive functioning, objective cognitive functioning, depression, and QoL were 67.74, 26.10, 12.55, and 91.26, respectively. Significant correlations were observed between cognitive functioning, depression, and QoL in breast cancer. Subjective cognitive functioning was negatively correlated with depression ($r = -0.470$, $p < 0.001$) and positively correlated with QoL ($r = 0.473$, $p < 0.001$). Objective cognitive functioning was also negatively correlated with depression ($r = -0.203$, $p = 0.010$) and positively correlated with QoL ($r = 0.275$, $p = 0.001$; Table 2). However, there was no significant correlation between subjective and objective cognitive functioning ($r = 0.040$, $p = 0.643$).

Mediation of depression on the relationship between cognitive functioning and QoL

The results of the mediating effect of breast cancer patients' depression on the relationship between subjective cognitive functioning and QoL are displayed in Table 3 and Fig. 1. Subjective cognitive functioning exerted a significant effect on depression in the first step ($B = -0.22$, $p < 0.001$). In the second step, subjective cognitive functioning was significantly predictive of QoL ($B = 0.57$, $p < 0.001$). When depression was added to step 3, the significance of the coefficient for subjective cognitive functioning ($B = 0.21$, $p = 0.004$) and depression ($B = -1.64$, $p < 0.001$) significantly predicted QoL. Moreover, the Sobel test demonstrated that depression had a

Table 1 Characteristics of Participants (N=130)

Variables	Categories	n (%)	Quality of life	
			Mean±SD	t or F (p)
Age (yr)	≤ 39	22 (16.9)	88.14±19.49	1.46 (0.228)
	40-49	52 (40.0)	95.56±16.78	
	50-59	45 (34.6)	89.28±23.96	
	≥ 60	11 (8.5)	85.24±16.25	
Educational level	≤ Middle school	22 (16.9)	88.03±22.25	0.39 (0.681)
	High School	57 (43.8)	92.47±20.18	
	≥ College	51 (39.2)	91.29±19.22	
Current marital status	Single	29 (22.3)	88.92±15.77	-0.71 (0.479)
	Married	101 (77.7)	91.93±21.17	
Religion	No	68 (52.3)	90.41±18.44	-0.50 (0.615)
	Yes	62 (47.7)	92.19±21.85	
Perceived economic status	High	12 (9.2)	105.58±19.32	9.37 (<0.001)
	Middle	94 (72.3)	92.73±16.18	
	Low	24 (18.5)	78.32±27.78	
Stages	I	60 (46.2)	96.89±18.41	5.60 (0.005)
	II	51 (39.2)	84.53±20.79	
	III	19 (14.6)	91.51±18.52	
Type of surgery	Partial mastectomy	103 (79.2)	91.84±21.30	0.64 (0.512)
	Total mastectomy	27 (20.8)	94.79±21.85	
Radiation therapy	No	10 (7.7)	92.30±17.44	0.17 (0.865)
	Yes	120 (92.3)	91.17±20.34	
Hormone therapy	No	34 (26.2)	93.30±19.12	0.67 (0.543)
	Yes	96 (73.8)	91.01±18.34	

Table 2 Descriptive Statistics and Correlations between Study Variables (N=130)

Variables	r (p)			
	Subjective cognitive functioning	Objective cognitive functioning	Depression	Quality of life
Subjective cognitive functioning (CogPCA+ CogPCI)	1	0.040 (0.643)	-0.470 (<0.001)	0.473 (<0.001)
Objective cognitive functioning (MoCA)		1	-0.203 (0.010)	0.275 (0.001)
Depression (BDI-II)			1	-0.762 (<0.001)
Quality of life (FACT-B)				1
Mean	67.74	26.10	12.55	91.26
Standard deviation	17.79	3.21	8.24	20.08
Minimum	10.0	12.0	0.0	23.0
Maximum	100.0	30.0	56.0	136.6

BDI-II=Beck Depression Inventory-II, CogPCA=perceived cognitive abilities, CogPCI=perceived cognitive impairments, FACT-B=Functional Assessment of Cancer Therapy-Breast, MoCA=Montreal Cognitive Assessment

significant partial mediating effect between subjective cognitive functioning and QoL ($Z = 4.91$, $p < 0.001$).

First, depression was regressed on objective cognitive functioning with a significant association ($B = -0.59$, $p = 0.009$). Second, objective cognitive functioning was significantly predictive of QoL ($B = 1.87$, $p = 0.001$). Finally, the QoL was regressed on objective cognitive functioning and depression in the regression analyses. The results indicated the significance of the coefficient for objective cognitive functioning ($B = 0.82$, $p = 0.025$) and depression ($B = -1.78$, $p < 0.001$) significantly predicted QoL. The Sobel test demonstrated that depression has a significant partial mediating effect between objective cognitive functioning and QoL ($Z = 2.62$, $p = 0.009$).

Discussion

Cognitive decline or impairments in specific cognitive functions are among the top complaints of cancer survivors [5–7].

This study tested how depression mediated the association between cognitive functioning and QoL in breast cancer patients who had completed primary treatment. The results showed that depression partially mediated the association between cognitive functioning and QoL in breast cancer patients.
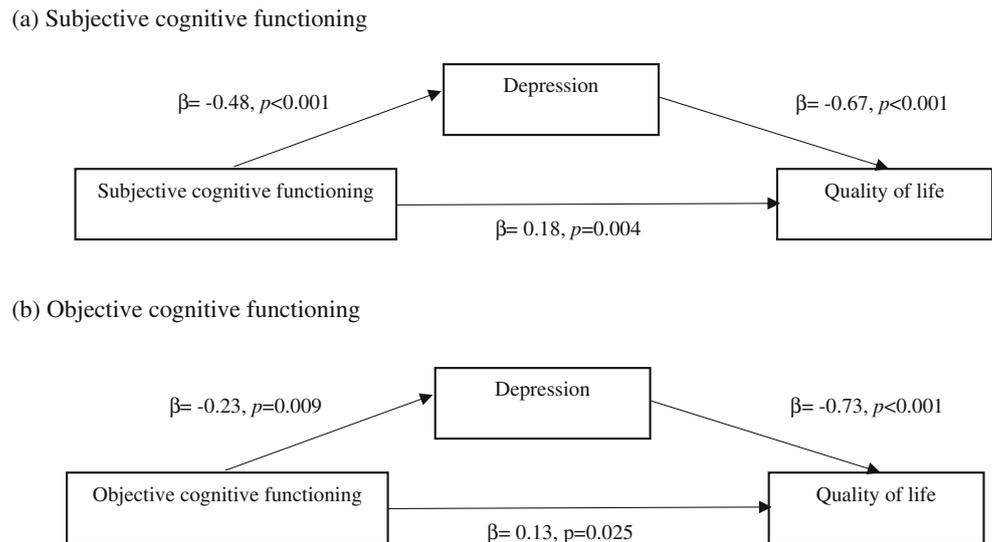
The subjective cognitive functioning measure—that is, the FACT-Cog and its subscales (CogPCI and CogPCA)—assessed any experience related to cognitive decline or impairment in order to examine patients' own perspective on their cognitive functioning, which cannot be detected through neuropsychological tests [6, 7]. In this study, the mean score was 67.74 (range 10–100), which was higher than was that of a previous study [11]. The difference in scores could be attributed to the participants being younger and having a higher level of education than those in the previous study [8]; thus, they could be more aware of problems with cognitive abilities compared with older adults [8]. By contrast, the subjective cognitive functioning scores in this study were lower than were

Table 3 Mediation of depression in the relationship between cognitive functioning and quality of life (N=130)

Dependent variable	Predictor		B	Standard error	β	R^2	F	p
Subjective cognitive functioning (Sobel test: Z = 4.91, p <0 .001)								
Step 1	Depression	Subjective cognitive functioning	-0.22**	0.04	-0.48	0.23	37.86	<0.001
Step 2	Quality of life	Subjective cognitive functioning	0.57**	0.09	0.51	0.26	43.92	<0.001
Step 3	Quality of life	Subjective cognitive functioning	0.21*	0.07	0.18	0.60	97.77	<0.001
		Depression	-1.64**	0.15	-0.67			
Objective cognitive functioning (Sobel test: Z = 2.62, p =0.009)								
Step 1	Depression	Objective cognitive functioning	-0.59*	0.22	-0.23	0.05	7.08	0.009
Step 2	Quality of life	Objective cognitive functioning	1.87*	0.53	0.30	0.08	12.60	0.001
Step 3	Quality of life	Objective cognitive functioning	0.82*	0.36	0.13	0.59	93.94	<0.001
		Depression	-1.78**	0.14	-0.73			

*$p < 0.05$, **$p < 0.001$

Fig. 1 Mediating effect of depression in the relationship between cognitive functioning and quality of life

(a) Subjective cognitive functioning

β= -0.48, *p*<0.001   Depression   β= -0.67, *p*<0.001

Subjective cognitive functioning   Quality of life

β= 0.18, *p*=0.004

(b) Objective cognitive functioning

β= -0.23, *p*=0.009   Depression   β= -0.73, *p*<0.001

Objective cognitive functioning   Quality of life

β= 0.13, p=0.025

those for diverse follow-up periods—from 6 months to 10 years after completion of chemotherapy—in a previous study [14]. According to the evidence [11, 14], the longer the period after treatment, the better the overall cognitive functioning.

In this study, the mean score for objective cognitive functioning, which was measured using the MoCA, was 26.10 (median 27.00, range 12–30). Because the mean score was above the cut score of 26 out of 30 [22, 24], most survivors are considered not cognitively impaired. Those who scored between 18 and 25 (30%) were considered to have mild cognitive impairment, while those who scored between 10 and 17 (1.5%) were considered to have severe cognitive impairment (i.e., at the same level as Alzheimer's disease). These observed scores were slightly lower than were those in a previous study [9] assessing objective cognitive functioning in cancer patients after treatment (with a duration since treatment of 1 to 14 years). Considering that the level of cognitive functioning varies according to the survival period of cancer patients [8, 9, 11], it is necessary to conduct a longitudinal follow-up study to determine the trajectory of cognitive functioning among breast cancer patients from diagnosis to provide a timely intervention for cognitive decline.

The mean score of the QoL in this study was 91.26 (range 23–136.6). This score was slightly lower than were the scores observed in previous studies performed with breast cancer survivors [15, 20]. The difference in scores could be attributed to our participants being younger (mean age = 45.12 years) than those in two previous studies (mean age = 53.0, 53.5 years) [15, 20]. Generally, women with breast cancer in South Korea are younger than are those in western countries [1], and the QoL in younger patients treated for breast cancer is seriously compromised. Consequently, these women tend to suffer from severe psychological distress, infertility,

premature menopause, and childcare difficulties [21]. Therefore, finding ways to reduce and manage stress and anxiety may promote adaptation and QoL.

This study aimed to determine whether depression was a mediating variable between subjective and objective cognitive functioning and QoL. Our findings indicated that depression was a mediator of this relationship, which implies that depression is responsible, at least in part, for the adverse effects of cognitive decline on QoL. More importantly, the explained variance of depression as a mediator was greater in the relationship between objective cognitive functioning and QoL ($\Delta R^2 = 0.51$) than in the relationship between subjective cognitive functioning and QoL ($\Delta R^2 = 0.34$). Although there is growing interest in the cognitive impairment of cancer patients, the research remains in its infancy. Only one study [18] has examined the mediating role of depression in the association between subjective cognitive functioning and QoL in colorectal cancer patients. Depression and cognitive impairment not only are known to be closely related but also are difficult to distinguish because of the similarity of questionnaire items, such as fatigue and reduction in attention and ability to concentrate [8, 30]. Health care providers must be able to identify cancer survivors with mild cognitive impairment and depression using susceptibility and sensitivity tools and in-depth observations. Moreover, patients with severe cognitive decline might deny their cognitive and psychological problems [15]. Therefore, breast cancer survivors who received chemotherapy should be referred to appropriate specialists who could monitor cognitive change and depression. Furthermore, health care providers must provide a multidisciplinary intervention focusing on cognitive decline as well as psychological problems such as depression [2].

However, unlike our study, the prior study [18] reported that depression did not have a significant mediating effect on the association between objective cognitive functioning and

QoL. The difference between this previous study and our own could be attributed to the previous study's inclusion of cancer patients who underwent chemotherapy and its use of the MMSE for assessing moderate and severe objective cognitive dysfunction (e.g., dementia). As noted earlier, the MMSE was developed to detect patients with moderate and severe dementia rather than patients with mild cognitive dysfunction; as a result, it is not suitable to detect cognitive dysfunction in cancer patients, who tend to have subtle and mild cognitive decline [22]. In clinical settings, standardized neuropsychological tests are generally employed to measure objective cognitive functioning, but such tests are not always feasible or affordable. Indeed, it can take hours to administer neuropsychological tests, which can lead to fatigue, loss of attention, and decreased motivation for patients; furthermore, they require trained specialists to administer and interpret the tests [3, 6]. For this reason, we employed the MoCA in this study to identify mild objective cognitive impairment, as it has proven to be a valid brief screening tool for cancer patients in a practical setting. However, there is still insufficient evidence to confirm the validity of the MoCA for cancer survivors; thus, further studies must be conducted to confirm its validity and to determine the unique characteristics of cognitive impairment after chemotherapy, such as the instantaneous manifestation of symptoms and subtle changes [6, 9].

Overall, our findings suggest that depression plays an important mediating role in the association between cognitive functioning and QoL in cancer patients. Therefore, a multidisciplinary approach to managing depression as part of survivor care programs for cancer patients is necessary. Still, this study has several limitations. In addition, certain implications for future research must also be addressed. First, this was a cross-sectional study conducted with breast cancer survivors chosen via convenience sampling. Because a cross-sectional study does not allow to infer causal mechanisms, therefore, care should be taken when interpreting the relationships between cognitive impairment, depression, and QoL. A longitudinal study is needed to confirm these cross-sectional findings. A longitudinal studies could provide new perspectives regarding the exact underlying role of depression at specific time points, such as prior to, during, and following chemotherapy. Second, depression could be mediating and moderating role of cognitive function and QoL even though depression did not moderate the relationship between cognitive decline and QoL when we conducted additional analysis. So, further larger studies are needed to elucidate the mediating and/or moderating mechanism of depression on association between cognitive decline and QoL clearly. Third, the tools used for measuring subjective and objective cognitive functioning differ from those used in prior studies. Hence, there are limits to our ability to aggregate our knowledge of cognitive functioning levels in cancer survivors. Thus, further research must be conducted to measure cognitive functioning using

similar methods. Moreover, the development of a comprehensive and practical tool for assessing both subjective and objective cognitive functioning among cancer survivors is required. Finally, this study was conducted in a single center, which limits the generalizability of our findings to other institutions or populations. For this reason, future studies with larger numbers of patients are needed to clarify the predictors of QoL among breast cancer survivors.

Conclusion

Cognitive decline or impairment is common and leads to maladjustment after completion of primary treatment and poor QoL. We observed the mediating role of depression on the relationship between subjective and objective cognitive decline and QoL among breast cancer survivors. Healthcare providers' knowledge of assessing and detecting depressed cancer survivors who experience cognitive decline is crucial. Therefore, health care providers must recognize the importance of carefully monitoring cognitive function and depressive symptoms to improve QoL. Moreover, considering the high prevalence of cognitive impairment in cancer, repetitive studies on the effects of psychological variables, such as depression, on the QoL of patients with objective and subjective cognitive impairments must be conducted.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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