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RESEARCH ARTICLE

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Mobile web-based self-management program for breast cancer patients with chemotherapy-induced amenorrhoea: A quasi-experimental study

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Abstract

Aim: The aim of this study was to examine the effects of a mobile web-based self-management program on menopausal symptoms, self-efficacy and quality of life in breast cancer patients with chemotherapy-induced amenorrhoea.

Design: A quasi-experimental pretest–posttest design with repeated measures.

Methods: The study was carried out at a university medical centre between October 2017 and September 2018. The intervention group received a 12-week mobile web-based self-management program including education and coaching/support. Multiple instruments were used to measure menopausal symptoms, self-efficacy, and quality of life at pre-test, after the intervention (post-test), and 3 months post-intervention (follow-up test). Repeated measure ANOVA was used to analyse the data.

Results: In the intervention group, menopausal symptoms were significantly improved compared to the control group at the follow-up test. In the follow-up test, the intervention group's self-efficacy and quality of life were significantly improved, whereas that of the control group was decreased.

KEYWORDS

adjuvant chemotherapy, amenorrhoea, breast neoplasms, internet-based intervention, mobile applications, nursing, premature menopause, quality of life, self-efficacy, self-management

1 | INTRODUCTION

The annual incidence of breast cancer in South Korea has increased approximately 3-fold in the last 10 years, from 24.5 to 45.4 persons per 100,000 (Jung et al., 2019). However, the survival rate of breast cancer patients is rising noticeably as a result of recent advances in medical technology, as well as early diagnosis and proactive adjuvant therapy. Particularly, chemotherapy, administered to most breast cancer patients, has dramatically reduced recurrence rates and increased survival rates for these patients. Nevertheless, patients who receive chemotherapy are at risk of secondary health issues, such as menopause, sexual dysfunction, cognitive impairment and osteoporosis (Marino et al., 2016).

2 | BACKGROUND

Chemotherapy-induced amenorrhoea (CIA) is the most common symptom caused by anticancer therapy in young women diagnosed with breast cancer before menopause (Meng et al., 2013; Yoo

et al., 2013). CIA causes irregular menstrual cycles or amenorrhoea due to chemotherapy suppressing the ovarian function and lowering estrogen levels. It presents with physical and emotional symptoms, including hot flashes, night sweats, sleep changes, fatigue, mood changes, vaginal atrophy and lowered libido (Koga et al., 2017; Zha et al., 2015). Compared to natural menopause due to ageing, CIA, as a result of acute ovarian failure, causes more severe sexual dysfunction and menopausal symptoms and negatively affects the health and quality of life (QOL) of breast cancer patients, causing osteoporosis, cardiovascular disease, genitourinary dysfunction and psychological health issues (Im et al., 2019; Koga et al., 2017; Mazor et al., 2018).

The incidence of CIA is reportedly 65%–100% in breast cancer patients receiving chemotherapy; however, this differs depending on the type of drug, cumulative dose and patient's age (Mann et al., 2012; Marino et al., 2016; Mazor et al., 2018; Zha et al., 2015). Although some patients' ovarian function may recover after a period once chemotherapy has ended, the ovarian function of others may never recover if CIA persists for over a year. Additionally, even if the patient begins menstruating again after chemotherapy, menopause will occur earlier for them.

Although CIA cannot be prevented and is a necessary consequence of breast cancer treatment, the patient's QOL can be improved depending on how well the CIA-related symptoms are managed. Given that CIA has been reported to increase the risk of depression and various chronic diseases when it is not properly managed, proactive interventions to improve QOL must be provided for breast cancer patients experiencing CIA (Zha et al., 2015). Since the symptoms and health problems caused by CIA are an important cause of poor health status and reduced QOL in survivors, it is essential to establish strategies to prevent secondary health problems and improve self-management capabilities (Koga et al., 2017; Santen et al., 2017).

Recently, cognitive behavioural approaches, including psychoeducation and social support, have been studied as non-medical interventions for CIA. Unlike medical treatments, which can cause adverse effects, cognitive behavioural interventions focus on the strength of positivity to overcome physical and psychological problems, recovering even when faced with difficulties, and on the ability to perform adaptive functions (Mann et al., 2012; Verbeek et al., 2018). Accordingly, the interventions are a preventive approach to stop problems from occurring, and they have long-lasting effects. Moreover, by helping breast cancer patients develop a more accurate understanding of their disease, these interventions help prevent unnecessary despair or desperation, provide patients with motivation for self-management, and enable patients to monitor changes in their health and adopt appropriate behaviours in response (Van Dijck et al., 2016; Van Driel et al., 2019).

Mobile-based healthcare is being used increasingly, often in the self-health management of chronic patients (Abrahams et al., 2017; van den Berg et al., 2015). Mobile healthcare refers to the use of mobile communication devices to deliver healthcare services. Mobile devices are an excellent means of delivering medical interventions because of their technical capabilities, universality and portability. A study analysing the state of mobile healthcare found that mobile devices are a useful tool for providing medical interventions, collecting data, involving medical personnel in self-management, enhancing effects on the patient's social environment and increasing accessibility to medical information. Additionally, because of their portability, mobile devices can be used to monitor daily living, offering accessibility, since they can function with other devices or services at any time and place via a network (van den Berg et al., 2015).

2.1 | Research question

This study aimed to examine the effects of a mobile web-based self-management program on the menopausal symptoms, self-efficacy and quality of life of breast cancer patients with CIA.

3 | METHODS

3.1 | Design

This study used a quasi-experimental pretest–posttest design with a non-equivalent control group.

3.2 | Participants

Participants were recruited from a university hospital's outpatient clinic, from patients scheduled to complete primary treatment for breast cancer. A convenience sample consisting of patients with scheduled outpatient visits between October 2017 and March 2018 was used.

The participants were selected based on the following inclusion criteria: Patients with stages 1, 2 or 3 breast cancer patients aged ≥19 years and ≤55 years; who had regular menstruation before starting the chemotherapy; who developed amenorrhoea while receiving chemotherapy; who had completed their primary cancer treatments with surgery, radiation and/or chemotherapy within a month (excluding endocrine and/or HER2 targeted therapy) and those who were capable of communicating and responding to the questionnaires. The exclusion criteria were as follows: persons with relapse, metastasis or another primary cancer; persons currently undergoing surgery or anticancer therapy; persons with previous experience participating in a similar study; persons who could not easily participate in the study program and persons with cognitive dysfunction or psychiatric issues.

The sample size for this study was calculated based on Cohen's formula (Cohen, 1988), considering power analysis and the statistical tests to be used. Calculations of a repeated measures ANOVA with a significance level (α) of 0.05, power of 0.80, effect size (f) of 0.25 and number of measurements of 3 indicated the required sample size to be 44 persons. Considering a potential loss of power because of a

maximum of 25% dropout rate, we finally included 60 participants in this study. All baseline measures were repeated after the completion of the intervention (the post-test, T2) and 6 months after the baseline (the follow-up test, T3). A participant from each group was lost during the follow-up, resulting in 85% retention (intervention, 27/30 and control, 24/30) (Figure 1).

3.2.1 | Intervention

The mobile web-based self-management program was a 12-week integrative cognitive behavioural intervention. The app's responsive design approach (Turner-McGrievy et al., 2017) allows users to access the program from multiple devices and screen sizes (mobile phone, tablet and computer). Specifically, the program is aimed to encourage participants to independently engage in health behaviours via the provision of education, coaching and psychosocial support, and to enable participants, through self-management, to enjoy a healthy life and to adapt and return to daily living and society. This program was composed of three modules. The first module provided education and information by showing self-management techniques for menopause-related symptoms and health issues experienced by breast cancer patients with CIA. The second was a communication module for coaching and providing psychosocial support, which included a self-help group and a community consisting of consultations with health care providers, such as physicians and breast cancer center coordinators. The third module consisted of a health diary for self-management. After this program was developed, and prior to conducting this study, five breast cancer survivors who had experienced CIA and five experts consisting of breast surgeons and breast oncology nurse coordinators evaluated its feasibility and applicability. As a result, there was a phrase modification in the education and information module, and the program was modified by commenting that it would be good to download the health diary.

Education and information

The education and information module consisted of information about techniques for managing relevant symptoms, including menopausal symptoms, fatigue, and cognitive dysfunction, preventive management for secondary health problems (osteoporosis, cardiovascular disease, etc.), education about infertility and sexual health, improvement of psychological well-being (fatigue, stress, anxiety, etc.), management of daily living (exercise, adopting healthy lifestyle

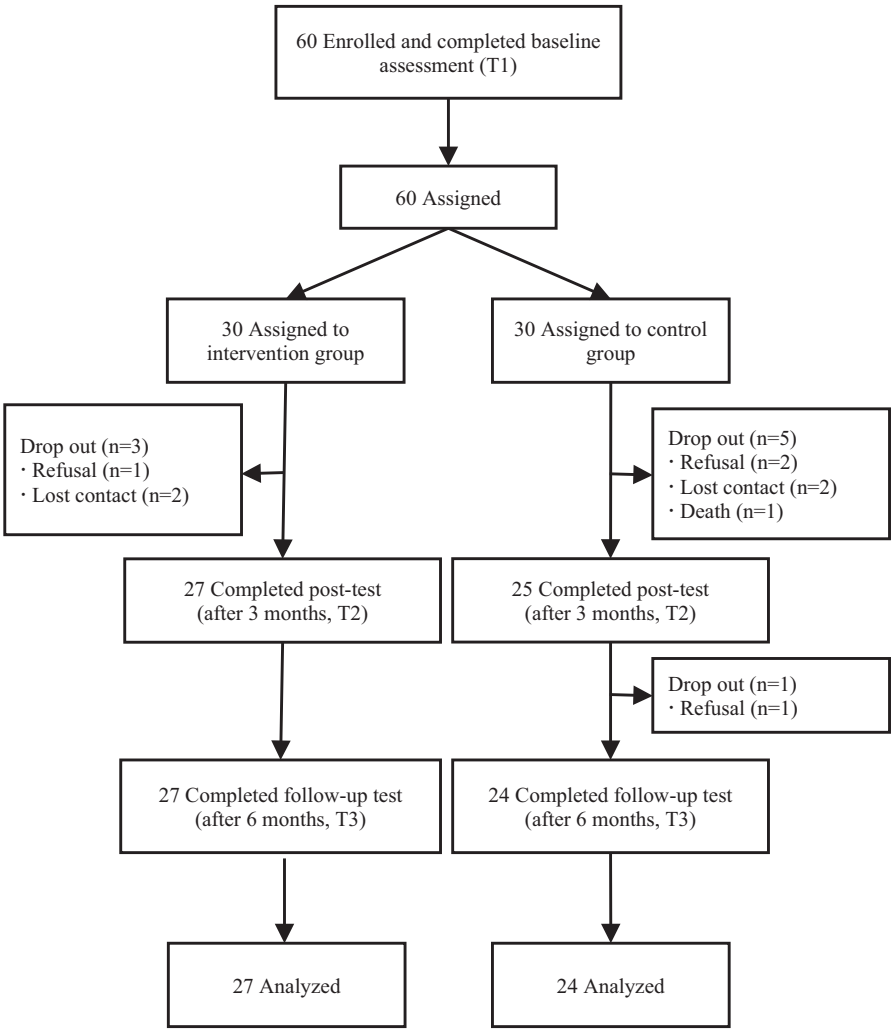

FIGURE 1 Flow diagram of study participants

habits, etc.) and improvement of interpersonal relations (understanding oneself, resuming one's roles, etc.).

Coaching and psychosocial support

By offering communication through communities, this module went beyond the general or one-to-many communication approaches in conventional educational media by enabling interactive communication and supporting active participation. The module was composed broadly of a self-help community and a community with health experts. Joining the self-help community enabled participants to develop friendships and share information in a network of people with shared interests, thereby forging bonds and providing social support. The community with health experts provided personalized information and psychological support, improving knowledge, self-efficacy and encouraging participants to achieve sustained self-management.

Health diary

The health diary included self-management, goal-setting, and self-report forms, aimed at helping participants to check their daily performance of health-improving activities. Participants indicated their degree of implementation of daily health behaviours according to a list of items. They were encouraged to alter their behaviours themselves and adopt a healthy lifestyle pattern.

3.2.2 | Procedure and data collection

Pre-test

A list of eligible patients was provided by clinical staff. The control group consisted of breast cancer patients scheduled to finish their primary treatment for breast cancer between October and December 2017. To minimize contamination of the intervention, the intervention group was selected between January and March 2018. A research assistant provided information about the research procedure, including the study aims and content, research ethics, and data collection methods, and administered the questionnaires only to patients who gave written consent to participate in the study.

Administration of the intervention program

The intervention group received an invitation mail to allow them to participate in the 12-week mobile web-based self-management program and met face-to-face with a researcher to receive instructions about how to use the program. The start of participation in the program was defined as the moment the participants used the URL address in the invitation mail to access the website and register an account. Participants in the intervention group received a 10-part education in CIA symptom and health management and participated in the program via the website, including accessing the latest news and specific data, filling in the health diary for self-management, monitoring results, sharing thoughts and experiences using the community section, and accessing a Q&A section. Login frequency and duration of use were recorded continuously to verify the fidelity of the intervention. Participants were provided regular weekly feedback by email to encourage them to consistently access the website, learn about self-management and fill in the health diary. The criteria for termination of participation in the intervention group was either failure to login to the mobile web-based self-management program at least twice per week for 12 weeks or an expressed intention to stop their participation in the study.

Control group management

The control group received the standard education provided by the hospital nurses. Additionally, the participants in the control group were permitted to access the mobile-based self-management program after they completed the follow-up test (T3) and were able to receive the same education and consultations as the intervention group.

Post-test and follow-up test

The post-test (T2) was administered to the intervention and control groups at the end of the intervention program (3 months after the baseline). The follow-up test (T3) was administered to the intervention and control groups at 3 months after the intervention (6 months after the baseline).

3.2.3 | Outcome measures

Menopausal symptoms

Menopausal symptoms were measured using the Korean version of the Functional Assessment of Cancer Therapy of patients with Endocrine Symptoms questionnaire-version 4 (FACT-ES). The FACT-ES was developed and tested validity and reliability in 268 breast cancer women receiving endocrine therapy by Fallowfield et al. (1999). The FACT-ES is a 19-item scale that evaluates commonly reported menopausal symptoms, including vasomotor symptoms, vaginal symptoms and sexual dysfunction. Respondents indicated scores from '*not at all*' (0 points) to '*very much*' (4 points) on how often they had experienced a symptom during the preceding 7 days. All items were reverse coded, so a higher score indicated lower symptom experience. The possible total score ranged from a minimum of 0 points to a maximum of 76 points. The content validity and reliability of the Korean version of the FACT-ES have been tested for 189 breast cancer patients by Lee (2006). The Korean version of FACT-ES has been proven to be reliable and valid in studies on Korean breast cancer patients (Chang et al., 2008; Jang et al., 2021; Park et al., 2019). Cronbach's α of the Korean version of FACT-ES was reported to be 0.79–0.93 and 0.83 in this study.

Self-efficacy

Self-efficacy was measured using the Self-Efficacy Scale for Self-Management of Breast Cancer (SESSM-B) developed and tested validity and reliability for 303 breast cancer patients by Lee et al. (2012). This instrument comprises 13 questions in 5 subdomains: 'coping with psycho-informational demand' (3 questions), 'management of side-effects' (3 questions), 'maintenance of a healthy lifestyle' (3 questions), 'treatment compliance' (2 questions) and 'sex life' (2 questions). Each item is scored on a 5-point scale from *'not at all'* (1 point) to *'very much*

so' (5 points), with higher scores indicating higher self-efficacy for self-management. The possible total score ranged from a minimum of 13 points to a maximum of 65 points. Cronbach's alpha for the total scale was 0.78, and that for the subscales ranged from 0.61 to 0.79 in the study by Lee et al. (2012). In this study, Cronbach's α for the total scale was 0.81, and that for the subscales were 0.84–0.87.

Quality of life

Quality of life was measured using the Korean version of the Functional Assessment of Cancer Therapy-General (FACT-G), developed for adult patients with cancer at mixed sites, and reported its reliability and validity by Cella et al. (1993). This instrument comprises 27 questions on physical well-being (7 questions), social and family well-being (7 questions), emotional well-being (6 questions) and functional well-being (7 questions) in the last week. Respondents answered the questions on a scale from *'not at all'* (0 points) to *'very much'* (4 points), with higher scores indicating higher QOL. The possible total score ranged from a minimum of 0 points to a maximum of 108 points. The validity and reliability of the Korean version of the FACT-G have been tested for 193 breast cancer patients by Lee et al. (2004). The Korean version of the FACT-G was found to be a reliable and valid tool (Lee, 2006; Park et al., 2019). Cronbach's α of The Korean version of FACT-G was reported to be 0.89–0.93 and 0.83 in this study.

3.3 | Analysis

The collected data were analysed using SPSS WIN 24.0. The control and test groups' sociodemographic characteristics, disease-related characteristics, and main variables were analysed using descriptive statistics. Independent *t*-tests and χ^2 tests were used to test the homogeneity of sociodemographic characteristics, disease-related characteristics, menopausal symptoms, self-efficacy and QOL between the control and test groups. Independent *t*-tests were used to analyse differences between the two groups in menopausal symptoms, self-efficacy and QOL at each time point after the program. A repeated measures ANOVA was used to analyse the patterns of changes in menopausal symptoms, self-efficacy and QOL in the two groups at different time points. In the event of a significant interaction between group and time, Bonferroni correction was used for post hoc multiple comparisons. To assess the effect size of the intervention, Cohen's *d* was calculated in accordance with the guidelines for the design of pre-post-test control group studies. A result of 0.2 was defined as a small effect size, 0.5 as a medium effect size and 0.8 as a large effect size (Cohen, 1988).

3.4 | Ethics

Ethical approval was obtained from the university hospital's Institutional Review Board (AJIRB-MED-SUR-17-129). The study was conducted in accordance with the Declaration of Helsinki. All the participants provided signed informed consent after the study was explained to them in detail.

4 | RESULTS

4.1 | Homogeneity test of the participants' sociodemographic and disease-related characteristics, and dependent variables

There were no differences between the intervention and control groups in sociodemographic or disease-related characteristics (Table 1). The dependent variables of menopausal symptoms, self-efficacy and QOL also showed no statistically significant differences between the two groups, showing a homogeneous distribution (Table 2).

4.2 | Effects of a mobile web-based self-management program

Table 3 shows the results of testing the effects of the mobile web-based self-management program. Menopausal symptom scores differed significantly by time point ($F = 9.57$, $p = .003$) and by group ($F = 1.69$, $p = .033$). The interaction effect of group × time was significant ($F = 5.24$, $p = .007$). In the post hoc analysis, the intervention group showed an increase of 7.22 points in the follow-up test (T3) compared to the pre-test (T1), whereas the control group showed a decrease of 0.21 points, indicating a statistically significant difference between the groups ($p = .015$). This result was a medium effect, with a Cohen's *d* of 0.53.

Self-efficacy scores did not show a significant difference by time point ($F = 0.94$, $p = .386$), nor did they show a significant difference by group ($F = 0.33$, $p = .569$). However, the interaction effect of group × time was statistically significant ($F = 3.67$, $p = .035$). In the post hoc analysis, the intervention group showed an increase of 2.48 points at the follow-up test (T3) compared to the pre-test (T1), whereas the control group showed a decrease of 1.63 points, indicating a statistically significant difference between the groups ($p = .009$). This was a small effect, with Cohen's *d* of 0.49.

QOL scores differed significantly by time point ($F = 4.19$, $p = .018$) and by group ($F = 7.42$, $p = .009$). Additionally, the interaction effect of group × time was also statistically significant ($F = 3.47$, $p = .035$). In the post hoc analysis, the intervention group showed an increase of 5.26 points post-test (T2) compared to the pre-test, whereas the control group showed an increase of 3.04 points, which was not a significant difference between the two groups ($p = .486$). The intervention group showed an increase of 8.07 points at the follow-up test (T3) compared to the pre-test (T1), whereas the control group showed a decrease of 0.17 points, indicating a significant difference between the groups ($p = .016$). This was a medium effect, with a Cohen's *d* of 0.54.

We also examined each subscale of the QOL. Physical well-being showed a statistically significant interaction effect of group × time ($F = 3.72$, $p = .035$). In the post hoc analysis, the intervention group showed an increase of 4.48 points at the follow-up test (T3) compared to the pre-test (T1), whereas the control group showed an increase

TABLE 1 Homogeneity test of sociodemographic and disease-related characteristics between two groups

Variables	*N* (%) or Mean (*SD*)				
	Total (*N* = 51)	Intervention group (*N* = 27)	Control group (*N* = 24)	χ^2 or *t*	*p*
Age (year)	42.78 (4.70)	42.78 (4.70)	45.0 (5.00)	−1.64	.109
Educational level					
≤ High school	20 (39.2)	10 (37.0)	10 (41.7)	0.11	.735
≥ University	31 (60.8)	17 (63.0)	14 (58.3)		
Marital status					
Single	5 (9.8)	4 (14.8)	1 (4.2)	—	.202[a]
Married	46 (90.2)	23 (85.2)	23 (95.8)		
Perceived economic status					
High	4 (7.9)	1 (3.7)	3 (12.5)	3.72	.156
Moderate	40 (78.4)	24 (88.9)	16 (66.7)		
Low	7 (13.7)	2 (7.4)	5 (20.8)		
Working status					
No	35 (68.6)	18 (66.7)	17 (70.8)	—	.749[a]
Yes	16 (31.4)	9 (33.3)	7 (29.2)		
Body mass index (kg/m^2)					
<25	34 (66.7)	16 (59.3)	18 (75.0)	—	.234[a]
≥25	17 (33.3)	11 (40.7)	6 (25.0)		
Clinical stage					
Stage I	8 (15.7)	6 (22.2)	2 (8.3)	2.95	.229
Stage II	34 (66.7)	18 (66.7)	16 (66.7)		
Stage III	9 (17.6)	3 (11.1)	6 (25.0)		
Cycles of Chemotherapy					
4 cycles	32 (62.7)	19 (70.4)	13 (54.2)	1.43	.232
6 cycles	19 (37.3)	8 (29.6)	11 (45.8)		
Hormonal therapy					
No	6 (11.8)	3 (11.1)	3 (12.5)	—	.811[a]
Yes	45 (88.2)	24 (88.9)	21 (87.5)		
Target therapy					
No	33 (64.7)	16 (59.3)	17 (70.8)	—	.388[a]
Yes	18 (35.3)	11 (40.7)	7 (29.2)		
Radiotherapy					
No	12 (23.5)	9 (33.3)	3 (12.5)	—	.080[a]
Yes	39 (76.5)	18 (66.7)	21 (87.5)		

Abbreviation: *SD*, standard deviation.

[a]Analysed by Fisher's exact test.

of 0.58 points, indicating a statistically significant difference between the two groups ($p = .014$). This was a medium effect, with a Cohen's *d* of 0.65. Emotional well-being also showed a significant interaction effect of group × time ($F = 7.84$, $p = .001$). In the post hoc analysis, the intervention group showed an increase of 2.07 points at the follow-up test (T3) compared to the pre-test (T1), whereas the control group showed a decrease of 0.88 points, indicating a statistically significant difference between the groups ($p = .002$). This was a large effect, with Cohen's *d* of 0.83.

5 | DISCUSSION

We used a quasi-experimental study to investigate the effects of a mobile web-based self-management program for breast cancer patients with CIA through education, coaching and psychosocial support. Specifically, we analysed the impact of a mobile web-based self-management program on menopausal symptoms, self-efficacy and QOL. Menopausal symptom scores in the control group decreased by 0.21 points in the follow-up test compared to the

TABLE 2 Homogeneity tests of dependent variables between two groups

Variables	Mean (*SD*)			*t*	*p*
	Total (*N* = 51)	Intervention group (*N* = 27)	Control group (*N* = 24)		
Menopausal symptoms	50.31 (10.78)	50.63 (9.07)	49.96 (12.63)	0.22	.827
Self-efficacy	51.55 (8.46)	51.56 (8.75)	51.5 (8.31)	0.01	.995
Quality of life	72.14 (16.84)	75.41 (16.15)	68.46 (17.17)	1.49	.143
Physical well-being	19.57 (6.75)	21.19 (6.49)	17.75 (6.70)	1.86	.069
Social/family well-being	18.80 (5.63)	19.89 (4.72)	17.58 (6.38)	1.48	.146
Emotional well-being	16.61 (4.36)	16.56 (4.55)	16.67 (4.22)	−0.09	.929
Functional well-being	17.16 (5.81)	17.78 (6.22)	16.46 (5.36)	0.81	.424

Abbreviation: *SD*, standard deviation.

pre-test. Conversely, menopausal symptom scores in the intervention group, who received the mobile-based program to improve self-management, increased by 7.22 points at the follow-up compared to the pre-test, demonstrating that the program was effective at alleviating menopausal symptoms in breast cancer patients with CIA. This result supports the findings of previous studies that provided cognitive behavioural interventions, such as education and coaching, to breast cancer patients and reported a decrease in the severity of menopausal symptoms (Baker et al., 2012; Im et al., 2019). The intervention group in this study showed a continuous increase in menopausal symptom scores, whereas the control group showed a slight increase post-test compared to the pre-test, but showed significantly lower scores on the follow-up test, similar to that of the pre-test. This pattern of change is similar to that of Baker et al. (2012). The intervention effect appears to have been delayed because it was already a time when menopause symptoms began to appear after the end of chemotherapy.

CIA, an adverse effect of chemotherapy, requires continuous attention and interventions, since it has negative effects on breast cancer patients' adaptation and QOL, and can cause secondary health issues such as infertility (Kasum et al., 2014; Turan & Oktay, 2014), sexual dysfunction (Rogers & Kristjanson, 2002; Turan & Oktay, 2014), osteoporosis (Taxel et al., 2012) and cardiovascular disease (Bradshaw et al., 2016). Breast cancer patients, in particular, especially younger patients who develop CIA, experience severe menopausal symptoms. Therefore, this study is valuable because we investigated the effects of the intervention on younger breast cancer patients with CIA.

We also found that self-efficacy scores in breast cancer patients with CIA increased significantly more in the intervention group that received a mobile web-based self-management program compared to the control group. This result supported Zhu et al.'s (2017) study with mobile-based support programs, and van den Berg et al.'s (2015) study with web-based self-care programs for breast cancer patients, which reported that cognitive behavioural interventions for improving self-management abilities were effective in enhancing self-efficacy. Likewise, Im et al. (2019) administered a program based on education, coaching and social support to alleviate menopausal symptoms in breast cancer survivors, reporting improved self-efficacy. Thus, education and psychosocial support for managing menopausal symptoms are effective intervention methods for increasing self-efficacy in breast cancer patients. Self-efficacy is a type of self-belief that one can perform certain behaviours to achieve a defined goal (Bandura, 1982), and reportedly plays an important mediating role in symptom management (Foster et al., 2015; Liang et al., 2016). According to Zhu et al. (2017), a decrease in self-efficacy scores after starting chemotherapy was associated with an increase in symptom severity and distress. Increasing self-efficacy increases the ability to cope with symptom management and leads to improvements in adaptation to daily living and QOL, to improve and maintain symptom management in breast cancer patients with CIA. Therefore, it is necessary to develop intervention strategies that enhance self-efficacy.

Regarding QOL, we observed that the intervention group showed significantly more improvements, compared to the control group. Furthermore, among the QOL subscales, physical and emotional well-being showed significant improvements. This result is consistent with the findings of studies by Mann et al. (2012) and Ayers et al. (2012), who applied cognitive behavioural interventions and analysed the effects on symptom management and QOL. CIA has been reported to have negative effects, particularly on the physical and emotional well-being of breast cancer patients (Broeckel et al., 2000; Schmidt et al., 2018; Yeo et al., 2020). As a consequence, cognitive behavioural interventions aimed at improving self-management ability for symptom control, specifically in breast cancer patients with CIA, showed positive effects on physical and emotional well-being. Experiencing menopausal symptoms, physical dysfunction, sleep disorders, joint pain, cognitive problems, and fatigue, after chemotherapy, causes continual decline in breast cancer patients' QOL (Schmidt et al., 2018), and CIA is reported to have a negative impact on QOL (Yeo et al., 2020; Yoo

TABLE 3 The effects of a mobile web-based self-management program on menopausal symptoms, self-efficacy and quality of life

	Intervention group ($N = 27$)	Control Group ($N = 24$)				Difference[b]				
			Group[a]	Time[a]	Group × Time[a]	Time difference	Intervention group	Control group	p	
Variables	Mean (*SD*)	Mean (*SD*)	*F* (*p*)	*F* (*p*)	*F* (*p*)		Mean (*SD*)	Mean (*SD*)		$d_{intervention-control}$
Menopausal symptoms										
T1	50.63 (9.07)	49.95 (12.63)	1.69 (0.033)	9.57 (0.003)	5.24 (0.007)	T1-T2	−5.74 (7.55)	−5.92 (10.57)	.945	0.19
T2	56.37 (10.03)	55.88 (8.98)				T1-T3	−7.22 (9.72)	0.21 (11.36)	.015	0.53
T3	57.85 (7.93)	49.75 (11.68)								
Self-efficacy										
T1	51.56 (8.74)	51.54 (8.31)	0.33 (0.569)	0.94 (0.386)	3.67 (0.035)	T1-T2	1.15 (5.54)	0.54 (8.89)	.769	0.07
T2	50.41 (7.99)	51.00 (8.80)				T1-T3	−2.48 (5.66)	1.63 (5.01)	.009	0.49
T3	54.04 (7.39)	49.92 (8.59)								
Quality of life										
T1	75.41 (16.15)	68.49 (17.17)	7.42 (0.009)	4.19 (0.018)	3.47 (0.035)	T1-T2	−5.26 (9.47)	−3.04 (13.01)	.486	0.14
T2	80.67 (15.06)	71.50 (14.72)				T1-T3	−8.07 (11.02)	0.17 (12.64)	.016	0.54
T3	83.48 (12.83)	68.29 (15.08)								
Physical well-being										
T1	21.19 (6.49)	17.75 (6.70)	14.26 (<0.001)	6.30 (0.005)	3.72 (0.035)	T1-T2	−2.33 (4.93)	−0.92 (6.78)	.394	0.22
T2	23.52 (4.38)	18.67 (7.04)				T1-T3	−4.48 (5.11)	−0.58 (5.87)	.014	0.65
T3	25.67 (2.91)	18.33 (6.14)								
Social/family well-being										
T1	19.89 (4.72)	17.58 (6.38)	1.78 (0.189)	1.38 (0.256)	1.21 (0.301)	T1-T2	−0.44 (5.12)	−0.21 (3.62)	.852	0.04
T2	20.33 (5.31)	17.79 (6.24)				T1-T3	1.56 (4.15)	−0.08 (4.20)	.168	0.30
T3	18.33 (5.18)	17.67 (5.84)								
Emotional well-being										
T1	16.56 (4.55)	16.67 (4.22)	1.08 (0.303)	3.09 (0.050)	7.84 (0.001)	T1-T2	−1.22 (2.50)	−1.33 (3.90)	.903	0.03
T2	17.78 (4.36)	18.00 (3.44)				T1-T3	−2.07 (2.93)	0.88 (4.67)	.002	0.83
T3	19.26 (4.45)	15.79 (3.92)								
Functional well-being										
T1	17.78 (6.22)	16.46 (5.36)	3.06 (0.087)	2.15 (0.122)	1.98 (0.144)	T1-T2	−1.26 (3.34)	−0.58 (4.35)	.534	0.13
T2	19.04 (5.17)	17.04 (4.71)				T1-T3	−2.44 (5.01)	−0.04 (5.11)	.097	0.42
T3	20.22 (5.17)	16.50 (5.74)								

Note: ***d***intervention-control effect size for intervention group improvement corrected for control group improvement.*d* = Cohen *d* effect size (0.2 ~ small size, 0.5 ~ medium size, 0.8~ large size).

Abbreviation: *SD*, standard deviation.

[a]Analysed by repeated measures ANOVA.

[b]Analysed by Bonferroni correction.

et al., 2013). A need for cognitive behavioural interventions is clearly indicated for these patients.

This study is valuable because we provided a mobile web-based self-management program for breast cancer patients and demonstrated that this program reduces menopausal symptoms while enhancing self-efficacy and QOL. Additionally, we confirmed that a mobile web-based program could be a sustainable nursing intervention, improving accessibility by eliminating spatial and temporal restrictions and aiding breast cancer patients' individual symptom control and compliance through self-management.

5.1 | Limitations

Some caution is required in interpreting the results of this study, owing to the following limitations. First, the participants for this study were recruited by convenience sampling of breast cancer patients with CIA at a single university hospital, limiting the ability to generalize the results. Second, we cannot exclude the possibility of selection bias in the recruitment process since we only selected patients capable of using a mobile device. Third, because we only used a self-report scale to assess the severity of menopausal symptoms, it is possible that symptoms could have been over- or underestimated. To reduce this risk, future studies should include objective assessment tools. Finally, even though a synchronized design was used to prevent contamination, there was some overlap between the intervention group's intervention period and the control group's follow-up test period.

6 | CONCLUSION

A mobile web-based self-management program administered to breast cancer patients with CIA was effective at reducing menopausal symptoms while improving self-efficacy and QOL. Moreover, the intervention effect persisted for at least 3 months after the end of the intervention. Providing educational information via mobile devices increased accessibility, mutual communication within a self-help community and a community with health experts provided personalized health coaching and psychosocial support, and the use of a health diary helped improve self-efficacy with regard to self-management. In future, it will be important to confirm the intervention effects observed in this study by expanding the sample population to include other female cancer patients, who also showed a high incidence of CIA, and repeating the experiment as a randomized trial. Additionally, it will be useful to conduct further studies to investigate the persistence of the intervention effects with a longer follow-up duration.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

AUTHOR CONTRIBUTIONS

J-HP: Conceptualization. J-HP, SHB: Design. YSJ, JYK: Resources and acquisition of data. J-HP: Analysis and interpretation of data. J-HP, SHB: Writing—original draft preparation. J-HP, SHB: Writing—review and editing. J-HP: Supervision. J-HP: Funding acquisition. All authors have read and agreed to the published version of the manuscript.

ETHICAL APPROVAL

Ethical approval was obtained from the university hospital's Institutional Review Board (AJIRB-MED-SUR-17-129). The study was conducted in accordance with the Declaration of Helsinki. All the participants provided signed informed consent, after the study was explained to them in detail.

DATA AVAILABILITY STATEMENT

Data cannot be shared publicity because of privacy protection of the participants. Data are available from the Ajou Medical Center Institutional Data Access/ Ethics Committee (Contact Via AJIRB, ajou_irb@aumc.ac.kr) for researchers who meet the criteria for access to confidential data.

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