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Effects of self-monitoring interventions in breast cancer patients suffering from taste alterations induced by chemotherapy: A randomized, parallel-group controlled trial

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ABSTRACT

Purpose: This study quantitatively evaluates the effect of a randomized self-monitoring interventions on taste alterations in breast cancer patients undergoing outpatient chemotherapy.
Methods: Thirty-four participants were divided into two groups: a self-monitoring (SMG) group (n = 17) and a control group (CG) (n = 17). A conceptual framework was developed with reference to the components of self-management, cognitive behavioral therapy, and the concepts of self-monitoring. Interventions were based on this framework. SMGs recorded their taste symptoms as homework and worked with the researcher to set goals and provide feedback four times every three weeks. In the feedback, the researcher actively listened to the SMG about their feelings and coping strategies during the taste change, and gave approval and praise for these. The implementation period was 9 weeks for one participant; the CG provided conventional nursing support. The intervention was evaluated by comparing the items of symptom improvement, quality of life (QOL), and self-efficacy between the groups before and after the start of the intervention using a scale score. Scale scores were also compared for recognition of taste change, concerns during treatment, distress, and impacts on each treatment day.
The results: SMG was significantly lower than CG for perceived change in taste ($p = 0.009$), and there was an interaction with CG ($p = 0.008$). SMG was also significantly lower than CG in concern scores during treatment ($p = 0.015$).
Conclusion: This study showed that self-monitoring interventions weakened negative cognition of taste alterations and reduced discomfort. The results suggest that self-monitoring interventions is an effective nursing support for chemotherapy-induced taste alterations.

1. Introduction

Taste alterations constitute one of the side effects of chemotherapy, which is experienced by many patients who receive this treatment (Ishikawa et al., 2013; Amézaga et al., 2018). It is seen in about 70% of breast cancer patients (Bernhardson et al., 2008). Taste alterations due to chemotherapy may be attributed to various causes, such as neurotransmission blockage, decreased salivation, or psychological effects (McLaughlin and Mahon, 2012; Sakaguchi et al., 2013; Sözeri and Kutlutürkan, 2015; van Oort et al., 2018). The treatment for coping with taste alterations include zinc intake (Murtaza et al., 2017), use of herbal medicines (Ben Arye et al., 2018), and gargling and dietary changes (Speck et al., 2013). However, these are not established treatments, and currently not many effective supportive therapies exist for coping with taste alterations. It has been found that taste alterations cause not only physical distress, such as decreased appetite, but also psychological distress among breast cancer patients, thus lowering their quality of life (QOL) (Bernhardson et al., 2009; Marinho et al., 2017; de Vries et al., 2018). In addition, breast cancer patients undergoing treatment may have to prepare meals for their families, and thus would be socially impacted by taste alterations (Bernhardson et al., 2009; Speck et al., 2013). Therefore, breast cancer patients undergoing outpatient chemotherapy may have to cope with taste alterations at home in this context. As taste alteration symptoms vary from person to person, no single approach can be used uniformly for all patients. Therefore, developing a self-management system to cope with individ-

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ual taste changes (Bernhardson et al., 2008, 2009) is an important issue.

Self-management, with appropriate interventions, has been shown to improve quality of life and well-being of cancer patients (Shneerson et al., 2014), and similar reports have been found in self-management interventions among breast cancer patients (Cimprich et al., 2005; Gaston-Johansson et al., 2012). One of the components of self-management is self-monitoring, which has also been used for cancer patients as a self-report of chemotherapy side effects (Basch et al., 2016; Campagna et al., 2018; de Vries et al., 2018). Additionally, in studies on self-monitoring conducted over the Internet (Gustafson et al., 2013; Børøsund et al., 2014; Fridriksdottir et al., 2018), improvement was reported in symptom distress. Self-monitoring is already being used in cognitive-behavioral therapy (CBT); it has been found to improve depressive symptoms and fatigue in cancer patients as well as their quality of life and self-efficacy (Watson and Kissane, 2011; Moorey and Greer, 2012). Our previous research suggested that self-monitoring combined with methods such as goal setting and feedback led to improved symptoms (Kinjou et al., 2015). However, although self-monitoring has been shown to be effective in various ways, as described above, so far, there have been no studies on self-monitoring interventions for taste alterations in breast cancer patients. Hence, a novel suggestion is to examine the usefulness of self-monitoring interventions in managing patients' side effects and improving their quality of life as a countermeasure to taste alterations with less supportive care.

Therefore, this study aims to quantitatively evaluate the effectiveness of self-monitoring interventions in breast cancer patients experiencing chemotherapy-induced taste alterations.

1.1. Operational definition of terms

- Self-monitoring interventions: Participants observe and record their recognition, moods, and behaviors toward taste changes and set goals for coping in collaboration with the researcher. Based on the recordings and observations, participants are expected to self-manage the taste alterations by providing feedback to the researcher periodically.
- Taste alterations: Changes in taste and oral conditions caused by the side effects of chemotherapy. It also includes conditions that cause physical, mental, and social distress resulting from this.

1.2. Conceptual framework (Fig. 1)

The components of self-management, the concept of CBT, and Wilde and Garvin's concept of self-monitoring were used to establish a conceptual framework for a self-monitoring intervention focused on patients with chemotherapy-induced taste alterations.

Components of self-management include providing information and knowledge, communicating with health care providers, problem solving and goal setting, and self-monitoring (Barlow, 2002, Wilde and Garvin, 2007). Self-monitoring in particular is an important component of self-management because it allows for recognition of symptoms and in turn to symptom improvement. Effective self-management also includes the ability to monitor one's condition and bring about the necessary cognitive, emotional responses and behaviors to maintain a satisfactory quality of life (Barlow, 2002).

CBT is also a psychological treatment with structured techniques based on cognitive, affective, and behavioral interactions to gather information and feedback related to them (Watson and Kissane, 2011). CBT involves effective self-monitoring, goal setting, and feedback to promote cognitive behavioral change in patients.

According to Wilde and Garvin, the concept of self-monitoring involves (1) being aware of one's physical symptoms, sensations, daily activities, and cognitive processes, and (2) measuring, recording, and observing these to provide information or data to care providers for consultation and recommendation for independent activities. The two interact in a complementary manner to enhance self-management (Wilde and Garvin, 2007).

In this study, willingness to participate in the study and knowledge about taste alterations were prerequisites for the participants. Specific methods of self-monitoring interventions include homework, which involves daily recording of taste symptoms, feelings, and coping strategies, and setting collaborative goals to improve taste alterations. The self-monitoring interventions include providing regular feedback to the healthcare provider. Thus, participants' cognitive and behavioral changes toward taste alterations will improve their self-management by improving their symptoms, QOL, and self-efficacy.

2. Methods

2.1. Participants

Participants were breast cancer patients aged between 20 and 80 years, who were scheduled to receive preoperative or postoperative adjuvant therapy for 12 weeks at the Outpatient Chemotherapy Center of Gunma University Hospital. All potential participants received a detailed explanation of the interventional trial prior to treatment and were given adequate time to consider study participation. On the third treatment day after the first treatment week, patients who presented with taste changes reconfirmed their willingness to participate in the study and informed consent was obtained. Participants in the study were recruited through posts put up in the hospital from February 29, 2016, to February 28, 2018.

2.2. Participant selection criteria

Patient recruitment had to satisfy all of the following criteria:

- Patients who had been administered Fluorouracil or a taxane drug (paclitaxel/docetaxel) during treatment, and after the first treatment, were evaluated for their taste using the Common Terminology Criteria Adverse Events (CTCAE) v4.0-JCOG (Japan Clinical Oncology Group) severity grading scale: patients who scored between grade 1 and 2 were recruited.
- Performance Status (PS) score {Common Toxicity Criteria, Version 2.0 Publish Date April 30, 1999}: patients with a PS score between 0 and 1 were selected.
- Patients who were medically diagnosed as physically and mentally stable by a physician prior to the start of the study, and who were available to participate in the interventional study, were included in the study.
- Patients with cognitive/linguistic ability for daily conversation and who were capable of recording their observations in Japanese.
- Patients who understood the purpose of the research and agreed to cooperate with the research.

2.3. Randomization and allocation

Before starting the study, the researcher used a random number table to create an allocation table for the intervention and control groups. Staff nurses used it to sequentially enroll and randomize patients who met the selection criteria after the first treatment and divided them into two groups: a self-monitoring group (SMG) and a control group (CG).

2.4. Study design

This study is a randomized, parallel-group trial. The researchers provided all potential participants with a brochure and oral care education on taste alterations prior to the treatment.

For participants on a regimen of four 3-week cycles of treatment (FEC: Fluorouracil + Epirubicin + Cyclophosphamide, DC: Docetaxel + Cyclophosphamide, Docetaxel only) over a 12-week treatment period, the third week after the first treatment was defined as baseline (T0), followed by the third week from baseline (T1), the sixth week from baseline (T2), and the ninth week from baseline (T3).

Similarly, participants on a regimen of 12-weekly treatments (Weekly PTX: Weekly Paclitaxel) were also measured at 4 points. However, no interventions were performed on treatment days or on any day other than the four points, and care was provided as usual. Both SMG and CG followed these measurement times.

Measurements were taken based on a questionnaire that followed the assessment items, and participants were asked to complete it before receiving treatment regarding their condition during the most recent week.

The intervention period for each participant was 9 weeks, from T0 to T3, and the intervention points were conducted four times from T0 to T3. The intervention was conducted one-on-one in an individual space in between treatments. The intervention period implemented for all the participants was from February 29, 2016 to April 30, 2018.

2.5. Ethical considerations

Approval (No. 15–121) was obtained after the study design was evaluated by the Medical Research Ethics Review Committee for people at the research facility. The participants were given a written and verbal explanation of the study, and they voluntarily agreed to participate in the study. Strict confidentiality was maintained to respect the privacy of the participants during the entire process of research. In addition, permission was obtained as and when required to use the evaluation scales. This research was started by pre-registering with the UMIN-CTR (University Hospital Medical Information Network – Clinical Trial Registry): Registration number (000022739).

2.6. Intervention method

The SMG was 1) educated about taste alterations through information in pamphlets, 2) provided oral care education, and 3) were helped to understand self-monitoring interventions to promote cognitive behavioral changes. Self-monitoring interventions were carried out by the participants mainly through (1) Homework, (2) Goal setting, and (3) Feedback in collaboration with researchers.

(1) Homework, which is a taste diary, consists of a survey form that the participants filled out recording: changes in taste, degree of appetite, meal content, meal amount, meal satisfaction, weight, other side effects, mood of the day, and feelings experienced after dinner every day.
(2) The goal setting exercise deals with taste alterations, and hence, the researchers flexibly change the goals according to the participant's likelihood of achieving them. The researcher presents the goal setting to the participant step by step: 1) You can understand the timing and state of taste changes, 2) Deal with the changes in taste that you are aware of, and 3) Attempt to expand your coping repertoire by including methods you have never tried before.
(3) Feedback was to be given at three-week intervals, in four individual sessions of 15–30 min each, including the first time. The researcher and the participants discuss the changes in taste, how participants are coping with the changes, and to what extent they feel they have achieved the goals they had set. In each session, participants use their diaries to report to the researcher on 1) Their state of taste, 2) How they are dealing with changes in taste, and 3) The feelings they experience when there is a change in taste. The researcher then assists the participant as follows, in response to their report: 4) Confirming the achievement of the goal and setting the next goal; 5) Approval and praise for their continued efforts to record their experiences; 6) Approval and praise for successful coping, and suggestions for measures to be taken in case of failure to cope; and 7) Active listening.

To compare the effectiveness of the self-monitoring group, the CG would perform only 1) and 2) at the first visit and managed the side effects of taste change with conventional nursing support.

2.7. Measures and outcomes

Measurement involves collecting information about the (1) basic attributes (age, number of family members, employment); and (2) disease and treatment progress (breast cancer stage, treatment regimen, operation, HER2 receptor) from the medical record of the participant after obtaining consent and use it as basic data for outcomes.

2.7.1. Evaluation items

2.7.1.1. Evaluation of taste alteration symptom improvement. Evaluation items were set for recognition, emotion, and behavior during taste alterations. For those without a scale, the Visual Analogue Scale (VAS) was used, and a control score was set independently.

2.7.1.1.1. Taste change evaluation scale associated with chemotherapy; chemotherapy-induced Taste Alterations Scale (CiTAS). It is a scale consisting of 18 items developed by Kano and Kanda (2013) and proven to be reliable and valid. The scale is graded from 1 to 5 points, with a minimum of 18 points and a maximum of 90 points. The higher the score, the more the taste change and its discomfort. This scale measures the participant's recognition of taste alterations. Short-term evaluation of each treatment course is also performed.

2.7.1.1.2. Emotional and behavioral control scores during taste alterations using VAS (VAS). Emotional and behavioral control during taste alterations were measured using the VAS. “Emotional control when eating foods” was measured based on whether the participants were able to control their emotions when they had taste alterations. Behavioral control was measured by the degree of “meal satisfaction” and “meal satiety” during the taste alterations.

The higher the VAS score, the better the trend. The phrases used to measure the VAS were as follows: When you experienced taste alteration, (1) were you able to control your emotions well? (2) were you satisfied with your meals? and (3) did the meal make you feel fuller?

The VAS has been used as a cancer pain control scale and as a scale for a subjective assessment of taste changes (Clinical Guidelines for Cancer Pain Management, 2014; de Vries et al., 2018).

2.7.1.2. QOL evaluation.

2.7.1.2.1. QOL questionnaire for cancer patients treated with Anticancer Drugs (QOL-ACD). Developed by Kurihara et al. (Eguchi et al., 1993; Kurihara et al., 1999), it is a credible/validated, 22-item scale. Each item is allocated points between 1 and 5, with a minimum of 22 points and a maximum of 110 points. The higher the score, the higher the QOL.

2.7.1.2.2. Cancer-chemotherapy concerns rating scale (CCRS) for outpatients receiving chemotherapy. It is a scale developed by Kanda et al. (2007), and its reliability and validity have been proven. It consists of 15 items, with each item allocated between 1 and 4 points, with a minimum of 15 points and a maximum of 60 points. A higher score indicates a high level of concern.

2.7.1.2.3. Distress and impact thermometer (DIT). The DIT is a screen tool developed by Akizuki et al. (2005) for measuring adaptation disorders and depression in cancer patients, and its validity has been proven. It comprises a self-administered questionnaire assigned 0–10 points. The higher the score, the greater is the psychological distress of the patient. As a secondary evaluation of QOL, we measure the difficulty in matters concerned with daily life and with taste.

As CCRS and DIT have been reported as factors that decrease QOL (Isida et al., 2004; Hirai et al., 2014), we added these two items as short-term assessments for each treatment course.

2.7.1.3. Self-efficacy evaluation.

2.7.1.3.1. Self-efficacy scale for advanced cancer (SEAC). Developed by Hirai et al. (2001), SEAC is a measure of disease self-efficacy in patients with advanced cancer, and it has been proven to be reliable and valid. It consists of 18 items and is assigned 0–100 points; the higher the score, the higher is the self-efficacy.

2.7.2. Evaluation period

VAS, QOL-ACD, and SEAC, were assessed twice: at baseline (T0) and at 9 weeks (T3). CiTAS, CCRS, and DIT were measured four times: at baseline (T0), 3 weeks (T1), 6 weeks (T2), and 9 weeks (T3) of treatment days.

2.7.3. Statistical procedures

The sample size, which was set by estimating the number of people who could be surveyed within the time period, was 40. After the survey, G*Power software version 3 (Faul et al., 2007) was used to check whether the sample size was appropriate. The power was calculated using a *t*-test with an effect size of 0.25, an alpha level of 0.05, and a sample size of 34, resulting in a power of 0.29. The statistical software IBM SPSS Statistics 23 for Windows was used for data analysis. There is a significant difference if the significance probability is less than 5%.

2.7.4. Analysis of participant characteristics

A simple aggregation of the participant characteristics was performed, and it was confirmed that there is no difference in the backgrounds of the SMG when compared with those of the CG. Mann-Whitney *U* test was performed for age and family members. In addition, for breast cancer stage, treatment regimen, surgery, HER2 receptor, and occupation, $\chi 2$ test or Fisher's exact test was performed.

2.7.5. Analysis of evaluation items

The analysis of the evaluations items involved comparison of the following items between the two groups, SMG and CG, at baseline (T0) and 9 weeks later (T3): emotional control when eating foods (VAS), meal satisfaction (VAS), meal satiety (VAS), quality of life (QOL-ACD), and self-efficacy (SEAC). The average value was calculated, and *t*-test was performed for the two independent groups.

For CiTAS, CCRS, and DIT, which were short-term assessments, two-way ANOVA was performed at four time points: baseline (T0), 3 weeks (T1), 6 weeks (T2), and 9 weeks (T3).

3. Results

3.1. Flow diagram (Fig. 2)

Using a pamphlet on taste alterations, researchers provided information and knowledge about oral care, prior to their treatment, to 105 preoperative and postoperative breast cancer patients who had no recurrence and were visiting the outpatient chemotherapy center. Patients who presented themselves to the hospital but did not have taste alterations three weeks after the initial treatment (n = 42) were excluded. Further, patients who consented to participate in the study (n = 34) were included. The participants were randomly assigned in a sequential enrollment method and were divided into a self-monitoring group (n = 17) and a control group (n = 17).

There were no changes in the trial after the start of the intervention.

3.2. Demographic and clinical characteristics

The median age of the participants was 48 years (range 33–75). There were 8 preoperative patients (23.5%) and 26 postoperative patients (76.5%). The median number of family members was three (range 1–6), and there was no significant difference in the characteristics of the participants between the two groups (Table 1).

3.2.1. Evaluation of symptom improvement for taste alterations

3.2.1.1. Recognition of taste change using CiTAS (Fig. 3). The transition of the SMG value was higher in T1 than in T0, but decreased in T2, and slightly increased in T3 compared with T0. In contrast, the transition of the CG value gradually increased from T0, peaked at T2, and the value at T3 was even higher than at T0. There was a significant difference between SMG and CG [F (3, 30) = 4.60 p = 0.009**, effect size = 0.68]. An interaction was observed between SMG and CG [p = 0.008].

3.2.1.2. Emotional and behavioral control scores during taste alterations using VAS. The value of "emotional control when eating foods" at T3 was slightly higher in SMG than in CG [95% CI: −2.84 to 1.70, df = 32, p = 0.612]. The value of "meal satisfaction" at T3 tended to be higher in SMG than in CG [95% CI: −3.73 to 1.16, df = 32, p = 0.294]. Regarding the value "meal satiety" at T3, SMG tended to have a slightly higher satiety value than CG, but there was no significant difference in any of the items [95% CI: −2.97 to 0.89, df = 32, p = 0.279] (Table 2).

3.2.2. QOL evaluation: QOL-ACD

In QOL-ACD, there was no significant difference between SMG and CG at T0 [95% CI: −12.46 to 4.69, df = 32, p = 0.363]. At T3, the values of QOL-ACD of T3 decreased in both SMG and CG, but the value of SMG decreased less than that of CG [95% CI: −17.32 to 2.73, df = 32, p = 0.148] (Table 2).

3.2.2.1. Concerns during chemotherapy by CCRS (Fig. 4). In SMG, the value increased at T1 but decreased at T2, and there was no sharp increase at T3. In contrast, in CG, it gradually increased from T0 to T3, and peaked at T3. There was a significant difference between SMG and CG [F (3, 30) = 4.07, p = 0.015*, effect size = 0.64].

3.2.2.2. Distress and impact thermometer (DIT). While the value of distress did not increase significantly for SMG in any period, it increased gradually for CG, peaked at T2, and did not decrease at T3. No significant difference was found between SMG and CG [F (3, 30) = 2.21, p = 0.107, effect size = 0.47]. No significant difference was found between SMG and CG on the Impact thermometer [F (3, 30) = 1.53, p = 0.228, effect size = 0.39]. Both SMG and CG showed gradual increase, but SMG tended to have lower scores than CG.

3.2.3. Self-efficacy evaluation: SEAC

There was no significant difference in SEAC between SMG and CG at T0 [95% CI: −319.77 to 86.83, df = 32, p = 0.252]. At T3, the SEAC value was lower for both SMG and CG. However, SMG tended to show less decrease than CG [95% CI: −416.02 to 26.61, df = 31.73, p = 0.083] (Table 2).

Table 1
Demographic and clinical characteristics.

Characteristic	SMG (n = 17)		CG (n = 17)		Overall (n = 34)		p-values
	n	%	n	%	n	%	
Age (years)							
Median (range)	47 (33–75)		48 (34–66)		48 (33–75)		0.610[a)]
Stage of breast cancer							
I	3	17.6	7	41.2	10	29.4	0.312[b)]
II	13	76.5	9	52.9	22	64.7	
III	1	5.9	1	5.9	2	5.9	
Operation							
neo adjuvant	4	23.5	4	23.5	8	23.5	0.656[c)]
adjuvant	13	76.5	13	76.5	26	76.5	
Regimen							
Weekly PTX	3	17.6	1	5.9	4	11.8	0.392[b)]
DC	3	17.6	6	35.3	9	26.5	
Docetaxel only	1	5.9	0	0	1	2.9	
FEC	10	58.8	10	58.8	20	58.8	
HER2 receptor							
negative	11	64.7	8	47.1	19	55.9	0.491[c)]
positive	6	35.3	9	52.9	15	44.1	
Number of family members							
Median (range)	3 (1–6)		3 (1–6)		3 (1–6)		0.660[a)]
Employment							
Full time	2	11.8	3	17.6	5	14.7	0.357[b)]
On leave	8	47.1	4	23.5	12	35.3	
Unemployed	7	41.2	10	58.8	17	50	

NOTE. Data presented as average and percentage excluding age and number of family members. The age and the number of family members are shown by the median (range).
No significant differences were observed in the study, either overall or by comparison in each group.
Abbreviations: SMG: Self-Monitoring Group; CG: Control Group; Weekly PTX: Weekly Paclitaxel; DC: Docetaxel + Cyclophosphamide; FEC: Fluorouracil + Epirubicin + Cyclophosphamide.
[a] Mann-Whitney *U* test.
[b] Chi-squared test.
[c] Fishers Exact test.

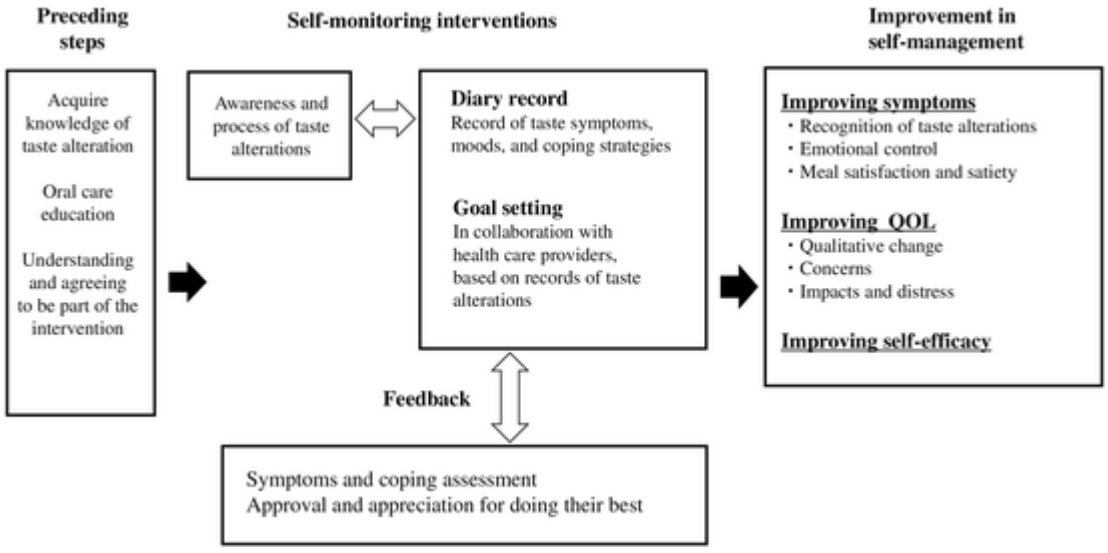

Fig. 1. Conceptual framework of self-monitoring interventions for taste alterations in breast cancer patients.

3.3. Characteristic participant observations and researcher suggestions during feedback

One of the participants made a saline solution of about 1% every night and kept it in the refrigerator. She recorded that she gargled with it every morning. The participant's records showed that the saline solution made at the same temperature and concentration tasted different on different days, and that she changed her diet or adjusted the seasoning depending on how salty she felt that day.

Participants who preferred sour taste also found that adding lemon juice to soda water made it easier to drink. As sourness was perceived differently on different days, lemon juice was adjusted to achieve the desired sourness.

Immediately after the treatment, when the change in taste was more pronounced, many participants did not eat their favorite food. Participants ate their favorite food only after their taste buds returned to normal.

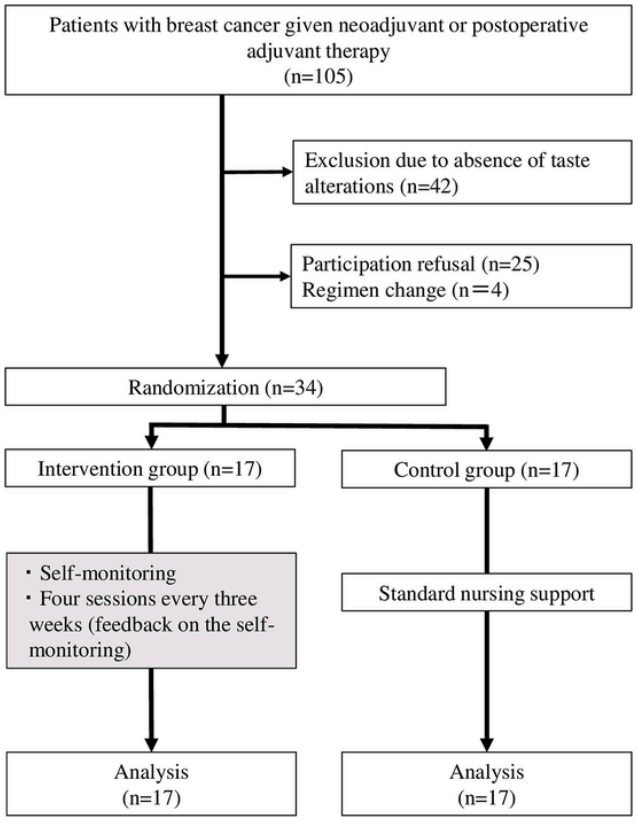

Fig. 2. Flow diagram of the parallel randomized trial between two groups.

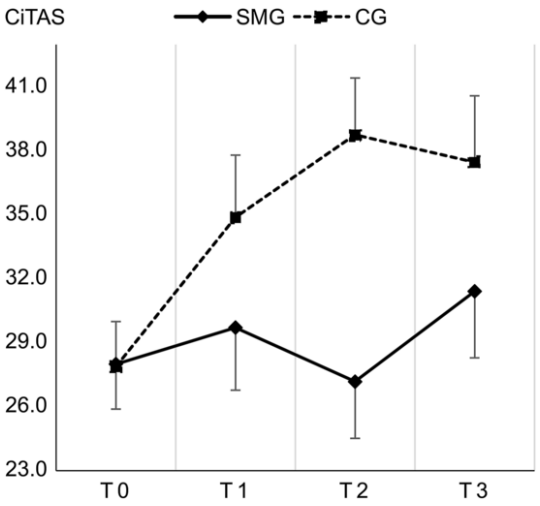

Fig. 3. Recognition of taste change using CiTAS. Analysis was performed with the 2way-ANOVA of the values of CiTAS of SMG and CG. The difference between the mean values of CiTAS at each period was significantly lower in SMG than in CG. [F (3, 30) = 4.60: p = 0.009**: effect size = 0.68]. Abbreviations: SMG: Self-Monitoring Group; CG: Control Group; T0: baseline; T1: Points 3weeks after baseline; T2: Points 6weeks after baseline; T3: Points 9weeks after baseline; CiTAS: Chemotherapy-induced Taste Alterations Scale.

Some of the participants did not find anything tasty. The researcher's feedback was to set a goal of trying different foods. To put this into practice, the person added crunchy items such as nuts or cereals to some of the foods and recorded that changing the texture of the food made it easier to eat.

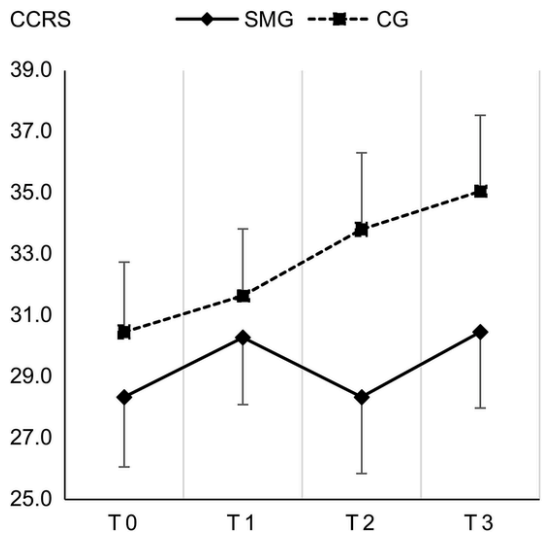

Fig. 4. Concerns during chemotherapy by CCRS. Analysis was performed with 2way-ANOVA of the values of CCRS of SMG and CG. The difference between the mean values of CCRS at each period was significantly lower in SMG than in CG. [F (3, 30) = 4.07, p = 0.015*, effect size = 0.64]. Abbreviations: SMG: Self-Monitoring Group; CG: Control Group; T0: baseline; T1: Points 3weeks after baseline; T2: Points 6weeks after baseline; T3: Points 9weeks after baseline; CCRS: Cancer-Chemotherapy Concerns Rating Scale.

4. Discussion

4.1. Effects on improving symptoms

The CiTAS, an assessment of symptom improvement, showed a significant difference between the SMG and the CG (p = 0.009). Compared with CG, the SMG had a lower level of recognition of unpleasant taste. This may be because the SMG adapted to changes in taste by trying various coping strategies, and thus no longer perceived taste as unpleasant. In their daily homework, the SMG maintained a record of the tastes they disliked, when the sensation appeared, and when it disappeared. Chemotherapy is characterized by a mixture of various side effects immediately after the treatment, which may lead to taste alterations (Bernhardson et al., 2009). The SMG could easily recognize different types of unpleasant tastes by focusing on taste alterations and maintaining their homework taste diary. Moorey and Greer (2012) define cognition as an "unconscious thought or visual image," and state that it takes a little practice to understand the cause of a problem. In this study, there was no cognitive difference between the SMG and the CG before intervention. After nine weeks, the SMG was able to recognize vague and unpleasant tastes by doing their homework and by learning how to deal with one's taste alterations. It was found that they could manage unpleasant taste.

In cognitive-behavioral therapy, one can overcome a state of total inability and progress to the next stage of recovery with the help of self-monitoring and recording (Sakano, 1995). Similarly, by recording their experiences, the SMG was not only better able to identify when taste changes were likely to occur but was also able to adjust the timing of eating accordingly. This resulted in a cognitive change that made it harder to perceive unpleasant tastes and find food more delicious when the taste improved. This shows that the unpleasant taste caused by the taste alterations can be mildly arrested.

Furthermore, in the intervention, participants from the SMG worked with the researcher to provide feedback on the homework each time. They approved and praised the participants' independent coping response to taste changes. This practice made the participants more confident in their actions. The fact that the self-designed coping strategy helped them to experience delicious taste even during taste alter-

Table 2
Evaluations items of self-monitoring interventions for taste alterations in breast cancer patients.

		Baseline (T0)					9 weeks later (T3)				
		SMG	CG	95%Cl	df	p-values	SMG	CG	95%Cl	df	p-values
1. Evaluation of symptom improvement	Emotional control when eating foods	5.818	7.053	[-1.08 to 3.55]	32	0.285	5.74	5.17	[-2.84 to 1.70]	32	0.612
		SD (3.64)	SD (2.94)				SD (3.02)	SD (3.45)			
	Meal satisfaction	4.94	5.38	[-1.97 to 2.85]	32	0.712	3.98	2.70	[-3.73 to 1.16]	32	0.294
		SD (3.73)	SD (3.14)				SD (3.98)	SD (3.07)			
	Meal satiety	6.68	5.74	[-2.71 to 0.81]	32	0.281	5.85	4.81	[-2.97 to 0.89]	32	0.279
		SD (2.60)	SD (2.44)				SD (2.65)	SD (2.86)			
2. QOL evaluation	QOL-ACD	87.59	83.71	[-12.46 to 4.69]	32	0.363	81.94	74.65	[-17.32 to 2.73]	32	0.148
		SD (13.21)	SD (11.27)				SD (14.92)	SD (13.76)			
3. Self-efficacy evaluation	SEAC	1374.71	1258.24	[-319.77 to 86.83]	32	0.252	1323.53	1128.82	[-416.02 to 26.61]	31.73	0.083
		SD (282.96)	SD (298.79)				SD (330.89)	SD (306.76)			

NOTE. Data was compared to baseline (T0) and 9 weeks later (T3) using two independent t-tests for each subset.
1. For Evaluation of symptom improvement, VAS used to measure the "Emotional control when eating foods", the "Meal satisfaction", and the "Meal satiety" when taste alteration were presented.
2. For evaluation on improvement of QOL, average of QOL-ACD was used.
3. For evaluation of self-efficacy, average of SEAC was used.
Abbreviations: SMG: Self-Monitoring Group; CG: Control Group; QOL-ACD: Quality of Life Questionnaire for Cancer Patients Treated with Anticancer Drugs; SEAC: Self-efficacy scale for advanced cancer.

ations and that their achievements were appreciated, encouraged them to gain more confidence. In addition, by setting goals together with the researcher, the participants were able to actively eat a variety of foods and look for alternatives to achieve their goals. Receiving praise at each step further motivated them to achieve the next step (Moorey and Greer, 2012). Based on the researchers' advice, they encouraged themselves to meet their goal, and writing and memorizing how to deal with their current taste sensations, helped them take necessary actions to improve their symptoms, thereby mastering the practice.

4.2. Effects on improving QOL

Scores from the CCRS, which is an evaluation of QOL, showed a significant difference in the change pattern between the two groups ($p = 0.015$). Although scores of the SMG showed a temporary increase, it did not increase thereafter. However, scores of the CG increased with the passage of time, and after nine weeks scores reached their peak. This indicates that the self-monitoring interventions reduced patients' discomfort due to the taste alterations and the intervention effect was achieved.

Feedback on the intervention was less about answering questions and more about confirming symptom changes and coping strategies and asking about the feelings they were experiencing at the time. The researchers actively listened to the participants' narratives and praised them for their efforts in maintaining their records well and coping effectively.

The researcher sympathized with the participants' emotions when they were facing a hard time or when they were happy as they acknowledged their emotional records in their diaries. Taste alterations are considered a minor side effect and may not be recognized as a serious problem among healthcare providers (McLaughlin et al., 2012). Taste alterations are not visible symptoms and can only be understood by the person experiencing them. It is a side effect that is difficult to express because of the various emotions involved in the experience. Therefore, if this suffering is not understood by others, it can affect the patient's QOL and self-efficacy. Kawana (2014) states that through conversations with both the patient and the nurse, it is important to understand the stress a patient experiences so that the unresolvable problems faced by the patient can be discussed.

Ishida et al. (2004) explain that various side effects are simultaneously worrisome during treatment, and extra-family support reduces this worry. The presence of medical staff who can talk informally with patients was acknowledged as an important factor as it was recognized that the feedback sessions during the intervention prevented the patients from being unduly worried and anxious. Thus, it was suggested that the researchers' timely involvement and listening to patients' problems with not only focusing on taste alterations, but also other anxieties may reduce distraction.

4.3. Effects on improving self-efficacy

Regarding the self-efficacy score, no significant difference was found between the two groups. Nine weeks after starting the intervention, the self-efficacy score decreased in both groups, but scores of the CG were lower than that of the SMG. Various results have been obtained in studies on interventions of cognitive-behavioral therapy on the Internet. Børøsund et al. (2014) found no significant differences in self-efficacy among the study groups, while Ruland et al. (2013) found that the self-efficacy of only the control group decreased significantly over time.

It is posited that participants' positive feelings about foods they used to find tasty were replaced by negative feelings, as the altered taste no longer evoked pleasant emotions in them, and that the experience of not being able to cope with the taste alterations further reduced the self-efficacy of both groups.

Participants are in an uncertain state because treatment for taste alterations has not been established, and symptoms change with the number of treatments (Bernhardson et al., 2008). Saito (2009) reported that chemotherapy was associated with somatic symptoms and self-

efficacy, and increased patient distress was associated with lower self-efficacy.

In this study, the results of CiTAS indicate that the difference in taste change was small in the SMG even after repeated treatments, whereas in the CG, the score of taste change gradually increased with each treatment. As the SMG was able to decrease symptoms of taste change by self-monitoring interventions, the reduction of self-efficacy was also low. In contrast, the CG reported lower self-efficacy because the taste change worsened with each treatment, and the change in diet before and after the treatment also became extensive; even if the diet plan was revised, food did not taste delicious. This finding is supported by Kitamura (2014), who reported that patients with somatoform symptoms improve self-efficacy and QOL by acquiring self-management abilities. In addition, cancer patients have been found to increase self-efficacy by increasing communication with their healthcare providers during chemotherapy. Farias et al. (2017) noted an increase in breast cancer patients' self-efficacy through communication with trusted healthcare providers, while Papadopoulou et al. (2017) reported a decrease in cancer-related anxiety as a result of increased self-efficacy. Compared to CG, the SMG did not show a significant decrease in self-efficacy scores because, in addition to self-monitoring, participants discussed treatment details and side effects with the researcher, which helped participants to maintain their self-efficacy.

As described above, the self-monitoring intervention was implemented according to the set research framework. Thus, we were able to transform cognition into a side effect that can be dealt with and promote self-management acquisition. Furthermore, alleviating the patient's concerns by giving timely feedback and maintaining continuous engagement and active dialogue helped them. Although these are indirect approaches, they affect patients' QOL and self-efficacy. Thus, it is suggested that self-monitoring interventions are an effective form of nursing support for taste alterations. The research framework set up for this is, therefore, one that will maintain self-efficacy.

5. Conclusion

A self-monitoring intervention for breast cancer patients with taste alterations has been shown to diminish negative cognition of altered taste and reduce concern. Patients acquire self-management, which indirectly contributes to improved QOL and maintenance of self-efficacy. Thus, it is suggested that a self-monitoring intervention can be an effective nursing support to improve self-management for breast cancer patients with chemotherapy-induced taste alterations.

5.1. Limitations and implications for practice

As this study was conducted as a mixed test including qualitative evaluation, it was difficult to include a sufficient sample size. Therefore, the effect size may be small depending on the outcome item. In addition, we should have included qualitative data in our report, but the large amount of data prevented us from doing so, and we could conduct only quantitative evaluation, which is a limitation of our research.

Furthermore, it is possible that the results of this survey were biased by the intervention of researchers themselves and their involvement in the evaluation. As a future goal, further effectiveness can be demonstrated by increasing the number of researchers and target people and conducting research at multiple facilities. However, the trial proved that this self-monitoring intervention can be an effective approach to cope with the taste alterations associated with chemotherapy.

Declaration of competing interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this work. The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Authors' contributions

Kinjo T contributed to data analysis, manuscript writing, research, planning, intervention, and data collection. **Fujimoto K** and **Kanda K** created the research plan, analyzed the data, and created the manuscript. **All authors** have read and approved the final manuscript.

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CRediT authorship contribution statement

Taeko Kinjo: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization. **Kiyoko Kanda:** Conceptualization, Methodology, Formal analysis, Resources, Data curation, Writing – review & editing, Supervision, Project administration, Funding acquisition. **Keiko Fujimoto:** Conceptualization, Methodology, Formal analysis, Resources, Data curation, Writing – review & editing, Supervision.

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