The effect of Benson relaxation application ('Bens app') on reducing fatigue in patients with breast cancer undergoing chemotherapy: A quasi-experimental study

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Abstract

Background: Fatigue is the most common symptom in patients with breast cancer undergoing chemotherapy. Benson's relaxation technique is considered effective to reduce fatigue, but its effect in combination with smartphone technology is limited.

Objective: This study aimed to analyze and determine the effect of the Benson relaxation application (Bens app) on fatigue in patients with breast cancer undergoing chemotherapy.

Methods: A quasi-experimental design with a pretest-posttest comparison group was used. Fifty-six patients were included using consecutive sampling technique, of which 28 were assigned to the experimental group (received Benson relaxation technique using Bens app) and comparison group (obtained Benson relaxation technique using booklet). The Benson relaxation was done two times per day for seven days, and the Brief Fatigue Inventory questionnaire was used to measure the patients' fatigue levels. Data were analyzed using paired and independent *t*-tests.

Results: The experimental group ($p = 0.001$) and the comparison group ($p = 0.015$) showed a significant reduction in fatigue after receiving the Benson relaxation for seven days. However, there was a statistically significant difference in fatigue between the experiment and comparison groups after the intervention ($t_{55} = 2.481$, $p = 0.016$).

Conclusion: Benson relaxation could reduce fatigue in patients with breast cancer using the Bens app and booklet. However, the Bens app is considered more effective than a booklet. Therefore, the Bens app can be viewed as an alternative to help patients perform Benson relaxation and integrated into the nurse palliative care program for patients with cancer.

Keywords

Background

Breast cancer is a type of cancer with the highest prevalence. In Indonesia, there were 58,256 new cases of breast cancer in 2018 (Indonesian Ministry of Health, 2018), and chemotherapy is the most widely used treatment. Chemotherapy has been proven to increase the success of treatment at all stages of breast cancer (Vuttanon et al., 2019). However, due to chemotherapy, patients feel many side effects, such as pain, nausea, vomiting, anxiety, alopecia, and fatigue (Ha & Thanasilp, 2021; O'Regan et al., 2019; Wang & Woodruff, 2015).

Fatigue is the most commonly complained symptom in almost all patients with breast cancer undergoing chemotherapy (Oh & Cho, 2020). Fatigue is characterized by several symptoms, i.e., lack of energy, and its symptoms are persistent or not relieving with rest and increase when the patient is undergoing chemotherapy (Al Maqbali et al., 2021).

There are several causes of fatigue in patients with breast cancer, including a decrease in red blood cells (anemia), impaired adenosine triphosphate (ATP) formation, stimulated production of pro-inflammatory cytokines, interleukin (IL) -1β, and tumor necrosis factor (TNF)–α, and HPA axis dysfunction which results in dysregulation of the metabolic and endocrine systems (Wolvers et al., 2018).

Evidently, a previous study showed that 82–96% of fatigue occurs in patients undergoing chemotherapy, or more than 30% of patients who have completed chemotherapy also feel fatigued (O'Regan et al., 2019). In addition, research conducted by Junghaenel et al. (2015) found that the peak of fatigue in patients with breast cancer occurs after the administration of chemotherapy drugs, especially when the patients return home.

In addition, research in Taiwan shows that 45% of patients who experience fatigue did not get proper treatment in the hospital (Rau et al., 2020). Many patients who experience moderate to severe fatigue prefer not to continue their

chemotherapy. However, improperly anticipated fatigue can lead to decreased physical activity, impaired social relationships, emotional disturbances, and decreased cognitive function, reducing the patient's quality of life (Wolvers et al., 2018).

Conceptually, there is no standard to cure fatigue in patients with breast cancer. Therefore, a combination of pharmacological and non-pharmacological approaches is usually used to overcome fatigue in cancer patients. Thus, in this study, the researchers used the Benson relaxation technique in a smartphone to reduce fatigue.

According to literature, Benson relaxation is a mind-body intervention that affects the balance of the posterior and anterior hypothalamus, reduces sympathetic nerve activity, and stimulates catecholamine secretion so that the body will become more comfortable and relaxed (Rambod et al., 2014). Although Jafari et al. (2018) revealed that Benson relaxation significantly reduces fatigue in patients with leukemia, it has never been tried with patients with breast cancer, especially in combination with smartphone applications. The use of smartphone applications is expected to provide an added value that can accommodate Benson's relaxation interventions given to patients by making it easier for patients to understand how to do Benson relaxation, making it easier for patients to follow educational information provided through the applications on the patient's smartphone, and increase patients' independence in performing Benson relaxation. However, the results of this study are expected to be an alternative for oncology nurses to reduce fatigue among patients with breast cancer.

Methods

Study Design
Quasi-experiment with a comparison group design was employed in this study.

Samples/Participants
The target population was patients with breast cancer undergoing chemotherapy. In this study, 65 patients with breast cancer undergoing chemotherapy were selected using a consecutive sampling technique. The sample size was determined based on unpaired numerical comparative test calculations according to Karagozoglu and Kahve (2013), in which the patients were divided into two groups (experiment and comparison groups).

The inclusion criteria of the sample were (1) patients with breast cancer aged > 18 years, (2) owned a smartphone, (3) were able to communicate in and understand the Indonesian language, (4) post-mastectomy, (5) underwent chemotherapy of at least the 2nd cycle, (5) pain scale < 7, and (6) lived with family members. The exclusion criteria were patients who did not have internet access, had hearing loss, and had Benson relaxation. In addition, the criteria for dropout in the study were patients who did not regularly perform Benson relaxation and resigned during the study.

Instruments
A questionnaire and daily checklist were used as the instrument in this study. The questionnaire consisted of (1) patients' characteristics, developed by the researchers, including age, hemoglobin, chemotherapy cycle, education level, long time suffering from cancer, and cancer stage, and (2) Brief fatigue inventory (BFI) questionnaire, consisting of 10 questions to measure patient fatigue: four questions related to the level of fatigue and six questions that focus on the impact of fatigue on the patient's daily life for 24 hours (Paramita et al., 2016). The Indonesian version of the BFI was available in Paramita et al. (2016) with acceptable validity and reliability.

Another instrument was a daily checklist used by family members of the participants as documentation to ensure that the patient performed the Benson relaxation technique. The checklist content consisted of the time (when participants performed Benson relaxation) and the reason why the participants did not perform the relaxation technique.

Interventions
It is noted that both experiment and comparison groups received standard drugs given by the hospital to all patients with chemotherapy, including mefenamic acid, vitamin B, and ranitidine. However, for the experimental group, the Benson relaxation treatment was added as the innovation proposed in this study. The Benson relaxation was carried out using the smartphone-based application (called the Bens app). While for the control group, the Benson relaxation treatment was given using a booklet.

According to the agreement, the patients in both groups were required to perform the Benson relaxation technique regularly twice daily (morning and evening) for seven days in a row. Each session lasted 15 minutes. In addition, in order to comply with the requirement, the researchers involved a family member of each patient to make observations on the patients using a daily checklist whether they did the Benson relaxation technique or not. The researchers also followed up every day using a telephone.

It is also noted that, before conducting the Benson technique, the researchers taught and explained the steps of the method to every patient until they could do it by themselves. In addition, the researchers told the family members how to fill out the checklist to assist the researchers in ensuring all patients followed the instructions accordingly.

The Benson relaxation consisted of the following steps: (1) Sitting or lying down quietly in a comfortable position; (2) Closing eyes; (3) Deeply relaxing all muscles, beginning at the feet and progressing up to the face. Keeping them relaxed; (4) Breathing through the nose. Becoming aware of breathing. Focus on a word, phrase, a short prayer, or only breathing. Suppose choosing, for example, the word "alhamdulillah", when breathing out, saying the word, "alhamdulillah", silently. Breathing easily and naturally; (5) Maintaining a passive attitude and permitting relaxation to occur at its own pace; (6) Continuing for 15 minutes. When finished, sitting quietly for several minutes, at first with eyes closed and later with eyes opened. Do not stand up for a few minutes.

Bens app is a newly developed application in this study. This application is an android based application (Android 5.1 Lollipop OS) that contains Benson relaxation techniques. To use the app, the participants need the Internet. The procedure for developing this application is as follows: (1) Studying the literature to compile the content of the application (Ai et al., 2020; Kayyali et al., 2017; Marques et al., 2020; Poorolajal et

al., 2017; Zhou et al., 2019); (2) Consultation with experts or lecturers in determining the intervention used and health information included in the application to help patients. Three experts in palliative care for cancer were included in this stage; (3) Consultation and process of making Bens app with programmers; and (4) Assessment and evaluation by 25 patients with breast cancer to view content, display applications, use of language, and application functions. The researchers used the mHealth App Usability Questionnaire (MAUQ) (Zhou et al., 2019) to evaluate the app. Usability tests results showed there were three items get the highest average MAUQ score, "I will use this application again" (6.5/7), "Applications that are useful for health and me" (6.5 / 7),

"Applications improve my access to health services" (6.5/7). The lowest average score on the item "I can use the application when the internet network is poor or unavailable" (5.28/7).

The Bens app features are (1) an "education" feature about cancer, fatigue, and Benson relaxation techniques; (2) a "Benson relaxation guide" feature using audio (recording); (3) a "reminder" feature that will provide notification via smartphone; (4) "self-monitoring" feature using BFI to measure fatigue; and (5) "documentation" feature of patient usage history of Bens app through a web-based application. The example of the Bens app can be seen in **Figure 1**.
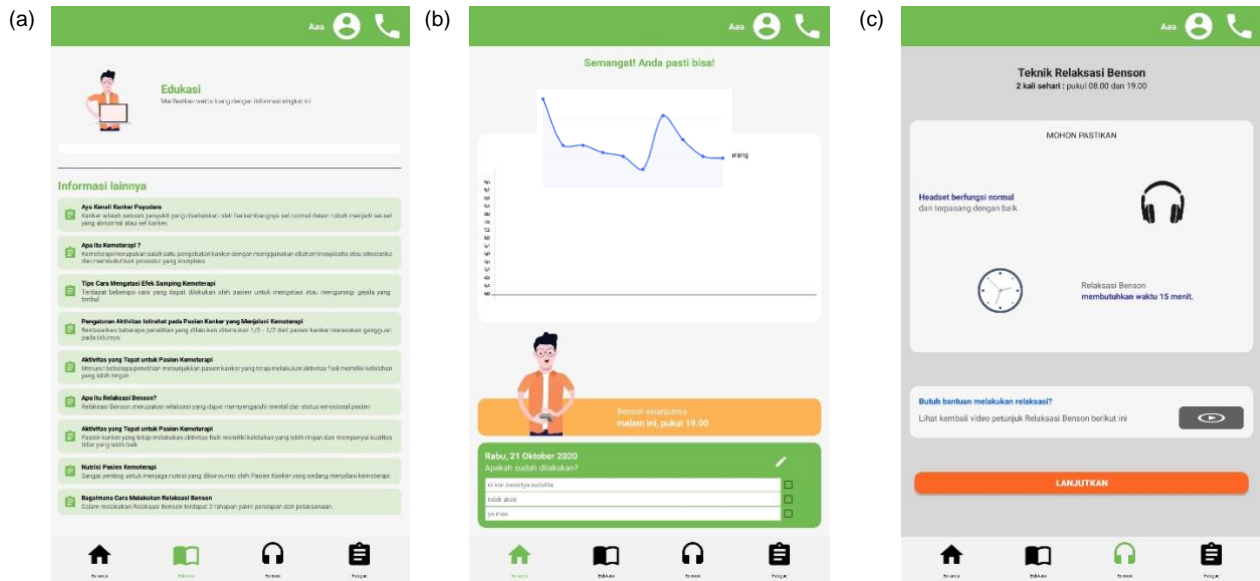
Figure 1 Bens app menu (a) The health education menu that patients can access with the aim of increasing exposure to important information related to chemotherapy; (b) The diagram on the main page is the level of fatigue of the patient after completing the asses

For the comparison group, a booklet was used in conducting the relaxation technique. The booklet contained the definition of Benson relaxation, its four components (quiet environment, comfortable position, mental devices, passive or submissive attitude) (Benson et al., 1975), and the steps to do the Benson relaxation. The example of the booklet can be seen in **Figure 2**. Both the experiment and comparison groups had the same stages of the Benson relaxation technique, only the experimental group used the Benson app, and the comparison group used the booklet.

Data Collection

Data were collected by the researchers from June to August 2020 at the chemotherapy unit of Baladhika Husada Hospital Jember, Indonesia, which has a one-day care service. There was no research assistant.

Data Analysis

As data were normally distributed, paired and independent *t*-tests were used to analyze and determine the effect of Ben-Apps on fatigue in patients with breast cancers. All data were analyzed using SPSS version 20.

Figure 2 Benson relaxation booklet

Ethical Considerations

This research has received research ethics approval from the Faculty of Nursing, Universitas Indonesia, Number SK-76/UN2.F12.D1.2.I/ETIK.2020. The study's aim and procedure were explained to the respondents prior to data collection. Each respondent was asked to sign an informed consent, and they could withdraw at any time without penalty.

Results

Response Rate

Nine patients were dropped out during this research. In the comparison group, three patients did not perform Benson relaxation regularly, and the other three withdrew in the middle of the study. Meanwhile, in the experimental group, two patients did not open the application regularly, and one participant passed away (**Figure 3**). However, the data distribution of the patients' characteristics in the experiment and comparison groups were almost the same. Furthermore, the results of the data normality test with Kolmogorov Smirnov on fatigue showed normally distributed ($p > 0.05$).

Participants' Characteristics

The characteristics of the participants, as shown in **Table 1**, show that the mean age of the participants in the experiment group was 44.82 years and the comparison group was 50.82 years, with a range of 30-60 years. Hemoglobin levels showed almost the same results in both groups, with hemoglobin mean of 11.84gr/dL and 12.48gr/dL, respectively. Forty patients (71.4%) had chemotherapy cycles less than six times. There were 35 (62.5%) patients who had a low education level, 24 (42.9%) patients who had breast cancer for 1-3 years, and 43 (76.8%) had cancer stage III. There was no significant difference in patients' characteristics in both groups ($p >0.05$).

Table 1 Characteristics of the participants ($N = 56$)

| Variable	Category	Experiment group ($n = 28$) n (%)	Comparison group ($n = 28$) n (%)	Total n (%)
Chemotherapy cycle	≤ 6 times	21 (75)	19 (67.8)	40 (71.4)
	> 6 times	7 (25)	9 (32.2)	16 (28.6)
Level of education	Low (primary & junior high school education)	15 (26.8)	20 (35.7)	35 (62.5)
	High (senior high school and college level)	13 (23.2)	8 (14.3)	21 (37.5)
Long time suffering from cancer	<1 year	11 (39.3)	9 (32.2)	20 (35.7)
	1-3 years	10 (35.7)	14 (50)	24 (42.9)
	> 3 years	7 (25)	5 (17.8)	12 (21.4)
Cancer stage	Stage II	6 (21.5)	4 (14.2)	10 (17.9)
	Stage III	20 (71.3)	23 (82.2)	43 (76.8)
	Stage IV	2 (7.2)	1 (3.6)	3 (5.4)
Age (Mean ± SD)		44.82 ± 8.08	50.82 ± 5.90	
Hemoglobin (Mean ± SD)		11.84 ± 1.27	12.48 ± 1.25	
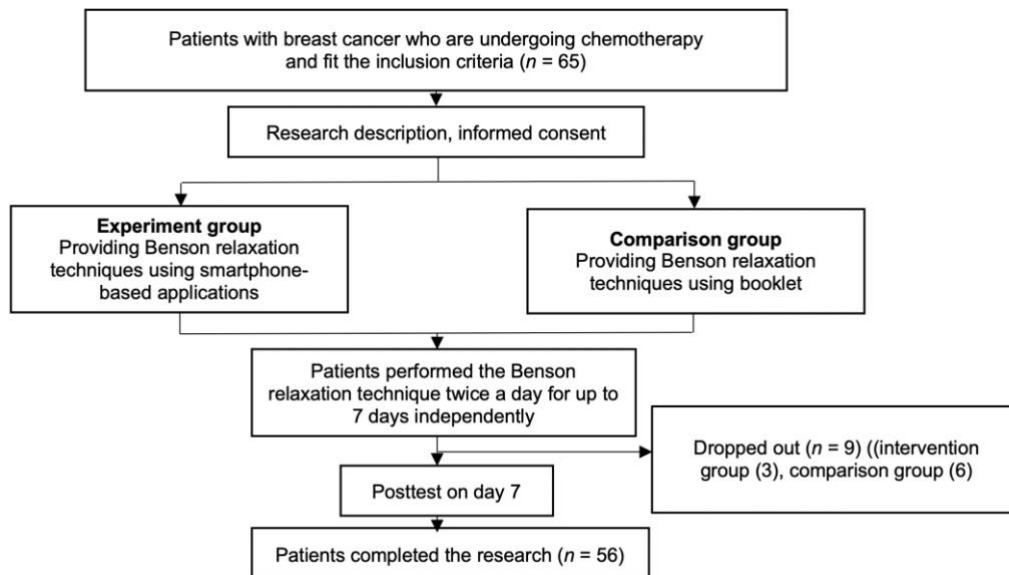
Figure 3 Flow of the study participants

Effect of Intervention on Fatigue

The paired *t*-test showed that the Benson relaxation had a significant effect on fatigue in both the experimental group that used the Bens app ($t_{27} = 6.320$, $p = 0.001$) and the comparison group that used the booklet ($t_{27} = 2.592$, $p = 0.015$) (**Table 2**).

The Difference in Fatigue in the Experiment and Comparison Groups

Table 3 shows a statistically significant difference between the experiment and comparison groups before intervention ($t_{55} = 1.299$, $p = 0.115$) and after the intervention ($t_{55} = 2.481$, $p = 0.016$).

Table 2 Difference in fatigue before and after intervention ($N = 56$)

Fatigue	Comparison group				Experiment group			
	Mean ± SD	t	df	p-value	Mean ± SD	t	df	p-value
Pretest	65.42 ± 8.57	2.592	27	0.015 *	68.03 ± 6.26	6.320	27	0.001 *
Posttest	60.96 ± 8.08				57.67 ± 9.88			

*) significant if α < 0.05 with paired t-test

Table 3 Differences in decreased fatigue between experiment and comparison groups ($N = 56$)

Fatigue	Experiment group	Comparison group	Mean difference	t	p-value
	Mean ± SD	Mean ± SD			
Pretest	68.03 ± 6.26	65.42 ± 8.57	2.60	1.299	0.115
Pretest-Post test	10.35 ± 8.67	4.46 ± 9.09	5.89	2.481	0.016 *

*) significant if α < 0.05 with independent t-test

Discussion

This study aimed to determine the effect of the Bens app in reducing fatigue among patients with breast cancer undergoing chemotherapy. The results revealed that there was a significant effect of the Bens app on fatigue and a significant mean difference in comparison with the group that used the Benson booklet only. This indicates that the Bens app is effective to use among patients with breast cancer undergoing chemotherapy.

Theoretically, Benson's relaxation techniques can influence the balance of the posterior and anterior hypothalamus, inhibit sympathetic nerve activity, stimulate catecholamine secretion, and reduce cortisol levels so the patient will feel relaxed (Wulansari & Margawati, 2018). When the patient is in a relaxed state, the response to stress is inhibited, thereby reducing body discomfort, muscle contraction and tension, anxiety, mood disorders, sleep disorders, and fatigue (Rambod et al., 2014; Soheili et al., 2017; Yona & Dahlia, 2020).

The results of this study, however, support the result of Jafari et al. (2018), who conducted a study on the effect of Benson relaxation techniques in reducing fatigue in 20 leukemia patients who were given Benson relaxation two times a day for 14 days.

Benson's relaxation technique can be done properly and correctly if the four essential components (quiet environment, comfortable position, mental devices, passive or submissive attitude) can be adequately fulfilled (Benson et al., 1975). Participants who perform Benson relaxation using the application can start relaxation more calmly. Directions are provided through the guide on the application so that the patient performs the steps in accordance with the sequence. Besides, the respondents are more focused on saying the words that are believed and resigned. This is in line with Höfler et al. (2022) showed that the level of compliance and quality in performing Progressive Muscle Relaxation (PMR) was better in patients who were given PMR using a Smartphone compared to the group given standard hospital care.

The Benson relaxation technique using a smartphone application can be carried anywhere, facilitates access to health information needed by patients, and makes it easier for them to perform Benson relaxation techniques independently with audiovisual guidance. However, all respondents must have a smartphone and good internet access in order to use this app. Internet access is the main problem for respondents when using this application, such as poor signal and audio that stops when the signal is unstable. In the comparison group, a booklet is a simple educational media widely used in health services and cost-efficient. However, the information in the booklets is more limited, and the guidelines for Benson's relaxation techniques are only a form of writing and patient experiences when practicing with the researchers.

The quality of the Benson relaxation technique performed by a patient is influenced by several factors, such as the patient's understanding, regularity in doing Benson relaxation, focus or concentration level in saying the words that are believed, and a calm environment (Benson et al., 1975). The better the quality of Benson's relaxation technique performed by the patient, the greater the therapeutic effect obtained will be.

In our study, the Benson relaxation application has several features, including an "educational" feature to improve patient understanding, a "reminder" in increasing the regularity of patients doing Benson relaxation, and a "Benson relaxation guide" using audiovisual which makes it easier for patients to do it independently, as well as self-monitoring. Most of the patients who performed Benson relaxation techniques using a smartphone application revealed that it was beneficial because they could perform Benson relaxation efficiently, i.e., only using a headset, then playing the guides in the application, and following the directions. In addition, they also received health information that improved their patient insight about the application that can help the participants fulfill four essential components required for carrying out Benson relaxation.

With the findings of this study, the Bens app can be integrated into nursing care plans for cancer management in all hospitals as one of the non-pharmacological interventions to overcome fatigue in patients with cancer. In addition, nurses must have good knowledge about relaxation techniques so that they are able to educate and practice relaxation therapy for patients using the Bens app.

This study has some limitations: first, the study was not a true experimental design. Therefore, the selection bias of the participants might be possible. Therefore, further research with a randomized control trial is needed; second, this application only involved Indonesian participants as a target population; thus, it might only be effective for Indonesians.

Conclusion

Benson relaxation could reduce fatigue in patients with breast cancer using the Bens app and booklet. However, the Bens app was more effective than the booklet, with a statistically significant difference in fatigue reduction. Therefore, the Bens app can be considered one of the alternative media that can be used to help patients in performing Benson relaxation. It can also be integrated with the palliative care program for patients with cancer, but the information regarding the role of nurses, languages, competencies, and health information should be continually updated.

Declaration of Conflicting Interest

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Authors' Contributions

All authors contributed substantial contributions to the study, critically reviewed and revised the manuscript, approved the version to be published, and agreed to be responsible for all aspects of the work. Specifically, study conception and design: HDC, DI, MA. Data collection: HDC, DI, MA. Data analysis and interpretation: HDC, MA. Drafting article: HDC, DI. Critically revised the article: HDC, DI, MA.

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Data Availability

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

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