EDUDARA-April 2024

by 05 Turnitin Check

ORIGINAL RESEARCH

Effectiveness of Self-Management Training, "EDUDARA," on Psychological Wellbeing and Cortisol Levels in Breast Cancer Patients during the COVID-19 Pandemic

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Abstract

Background: Women diagnosed with breast cancer often experience emotional distress, leading to a decrease in psychological well-being. Online self-management training during the COVID-19 pandemic is crucial for maintaining psychological well-being, as it is closely related to stress hormone cortisol levels, which play a vital role in boosting the body's immune system. However, research on self-management strategies for breast cancer patients, particularly regarding psychological aspect and its relationship to cortisol levels during the COVID-19 pandemic, remains limited.

Purpose: The purpose of this study was to measure the effectiveness of self-management training on psychological well-being and salivary cortisol levels in breast cancer patients.

Methods: This study used a pre-post-test quasi-experimental design with a control group. The participants included 70 breast cancer patients undergoing chemotherapy at a hospital in Malang City, East Java, Indonesia, recruited using simple random sampling. Self-management training using the EDUDARA *(Edukasi Kanker Payudara)* was administered to the participants in the intervention group for six weeks. Data on wellbeing were collected using the Ryff Psychological Wellbeing Questionnaire, while salivary cortisol levels were measured with the DBD cortisol kit using the competitive ELISA method. SPSS with t-tests was used to analyze the data.

Results: The average post-test psychological well-being score in the intervention group was 90.3, while in the control group, it was 82.69. The results of statistical tests showed a significant difference in psychological well-being between the two groups, with the intervention group showing greater improvement after the training. Additionally, the mean salivary cortisol level post-training was 4.531 in the intervention group and 6.169 in the control group (p=0.001). This indicates a greater reduction in cortisol levels in the intervention group after training, showing that participants' psychological condition following the "EDUDARA" training was better than that of the control group.

Conclusion: Self-management training had a positive effect on increasing psychological well-being and decreasing salivary cortisol levels among breast cancer patients. Therefore, structured self-management training for these patients can be used for nursing intervention

1. Introduction

The incidence of COVID-19 in Indonesia, collected from 514 districts since the first cases were detected until February 2021, has reached 41,682 people (Surendra et al., 2023). The spike in COVID-19 cases during the second wave of the pandemic in Indonesia was very significant. Data showed an increase in new active cases by 56.6% and in death cases by 3.52% (Ministry of Health Republic of Indonesia, 2023. In fact, five provinces in Indonesia experienced a spike of above 50%. Data from the Indonesian Ministry of Health showed, as of 29 April 2023, there were 161,272 deaths (2.38%) and 6,773,146 confirmed cases associated with COVID-19. In contrast to worldwide

data, Indonesia's covid-19 fatality rate was comparatively elevated (Ministry of Health Republic of Indonesia, 2023; Novarisa et al., 2023). The death rate of COVID-19 in East Java is around 6.92% (Mahendradhata et al., 2022; Supriati et al., 2022).

Breast cancer is the most frequent type of cancer that causes death in women (Bray et al., 2018). It is the most commonly treated cancer in hospitals in Indonesia (Supriati et al., 2022). The first report on the discovery of COVID-19 in cancer patients was submitted in February 2020, with 18 patients in China diagnosed with COVID-19, and as many as 39% were treated intensively (Guan et al., 2020). The pandemic has created stressor for breast cancer patients (Guan et al., 2020; Supriati et al., 2023), and it had effect on disruption to the cancer care system, including the shift to virtual consultations, limited family visits and therapy, and a large amount of information on alternative treatment offers (Koinig et al., 2021; Verma et al., 2022). Previous study mentioned that 80% of breast cancer patients paid more attention to their own health and as many as 17% reported delaying treatment appointments at the hospital for fear of being infected with the COVID-19 virus; they also tended to worry about visiting the hospital (Koinig et al., 2021). During the COVID-19 outbreak, all countries have implemented of social limitations and individual limitation to decrease the spread of infection, including the number of visits by cancer patients (Viale et al., 2020). Furthermore, the COVID-19 pandemic has given rise to the uncertainty perception regarding cancer and increase the fear of COVID-19 death related to their cancer. Consequently, it has resulted in many negative emotional responses among breast cancer patients (Arambasic et al., 2019; Koinig et al., 2021).

Breast cancer patients experience a decrease in psychological wellbeing related to emotional distress during the COVID-19 pandemic (Maculaitis et al., 2023). In this regard, psychological factors can affect immunological and endocrine function. It is widely recognized that stress can influence the formation and spread of tumors through these routes (Ramírez-Expósito et al., 2021). A previous study mentioned that psychological wellbeing is associated with stress cortisol hormone and decreased natural killer (NK) cell activity, thereby potentially increasing cancer recurrence, although research results are still inconsistent (Pace et al., 2021; Ramírez-Expósito et al., 2021). Adrenocorticotropin and cortisol are released into the bloodstream in reaction to stress due to the hypothalamic-pituitary-adrenal axis being activated. The adrenal cortex produces the glucocorticoid hormone cortisol from cholesterol. The cortisol called "stress hormone" is only released under stressful circumstances (Soetrisno et al., 2020). Stress causes illness that are dependent on chemicals like cortisol, catecholamines, and immune system degradation; these mediators affect DNA repair mechanisms as well as the growth and spreading of cancer (Ortega et al., 2020). Cortisol is the most widely used stress hormone as an indicator of stress in humans, although its relationship to psychological wellbeing is still contradictory. The relationship between psychological problems of stress and cortisol is influenced by various conditions of cancer patients. There was no direct relationship found between stress and cortisol levels, but it was mediated by the type and amount of therapy (Frausto et al., 2020). Stress and psychological wellbeing are different aspects, but interrelated. Psychological wellbeing has a positive influence on patient health (Hernandez et al., 2018). Patients with higher psychological wellbeing will have better mental and physical health than patients with lower psychological wellbeing. Hence, it is important to know about the cortisol level of breast cancer patient during stressful conditions in the COVID-19 pandemic.

Furthermore, breast cancer requires considerable emotional management skills (Ahmadzadeh et al., 2021). The paradigm of treating cancer patients has changed; it must be managed like a chronic disease that requires long-term surveillance and good skill self-management. Clinical research has turned attention to improving the quality of life, functioning and psychosocial health and self-care behaviour of patients (Luo et al., 2022). Since there was a surge in the second wave of COVID-19 virus infection, it was not possible for patients to visit the hospital directly freely and there was limited information about self-management of the disease and the emotions felt by patients because of fears of the spread of the virus. Therefore, it is needed to use technology to give training related to self-management among patients. Mental health management is a field that has seen rapid progress in the field of online training; however, it is still rare to focus on self-management behaviour in breast cancer patients (Lally et al., 2019; Mohammadzadeh et al., 2022).

In this study, we developed EDUDARA *(Edukasi Kanker Payudara),* an online web program education about self-management for breast cancer patients during the COVID-19 pandemic. This application provides knowledge and skills for patients in managing disease and psychological

problems related to breast cancer during the pandemic. Limited patients visited hospitals during the pandemic, and EDUDARA makes it easy for patients to manage the psychological problems and stress. It consists of information about cancer, management of chemotherapy side effects, pain management, stress management, uncertainty management and an online guide on how to affirm and be grateful by interpreting life positively. EDUDARA is carried out with the concept of combined education and training online by phone, web and also visiting patients' homes one by one with due observance of strict health protocols in preventing COVID-19.

Due to limited access to hospital visits during the COVID-19 pandemic, causing psychological problems and limited health information access, cancer patients must be able to carry out self-management behaviour. Patients need to be given an approach to manage their disease by self-management training using EDUDARA through easy online web access. Self-management refers that patients must adjust their behavior in order to accomplish life objectives, satisfaction, wellbeing, and the ability to control stressful situations. The COVID-19 pandemic has caused substantial changes in life, therefore, patients must be able to self-manage their illness, side effects of treatment, and emotions more actively (Kong et al., 2022; McBride et al., 2021). Interventions delivered online are important to break barriers to provide information about self-management during the COVID-19 pandemic (Smith et al., 2020). However, research on self-management strategies for breast cancer patients, particularly regarding psychological aspect and its relationship to cortisol levels during the COVID-19 pandemic, remains limited. Accordingly, this study was conducted to examine the effectiveness of EDUDARA self-management training on psychological wellbeing of breast cancer patients, which is also associated with their cortisol levels.

2. Methods

2.1. Research design
This study used a pre-post-test quasi-experimental design with a control group. This design was chosen to assess the differences in psychological well-being and cortisol levels between two groups: the intervention group and the control group, with randomization.

2.2. Setting and samples
This study was conducted at one of the hospitals in Malang City, East Java, where patients receive chemotherapy services and also serves as a hospital for the treatment of COVID-19 patients. This situation has impacted the health services, particularly as the hospital must limit the number of chemotherapy sessions for breast cancer patients. The data were collected from March to August 2022. The population consisted of 110 cancer patients aged between 26 and 60 years old. Normally, approximately 10 patients with breast cancer underwent chemotherapy at this hospital every day. However, during the COVID-19 pandemic, there was a five-patient daily maximum for chemotherapy patients. The sample size was determined using the two-sample mean formula, taking into account the risk of dropout (Sugiyono, 2019). It was calculated that 35 respondents per group were required, resulting in a total of 70 samples. These samples were were divided into two groups: the intervention group and the control group, using simple random sampling techniques.

The inclusion criteria included breast cancer patients who had already undergone one cycle of chemotherapy and had access to a mobile phone. The exclusion criteria were patients who had taken anti-anxiety and anti-depressant drugs in the month prior to the study, those with weak or decreased consciousness, and patients with mental disorders. The randomization technique involved the drawing of numbers, with patients assigned to the intervention group if they received an even number and to the control group if they received an odd number. To minimize bias, a homogeneity test was conducted on characteristics such as cancer stage, age, education level, and socioeconomic status. This was done to ensure that any differences in psychological well-being and cortisol levels after the intervention were attributable to the effects of the intervention rather than other factors. The recruitment of the participants is illustrated in Figure 1.

2.3. Intervention
The intervention provided to the intervention group involved a self-management program using EDUDARA. In this study, EDUDARA stands for *"Edukasi Kanker Payudara,"* which translates to breast cancer education. Its core application revolves around educating individuals about breast cancer, chemotherapy, pain and emotional management, as well as guiding them on interpreting life with breast cancer and fostering positive thinking. EDUDARA is an online

application accessible via mobile phones and a web-based system, ensuring easy download and free access for patients anytime and anywhere.
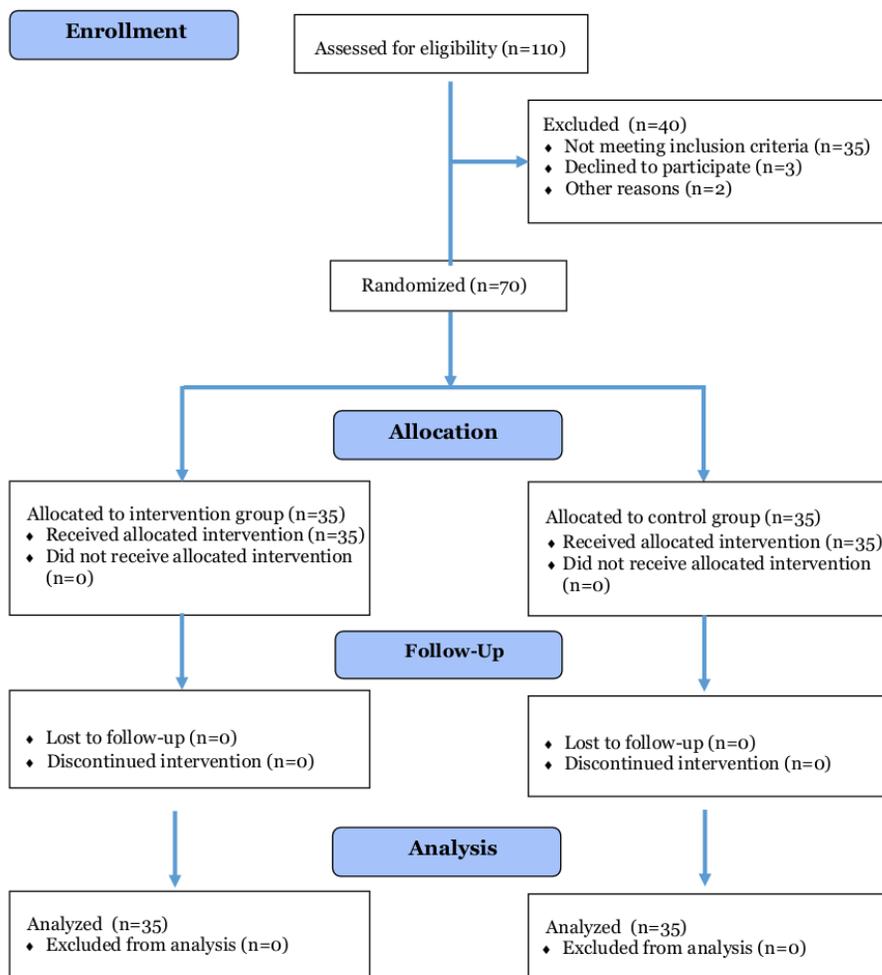
Enrollment

Assessed for eligibility (n=110)

Excluded (n=40)
- Not meeting inclusion criteria (n=35)
- Declined to participate (n=3)
- Other reasons (n=2)

Randomized (n=70)

Allocation

Allocated to intervention group (n=35)
- Received allocated intervention (n=35)
- Did not receive allocated intervention (n=0)

Allocated to control group (n=35)
- Received allocated intervention (n=35)
- Did not receive allocated intervention (n=0)

Follow-Up

- Lost to follow-up (n=0)
- Discontinued intervention (n=0)

- Lost to follow-up (n=0)
- Discontinued intervention (n=0)

Analysis

Analyzed (n=35)
- Excluded from analysis (n=0)

Analyzed (n=35)
- Excluded from analysis (n=0)

Figure 1. The recruitment of the participants

EDUDARA was developed based on evidence from previous research, such as studies on self-management related to physical activity management, which positively impact patients' quality of life and have the potential to improve BCS oncological issues (Bò et al., 2023). Other research incorporated into the development of EDUDARA focuses on self-management to enhance education by improving literacy understanding among breast cancer patients (Ahmadzadeh et al., 2021). It was found that aspects of self-care, such as self-care confidence, self-care management, and self-care maintenance, and aspects of health literacy, such as access, reading, assessment,

decision-making, and understanding, are positively and significantly correlated (Ahmadzadeh et al., 2021). EDUDARA was delivered both offline and online based on previous research showing that providing self-management via cellphone for a minimum of four weeks has a significant impact on emotional regulation abilities in breast cancer patients (Mohammadzadeh et al., 2022). This self-management training serves as an effective intervention in reducing stress and the hormone cortisol in breast cancer patients for at least one month (Mészáros Crow et al., 2023), thus the EDUDARA training was conducted for six weeks.

The intervention consisted of online and offline components, including: (1) the concept of self-management to improve the psychological wellbeing of breast cancer patients, (2) Informational support materials about breast cancer and chemotherapy, (3) Emotional management and pain management, and (4) Telephone follow-up to monitor the self-management exercises and address obstacles faced that were given twice by phone. This intervention was delivered by a team including nurses, doctors, and two palliative volunteers. All information was provided online via handphone and downloadable modules. The implementation of EDUDARA self-management training comprised four sessions for each respondent, three of which were face-to-face sessions and one session conducted via telephone. These sessions included: Session 1 (week 1): Self-regulation material to improve the psychological wellbeing of breast cancer patients for 45 minutes; Session 2 (week 2): Informational support materials about cancer and chemotherapy for 30 minutes; Session 3 (week 3): Emotional management and pain management for 60 minutes; Session 4, 5 (week 4, 5): Telephone follow-up to monitor self-management exercises and address obstacles faced; Session 6 (week 6): Post test. The details of the intervention are provided in Table 1.

EDUDARA was developed through discussions with oncology doctors, palliative teams, and representatives of breast cancer patients, along with technology and informatics experts. The control group did not receive the intervention but followed standard therapy provided by nurses at the hospital, which included a single session of breast cancer education. Pre-tests were conducted in both groups before self-management training to measure psychological wellbeing and cortisol levels, with post-tests conducted after week 6 of interventions.

Table 1. The details of the intervention

Group	Stage of intervention	Duration	Session	Purpose
Intervention group	Concept of self-management in breast cancer	1 x 45 minutes for each patient	Session 1 (week 1)	Increase understanding of self-management in improving psychological wellbeing
	Information support materials about breast cancer and chemotherapy	1 x 30 minutes for each patient	Session 2 (week 2)	Increase knowledge about breast cancer and chemotherapy
	Pain and Emotional management	1 x 60 minutes for each patient	Session 3 (week 3)	Increase knowledge, skills, and experience of breast cancer patients in emotional and pain management
	Follow up by telephone	2 x 15 minutes for each patient by phone	Session 4 and 5 (week 4 and 5)	Assess self-management exercises performed by patients and address any obstacles faced
	Post test	-	Session 6 (week 6)	-
Control group	Breast cancer education	1 x 45 minutes for each patient	Session 1 (week 1)	Increase knowledge about breast cancer diseases through leaflets

2.4. Measurement and data collection
This study used the Ryff's Psychological Wellbeing Scale for data collection (Ryff, 1989). This instrument consisted of 30 closed-ended questions that assess six indicators, including self-acceptance (questions 1-5), autonomy (questions 6-10), environmental mastery (questions 11-15), relationships with others (questions 16-20), personal growth (questions 21-25), and life goals (questions 26-30). A Likert scale with four options was employed: 1 for never, 2 for sometimes, 3

for often, and 4 for always. Total scale scores for psychological wellbeing ranged from 30 to 120, categorized as follows: scores of 30-75 indicating negative psychological wellbeing, and scores of 76-120 indicating positive psychological wellbeing. All scores were analyzed as continuous variables. The questionnaire was forward translated from English into Bahasa it was also adapted to the context of the investigation. Translation and adaptation were performed by a professional language translator, and the validated retranslation into English was also conducted (Muttaqin, 2022; Villarosa & Ganotice, 2018). The validity of the questionnaire was conducted among 30 breast cancer patients with characteristics matching those of the resaerch respondents in a hospital in Batu City, East Java. The resulting product moment values for all question items exceeded 0.361, confirming their validity. Initially, the 30-item psychological wellbeing instrument yielded 27 valid items and three invalid ones. To ensure balance across sub-indicators, the invalid questions underwent sentence statement revisions and were retested for validity, all of which were subsequently validated. The reliability value, indicating consistency in measuring psychological wellbeing variables, was 0.925.

The measurement of cortisol was conducted by examining the patient's saliva before and after the intervention by professionals in the physiology laboratory of the Faculty of Medicine, Universitas Brawijaya. Salivary examination was performed using the DBD cortisol kit with the competitive ELISA method. Measurements were taken in the morning between 8-10 a.m. The saliva samples from patients were taken using a specific micro pipette and stored in a box with ice during transfer to the laboratory. Upon arrival in the laboratory, the samples were frozen at a temperature of -4 to -10 degrees Celsius for at least 2 hours before undergoing centrifugation. Centrifugation was conducted at a speed of 100-250 rpm for 5 to 8 minutes to separate the enzyme/ supernatant precipitate. The laboratory assistant then carefully extracted the necessary enzyme for examination and stored it in a small tube in the refrigerator until all samples were obtained. Subsequently, the samples underwent a mixing process using an ELISA kit, following calibration based on predetermined standard values using a computer program. Analysis was performed by the laboratory assistant, who later presented the results, along with standard values, to the researcher. The significance of the results from the ELISA kit, as indicated by color changes and analysis indicators, was explained during this presentation.

This study also collected demographic data of the respondents, including the education, age, marital status, illness severity, cancer stage, lenght of sickness, occupation, and economic status. This study involved nurses in the chemotherapy room as providers of information about patients who met the research inclusion criteria. The process of filling out the demographic questionnaire was carried out when the patient came to the hospital for chemotherapy. Compliance with the strict COVID control protocol at the hospital was carefully ensured. Patients were given an informed consent regarding the purpose, process and mechanism of involvement in research. If they agreed, the next meeting would be held by visiting the patient's house in accordance with the intervention procedures carried out by the researcher.

2.5. Data analysis
Demographic characteristics were analyzed using descriptive statistics (frequency, percentage, mean, and standard deviation). The Chi-square test was used to depict demographic differences between the patients in the intervention and control groups. The Shapiro-Wilk test was also used to determine whether the data were normally distributed. The independent samples t-test and paired t-samples test were used to identify intragroup and intergroup differences in psychological wellbeing before and after the training to determine if the data were normally distributed. The results of the data normality test showed a p-value < 0.05, indicating that psychological wellbeing had an abnormal distribution, so the Wilcoxon and Mann-Whitney tests were used.

2.6. Ethical considerations
This study obtained ethical approval from the Institutional Review Board (IRB) of the Faculty of Nursing, Universitas Airlangga, with a reference number 2386-KEPK. Respondents were contacted based on predetermined criteria and provided with a clear explanation of the study's objectives. They were also given detailed information about the research, including its aims, procedures, potential discomfort, risks, benefits, and consequences of participation. Subsequently, they signed an informed consent form for their participation.

3. Results

3.1. Characteristics of the participants

Table 2 shows the characteristics of the respondents. Based on the table, most of respondents in both groups had an elementary school education level, with most of them being unemployed, and the highest cancer stage observed was stage II. The average age of the respondents was 47 years, and the average duration of illness was 1-5 years. The results of the homogeneity test, conducted using the Chi-square test for categorical data and the Mann-Whitney test for the age variable, indicated that patient characteristics (education, age, marital status, severity, stage, duration of illness, occupation, and economy) were homogeneous between the intervention and control groups ($p>0.05$).

3.2. Psychological wellbeing and salivary cortisol levels

Table 3 provides a description of the dependent variables. It indicates that the psychological wellbeing scores before intervention on average were 83.89 and 80.46 in the intervention and control groups, respectively. Both of theme were in the positive psychological wellbeing category. Following the intervention, the average post-test psychological wellbeing score increased to 90.3 in the intervention group and to 82.69 in the control group. Across all indicators of psychological wellbeing—self-acceptance, autonomy, environmental mastery, relationships with others, and personal growth—scores in the intervention group showed improvement. Regarding cortisol levels, the average pre-test cortisol level in the intervention group was 6.221, and the post-test level was 4.531, while in the control group, the pre-test score was 6.136, and the post-test score was 6.169. This indicates that the average cortisol levels in the intervention group decreased more after receiving the EDUDARA self-management training compared to the control group.

Table 2. Characteristics of the respondents

Characteristic	Intervention Group (n=35) n (%)	Control Group (n=35) n (%)	p-value
Education			
Elementary school	13(37.1)	15(42.9)	
Junior high school	12(34.3)	7(20.0)	0.438
Senior high school	5(14.3)	9(25.7)	
University	5(14.3)	4(11.4)	
Age			
Mean ± SD	48.06±7.91	48.34±7.56	0.855
Minimum- *Maximum*	36 – 60	36 – 64	
Marital status			
Married	21(60.0)	24(68.6)	
No married	14(40.0)	14(31.4)	0.618
Illness severity			
Normal	17(48.6)	15(42.9)	
Limited to light activity	13(37.1)	17(48.6)	0.560
50% Time still ambulatory	5(14.3)	3(8.6)	
Cancer stage			
I	3(8.6)	3(8.6)	
II	18(51.4)	20(57.1)	
III	11(31.4)	10(28.6)	0.950
IV	3(8.6)	2(5.7)	
Length of sickness			
3 months -1 year	16(45.7)	15(42.9)	
1 - 5 year	19(54.3)	20(57.1)	1.000
Occupation			
Employed	16(45.7)	16(45.7)	
Unemployed	19(54.3)	19(54.3)	1.000
Economic status			
Low	24(68.6)	21(60.0)	
High	11(31.4)	14(40.0)	0.618

Table 3. Psychological wellbeing and salivary cortisol levels

Variable	Descriptive	Intervention Group		Control Group	
		Pre-test	Post-test	Pre-test	Post-test
Psychological wellbeing	Minimum	60	72	59	59
	Maximum	107	117	107	108
	Mean	83.89	90.63	80.46	82.69
	Standard Deviation	13.02	12.92	12.72	11.38
Self-acceptance	Minimum	10	11	10	11
	Maximum	19	19	20	19
	Mean	14.29	15.11	13.20	13.40
	Standard Deviation	3.121	2.99	3.18	2.92
Autonomy	Minimum	10	13	10	10
	Maximum	19	19	19	18
	Mean	13.83	14.94	13.66	13.74
	Standard Deviation	2.76	1.76	2.9	1.86
Environmental mastery	Minimum	10	12	10	12
	Maximum	19	19	19	19
	Mean	13.91	15.63	13.43	14.2
	Standard Deviation	2.46	2.237	2.20	1.86
Relationship with others	Minimum	10	11	11	11
	Maximum	19	19	19	19
	Mean	14.69	15.97	14.14	14.26
	Standard Deviation	2.518	2.32	2.636	2.513
Personal growth	Minimum	9	12	9	9
	Maximum	19	19	19	19
	Mean	14.14	15.23	13.29	13.63
	Standard Deviation	2.366	1.75	2.321	2.129
Life purpose	Minimum	10	11	9	9
	Maximum	17	19	17	17
	Mean	13.17	14.83	12.89	13.54
	Standard Deviation	1.689	2.358	2.026	2.241
Salivary cortisol	Minimum	1.78	1.08	1.462	1.25
	Maximum	15.2	9.99	16.56	15.87
	Mean	6.221	4.531	6.136	6.169
	Standard Deviation	3.242	2.584	3.666	3.424

3.3. Comparison of psychological wellbeing in the intervention and control groups

Table 4 shows that the results of statistical analysis using the Wilcoxon test in the experimental group for psychological well-being yielded a significance value of $p<0.05$. Therefore, it can be stated that there was a significant effect of the self-management training EDUDARA intervention on psychological well-being and all of its indicators (self-acceptance, autonomy, environmental mastery, relationships with others, personal growth, and life purpose) in the intervention group. Similarly, in the control group, using the paired t-test on the psychological well-being variable also yielded a significant value ($p<0.05$). However, in the control group, only the indicators of environmental mastery, personal growth, and life purpose showed significant differences.

Furthermore, differences in delta values (post-test – pre-test) for all variables were tested using the Mann-Whitney test because the distribution of the mean difference of pre-post in this study was not normally distributed. The test results for the mean different values of psychological well-being and their indicators in the two groups can be seen in Table 5, which shows the different test results of psychological well-being delta values (mean difference pre-post). The results depicted a significant difference between the intervention and control groups ($p=0.021$), as well as all psychological well-being indicators, namely self-acceptance, autonomy, environmental mastery, relationships with other people, personal growth, and life purpose. Psychological well-being and all indicators in the intervention group increased higher than in the control group.

Table 4. Comparison of psychological wellbeing in the intervention and control groups

Variables	Mean±SD Intervention group			Mean±SD Control group		
	Pre	Post	*p*	Pre	Post	*p*
Psychological wellbeing Indicators	83.89±13.02	90.63±12.92	0.000 [b]	80.46±12.72	82.69±11.38	0.030[a]
Self-acceptance	14.29±3.121	15.11±2.99	0.002 [b]	13.20±3.18	13.74±1.86	0.299[b]
Autonomy	13.83±2.76	14.94±1.76	0.003 [b]	13.66±2.9	13.74±1.86	0.645[b]
Environmental mastery	13.91±2.46	15.63±2.237	0.000 [b]	13.43±2.20	14.2±1.86	0.005[b]
Relationship with others	14.69±2.518	15.97±2.32	0.006 [b]	14.14±2.636	14.26±2.513	0.947[b]
Personal growth	14.14±2.366	15.23±1.75	0.009 [b]	13.29±2.321	13.63±2.129	0.017[b]
Life purpose	13.17±1.689	14.83±2.358	0.000 [b]	12.89±2.026	13.54±2.241	0.000[b]

Notes: [a]: Paired t-test; [b]: Wilcoxon Test

Table 5. The difference in delta values for psychological well-being between the intervention and control groups

Variable	Group	Delta (Δ)	*Sig.*
Psychological wellbeing	Intervention	6.74	0.021
	Control	2.23	
Indicators			
Self-acceptance	Intervention	0.82	0.015
	Control	0.54	
Autonomy	Intervention	1.11	0.015
	Control	0.08	
Environmental mastery	Intervention	1.72	0.028
	Control	0.77	
Relationship with others	Intervention	1.28	0.007
	Control	0.12	
Personal growth	Intervention	1.09	0.003
	Control	0.34	
Life purpose	Intervention	1.66	0.043
	Control	0.65	

3.4. Comparison of salivary cortisol levels in the intervention and control groups

Table 6 shows that in the intervention group, the mean salivary cortisol level was 6.221, while in the control group, it was 6.136. The results of the Wilcoxon test in the intervention group for salivary cortisol levels yielded a significance value of $p<0.05$. Therefore, it can be stated that there was a significant effect of EDUDARA self-management on salivary cortisol in breast cancer patients. Additionally, the cortisol level decreased by approximately 1.69.

Table 6. Comparison of salivary cortisol levels in the intervention and control groups

Variable	Mean±SD Intervention group			Mean±SD Control group		
	Pre	Post	*p*	Pre	Post	*p*
Salivary cortisol	6.221±3.242	4.531±2.584	0.000	6.136±3.666	6.169±3.424	0.731

4. Discussion

The purpose of this study was to identify the effectiveness of "EDUDARA" self-management training on psychological well-being, which is also associated with cortisol levels. The results showed that this intervention is more effective in increasing the psychological well-being among breast cancer patients compared to the standard education. It is more holistic, not only providing information about the disease and therapy but also individual training about disease, therapy, symptom management, side effects of therapy, and training to manage emotions and uncertainty.

The results of this study showed that the intervention and control groups at the pre-test had an average score of psychological well-being of 83.89 and 80.46, respectively. The average post-test psychological well-being score in the intervention group increased more than in the control group. Indicators of psychological well-being, namely self-acceptance, autonomy, environmental mastery, relationships with other people, and personal growth, increased significantly before and after self-management training in the intervention group, while in the control group, only the indicators of environmental mastery, personal growth, and life goals increased. The intervention group experienced higher scores in all indicators of psychological well-being compared to the control group. This is similar with other research by Gilbertson et al. (2019), which stated that educational interventions lead to increased knowledge only. Self-management is the emotional process of actively expressing feelings, which provides an increased assessment of the health status and adaptation of breast cancer patients (Avila et al., 2015). Therefore, self-management, including emotional aspects, is very important in the adaptation of breast cancer patients.

This study showed that after implementing self-management using EDUDARA, all indicators of psychological well-being showed a significant increase. This result is in line with other research that showed providing training in managing emotions in cancer patients through a self-regulation program increased positive perceptions of pain and patient enthusiasm, leading to more positive well-being (Iddon et al., 2019). Self-management means that patients can adjust their behavior to be able to achieve life goals, achieve satisfaction and well-being, and they can control stressful situations. Generally, chronic stress experienced by breast cancer patients decreases psychological well-being because patients are unable to perform self-management properly (Larasati et al., 2020).

The COVID-19 pandemic has brought many changes to human life, including chemotherapy services at hospitals in the city where this study took place There were health protocols in place to prevent the COVID-19 virus from spreading to patients and health workers, such as changing the number of service capacities for patients receiving chemotherapy on a daily basis and limiting patient-health worker interaction. These situations were comparable in Rome, Italy, demonstrating that the COVID-19 epidemic had affected the distribution of medical resources, causing growing fear among patients, particularly about treatment, and creating anxiety issues associated to COVID-19 (Vanni et al., 2020). These conditions also cause stress for patients, so they must be able to actively gain information and skills to manage the effects of negative emotions on the body. Through EDUDARA intervention, the patients were given education and training in managing their emotions by recognizing their own emotions, recognizing the emotions of others, conveying emotions to others, and being taught about being grateful in life every day. Patients learned to think positively in life by taking the meaning of life more positively. Additionally, patients were trained to do deep breathing relaxation for at least two weeks every morning and evening, accompanied by positive affirmations. The results of this study were similar to the results of other studies which stated that the self-management behavior of breast cancer patients with educational strategies was effective in reducing the distress of cancer patients (Younis et al., 2021; Mohammadzadeh et al., 2022). Furthermore, patient's self-management training on the emotional aspect through relaxed breathing with full awareness, which involves meaning and attention in the patient's daily life, has been shown to be effective in reducing depression and improving well-being after intervention (Durosini et al., 2022; Nihayati et al., 2021).

The relationship between psychological aspects and cortisol levels involves the concept of psychoneuroimmunology, which is the study of the interaction between behavior, neuroendocrine, and the immune system (Chen et al., 2023). It is also in accordance with the process of pain management (Pugh et al., 2021). The breast cancer journey and therapy that patients undergo have an impact on the patient's physical, emotional, and psychological symptoms (Badana et al., 2019; Pace et al., 2021). The results of this study showed that self-management training is significant in decreasing salivary cortisol in the intervention group. This is similar with other research reporting that education and training relaxation programs as self-management, including pain management, significantly decreased cortisol in patients with stage 0- stage 3 cancer without metastasis (Alhazmi et al., 2021). Breathing relaxation exercises help improve the patient's ability to reduce tension and increase the patient's ability to relax, thus decreasing stress and blocking cortisol through the HPA axis system (Ramírez-Expósito et al., 2021; Soetrisno et al., 2020). One sign of endocrine dysregulation regarding distress is a disruption in the circadian cortisol rhythm (Herrera et al., 2022; Ramírez-Expósito et al., 2021). Relaxation exercises, positive thinking in interpreting life,

recognizing one's emotions, and increasing positive perceptions about breast cancer give auditory-visual and somatosensory stimuli that will be forwarded to the limbic system and the lateral Bed Nucleus of the Striae Terminalis (BNST), which is the main effector of the emotional response structure. From the BNST, it is passed to the paraventricular nucleus (PVN), which will inhibit the HPA axis so that cortisol levels decrease. Cortisol is a hormone produced in response to physical and psychological stress in humans, which is related to the stress and anxiety response of breast cancer patients (Endang et al., 2019; de la Torre-Luque et al., 2020). Providing self-management training increases cognitive structuring abilities and more positive illness perception, which has an impact on reducing stress hormones (Endang et al., 2019).

5. Implications and limitations

The findings of this study hold practical implications for nurses as professional healthcare practitioners seeking to increase psychological well-being in breast cancer patients. Nurses can utilize the "EDUDARA" online self-management intervention system as a guide for mental nursing care, offering psychological support to breast cancer patients. To effectively improve patients' psychological well-being and reduce cortisol levels, nurses must provide interventions that extend beyond disease education, encompassing emotional support, psychological guidance, and stress management skills.

However, it is important to note that this study has limitations. It overlooked treatments that patients had already undergone, such as mastectomy and radiotherapy, which could significantly influence their psychological well-being. Additionally, the sample was collected from a single study center and may not fully represent the broader population of interest.

6. Conclusion

This study shows a significant effect of providing self-management training through the EDUDARA intervention on increasing the psychological well-being and significantly reducing cortisol levels in breast cancer patients. Therefore, it is important for nurses to improve psychological well-being by providing education and skill training in self-management. This study suggests that nurses should be aware of the psychological distress, emotions, and uncertainty responses experienced by breast cancer patients, which can impact their psychological well-being. Negative psychological well-being is correlated with excessive stress hormone cortisols, which can certainly affect the patient's health. Therefore, breast cancer patients should be given self-management support in managing the disease, therapy side effects, and also stress. The results of this study are limited in their ability to explain the medical therapy factors that need to be considered in developing psychological well-being and cortisol levels. Thus, future research should focus more on investigating these aspects.

Author contribution

LS communicated the research concept. Subsequently, LS, RN, A, and MR engaged in preliminary deliberations concerning research proposals and methodological design. LS, NH, and IAR were involved in the draft and revised manuscript, which were supervised by LS. The writing and review process of the manuscript was jointly accomplished by all authors. All authors have contributed equally to this manuscript without exception, regardless of their respective roles.

Conflict of interest

We declare that there is no potential conflict of interest concerning this research, authorship, and/or publications of this article.

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