

Effectiveness of Structured Educational Intervention on Breast Cancer Patients' Knowledge and Practice Regarding Chemotherapy Side Effects in Sulaimani City: "A Quasi-Experimental Study"



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ABSTRACT

Background: Chemotherapy is the main component of breast cancer treatment; however, it is associated with numerous adverse effects challenging patients to cope. Therefore, this study examines an educational intervention on knowledge and practice related to chemotherapy adverse effects in women with breast cancer. **Methods:** This quasi-experimental study was administered at Hiwa Hospital in Sulaimani City between February and October 2025. A total of 108 participants were selected through purposive sampling and evaluated at two time periods. Data were collected through a validated instrument comprising sociodemographic and clinical characteristics along with a developed 12-item-based knowledge and practice questionnaire. The intervention group underwent 2 months of educational intervention, while the control group received standard care. Before the study, pilot testing was conducted to determine the practicality of the instrument. Data were analyzed employing the Statistical Package for the Social Sciences version 27. **Results:** The baseline test confirmed deficient knowledge and practice about chemotherapy adverse effects, with no significant disparity between groups ($P > 0.05$). Following the post-test, the intervention group significantly improved knowledge and practice ($P < 0.001$) compared to the control group. The level of education was the sole factor significantly correlated with the knowledge domain ($P = 0.015$). **Conclusion:** The study concluded that structured educational intervention significantly improved breast cancer patients' knowledge and practice concerning chemotherapy adverse effects.

Index Terms: Breast Cancer, Chemotherapy, Adverse Effects, Structured Educational Program, Knowledge, Practice

1. INTRODUCTION

Breast cancer represents a significant global health issue; it is the most commonly diagnosed malignancy and the

fundamental cause of cancer-related mortality among women [1]. In Iraq, breast cancer in women is among the top leading cancer incidence; their rates rose notably from 36.6 to 61.9/100,000 between 2012 and 2022 [2]. In 2023, the age-standardized incidence rate (ASIR) was 65.5/100,000 for the Iraqi women population. The Kurdistan Region within the country has some of the highest rates. Erbil had the highest ASIR of any governorate at 92.3/100,000, with similar but lower rates in Sulaimani and Duhok (58.0 and 57.4/100,000), respectively [3]. Chemotherapy, which eradicates micrometastases, reduces the risk of recurrence,

Access this article online

DOI: 10.21928/uhdjst.v10n2y2026.pp178-187

E-ISSN: 2521-4217

P-ISSN: 2521-4209

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Received: 01-07-2026

Accepted: 09-09-2026

Published: 30-09-026

and increases the survival rate, has emerged as the essential component of treatment-related breast cancer [4]. In addition to its therapeutic value, chemotherapy is associated with numerous physical adverse effects, as well as psychological distress that reduces patients' quality of life [5]. However, prioritizing effective management of adverse effects is crucial to maintain patient health and treatment adherence, focusing on patient empowerment through providing information and involving patients in their own care [6].

The literature widely recognizes that providing adequate knowledge and actionable self-care practices regarding chemotherapy-related adverse effects can improve symptom management outcomes for breast cancer patients [7]. However, studies continuously reveal that breast cancer women receiving chemotherapy show deficiencies in their knowledge and self-care practices regarding chemotherapy and anticipating side effects [8]. These gaps in knowledge related to chemotherapy tend to result in inadequate self-care practices, raised symptom distress, increased hospitalization, and lowered quality of life [9]. Developing countries in particular mostly suffer from this challenge, where cancer patient education programs within oncology outpatient not formally included or inconsistently applied before chemotherapy [10].

Oncology nurses are in an ideal position to carry out of pre-chemotherapy educational interventions. Women are empowered through health education programs by providing specific information and practical skills related to chemotherapy and its side effects. The intervention assists the patients in changing from passive recipients to active participants in their own treatment by fostering self-care. This could result in better personal well-being and more control over their treatment experience [11], [12]. Educational programs by nurses for women diagnosed with primary breast cancer are primarily aimed at delivering information and enhancing cognitive abilities concerning the effects of chemotherapy and promoting patients to engage in their self-care practice [13].

Evidence continues to show that when structured educational programs are included as part of regular oncology nursing care, improved patient outcomes, decreased hospitalization, practical and cost-effective, and patient-centered care [14]. However, structured pre-chemotherapy patient education is not formally embedded within oncology care in the Kurdistan Region of Iraq, and few interventional studies have evaluated such programs in this setting [15]. This study is guided by a self-care framework, whereby providing

structured information improves patients' knowledge, which in turn strengthens their ability to perform appropriate self-care practices for managing chemotherapy adverse effects. Accordingly, this study aimed to evaluate the effectiveness of a structured educational program on knowledge and self-care practices regarding chemotherapy adverse effects among women with breast cancer at Hiwa Hospital, Sulaimani, Iraq. We hypothesized that women receiving the intervention would improve significantly more in knowledge and self-care practices than those receiving standard care alone.

2. METHODOLOGY

2.1. Research Design and Setting

A quasi-experimental study with a non-equivalent two-group pre-test and post-test design was performed. Groups were recruited sequentially. Participants were recruited based on time of enrollment rather than random assignment. This design was chosen because randomization was impractical and risked information leakage between groups. Furthermore, it allowed for standardized procedures in the delivery of the educational program and helped to address ethical issues related to the study. The study was carried out at the outpatient chemotherapy clinic of Hiwa Hospital in Sulaimani City, Kurdistan Region of Iraq, between February and October 2025.

2.2. Sampling and Participants

Non-probability purposive sampling was performed to enroll a total of 108 women with breast cancer who were undergoing chemotherapy for the first time. The enrollment process was conducted in two phases. In the first phase, 57 women meeting the inclusion criteria were assigned to the control group between early February and mid-June 2025 and received standard care only; three were subsequently lost to follow-up, leaving 54 for analysis. Each participant was pre-tested, monitored for two months, and then administered a post-test assessment. Upon completion, control participants were informed of the main points of self-care during chemotherapy. In the second phase, 58 participants were assigned to the intervention group between mid-June and late October 2025 and received the self-care educational program in addition to standard care; four participants were lost to follow-up, departing 54 for the last analysis. Like the control group, each was pre-tested, followed individually for about 2 months from enrollment, and then post-tested. The sample size was estimated a priori using G*Power (version 3.1.9.7) for a two-tailed independent-samples *t*-test on the primary outcomes, knowledge, and self-care

practice. Assuming a medium-to-large effect (Cohen's $d = 0.6$) [16] consistent with a nurse-led education program that significantly improved knowledge and self-care behavior in breast cancer patients receiving AC [17] with $\alpha = 0.05$, power $(1-\beta) = 0.87$, and a 1:1 allocation ratio, a minimum of 108 participants (54/group) was required. The predefined participation criteria were employed to identify accessible respondents within the research period.

2.3. Inclusion Criteria

- Adult female aged ≥ 18
- Histologically diagnosed with non-metastatic breast cancer (stages I–III)
- Capable of reading and writing Kurdish
- Scheduled to begin systemic adjuvant or neoadjuvant chemotherapy.

2.4. Exclusion Criteria

- Age > 70 years
- Women who are diagnosed with metastatic breast cancer
- Patients with psychiatric or severe comorbidities
- Unwillingness to obtain informed consent.

2.5. Research Instrument

For the aims of data collection, a standardized questionnaire was created and validated, including:

- Sociodemographic characteristics: Captured information related to the research respondents, consisting of age, marital status, level of education, and occupation
- Clinical characteristics: Covered disease-related information such as breast cancer laterality, type of chemotherapy, menopausal status, and family history of breast cancer
- Knowledge and practice questionnaire: A 12-item questionnaire, consisting of seven knowledge items and five practice items, was developed by the researcher based on previous research [18], [19]. This questionnaire was translated to the Kurdish language by the researcher using forward translation [20] and was evaluated by two medical bilinguals (doctoral degrees), ensuring that the original meanings and nuances of the questions were preserved. The items cover four main domains, including (1) common chemotherapy mechanisms (items 1 and 2); (2) chemotherapy-induced side effects and symptom management, including fatigue (6, 12), skin care (4), risk of bleeding (5), taste changes (7), and fertility problems (3); (3) infection control and emergency precautions, such as fever (10, 11); and (4) dietary changes and hydration (9, 8). The knowledge items were answered using a (True/False) response, and the practice items

were answered using a (Yes/No) response format. Each valid answer received 1 point, and each invalid answer scored 0 points. The raw scores were converted into a normalized index falling between 0 and 1, in which higher scores indicate greater knowledge or better practice. The knowledge and practice scores were introduced as continuous and categorical variables. Continuous variable scores are reported as mean $\pm$ standard deviation. Based on modified Bloom's cut-off points [21], scores were classified as (low = $< 50\%$, moderate = $50\text{--}75\%$, and high = $> 75\%$).

2.6. Validity and Reliability

The content validity of the questionnaire was obtained through a panel of experts from various subspecialties, including adult nursing and clinical oncology. Before the main study, a pilot study was conducted with 10 breast cancer patients undergoing chemotherapy over 14-day interval. The goals of the preliminary study were to evaluate the clearness, understandability, and practicability of the instrument for data collection. Test–retest reliability assessed the questionnaire's stability over time. Intraclass correlation coefficients (ICCs) showed acceptable stability for the combined knowledge and practice domain (ICC = 0.72, 95% confidence interval [CI] 0.25–0.92) and knowledge subscale (ICC = 0.70, 95% CI 0.21–0.92) but poor stability for the practice subscale (ICC = 0.47, 95% CI $-0.18\text{--}0.83$). Given the small pilot sample, these estimates remain preliminary.

2.7. Educational Program

The program was delivered by the researcher with a Master of Science in Nursing, who was trained in the study protocol and the booklet content before delivery. Sessions were delivered individually, face-to-face, in an outpatient chemotherapy unit of Hiwa Hospital, using discussion and a question-and-answer approach to encourage participation. The program comprised three sessions of 20–30 min each: Session one covered the goals and mechanism of chemotherapy, hair loss, and self-care strategies. Session two covered the common adverse effects (e.g., fatigue, mouth and gastrointestinal changes, and fertility), and session three covered self-care management, infection precautions, and dietary and hydration advice. Content was developed from the study objectives and evidence-based guidelines [22], [23]. The baseline test and first session were delivered at the first chemotherapy cycle for all participants, with the second and third sessions delivered at the second and third cycles, respectively. Because cycle length varied (14 or 21 days), the post-test was timed to a comparable interval (2 months) rather than a fixed cycle number. Accordingly, the post-test was conducted at the fifth cycle for participants

on a 14-day schedule (56 days) and at the fourth cycle for those on a 21-day schedule (63 days). A structured self-care booklet in Kurdish, written in simple language, was provided to each participant to reinforce and consolidate the session content between visits. All participants attended the three scheduled sessions. Delivery consistency was maintained by a standardized session checklist and the same educator, ensuring each participant received the same content in the same sequence.

2.8. Data Collection

At the outpatient chemotherapy department, all new cases diagnosed with breast cancer are identified through the computerized system. After confirming the eligibility criteria for the study, verbal and written consent was obtained. The data collection procedure occurred at two distinct time intervals: The baseline test was conducted directly before the first cycle of chemotherapy started. Furthermore, the post-test assessment was implemented 2 months following baseline recruitment based on the regimen cycle, whether 14 days or 21 days. All participants from both groups completed a questionnaire through individual interviews, encompassing sociodemographic and clinical data, as well as knowledge and practices related to the chemotherapy. Both the control and intervention groups received standard care. In this context, oncologists are the main formal source of information for patients, including diagnosis, treatment planning, and prognosis. No formal educational program exists for newly diagnosed breast cancer patients before chemotherapy. Nurses receive patients, ensure blood tests and vital-sign records, administer chemotherapy, and monitor treatment yet hold no formal or written responsibility for patient education. In contrast, the intervention group attended all three teaching sessions, delivered over the scheduled program period before the post-test assessment. The data collection process was completed over a 9th-month duration.

2.9. Statistical Analysis

Analysis of statistical data was accomplished with the Statistical Package for the Social Sciences version 27. Descriptive statistics were applied to calculate frequencies, percentages, means, and standard deviations. The normality test of continuous variables was examined through the Shapiro–Wilk test. However, categorical variable differences between groups were assessed by Chi-square and Fisher's exact tests. A non-parametric test such as the Mann–Whitney U test was used in comparison between two variables, while the Kruskal–Wallis test was used when the examined variables had more than three groups. Post-intervention scores were compared between groups using Analysis of

Covariance, adjusting for baseline, with results reported as adjusted mean differences, 95% CIs, and partial eta squared (η^2). Furthermore, effect sizes were reported as Cramér's V for categorical relations and as rank-biserial r (Mann–Whitney) or epsilon-squared (Kruskal–Wallis) for exploratory sub-analyses. The P -value at $P < 0.05$ was set as statistical significance.

2.10. Ethical Considerations

The study was approved by the Institutional Review Board (IRB) Committee at the University of Raparin (No.: 17; Reference 2866/28-S-2023; date: 15 August 2024), before the start of data collection. This research has been examined by the IRB of the College of Nursing and adheres to all ethical standards with no recognized legal concern. This project was not prospectively registered, but ethical permission was obtained through institutional review after proposal acceptance.

3. RESULTS OF THE STUDY

In this study, 115 breast cancer patients completed the baseline assessment (57 control, 58 intervention). Following 7 dropouts, 108 participants (54/group) completed the post-intervention assessments and were included in the final analysis (Fig. 1). This section presents sociodemographic and clinical information and ratings of pre- and post-intervention knowledge and practice.

3.1. Sociodemographic and Clinical Characteristics of the Study Population

Table 1 shows baseline comparisons of sociodemographic and clinical data of the study sample between control and intervention groups. A total of 108 women participated in the study ($n = 54/\text{group}$). The mean age was (control = 48.24 ± 10.99 vs. intervention = 44.72 ± 9.31) years, respectively. The majority of the participants were married (87% vs. 83.3%). The study sample varied in terms of educational level, with the largest proportion having completed primary school (40.7% vs. 27.8%), and the majority of them were housewives (68.5% vs. 70.4%). From the population surveyed, breast cancer affected both sides relatively equally, with about half presenting on the right side (50%) and half on the left (50%). Most participants received adjuvant chemotherapy (63% vs. 61%), and the vast majority of women were at pre-menopause (66.7% vs. 74.1%), with no family history of breast cancer (70.4% vs. 77.8%). Statistically, no significant differences were observed between control and intervention groups for any sociodemographic and clinical characteristics (all $P > 0.05$).

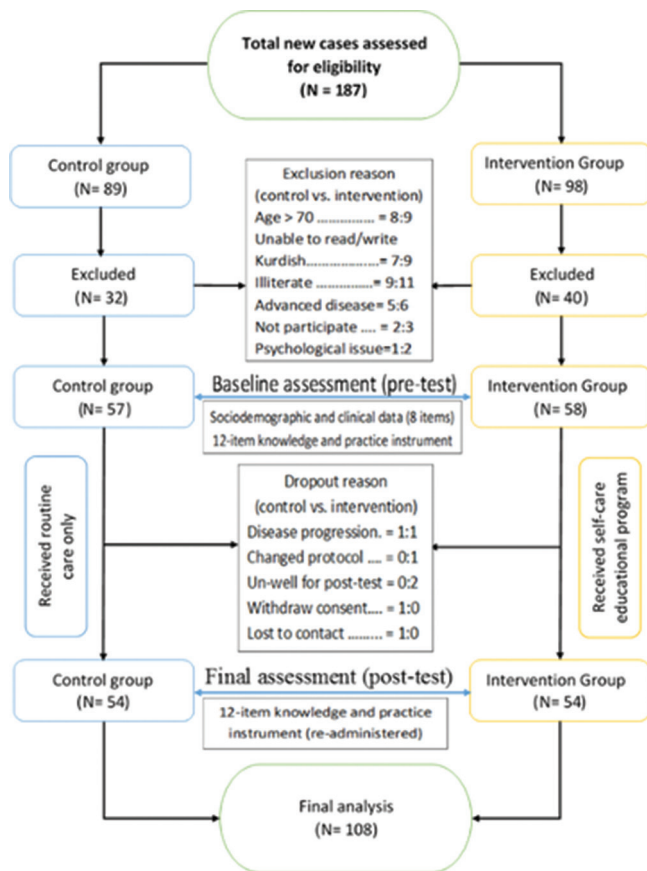


Fig. 1. Distribution of the study sample.

3.2. Knowledge and Practice Related to Chemotherapy

Table 2 demonstrates a baseline and post-test comparison of overall mean scores in both groups regarding knowledge and practice of chemotherapy among breast cancer patients. At baseline, no significant difference was observed between the two groups regarding knowledge and practice ($P > 0.05$). Following post-test, compared to the control group, the intervention group significantly demonstrated higher mean scores across all domains, including knowledge (0.386 ± 0.179 vs. 0.735 ± 0.179), practice (0.622 ± 0.229 vs. 0.778 ± 0.208), and combined knowledge and practice (0.485 ± 0.164 vs. 0.753 ± 0.149) ($P < 0.001$). After adjusting for baseline, the intervention group scored significantly higher across all outcomes, with large effects for knowledge (0.344 , 95% CI 0.276 – 0.411 ; $\eta^2 = 0.491$) and the combined score (0.259 , 0.200 – 0.318 ; $\eta^2 = 0.418$), and a smaller but significant effect for practice (0.154 , 0.069 – 0.238 ; $\eta^2 = 0.110$), reflecting the control group's own improvement in practice over time.

As shown in Fig. 2, the post-test analysis of correct response rates indicates that the experimental group showed a

TABLE 1: Sociodemographic characteristics of the study sample

Studied variable	Control group <i>n</i> (%)	Intervention <i>n</i> (%)	<i>P</i> -value
Age groups			
30–39	12 (22.2)	19 (35.2)	0.273 ^{x2}
40–49	23 (42.6)	23 (42.6)	
50–59	11 (20.4)	5 (9.3)	
60+	8 (14.8)	7 (13)	
(Mean±SD)	48.24±10.99	44.72±9.31	
Marital status			
Married	47 (87)	45 (83.3)	0.828 ^{x2}
Unmarried	5 (9.3)	7 (13)	
Widowed/Divorced	2 (3.7)	2 (3.7)	
Level of education			
Literate	10 (18.5)	14 (25.9)	0.495 ^x
Primary school	22 (40.7)	15 (27.8)	
Secondary school	8 (14.8)	7 (13)	
Institute level	4 (7.4)	8 (14.8)	
≥University level	10 (18.5)	10 (18.5)	
Occupation			
Employed	15 (27.8)	13 (24.1)	0.837 ^{x2}
Housewife	37 (68.5)	38 (70.4)	
Retired	2 (3.7)	3 (5.6)	
Laterality breast cancer			
Right side	27 (50)	24 (44.4)	0.750 ^A
Left side	23 (42.6)	27 (50)	
Bilateral	4 (7.4)	3 (5.6)	
Type of chemotherapy			
Neoadjuvant	20 (37)	21 (38.9)	1.000 ^B
Adjuvant	34 (63)	33 (61.1)	
Menopausal status			
Pre-menopause	36 (66.7)	40 (74.1)	0.608 ^B
Menopause	6 (11.1)	3 (5.6)	
Post-menopause	12 (22.2)	11 (20.4)	
Family history of breast cancer			
No	38 (70.4)	42 (77.8)	0.676 ^{x2}
First degree	9 (16.7)	7 (13)	
Second degree	7 (13)	5 (9.3)	

Test symbols ^UMann–Whitney U, ^{x2}Chi-square test, ^AFisher–Freeman–Halton exact test, ^BFisher's exact test, SD: Standard deviation

significant enhancement toward knowledge and self-care practice. Among the intervention group, several knowledge items, including chemo-related hematologic effects (item 5: 72.2% vs. 20.4%), chemotherapy only destroying cancer cells (item1: 81.5% vs. 25.9%), and sunscreen safety (item 4: 81.5% vs. 29.6%), significantly had a higher correct response rates in comparison to the control group. In terms of practice, participants from the intervention group showed the greatest change in avoiding harmful practice habits related to unnecessary home isolation (item 10: 87% vs. 25.9%) and fatigue-related light exercise management (item 12: 88.9% vs. 37%) compared to the control group.

Table 3 demonstrates the association between study group and levels of knowledge and practice toward

TABLE 2: Comparison of knowledge and practice between groups at baseline and post-intervention

Study outcome	Groups (54/G)	Baseline		Post-intervention		Baseline-adjusted effect (ANCOVA)		
		Mean±SD	P-value	Mean±SD	P-value	Adj. diff.	95% CI	η ² (p)
Knowledge	Control	0.275±0.173	0.383	0.386±0.179	<0.001	0.344	0.276–0.411	0.491
	Intervention	0.307±0.195		0.735±0.179				
Practice	Control	0.389±0.203	0.107	0.622±0.229	<0.001	0.154	0.069–0.238	0.110
	Intervention	0.441±0.200		0.778±0.208				
Knowledge and Practice	Control	0.323±0.137	0.144	0.485±0.164	<0.001	0.259	0.200–0.318	0.418
	Intervention	0.363±0.152		0.753±0.149				

P-values from the Mann–Whitney U Test, ANCOVA: Analysis of Covariance, Adj. diff.: baseline-adjusted mean difference, η²: partial eta squared, SD: Standard deviation

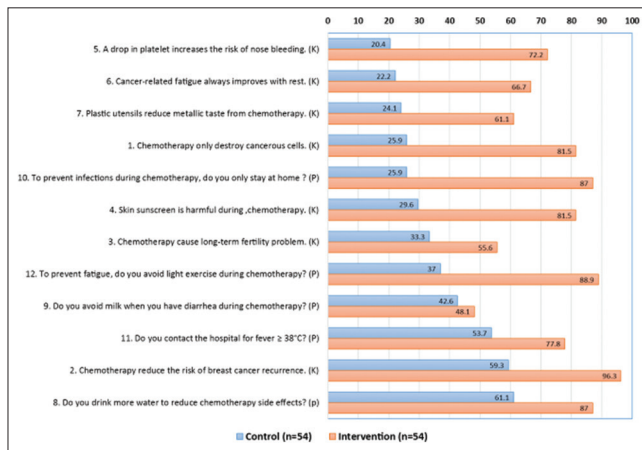


Fig. 2. Post-intervention correct response rate (%) for knowledge and practice by groups.

chemotherapy at baseline and post-intervention. At baseline, both groups started with statistically parallel distributions of knowledge, with the largest portion located in the low category ($P > 0.05$). Following the post-test, the intervention group showed a significant increase in the level of knowledge ($P < 0.001$) and practical domain ($P = 0.005$); the intervention group largely transitioned into a (high) knowledge level (81.5%), practice (68.5%), and combined knowledge and practice (70.4%). However, a large proportion of the control group remained at a low level of knowledge (48.1%) and showed slight movement from low to high level of practice (38.9%), and a large proportion expressed a low level (46.3%) of knowledge and practice in combination. These post-intervention associations were very strong for knowledge (Cramér's $V = 0.77$) and the combined outcome ($V = 0.66$) and moderate for practice ($V = 0.31$), consistent with the baseline-adjusted effects in Table 2.

3.3. Association between Sociodemographic and Clinical Characteristics with the Study Outcome

As shown in Table 4, an exploratory analysis within the

intervention group at post-intervention ($n = 54$) indicated that age, marital status, occupation, laterality, type of chemotherapy, and family history of breast cancer were not significantly associated with patients' knowledge and practice ($P > 0.05$). While the level of education showed a significant, large association with knowledge ($\epsilon^2 = 0.23$, $P = 0.015$); however, as an exploratory finding among multiple uncorrected comparisons, it should be interpreted with caution.

4. DISCUSSION

This quasi-experimental study examined the effectiveness of a systematic educational program on chemotherapy adverse effects-related knowledge and self-care practice among women with breast cancer in the oncology outpatient unit. The findings supported that a concise, structured intervention program accompanied by a booklet over 2 months significantly improved participants' understanding of cytotoxic adverse effects and their self-care management.

Before the intervention, results revealed no significant differences between the control and intervention groups on any of the examined sociodemographic data, clinical characteristics, or knowledge and practice domain of the study sample. This homogeneity supports linking the observed changes to the educational intervention rather than baseline differences [24]. Furthermore, the study results indicated that participants from both control and intervention groups had low levels of knowledge and inadequate self-care practices toward chemotherapy and related adverse effects. This outcome aligns with previous results from local and international studies that acknowledged that patients with cancer, including breast cancer, had a lack of information and practice about chemotherapy and related adverse effects [25], [26].

The post-intervention test revealed that the overall mean score of knowledge and practice was improved among breast cancer respondents in the intervention group. As well,

TABLE 3: Association between study group and levels of knowledge and practice at pre- and post-intervention

Time	Outcome	Outcome levels	Control (54) F (%)	Intervention (54) F (%)	P-value	Cramér's V
Baseline	Knowledge	Low	36 (66.7)	32 (59.3)	0.655	—
		Moderate	17 (31.5)	20 (37.0)		
		High	1 (1.9)	2 (3.7)		
	Practice	Low	39 (72.2)	31 (57.4)	0.160	—
		Moderate	11 (20.4)	20 (37.0)		
		High	4 (7.4)	3 (5.6)		
Post-test	Knowledge and Practice	Low	46 (85.2)	39 (72.2)	0.100	—
		Moderate	8 (14.8)	15 (27.8)		
		High	4 (7.4)	3 (5.6)		
	Knowledge	Low	26 (48.1)	1 (1.9)	<0.001	0.77
		Moderate	24 (44.4)	9 (16.7)		
		High	4 (7.4)	44 (81.5)		
	Practice	Low	17 (31.5)	6 (11.1)	0.005	0.31
		Moderate	16 (29.6)	11 (20.4)		
		High	21 (38.9)	37 (68.5)		
	Knowledge and Practice	Low	25 (46.3)	2 (3.7)	<0.001	0.66
		Moderate	24 (44.4)	14 (25.9)		
		High	5 (9.3)	38 (70.4)		

P-values from the Chi-square test, Cramér's V is reported as the effect size for significant post-intervention associations (≈ 0.07 small, 0.21 medium, 0.35 large), —: not reported for non-significant baseline comparisons. Bold values: indicates significant association ($P < 0.05$) and their effect size.

TABLE 4: Association between participants' characteristics and the study outcomes related to chemotherapy

Participants characteristic	n	Knowledge			Practice		
		Mean $\pm$ SD	P-value	Effect size	Mean $\pm$ SD	P-value	Effect size
Age (Groups)							
<45	31	0.747 $\pm$ 0.191	0.421 ^U	0.11 ^r	0.768 $\pm$ 0.207	0.614 ^U	0.07 ^r
≥ 45	23	0.721 $\pm$ 0.164			0.791 $\pm$ 0.213		
Marital status							
Married	45	0.743 $\pm$ 0.182	0.269 ^U	0.15 ^r	0.800 $\pm$ 0.195	0.114 ^U	0.22 ^r
Unmarried	9	0.698 $\pm$ 0.167			0.667 $\pm$ 0.245		
Level of education							
Literate	14	0.602 $\pm$ 0.225	0.015 ^K	0.23 ^{e2}	0.671 $\pm$ 0.202	0.318 ^K	0.03 ^{e2}
Primary school	15	0.752 $\pm$ 0.166			0.800 $\pm$ 0.131		
Secondary school	7	0.796 $\pm$ 0.076			0.771 $\pm$ 0.138		
Institute level	8	0.768 $\pm$ 0.074			0.800 $\pm$ 0.107		
$\geq$ University	10	0.829 $\pm$ 0.148			0.760 $\pm$ 0.184		
Occupation							
Employed	13	0.780 $\pm$ 0.138	0.570 ^U	0.08 ^r	0.831 $\pm$ 0.138	0.427 ^U	0.11 ^r
Housewife/Retired	41	0.721 $\pm$ 0.189			0.761 $\pm$ 0.225		
Laterality breast cancer							
Right side	24	0.702 $\pm$ 0.188	0.631 ^K	0.02 ^{e2}	0.800 $\pm$ 0.204	0.560 ^K	0.02 ^{e2}
Left side	27	0.762 $\pm$ 0.177			0.748 $\pm$ 0.219		
Bilateral	3	0.762 $\pm$ 0.082			0.867 $\pm$ 0.115		
Type of chemotherapy							
Neoadjuvant	21	0.708 $\pm$ 0.224	0.686 ^U	0.05 ^r	0.762 $\pm$ 0.175	0.392 ^U	0.12 ^r
Adjuvant	33	0.753 $\pm$ 0.144			0.788 $\pm$ 0.229		
Family history of breast cancer							
Yes (1 st and 2 nd degree)	12	0.655 $\pm$ 0.255	0.169 ^U	0.19 ^r	0.867 $\pm$ 0.178	0.087 ^U	0.23 ^r
No	42	0.759 $\pm$ 0.146			0.752 $\pm$ 0.211		

Test symbols: U=Mann-Whitney U, K=Kruskal-Wallis test, Effect size: ϵ^2 =Epsilon-squared, r=Rank-biserial r. SD: Standard deviation

the level of knowledge and self-care practice transitioned toward the high category, while the control group remained

mainly in the low and moderate categories. This outcome suggested that the three-session educational program played

an important and valuable role in supporting and empowering clients during chemotherapy. The significant achievement of these outcomes informatively and clinically is primarily due to predetermined gaps and a detailed methodological plan for intervention. The three meetings' design permitted effective information repetition and consolidation, while the self-care booklet significantly adapted the complex chemotherapeutic process into applicable, continuous self-care practice. By addressing the disparity between conceptual knowledge and practical implementation, the educational resources empowered breast cancer patients to actively expand their knowledge and adhere to self-care practice toward side effects. Similar to our results, previous studies that have the same design and population have stated that structured educational programs are associated with greater knowledge and practice concerning chemotherapy and related adverse effects [27].

In the present study, a remarkable change was noticed in the knowledge domain among participants from the intervention group after the program. A high proportion of several items were correctly answered by participants, such as item 5 concerning chemotherapy-related hematologic effects, item 1 related to chemotherapy mechanisms, and item 4 linked to skin care during chemotherapy. Conversely, this alteration was not detected in the control group. By means of this educational program, breast cancer patients expanded their understanding of how chemotherapy affects normal and cancerous cells and how this effect translates to various signs and symptoms in the body organs. The educational information also extended to focus on specific changes from skin and hair to effects on hematologic changes from their basic source in the bone marrow. Our results are also similar to an interventional study by Iranian researchers showing that peer education trials significantly result in improved chemotherapy-related knowledge and comprehension among cancer patients [28].

In terms of the self-care practice domain, the present study also indicated that the largest improvement was reported in practice items such as item 10 related to unnecessary home isolation and item 12 concerning management of fatigue-related chemotherapy. Introducing such scientific behavior in the management of self-care during chemotherapy is fundamentally linked to intervention-based knowledge that results in correction of misconceptions, enhanced symptom management, and increased quality of life. These outcomes support global evidence indicating the impact of structured education in improving self-care practice during chemotherapy [29], [30]. The control group's practice

score also rose (0.389–0.622) without any formal teaching. This likely reflects a testing effect [24], since the baseline interview itself drew attention to self-care behaviors, alongside informal learning from oncologists, nursing staff, and other patients over 2 months, and symptom-driven adaptation as women managed fatigue and febrile episodes for the first time. Accordingly, the intervention's gradual effect on practice was modest (adjusted difference 0.154; $\eta^2 = 0.110$).

In this study, the only factor significantly associated with knowledge was level of education ($\epsilon^2 = 0.23$, $P = 0.015$). Although this was an exploratory analysis with multiple uncorrected comparisons, the finding is consistent with well-established evidence on the role of health literacy in cancer patients' ability to understand complex medical information [31], [32], giving it credibility. Perhaps clinically, the most encouraging aspect of this study was that participants' background did not determine their ability to improve their health behaviors. As shown in Table 4, sociodemographic and clinical factors, including age, marital status, occupation, laterality of breast cancer, type of chemotherapy, and family history of breast cancer, revealed no statistically significant association with knowledge and self-care practice improvement. This result is similar to previous studies that indicated no association between study outcomes and sociodemographic data [26], [33]. In addition, this standardized improvement in knowledge and practice related to chemotherapy supports self-efficacy in oncology care. These results suggest that the interventions benefited breast cancer patients across sociodemographic backgrounds.

5. LIMITATION OF THE STUDY

Limitations included non-randomization with sequential allocation; lack of blinding; self-reported binary outcomes subject to testing and social-desirability effects; a researcher-developed instrument; small sample size; short (two-month) follow-up; and a single-center setting limiting generalizability. Future research should use randomized controlled designs, larger and more heterogeneous samples, longer follow-ups, and externally validated instruments.

6. CONCLUSION

The findings of this study indicated that structured educational intervention was associated with improvement in knowledge and self-care practice of chemotherapy adverse

effects in patients with breast cancer. The post-test results showed a significant improvement in knowledge and self-care practice in the intervention group after adjustment for baseline. The only characteristic that was associated with knowledge was the level of education, but this exploratory finding needs to be confirmed in future studies.

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