

Effectiveness of slow deep breathing exercises on fatigue in patients undergoing chemotherapy

Zahraa Jasim Alwan¹, Hassan Abdullah Athbi²

¹ Academic Nurse, Imam Al-Hussein Medical City Ministry of Health, Kerbala Health Directorate, Iraq

² PhD/Associate Professor, Adult Nursing Department, College of Nursing, University of Kerbala, Iraq

ABSTRACT

Background: Fatigue is one of the most common distressing side effects of cancer and its treatment. Cancer-related fatigue disrupts many aspects of a patient's quality of life.

Objectives: This study is designed to examine the effectiveness of slow deep breathing exercises on fatigue in patients undergoing chemotherapy.

Methods: A quasi-experimental study was conducted from September 26th, 2022, to June 12th, 2023, at the Imam Al-Hussein Center for Oncology and Hematology and the oncology wards of Imam Al-Hassan Al-Mujtaba Teaching Hospital, Kerbala, Iraq. Forty-eight patients with cancer undergoing chemotherapy were divided into two groups of 23 and 25 as intervention and control groups, respectively. Patients in the intervention group performed slow, deep breathing exercises for 7 days. The control group's patients received routine conventional care. Both a descriptive analysis procedure (e.g., frequency, percentage, and mean of score) and an inferential analysis procedure (e.g., paired sample T-test, independent sample T-test) were used to examine and measure the study results; a p-value of <0.05 was determined to be statistically significant.

Results: Most of the participants were in the age group of 51 years–60 years old. More than one-third (39.1%) of the participants in the intervention group had breast cancer, and 34.8% of them had gastrointestinal cancer, while 24% of the control group had gastrointestinal cancer. At the pre-test, 60.9% of participants in the intervention group had a high fatigue level, and 39.1% presented with a borderline fatigue level. However, after the intervention, 56.5% of patients in the intervention group had a borderline fatigue level, and 43.5% did not have fatigue. A significant difference at a P-value ≤ 0.001 was found between the post-test and pre-test of the intervention of slow, deep breathing exercises.

Conclusion: Slow, deep breathing exercises can be effectively used for 15 minutes-20 minutes twice daily for seven days to reduce fatigue levels among patients receiving chemotherapy.

Key words: slow deep breathing exercises, cancer-related fatigue

INTRODUCTION

Chemotherapy is significant treatment option for patient with cancer by which medications can eradicate cancerous cells. It is the cornerstone of cancer treatment and effectively extends and improves quality of life by easing or relieving cancer symptoms [1]. The Food and Drug Administration (FDA) has approved a variety of chemotherapeutic drugs that have been used specifically for cancer patients [2]. Sleep issues, pain, nausea, vomiting, anorexia, anxiety, depressive symptoms, fatigue, diarrhoea, constipation, and alopecia are a few of the adverse effects associated with chemotherapy [1].

Cancer-Related Fatigue (CRF) is one of the main factors contributing to the distress of cancer survivors. The prevalence of CRF reported by patients in the United States of America (USA) previously ranged from 4% to 99%; however, a recent study conducted in the USA discovered a prevalence of 45% of moderate to severe CRF in cancer survivors [3]. CRF affect the physical health, cognitive abilities, and affective abilities (reduce motivation). The ability to return to normal life, including their work ability, is also limited by CRF [4].

The National Comprehensive Cancer Network (NCCN) Guidelines recommended evidence-based pharmacological interventions, such as psychostimulant drugs as a viable option for treating persistent nontrivial CRT [5]. CRF has been treated with antidepressants with Selective Serotonin Reuptake Inhibitor (SSRI) activity, both with and without norepinephrine and dopamine neurotransmitter systems [6]. The NCCN Clinical Practice Guidelines in Oncology recommended that the first line of treatment for CRF should be non-pharmacological interventions [7].

Deep breathing, also called diaphragmatic breathing, is a mind and body technique for relaxation. Participants in this exercise must contract their diaphragms while inhaling and exhaling slowly. It is also stimulating the vagus nerve and increase the blood oxygen level, also it is stimulating the vagus nerve [8]. Deep breathing exercises causes incoming oxygen to be stimulated, which can increase the lung ventilation and lead to relaxation. The result will stimulate the body to release endogenous opioids, enkephalin, and endorphins by causing vasodilation and increasing blood flow to spasm and ischemic regions [9]. Deep breathing exercises have been shown to regulate nearly all physiological activities in the body. As a result, in addition to intensifying the process of energy production, breathing slowly and deeply results in increased transport of oxygen to the vital body organs. Additionally, it increases muscle relaxation, boosts cardiovascular health, and

Address for correspondence:

Zahraa Jasim Alwan,
Academic Nurse, Imam Al-Hussein Medical City Ministry of Health,
Kerbala Health Directorate, Iraq
Email: zahraa.j@s.uokerbala.edu.iq

Word count: 3855 **Tables:** 04 **Figures:** 01 **References:** 15

Received:- 25 July, 2023, Manuscript No. OAR-23-110627

Editor assigned:- 28 July, 2023, Pre-QC No. OAR-23-110627 (PQ)

Reviewed:- 05 August, 2023, QC No. OAR-23-110627 (Q)

Revised:- 12 August, 2023, Manuscript No. OAR-23-110627 (R)

Published:- 01 September, 2023, Invoice No. J-110627

therefore has a helpful impact on reducing fatigue [10]. Although, several studies provide the effectiveness of non-pharmacological intervention in reducing fatigue level. A randomized controlled study conducted in Japan to examine the effects of deep breathing on fatigue in women with gynaecological cancer receiving chemotherapy revealed that deep breathing exercises can decrease fatigue in this type of patient [11]. A randomized controlled trial was conducted in Egypt's Mansoura city to examine the effect of relaxation breathing exercises on fatigue in women with gynaecological cancer receiving chemotherapy. The study emphasized that this exercise is a safe procedure to decrease CRF [12].

Fatigue caused by cancer or its treatment is still a stressful issue for cancer survivors and has an adverse effect on their health and quality of life. Despite previous studies on managing fatigue in patients with cancer, the environment and psychological state of the patient also greatly impact the fatigue they feel. Since it is now commonly known that deep breathing has a relaxing impact and that doing so may help with fatigue, the researchers in this study attempted to find out how slow, deep breathing affects fatigue levels in patients receiving chemotherapy.

Objectives

This study aimed to examine the effectiveness of slow-deep breathing exercises on levels of fatigue in patients undergoing chemotherapy.

MATERIALS AND METHODS

Study design and participants

A quasi-experimental study was conducted from 26th September 2022, to 12th June 2023. The study was conducted at Imam Al-Hussein Oncology and Hematology Center, and the oncology wards at Imam Al-Hassan Al-Mujtaba Teaching Hospital which is located in Holy Kerbala City. The sample was selected using a purposive nonrandomized sampling method, the sample size was 48 patients with cancer receiving chemotherapy, and those were distributed into two groups, 25, and 23 as a control and intervention group respectively (Figure 1).

Data collection instruments

The study instrument consist of two parts:

First part: Socio-demographic features and clinical data that includes age, gender, marital status, education level, occupation, cancers location/system, tumor stage, and pre-existing chronic diseases.

Second part (Fatigue severity scale): This part is concerned with fatigue severity which was firstly developed by Krupp et.al, (1988). This scale includes nine items to determine the severity of fatigue by encircling the numbers (1) for strongly disagree to (7) for strongly agree in front of the scale phrases. The scoring was prepared by calculating the average responses to the questions (adding up all the answers and divided by nine). The fatigue severity scores were classified into three levels of 'high fatigue level' (fatigue severity score ≥ 5), 'borderline fatigue level' ($4 < \text{fatigue severity score} < 5$) and 'no fatigue' (fatigue severity score ≤ 4) [13].

Intervention

The interventional protocol for this study was prepared by the researchers after reviewing related references and previous studies [10, 12, 14], as well as their own experience. This interventional protocol includes the application of slow, deep breathing exercises through the nose while the mouth is closed, keeping them on for a few seconds, and then exhaling slowly through the mouth. The patients in the intervention group were instructed to perform deep breathing exercises at home for 15 minutes-20 minutes twice daily for seven days starting from the day of the chemotherapy session. The researchers followed up with the patients two times per day to remind them to perform the exercises and to instruct them on the protocol. The follow-up method was done through the phone by establishing communication groups on social media sites (WhatsApp and Telegram) and naming them breathing exercise groups, and by communicating with patients through telephony (SIM-Card). During this follow-up, the researchers monitored the patient's adherence and responses to the intervention. The data collection process was carried out from February 10th, to April 15th, 2023, using the interviewing technique.

Statistical analysis

The study data were investigated and analysed by using the IBM program of Statistical Package of Social Sciences Version 26, both a descriptive analysis procedure e.g, frequency, percentage, and mean of score were used to summarized the study result, and inferential analysis procedure e.g, paired sample T-test were used

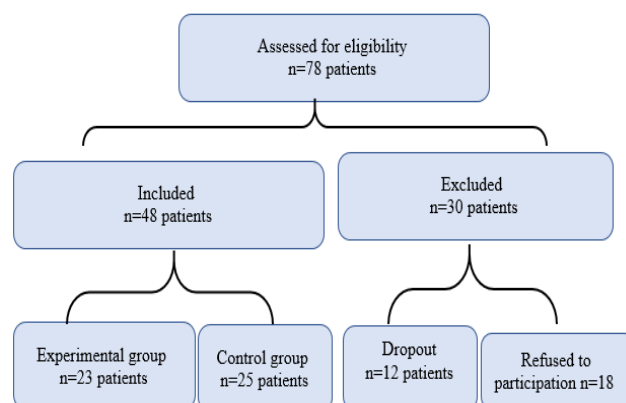


Fig 1. Flowchart of the eligibility criteria.

to compare among the same group, independent sample T-test were used to compare among the two group, chi square test were used to investigate the difference between groups. A p-value of <0.05 was determined as a statistically significant.

Ethical considerations

An authorization was achieved from the Ethical Committee at the College of nursing/ University of Kerbala (code: IQUOKCON. 1502.66) at 3 November 2022. Furthermore, an informed consent was attained from each patient who participated in this study, as well as, each participant is assumed the right to be withdrawn from the study at any time.

RESULTS

Table 1 indicates that most of patients were within age group (51-60) years old, and accounted 39.1% and 36% for intervention and control group respectively; approximately two thirds (65.2%) of the intervention group and about one half (52%) of the control group were females. Regarding the marital status, the majority of the patients in the intervention and control group were married and accounted (80%) and (95.7%) for control and intervention group respectively. In concern to the education level approximately one-third (34.8%) of patients were in the intervention group and 44% in the control group have had middle school education.

Table 2 indicates that are 39.1% of the patients in the intervention group were have breast cancer and 34.8% of them have gastrointestinal cancer. 16%, and 24% for patient involves in the control group have a breast cancer and gastrointestinal respectively.

Concerning to the tutor stage in the intervention group there are approximately one-third (39.1%, 34.8%) were have stage II and stage IV, also in the control group there are approximately one half (48%) and more than quarter (28) have stage II and stage III respectively. Regarding the pre-existing chronic disease this table exposed that about one-half (56.5%), (52%) of the intervention and control group didn't have a chronic disease respectively.

Table 3 reveals that are 68% of patients in the control group have a high fatigue level at the pretest period, while after seven days most (76%) of participants have a high fatigue level, this indicate that the conventional therapy does not effective in reducing the fatigue levels and there was a significant statistical difference was found between pre-test and post-test was found at p-value of (0.002). On the other hand, two third (60.9%), and more than one third 39.1% of participants in the intervention group have a high level and borderline fatigue level at pre-test period, and after implementing the procedure, more than one half (56.5%) within borderline fatigue and 43.5% does not have fatigue, in addition to that, there are a significant statistical difference in the fatigue levels between pre-test and post-test at p-value of (0.001).

Table 4 show a non-significant statistical difference (p=0.078) in fatigue level between intervention and control group (pre-test), while after 7 days of intervention, this table exposed a significant statistical difference at p-value=0.02 between intervention and control group at post-test period.

DISCUSSION

The results of this study, as shown in Table 3, reveal that more

Tab. 1. Comparisons the participants' socio-demographic characteristics between intervention and control groups

Socio-demographic characteristics		Intervention group		Control group		P-value
		Frequency	%	Frequency	%	
Age groups(years)	20-30	2	8.7	4	16	0.788 ^a
	31-40	6	26.1	4	16	
	41-50	6	26.1	8	32	
	51-60	9	39.1	9	36	
	MS ± SD	45.6±10.4		45.4 ± 10.8		
	Total	23	100	25	100	
Gender	Male	8	34.8	12	48	0.653 ^b
	Female	15	65.2	13	52	
	Total	23	100	25	100	
Marital status	Not married	0	0	3	12	0.393 ^a
	Married	22	95.7	20	80	
	Widow/	0	0	2	8	
	Widower					
	Divorced	1	4.3	0	0	
Total	23	100	25	100		
Educational level	Reads and writes	1	4.3	0	0	0.616 ^a
	Elementary school	5	21.7	4	16	
	Middle school	8	34.8	11	44	
	High school	3	13	6	24	
	Diploma	3	13	2	8	
	Bachelor's and above	3	13	2	8	
	Total	23	100	25	100	
Occupation	Worker	2	9.1	2	8.7	0.491 ^a
	Farmer	2	9.1	1	4.3	
	Employment	7	31.8	8	34.8	
	Retired	0	0	1	4.3	
	Housewife	9	40.9	11	47.8	
	Does not work	2	9.1	0	0	
	Total	22	100	23	100	

%=Percentages; MS=Mean of score; SD=Standard deviations; NS=Non- significant (P value >0.05), an Independent-sample t-test, b Chi-square test.

Tab. 2. Comparisons the participants' clinical data between intervention and control groups

Variables	Intervention group		Control group		p-value	
	Frequency	%	Frequency	%		
Cancers Location/System	Breast Cancer	9	39.1	4	16	0.71 ^a NS
	Respiratory	3	13	4	16	
	Gastrointestinal	8	34.8	6	24	
	Hematologic/ Blood	0	0	2	8	
	Genitourinary	1	4.3	4	16	
	Gynecologic	1	4.3	2	8	
	Others	1	4.3	3	12	
Cancer Stage	Stage I	2	8.7	0	0	0.425 ^a NS
	Stage II	9	39.1	12	48	
	Stage III	4	17.4	6	24	
	Stage IV	8	34.8	7	28	
Preexisting chronic diseases	Hypertension	7	30.4	4	16	0.344 ^a NS
	DM	1	4.3	5	20	
	Both	2	8.7	3	12	
	No	13	56.5	13	52	

%=Percentages; X2: NS=Non- significant (p-value >0.05), a Independent-sample t-test.

Tab 3. Comparison the fatigue levels within groups at pre-test and post-test period

Fatigue levels	Control group		p-value ^a	Intervention group		p-value ^a
	Pre-test	Post-test		Pre-test	Post-test	
	f(%)	f(%)		f(%)	f(%)	
No fatigue	0	0	0.002	0	10	0.001
	0	0		0	-43.5	
Borderline fatigue	8	6	S	9	13	S
	-32	-24		-39.1	-56.5	
High fatigue	17	19		14	0	
	-68	-76		-60.9	0	
Total	25	25		23	23	
	-100	-100		-100	-100	
MS ± SD	5.59 ± 0.84	5.80 ± 0.83		5.20 ± 0.59	4.05 ± 0.47	

f=frequencies; %=Percentage; a paired-sample t-test; S=Significant (p-value ≤ 0.05).

Tab 4. Comparison the fatigue level between groups in two-time period

Fatigue levels	Pre-test		p-value ^a	Post-test		p-value ^a
	Control	Intervention		Control	Intervention	
	f(%)	f(%)		f(%)	f(%)	
No fatigue	0	0	0.078	0	10	0.02
	0	0		0	-43.5	
Borderline fatigue	8	9	NS	6	13	
	-32	-39.1		-24	-56.5	
High fatigue	17	14		19	0	S
	-68	-60.9		-76	0	
Total	25	23		25	23	
	-100	-100		-100	-100	
MS ± SD	5.59 ± 0.84	5.20 ± 0.59		5.80 ± 0.83	4.05 ± 0.47	

f=frequencies; %=Percentage; a independent-sample t-test; NS=Non significant; S=Significant (p-value ≤ 0.05).

than two-thirds (68%) of patients in the control group had a high fatigue level at the pre-test period, while after seven days, most (76%) of patients had a high fatigue level. This indicates that conventional therapy was not effective in decreasing the level of fatigue, and in addition to that, a significant statistical difference at a p-value of 0.002 was found between the pre-test and post-test for the control group, this indicates that a deterioration in fatigue level in this group of patients. On the other hand, for the intervention group, 60.9% and 39.1% of patients had a high and borderline fatigue level at the pre-test period, more than one-half (56.5%) had borderline fatigue, and 43.5% did not have fatigue at the post-test period. In addition to that, there is a significant statistical difference at a P-value of 0.001 in the fatigue level between the pre-test and post-test for the intervention group. This means not implementing the procedure significantly increases the fatigue

level in patients undergoing chemotherapy, while implementing slow, deep breathing exercises may reduce the fatigue level in patients undergoing chemotherapy. A quasi-experimental study conducted to examine the effectiveness of relaxation breathing exercises on fatigue levels among patients with gynaecological cancer undergoing chemotherapy. This study reported that performing relaxation breathing exercises four times a day for seven days was more effective in relieving fatigue than doing them two times a day for seven days [14]. Also, this finding comes along with the result of a study that was conducted to examine the effectiveness of deep breathing exercises and pranayama in decreasing fatigue levels among patients with breast cancer receiving radiation therapy. The result of this study revealed that the level of fatigue increased from the beginning of radiation therapy through the end of the treatment for the control group (five weeks later). The

fatigue decreased in both intervention groups when compared to the beginning of the radiation therapy [15].

When comparing the fatigue level between the control and intervention groups at pre- and post-intervention, as shown in Table 4, the result exposed a non-significant statistical difference at a p-value of 0.078 in the fatigue level between the two groups at pretest. Conversely, a significant statistical difference at a P-value of (0.02) in the fatigue level between two groups at the post-test indicates the beneficial effect of performing slow, deep breathing exercises in decreasing the level of fatigue. This finding, which was supported by the findings of a randomized quasi-experimental study conducted to investigate the impact of deep breathing exercise training on fatigue level in maintenance haemodialysis patients, reveals that the total mean fatigue score was higher in the intervention group before participating in breathing exercise than in the control group, with a non-statistical significance difference at a p-value of 0.167. Additionally, the total mean fatigue score was statistically lower in the intervention group than in the control group following the implementation of the intervention (p=0.001) [10].

STUDY LIMITATIONS

The main limitation of the current study was that patients self-administered slow, deep breathing exercises; thus, they might not have followed the intervention closely because of physical or psychological issues. Additionally, there was no follow-up assessment time, and the study intervention was also rather brief. Additional study is recommended to assess the long-term impacts of slow, deep breathing exercises on CRF.

CONCLUSION

Slow, deep breathing exercises can be used effectively as a non-invasive non-pharmacological intervention for 15 minutes-20 minutes twice daily for seven days to reduce fatigue levels in patients receiving chemotherapy. This intervention is helpful for all patient regardless their sociodemographic characteristics and clinical data.

Nursing implications

Patients with different types of cancer who are planned for chemotherapy complains of great complications such as fatigue. Thus, the nurse must act as an active member to provide a holistic care for patients with cancer by enabling them to perform self-care approaches to decrease or relieve their complaints, thereby enhancing their quality of life. Therefore, the application of slow deep breathing exercises in the routine hospital care is important in providing a practical nursing role for such patients, as well as, this intervention may contribute to improve quality of nursing care. Slow deep breathing exercises can be performed independently anytime and anywhere, which expands their applicability, therefore, this exercises can be taught to patients undergoing chemotherapy to reduce the fatigue level and consequently improving their functional abilities.

ACKNOWLEDGMENTS

The authors would like to express a deepest appreciation to all participated patients for their cooperation, as well as a grateful thanks to the Research Ethics Committee members at the Karbala University/College of Nursing for their guidance and advice. Also, special thanks to all members in the Holy Kerbala Health directorate/Imam Al-Hussein Center for Oncology and Hematology and Imam Al-Hassan AL-Mujtaba for their positive efforts and valuable assistance.

FINANCIAL DISCLOSURE

This study derived from a Master's thesis in nursing science accepted and approved by College of nursing at Kerbala University, Kerbala, Iraq.

CONFLICT OF INTEREST

Nothing will happen to harm any person.

REFERENCES

1. Rosyid FN, Kristinawati B, Fitriani N, Rahman AF. Reducing Sleep Disturbance by Using Slow Deep Breathing and Dhikr in Cancer Patients During Chemotherapy. *Nusantara Sci Technol Proc.* 2022 Mar 30:54-60.
2. Zhao CY, Cheng R, Yang Z, Tian ZM. Nanotechnology for cancer therapy based on chemotherapy. *Molecules.* 2018; 23:826.
3. Kessels E, Husson O, Van der Feltz-Cornelis CM. The effect of exercise on cancer-related fatigue in cancer survivors: a systematic review and meta-analysis. *Neuropsychiatr Dis Treat.* 2018 9:479-94.
4. Ruiz-Casado A, Alvarez-Bustos A, de Pedro CG, Mendez-Otero M, Romero-Elias M et al. Cancer-related fatigue in breast cancer survivors: a review. *Clin Breast Cancer.* 2021; 21:10-25.
5. Belloni S, Arrigoni C, de Sanctis R, Arcidiacono MA, Dellafiore F., et al. A systematic review of systematic reviews and pooled meta-analysis on pharmacological interventions to improve cancer-related fatigue. *Crit Rev Oncol Hematol.* 2021; 166:103373.
6. Yennurajalingam S, Lu Z, Rozman De Moraes A, Tull NN, Kubiak MJ, et al. Meta-Analysis of Pharmacological, Nutraceutical and Phytopharmaceutical Interventions for the Treatment of Cancer Related Fatigue. *Cancers.* 2022; 15:91.
7. Wu C, Zheng Y, Duan Y, Lai X, Cui S, et al. Nonpharmacological interventions for cancer-related fatigue: A systematic review and Bayesian Network Meta-Analysis. *Worldviews Evid Based Nurs.* 2019; 16:102-10.
8. Toussaint L, Nguyen QA, Roettger C, Dixon K, Offenbacher M, et al. Effectiveness of progressive muscle relaxation, deep breathing, and guided imagery in promoting psychological and physiological states of relaxation. *Evid Based Complement Alternat Med.* 2021; 2021.
9. Isnaini N, Hidayati T, Sumaryani S. Effect of combination of slow deep breathing and ice therapy towards comfort level in arteriovenous fistula insertion of hemodialysis patients in PKU Muhammadiyah Hospital Yogyakarta. *Farmasi.* 2018; 7.
10. A Hamed L, Mohamed Abdel Aziz T. Effect of Deep Breathing Exercise Training on Fatigue Level among Maintenance Hemodialysis Patients: Randomized Quasi-experimental Study. *Egyptian J Health Care.* 2020; 11: 634-44.
11. Hayama Y, Inoue T. The effects of deep breathing on 'tension-anxiety' and fatigue in cancer patients undergoing adjuvant chemotherapy. *Complement Ther Clin Pract.* 2012; 18:94-8.
12. Ibrahim El-Feshawy N, Abo Bakr Mohamed H, El-Sayed Mohamed El-Sayed H, Ibrahim Hamdy Aboraiah M. Effect of relaxation breathing exercise on fatigue for women with gynecological cancer receiving chemotherapy. *Egyptian J Health Care.* 2020; 11:821-32.
13. Ferentinos P, Kontaxakis V, Havaki-Kontaxaki B, Dikeos D, Lykouras L. Psychometric evaluation of the Fatigue Severity Scale in patients with major depression. *Qual Life Res.* 2011:457-65.
14. Afyanti Y, Achmad EK, Sangkala MS. Effectiveness of relaxation breathing exercise on fatigue in gynecological cancer patients undergoing chemotherapy. *Int J Nurs Sci.* 2018; 5:331-5.
15. Gündođdu F, Koçuşlı S. Using Pranayama and Deep Breathing Exercises to Reduce Cancer-Related Fatigue and Insomnia during Radiotherapy: A Randomized Controlled Study.