RESEARCH ARTICLE

Editorial Process: Submission:05/31/2024 Acceptance:06/01/2025

The Effect of Laughter Yoga on Chemotherapy-Induced Symptoms and Sleep Quality in Patients with Haematologic Cancer

Ozlem Ugur*, Gulsah Bedez, Solmaz Zeybekci, Ezgi Karadag

Abstract

There are international studies that examine the effects of laughter yoga on the symptoms and quality of life of cancer patients as a complementary therapeutic method. **Aim:** This study aims to examine the effect of laughter yoga on chemotherapy-induced symptoms and sleep quality in patients with haematologic cancer. **Materials and Methods:** This study was conducted as a randomised controlled trial with two parallel treatment arms. The study was between November 2020 and December 2021. The sample was calculated with 60 patients including in the study. A total of 4 sessions of laughter yoga were applied in the experimental group for 45 minutes twice a week for two weeks. No intervention was applied to the control group; clinical routine care continued. **Results:** Pittsburgh Sleep Quality Index scores was analysed, a statistically significant difference was found between the scores of the intervention and control groups in the subjective sleep quality component. A significant difference was found between the scores of the intervention group in the sleep duration and sleep disturbances components. Based on the results from the Edmonton Symptom Assessment System, a statistically significant difference was found in the scores of pain and anxiety components in the intervention group, in the scores of tiredness/nausea/depression/drowsiness/appetite/well-being components in the intervention and control groups. **Conclusion:** A significant difference was found in the scores of the pain and anxiety components in the intervention group. It was also found that the scores of the sleep duration and sleep disturbances components in the intervention group were better than the control group.

Keywords: Laughter Yoga- chemotherapy-induced symptoms- sleep quality- haematologic cancer

Asian Pac J Cancer Prev, **26 (6)**, 1959-1970

Introduction

Cancer is not only a disease but also the second leading cause of death worldwide and globally one out of six deaths is due to cancer [1]. Although the incidence of haematologic malignancies ranks first among childhood cancers worldwide and in Turkey, they also represent an important group in adult patients [2].

Symptoms resulting from cancer and its treatment are common, regardless of the type of cancer, stage of the disease, or treatment received. Chemotherapy is particularly commonly used as a treatment. Symptoms such as pain and fatigue represent two of the most common symptoms experienced by individuals undergoing cancer treatment [3]. In a cross-sectional, observational study of 180 patients with hematological malignancies, the most distressing symptoms reported by patients were difficulty sleeping, pain, constipation, difficulty swallowing, problems with urination, low libido, swelling in the extremities, and hair loss. In particular, pain, difficulty sleeping, lack of energy/fatigue, and "I don't look like myself" were reported as "quite a lot" or "very distressing" by at least 50% of patients [4]. When studies on other cancer patients are examined, it has been shown that patients suffer intensely from many physical and emotional disorders such as pain, cachexia, taste changes, nausea, vomiting, fatigue, and anxiety related to the disease and treatment [5-7].

Sleep is an important notion that affects psychological and physiological health as well as being one of the essential daily life activities of individuals [8]. Sleep is also a recuperation process that frees the person from stress and responsibilities and restores his/her physical and mental energy. Sleep regulates, strengthens and repairs brain functions and allows the body to rest. It is important to define the sleep problems that patients suffer from and to identify the factors that cause problems in terms of symptom management [9]. Sleep disorders are very common in cancer patients, but they often ignore important problems that negatively affect the quality of life of patients. Studies have emphasized that the frequency of sleep disorders varies between 5-35% in the general

*Oncology Nursing, Dokuz Eylül University Nursing of Faculty, İzmir, Turkiye. *For Correspondence: ozlem.ugur@deu.edu.tr*

population, while it varies between 30% and 50% in cancer patients [10]. When analysed from this perspective, the symptoms that cancer patients go through should be managed and here, laughter therapy one of the best complementary and alternative therapeutic approaches can be used [7, 11-12].

Laughter therapy is a set of exercises that is named after the combination of laughter, relaxation and breathing exercises and involves breathing techniques and unconditional laughing [11]. In the literature it has been reported that laughter yoga physiologically improves breathing, relaxes muscles, stimulates circulation and the immune system, raises the pain threshold and pain tolerance by boosting endorphin hormone release, strengthens mental function by lowering the level of stress hormones, reduces the level of depression and anxiety, enhances sleep quality, and promotes psychological well-being by enhancing the interpersonal relationship and social interaction [13-14]. Laughter is reported to have a stress-reducing effect by suppressing the bioactivities of epinephrine, cortisol and 3,4-dihydrophenylacetic acid (a major dopamine catabolite). It is emphasised that reduced neurotransmitter activities such as norepinephrine, serotonin and dopamine are associated with depression and laughter produces a positive effect on anxiety and depression by boosting dopamine and serotonin activities [15]. It is reported to relax muscles by increasing physiological breathing in the body, lower depression and anxiety levels and enhance sleep quality [13, 16]. However, when the literature is examined, there is no study examining the effect of laughter yoga on symptom management in hematological cancers. Generally, existing studies are on dialysis patients, cancer patients and student studies [8, 17-19]. The study is important in this context in order to fill a gap. In this regard, this study aims to examine the effect of laughter yoga on chemotherapy-induced symptoms and sleep quality in patients with haematologic cancer.

Materials and Methods

Design of the Study and setting

This study was conducted as a randomised controlled trial with two parallel treatment arms. The experimental and control groups were designed with a parallel group structure consisting of hospitalized patients.The study was carried out in the Haematology Ward of the Dokuz Eylül University Research and Application Hospital between November 2020 and December 2021.

Participants and randomisation

The sample was calculated with G*Power version 3.1 based on a power interval of 80% and 60 patients including 30 in the intervention group and 30 in the control group were included in the study [17]. For randomisation, the participants were randomly assigned to two groups (Group A and Group B) in a 1:1 ratio as intervention and control groups. The randomisation through minimisation was achieved by stratification for gender and cancer type (leukaemia, lymphoma, multiple myeloma and others). The randomization process was conducted using the website https://www.randomizer.org/. Since patients were aware of their assigned group, blinding was not possible. The study's flow diagram is presented below (Figure 1). The study was planned as single blind since the patients were in single rooms. There was no interaction between

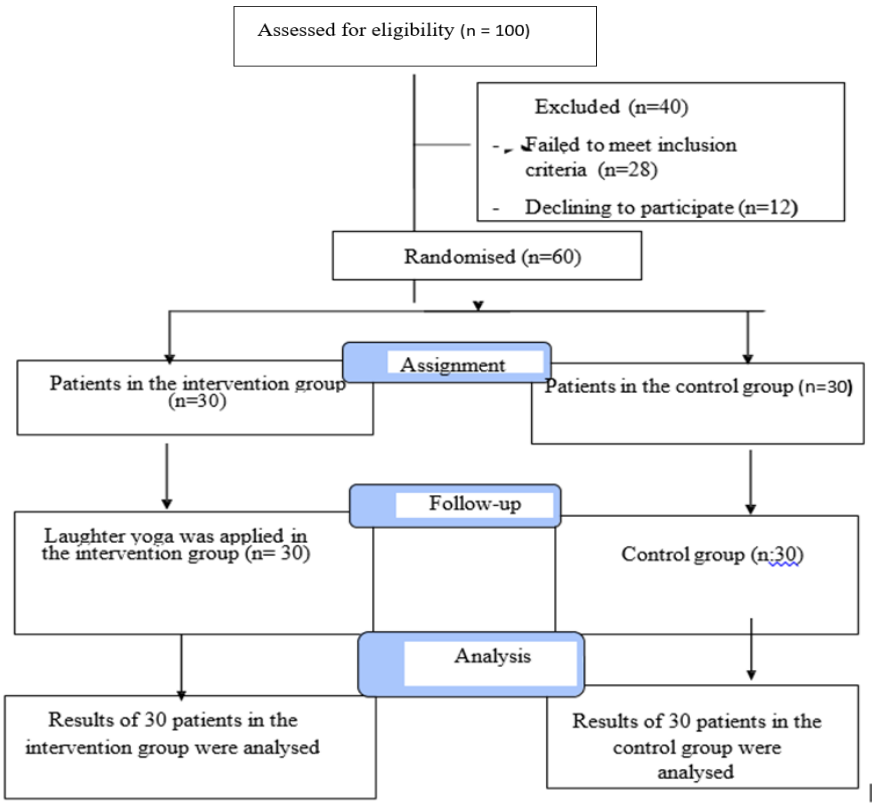

Figure 1. Consort Diagram

the experimental and control groups.

Inclusion Criteria

The patients who were 18 years of age or older, could speak Turkish, suffered from haematologic cancer (AML, ALL, Lenfoma, Multiple Myeloma), had no hearing or visual loss, had no cognitive and cognitive impairment, were treated with chemotherapeutic agents with high or moderate emetogenic risk and had an Eastern Cooperative Oncology Group (ECOG) performance score between 0-3 were included in the study [18].

Exclusion Criteria

The patients who were "involuntary to participate" in the study or not wanting to continue working from the study, had a major depressive disorder as a result of the file review, and had communication difficulties were excluded from the study [17].

Data Collection Tools

A Patient Information Form [17-19], the ECOG Performance Scale [20] , the Edmonton Symptom Assessment System [21], the Pittsburgh Sleep Quality Index [22] and the VAS - Sleep and Patient Satisfaction Scale [13, 23] were used to collect the data.

Patient Information Form: The researcher prepared the form by revi ewing the literature. [17-19]. The form includes questions such as age, gender, marital status, educational background, type of haematologic malignancy, economic level, number of chemotherapy cycles, and vital signs.

ECOG Performance Scale

The Zubrod score, first published in 1982, has since been adapted into the nearly identical WHO and ECOG (Eastern Cooperative Oncology Group) scores. These scores are entirely subjective and depend on the experience and opinion of the rater. The ECOG performance scale is used to assess patients' well-being and dependency levels. A score ranging from "0" to "5" points is given according to the dependency level of the patient. "0" point indicates that the patient is asymptomatic, "1" point indicates that the patient is symptomatic but fully ambulatory and able to function, and "2" points indicate that the patient is symptomatic and in bed, less than 50% of the day, "3" points indicate that the patient is symptomatic, has difficulty in self-care and is in bed more than 50% of the day, "4" points indicate that the patient is unable to self-care and is dependent on a chair or bed, and "5" points indicate "death" [19]. The only statement we see that has potential to be measured is a statement in the ECOG system about staying in bed, where one of the descriptions of activity is based on the position of the body. There are distinctions between ECOG 2 and 3 on the basis of being recumbent or supine. Grade ECOG 2 marks the position of the body as being up and about more than 50% of waking hours, and grade ECOG 3 marks the state as confined to bed or chair 50% or more of waking hours.

Edmonton Symptom Assessment System (ESAS)

The scale was developed by Bruera et al. [21] for the assessment of symptoms commonly observed in cancer patients. The scale includes 10 symptoms including tiredness, pain, well-being, nausea, depression, anxiety, drowsiness, shortness of breath, loss of appetite, and others. The severity of each symptom is assessed with a scale ranging from 0 to 10 in the form of a visual analogue scale. While 0 point indicates that there is no symptom, 10 points indicate that the symptom is highly severe [21]. Yeşilbalkan et al., (2008) adapted the scale to the Turkish population. The Cronbach's Alpha coefficient was found to be 0.77 [22].

Pittsburgh Sleep Quality Index (PSQI): The PSQI is a self report scale that assesses sleep quality and sleep disturbance over a one-month time interval. Buysse et al., developed the PSQI in 1989. The Cronbach's alpha coefficient was found to be 0.80 [23]. Ağargün et al. [24] adapted the scale to the Turkish population, and found that Cronbach's alpha coefficient was 0.79. 19 out of a total of 24 items included in the PSQI are self report questions. 5 items are responded to by a partner or a roommate. The scale has 19 items and 7 components (Subjective Sleep Quality, Sleep Latency, Sleep Duration, Habitual Sleep Efficiency, Sleep Disturbances, Use of sleep medications, and Daytime Dysfunction. Each component is rated between 0-3 points. The total score of the 7 components gives the scale total score. Each of wichh addresses a specific aspect of subjective sleep qoality The PSQI discriminated groups of healthy middle-aged subjects, depressed patients and sleep-disorder patients. The instrument had good internal consistency and test-retest reliability, and its validity was supported by polysomnographic results. The total score ranges from 0 to 21. A total score greater than 5 indicates "*poor sleep quality*" [24].

VAS – Sleep

Focusing on the assessment of sleep adequacy, this method aims to describe the patient's sleep with numbers. The scale begins with sleep inadequacy (0) and assesses the level of adequate sleep [13]. The VAS is a line, usually 10 cm long, horizontal or vertical, beginning with "*Inadequate Sleep*" and ending with "*Adequate Sleep*". The patient indicates the adequacy of his/her sleep by putting a mark where he/she deems appropriate on this line. The instructions that were given to the participants before completing the VAS were "*place an X on the line below to show on average, over the past week, how likely you are to fall asleep during the day.*" VAS is recorded on paper. The VAS was measured by a ruler, and the score was to the nearest millimeter[23].

Patient Satisfaction Scale

The scale is rated from 0 to 10 in the form of an Analogue Scale to determine the satisfaction level of the patients in the intervention group with their laughter yoga experience. The VAS is a line, usually 10 cm long, horizontal or vertical, beginning with "*I am satisfied*" and ending with "*I am not satisfied*". Participants were also asked to rate the ease of use of both measures on the scale of zero (least easy) to 10 (most easy). The VAS was developed by a consensus of experts [23].

Interventions

The necessary explanations were made to the patients about the interventions to be followed for the intervention and control groups. After the consent of the patients was obtained, the patient information form was given to both groups at the first interview.

Intervention Group

The interventions were applied by the researcher who received the training on "*Laughter Yoga Leader*". The Laughter Yoga Leader is the person who is present at the laughter session with the group/person, ensures that the individuals adapt to the activity with breathing exercises, initiates movements that trigger laughter, continues the fun movements that follow one after another, motivates the group/person, does the movements with them, dances and ends the laughter yoga session with relaxation exercises that gradually increase the individual's self-awareness. A total of 4 sessions of laughter yoga were applied in the experimental group for 45 minutes twice a week for two weeks. The researcher decided on the duration and number of laughter yoga sessions by reviewing the literature [17-18, 24]. During the two weeks that the laughter yoga sessions continued for the patients in the intervention group, ESAS and PSQI were performed four times at the beginning of the week (1st measurement: 1st day, 3rd measurement: 8th day) and at the end of the week (2nd measurement: 5th day, 4th measurement: 12th day).

Control Group

No intervention was applied to the control group; clinical routine care continued. During the two weeks that the laughter yoga sessions continued for the patients in the control group, in coordination with the intervention group, ESAS and PSQI were performed totally four times at the beginning of the week (1st measurement: 1st day, 3rd measurement: 8th day) and at the end of the week (2nd measurement: 5th day, 4th measurement: 12th day) (Figure 2).

Data Analysis

Percentage distributions were used to analyse the descriptive and socio-demographic characteristics of the patients in the intervention and control groups and the chi-square test was used for the homogeneity of the groups. The dependent samples t-test, independent samples t-test, Friedman test and Mann-Whitney U test were used in the pretest and posttest data analyses of the intervention and control groups. The variance analysis tests were applied to compare the pretest and posttest measurements.

Ethical considerations

Approval from the non-invasive Ethics Committee of the Department of Haematology, Dokuz Eylül University Research and Application Hospital granted (Decision No: 2020/28-05, Date: 23/11/2020) and necessary written

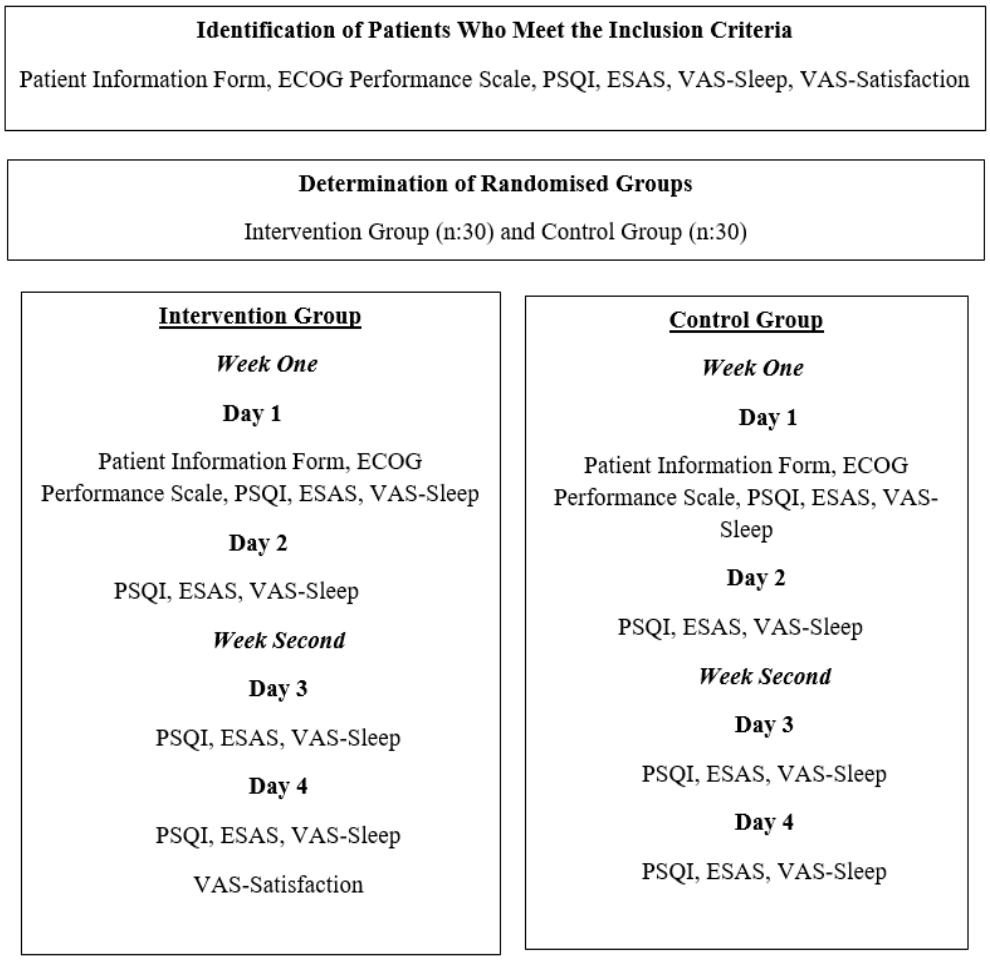

Figure 2. Research Plan

permissions from the authors who conducted the Turkish validity and reliability study of the scales in the study for their use in the study were obtained.

Results

The results indicated that there was no statistically significant difference between the control group and the intervention group in terms of socio-demographic distribution and ECOG performance scores of the patients (p>0.05). Likewise, no statistically significant difference was found between the groups in terms of the presence of chronic diseases, cancer types, number of cycles, distribution of chemotherapy based on the emetogenic risk and past treatment history (p>0.05) (Table 1).

Based on the results from the Edmonton Symptom Assessment System, a statistically significant difference was found in the scores of pain and anxiety components in the intervention group, in the scores of tiredness/nausea/depression/drowsiness/appetite/well-being components in the intervention and control groups, in the scores of shortness of breath/changes in skin and nails/numbness

Table 1. Socio-Demographic Characteristics of the Participants in the Intervention and Control Groups

	Control Group		Intervention Group		ΨX²	p
	N	%	N	%		
Gender					1.669	0.196
Female	17	28.3	12	20		
Male	13	21.7	18	30		
Age Groups					0.759	0.944
19 – 30 years	4	6.7	6	10		
31 – 42 years	6	10	5	8.3		
43 – 54 years	8	13.3	7	11.7		
55 – 66 years	9	15	8	13.3		
67 – 78 years	3	5	4	6.7		
Marital Status					0	1
Single	5	8.3	5	8.3		
Married	25	41.7	25	41.7		
Educational background					6.278	0.099
Illiterate	4	6.7	8	13.3		
Primary school	11	18.3	8	13.3		
High school	6	10	11	18.3		
Higher education	9	15	3	5		
Income status					1.083	0.582
High	4	6.7	4	6.7		
Moderate	23	38.3	25	41.7		
Low	3	5.0	1	1.7		
Occupation					1.608	0.807
Housewife	10	16.7	7	11.7		
Civil servant	2	3.3	1	1.7		
Retired	5	8.3	8	13.3		
Self-employed	9	15.0	10	16.7		
Other	4	6.7	4	6.7		
Employment status					2.222	0.136
Employed	10	16.7	5	8.3		
Unemployed	20	33.3	25	41.7		
Presence of children					0.48	0.488
Yes	26	43.3	24	40		
No	4	6.7	6	10		
Number of children					0.025	0.874
2 and less	20	40	18	36		
3 and more	6	12	6	12		
Presence of chronic disease					2.857	0.091

Ψ, Chi-Square Test; a, Variable with more than one response; Ш, Mann Whitney U Test; ECOG, Eastern Cooperative Oncology Group

Table 1. Continued

	Control Group		Intervention Group		ΨX²	p
	N	%	N	%		
Presence of chronic disease					2.857	0.091
Yes	6	10	12	20		
No	24	40	18	30		
Chronic disease					-	-
Diabetes	6	10.2	3	5.1		
Hypertension	5	8.5	11	18.6		
Other	0	0	4	6.8		
Type of cancer					3.234	0.357
AML	8	13.3	13	21.7		
Lymphoma	12	20	11	18.3		
Multiple myeloma	4	6.7	4	6.7		
ALL	6	10	2	3.3		
Number of cycles					2.308	0.129
<10 cycles	24	40	28	46.7		
10 - 20 cycles	6	10	2	3.3		
Chemotherapy Distribution based on Emetogenic Risk					3.268	0.071
High Risk	7	11.7	2	3.3		
Moderate Risk	23	38.3	28	46.7		
Past treatment history					0.089	0.766
Chemotherapy	23	38.3	22	36.7		
None	7	11.7	8	13.3		
Regularly Used Drugs					-	-
Anti-infective / Antiviral	5	8.3	2	3.3		
Insulin	4	6.7	3	5		
Heart medication	3	5	8	13.3		
Antihypertensive	1	1.7	4	6.7		
Other	5	8.3	4	6.7		

	Control Group	Intervention Group	ЏZ	p
	X ± SD (Min - Max)	X ± SD (Min - Max)		
ECOG Performance Score	0.73 ± 0.98 (0 - 3)	0.77 ± 0.94 (0 - 3)	-0.316	0.752

Ψ, Chi-Square Test; a, Variable with more than one response; Џ, Mann Whitney U Test; ECOG, Eastern Cooperative Oncology Group

in the hands components in the intervention group, and in the scores of the sore in the mouth component in both intervention and control groups. Table 2 shows the results of the Post-hoc test applied to find out which measurement accounts for the difference between the measurements.

When the distribution of Pittsburgh Sleep Quality Index scores was analysed, a statistically significant difference was found between the scores of the intervention and control groups in the subjective sleep quality component. However, no statistically significant difference was found between the scores of the intervention and control groups in the sleep latency/habitual sleep efficiency/use of sleep medications/daytime dysfunction components. A significant difference was found between the scores of the intervention group in the sleep duration and sleep disturbances components. The total score of the Pittsburgh Sleep Quality Index was found to be significant in the intervention group. The results of the post-hoc test showed that the total PSQI scores of the patients in the intervention group for the 2nd measurement were lower than those of the 4th measurement and the total PSQI scores of the patients for the 3rd measurement were lower than those of the 4th measurement. When the distribution of the Visual Analogue Scale- Sleep scores of the patients in the control and intervention groups was analysed, a statistically significant difference was found in the intervention group (X^2=11.822, $p<0.05$). The results of the post-hoc test showed that the VAS sleep scores of the patients in the intervention group for the 1st measurement were lower than those of the 4th measurement (Table 3).

The level of patients' satisfaction with laughter yoga in the intervention group varied between 5 and 10, and the mean satisfaction level was found to be 7.23 ± 1.43 (Table 4).

Discussion

Laughter relieves stress by boosting the release of

Table 2. Distribution of the Edmonton Symptom Assessment System Scores of the Intervention and Control Groups

Components	Measurement	Control Group X ± SD (Min - Max)	Intervention Group X ± SD (Min - Max)	ΨZ	p
Pain	1st measurement (1)	1.87 ± 2.60 (0 - 9)	0.73 ± 1.55 (0 - 5)	-1.918	0.055
	2nd measurement (2)	2.57 ± 2.67 (0 - 8)	1.57 ± 1.98 (0 - 7)	-1.625	0.104
	3rd measurement (3)	2.40 ± 2.44 (0 - 8)	1.60 ± 1.89 (0 - 5)	-1.268	0.205
	4th measurement (4)	1.93 ± 2.24 (0 - 6)	0.53 ± 1.11 (0 - 3)	-2.734	0.006*
	Test Statistics	ΨX²=11.660, p=0.112	ΨX²=57.942, p=0.000* 1<2, 2>3		
Tiredness	1st measurement (1)	4.20 ± 2.67 (0 - 10)	4.23 ± 1.96 (0 - 8)	-0.06	0.952
	2nd measurement (2)	5.33 ± 2.52 (0 - 10)	4.63 ± 2.17 (0 - 8)	-0.896	0.37
	3rd measurement (3)	4.87 ± 3.09 (0 - 10)	4.37 ± 2.03 (0 - 8)	-1.031	0.302
	4th measurement (4)	4.17 ± 3.06 (0 - 10)	3.70 ± 2.02 (0 - 8)	-0.747	0.455
	Test Statistics	ΨX²=34.593, p=0.000* 1<2, 2>3	ΨX²=66.438, p=0.000* 1>3, 2>3		
Nausea	1st measurement (1)	2.23 ± 2.64 (0 - 8)	0.33 ± 1.37 (0 - 7)	-3.778	0.000*
	2nd measurement (2)	4.20 ± 2.82 (0 - 10)	3.27 ± 2.15 (0 - 10)	-1.12	0.263
	3rd measurement (3)	2.80 ± 2.55 (0 - 7)	1.57 ± 1.98 (0 - 6)	-1.941	0.052
	4th measurement (4)	1.73 ± 2.55 (0 - 8)	0.20 ± 0.66 (0 - 3)	-2.849	0.004*
	Test Statistics	ΨX²=43.357, p=0.000* 1<2, 2>3	ΨX²=93.876, p=0.000* 1<2, 2>3		
Depression	1st measurement (1)	4.87 ± 3.37 (0 - 10)	4.60 ± 2.39 (0 - 10)	-0.298	0.766
	2nd measurement (2)	4.77 ± 3.10 (0 - 10)	4.63 ± 2.27 (0 - 8)	-0.225	0.822
	3rd measurement (3)	4.27 ± 2.49 (0 - 9)	4.37 ± 2.17 (0 - 8)	-0.067	0.946
	4th measurement (4)	3.87 ± 2.75 (0 - 10)	3.53 ± 1.80 (0 - 6)	-0.531	0.595
	Test Statistics	ΨX²=16.231, p=0.023*	ΨX²=73.299, p=0.000* 1>3, 2>3		
Anxiety	1st measurement (1)	5.07 ± 3.29 (0 - 10)	5.00 ± 2.29 (0 - 10)	-0.082	0.935
	2nd measurement (2)	4.83 ± 3.04 (0 - 10)	5.00 ± 2.27 (0 - 9)	-0.246	0.806
	3rd measurement (3)	4.43 ± 2.64 (0 - 10)	4.83 ± 2.21 (0 - 8)	-0.695	0.487
	4th measurement (4)	4.27 ± 2.92 (0 - 10)	3.87 ± 1.93 (0 - 8)	-0.689	0.491
	Test Statistics	ΨX²=12.036, p=0.099	ΨX²=84.776, p=0.000* 1>3, 2>3		
Drowsiness	1st measurement (1)	4.23 ± 3.74 (0 - 10)	3.47 ± 2.29 (0 - 8)	-0.507	0.612
	2nd measurement (2)	4.57 ± 3.65 (0 - 10)	3.97 ± 2.27 (0 - 8)	-0.581	0.561
	3rd measurement (3)	4.17 ± 3.15 (0 - 9)	3.63 ± 2.34 (0 - 8)	-0.746	0.456
	4th measurement (4)	4.03 ± 2.99 (0 - 10)	3.17 ± 2.07 (0 - 8)	-1.413	0.158
	Test Statistics	ΨX²=17.516, p=0.014* 2>3	ΨX²=46.997, p=0.000* 2>3		
Appetite	1st measurement (1)	3.80 ± 3.27 (0 - 10)	2.97 ± 2.36 (0 - 10)	-0.8	0.424
	2nd measurement (2)	5.07 ± 3.36 (0 - 10)	4.13 ± 2.47 (0 - 10)	-1.187	0.235
	3rd measurement (3)	4.43 ± 3.38 (0 - 10)	3.83 ± 2.35 (0 - 10)	-0.723	0.469
	4th measurement (4)	4.03 ± 3.35 (0 - 10)	2.73 ± 1.93 (0 - 7)	-1.184	0.236
	Test Statistics	ΨX²=30.197, p=0.000* 1<2, 2>4	ΨX²=76.352, p=0.000* 1<2, 2>3		
Well-being	1st measurement (1)	4.90 ± 2.71 (0 - 10)	4.67 ± 2.31 (0 - 10)	-0.525	0.6
	2nd measurement (2)	5.47 ± 2.83 (0 - 10)	4.97 ± 2.33 (0 - 9)	-0.693	0.488
	3rd measurement (3)	5.20 ± 2.50 (0 - 10)	4.90 ± 2.07 (0 - 8)	-0.598	0.55
	4th measurement (4)	4.47 ± 2.56 (0 - 10)	4.00 ± 1.93 (0 - 8)	-0.772	0.44
	Test Statistics	ΨX²=50.687, p=0.000* 2>4, 2>3	ΨX²=75.554, p=0.000* 1<2, 1>4, 2>4, 2>3		

Table 2. Continued

Components	Measurement	Control Group X ± SD (Min - Max)	Intervention Group X ± SD (Min - Max)	ΨZ	p
Shortness of breath	1st measurement (1)	0.73 ± 2.15 (0 - 10)	0.20 ± 0.81 (0 - 4)	-1.207	0.228
	2nd measurement (2)	0.80 ± 2.16 (0 - 10)	0.37 ± 1.00 (0 - 4)	-0.695	0.487
	3rd measurement (3)	0.77 ± 2.14 (0 - 10)	0.40 ± 1.10 (0 - 4)	-0.428	0.668
	4th measurement (4)	0.67 ± 1.79 (0 - 7)	0.40 ± 1.10 (0 - 4)	-0.15	0.881
	Test Statistics	ΨX²=10.996, p=0.139	ΨX²=14.261, p=0.047*		
Changes in skin/nails	1st measurement (1)	2.47 ± 2.22 (0 - 8)	1.57 ± 1.87 (0 - 5)	-1.56	0.119
	2nd measurement (2)	2.77 ± 2.46 (0 - 9)	2.10 ± 2.09 (0 - 6)	-1.01	0.313
	3rd measurement (3)	2.67 ± 2.35 (0 - 9)	1.93 ± 1.76 (0 - 5)	-1.104	0.269
	4th measurement (4)	2.73 ± 2.56 (0 - 10)	1.60 ± 1.57 (0 - 4)	-1.595	0.111
	Test Statistics	ΨX²=8.113, p=0.323	ΨX²=37.278, p=0.000* 1<2, 2>4		
Sore in the mouth	1st measurement (1)	1.37 ± 1.59 (0 - 6)	0.37 ± 0.76 (0 - 2)	-2.798	0.005*
	2nd measurement (2)	1.77 ± 1.70 (0 - 5)	2.03 ± 1.16 (0 - 5)	-0.917	0.359
	3rd measurement (3)	2.43 ± 1.94 (0 - 7)	2.30 ± 0.95 (0 - 5)	-0.15	0.881
	4th measurement (4)	2.33 ± 2.23 (0 - 8)	0.97 ± 1.67 (0 - 8)	-2.969	0.003*
	Test Statistics	ΨX²=25.808, p=0.001* 1<2, 3<4 a	ΨX²=109.157, p=0.000* 1<2, 3>4, 2>4		
Numbness in the Hands	1st measurement (1)	0.70 ± 1.73 (0 - 8)	0.47 ± 1.28 (0 - 5)	-0.627	0.531
	2nd measurement (2)	0.80 ± 1.69 (0 - 8)	0.63 ± 1.25 (0 - 4)	-0.254	0.8
	3rd measurement (3)	0.80 ± 2.12 (0 - 8)	0.47 ± 1.28 (0 - 5)	-0.393	0.695
	4th measurement (4)	0.73 ± 1.76 (0 - 8)	0.43 ± 1.22 (0 - 5)	-0.695	0.487
	Test Statistics	ΨX²=4.003, p=0.779	ΨX²=18.595, p=0.010*		

Ψ, Friedman Test; Ψ, Mann Whitney U Test*p<0.05; a, Bonferroni Post-hoc Test

endorphins and brings mental and physical relaxation. It is one of the cognitive behavioural therapies used to create a happy atmosphere in hospitals, to promote the patient's adaptation to the process by triggering his/her happiness during the hospital stay and to reinforce the ability to cope with symptoms [12, 25].

Symptom Management

It is important to define the symptoms that patients suffer from and to identify the factors that cause problems in terms of symptom management [9]. Results of the present study on the Edmonton Symptom Assessment System showed statistically significant differences between the scores of pain and anxiety components in the intervention group, tiredness/nausea/depression/ drowsiness /appetite /well-being components in the intervention and control groups, shortness of breath/changes in skin and nails/ numbness in the hands components in the intervention group, and the sore in the mouth component in both intervention and control groups (Table 3). Laughter yoga has been found to physiologically improve breathing in the body, relax muscles, stimulate circulation and the immune system, and raise pain threshold and pain tolerance by boosting endorphin hormone release [13]. Based on his own experience, Cousins used laughter as a therapeutic intervention to overcome a chronic illness and stated that 10 minutes of laughter relieved the pain for two hours with no medication [26]. In the literature it is emphasised that laughter yoga relieves pain intensity in individuals with osteoarthritis, alleviates pain, anxiety, stress, depression and fatigue in patients undergoing haemodialysis, and improves immunity, quality of life, happiness and sleep quality [14]. Findings of the present study are compatible with the literature. The literature lacks studies that examined the effect of laughter yoga on all symptoms that cancer patients suffer from. The present study is significant in this regard. The study by Naghibeiranvand et al. [15], in which they examined the effect of laughter therapy on chemotherapy-induced nausea and vomiting in cancer patients, reported no statistically significant difference between the intervention and control groups but reduced the frequency and severity of nausea in the intervention group. The present study also revealed that nausea/loss of appetite symptoms were alleviated in the intervention group in this dimension. Findings of the present study are compatible with the literature [27]. The present study showed a reduced incidence of mouth sores in both the intervention and control groups. There is no study in the literature on this finding. However, it is stated that laughter lowers salivary Chromogranin A (CgA) levels but elevates serum endorphin and serotonin levels, and boosts Natural Killer (NK) cell activity. NK cells constitute the first defence step of the innate immune system against viral, bacterial and parasitic infections in

Table 3. Distribution of PSQI and VAS-Sleep Scores of the Intervention and Control Groups

Subscales	Measurement	Control Group	Intervention Group	ЩZ	p
		X ± SD (Min - Max)	X ± SD (Min - Max)		
Subjective sleep quality	1st measurement (1)	1.70 ± 0.88 (0 - 3)	1.40 ± 0.62 (0 - 3)	-1.461	0.144
	2nd measurement (2)	1.77 ± 0.94 (0 - 3)	1.37 ± 0.61 (0 - 3)	-2.001	0.045*
	3rd measurement (3)	1.77 ± 0.90 (0 - 3)	1.40 ± 0.62 (0 - 3)	-1.772	0.076
	4th measurement (4)	1.57 ± 0.86 (0 - 3)	1.23 ± 0.50 (0 - 2)	-1.609	0.108
	Test Statistics	ΨX²=8.040, p=0.045*	ΨX²=10.200, p=0.017*		
Sleep latency	1st measurement (1)	2.13 ± 0.90 (0 - 3)	1.17 ± 0.95 (0 - 3)	-3.65	0.000*
	2nd measurement (2)	2.03 ± 1.07 (0 - 3)	1.30 ± 1.18 (0 - 3)	-2.413	0.016*
	3rd measurement (3)	2.00 ± 1.20 (0 - 3)	1.07 ± 1.20 (0 - 3)	-2.697	0.007*
	4th measurement (4)	1.83 ± 1.18 (0 - 3)	0.97 ± 1.07 (0 - 3)	-2.766	0.006*
	Test Statistics	ΨX²=3.777, p=0.287	ΨX²=4.113, p=0.250		
Sleep	1st measurement (1)	1.93 ± 1.14 (0 - 3)	1.80 ± 0.89 (0 - 3)	-0.883	0.377
duration	2nd measurement (2)	1.90 ± 1.09 (0 - 3)	1.83 ± 0.83 (0 - 3)	-0.589	0.556
	3rd measurement (3)	1.87 ± 1.04 (0 - 3)	1.67 ± 0.96 (0 - 3)	-0.949	0.343
	4th measurement (4)	1.80 ± 1.06 (0 - 3)	1.63 ± 0.93 (0 - 3)	-0.893	0.372
	Test Statistics	ΨX²=2.410, p=0.492	ΨX²=11.333, p=0.010*		
Habitual sleep efficiency	1st measurement (1)	0.93 ± 1.08 (0 - 3)	1.50 ± 1.20 (0 - 3)	-1.836	0.066
	2nd measurement (2)	0.80 ± 1.10 (0 - 3)	1.47 ± 1.20 (0 - 3)	-2.215	0.027*
	3rd measurement (3)	1.07 ± 1.26 (0 - 3)	1.50 ± 1.17 (0 - 3)	-1.468	0.142
	4th measurement (4)	1.07 ± 1.17 (0 - 3)	1.37 ± 1.13 (0 - 3)	-1.073	0.283
	Test Statistics	ΨX²=4.455, p=0.216	ΨX²=2.178, p=0.536		
Sleep disturbances	1st measurement (1)	0.90 ± 0.31 (0 - 1)	0.67 ± 0.48 (0 - 1)	-2.175	0.030*
	2nd measurement (2)	0.90 ± 0.31 (0 - 1)	0.83 ± 0.38 (0 - 1)	-0.753	0.451
	3rd measurement (3)	0.93 ± 0.25 (0 - 1)	0.83 ± 0.38 (0 - 1)	-1.196	0.232
	4th measurement (4)	0.93 ± 0.25 (0 - 1)	0.67 ± 0.48 (0 - 1)	-2.56	0.010*
	Test Statistics	ΨX²=3.000, p=0.382	ΨX²=12.500, p=0.006*		
Use of sleep medications	1st measurement (1)	0.30 ± 0.92 (0 - 3)	0	-1.762	0.078
	2nd measurement (2)	0.30 ± 0.92 (0 - 3)	0	-1.762	0.078
	3rd measurement (3)	0.30 ± 0.92 (0 - 3)	0	-1.762	0.078
	4th measurement (4)	0.30 ± 0.92 (0 - 3)	0	-1.762	0.078
	Test Statistics	ΨX²=0.000, p=1.000	ΨX²=0.000, p=1.000		
Daytime dysfunction	1st measurement (1)	0.90 ± 1.09 (0 - 3)	0.37 ± 0.72 (0 - 3)	-2.077	0.038*
	2nd measurement (2)	0.87 ± 1.01 (0 - 3)	0.40 ± 0.77 (0 - 3)	-2.106	0.035*
	3rd measurement (3)	0.90 ± 0.99 (0 - 3)	0.40 ± 0.81 (0 - 3)	-2.406	0.016*
	4th measurement (4)	0.83 ± 1.09 (0 - 3)	0.30 ± 0.65 (0 - 2)	-2.23	0.026*
	Test Statistics	ΨX²=0.923, p=0.820	ΨX²=3.600, p=0.308		
PSQI	1st measurement (1)	8.80 ± 3.93 (2 - 18)	6.90 ± 3.21 (2 - 16)	-1.982	0.047*
Total	2nd measurement (2)	8.57 ± 4.33 (1 - 18)	7.20 ± 3.60 (3 - 16)	-1.329	0.184
	3rd measurement (3)	8.83 ± 4.35 (1 - 18)	6.87 ± 3.52 (2 - 16)	-1.996	0.046*
	4th measurement (4)	8.33 ± 4.4 (1 - 16)	6.17 ± 3.14 (2 - 14)	-2.199	0.028*
	Test Statistics	ΨX²=3.232, p=0.357	ΨX²=14.845, p=0.002*		
			2>4, 3>4 a		
VAS- Sleep	1st measurement (1)	5.60 ± 2.49 (2 - 10)	5.83 ± 1.98 (2 - 10)	-0.366	0.714
	2nd measurement (2)	5.47 ± 2.43 (2 - 10)	5.80 ± 1.67 (3 - 9)	-0.817	0.414
	3rd measurement (3)	5.30 ± 2.59 (1 - 10)	6.03 ± 1.73 (3 - 9)	-1.398	0.162
	4th measurement (4)	5.73 ± 2.12 (2 - 10)	6.17 ± 1.82 (3 - 9)	-1.117	0.264
	Test Statistics	ΨX²=3.750, p=0.290	ΨX²=11.822, p=0.008*		

Ψ, Friedman Test; Щ, Mann Whitney U Test*p<0.05; a, Bonferroni Post-hoc Test; PSQI, Pittsburgh Sleep Quality Index; VAS, Visual Analog Scale

Table 4. Distribution of the Level of Satisfaction with Laughter Yoga for the Intervention Group

n:30	X ± SD	Min - Max
Level of Satisfaction with Laughter Yoga	7.23 ± 1.43	5 - 10

our body. When activated, they can kill the target cell by lysis [28]. When analysed in this context, it can be considered to be one of the factors for the incidence of oral mucositis in the intervention group in which laughter yoga was practised. Likewise, in the present study it was found that the skin and nail changes and the hand numbness in the intervention group were lower than in the control group. However, there are no studies that support this finding up in the literature. This finding may be due to the lesser use of chemotherapy protocol that may lead to skin/nail changes and numbness in the hands of the patients in the intervention group. It was found in the present study that there was a difference between the pretest and posttest mean scores of the Edmonton Symptom Assessment System components of the patients in the intervention group treated with laughter yoga.

Sleep Management

In the present study, it was found that the distribution of the Pittsburgh Sleep Quality Index total score and the Visual Analogue Scale-Sleep scores was significant in the intervention group (Table 4). A study by Eunok (2013) reported that laughter yoga practised once a week for eight weeks decreased depression scores and positively affected sleep quality in elderly individuals with depressive and sleep disorders; it was stated that laughter yoga was an effective nursing practice to treat depression and insomnia. Another study that assessed the effect of laughter yoga on the overall health of nursing students reported that students practised laughter yoga twice a week for a total of 8 sessions, and as a result of the evaluation and it was found that laughter yoga had a positive effect on the overall health of students, improved the symptoms of physical and sleep disorders, alleviated anxiety and depression, and improved social functions [29]. The present finding thereof is compatible with the literature.

The present study showed statistically significant differences between the scores of sleep duration and sleep disturbance components of the Pittsburgh Sleep Quality Index in the intervention group and the subjective sleep quality component in both intervention and control groups. A study by Memarian et.al. [30] that assessed the effect of laughter yoga on anxiety and sleep quality of Parkinson's patients reported that the total scores of sleep efficiency, sleep disturbance, use of sleep medications, daytime dysfunction components of PSQI and the total scores of PSQI were significantly lower than those of the control group, and it was reported that laughter yoga led to a significant improvement in sleep quality in Parkinson's patients. A study by Han et al. [16] reported that laughter yoga practised twice a week for 8 sessions reduced depression scores and enhanced sleep quality. It was found that subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency and daytime dysfunction, all of which are subcategories of PSQI, improved significantly with laughter yoga. The present study yielded similar results to the literature in this regard. The results of the post-hoc test run similar to the present study showed that the total PSQI scores of the patients in the intervention group for the 2nd measurement were lower than those of the 4th measurement, and the total PSQI scores of the patients for the 3rd measurement were lower than those of the 4th measurement. When analysed on this basis, findings of the present study are compatible with the literature. In their study Ellis et al. [31] practised laughter yoga for 30 minutes once a week for 6 weeks to 28 elderly individuals living in an elderly nursing home. After the practice (1st, 3rd and 6th sessions), there was an increase in happiness scores, a decrease in positive and negative mood scores (3rd and 6th sessions) and a decrease in systolic blood pressure (1st and 6th sessions). It is possible to find studies in the literature that support the results of the study as well as studies where the results are different. In their study, Ko and Youn [32] evaluated the effect of laughter yoga practised once a week and 4 times in total on cognitive function, depression, sleep and quality of life of community-dwelling adults. While there was a decrease in the depression levels of elderly individuals in the intervention group after laughter yoga, no statistically significant correlation was reported in sleep quality scores. This was interpreted as a positive correlation between the increase in the number of laughter yoga sessions provided to the patients and sleep quality. Another study that examined the effect of laughter yoga on depression, anxiety, fatigue and sleep quality in patients with gastrointestinal system cancer who were undergoing chemotherapy reported that eight sessions of laughter yoga were effective in alleviating fatigue (p= .019) and improving sleep satisfaction (p= .030), and there was no difference between depression (p = .129) and anxiety (p = 0.200) scores of the groups [32]. It was found that there was a difference between the pretest and posttest mean scores on the Pittsburgh Sleep Quality Index of the patients in the intervention group to whom laughter yoga was practised.

Satisfaction Level

The present study revealed that the level of patients' satisfaction with laughter yoga in the intervention group varied between 5 and 10, and the mean satisfaction level was 7.23 ± 1.43. A systematic review reported that laughter had positive effects on the health of the individual and laughter yoga could be beneficial to patients as a complementary therapy method [33].Laughter has also been reported to release endorphins—the body's natural painkillers—and bring an overall feeling of happiness and satisfaction [13]. The study by Mora-Ripoll [34] with laughter yoga reported that 8 sessions once a week led to a decrease of 55% in pain scores; an increase of 12% in functional mobility; a decrease of 50% in depression symptoms and a decrease of 42% in anxiety symptoms. People reported that they felt more comfortable, energetic, happy and excellent. In this sense, the findings of the

present study are compatible with the literature [34].

In conclusion, laughter yoga was found to have an effect on chemotherapy-induced symptoms and sleep quality in patients with haematologic cancer. It may be recommended that laughter yoga be integrated into patient care to ensure patient compliance and continuity with treatment. Group or individual laughter yoga therapies can be performed in appropriate settings in the clinic. For this reason, health professionals can be informed about the importance of complementary integrated practices at intervals during in-service practices. In this context, it is recommended that nurses attend certification programs on complementary practices. Courses on the subject can be added to the curriculum of undergraduate education programs. It may be recommended that future studies be conducted with a larger sample group.

Author Contribution Statement

All authors contributed equally in this study.

Acknowledgements

None.

References

1. World Health Organization. Available from: https://www.who.int/health topics/cancer#tab=tab_1 Erişim Tarihi: 11.02.2020.
2. Kara F, İlter H, Keskinkılıç B, Türkyılmaz M. Turkey cancer statistics 2015. Halk Sağlığı Genel Müd. Sağlık Bakanlığı 2018.
3. Laird BJA, Scott AC, Colvin LA, McKeon AL, Murray GD, Fearon KCH, et al. Pain, depression and fatigue as symptom clusters in advanced cancers. J Pain Symptom Manage. 201;42(1):1–11. https://doi.org/10.1016/j.jpainsymman.2010.10.261.
4. Manitta V, Zordan R, Cole-Sinclair M, Nandurkar H, Philip J. Symptom burden of patients with hematologic malignancies: a cross-sectional observational study. J Pain Symptom Manage. 2011;42(3):432-42. https://doi.org/10.1016/j.jpainsymman.2010.12.008.
5. Hintistan S, Çilingir D, Nural N, Akkaş Gürsoy A. Applications for Chemotherapy-Related Symptoms Experienced by Patients with Hematological Cancer. Gümüşhane Üniversitesi Sağlık Bilimleri Dergisi. 2012;1(3):153-164.
6. Reeve BB, Mitchell SA, Dueck AC, Basch E, Cella D, Reilly, et al. Recommended patient-reported core set of symptoms to measure in adult cancer treatment trials. J Natl Cancer Inst. 2014;106(7):dju129. https://doi.org/10.1093/jnci/dju129.
7. Inhestern L, Beierlein V, Bultmann JC, Möller B, Romer G, Koch U. et al. Anxiety and Depression in Working-Age Cancer Survivors: A Register-Based Study. BMC cancer. 2017;17(1):347. https://doi.org/10.1186/s12885-017-3347-9.
8. Şahin L, Aşçıoğlu M. Sleep and Sleep Regulation. Journal of Health Sciences 2013; 22(1):93-98.
9. Farifteh S, Mohammadi-Aria A, Kiamanesh A, Mofid B. The Impact of Laughter Yoga on the Stress of Cancer Patients Before Chemotherapy. Iran J Cancer Prev. 2014;7(4):179-83.
10. Savard J, Morin CM. Insomnia in the context of cancer: a review of a neglected problem. J Clin Oncol. 2001;19(3):895-908. https://doi.org/10.1200/JCO.2001.
11. Kardaş Kin Ö, Yıldırım Y, Yeşilbakan Usta Ö. Laughter Therapy and Examples of Use in Healthcare. Anadolu Nursing and Health Sciences. Dergisi. 2017;20(1):63-66.
12. Qureshi M, Zelinski E, Carlson LE. Cancer and Complementary Therapies: Current Trends in Survivors' Interest and Use. Integr Cancer Ther. 2018;17(3):844-53. https://doi.org/10.1177/1534735418762496.
13. Yim J. Therapeutic Benefits of Laughter in Mental Health: A Theoretical Review. The Tohoku J Exp Med. 2016;239(3):243-9. https://doi.org/10.1620/tjem.239.243.
14. Bennett Mp, Lengacher C. Humor and laughter may influence health: III. Laughter and Health Outcomes. Evid Based Complement Alternat Med. 2008;5(1):37-40. https://doi.org/10.1093/ecam/nem041.
15. Naghibeiranvand M, Khodaei S, Alipour Z, Jafari Z, Khomeini BM. The Effects of Laughter Therapy on Nausea and Vomiting in Patients with Cancer Undergoing. Chemot Govaresh. 2022;26(3):176-83.
16. Han JH, Park KM, Park H. Effects of laughter therapy on depression and sleep among patients at long-term care hospitals. Korean J Adult Nurs. 2017;29(5):560-8. https://doi.org/10.7475/kjan.2017.29.5.560
17. Kim SH, Kim YH, Kim HJ. Laughter and Stress Relief in Cancer Patients: A Pilot Study. Evid Based Complement Alternat Med. 2015:2015:864739. https://doi.org/10.1155/2015/864739.
18. Ovayolu Ö, Ovayolu N. Evidence-Based Complementary Methods Used in Symptom Management in Oncology and Their Effects. ERÜ Sağlık Bilimleri Fakültesi Dergisi. 2013;1(1):83-98.
19. Dadkhah B, Anisi E, Mozaffari N, Amani F, Pourghasemian M. Effect of Music Therapy With Periorbital Massage on Chemotherapy-İnduced Nausea and Vomiting in Gastrointestinal Cancer: A Randomized Controlled Trail. J Caring Sci. 2019;8(3):165-171. https://doi.org/ 10.15171/jcs.2019.024.
20. Oken MM, Creech RH, Tormey DC, Horton J, Davis TE, McFadden ET, et al. Toxicity and response criteria of the eastern cooperative oncology group. Am J Clin Oncol. 1982;5(6):649-55.
21. Bruera E, Kuehn N, Miller MJ, Selmser P, Macmillan K. The Edmonton Symptom Assessment System (ESAS): A Simple Method for The Assessment of Palliative Care Patients. J Palliat Care. 1991;7(2):6-9.
22. Yesilbalkan ÖU, Özkütük N, Karadakovan A, Turgut T, Kazgan B. Validity and reliability of the Edmonton Symptom Assessment Scale in Turkish cancer patients. Turkish Journal of Cancer. 2008;38(2):62. https://doi.org/10.1016/j.jpainsymman.2019.04.020.
23. Buysse DJ, Reynolds CF, Monk TH, Hoch CC, Yeager AL, Upfer DJK . Quantification of subjective sleep quality in healthy elderly men and women using the Pittsburgh Sleep Quality Index (PSQI). Sleep. 1991;14(4):331-338.
24. Ağargün MY, Kara H, Anlar O. Validity and reliability of the Sleep Quality Index. Türk Psikiyatri Dergisi 1996; 7:107-111.
25. Arslan S, Fadiloglu C. The Effect of Sleep Problems on Quality of Life in Cancer. Master's Thesis, Konya; 2005.
26. Ozturk FO, Tezel A. Effect of laughter yoga on mental symptoms and salivary cortisol levels in first-year nursing students: A randomized controlled trial. Int J Nurs Pract. 2021;27(2):12924. https://doi.org/10.1111/ijn.12924.
27. Hatzipapas I, Visser Mj, Rensburgc Ejv, Sahara J. Laughter Therapy As an İntervention to Promote Psychological Well-Being of Volunteer Community Care Workers Working with HIV-Affected Families. Sahara J. 2017;14(1):202- 212. https://doi.org/10.1080/17290376.2017.1402696

28. Supekar NR, Shimpi AP, Madane AV, Rairikar SA, Shyam AK, Sancheti PK. Role of laughter clubs in promotion of health in community (A case control study). Indian J Physiother Occup. 2014;8(2):110. https://doi.org/10.5958/j.0973-5674.8.2.070
29. Eunok P. Effects of Visiting Laughter Therapy on Depression and Insomnia among the Vulnerable Elderly. J Korean Acad Community Health Nurs. 2013;24(2):205-213. https://doi.org/10.12799/jkachn.2013.24.2.205
30. Memarian A, Sanatkaran A, Bahari SM. The effect of laughter yoga exercises on anxiety and sleep quality in patients suffering from Parkinson's disease. Biomed Res Ther. 2017;4(7):1463–1479. https://doi.org/10.15419/bmrat.v4i07.200
31. Ellis MJ, Moshe BR, Teshuva K. Laughter yoga activities for older people living in residential aged care homes: A feasibility study. Australas J Ageing. 2017;36(3):28-31. https://doi.org/10.1111/ajag.12447.
32. Ko H, Ho Youn C. Effects of laughter therapy on depression, cognition and sleep among the community-dwelling elderly. Geriatr Gerontol Int. 2011;11(3):267-74. https://doi.org/10.1111/j.1447-0594.2010.00680.x.
33. Noji S, Takayanagi K. A case of laugher therapy that helped that improve advanced gastric cancer. JPN Hosp. 2010;29:59-64.
34. Mora-Ripoll R. The therapeutic value of laughter in medicine. Altern Ther Health Med . 2010;16(6):56-64.