Research Paper

Effects of Aromatherapy Using Sour Lemon on Nausea in Patients Undergoing Chemotherapy: A Quasi-Experimental Study

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ABSTRACT

Objectives: Nausea is one of the most important symptoms of patients undergoing chemotherapy. This study aims to determine the effects of aromatherapy with sour lemon on nausea in patients undergoing chemotherapy.

Methods: A total of 50 patients undergoing chemotherapy were randomly assigned to experimental and placebo (control) groups. The two groups completed the visual analogue scale for nausea before and the first to the fourth week after starting the intervention. The intervention was performed during chemotherapy. Using a dropper, a paper towel was saturated with 3 drops of sour lemon essential oil; however, for the control group, 3 mL of water as a placebo was spread on a paper towel. The intervention in the experimental and control groups was performed once a week for 4 weeks during weekly chemotherapy sessions.

Results: At the beginning of the study, no significant difference was observed between the mean score of nausea in the two groups ($P>0.05$). The first to the fourth week after starting the intervention, significant differences were observed between the mean score of nausea in the two groups ($P<0.05$). The results of the repeated measures analysis of variance indicated that the mean score of nausea changed over time in the experimental group, indicating a gradual decrease in the mean score of nausea ($P<0.05$).

Discussion: Our findings indicated that aromatherapy with sour lemon can be effective in reducing nausea in patients undergoing chemotherapy.

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Highlights

- Nausea is one of the most prominent physical symptoms in patients undergoing chemotherapy.
- Sour lemon is a type of medicinal plant suggested for managing nausea.
- Aromatherapy with sour lemon can be effective in reducing nausea in patients undergoing chemotherapy

Plain Language Summary

The current study assessed the effects of aromatherapy with sour lemon on nausea in patients undergoing chemotherapy in a hospital in Kashan City, Iran. Studies show that more than 85% of chemotherapy patients experience nausea and vomiting. Nausea can cause metabolic disorders, poor nutritional intake, and reduced bodily functions. Aromatherapy with lemon is effective in reducing nausea and vomiting in patients.

1. Introduction

Cancer has a high mortality rate. It is the second leading cause of death in the United States [1] and the third leading cause of death in Iran [2]. Chemotherapy is a frequent cancer treatment used to eliminate cancerous or fast-growing cells in the body [1]. Studies showed that chemotherapy is associated with many physical and psychological complications, such as fatigue, nausea, vomiting, anemia, alopecia, insomnia, anxiety, and depression, which can negatively affect the quality of life [3, 4]. Nausea is one of the most prominent physical symptoms in patients undergoing chemotherapy [5].

Nausea can be associated with direct or indirect effects related to cancer and cancer treatments, such as chemotherapy [6]. Studies show that more than 85% of chemotherapy patients experience nausea and vomiting [7, 8]. Nausea can cause metabolic disorders, poor nutritional intake, and reduced bodily functions [8]. There are two types of nausea associated with chemotherapy: acute and delayed nausea. Acute nausea develops immediately until 24 h after receiving chemotherapy, whereas delayed nausea develops after 24 h of receiving chemotherapy [7, 9]. Nausea can persist even with the use of antiemetic medications, such as metoclopramide [10, 11]. Additionally, antiemetic medications have adverse side effects, such as dizziness, headache, drowsiness, and fatigue.

Given the disadvantages of traditional and pharmacological treatments, research teams have studied a variety of non-pharmacological and complementary interventions to treat complications associated with chronic diseases [12-14]. Studies have shown that complementary and non-pharmacological interventions are increasingly recommended for managing both chronic diseases, complications associated with diseases, and their treatments [14]. There are several non-pharmacological interventions for managing nausea, including yoga [15], acupressure [16], and ginger [11]. Based on the advantages of these interventions, patients tend to use non-pharmacological interventions, such as herbal medicines, to control their nausea [15-16].

Sour lemon is a type of medicinal plant suggested for managing nausea [17]. Sour lemon is a ripe fruit of Citrus Limonun that contains volatile oil. Sour lemon essential oil is obtained by squeezing the fresh external peel of sour lemon. Sour lemon's pleasant smell is related to citral, which makes up 4% to 7% of sour lemon [18]. Sour lemon is also a great source of vitamin C, vitamin B6, magnesium, potassium, and phosphorus [19]. Because of these nutritional values, studies indicate that sour lemon can be effective in managing diseases and side effects related to the treatment of diseases [18]. Research teams investigated the effects of lemon essential oil on nausea in different patients, such as pregnant women and breast cancer patients. Yavari Kia et al. reported that aromatherapy with lemon is effective in reducing nausea and vomiting in pregnancy [17]. However, Somasundaram et al. indicated that lemon essential oil had no beneficial effect in reducing the symptoms of breast cancer patients undergoing chemotherapy, including nausea, vomiting, and pain [20]. However, there is a lack of research on the effects of sour lemon on nausea in cancer patients.

Research teams have reported contradictory results regarding the effectiveness of aromatherapy by using the essential oils of different plants on the side effects of chemotherapy. These teams investigated the effects of dif-

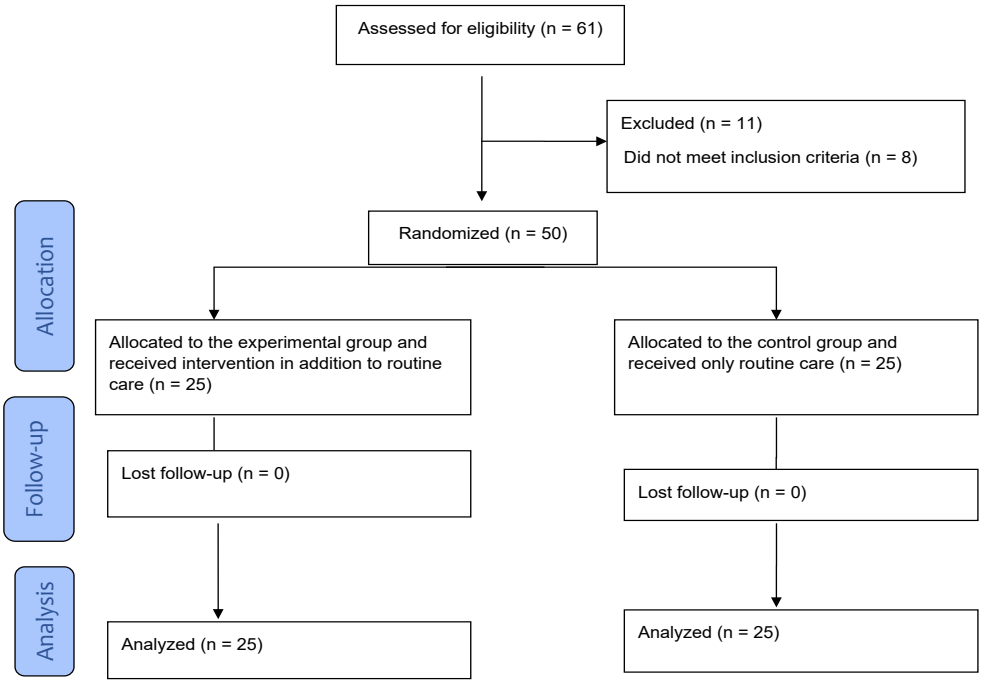

Figure 1. Sampling flow diagram

ferent essential oils on physical and psychological health aspects in chemotherapy patients. The essential oils included mint [21], chamomile [22], cardamom [23], and ginger [24]. However, the results of these aromatherapy studies are contradictory regarding the effectiveness of this intervention. To the authors' knowledge, studies on aromatherapy with lemon essential oils are limited and there is a lack of knowledge regarding the effect of lemon essential oil on nausea among cancer patients. Thus, it is necessary to investigate innovative strategies to manage complications associated with cancer and chemotherapy by using non-pharmacological interventions. This study aims to determine the effect of sour lemon aromatherapy on nausea in cancer patients undergoing chemotherapy.

2. Materials and Methods

Design, setting, and participants

A quasi-experimental study was performed on 50 chemotherapy patients referred to Shahid Beheshti Hospital in Kashan City, Iran, from April to September 2020. The sample size was calculated according to Kustriyanti and Putri [25]. The participants were divided into control and experimental groups. Based on β=0.10, α=0.01, S1=1.5, S2=1.44, μ=7.16, and μ=5.5, the sample size equaled 20 people for each group. Considering the 10% probability of attrition, the sample size in each group was 25 people. Before starting the study, 61 patients undergoing chemotherapy were evaluated for eligibility. At this time, to evaluate the severity of nausea, potential participants completed the visual analogue scale for nausea (VAS-Nausea). A 10-centimeter line was used, and 0=no nausea while 10=the most intense and unbearable nausea. Using the VAS-Nausea, the participants were asked to rate their nausea.

The inclusion criteria in this study comprised the following items: age over 18 years; having breast, esophagus, stomach, and intestine cancer (given the similar nature of the diseases and their chemotherapy medicines); being on the first day of their chemotherapy sessions; a healthy sense of smell (assessed by smelling medical alcohol); no history of asthma or chronic obstructive pulmonary disease; no allergy to plants or essential oils; VAS-Nausea score of 2 or higher; having chemotherapy sessions once a week; having stage I or II cancer. The exclusion criteria included the following items: having mental disorders and using other methods of complementary therapy, such as music therapy and hydrotherapy. We assessed 61 patients for eligibility. Eight patients did not pass the inclusion criteria, and 3 patients did not want to participate in the study. Finally, 50 patients undergoing chemotherapy were divided into control (n=25) and experimental (n=25) groups by the block randomization method (Figure 1).

Before starting the study, the participants in the experimental and control groups completed a socio-demographic questionnaire regarding gender, age, marital status, educational status, type of cancer, history of diseases, and duration of illness. Using the VAS-Nausea, the first author evaluated the nausea levels in both groups. At the end of the chemotherapy session, a week before the intervention, the severity of participants' nausea was measured in both groups. A week later, the intervention (aromatherapy with sour lemon) was initiated during chemotherapy in the experimental group. Aromatherapy was performed during weekly chemotherapy sessions for 4 weeks. At the end of the first to the fourth week of chemotherapy sessions, the nausea level was evaluated using the VAS-Nausea. All the participants were able to complete the questionnaires.

Intervention

The first author performed the intervention during four consecutive, weekly chemotherapy sessions. In the experimental group, routine care related to nausea (3 mL granisetron and 8 mg dexamethasone) with lemon essential oil was used for aromatherapy. The lemon essential oil was a product of Barij Essence Company and had a concentration of 95% lemon essence. Using a dropper, a paper towel was saturated with 3 drops of sour lemon essential oil. Then, the paper towel was positioned under the participant's mask. The patients routinely use surgical masks during chemotherapy. The participants were asked to breathe normally. This method was done once a week during chemotherapy sessions for 4 consecutive weeks. The lemon essential oil aromatherapy was initiated 5 min before the start of the chemotherapy session and lasted until the end of the session.

In the control group, in addition to the routine care related to nausea (3 mL granisetron and 8 mg dexamethasone), the first author poured 3 mL water, as a placebo, on a paper towel and placed it under the participants' mask during chemotherapy. In both groups, antiemetic medications (3 mL granisetron and 8 mg dexamethasone) were routinely used. In both groups, nausea was evaluated using the VAS-Nausea scale. At the end of each chemotherapy session, the severity of nausea was measured. Both groups were compared before the intervention and four weeks after initiating the aromatherapy, at the end of the first to the fourth week of chemotherapy sessions.

Data analysis

The data were analyzed using the SPSS software, version 18.0. The Kolmogorov-Smirnov test was used to determine the normal distribution. Data were analyzed by the Chi-square test and an independent t test. Comparing the severity of nausea before the intervention and at the end of the first to the fourth week was done by the repeated measures analysis of variance (ANOVA) method. The significance level was considered at P=0.05.

3. Results

The Mean+SD age of the experimental and the control group participants was 52.20±9.63 and 51.48±12.29, respectively. Regarding gender, 52% and 44% of participants were female in the experimental and the control group, respectively. The two groups did not have significant differences in the demographic data (P>0.05) (Table 1). Also, both groups did not have a significant difference in the mean score of nausea at the beginning of the study (P>0.05).

The Mean+SD of nausea at the end of the first to the fourth week in the experimental group was 4.84±1.14, 3.76±1.47, 2.82±1.21, and 1.92±0.90, respectively. No statistically significant difference was observed in both groups at the beginning of the study and after one week (P>0.05). However, this difference was significant two, three, and four weeks after the intervention (P<0.05). The repeated measures ANOVA indicated a gradual decrease in the mean score of nausea in the experimental group (P<0.05) (Table 2).

4. Discussion

This study indicated that aromatherapy with sour lemon was effective in reducing nausea in participants. We compared the control and experimental groups in terms of the nausea scores at four different points in time. Before the study, the mean scores of nausea in the two groups were not significantly different. The participants in the experimental group had a lower score of nausea in the second, third, and fourth weeks after the intervention compared to the control group. Furthermore, the mean score of nausea gradually decreased in the course of the study in the experimental group.

In similar research, Yavari Kia et al. found that lemon aromatherapy can be effective in reducing nausea among pregnant women [17]. The results of Khalili et al. also showed that aromatherapy using cardamom essential oil in cancer patients undergoing chemotherapy can reduce

Table 1. Demographic characteristics of the participants in both groups (n=25)

Variables		Mean±SD/No (%)		P
		Experimental	Control	
Age (y)		52.20±9.63	51.48±12.29	0.81*
Duration of illness (mon)		40.04±27.53	35.32±19.57	0.48*
Gender	Female	13(52)	11(44)	0.77**
	Male	12(48)	14(56)	
Educational status	Elementary level	24(96)	23(92)	0.58**
	Higher than elementary	1(4)	2(8)	
Marital status	Single	4(16)	4(16)	1¥
	Married	21(84)	21(84)	
History of disease	Diabetes	5(20.8)	7(28)	0.73**
	Hypertension	7(29.2)	1(4)	
	Kidney	4(16.7)	3(12)	
	Pulmonary	2(8.3)	8(32)	
	Other	7(25)	0	
Type of cancer	Stomach	4(16)	0	0.16**
	Intestine	8(32)	7(28)	
	Breast	12(48)	15(60)	
	Pulmonary	1(4)	3(12)	

* Independent t-test; ** Chi-square test; ¥ Fisher exact test.

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Table 2. Mean+SD of nausea in both groups in the five time periods

Group Nausea	Mean+SD		Type and Result of the Test		
	Experimental	Control	*Interaction of Time and Group		Inter Group Comparison¥
			Mauchly Test	Greenhouse-Geisser	
Before the intervention	5.72±1.54	5.52±1.29			P=0.62
1 week after	4.84±1.14	5.32±1.31			P=0.17
2 weeks after	3.76±1.47	4.84±1.02	F=16.24 P=0.056	F=33.57 P<0.0001	P=0.004
3 weeks after	2.84±1.21	5.16±1.14			P=0.0001
4 weeks after	1.92±0.90	5.16±1.14			P=0.0001
Time effect	F=3.62 P=0.014	F=56.36 P=0.08			

* Repeated measures analysis of variance, ¥independent t

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nausea and vomiting [26]. Furthermore, Maghami et al. found that aromatherapy using peppermint essential oil was effective in managing vomiting and nausea after cardiac surgery [27]. The results of these studies are in line with the present study.

Our results also reported that nausea in the experimental group significantly decreased throughout the intervention. Other studies also indicated that the severity of nausea in pregnant women [28, 29] and cancer patients [30] decreased more significantly when the number or the duration of the intervention (the use of other essential oil) increased. These studies indicate the significance of adherence to aromatherapy intervention over time.

Consistent with the present research, several studies showed the significance of aromatherapy in managing vomiting and nausea among patients [17, 27]. In contrast, Lua et al. found that aromatherapy with ginger was not effective on nausea and vomiting in breast cancer patients [31]. Furthermore, Ferruggiari et al. reported that aromatherapy was not effective in reducing postoperative nausea among women [32]. The contradictory results between these studies can be associated with the studies' populations, methods, and interventional designs. For instance, Maghami et al. indicated that aromatherapy using peppermint's essential oil was performed for 20 min for 1 week after cardiac surgery [27]. However, Lua et al. performed aromatherapy using ginger essential oil for 30 min once a day for 5 days [31]. The contradictory results indicate a need for further investigation.

Innovative interventional designs should be developed to meet patients' needs and to reduce complications associated with chronic diseases and their treatments. Further research is needed to support the results of the present study to integrate the findings into the knowledge base for evidence-based practice. Moreover, further investigations are needed to verify and propose an effective design of aromatherapy for managing nausea and vomiting in cancer patients. In the present study, vomiting was not assessed because the participants did not report vomiting during chemotherapy.

Study limitations

The small sample size was a limitation of this study. The participants' pharmacological treatments, such as antiemetic medications, were out of our control. However, the participants in both groups received their routine care and medications.

5. Conclusion

The findings of this study indicated that aromatherapy with lemon essential oil significantly reduced nausea in the participants. Therefore, we recommend this technique as an innovative, complementary, and safe method to reduce nausea among cancer patients undergoing chemotherapy. However, there is a lack of relevant studies regarding the effects of aromatherapy using lemon essential oil on cancer patients to verify our findings.

Ethical Considerations

Compliance with ethical guidelines

The research aim was explained to the participants before the initiation of the study. They were assured that their information would remain confidential and they could withdraw from the study at any time. All participants completed written informed consent letters.

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declareed no conflict of interest.

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