

## Effect of Cinnamon Essential Oil on the Chemotherapy-Induced Nausea and Vomiting of Cancer Patients

### Abstract

**Background:** Despite progress made in antiemetic control, most cancer patients still experience chemotherapy-induced nausea and vomiting. In oncology departments, nurses can evaluate the effects of complementary therapies such as use of essential oil on reducing nausea and vomiting of patients undergoing chemotherapy. Therefore, this study was conducted to explore the effect of cinnamon essential oil on the chemotherapy-induced nausea and vomiting of cancer patients. **Materials and Methods:** This is a two-group experimental study with a pretest-posttest design that was conducted between January 20 and March 15 of the year 2020. Through convenience sampling, 70 patients experiencing chemotherapy-induced nausea and vomiting were recruited to participate in this study. The participants were randomly allocated to two control and intervention groups. A pad moistened with 2 ml of isotonic saline and 0.2 ml of cinnamon essential oil was first placed inside a plastic bag, and then patients in the intervention group were asked to take three deep breaths while their face was towards the bag for two times at five-minute intervals. Patients in the control group used a placebo (a pad moistened with 2 ml of isotonic saline) instead of cinnamon essential oil during the intervention period. Participants in the two groups received routine antiemetic treatment. Using Visual Analog Scale (VAS), the severity of nausea and vomiting was measured in both groups before the intervention. For this reason, the severity of nausea and vomiting was measured after the first three breaths, and then after the second three breaths. Data were analyzed by SPSS software, using independent *t*-test, Chi-squared test, and Fisher's exact test. Repeated measures ANOVA were also used to evaluate nausea and vomiting between the two groups across times. The significant level of 0.05 was considered for all tests. **Results:** There were no significant differences between the two groups in terms of demographic characteristics and the severity of chemotherapy-induced nausea and vomiting before the intervention. The severity of chemotherapy-induced nausea and vomiting was significantly lower in the cinnamon group than the control group after the first 3.08 (0.55), ( $F_2 = 13.27$ ,  $p < 0.001$ ) and second breaths 1.91 (0.33) ( $F_2 = 11.39$ ,  $p < 0.001$ ). **Conclusions:** Nurses can educate patients and their families to use of cinnamon essential oil. Nursing managers can also emphasize on the use of cinnamon essential oil, which is one of the non-pharmacological, low-cost, and effective methods of reducing chemotherapy-induced nausea and vomiting, by holding in-service training classes.

**Keywords:** Cancer, chemotherapy, cinnamon oil, nausea, vomiting

### Introduction

Chemotherapy is regarded as one of the main treatments for cancer patients, but it has some side effects such as nausea and vomiting.<sup>[1]</sup> Nausea and vomiting are the most undesirable side effects of chemotherapy for cancer patients.<sup>[2]</sup> Chemotherapy-Induced Nausea and Vomiting (CINV) are experienced in different incidences. In recent studies, it has been shown that nausea and vomiting are experienced by 70% and 50% of cancer patients, respectively.<sup>[3]</sup> Other

studies reported that the incidence of CINV was 83.3% for nausea and 78.9% for vomiting. Ineffective control of CINV will cause other complications for patients, including nutritional disorders, dehydration, electrolyte disturbances, and impaired psycho-physiological functions. In the long-term, uncontrolled CINV may result in delayed chemotherapy, refusal or discontinuation of chemotherapy, and patient's noncompliance with treatment plans, while having negative effects on the patient's quality of life.<sup>[1,3,4]</sup>

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Nowadays, antiemetic drugs are commonly used to control CINV, but the complete treatment of these side effects has not been achieved.<sup>[4]</sup> The use of complementary therapies is becoming more popular to manage the side effects of cancer treatment.<sup>[3-5]</sup> According to the World Health Organization, 80% of cancer patients use complementary therapies.<sup>[6,7]</sup> Some complementary therapies that are commonly used by the patients include acupuncture, acupressure, guided imagery, hypnosis, reflexology, psycho-educational support, massage, and aromatherapy, which may help to relieve symptoms associated with cancer treatment.<sup>[3-5]</sup> Aromatherapy is one of the most frequently used complementary therapies in cancer treatment. It is widely used to alleviate cancer symptoms and improve physical and mental health.<sup>[6,8-10]</sup> Aromatherapy is the practice of using essential oils for therapeutic benefit. In aromatherapy, essential oils can be massaged into the skin, inhaled, or immersed in water.<sup>[6,8]</sup> Inhalation of essential oils is noninvasive and also an interesting method of intervention. Essential oils are extracted from plants in a pure form and may provide a positive impact on the health and well-being of patients. They affect the limbic system and promote well-being.<sup>[10-12]</sup>

Many herbal plants have been recommended for the relief of CINV. Ginger, cinnamon, peppermint, chamomile, fennel, and rosewood are among the most common plants used for this purpose.<sup>[2]</sup> Cinnamon (*Cinnamomum Verum*) is one of the oldest traditional herbal medicines. Cinnamon (*Cinnamomum Verum*) is the inner bark of the *Cinnamomum zeylanicum* tree belonging to the Lauraceae family. It has been used as a spice for thousands of years to improve the taste of foods and drinks.<sup>[7,13]</sup> In Persian medicine, cinnamon is used as a flavoring for food and medicine.<sup>[1]</sup> In addition to its use as a food substance, cinnamon is believed to have some health advantages such as antimicrobial, antioxidant, anticholesterolemic, antiviral, antidiabetic, antitumor, analgesic, and anti-gastric ulcer effects.<sup>[14,15]</sup>

To our knowledge, no studies have been conducted on the effect of cinnamon essential oil on CINV, but the effects of other scents on the relief of CINV have been investigated. The results of Khalili *et al.*<sup>[16]</sup> (2014) study showed that aromatherapy with cardamom can significantly reduce the severity of nausea in cancer patients. The results of Eghbali *et al.*<sup>[6]</sup> (2018) showed that nausea and vomiting in the acute phase of chemotherapy in the breast cancer patients were lower in the group that used peppermint. Jaafarpour *et al.*<sup>[17]</sup> (2015) showed that pain, menstrual bleeding, nausea, and vomiting decreased in the female college students who took cinnamon.

Nurses have an ideal, unique, and strategic position in the healthcare system that allows them to use complementary and alternative medicine for the benefit of patients. Nursing is one of the first professions that facilitated the

use of complementary and alternative medicine because nurses look at patients holistically and complementary medicine corresponds to this philosophy. Complementary and alternative medicine is also used as an intervention for many nursing diagnoses, so that some nursing associations have supported the incorporation of this method into conventional health care and described its use as part of the nurses' job description. Aromatherapy is generally a very safe and inexpensive practice.<sup>[11]</sup> Although strategies to manage CINV have improved, patients still suffer from CINV and a complementary therapy like cinnamon aromatherapy can improve the patient experience. For this reason, this study was carried out to explore the effect of cinnamon essential oil on the Chemotherapy-Induced Nausea and Vomiting (CINV) of cancer patients.

## Materials and Methods

This is an experimental study in which, 70 patients with chemotherapy-induced nausea and vomiting were examined during January 20<sup>th</sup> and March 15<sup>th</sup>, 2020. The study population consisted of all patients with chemotherapy-induced nausea and vomiting referred to the oncology wards of Bahonar Hospital. Thirty patients were allocated in each group according to the study of Khalili *et al.*<sup>[16]</sup> (2014) that was conducted on cancer patients. The standard deviation (SD) of nausea in the intervention and control groups were (20.9) and (15.3), respectively (type I error of 0.05 and power of 80%). In this study, we wanted to determine the difference between the scores of intervention and control group by at least ( $\mu_1 - \mu_2 = 13.4$ ) points, so the number of subjects in each group was calculated to be 35 people. Therefore, 70 patients participated in this study. Patients were assigned to two intervention and control groups by randomized blocks of 4, where two patients were assigned to the intervention group and two to the control group in each block. The block randomization method ensures that a balanced number of participants in each group over time and the difference in the number of individuals in each group will never exceed half the number of individuals in each block. The samples were selected by convenience sampling method and randomly divided into two control and intervention groups. The responsibility of randomization was assigned to a statistician. It should be noted that the statistician was involved in all stages of the study, but he did not know which group was the intervention group and which one was the control group. The control and intervention groups were named as groups A and B, respectively.

Patients were matched in terms of the number of chemotherapy drugs, number of chemotherapy sessions, and type of cancer. Given that the samples were selected by convenience sampling method, only four types of cancer patients entered the study. One of the disadvantages of convenience sampling method is its bias in sampling. When participants are not chosen randomly from a larger

population, sampling bias such as lack of diversity may occur. Patients were blinded to the assigned intervention. Only the researcher knew the type of intervention provided to each group. Random allocation of patients to two groups was done by someone who was blinded to the groups. Also, the statistician did not know about the groups. Also, since the time of patients' visits to chemotherapy center were not known, the possibility of interference between the groups was minimal.

After obtaining informed consent, patients experiencing CINV were enrolled in the study. The inclusion criteria were; having a diagnosis of cancer of any type, receiving chemotherapy, being  $\geq 18$  years old, having a normal sense of smell through self-reporting; and having at least two remaining chemotherapy treatments. Patients were entered to the study when they experienced nausea with the severity of at least 20 out of 100 on VAS. Exclusion criteria included; experiencing vomiting without nausea, having asthma and COPD, being allergic to cinnamon, undergoing concurrent radiotherapy, and being unable to complete VAS checklist. Using a 10-cm Visual Analog Scale (VAS) developed by McCormack *et al.* (1998), the severity of nausea and vomiting was measured in both groups. The VAS scale is a 10-cm line with on which the score of 0 on the left side reflects "no nausea" and score of 10 on the right side indicates "severe nausea." The patient indicated nausea and vomiting intensity by moving a mark on the scale.<sup>[17,18]</sup>

For data collection, the ethical code was obtained from the Ethics Committee of Kerman University of Medical Sciences. The sampling process began among patients experiencing CINV after attending the oncology wards of Bahonar Hospital and explaining the restudy objectives and methods. Patients in the intervention group inhaled a pad moistened with 2 ml of isotonic saline and 0.2 ml of cinnamon essential oil (Barij Essence in Kashan) placed inside a plastic bag for two times at five-minute intervals. With the declaration of nausea and vomiting by patients, the severity of nausea and vomiting was checked by the VAS scale. Patients who obtained the score of 20 mm out of 100 mm were asked to inhale the cinnamon essential oil three times deeply by placing their nose inside the plastic bag for three and exhale slowly through the mouth. They were also asked to repeat the intervention five minutes later. Patients in the control group used a placebo (isotonic saline) instead of cinnamon essential oil during the same specified time. Participants in the two groups received routine antiemetic treatment. Using VAS scale, the severity of nausea and vomiting were measured in both groups before the intervention, after the first 3 breaths, and then after the second 3 breaths.<sup>[16,19]</sup>

A demographic form and VAS scale were used for data collection. Data were collected at three time periods; before the intervention, after the first 3 breaths, and after the

second 3 breaths. Data were analyzed by SPSS software, using descriptive (frequency, percent, mean, and standard deviation), and analytical statistics (independent *t*-test, Chi-squared test, Fisher's exact test, and repeated measures ANOVA). Independent *t*-test and Chi-squared test were used to compare demographic variables between the two groups. Repeated measures ANOVA were used to assess the severity of nausea and vomiting between the two groups. The significant level was considered as 0.05.

### Ethical considerations

The Ethics Committee of Kerman University of Medical Sciences issued the ethical code (IR.KMU.RESEARCH.REC.1398.352) with registration No: 98000412 on 2019-10-21. Written informed consent was obtained from the participants, and explanation on the study objectives and method, confidentiality of personal information, and voluntary participation in the study were given to them.

## Results

### Descriptive results

The study population consisted of all patients with chemotherapy-induced nausea and vomiting referred to the oncology wards of Bahonar Hospital. A total of 70 patients with chemotherapy-induced nausea and vomiting were included in the study. It should be noted that no participant in the intervention and control groups was excluded, so the data of 35 participants in each group were analyzed. The study results showed that the Mean (SD) age of participants in the intervention and control groups was 50.02 (13.20) and 51.50 (12.41), respectively. Most of the samples in both groups were female, married, and housewives with high school diploma. According to the independent *t*-test and Chi-squared tests, there was no significant difference between the two groups in terms of age, gender, marital status, education level, occupation, type of cancer, family history, duration of disease, number of drugs used, and number of chemotherapy sessions [Table 1].

### Nausea and vomiting

Patients' nausea and vomiting scores are reported in Figures 1 and 2. Repeated measures ANOVA was used to compare the changes in nausea and vomiting scores between the two groups across the times [Figures 1 and 2]. Repeated measures ANOVA results showed that the Mean (SD) of nausea before the intervention was 5.02 (0.65), after the first 3 breaths was 3.08 (0.55), and then after the second 3 breaths was 1.91 (0.33). These results also showed a decrease in the Mean (SD) of nausea in the intervention group, while showing an increase in the control group ( $p < 0.001$ ) [Table 2]. The repeated measures ANOVA results also showed that the Mean (SD) of vomiting before the intervention was 3.48 (0.49), after the first 3 breaths was 2.25 (0.96), and then after the second 3

**Table 1: Comparison of demographic and cancer-related variables between the study groups**

Variable	Control n (%)	Intervention n (%)	Statistic	p
Gender	Male	10 (28.60)	$\chi^2=0$	0.99
	Female	25 (71.40)		
Marital status	Single	8 (22.90)	$\chi^2=0$	0.99
	Married	27 (77.10)		
Education level	Diploma	26 (74.30)	$\chi^2=0.59$	0.28
	Bachelor	9 (25.70)		
Occupation	Employed	8 (22.90)	$\chi^2=4.63$	0.09
	housewife	18 (51.40)		
	Retired	9 (25.70)		
Type of cancer	Digestive system	7 (20.00)	$\chi^2=1.98$	0.57
	Breathing system	4 (11.40)		
	Genital system	16 (45.70)		
	Musculoskeletal	8 (22.90)		
Duration of the disease (Month)	<6	16 (45.70)	$\chi^2=2.73$	0.25
	6-24	7 (20.00)		
	>24	12 (34.30)		
Number of drugs used	One drug	6 (17.10)	$\chi^2=4.35$	0.11
	two drugs	19 (54.30)		
	Three drugs and more	10 (28.60)		
Family history	Yes	18 (51.40)	$\chi^2=1.44$	0.22
	No	17 (48.60)		
Number of chemotherapy sessions	2-5	14 (40.00)	$\chi^2=1.44$	0.59
	6-15	11 (31.40)		
	16-25	10 (28.60)		
Age	Mean(SD)	Mean(SD)	$t^{**}=1.05$	0.63
	51.50 (12.41)	50.02 (13.20)		

\*Chi-squared test. \*\*Independent sample t-test

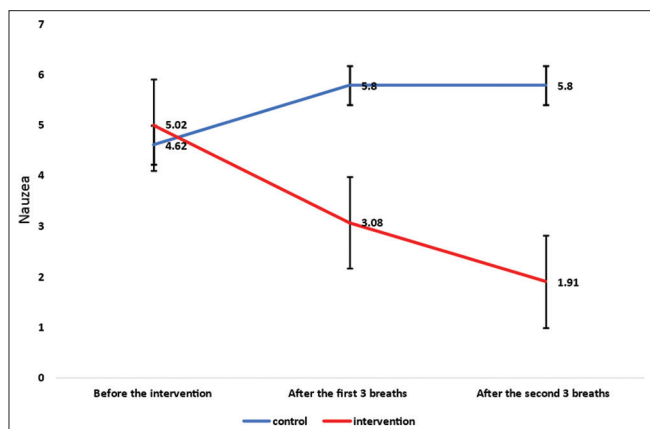


Figure 1: Nausea scores Mean (SD) are presented for intervention and control groups across the study time

breaths was 1.37 (0.45), showing a significantly decrease in the intervention group, while an increase in the control group ( $p < 0.001$ ) [Table 2].

### Discussion

The results of present study showed that patients with CINV who received aromatherapy with cinnamon essential oil had lower severity of chemotherapy-induced nausea and vomiting than patients who did not receive this therapy.

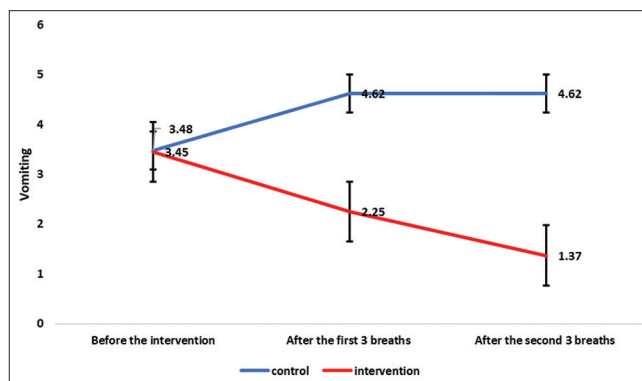


Figure 2: Vomiting scores Mean (SD) are presented for intervention and control groups across the study time

We found no comparable studies to measure the effect of cinnamon on nausea and vomiting after chemotherapy in patients experiencing CINV, but some studies have investigated the effects of other scents, such as ginger and cinnamon, as well as peppermint and cardamom on the nausea and vomiting of patients experiencing CINV.<sup>[1,3,6,20]</sup>

Amin *et al.*<sup>[20]</sup> (2022) conducted a randomized clinical trial on patients experiencing CINV who had chemotherapy in hospitals of Isfahan University of Medical Sciences. They showed that ginger and cinnamon can reduce nausea and

**Table 2: Comparison of the severity of nausea and vomiting in each group across time**

Variable	Assessment	Control group		Intervention group	
		Mean (SD)	<i>p</i>	Mean (SD)	<i>p</i>
Nausea	Pre	4.62 (0.36)	<i>F</i> =10.21*	5.02 (0.65)	<i>F</i> =13.27*
	After the first 3 breaths	5.80 (0.75)	<i>p</i> <0.001	3.08 (0.55)	<i>p</i> <0.001
	After the second 3 breaths	5.80 (0.75)		1.91 (0.33)	
Vomiting	Pre	3.45 (0.25)	<i>F</i> =9.32*	3.48 (0.49)	<i>F</i> =11.39*
	After the first 3 breaths	4.62 (0.67)	<i>p</i> <0.001	2.25 (0.96)	<i>p</i> <0.001
	After the second 3 breaths	4.62 (0.67)		1.37 (0.45)	

\*Repeated measures ANOVA

vomiting after chemotherapy. So, they concluded that cinnamon is useful for reducing nausea and vomiting after chemotherapy. This plant, like ginger, has antispasmodic property and increases digestive health. Eghbali *et al.*<sup>[6]</sup> (2018) concluded that peppermint oil is effective in decreasing the frequency and duration of acute nausea. They reported that in the delayed phase, although the use of peppermint oil aromatherapy reduced the frequency and duration of nausea and vomiting, this reduction was not statistically significant. Hudiyawati (2021) also argued that cardamom essential oil is effective in reducing vomiting and nausea in cancer patients undergoing chemotherapy.<sup>[1]</sup>

The finding of another study showed that peppermint essential oil significantly reduced the severity of nausea and the frequency of vomiting and nausea in patients undergoing chemotherapy.<sup>[3]</sup> In a study with a systematic review approach, the researcher evaluated the effect of aromatherapy in managing nausea and vomiting in cancer patients and showed that the direct use of aromatherapy is effective in reducing nausea and vomiting in cancer patients. However, in this systematic review, most of the reviewed studies had methodological limitations that made it impossible to generalize their results. So, the authors suggested that studies with accurate methodology and higher sample sizes are needed to confirm the effectiveness of aromatherapy.<sup>[21]</sup>

In general, vomiting is a reflex initiated by toxic substances, such as chemotherapeutic agents, that cause cell damage within the stomach and small intestines. Remarkably, these agents are sensed and detected in the gastric or small bowel mucosa and cause stimulation of vagal afferents that interact with the hindbrain of the Central Nervous System (CNS), resulting in the efferent vagal activity that eventually leads to an emetic reaction.<sup>[2]</sup>

Stimulation of Chemoreceptor Trigger Zone (CTZ) by chemotherapy agents circulating in the blood is the most significant cause of chemotherapy-induced nausea and vomiting. Cinnamon has antispasmodic property and promotes digestive health.<sup>[2]</sup> The cancer community has suggested the use of herbal supplements such as tea or aromatherapy to reduce CINV.<sup>[8]</sup> Indications of cinnamon use in the treatment of nausea and vomiting have not been sufficiently documented. According to Ayurveda, cinnamon is

packed with antiemetic and carminative properties that reduce the sense of nausea by stimulating the stomach cells lining. It also improves digestion and calms the lining of stomach.<sup>[22]</sup>

We could find no contradictory study to examine the effects of cinnamon aromatherapy on nausea and vomiting induced by chemotherapy in cancer patients. However, the results of studies conducted by Lua *et al.*<sup>[23]</sup> (2015) and Evans *et al.*<sup>[11]</sup> (2018) are not in line with our findings. They evaluated the effects of ginger aromatherapy on chemotherapy-induced nausea and vomiting.

Difference in scents and type of cancer could be the reason for these different findings. Also, this difference may be attributed to the different methods used in these studies. Another reason could be the duration of aroma application.

Lua *et al.*<sup>[23]</sup> (2015) examined the effectiveness of inhaling ginger aroma on CINV and the quality of life of breast cancer women. They reported that aromatherapy with ginger essential oil for five days had few effects on the reduction of CINV, except for reducing acute nausea. They concluded that patients who might not have been experiencing a high level of vomiting responded to the aromatherapy intervention. In this study, the severity of nausea was not evaluated before the enrollment.

Evans *et al.*<sup>[11]</sup> (2018) studied the effects of ginger aromatherapy on reducing chemotherapy-induced nausea in children with cancer. They reported no significant difference in the severity of nausea between the three study groups. They therefore concluded that aromatherapy with ginger essential oil has no sufficient effect on the chemotherapy-induced nausea in children with cancer.

Therefore, the search for solutions to improve the care of patients with cancer is essential and makes the management of CINV one of the primary concerns of oncology nurses. Complementary therapies could be a way to enhance nursing practice and improve the patients' experience.<sup>[21]</sup>

This investigation has some limitations such as its small study population, and the short follow-up interval between pre- and post-measurement. This study was also prone to the researchers' bias, because they avoided this problem during data collection by not transferring their knowledge and attitudes to the participants.

## Conclusion

The findings of this investigation reveal that cinnamon aromatherapy has a positive effect on CINV of cancer patients. Future clinical studies that include larger sample size and more follow-up time are required to confirm the effects of aromatherapy by cinnamon on the control of CINV in cancer patients. It should be noted that, aromatherapy is inexpensive and widely available to patients. Therefore, it can be considered as an effective intervention to reduce the severity of nausea and vomiting induced by chemotherapy.

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## Conflicts of interest

Nothing to declare.

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