



## DECREASING NAUSEA AND VOMITING DUE TO CHEMOTHERAPY INDUCTION THROUGH PEPPERMINT AROMATHERAPY

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### ABSTRACT

### Keywords

Nausea and vomiting often appear with under various conditions, including being a common side effect of using anti-neoplastic drugs. Chemotherapy-induced nausea and vomiting (CINV) was a major problem that can often alter the quality of life (QoL) and patient adherence to treatment if left untreated. Aromatherapy peppermint is one form of improvised nonpharmacological handling of CINV. This study aims to determine the effectiveness of giving peppermint aromatherapy in reducing CINV. This study was a queuey experiment with Control Group design, with total sample groups of 285 respondents with consecutive technique. Parameters in this study used Rhodes Index Nausea Vomiting and Reaching (RINVR). The data were analyzed using Wilcoxon sign rank test as a test of change of nausea scale of pre and post vomiting in experimental and control group. The results of the differences between both groups were tested with Mann Whitney-u test. Wilcoxon sign rank test analysis, showing differences in the incidence of nausea and vomiting. The result of a change of decrease in experimental group value  $p = 0,001$  is more significant than the control group with value  $p = 0,020$ . The difference is tested with Mann Whitney-u test with the result value  $p = 0.002$ . Aromatherapy works in one's body by triggering the release of neurotransmitter like enkephalin and endorphin which have an analgesic effect and increase the feeling of comfort and relax. Through inhalation, the fragrance of aromatherapy is transmitted through the limbic system into hypothalamus until pituitary and through the olfactory cortex, into thalamus and then head to the neocortex.

CINV,  
Chemotherapy,  
Peppermint  
aromatherapy

## INTRODUCTION

Vomiting or emesis is a condition due to strong intestinal muscle contraction that it pushes out the content of one's stomach through their mouth. This condition occurs with or without being nauseous previously. Nausea and vomiting often present together in many conditions, including as a common side effect of chemotherapy, well known as chemotherapy-induced nausea and vomiting (CINV) (Pazdur, 2003).

Nausea and vomiting are side effects which often occur after chemotherapy, and they can stay until 24 hours after the administration of chemotherapy drug (Smeltzer & Bare, 2002). High dose of IV (intravenous) Cisplatin and Cyclophosphamide can induce nausea and vomiting on more than 90% of the patients, compared to Bleomycin or Vincristine which can induce nausea and vomiting on less than 10% of the patients. (ASCO, 2016)

CINV process is triggered by chemotherapy agents involving central nervous system, peripheral nerve, neurotransmitter, and receptors. Chemotherapy cytotoxic can damage gastrointestinal tract and trigger enterochromaffin cells (EC) to be distributed to the whole gastrointestinal wall to release nervous signals through neurotransmitter release, i.e., serotonin (5-HT), substantial P (SP), dopamine (D2), monoamine (M), and histamine (H1). This neurotransmitter then enables afferent fibers of the vagus nerve by binding receptors (5-HT<sub>3</sub>, NK-1, etc.) and afterward, it stimulates dorsal complex of vagus nerve consisting of emetic/vomiting center (VC) *Chemoreceptor Trigger Zone* (CTZ), and *Nucleus Tractus Solitarius* (NTS). The sensory is then integrated and leads to vomit response activation (Janelins, 2013).

The frequency of chemotherapy administration can lead to traumatic feeling if the respondent has a record of nausea and vomiting, this will cause the relapse of nausea and vomiting. According to Apfel, Kranke, and Eberhart (2004) nausea and

vomiting record affect the relapse of nausea and vomiting in the coming condition. Paterson's statement (2012) supported Hewitt and Watts opinion (2000) that nausea and vomiting record could enter a patient's memory and bring about trauma and fear, this memory and fear will affect the performance of highest cortex center that induces the relapse of nausea and vomiting (Hewitt, 2009)

According to Callaghan and Cheung's theory (2012), anxiety could affect the occurrence of nausea and vomiting. Anxiety condition triggers the increase of catecholamine plasma and air stack in the gastrointestinal tract; this will lead to gastric distention and trigger the occurrence of nausea and vomiting (Gundzik, 2008).

The suggested actions to be taken to relieve nausea and vomiting complaint after chemotherapy among others is pharmacological therapy, i.e., anti-nausea and vomiting medicine before and after chemotherapy (pre-medication) and non-pharmacological, i.e. conducive environment for being quiet and comfortable, nutrition intake arrangement, and relaxation (Abdul Muthalib in Sudoyo, 2009).

Cancer patient experiencing several chemotherapy-induced nausea and vomiting (CINV) may delay their chemotherapy session and refuse their coming treatment due to fear of nausea and vomiting (Mustian, 2011). Uncontrollable nausea and vomiting highly affect the whole patient's therapy and influence therapy response as well as decrease cancer patient's recovery level. Besides, uncontrollable nausea and vomiting can bring about dehydration, electrolytes imbalance, weight loss, and malnutrition. Extended vomiting could also lead to esophageal, gastric damage, and bleed (Pazdur, 2003).

The occurrence of nausea and vomiting highly vary in chemotherapy cases that a good management for this disorder is

required for creating a rational therapy (appropriate, effective, safe, and convenient) as well as increasing the quality and life expectancy if cancer patients (ASCO, 2015). An inappropriate management of nausea and vomiting can hold the next chemotherapy process which may decrease cancer recovery rate, and trigger heavy anticipatory type of nausea and vomiting which has fear effect for chemotherapy patient (Grunberg, 2005). Pharmacological therapy is the main therapy. However, there are also several complementary and alternative therapies that can be used, i.e., herbal supplements in the form of aromatherapy that has been recommended by many to decrease CINV. This research proves the effectiveness of the use of peppermint aromatherapy against CINV.

## MATERIALS AND METHODS

The design of this research was pre-experimental with *Quasi-Experiment – Non-equivalent with control group design*. The population of this research is all patients in chemotherapy ward at Mojokerto District Hospital, as many as 285 patients undergoing chemotherapy (135 respondents of the control group, 150 respondents of the experimental group). Data gathering before research suggested that the number of the population meeting the criteria was 325 respondents. Sampling technique in this research was consecutive sampling, with inclusion criteria (Chemotherapy patients who experience nausea, no history of respiratory allergies, nasal function well, not pregnant, general condition good).

Data gathering method consisted of administrative procedures. The research was conducted from 22nd of May 2016 to 2nd of June 2017. Measuring tool used is RINVR, Rhodes of Index Nausea, Vomiting, and Retching (RINVR) with eight assessment items (Characteristics of Nausea, Vomiting, and Retching; Time of Nausea, Vomiting, and Retching; Frequency of Nausea, Vomiting, and Retching in the last 12 hours). Scores range from 0 to 32. With the

assessment criteria: 0= not Nausea and Vomiting ; 1-8 = Lightweight; 9-16 = medium; 17-24 = heavy; 25-32 = bad (Rhodes & McDaniel, 2001). Respondents in experiment group were given peppermint aromatherapy oil which is dropped into a cotton ball as many as three drops, and they were asked for about 5 minutes. Respondents of control group will receive therapy as the hospital's SOP. Peppermint therapy would not be given to respondents of control group; they only received pharmacological antiemetic therapy as a precaution for CINV. The therapy commonly used is ondansetron, diphenhydramine, and dexamethasone.

Data analysis in this research used Wilcoxon signed ranks test; the analysis is used to know the change between two variables, and Mann Whitney-U test as difference test result between two groups.

## RESULTS

The characteristics of those respondents are presented in a chart of frequency distribution and percentage as the followings:

Table 1 Distribution of respondents by age, alcohol consumption history, disease diagnosis and chemotherapy cycle in the control group and experimental group at Mojokerto District Hospital

N O	VARIABLE	Control group		Experimental group	
		Frequenc y	Percentag e	Frequenc y	Percentag e
1.	Age				
	21-30	0	0%	20	13%
	31-40	18	13%	20	13%
	41-50	18	13%	60	40%
	51-60	54	40%	10	6%
	61-70	45	33%	40	27%
	TOTAL	135	100%	150	100%
2.	History of alcohol consumption				
	Ya	40	29%	20	13%
	Tidak	95	71%	130	87%
	TOTAL	135	100%	150	100%
3.	Medical diagnosis				
	Ca Liver	5	4%	0	0
	Melanoma	4	3%	0	0
	Limfoma	4	3%	0	0
	Sarcoma	0	0	4	3%
	Ca serviks	31	23%	26	17%
	Ca paru	0	0	5	3%
	Ca	0	0	9	6%

nasofaring				
Ca Mammae	88	65%	100	7%
Ca colon	3	2%	6	4%
TOTAL	135	100%	150	100%
4. Cycle of chemotherapy				
Cycle 1-2	85	63%	20	13%
Cycle 3-4	15	11%	75	50%
Cycle 5-6	15	11%	45	30%
Cycle 7-8	15	11%	10	7%
Cycle 9-10	3	2%	0	0
Cycle 11-12	2	1%	0	0
TOTAL	135	100%	150	100%

The result of this research suggested that the average of respondent's age is 51 years old and most respondents were women (81.3%). This result is in line with Bourdeanue's research (2012) on 358 Asian women in California suffering from CINV, the average of patient's age was 49 years old. While Santosh's research (2011) on 30 patients receiving anti-cancer chemotherapy in India suggested that more than 50% of which were women (70%).

Based on the table it was suggested that the majority of both experimental and control group never consume alcohol. Respondents who never consumed alcohol experienced more nausea, vomiting, vomiting more easily controlled in patients with a history of chronic alcohol (> 100 g / day) than patients with no history of alcohol.

The majority of the experimental group were Ca Mammae. Based on the table it is known that the majority of respondents of the experimental group were on cycle 3 - 4 and the majority of the control group were on cycle 1-2. Chemotherapy is the time required for the administration of chemotherapy. One cycle takes once every 3 to 4 weeks, but there is also a cycle occurring every week (Tjokronegoro, 2006). Chemotherapy cycle affects nausea and vomiting symptoms. The more intense the chemotherapy is, the worse is nausea and the vomiting symptoms (McRonald & Leisher, 2005 in Marisa, 2014).

Table 2 Distribution of respondents by type of chemotherapy-induced nausea vomiting in control group and experimental group at Mojokerto District Hospital

N	Type	Control Group		Experimental group	
		Frequency	Percentage	Frequency	Percentage
1.	Acute	90	70%	100	70%
2.	Delayed	45	30%	50	30%
3.	Anticipatory	0	0	0	0
TOTAL		135	100%	150	100%

Based on nausea characteristics displayed on the table above, respondents suffering from acute nausea (70%) more with 90 respondents suffering from delayed nausea (30%) as many as 45 respondents, while no respondents are experiencing anticipatory nausea (0%).

Table 3 nausea and vomiting scale analysis of pre- and post-administration of peppermint aromatherapy in chemotherapy patients, the control group and the experimental group in Mojokerto District Hospital

No	Scale of nausea - vomiting	Control Group				Experimental group			
		Pre		Post		Pre		Post	
		Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	Not hind	0	0	9	7%	0	0	40	27%
2	Mild	45	33%	45	33%	40	27%	60	40%
3	Medium	36	27%	54	40%	30	20%	50	33%
4	Severe	36	27%	27	20%	60	40%	0	0
5	Bad	18	13%	0	0	20	13%	0	0
TOTAL		135	100%	135	100%	0	100%	0	100%
Average		3.19		2.75		3.44		2.13	
Standard deviation		1.04		0.856		1.031		0.806	
p-value		0.02		z-value= 2.333	-	0.001		z-value= 3.391	-

Results indicate that peppermint aromatherapy is effective against a decrease in the scale of nausea in chemotherapy patients, seen from the p-value of the experimental group (0.001) smaller than the control group(0.02).

## DISCUSSION

Chemotherapy-induced nausea and vomiting (CINV) are one of the side effects of chemotherapy that is often problematic can change the quality of life and adherence of patients to treatment, thereby reducing the rate of cure of cancer patients. Also, uncontrolled nausea vomiting can also cause dehydration, electrolyte imbalances, weight loss, and malnutrition. Prolonged vomiting can cause esophageal, gastric damage and bleed (Pazdur, 2003).

The effectiveness of peppermint aromatherapy can be triggered by factors affecting the functions of the olfactory system. One of the most influential factors is age (Larsson in MULLol, 2012), conducting identification to the prevalence of anosmia to 75 respondents suggested that most of which were aged 60-69 years old (22.7%). The influence of age toward olfactory factor was also explained by Doty and Kamath (2014) through Cross-Sectional study suggested that half of the population in the United States age 65 - 80 years old experienced loss of olfactory function (Doty, 2014).

Pharmacologically, fragrances from EO can deliver direct effects to a central nervous system and endocrine system unwittingly. While according to Geiger (2005 in Lua & Zakaria, 2012), they described that through inhalation, volatile molecules of EO passing olfactory receptor in the nose recognizing the molecular characteristics and send the signal to the brain through olfactory system. Besides, some main elements of the molecules enter the bloodstream through the lung and directly affect nerves in the brain after passing blood barrier in the brain. While Ondansetron works by blocking receptors in gastrointestinal and postrema area bound with serotonin in *chemoreseptortriggerzone* (CTZ) to medulla oblongata that it prevents nausea and vomiting reflect (Putri, 2010).

Aromatherapy works in one's body by triggering the release of neurotransmitter

like enkephalin and endorphin which have an analgesic effect and increases the feeling of comfort and relax (Potts, 2009). Through inhalation, the fragrance of aromatherapy is transmitted through two ways, first is through the limbic system into hypothalamus until pituitary. Second is transmitted through the olfactory cortex, into thalamus and then head to the neocortex. Through these two ways, aromatherapy shall be processed until it creates the individual perception (Cook, 2008). Hypothalamus acts as a relay and regulatory generating messages to be delivered to other parts of brain and body. The received messages shall be translated into action, i.e. releasing electrochemical substances that lead to euphoria (excessive pleasure), relaxation, and sedative. This limbic system is used mainly in emotional expression. One of the examples of perception expressed by an individual on inhaled peppermint aromatherapy is personal relaxation effect; this effect will decrease personal anxiety. The decrease of personal anxiety shall decrease the risk of nausea and vomiting incidences (Grunebaum, 2011).

Some researchers have explained that peppermint aromatherapy is effective in decreasing nausea. Tayarani research result suggested that there was a significant decrease in the intensity and count of chemotherapy-induced nausea and vomiting within first 24 hours by using *M. spicata* and *M. x. Piperita* on both treatment groups compared to that of the control group ( $p < 0.005$ ) (Tayarani, 2013). Peppermint aromatherapy can also decrease nausea scale on Postoperative Nausea (PON) patients. Hunt's research (2013) suggested that PON patient's nausea scale decreased significantly ( $p > 0.001$ ) after a mixed EO of ginger, spearmint, peppermint, and cardamom is given (Hunt, 2013). A brief view concerning the use of aromatherapy for nausea vomiting by Lua and Zakaria (2012) suggested that of 5 articles meeting the criteria of inclusion which included experiments with 328 respondents, it is



suggested that the inhalation of peppermint essential oil (EO) vapor not only decreased the incidence and severity of nausea and vomiting but also decrease the use of antiemetic medicine and as a result increase patient's satisfaction level.

Several things analyzed by the researcher were that the giving of peppermint of aromatherapy would be more effective in decreasing nausea and vomiting and influence patient's condition to be more relax as well as decreasing anxiety if conducted regularly and continuously maintained if the effects of aromatherapy fade out. Aromatic functions can be used to remove odor from a room as well as create a comfortable atmosphere in a room (Poerwadi, 2006). Thus, researchers added burning tools to every room if possible, as a combination to get a more optimum result. In this research, some chemotherapy respondents who were indicated for inpatient treatment that it made the researchers easier to focus and control the room's environmental to get the optimum therapeutic effect.

## CONCLUSIONS

Peppermint aromatherapy is effective on the decrease of the scale of chemotherapy-induced nausea and vomiting (CINV).

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