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Effect of Lavender Oil on Vital Signs among Mechanically Ventilated Patients

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Abstract

Background: Mechanical Ventilation (MV) is a major factor in the care of patients in critical conditions that is used to create better conditions for gas exchange at the alveolar surface and tissue through improvement and facilitating the entry and exit of the air. Although MV therapy is crucial, but brings different experiences of physical and psychological stress for the patient as well Using lavender essential oil is considered one of the complementary therapy and was reported to be effective in improving MV weaning outcomes. ***The aim of the study*** was to evaluate the effect of lavender oil on vital signs among mechanically ventilated patients. ***Design***: a quasi-experimental study. **Setting**: the study was carried out at general ICUs of Tanta University Emergency Hospital. ***Subjects***: a purposive sample of 60 adult patients from both genders newly admitted attached with mechanical ventilator was involved in this study. ***Data collection tool:*** Integrated Nursing Practice & weaning trial assessment tool was used to collect data. ***Results***: There was statistically significant difference between control and study groups before and after application of lavender oil regarding (body temperature, heart rate, respiratory rate, and SPO_2). ***Conclusion:*** Implementation of lavender oil has been shown to enhance mechanically ventilated patients outcomes. It is associated with significant improvement of vital signs, oxygenation and mean arterial blood pressure. ***Recommendation:*** this study recommends the importance of implementation of lavender oil using massage and inhalation techniques for mechanically ventilate patients.

Key words: *Aroma Therapy, Lavender Oil, Mechanical Ventilation*.

Introduction

Critically ill patient are those at high rate for actual or potential life threatening health problems. Many Critically ill patients require support with mechanical ventilation (MV) before they recover from their critical illness, which is associated with significant mortality and morbidity. Intensive Care Unit (ICU) help to monitor and care of patients with potentially severe physiologic instability requiring technical and/or artificial life support (**Jackson & Cairns., 2021)**.

Every year more than 6 million adults experience acute illnesses. Many of these patients in the ICU, require MV to maintain adequate oxygenation and protection of the airway. According to the present statistics in the world at least 15% of the patients who are hospitalized in ICU especially for long time (until 21 days and more) are under MV. In spite of life-giving benefits of MV for patients, like other interventions it is not without complication. Some complications have been preventable; it is while other complications can be just minimized, without being destroyed completely **(Ambrosino &Vitacca, 2018).**

Over the past decade, ICUs worldwide have adopted the goal of maintain the optimal level of comfort and safety for critical care potentials. Therefore, the use of evidence based practice and protocols are mandated by the accreditation agencies to achieve the optimum level of safety and standardize the provided care thus

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improving the quality of care. Benchmarking the quality of care for ventilated patients has been an elusive goal for regulators and quality advocates for many years (**Melnyk & Fineout-Overhold., 2022).**

Nowadays, use of alternative and complementary therapies with mainstream medicine has gained the momentum. Aromatherapy is one of the complementary therapies which use essential oils as the major therapeutic agents to treat several diseases. The essential or volatile oils are extracted from the flowers, barks, stem, leaves, roots, fruits and other parts of the plant by various methods. It came into existence after the scientists deciphered the antiseptic and skin permeability properties of essential oils. Inhalation, local application and baths are the major methods used in aromatherapy that utilize these oils to penetrate the human skin surface with marked aura **(Jafari-Koulaee, et. al., 2020)**.

Lavender oil can be used in aromatherapy massage as it is rapidly absorbed by the skin, and also can be used as inhalation therapy. It was found that lavender oil play an important role in enhancing the brain plasticity and improving the feeling of well-being and suppressing agitation Evaluation of the effects of aromas on the nervous system may be divided into two different forms of arousal, the cortical arousal such as brain wave activity and the autonomic arousal such as heart rate, skin conductance. Decreases of the cortical arousal and/or the autonomic arousal are interpreted in terms of a sedative/relaxing effect of aromas. In contrast, increases of the cortical arousal and/or the autonomic arousal are interpreted in terms of a stimulating effect of aromas ***(*** **Soares, et al.,2022*).***

Lavender (Lavandula officinalis Chaix.) belonging to the family of Lamiaceae, is a beautiful herb of the garden. It contains camphor, terpinen-4-ol, linalool, linalyl acetate, betaocimene and 1,8-cineole. Its constituent varies in concentration and therapeutic effects with the different species. Linalool and linalyl acetate have maximum and great absorbing properties from skin during massage with a depression of central nervous system. Linalool shows sedative effects and linalyl acetate shows marked narcotic actions. These two actions may be responsible for its use in lavender pillow anxiety patients with sleep disturbance pattern, improving the feeling of well-being, supporting mental alertness and suppressing aggression and anxiety ***(Babatabar Darzi, et al.,2020).***

Lavender oil shows its antibacterial and antifungal properties against many species of bacteria, especially when antibiotics fail to work, but the exact mechanisms are yet to be established. It is well documented that lavender oil is used for the treatment of abrasions, burns, stress, headaches, in promotion of new cell growth, skin problems, painful muscles and boosting an immune system ***(Tariq, et al.,2019).***

The use of lavender oil can help to boost the immune system, reduce stress, promote relaxation, stimulate circulation, promote digestion, and act as decongestant anti-inflammatory and antibacterial agent. Aromatherapy using lavender essential oil is also thought to work on mood by promotion the release of neurotransmitters, including encephalin, endorphins, serotonin, and noradrenalin. Encephalin and endorphins reduce pain and create feeling of well- being. Serotonin help in relaxation while noradrenaline act as a stimulant ***(Cui, et.al.,2022).***

Significance of the study

Despite several studies have been conducted to study the effect of aroma therapy using lavender oil on improving sleep quality and alleviating pain, stress, and anxiety among ICU patients, the effect of these intervention have not been extensively studied on vital signs and mechanical ventilation weaning outcomes. Moreover, the national and international studies that examined the effect of such complementary practices did not focus on the mechanically ventilated patients rather than focusing on ICU patients at general **(Mohamed,et al 2019)**.

Aim of the study

This study was aimed to evaluate the effect of lavender oil on vital signs among mechanical ventilated patients through:

1. Assessing studied patients clinical data.
2. Implementing lavender essential oil for mechanically ventilated patients.

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3. Evaluating the physiological parameters and weaning outcomes for studied patients after aromatherapy

Research Hypothesis

The mechanically ventilated patients who will be exposed to lavender oil will have more stability on vital signs and will achieve improvement in clinical outcomes than those patients whom will have routine care in the ICU.

Research design:

A quasi-experimental research design was utilized in this study.

Study Setting:

This study was carried out at general ICUs of Tanta University Emergency Hospital (TUHICU). These ICUs are equipped with necessary equipment to meet the critically ill patients' needs. TUHICU consists of two main halls with eleven beds. It receives approximately 30 patients per month with multiple body system alteration.

Sampling:

A purposive sample of 60 adult patients from both genders newly admitted attached with MV was involved in this study, based on Epi-Info program according to the following parameter: Population size=200 over 6 months, Confidence coefficient 95%, Expected frequency 50%, Margin of error 5%. Minimum sample size 60 who accepts to participate in the study then divided randomly into two equal groups (30 patients for each group).

Subjects criteria:

- Inclusion criteria

Adult patients , receiving MV for the first time during the current hospitalization ≥ 48 hours and with APACHE score of (10-19).

- Exclusion criteria

Patient with severe respiratory distress.
Patients who were receiving sensory suppression medications (sedatives, muscle relaxant).

Tools for data collection:

Data was collected using the following one tool:

Tool: Integrated Nursing Practice & weaning trial assessment

It was developed by the researcher after reviewing the relevant literature***(Pham et al., 2023)***.

Part I: Patient's Demographic Characteristics and Clinical Data

This part was used by the researcher to record patient's demographic and clinical data. Patients demographic data including (age and gender) and clinical data (diagnosis, days of MV before starting weaning trial, level of consciousness, initial ventilator parameters (mode, FiO_2, Vt, PEEP, PSV, f), number of weaning trials, and ABGs values on admission (PH, $PaCO_2$, PaO_2, HCo_3, SaO_2).

Part II: The Acute Physiology and Chronic Health Evaluation(APACHE II) Scoring System. It was used to select populaion acoording to their APACHE score **(Knaus., Draper., Wagner &Zimmerman., 1985)**.

Part III: Hemodynamic Responses Recording During Intervention.

This part was developed by researcher based on related literature. It was used to record and follow up of changes in heamodynamic parameters in both groups. It included physiological responses as heart rate, rhythm, respiratory rate, SpO_2, systolic and diastolic blood pressure and body temperature **(Papathanassoglou & Park.,2016)** .

Operational Item

It included preparatory phase, content validity and reliability, pilot study and field work.

A. Preparatory phase:

Prepare the study tool based on related literature review and develop the study tool and test its content validity and reliability.

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Pilot study

A pilot study was carried out on 6 patients (10% of the study subjects) in order to assess feasibility of the study and applicability of the tool. The necessary modifications were done accordingly**.**

Content validity

Validity ascertained by a panel of experts in branch of critical care nursing, who review the tool for the format, layout, consistency, accuracy, and relevance**.**

Tool Reliability

Reliability tested statistically using the appropriate statistical tests to assure that the tools are reliable before data collection. The correlation coefficient was (0.885) which was good.

Field work:

1- An informed consent was obtained from patient's legal guardians'. It included the aim of the study, potential benefits, risks and discomforts, associated with participation.
2- Tool was developed after reviewing recent relevant literatures.
3- Meeting and discussion was held between the researcher and the nursing administrative personnel to explain the objectives and the nature of the study to gain their cooperation during the implementation phase.
4- Newly admitted adult Mechanically ventilated patients who had met the inclusion criteria were randomly assigned through coins toss method into equal groups.
5- Data was collected over a period of six consecutive months. The data collection started at the beginning of December 2022 and was completed by May 2023. All the eligible patients was assigned to two studied groups. Those assigned to the control group received the conventional nursing care for mechanically ventilated patients provided by the CCNs (n = 30), while those in the study group received the aroma therapy(inhalation& massage therapy). (n = 30).
6- The demographic and clinical data of the studied patients was collected from the patient's chart or patient assessment and was recorded.
7- The baseline measurement of ventilator parameters was obtained at the 1st day of the study using study tool part I.
8- The baseline data of LOC, vital signs , and weaning criteria was assessed from the 1st day of the study using tool part IV.
9- The researcher observed the conventional nursing stimulation practices that may affect the patients' hemodynamic using tool part III.
10- Aromatherapy; in the current study, lavender oil was used for aromatherapy. Lavender oil was prepared as a cold pressed oil under the supervision of professor in Faculty of Science; Tanta University specialized in Botany and Microbiology
11- Aromatherapy massage were carried out for 90 minutes per day for four consecutive days for the study group. In aromatherapy massage, the patients in the study group were reclined in a lateral position, followed by applying 2% lavender(2 drops) essential oil and massage the back and the four limbs of the patient using the technique of stroking for 5 minutes**.** Afterward, the patient was positioned in a supine position for 5 minutes then return to comfortable position.
12- The different techniques used in therapeutic massage: **Effleurage** that is described as gliding or sliding movement over the skin with a smooth, continuous motion . Effleurage techniques stimulate the parasympathetic nervous system and evoke the relaxation response and enhance venous return**. Petrissage** that is described as lifting, wringing, or squeezing of soft tissues in a kneading motion, or pressing or rolling of the tissues under or between the hands. **Petrissage** techniques mobilize deep muscle tissue or the skin and subcutaneous tissue which increase local circulation ***(Miri, et al.,2023).***
Friction that is described An accurately delivered penetrating pressure applied through the fingertips. This technique treat muscle spasm or breaks up adhesions from old injuries. **Tapotement** in which various

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parts of the hand striking the tissues at a fairly rapid rate. Tapotement technique stimulates the tissues, either by direct mechanical force or by reflex action ***(Vijayakumar, et al.,2023).***

13- Vital signs (HR and rhythm, RR, BP, and body temperature) were measured before, during, and after intervention.

Ethical considerations:

An official permission to conduct the proposed study was obtained from the Scientific Research Ethics Committee, faculty of nursing Helwan university. Participation in the study was voluntary and subjects relatives was given complete full information about the study and their role before signing the informed consent. The ethical considerations included explaining the purpose and nature of the study, stating the possibility to withdraw at any time, confidentiality of the information where it could not be accessed by any other party without taking permission of the participants. Ethics, values, culture and beliefs was respected.

III- Administrative Item:

After explanation of the study aim and objectives, an official permission was obtained from the Dean of faculty of nursing Helwan university and the general manager of Tanta University Hospital asking for cooperation and permission to conduct the study.

IV-Statistical Item:

Upon completion of data collection, data was computed and analyzed using Statistical Package for the Social Science (SPSS), version 24 for analysis. For quantitative data, numbers, percentage, mean, and standard deviation (SD) were used to describe the results. For qualitative data which describe categorical set of data by frequency, percentage of each category was calculated. The following statistical tests were used:

1. Chi-square test was used for categorical variables to compare between different groups.
2. Fisher's Exact or Monte Carlo correction Monte Carlo correction: correction for chi-square when more than 20% of the cells have expected count less than 5.
3. Student t-test: for normally distributed quantitative variables, to compare between two studied groups.

Degrees of Significance of the results were:

- Non-Significant (NS) if $p > 0.05$.
- Significant (S) if $p < 0.05$.
- High Significant (HS) if $p < 0.01$.

Results:

Table (1): Distribution of the studied groups according to demographic data

	Control (n = 30)		Study (n = 30)		χ^2	P
	No.	%	No.	%		
Age						
18 > 30	1	3.3	4	13.3	8.451*	$^{MC}p=0.029^{*}$ (S)
30 > 40	0	0.0	5	16.7		
40 > 50	7	23.3	3	10.0		
50 > 60	22	73.3	18	60.0		
Mean age	52.30± 11.54		51.06 ± 13.88			
Gender						
Male	17	56.7	14	46.7	0.601	0.438 (NS)
Female	13	43.3	16	53.3		

χ^2: Chi square test, FE: Fisher's exact test, MC: Monte Carlo test, NS: Not Significant
S: Significant p: p value for comparing between the studied groups
*: Statistically significant at $p \leq 0.05$

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Table (1) shows that more than half (60% , 73.3%) of the patients in the study and control group were between 50– 60 years, respectively. The mean age was 52.30 ± 11.54 and 51.06 ± 13.88 year for the control and study groups of patients respectively. Concerning patients' gender, this table shows that 56.7% of the control groups of patients were males compared to 53.3% of the study group of female patients.

Table (2): Comparison between the two studied groups according to the acute physiology and chronic health evaluation (APACHE II) scoring system

Items	Control (n = 30)	Study (n = 30)	T	P
Temperature (c)	37.33 ± 0.50	37.26 ± 0.81	0.364	0.717
Mean arterial pressure	94.63 ± 13.01	87.97 ± 12.98	1.987	0.052
Heart rate	96.40 ± 12.25	96.20 ± 19.91	0.047	0.963
Respiratory rate	19.53 ± 4.25	22.0 ± 6.51	1.738	0.087
Oxygenation	117.99 ± 53.72	98.37 ± 2.93	1.998	0.055
Arterial PH	7.38 ± 0.13	7.37 ± 0.08	0.366	0.716
Serum sodium (mmo/L)	141.47 ± 5.60	139.23 ± 5.23	1.602	0.115
Serum potassium (mmo/L)	3.69 ± 0.47	3.87 ± 0.53	1.361	0.179
Serum creatinine (mg/100mL)	1.37 ± 0.39	1.06 ± 0.51	2.648*	0.010* (S)
Hematocrit (%)	38.52 ± 2.94	38.08 ± 5.75	0.373	0.711
WBCs (total/mm^3)x10^3	13.11 ± 1.98	13.10 ± 3.13	0.024	0.981
Glasgow coma score	10.37 ± 1.38	9.60 ± 1.65	1.952	0.056
Age score	52.30 ± 7.68	47.17 ± 10.91	2.107	0.040
Total APACHE II score	12.73 ± 2.53	12.57 ± 2.40	0.262	0.795

Quantitative data was expressed by Mean ± Standard division
NS: Not Significant, S: Significant, t: Student t-test
p: p value for comparing between the studied groups
*: Statistically significant at p ≤ 0.05

Table (2) illustrates that the mean value of **Temperature** was 37.26 ± 0.81for the study group compared to 37.33 ± 0.50 for the control group at the start of the study with no significant difference between the two groups (P=0.717). The current table presents that the mean values of **Mean arterial pressure** for study and control groups at the start of study were 87.97 ± 12.98 vs. 94.63 ± 13.01 respectively with no significance difference between the two groups (P = 0.052).

The same table represents that the mean values of **Heart Rate** at the start of the study in control and study groups were relatively convergent (96.40 ± 12.25 vs. 96.20 ± 19.91 respectively); with no significance difference between the two groups (P = 0.963). As regards ***Respiratory rate***, although this table depicts that the mean values of respiratory rate differed dramatically among patients in the study and control groups(22.0 ± 6.51, 19.53 ± 4.25 respectively); the difference was not significant (0.087).

In relation to serum creatinine, it can be observed that there were decrease in the mean value of study group compared to control group (1.06± 0.51, 1.37± 0.39 respectively); the difference was statistically significant (0.010). It can be concluded from this table that the mean values of total APACHE II score were convergent in both control and study group (12.73 ± 2.53, 12.57 ± 2.40 respectively); with no significance difference between the two groups (P = 0.795).

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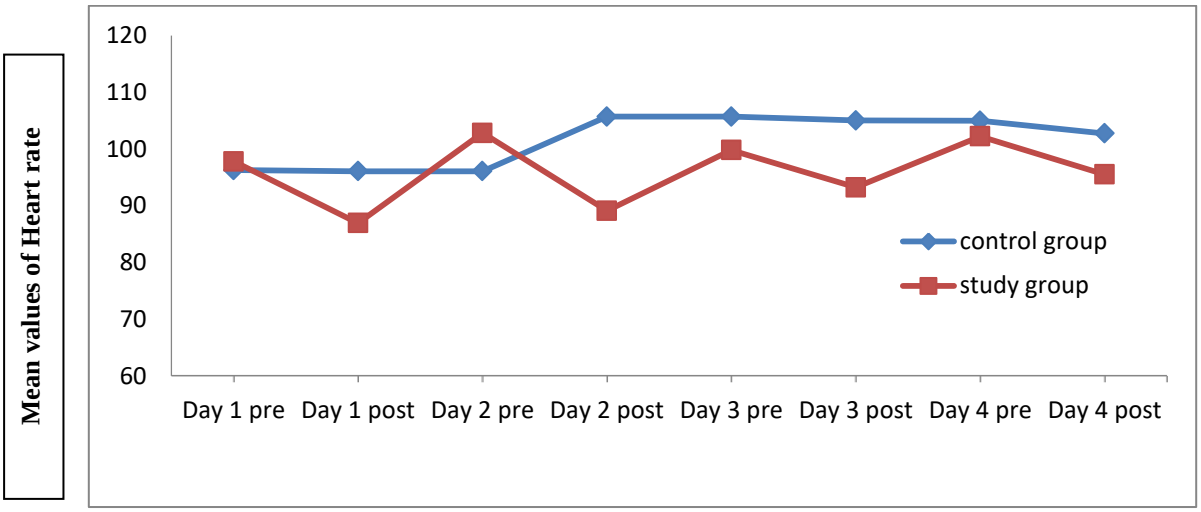

Figure (1): Mean values of Heart rate among the studied groups throughout the study period

As presented in fig (1), patients in the study group showed lower mean values of HR all over the study period after application of aroma therapy compared to control group.

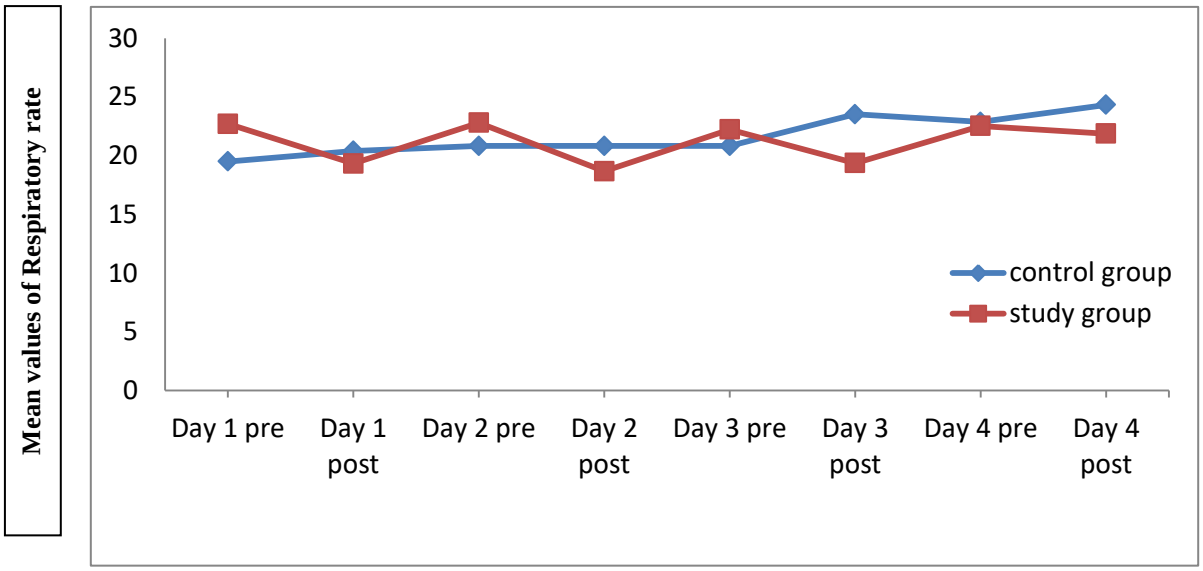

Figure (2): Mean values of respiratory rate among the studied groups throughout the study period.

Fig (2) illustrates that patients in the study group had lower mean values of RR all over the study period than patients in the control group**.**

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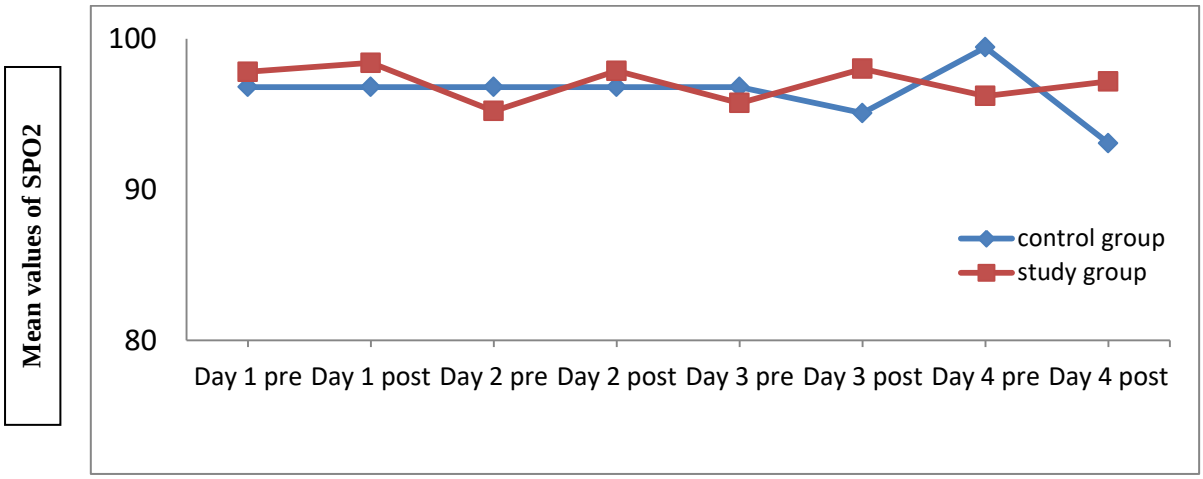

Figure (3): Mean values of SPO2 among the studied groups throughout the study period.

Furthermore, as shown in fig (3) despite the two groups were similar at the start of the study, patients in the study group had higher means of SPO_2 all over the study period after application of aroma therapy practices compared to control group.

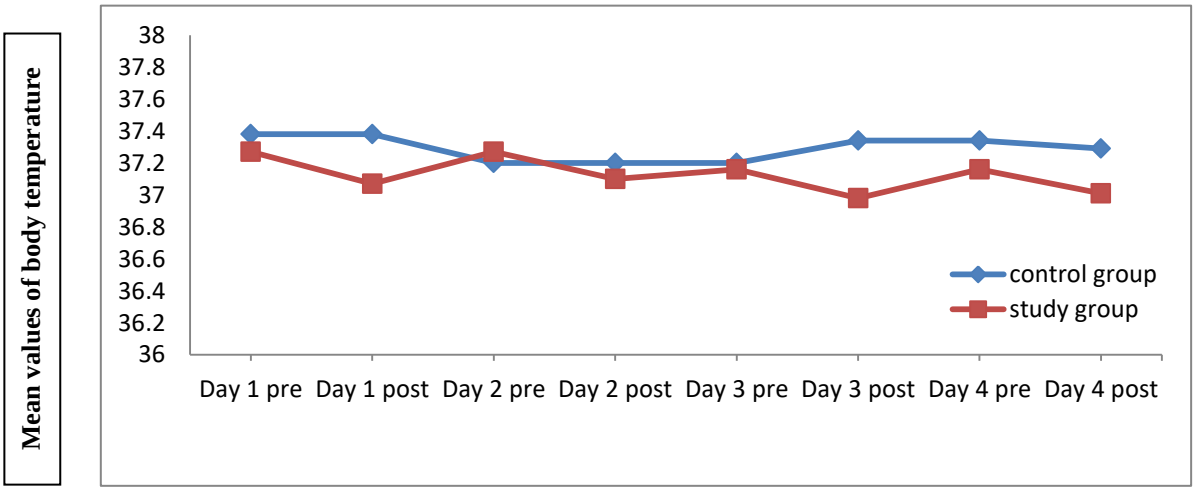

Figure (4): Mean values of body temperature among the studied groups throughout the study period

Fig (4) shows lower mean values of body temperature among patients in the study group compared to patients in the control group all over the study period**.**

DISCUSSION

Incorporation of integrative nursing practices in the care provided to critically ill patients may potentially promotes physical, emotional, and psychological health that could improve hemodynamic stability and enhance body functions recovery and further improve patient outcomes. Aromatherapy using lavender oil has recently gained traction as an alternative therapy. It perceives humans as holistic beings and focuses on their balance and harmony as components of nature. In response to this the current study was conducted to evaluate the effect of lavender oil on vital signs among mechanically ventilated patients (**Sebastian & Kear., 2024)**.

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Measurements of hemodynamic responses (vital signs, SPO_2, SBP, DBP and MAP) in relation to application of massage with lavender oil are helpful in assessing patients readiness for weaning from MV. It can provide an insight into central nervous system activity related to the perception and processing of environmental stimulation caused by using these practices, even in the absence of observable behavior (**Sattayakhom, Wichit, & Koomhin., 2023).**

Regarding **HR, and RR** results of the current study depicted that the mean values of HR, and RR decreased significantly among patients in the study group after application of aromatherapy nursing practices compared to patients in the control group. Regarding SPO2, the current study approved that the mean values of SPO2 in the study group were significantly higher than the mean values of SPO2 in the control group. This may be attributed to the calming and relaxation effects of implementing aromatherapy massage using lavender oil. Relaxation and calmness of critically ill patients in the ICU are strongly linked to decreasing of oxygen consumption, and oxygen demand and thus increasing the mean values of SPO2 **(Donelli, Antonelli, Bellinazzi, Gensini & Firenzuoli., 2019).**

The results of the current study were in agreement with **Kim et al., (2021).** They revealed that O2 saturation of patients in the study group who received lavender massage was significantly higher than the O2 saturation of patients in the control group. Findings of **Emami-Sigaroudi et al., (2021)** were in the same line of findings of the present study. They conducted a study to compare between the effect of aromatherapy with lavender and damask rose in patients undergoing coronary artery bypass graft. Where they reported that lavender oil had a significant effect on patients' SPO2 in the study group who received lavender compared to patients in the damask rose group.

On the other hand, **Davari, Ebrahimian, Rezayei, &Tourdeh., (2021)** found that there were no significant changes in the mean values of SPO2 between the study group who received aromatherapy with lavender oil and the control group.

In relation to the SBP and DBP, the present study found that the mean values of SBP and DBP in the study group were significantly lower than its values in the control group. These Findings may be attributed to that the odorant molecule of lavender oil binds the receptor and sends a signal to the brain, which is the center controlling body function. The major components of lavender oil are linalool and linalyl acetate. These substances affect the central nervous system, resulting in relaxation and stress reduction and have a positive association with hypertension therapy(**Seong, Hong ,Hur & Lee., 2023).**

According to the results of the current study, aromatherapy must be viewed as a complementary nursing intervention associated with improvement in critically ill patient hemodynamic status and enhancement of mechanically ventilated patient condition especially during weaning process. It is the nurses' role to pay more attention in assessing risks and physiological abnormalities and weaning failure criteria, planning and realization of integrative nursing practice.

Conclusion

Based on the findings of the current study, it was concluded that:

- Implementation of lavender oil has been shown to enhance mechanically ventilated patients outcomes. It is associated with significant improvement of vital signs, oxygenation and mean arterial blood pressure

Recommendations

- Vital signs, SBP, DBP, Sao_2 and GCS should be assessed routinely in ICU before and after each application of aroma therapy using lavender oil.
- Undergraduate critical care nursing courses should be focused on the vital role of the CCNs in enhancing of the mechanically ventilated patients' outcomes using alternative nursing practices
- Replication of this study on large sample is needed for to allow generalization of the findings and confirm the effect of the lavender oil.

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