Effectiveness of Aromatherapy Massage on Sleep Quality and Physiological Parameters of Post-operative Cardiothoracic Surgery Patients

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1.ABSTRACT

Background: Critically ill patients' sleep is significantly disrupted during intensive care unit (ICU) stay. It is connected to several negative effects on well-being including physiological parameters additionally the negative side effects from the use of sleep medications. An aromatherapy massage is a non-pharmacological approach that significantly improves sleep quality and provides a salutary effect on physiological parameters. **Aim:** This study aimed to investigate the effectiveness of aromatherapy massage on sleep quality and physiological parameters of post-operative cardiothoracic surgery patients. **Method:** A research design that was quasi-experimental. This study was conducted at the Cardiothoracic and Vascular Surgery Center at Mansoura University, Egypt. A sample of 62 post-operative cardiothoracic patients were allocated into two equal groups by random selection: The aromatherapy massage group and the routine care group. Each one consisted of 31 patients. The collected data was completed by using a physiological parameters assessment sheet and the Richards-Campbell Sleep Questionnaire scale. **Results:** A statistically significant reduction in the systolic blood pressure and respiratory rate was noted ($p<0.05$). There was between both groups a highly significant difference in sleep quality ($p<0.001$). **Conclusion:** Aromatherapy massage using lavender oil can significantly reduce respiratory rate and systolic blood pressure. This intervention at bedtime can improve the sleep quality score of post-operative cardiothoracic surgery patients. **Recommendations:** Integrating massage with lavender oil in nursing practices improves physiological parameters and sleep quality for critically ill patients, consequently enhancing patients' positive outcomes. Additional investigations are needed to augment the evidence of complementary therapy for sleep challenges and physiological indicators.

Keywords: *Aromatherapy massage, Cardiothoracic surgery patients, Physiological parameters, Sleep quality*

2.Introduction

The epidemiological burden of chronic diseases particularly cardiovascular diseases (CVDs) is increasing internationally, in developed and less developing countries **(El-Saadani, Saleh, & Ibrahim, 2021)**. Coronary heart diseases are one of the most popular CVDs and human suffering globally **(Wang et al., 2021)**. It affects approximately 1.72% of the world's population which is around 126 million individuals and nine million deaths. Also, the prevalent cause of global cardiovascular morbidity and mortality is valvular diseases **(Roy, Mazumder, Sinha, & Khandelwal, 2021)**.

The treatment modalities for cardiac diseases commonly require surgical intervention and ICU monitoring. During the early period after cardiac surgery, around seventy percent of patients experience sleep disturbance **(Greve & Pedersen, 2016)**. After discharge, sleep disturbance may be considerably exacerbated by alter in the mechanism of sleep during an ICU stay **(Medrzycka-Dabrowska, Lewandowska, Kwiecień-Jaguś, & Czyż-Szypenbajl, 2018)**. Negative short- and long-term effects on critically ill patients (CIPs) can result from qualitative and quantitative insufficient sleep during the ICU stay. Also, it impairs patients' ability to cure and rehabilitate early. More emphasis should be directed on the poor sleep issue in CIPs **(Cooke, Ritmala-Castren, Dwan, & Mitchell, 2020)**.

A quasi-experimental Egyptian study conducted on CIPs clarified that the majority of the findings sample included bad sleep on the first, third, and seventh day with a *p-value* = 0.027

(Sayed, Atea, El Maraghi, & Alam, 2022). Another research conducted at Assiut University illustrated that the majority of the CIPs included in the study did not get adequate sleep and experienced substantial changes in their respiratory rate, heart rate, and mean arterial blood pressure **(Tolba, Mehany, & Mohammed, 2021)**. Additionally, delirium percentages among CIPs associated with sleep disruption varied from 11% to 87% **(Hashemighouchani et al., 2020)**. Also, a study conducted by **Elgazzar, Elmaghraby, Sallam, Ebada, and Abdelmoteleb (2022)** on CIPs after cardiac surgery reported that 32% of them had sleep disturbance.

Undergoing surgical stress increased the patients' vulnerability to negative cardiac events **(Cao et al., 2021)**. Also, admission to the ICU produces a harmful impact on sleep quality and physiological parameters **(Tolba et al., 2021)**. Extensive use of complementary and integrative therapies (CIT) might raise patients' psychological and physical well-being **(Connor, 2019)** and thus enhance their sleep. Regarding CIPs, combining massage with aromatherapy may be a successful therapeutic approach **(Aslan & Altın, 2022)**. Sleep improvement in ICU patients using complementary therapies is a comparatively recent field of research.

Although the physiological effects of massage with lavender oil remain unclear, research to improve sleep and physiological parameters is necessary to explore this area and improve nursing practice in ICU. Complementary and integrative therapy is reliable, cost-effective and helps to alleviate the complications of ICU and its sequences **(Rai, & Psirides, 2021)**. A literature search accomplished by **Jun, Kapella, and Hershberger (2021)** illustrated that improvement of sleep quality in CIPs can result from use of CIT. Also, the study of **Jung, Kim, and Choi (2022)** concluded that the utilization of non-pharmacological therapies associated with a significant promoting of elders' sleep quality.

Relaxation, reflexology, aromatherapy, guided imagery, and massage are a non-pharmacological technique may participate in the reduction of contrary aspects that disrupt sleep in ICUs and impact vital signs which leads to improvement of sleep in CIPs **(Cooke et al., 2020; Kandeel, El-Hady, & Tantawy, 2019; Lee, Lim, Song, Kim, & Hur, 2017; Su & Wang, 2018)**. Aromatherapy is a healing modality dating back to the times of the ancient Egyptians, Mesopotamia, and ancient China **(Tuchtan, 2020)**. It is a biological-based therapy in CIT. Linalool

and Linalyl acetate are the main elements of lavender which are used as a sedative, antidepressant, analgesic, and treat cerebrovascular disease **(El-Shemy, 2020; Soares, Bhattacharya, Chakrabarti, Tagde, & Cavalu, 2022)**.

Massage therapy for many years has been demonstrated to be an efficient, harmless not medical in nature treatment modality. The history of massage beginning from Egypt in 2330 before Christ. Shifting healthcare intervention to an evidence-based practice allows massage therapy to be included in health care **(Lebert, 2020)**. Aromatherapy massage with lavender oil may be beneficial for several health problems including symptomatic management and psychological disturbances such as sleeplessness of cardiac patients **(Cheraghbeigi, Modarresi, Rezaei, & Khatony, 2019)**.

However, there is a controversy about influence of aromatherapy massage to enhance sleep and it is a positive effect on physiological indicators. There is still little evidence regarding the best intervention for improving sleep in ICU patients **(Brito et al., 2020)**. As far as we know, the non-invasive modalities in the selected ICU to improve sleep are not included. Studies that investigated the effectiveness of aromatherapy massage for improving sleep quality and physiological parameters of post-operative cardiothoracic patients in the ICU are scarce, particularly in Egypt. Hence, the purpose of conducting this study was to cover this area.

2.1 Aim of the Study

This study aimed to investigate the effectiveness of aromatherapy massage on sleep quality and physiological parameters of post-operative cardiothoracic surgery patients.

2.2 Research Hypotheses

H1: Aromatherapy massage will enhance sleep quality of post-operative cardiothoracic surgery patients. **H2:** Aromatherapy massage will improve the physiological parameters of post-operative cardiothoracic surgery patients.

3. Method

3.1 Study Design

A quasi-experimental research design was utilized to conduct this study (two groups pretest -posttest design). It is the best design used to answer research questions because of the effects of various confounding variables **(Miller, Smith, & Pugatch, 2020; Rogers, & Revesz, 2019)**.

3.2 Study Setting

The research was carried out at the cardiothoracic ICU of the Cardiothoracic and Vascular Surgery Center at Mansoura University. It consists of one ICU which has thirteen beds. It provides care for cardiac critically ill and post-operative patients such as following of coronary artery bypass grafts, valvular surgeries, and sub-lobar resection surgery. This unit is competent with sophisticated technology and the staff required for cardiothoracic patients care. Almost 1 to 2 was the nurse-patient ratio.

3.3 Study Participants

A convenience sample of 62 post-operative cardiothoracic patients at the previously mentioned setting were admitted and extubated during the collection phase were included in this study according to the following minimum requirements: ICU stay > 48 hours, both gender and conscious patients ≥ 18 years, physiologically or hemodynamically stable. Participants who consumed sedatives or narcotics, had a history of lavender oil allergies, or had skin infections or fractures in the massage area were excluded from this study. Also, patients who a mechanically ventilated and had a history of sleep or mental disorders were also excluded.

3.4 Sample Size Calculation

Based on data from the literature of **Özlü and Bilican (2017)** the sample size was calculated. It found that the standard deviation and average score for sleep were 53.80± 13.20 and 29.08± 9.71 in the experimental and control group respectively, with a significance level of 5% and a study power of 80%, the following formula: n = [(Zα/2+ Zβ) 2 × {2(SD) 2}]/ (mean difference between the two groups) 2 was used to calculate the sample size. Therefore, n= [(1.96 + 0.84)2× {2(13.2)2}]/ (9.5)2= 30.3. The sample size was 31 patients for each group according to the prior methodology.

3.5 Data Collection Tools

Two tools were utilized to gather data pertinent to this study:

Tool I: "Physiological Parameters Assessment Sheet"

The primary investigator (PI) developed this tool after reviewing the relevant literature **(Cooke et al., 2020; Jagan, Park, & Papathanassoglou, 2019; Lin et al., 2019; Özlü & Bilican, 2017; Zare, Shahabinejad, & Sadeghi, 2020)**. It was divided into three parts and was used to collect the patient's demographic and health-relevant data and assess the patient's physiological parameters.

Part I: Patient's Demographic Data

This part addressed the personal data of the patients, including educational level, original residence, marital status, occupation, age, gender, and smoking status.

Part II: Patient's Health-Relevant Data

The second part concentrated on the patient's health history such as the date of ICU admission, admission diagnosis to the ICU, body mass index (BMI), previous ICU experience, past medical history, previous surgery, surgical procedure, taking naps during the day, and duration of sleep.

Part III: Patient's Physiological Parameters Data

This part aimed to evaluate the effect of aromatherapy massage on a patient's physiological parameters. It included systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate (HR), respiratory rate (RR), and percutaneous oxygen saturation (SpO_2), which were assessed using the patients' bedside electronic monitor.

Tool II: "Sleep Quality Assessment Scale"

The Richards-Campbell Sleep Questionnaire (RCSQ) was adopted from **Nicolás et al. (2008)**. It was purposed to evaluate the quality of sleep in CIPs. It covers five aspects of sleep. It had a Cronbach's alpha of 0.89 by **Nicolás et al. (2008)**. The whole score is calculated by dividing the total by five and ranking as follows:

- Poor sleep: From 0 to 33 mm score.
- Normal or fair sleep: Between 33 to 66 mm score.
- Very good sleep: Over 66 mm score.

3.6 Reliability and Validity

The fulfilled clarity and validity of parts I and II of tool I were evaluated by a panel of five academic staff from the Critical Care and Emergency Nursing Department, Faculty of Nursing, Mansoura University. The coefficient of reliability was done to evaluate the internal consistency of the patient's physiological parameters data (Part III of tool I) and the patient's sleep quality assessment scale (Tool II) were 0.901 and 0.879 respectively, using the Cronbach's alpha value which indicates a high validity and reliability.

3.7 Pilot Study

A pilot study (10 % of the total sample) was carried out on six patients who were excluded from the study sample before starting the data collection to test the clarity, feasibility, and applicability of the tool.

3.8 Ethical Considerations

Research Ethics Committee of the Faculty of Nursing, Mansoura University confirmed the ethical approval with reference No.P.0237. The study was also registered on ClinicalTrials.gov under the code: NCT05408650. After providing the participants or the first kin with details about the study, including the aim, procedure, risks, and benefits, the written informed consent was obtained. During the study they were assured that their data would be kept confidential and informed that they had the right to accept or refuse to participate or withdraw from the study without responsibility.

3.9 Data Collection Process

The primary investigator collected the data between August 14 to November 15, 2022. The responsible authorities of the study setting provided the permission to implement the study after explaining the aim and nature of the study. The PI received practical training on massage therapy from the Egyptian Academy of Complementary Medicine. After that an early assessment was carried out by PI for all patients in the ICU during the phase of data collection to ensure that they were free from exclusion criteria. An informed consent was taken from the participants or their first kin.

Part I and Part II of Tool I were used to provide demographic and health-relevant data for patients. The aromatherapy massage group received 20 minutes of aromatherapy massage besides the routine care of the ICU. The patients' physiological parameters, including the SBP, DBP, MAP, HR, RR, and SpO_2 were assessed using the patient' bedside electronic monitor four times (at the baseline, immediately, 20 minutes, and 60 minutes after the aromatherapy massage) before and following the aromatherapy massage. The patients' sleep quality was measured by completing the RCSQ twice, on the morning before the aromatherapy massage and the next morning after the bedtime session in the ICU.

Aromatherapy Substance:

According to the **National Association for Holistic Aromatherapy (NAHA, 2021)** the PI diluted pure lavender essential oil with sweet almond oil at a dilution rate of 2.5% and applied to the hands and feet of the adult patient. A dilution rate of 2.5 % equals 15 drops of pure lavender oil diluted with 30 ml sweet almond oil.

Massage Technique:

The massage technique was adapted from **Salvo (2012)**. It was applied to the patient's hands (from fingers to elbow) and feet (from toes to knee) in a semi-fowler's position for 20 minutes for each extremity for 5 minutes as follows:

1. Spread the diluted lavender oil with sweet almond oil over the participant's hands and feet by using flat palms with fingers (effleurage).

2. Apply the petrissage (kneading) by using the thumb and fingers to make a short, gentle, rapid, and circular movement over the patient's entire fingers, palm, forearms, toes, soles, and forelegs.

3. Knead the heel and ankle of the participants between the PI's thumb and forefingers (petrissage).

4. Avoid an intravenous catheter-inserted and recent incision area if applicable.

5. The friction of the fingers, palm, forearms, toes, soles, and forelegs in a circular motion by the pads of fingers or the palm increases blood flow.

6. The lymphatic drainage technique was used to drain the area closest to the nodes first and work away with vibrations.

Evaluation Phase

This aimed to evaluate the effects of massage with lavender oil on sleep quality and physiological parameters of cardiothoracic surgery patients by comparing the patients' scores of RCSQ for sleep quality before and after the aromatherapy massage. The physiological parameters change was monitored at the baseline, immediately, 20 minutes, and 60 minutes following the aromatherapy massage.

3.10 Data Analysis

All statistical analyses were completed using Statistical Package for the Social Sciences (SPSS) for Windows version 20.0. Categorical data were expressed in numbers and percentages. Continuous data were normally distributed and were expressed in mean ± SD. The one-way analysis of variance test was used for comparison among more than two variables with continuous data. The chi-square test (or Fisher's exact test when applicable) was used for the comparison of variables with categorical data. Statistical significance was set at p-value <0.05. The Cronbach's alpha value (internal consistency) of

the patient's physiological parameters was 0.886, and the RCSQ was 0.902.

4. Results

Table 1 demonstrates the participants' demographic characteristics. It revealed that most patients in the aromatherapy massage and control groups were males in the age group above 50 years old, with a mean age of 54.8 ±9.8 and 55.6 ±12.4 years respectively. Concerning the education level, more than one-third of the aromatherapy massage and control groups were illiterate. Most of the patients in both groups were married in addition 51.6% of aromatherapy massage and 48.4% of the control groups were working. Besides, 90.3% of the aromatherapy massage and 77.4% of the control groups were rural. Regarding the smoking status, slightly more than half of the aromatherapy massage and control groups were nonsmokers. Accordingly, there were similarities between both groups regarding the patients' demographic characteristics before the intervention.

Table 2 clarifies the patients' health-relevant data regarding the admission diagnosis, body mass index, ICU experience, and past medical history. The findings revealed that the valvular disease was the most common admission diagnosis in the aromatherapy massage group (35.5%), compared with ischemic heart disease among the control group (48.4%). The most evident body mass index in the aromatherapy massage group was overweight while in the control group was overweight and obese with equal proportion (41.9%). Bedsides more than half of the aromatherapy massage and control groups did not have a previous ICU experience. Furthermore, the proportion of cardiovascular disorders between the aromatherapy massage and control groups was 54.8% and 77.4%, respectively, while more than half of the studied groups had a gastrointestinal disorder.

Between the two groups there were no statistically significant variations. The findings indicated that almost three quarters of the aromatherapy massage and control groups had previous surgeries. Valve replacement and repair was the most common surgical procedure among the aromatherapy massage group (35.5%) compared with coronary artery bypass graft surgeries in the control group (48.4%). The results stated that 83.9% of the aromatherapy massage and 74.2% of the control groups reported taking naps during the day. More than half of the patients in both groups slept 4-7 hours at night with a mean of 7.8 ± 2.5 & 7.0± 2.3, respectively. There were homogeneous differences among both groups regarding these data ($p > 0.05$).

Table 3 exhibits a comparison of sleep quality using the RCSQ scores between the two studied groups. It showed that there was no statistically significant variation in the RCSQ scores between the studied groups before the aromatherapy massage ($p= 0.159$). However, there was a highly statistically significant difference ($p<0.001$) in the RCSQ scores between the studied groups after aromatherapy massage.

Table 4 illustrates between the two studied groups there was no statistically significant variance regarding the patients' physiological parameters before the aromatherapy massage. However, there was a statistically significant difference regarding RR immediately and at 20 minutes after the aromatherapy massage ($p=0.014$ & 0.023 respectively) between them. Also, between both groups was shown a statistically significant difference regarding SBP immediately, at 20 minutes and 60 minutes after the aromatherapy massage ($p=0.006$, 0.013 & 0.028 respectively). Conversely, there were no statistically significant variations regarding the HR, DBP, MAP, and SpO_2 between both groups across four measurement times after the aromatherapy massage.

Table 1 *Patients' Demographic Characteristics of the Studied Group*

Variables	Aromatherapy Massage Group n= 31	Control Group n= 31	Significance Test	
	No. (%)	No. (%)	χ^2 / FET	*P value*
Age (Years)				
• 18 ≥ 50	8 (25.8%)	6 (19.4%)	0.369	0.544
• > 50	23 (74.2%)	25 (80.6%)		
Mean ±SD	54.8 ±9.8	55.6 ±12.4	0.273	0.786
Gender				
• Male	23 (74.2%)	25 (80.6%)	0.369	0.544
• Female	8 (25.8%)	6 (19.4%)		

Educational level				
• Illiterate	13 (41.9%)	14 (45.2%)		
• Bachelor	6 (19.4%)	3 (9.7%)	1.285	0.733
• Preparatory	2 (6.5%)	3 (9.7%)		
• Secondary	10 (32.3%)	11 (35.5%)		
Marital Status				
• Married	28 (90.3%)	27 (87.1%)	0.161	0.688
• Unmarried	3 (9.7%)	4 (12.9%)		
Occupation				
• Working	16 (51.6%)	15 (48.4%)		
• Not working	2 (6.5%)	7 (22.6%)	4.410	0.220
• Retired	6 (19.4%)	6 (19.4%)		
• Housewife	7 (22.6%)	3 (9.7%)		
Residence				
• Rural	28 (90.3%)	24 (77.4%)	1.908	0.167
• Urban	3 (9.7%)	7 (22.6%)		
Smoking Status				
• Current smoker	4 (12.9%)	3 (9.7%)		
• Former smoker	10 (32.3%)	12 (38.7%)	0.355	0.837
• Never smoked	17 (54.8%)	16 (51.6%)		

Data are presented as numbers (n) and frequency (%), statistically significant at $P \le 0.05$, P value measures by Chi-Square test (χ^2), and Fisher's exact test (FET), and standard deviation (SD).

Table 2 *Patients' Health-Relevant Data of the Studied Group*

Variables	Aromatherapy Massage Group n= 31	Control Group n= 31	Significance Test	
	No. (%)	No. (%)	χ^2 / FET	*P value*
Admission diagnosis				
• Ischemic heart diseases	10 (32.2%)	15 (48.4%)		
• Lung cancer	2 (6.5%)	2 (6.5%)		
• Valvular diseases	11 (35.5%)	9 (29.0%)	2.033	0.845
• Mediastinal cysts	5 (16.1%)	3 (9.7%)		
• Myxoma	1 (3.2%)	1 (3.2%)		
• Aortic dissection	2 (6.5%)	1 (3.2%)		
Body mass index (BMI)				
• Normal	7 (22.6%)	5 (16.2%)		
• Overweight	15 (48.4%)	13 (41.9%)	1.203	0.548
• Obese	9 (29.0%)	13 (41.9%)		
Mean ±SD	28.5 ±4.5	29.2 ±5.1	0.573	0.568
Previous ICU experience				
• Yes	11 (35.5%)	13 (41.9%)	0.272	0.602
• No	20 (64.5%)	18 (58.1%)		
Past medical history				
• Cardiovascular disorders	17 (54.8%)	24 (77.4%)	3.528	0.060
• Respiratory disorders	5 (16.1%)	1 (3.2%)	2.952	0.086
• Neurological disorders	3 (9.7%)	1 (3.2%)	1.069	0.301
• Gastrointestinal disorders	20 (64.5%)	16 (51.6%)	1.060	0.303
• Renal disorders	1 (3.2%)	2 (6.5%)	0.350	0.554
• Endocrine disorders	9 (29.0%)	9 (29.0%)	0.000	1.000
• Coagulation problems	4 (12.9%)	6 (19.4%)	0.477	0.490

• Others	9 (29.05)	7 (22.6%)	0.337	0.562
Previous surgery				
• Yes	26 (83.9%)	23 (74.2%)	0.876	0.349
• No	5 (16.1%)	8 (25.8%)		
Surgical procedure				
• Coronary artery bypass graft	10 (32.2%)	15 (48.4%)	2.018	0.732
• Sub-lobar resection	2 (6.5%)	2 (6.5%)		
• Valve replacement and repair	11 (35.5%)	9 (29.0%)		
• Bentall surgery	1 (3.2%)	1 (3.2%)		
• Chest excision/ resection	7 (22.6%)	4 (12.9%)		
Taking naps during the day				
• Yes	26 (83.9%)	23 (74.2%)	0.876	0.349
• No	5 (16.1%)	8 (25.8%)		
Duration of sleep (hours)				
• Less than 4	0 (0.0%)	2 (6.5%)	2.833	0.243
• 4 – 7	18 (58.1%)	20 (64.5%)		
• 8 or more	13 (41.9%)	9 (29.0%)		
• **Mean ±SD**	7.8 ±2.5	7.0 ±2.3	1.333	0.188

Note: Some of the studied patients had more than one past medical history which manipulates the total percentage to be more than 100%.

Table 4 *The Patients' Physiological Parameters Data of the Two Studied Groups Across Four Measurement Times*

Variables	Groups	Baseline $\overline{X} \pm SD$	Immediately After Intervention $\overline{X} \pm SD$	20 Minutes After $\overline{X} \pm SD$	60 Minutes After $\overline{X} \pm SD$
RR	GA	24.5 ±6.4	23.3 ±7.1	23.1 ±6.2	23.5 ±5.8
	GB	27.4 ±6.6	27.4 ±5.7	26.9 ±6.4	26.6 ±6.3
Student's T – test		T=1.779	T=2.545	T=2.342	T=1.984
		P=0.080	***P*=0.014***	***P*=0.023***	*P*=0.052
SpO$_2$	GA	95.7 ±3.6	95.4 ±3.3	95.7 ±3.3	95.7 ±3.0
	GB	95.7 ±2.7	95.4 ±3.5	95.6 ±3.4	95.5 ±3.1
Student's T – test		T=0.123	T=0.038	T=0.075	T=0.290
		P=0.902	*P*=0.970	*P*=0.940	*P*=0.773
HR	GA	92.7 ±12.1	93.8 ±12.0	90.7 ±12.8	92.9 ±13.3
	GB	96.9 ±14.7	96.7 ±14.5	95.8 ±15.2	94.6 ±16.7
Student's T – test		T=1.215	T=0.850	T=1.435	T=0.438
		P=0.229	*P*=0.399	*P*=0.156	*P*=0.663
SBP	GA	135.1 ±15.9	121.2 ±15.1	122.1 ±13.7	124.9 ±14.5
	GB	130.7 ±17.6	134.1 ±20.1	132.7 ±18.7	134.6 ±19.0
Student's T – test		T=1.038	T=2.860	T=2.558	T=2.248
		P=0.303	***P*=0.006***	***P*=0.013***	***P*=0.028***
DBP	GA	72.6 ±9.4	69.0 ±8.7	69.5 ±9.0	69.8 ±8.1
	GB	72.8 ±13.9	71.5 ±13.4	73.9 ±13.1	72.5 ±12.7
Student's T – test		T=0.096	T=0.843	T=1.550	T=1.000
		P=0.924	*P*=0.403	*P*=0.126	*P*=0.321
MAP	GA	92.4 ±10.0	86.0 ±10.0	86.5 ±9.3	87.7 ±9.5
	GB	90.2 ±14.0	89.5 ±14.6	91.4 ±14.8	91.3 ±15.3
Student's T – test		T=0.709	T=1.096	T=1.561	T=1.107
		P=0.481	*P*=0.277	*P*=0.124	*P*=0.273

GA: aromatherapy massage group, GB: control group, HR: heart rate، SBP: systole blood pressure، DBP: diastolic blood pressure, RR: respiratory rate, SpO$_2$: percutaneous oxygen saturation, MAP: mean arterial pressure, x̄: mean, SD: standard deviation, *: significant if P value ≤ 0.05, and P value by repeated measures Student's T –test (T).

5.Discussion

Sleep disturbance is a decidedly common problem among ICU patients (**Bani Younis & Hayajneh, 2018**). Improving sleep quality has a primary and secondary positive outcome on patients' health conditions including physiological parameters. Aromatherapy is a non-pharmacological approach that has a considerable effect on sleep quality improvement (**Tang et al., 2021**). Most patients in the aromatherapy massage and control group were males above 50 years old. This finding agrees with the fact that the advanced age and male gender are independent risk factors for CVDs due to aging changes and decrease of sex hormones which assist to protect from CVDs (**Dell'Osbel et al., 2023; Rodgers et al., 2019; Townsend et al., 2022**).

These results are adjusted with the findings of a systematic review including randomized involving 2176 participants (**Tan, Cai, & Ignacio, 2023**). In this line, Egyptian study was implemented on cardiac patients, mentioned that the predominant age of studied sample were males and more than fifty years old (**Elsayed, Kandeel & Abd El Aziz, 2019**). Contrary to recent results of **Abadi et al. (2018)** found that more than half of the intervention group and more than two thirds of control group were females. This discrepancy may be due to the nature of the study populations, which had many exclusion criteria made females the predominant gender in the study. There were similarities between both groups regarding the patients' demographic characteristics before aromatherapy massage application.

The results of the present study revealed more than one third of the aromatherapy group diagnosed with a valvular disease, compared with about half of the control group had an ischemic heart disease without statistically significant variations. This concords with the fact that the most common CVDs is coronary heart disease worldwide (**National Center for Complementary and Integrative Health [NCCIH], 2020**). Our findings are congruent with **Akbari, Rezaei, and Khatony (2019)** and the study fulfilled by **Chandrababu, Kurup, Ravishankar, and Ramesh (2019)**, which stated that more than half of the sample group had coronary heart disease and one third of them were diagnosed with a valvular disease. This similarity is due to the nature of the target populations involved in these studies, which included cardiac patients.

The most evident body mass index in the aromatherapy massage group was overweight while the control group was overweight and obese with equal proportion. This finding is harmonious with retrospective study on 12,005 consecutive patients delivered by **Wolf et al. (2022)**, disclosed that the most of study group was overweight category. This finding matching with fact that the major risk factors of CVDs are overweight or obese (**Dell'Osbel et al., 2023; World Health Organization [WHO], 2022**).

The results affirmed that more than half of the aromatherapy and control groups did not have a previous ICU experience. This result argues with **Jodaki et al. (2021)**. At the same line a descriptive exploratory Egyptian study, illustrated that the majority of included sample did not have a previous ICU admission (**Tolba et al., 2021**). This might be due to the nature of the ICU, which requires special criteria for admission, and the fact that those patients did not have a critical illness that required ICU admission.

More than half of the aromatherapy group and more than three quarters of the control group had a history of cardiovascular disorders, while more than half of them had a history of gastrointestinal disorders. This would be because the data was collected from the cardiothoracic ICUs and one of the main public health issues in Egypt is viral hepatitis (**Elbahrawy et al., 2021**).

These findings are in harmony with the randomized clinical trial of **Fazlollah, Darzi, Heidaranlu, and Moradian (2021)** and the results of **Nategh et al. (2022)**. They found that more than half of the studied groups had cardiovascular disorders. This relates to the medical diagnosis of the studied sample. These findings are dissimilar with **Emami-Sigaroudi et al. (2021)**, who noted that more than half of the intervention group and more than one third of the control group had diabetes mellitus. This would be assigned to the nature of the study populations, which included coronary artery patients only and diabetes mellitus are frequently a common consequence to this disease (**Tolba, Mohammed, Mohammed, Mehany, & Abdel-Galee, 2018**). Accordingly, there were not statistically significance differences

between the studied groups concerning their health relevant data ($p > 0.05$).

Regarding the sleep quality, there were no significant differences ($p=0.562$) between both groups before the aromatherapy massage. The findings illustrated that more than two thirds of the aromatherapy massage group compared with nearly one fifth of the control group had normal sleep. However, more than one quarter of the aromatherapy massage group had very good sleep and most of the control group had poor sleep. Consequently, there were differences that were highly statistically significant. ($p<0.001$) in the RCSQ scores between both groups after the aromatherapy massage application. This could be from the comfort effect of massage that reduce stress and the lavender oil which minimizes irritation, soothes, balances thoughts and emotions, and controls sleeplessness **(Salvo, 2022).**

This result is supported by the finding of **Emami-Sigaroudi (2021)**, who revealed a positive effect ($p<0.05$) on sleep quality from aromatherapy effect. Also, **Rafi, Khodadadizadeh, Nematabad, and Sayadi (2020)**, illustrated that the sleep scores between the studied group had a significant difference ($p<0.00001$). Besides, **Hsu, Guo, and Chang (2019)** reported that a 10-min massage may promote sleep duration, sleep status and RR in ICU patients. Incoherent to this result a nonequivalent pretest-posttest study among hospice patients, demonstrated that the sleep quality improved after aromatherapy massage on hand without a statistically significant variation (**Park, Chun, & Kwak, 2016)**. This mismatch could be due to different applications of intervention and hospice patients' responses.

In this study between the studied groups, there was a statistically significant variation referring to the RR immediately and 20 minutes after the aromatherapy massage. It also elucidated a statistically significant reduction in the mean of the RR at these readings compared to its baseline value. This reduction could be owed to the relaxation effect of lavender and massage therapy, which is used as a sedative, to relax the nervous system and reduce blood pressure (**A. Farrar & Farrar, 2020)**. The massage sedates the sympathetic system and activates the parasympathetic system. Eventually, decline of HR and BP from decrease effect of catecholamine levels in the blood and an increase in the relaxation response (**Beck, 2017)**.

This result aligned with the outcomes of **Büyükbayram, Aydin, and Arac (2021)**, who noted a decrease in the RR at 90 and 120 minutes

after the application of aromatherapy with lavender oil for CIPs compared with the pretest value with a statistically significant difference ($p= 0.040$). This is contrary to the research of **Özlü and Bilican (2017)**. The researchers noticed no significant change ($p > 0.05$) throughout 15, 30, 60, and 120 minutes after lavender massage in the respiration parameter. This could be due to different proportion of male to female of non-cardiac patients.

The current results illustrated a statistically significant between both groups concerning the SBP immediately, 20 minutes, and 60 minutes after the aromatherapy massage compared to the baseline data. This result corresponds with the research review and meta-analysis that was implemented by **Kim, Nam, Lee, and Kang (2021)**. Contrary, a study reported that there was not a significant variation between the studied groups regarding the SBP **(Davari, Ebrahimian, Rezayei, & Tourdeh, 2021)**. This disparity could be due to the difference in the application method of aromatherapy via inhalation and the long measurement times after the intervention.

6. Conclusion and Recommendations

According to the study finding, the aromatherapy massage using lavender oil can significantly reduce the respiratory rate and systolic blood pressure. Additionally, the intervention at bedtime can improve the sleep quality of post-operative cardiothoracic surgery patients. Integration of massage with lavender oil in nursing practice to produce a beneficial effect on the physiological parameters and sleep quality consequently enhances patients' outcomes and reduces the side effects of pharmacological drugs used in the ICUs. Additional investigations with large samples are needed to augment the evidence related to using complementary therapy for sleep quality and physiological parameters for all intensive care patients.

7. Limitations

The generalizability of the study's findings may be constrained by the study's limited sample size, which was gathered from one hospital in one region of Egypt.

8. Acknowledgment

9.Declaration of competing interests

There are no potential conflicts of interest.

10.References

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