The Effect of Foot Massage on Pain Severity, Hemodynamic Parameters, and Mechanical Ventilation Weaning Time among Patients in Critical Care Settings

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Abstract

Foot massage is considered one of the essential complementary modalities that became an issue of concern in critical care settings, it is non-invasive, simple to use, less expensive, and produces few risks or complications. This research **aimed** to determine the effect of foot massage on pain severity,hemodynamic parameters, and the length of mechanical ventilation weaning time among patients in critical care settings. **Methods:** Quasi-experimental design was used in three intensive care units affiliated with Mansoura Emergency Hospital.A convenience sample of 62 critically ill patients was enrolled and chosen at random to the foot massage group and the control group. Data were collected using the patients' demographic, and health-relevant data; the hemodynamic parameters assessment sheet, mechanical ventilator weaning time, andthe behavioral pain scale tool. **Results:** Statistically significant differences were found in comparison to the control group and the foot massage group regarding pain score, and hemodynamic parameters at ($P < 0.05$). Additionally, statistically significant variations in the length of MV weaning period between the two study groups were detected at ($P=0.036$). **Conclusion:**In critical care settings, foot massage is a useful strategy for reducing pain intensity, stabilising hemodynamic parameters, and reducing patients'dependence on ventilators.**Recommendation:** The study recommended that foot massage can be introduced as an auxiliary intervention to conventional nursing care for critically ill patients.

Keywords: Foot Massage, Hemodynamic Parameters, Mechanical Ventilation Weaning Time, Critical Care Setting'Patients

Introduction

Pain is frequently encountered in critical care. An painful sensory, emotional, or mental sensation connected to actual or potential tissue injury is what it is known as **(Momeni, Arab, Dehghan & Ahmadinejad, 2020)**. During their time in the intensive care units (ICU), roughly 33% of patients report feeling some level of pain, but only about 50% of patients report feeling discomfort when receiving everyday nursing care such as tracheal suctioning, changing position, and wound cleaning (**Elay & Ozkaya, 2020)**. It was found that severe pain negatively affects hemodynamic parameters and clinical outcomes.

However, Patients' capacities to express and communicate their pain may be impacted in critical care by a variety of circumstances, including the use of mechanical ventilation, altered levels of consciousness, and delirium **(Severgnini, et al., 2016)**. These obstacles, make pain assessment and management more complex. By allowing the patient to report the presence of pain, the adoption of proper communication techniques is crucial in this case to lessen the patient's anxiety related to the endotracheal tube comprehensively (**Ayasrah, O'Neill, Abdalrahim, Sutary, & Kharabsheh, 2014; Higgs, et al., 2018).**

Thibaut, et al. (2015) emphasized the professional responsibility of the nurse to provide effective and safe management of pain. As mentioned by **Shaikh, et al. (2018),** the conventional method for pain management in the ICU is using pharmacological modalities. Despitethe importance ofthese agents, They affect ICU patients' conditions negatively in a number of ways as may delay weaning, increase the length of ICU stay, hemodynamic instability, and eventually raise health care costs.**(Deldar, Froutan, & Ebadi, 2018 ; Hamdan, 2019; Shaikh et al., 2018).**

Therefore, current evidence in critical care leads to an emphasis on using it under close intervention and incorporating non-pharmacological interventions as adjuncts to promote pain relief and general comfort for critically ill patients (**Demir, 2012; El Geziry, Toble, Al Kadhi, Pervaiz, & Al Nobani, 2018).**A wide variety of complementary and alternative therapies exist as nonpharmacologic

alternatives to the management of pain and other distressing symptoms in the critically ill. The critical care nurse can offer music therapy, pet therapy, art therapy, healing touch or massage, aromatherapy, and other therapies**.** (**Gatlin, & Schulmeister, 2007; Wagner, Thompson, Kreitzer, & Koithan, 2014).** It has been proven that complementary methods have been employed to manage pain, tension, anxiety, and lack of sleep. Additionally, they are most accessible, cost-effective, and safe **(John, et al., 2018)**.

Massage therapy is considered one of the common complementary techniques used in the ICU. It stimulates mechanoreceptors that activate nerve fibers and send impulses that interfere with pain transmission in the spinal cord**(Boitor, Martorella, Arbour, Michaud, & Gelinas, 2015; Wang, & Keck, 2004).** Massage can be applied to the head, neck, shoulders, back, abdomen, hands, and feet.**(Field, 2016; Walusis, Keister, & Russell, 2010).**

However, in ICU, it is mostly applied to the feet because Each bodily part has zones in the foot that correspond to it , therefore when foot massage is performed a specific area is excited, and creates an effect on the corresponding nerves, tissues, and organs **(Ernst, Posadzki, & Lee, 2011; Embong, Soh, Ming, & Wong, 2015)**

Several studies have indicated the efficacy of foot massage on relieving postoperative pain, decreasing anxiety levels, and depression, and enhancing sleep quality **(Oshvandi, Veladati, Mahmoodi, Rahimi Bashar, & Azizi, 2020; Field, 2017; Jagan, Park & Papathanassoglou, 2019)**.

It has been proven that foot massage has an immediate effect on heart rate and blood pressure reduction as the parasympathetic nervous system is activated. (**Aourell, Skoog, & Carleson, 2005; Field, Diego, & Hernandez-Reif, 2010; Field, 2016).** It is also can be used to enhance hemodynamic parameters in a critically ill patient **(Field, 2016)**

Despite the great evidence of the clinical impact of foot massage on pain, fatigue, stress, and anxiety **(Bagheri-Nesami, Shorofi, Zargar, Sohrabi, Gholipour-Baradari, & Khalilian, 2014; Öztürk, Sevil, Sargin,& Yücebilgin, 2018; Abbaszadeh, Allahbakhshian, Seyyedrasooli, Sarbakhsh,Goljarian, & Safaei, 2018).** This issue is limited and unpopular in Egypt and most critically ill patient's pain is managed by pharmacological intervention **(Khalil, 2018).** Moreover, most studies have been done on postoperative conscious patients who can verbally express their pain **(Abdelaziz, & Mohammed, 2014; Abdou, & Abd El-Hafez, 2018; Ebadi, Kavei, Moradian, & Saeid, 2015).** Papers that looked examined how foot massage affected pain reduction are scarce. Therefore, this study was conducted to address this issue.

Aim of the study:

This study aimed to investigate the effect of foot massage on pain score, hemodynamic parameters, and the length of mechanical ventilation weaning time in critical care settings.

Study hypotheses:

1. Patients who are subjected to foot massage therapy experienced a reduction in pain scores compared to those who are not subjected to this intervention.
2. Patients who are subjected to foot massage therapy will have better hemodynamic parameters compared to those who are not subjected to this intervention.
3. Patients who are subjected to foot massage therapy will have shorter mechanical ventilation weaning time than patients who are not given this intervention.

Subjects and Methods:

Study design:

The study is aquasi-experimental design (before and after the design of a time series).

Study setting:

This study was conducted in three adult ICUs affiliated with Mansoura Emergency Hospital, Egypt namely; unit I, unit II, and unit III. The total bed capacity of these ICUs is 32 beds. All ICUs are well equipped with advanced technology to serve multiple traumatic patients.In these units, the nurse-to-patient ratio is quite close to 1:2.

Subjects:

62 patients from a convenience sample were randomly divided into two groups: the

intervention group who received foot massage and the control group receiving routine nursing care (31 patients in each group).

Inclusion Criteria:

In order to be eligible, patients had to aged between 18 and 65 years old of both gender, unconscious for more than 4 days with Glasco Coma Scale (GCS) between 5 and 8, hemodynamic stable, and not receiving muscle relaxant drugs.

Exclusion criteria:

Patients diagnosed with brain stem death, deep vein thrombosis, foot fracture, spinal cord damage, addictions, neuropathy of the peripheral nervous system, changes in the patient's GCS, and transfer to other wards or death.

Sample size:

By using the G*power analysis program, to find a significant standardised difference (i.e. a difference of at least 0.8 SD) after 7 days of the intervention of both study groups, with 80% power and $\alpha = 0.05$, allocation ratio 1:1, 26 ICU patients would be necessary for every group. presuming a 20% non-response rate, the required sample size was calculated for every group to be 31 patients.

Data Collection tools:

To gather the data required for the investigation, two tools were used. Tool (I) was created by the researchers based on relevant studies **(Aourell et al., 2005; Abdelaziz, & Mohammed, 2014; Abdou, & Abd El-Hafez, 2018;Abbaszadeh et al., 2018;Ebadi et al., 2015).**

It included two parts, **Demographic and health-relevant data part** which includes information about patients' demographic data such as age, gender, marital status, level of educational, and occupation. It also coveredthe participant's health-relevant data such as admission data, medical diagnosis, past history, previous admission to ICU, analgesic use, GCS score, type of intubation, mechanical ventilation (MV) data, MV weaning time, and length of ICU stay.

The second part was the **Hemodynamic Parameters Assessment Sheet:** This part was utilised to record changes in hemodynamic parameters that indicate stimulation of sympathetic or parasympathetic activity in response to the application of foot massage. It included heart rate (HR), systolic bloodpressure (SBP), diastolic blood pressure (DBP), respiratory rate (RR), and oxygen saturation (SPO2). **Tool (II): Behavioral Pain Scale (BPS)**: This scale was adopted by **Dehghani, Tavangar, & Ghandehari, (2014)** to evaluate pain in individuals who are mechanically ventilated and unconscious. Three parameters had to be measured in order for this scale to perform: facial expression, upper extremities movements, and ventilator compliance. a. BPS has a total score between 3 and 12. A score (3) is used to indicate no pain, and a score (12) is used to confirm severe pain. This tool was validated in the previous relevant literature of (**Kotfis, Zegan-Baranska, Szydlowski, Zukowski, &Ely 2017; Severgnini, et al., 2016)**

Validity and Reliability of the study tools:

Ten experts in the specialty of emergency medicine, critical care and emergency nursing evaluated the study instruments' content validity. Accordingly, the necessary adjustments were made. With the help of Cronbach's alpha, the tool's reliability was evaluated to indicate a reliable tool(r= 0.85).

A pilot studywas carried out on 10% of the total sample size (6 patients) to test the clarity, feasibility, and applicability of tools.

Ethical Considerations

The Ethics Committee of the Faculty of Nursing of Mansoura University granted ethical permission. Informed consent was gained from the patients' legal guardians before the intervention , and after giving them a thorough explanation of the study's purpose, advantages, risks, process, and duration. All guardians of eligible patients received special emphasis on the voluntariness of involvement. Additionally, they were made aware of their freedom to quit at any time, and without consequence. Additionally, patient data confidentiality was guaranteed.

Procedure

Preparation phase:

The researchers checked patients' records to select patients who matched the requirements for inclusion one day before applying the foot

massage and to explain the nature of the research to patients' guardians participating in the study. The accepted patients were participated in the research. Patients' demographic and health-relevant data were taken from their medical records by using tool one. Allocation of patients was done the day before foot massage intervention by using the lottery randomization technique by choosing one of two cards labeled group A (foot massage group) and group B (control group). The day after, the researchers started at afternoon shift because it is quieter than the morning shift; external interruptions were lessened as possible. Data about patients' pain scores and hemodynamic parameters were obtained for both study groups (massage, and control groups), and used tool two to obtain baseline data before beginning foot massage. Then, the researchers examined the patients' legs for the presence of any massage barriers or leg-related issues.

Implementation (foot massage) phase:

The foot massage can be applied either using the foot classical massage technique (Swedish) or foot reflexology massage. In this study, the Swedish technique was used. The control group got only conventional nursing care while the intervention group received both conventional nursing care and the Swedish technique performed by researchers. The Swedish technique was applied for seven consecutive days for 20 minutes (10 minutes to each foot). This technique was applied after placing the patients in a supine position and placing a pillow under their feet and elevating the head of the bed to 30 degrees. The five hand movements used in the Swedish technique are stroking, kneading, rubbing, tapping, and vibrating. It helps to increase circulation and relax the muscles. It included the sole and the dorsum of the legs from the ankle to the tip of the toes. A small amount of baby oil (1-2 cc) was used to facilitate massage and it had no other therapeutic value.

Evaluation phase

The pain score and hemodynamic parameters were reevaluated in both study groups immediately after the massage, and continually checked before, and after massage therapy for (one week). Besides, evaluating the length of MVweaning time (the duration that patients spent on MV) on the seventh day of the massage therapy.

Statistical Analysis

Data were analyzed by SPSS 20. Descriptive statistics (frequency, percentage, mean, and standard deviation) were utilized to describe patients' demographic and clinical data. The Kolmogorov-Smirnov test was used to determine the normality of the study's data.For normally distributed variables, repeated measure ANOVA was used to indicate an actual difference between the three dependent groups. For comparison between two normally distributed, paired t-test was used to compare related groups, while, an independent t-test was hired for independent groups. For qualitative variables, chi-square analyses were used to examine homogeneity between both study groups, the cutoff for significance is set at a level of 5%. (p-value).

Results:

The socio-demographic characteristics **Table 1** reveals homogeneity between both study groups, as the Chi-square testshows no significant differences in terms of age (P=0.913), gender (P=0.445), marital status (P=0.449), education (P=0.580), and occupation (P=0.716) in between control group and the intervention. The mean age of the intervention group was 49.29 +12.80 and was 50.03 +11.79 among the control group. 58.1% of intervention and 48.4% of control patients were female. Regarding marital status, 83.9% of intervention and 90.3% of control patients were married. Concerning educational level, more than two third of the intervention group (67.7%) and the control group (71%) were in secondary school. In addition to more than two third of the intervention group (71%) and the control group (61.3%) had free work.

Figure 1 portrays the pain level before, immediately post, and one week after the massage for the study and control groups. Before the massage, nearly two-thirds of the patients in both groups reported similar moderate pain levels. In contrast to one week after the massage, this moderate pain level improved in the study group to no pain among 51.6% but remained moderate pain among 48.4% of the control group.

Paired t-test results indicated highly statistically significant differences in the intervention group regarding all the hemodynamic parameters as follows: systolic blood pressure (P ≤0.001); diastolic blood pressure (P =0.025); heart rate (P =0.002); respiratory rate (P=0.021); and oxygen saturation (P≤0.001).

No statistically significant differences were observed among the intervention and control group in the length of ICU stay (P=0.686), GCS (P=0.230), MV (P=0.189), intubation (P=0.409), previous admission to ICU (P=0.319), past history (P=0.162), and analgesic (P=0.224), as showed in **Table 2.**The mean length of ICU stay in the intervention group was 4.74 +2.09 and was 4.34+2.3 in the control group. More than half of both study groups were intubated and attached to MV. Less than one-fourth of the intervention (22.6%), and control group (12.9%) were previously admitted to the ICU. More than three fourth of the intervention (71%), and control group (83.9%) were administrated analgesics.

Repeated measure ANOVA results indicated very high statistical differences in the intervention group mean score from before the massage 6.06±1.73 to immediately after the massage 4.77±1.38, and after seven days of the massage 3.80±0.98 at (F=54.54, P ≤0.001) with a high effect size (η^2=0.65) of the massage on the pain score, compared with the control group results showed insignificant differences at the three measurements at (F=4.00, P=0.054) with extremely minimal reduction in mean pain score. In addition, the Independent t-test showed similarity in the pain score before the massage at (t=1.29, P=0.20). While immediately after the massage, and one week after the massage, there were statistically significant differences between the intervention and control group at (t=4.26, P ≤0.001), and (t=6.36, P ≤0.001) respectively as shown in **Table 3**.

In comparing with non-significant differences in the control group regarding all hemodynamic parameters at (P>0.05). Additionally, the Independent t-test indicated a homogeneity between both study groups before the massage regarding all the hemodynamic parameters at (P>0.05). While, after seven days of the foot massage, there were highly statistically significant differences between the intervention group and control regarding all the hemodynamic parameters as follows: systolic blood pressure (P =0.03); diastolic blood pressure (P =0.038); heart rate (P =0.044); respiratory rate (P ≤0.001); and oxygen saturation (P =0.025) as shown in **Table 4**.

Table 5 compares the average number of days on the ventilator before and one week after the massage between the intervention and control groups. As Independent t-test showed similarity between both study groups before the massage at (P= 0.686). While one week after the massage, there was a highly statistically significant difference between the means of intervention and the control group at (P =0.036), as the mean number of days that the intervention group spent on the ventilator is three days, that shorter than the control group' days spent on the ventilator which is five days.

Table 1: Distribution of the studied ICU patients according to their socio-demographic features:

Items	Intervention groupN=(31)		Control group N=(31)		P-value
	No.	%	No.	%	
Age					
18-<38	4	12.9	3	9.7	0.913
38-<58	12	38.7	13	41.9	
≥58	15	48.4	15	48.4	
$\bar{X}$(SD)	49.29 (12.80)		50.03 (11.79)		
Gender					
Male	13	41.9	16	51.6	0.445
Female	18	58.1	15	48.4	
Marital status					
Single	5	16.1	3	9.7	0.449
Married	26	83.9	28	90.3	
Educational level					
Primary	7	22.6	8	25.8	0.580
Secondary	21	67.7	22	71	
University	3	9.7	1	3.2	
Occupation					
Clerk	7	22.6	9	29	0.716
Free work	22	71	19	61.3	
Not working/housewife	2	6.5	3	9.7	

P-value of chi square, **t***: Independent t-test * Statistically significant at p < 0.05.

Figure 1: Comparison of the pain level before, and one week after the massage intervention between both study groups

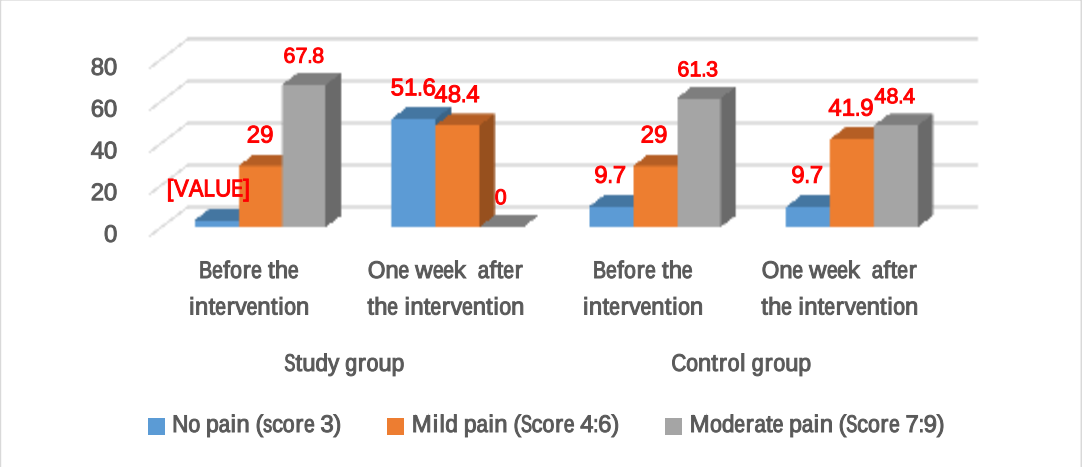

Table 2: Distribution of the studied ICU patients according to their clinical history

Items	Intervention group N=(31)		Control group N=(31)		P-value
	No.	%	No.	%	
Length Of ICU Stay					
$\bar{X}$(SD)	4.74(2.09)		4.34(2.3)		0.686
GCs					
$\bar{X}$(SD)	6.35(1.68)		5.80(1.86)		0.230
Mechanical ventilation					
Yes	17	54.8	22	71	0.189
No	14	45.2	9	29	
Intubation					
Yes	20	64.5	23	74.2	0.409
No	11	35.5	8	25.8	
Previous admission to ICU					
Yes	7	22.6	4	12.9	0.319
No	24	77.4	27	87.1	
Past history					
Yes	27	87.1	30	96.8	0.162
No	4	12.9	1	3.2	
Analgesic use					
Yes	22	71	26	83.9	0.224
No	9	29	5	16.1	

The P-value of **chi-square between percentages**, and the Independent t-test between means, *Statistically significant at $p < 0.05$.

Table 3: Comparison of the mean of pain intensity before, immediately post, and one week after the massage intervention between both study groups:

Items	Study group N=(31)		Control group N=(31)		Significance test
	$\bar{X}$	SD	$\bar{X}$	SD	t
Before the intervention (baseline measure)	6.06	1.73	6.67	1.98	t=1.29 P=0.20
Immediately post the intervention	4.77	1.38	6.54	1.85	t=4.26 P ≤0.001*
7th day post the intervention	3.80	0.98	6.22	1.68	t=6.36 P ≤0.001*
P-value between three successive measurements	F=54.54 P ≤0.001* η^2 =0.65		F=4.00 P=0.054 η^2 =0.11		

F: for repeated measure ANOVA, η^2: Partial Eta Squared (the effect size for RM-ANOVA), t: Independent t-test, P Significance * Significant ($p \leq 0.05$).

Table 4: Comparison of the mean of hemodynamic parameters before, and one week after the massage intervention between both study groups:

Items	Study group N=(31)	Control group N=(31)	P-value
	$\bar{X}$ (SD)	$\bar{X}$ (SD)	
Systolic blood pressure			
Before the intervention (baseline measure)	127.09(18.09)	123.38(20.55)	t*=0.754 P= 0.454
7th day post the intervention	112.25(15.90)	122.03(18.70)	t*=2.21 P =0.03*
P-value between pre and 7th day post of massage	t**=14.18 P ≤0.001*	t**=1.56 P=0.129	
Diastolic blood pressure			
Before the intervention (baseline measure)	75.22(14.23)	76.77(13.73)	t*=0.436 P=0.665
7th day post the intervention	79.54(6.56)	73.06(15.69)	t*=2.12 P =0.038*
P-value between pre and 7th day post of massage	t**=2.35 P =0.025*	t*=1.54 P=0.133	
Heart rate			
Before the intervention (baseline measure)	94.96(24.5)	96.77(16.79)	t*=0.339 P= 0.736
7th day post the intervention	85.58(12.79)	95.93(24.89)	t*=2.06 P =0.044*
P-value between pre and 7th day post of massage	t**=3.36 P =0.002*	t*=0.153 P=0.880	
Respiratory rate			
Before the intervention (baseline measure)	25.35(7.01)	28.61(5.94)	t*=1.97 P=0.053
7th day post the intervention	23.74(5.85)	28.90(7.54)	t*=0.053 P ≤0.001*
P-value between pre and 7th day post of massage	t**=2.43 P =0.021*	t*=0.369 P=0.714	
Oxygen saturation			
Before the intervention (baseline measure)	90.83(2.85)	89.41(4.80)	t*=1.41 P= 0.162
7th day post the intervention	97.19(1.85)	90.83(2.85)	t*=2.30 P =0.025*
P-value between pre and 7th day post of massage	t**=11.05 P ≤0.001*	t*=1.144 P=0.158	

Table (5): Comparison of the mean number of days on the ventilator before and one week after the massage intervention between both study groups

Items	Study group N=(31)	Control group N=(31)	P-value
	$\bar{X}$ (SD)	$\bar{X}$ (SD)	
Average number of days on the ventilator			
Before the intervention (baseline measure)	3.74(3.09)	3.34(3.3)	t*=0.407 P= 0.686
7th day post the intervention	6.61(2.70)	8.38(3.73)	t*=2.14 P =0.036*

t*: Independent t-test, **P** Significance * Significant (p≤ 0.05).

5. Discussion:

Our research was focused on examining the effect of foot massage on pain score, hemodynamic parameters, and the length of MV separation time in critical care setting' patients. The statistical results of this study confirmed the hypotheses that foot massage reduces pain score, stabilize hemodynamic parameters, Patients in a critical care setting who receive foot massages have lower (HR, RR, SBP, DBP, and SPO2) and less MV dependency as compared with patients who didn't receive foot massage **(Abbaszadeh et al., 2018).**

Stillerman, (2016) explicated**,** that this improvement could be interpreted by the almost 15,000 nerves in the foot that energise every part of the body. As a result, when using the massage technique, the nervous system is calmed, and positively influences hemodynamic functions of the heart and lungs, because it encourages them to circulate oxygen-rich blood around the body, which increases oxygenation, lowers the need for breathing, and makes it easier to separate from the MV **Russo, Santarelli, & O'Rourke, 2017)**.

Concerning the effect of massage on pain score, the results of our study illustrated a very high statistical reduction in the massage group's pain score within the three measurements at (P ≤0.001) with a high effect size (η^2=0.65), in contrast, the control group results showed insignificant differences at the three

measurements at (P=0.054). These results are consistent with several research that showed how effective foot massage is at reducing pain intensity as **Yaghoubinia, Navidian, Sheikh, Safarzai, and Tabatabaei, (2016)** indicated that the foot massage decreased the pain score in unconscious critically ill patients.

Furthermore, **Momeni, et al. (2020)** concluded that "the Swedish massage can reduce the pain of critically illpatients and improve quality of the nursing care with low cost and few complications. Also, **Abdou and Abd El-Hafez, (2018)** found that lower pain was experienced by the intervention group that practised foot reflexology compared to the control group who didn't receive it. The findings of the above investigations all support those of the current study. All investigations demonstrated that massage has an impact on pain level, despite the fact that the targeted patients in each study varied greatly in terms of the type, location of massage , and pain measuring equipment.

Regarding the effect of massage on hemodynamic parameters, the study results showed highly significant differences in the massage group regarding all the hemodynamic parameters at (P<0.05),in contrast to non-significant differences in the control group at (P>0.05). These results are consistent with those of **YekeFallah, Azimian, Aghae, Alipour Heidari, and Hasandoost (2018),** who explored how massage affected patients with severe trauma's vital signs. In contrast to the control group, they discovered that the mean hemodynamic values of HR and RR significantly lowered in the study group. Consistent with the findings of **Azami et al. (2015)** who investigated the effect of foot massage on MAP of ICU patients. They reported that MAP is significantly decreased among the study group compared to the control group. Similarly, a study conducted by **Khaledifar, Nasiri, Khaledifar, Khaledifar, andMokhtari, (2017)** demonstrated that patients undergoing coronary angiography showed a significant improvement in various hemodynamic parameters such as DBP, HR, and RR after foot massage.

Concerning SPO_2, the present study proved the mean SPO_2 values in the control group were considerably lower than the values in the study group. This finding could be supported by **Papathanassoglou, and Park, (2016)**, who explicated that the relaxation and calmness effect of foot massage in ICU trauma patients are significantly correlated with lower HR, RR, oxygen demand, and oxygen consumption, which raises mean SPO2 readings. The findings of the present study agreed with earlier research that showed the effectiveness of body massage in improving O_2 saturation of trauma patients in the study group significantly higher than in the control group **(Hatefi, Jaafarpour, Khani, Khajavikhan, &Kokhazade, 2015; Jamaati et al., 2015; Indriani, Santoso, Arwani, & Mardiyono, 2018).**

Reducing the length of MV weaning time is a major indicator of massage effectiveness, which was confirmed by the current study findings as the mean of MV dependence among the massage group was reduced to three days, compared to five days that the control group spent on MV. There is a scarcity of studies that examined the effectiveness of foot reflexology or foot massage on the separation time from MV. Similarly, **Kandemir, (2019)** concluded that the experimental group's separation period from MV following reflexology was shorter than the control group's. (p = 0.023). Also,**Ebadi, Kavei, Moradian, and Saeid, (2015)** examined the effect of reflexology on hemodynamic parameters and MV separation time in open-heart surgery patients in Iran. Homogeneously, our findings are confirmed by other primary and secondary studies which indicated that reflexology therapy/ foot massage is a useful strategy for lowering the amount of analgesics and sedative needed by patients undergoing MV, which eventually acceleratesthe weaning process **(Khaledifar, et al., 2017; Chen, Liu, Chen, & Wang, 2014)**.

Conclusion:

Our study's findings led us to the conclusion that foot massage can considerably lower pain levels, improve hemodynamic parameters, and lessen MV dependence in ICU patients.

Recommendations:

For patients in critical care settings, the intervention of foot massage should be a nursing care priority in ICUs that is coordinated with pharmacological modalities and conventional nursing care. Therefore, it is essential that nurses receive the proper

training, and workshops for massage therapy to have knowledge about the best techniques of massage and how to use it effectively.

References

Abbaszadeh, Y., Allahbakhshian, A., Seyyedrasooli, A., Sarbakhsh, P., Goljarian, S., & Safaei, N. (2018). Effects of foot reflexology on anxiety and physiological parameters in patients undergoing coronary artery bypass graft surgery: a clinical trial. *Complementary Therapies in Clinical Practice*, *31*, 220-228. Retrieved from https://doi.org/10.1016/j.ctcp.2018.02.018

Abdelaziz, S. H. H., & Mohammed, H. E. (2014). Effect of foot massage on postoperative pain and vital signs in breast cancer patient. *Journal of Nursing Education and Practice,* *4*(8), 115.DOI:10.5430/jnep.v4n8p115

Abdou, F., & Abd El-Hafez, A. (2018). Effect of Foot Reflexology Practice on Acute Pain and Anxiety of Critically ill Patients after Cardiothoracic Surgery. *International Journal of Innovative ResearchIn Medical Science*, *3*(0).

Abdou, F., & Abd El-Hafez, A. I. (2018). Effect of Foot Reflexology Practice on Acute Pain and Anxiety of Critically ill Patients after Cardiothoracic Surgery. *International Journal of Innovative Research in Medical Science (IJIRMS)*, *3*(08).

Aourell, M., Skoog, M., & Carleson, J. (2005). Effects of Swedish massage on blood pressure. *Complementary Therapies in Clinical Practice*, *11*(4), 242-246. Retrieved from https:// doi. org/ 10. 1016/ j. ctcp. 2005.02.008

Azami, H., Khaledi, B., Rezae,i M., & Samadzadeh, S. (2015). The impacts of short-term foot massage on mean arterial pressure of neurosurgical patients hospitalized in intensive care units. *Iran J Crit Care Nurs*, *8*(3),133-42.

Bagheri-Nesami, M., Shorofi, S. A., Zargar, N., Sohrabi, M., Gholipour-Baradari, A., & Khalilian, A. (2014). The effects of foot reflexology massage on anxiety in patients following coronary artery bypass graft surgery: a randomized controlled trial. *Complementary Therapies in Clinical Practice*, *20*(1), 42-47. Retrieved from https://doi.org/10.1016/j.ctcp.2013.10.006

Boitor, M., Martorella, G., Arbour, C., Michaud, C., & Gelinas, C. (2015). Evaluation of the preliminary effectiveness of hand massage therapy on postoperative pain of adults in the intensive care unit after cardiac surgery: A pilot randomized controlled trial. *Pain Management Nursing*, *16*(3), 354-366. Retrieved from https://doi.org/10.1016/j.pmn.2014.08.014

Chen, H. B., Liu, J., Chen, L. Q., & Wang, G. C. (2014). Effectiveness of daily interruption of sedation in sedated patients with mechanical ventilation in ICU: A systematic review. *International Journal of Nursing Sciences*, *1*(4), 346-351.

Çirak, Y., Yelvar,G., Çirak, A.O., & Karadüz,B.N.(2016). Pain assessment in the intubated and sedated intensive care patients. *European Respiratory Journal*, *48* (60) 4428.

Dehghani, H., Tavangar, H., & Ghandehari, A. (2014). Validity and Reliability of Behavioral Pain Scale in Patients With Low Level of Consciousness Due to Head Trauma Hospitalized in Intensive Care Unit. Archives Of Trauma Research, 3(1). doi: 10.5812/atr.18608

Demir, Y. (2012). Non-pharmacological therapies in pain management. In Pain Management-*Current issues and opinions*. IntechOpen.

Deldar, K., Froutan, R., & Ebadi, A. (2018). Challenges faced by nurses in using pain assessment scale in patients unable to communicate: a qualitative study. *BMC nursing*, *17*(1), 1-8.

Ebadi, A., Kavei, P., Moradian, S. T., & Saeid, Y. (2015). The effect of foot reflexology on physiologic parameters and mechanical ventilation weaning time in patients undergoing open-heart surgery: A clinical trial study. *Complementary Therapies in Clinical Practice*, 21(3), 188-192.

Ebadi, A., Kavei, P., Moradian, S. T., & Saeid, Y. (2015). The effect of foot reflexology on physiologic parameters and mechanical ventilation weaning time in patients undergoing open-heart surgery: A clinical trial study. *Complementary Therapies in Clinical Practice*, *21*(3), 188-192.https://doi.org/10.1016/j.ctcp.2015.07.001

El Geziry, A., Toble, Y., Al Kadhi, F., Pervaiz, M., & Al Nobani, M. (2018). Non-pharmacological pain management. *Pain Management in Special Circumstances*, 1-14.doi: 10.5772/intechopen.79689

Elay, G., & Ozkaya, M. (2020). The Effect of Music and Massage on the Pain Scales and Vital Signs of ICU Patients with Hemodialysis Catheter. European *Journal of Therapeutics*, *26*(3), 263-269. doi: 10.5152/eurjther.2020.20075

Embong, N. H., Soh, Y. C., Ming, L. C., & Wong, T. W. (2015). Revisiting reflexology: Concept, evidence, current practice, and practitioner training. *Journal of traditional and complementary medicine*, *5*(4), 197-206. Retrieved from https://doi. org/ 10. 1016/ j.jtcme.2015.08.008

Ernst, E., Posadzki, P., & Lee, M. S. (2011). Reflexology: an update of a systematic review of randomized clinical trials. *Maturitas*, *68*(2), 116-120. Retrieved from https:// doi. org/ 10. 1016/ j.maturitas.2010.10.011

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behavior Research Methods, 39, 175-191.

Field, T. (2016). Massage therapy research review. *Complementary therapies in clinical practice*, *24*, 19-31. *Complementary Medicine*, *5*(4), 197-206. Retrieved from https://doi.org/10.1016/j.ctcp.2016.04.005

Field, T. (2017). Massage therapy research review. *Journal of Orthopedics &Amp; Bone Disorders*, 1(7).

Field, T., Diego, M., & Hernandez-Reif, M. (2010). Moderate pressure is essential for massage therapy effects. *International Journal of Neuroscience*, *120*(5), 381-385. Retrieved from https://doi. org/ 10. 3109/ 00207450903579475

Gatlin, C. G., & Schulmeister, L. (2007). When medication is not enough: nonpharmacologic management of pain. *Clinical Journal of Oncology Nursing*, *11*(5).

Hamdan, K. M. (2019). Nurses' assessment practices of pain among critically ill patients. *Pain Management Nursing*, *20*(5), 489-496.Retrieved from https://doi.org/10.1016/j.pmn.2019.04.003

Hatefi, M., Jaafarpour, M., Khani, A., Khajavikhan, J., & Kokhazade, T. (2015). The Effect of Whole Body Massage on the Process and Physiological Outcome of Trauma ICU Patients: A Double-Blind Randomized Clinical Trial. *Journal of Clinical and Diagnostic Research*, *9*(6), 5–8.

Higgs, A., McGrath, B. A., Goddard, C., Rangasami, J., Suntharalingam, G., Gale, R., ... & Society, D. A. (2018). Guidelines for the management of tracheal intubation in critically ill adults. *British Journal of Anaesthesia*, *120*(2), 323-352 .Retrieved from https:// doi. org/ 10. 1016/ j.bja. 2017. 10.021

Indriani, N., Santoso, B., Arwani, A. and Mardiyono, M., (2018). Comparison of Effectiveness of a Progressive Mobilization and Mozart Music Therapy on Non-Invasive Hemodynamic Status Changes in Patients with Head Injury in the Intensive Care Unit. *Belitung Nursing Journal*, *4*(2), 135-144.

Jagan, S., Park, T., & Papathanassoglou, E. (2019). Effects of massage on outcomes of adult intensive care unit patients: a systematic review. *Nursing in Critical Care*, *24*(6), 414-429.

Jamaati, H., vahedian-azimi, A., Ebadi, A., Ahmadi, F., Saadat, S., Kashafi, M.B., Asghari-Jafarabadi, M., Avazeh, A., & Hashemian, S.M. (2015). Therapeutic Effect of Massage on the Patients in Intensive Care Unit.*Arch Crit Care Med*,*1*(1), 1-8.

John, W.D., Yoanna, S., Céline, G., Dale, M.N., Arjen, J.C.S., & Pratik, P.P., et al. (2018). Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU. *Crit Care Med, 46*, 825-873

Kandemir, D. (2019). How Effective Is Reflexology on Physiological Parameters and Weaning Time from Mechanical Ventilation in Patients Undergoing Cardiovascular Surgery?. European *Journal of Integrative Medicine.* 26. Doi: 10. 1016/j.eujim.2019.01.008.

Khaledifar, A., Nasiri, M., Khaledifar, B., Khaledifar, A., &Mokhtari, A. (2017). The effect of reflexotherapy and massage therapy on vital signs and stress before coronary angiography: An open-label clinical trial. *ARYA Atherosclerosis, 13*(2), 50-55.

Khalil, N. S. (2018). Critical care nurses' use of non-pharmacological pain management methods in Egypt. *Applied Nursing Research, 44*, 33-38. Retrieved from https://doi.org/10.1016/j.apnr.2018.09.001

Kotfis, K., Zegan-Barańska, M., Strzelbicka, M., Safranow, K., Żukowski, M., & Ely, E. (2017). Validation of the Polish version of the Critical Care Pain Observation Tool (CPOT) to assess pain intensity in adult, intubated intensive care unit patients: the POL-CPOT study. Archives Of Medical Science. DOI: 10.5114/aoms.2017.69752.

Momeni, M., Arab, M., Dehghan, M., & Ahmadinejad, M. (2020). The Effect of Foot Massage on Pain of the Intensive Care Patients: A Parallel Randomized Single-Blind Controlled Trial. *Evidence-Based Complementary And Alternative Medicine*, 1-8.

Oshvandi, K., Veladati, Z., Mahmoodi, M., Rahimi Bashar, F., & Azizi, A. (2020). Effects of Foot Massage on Pain Severity during Change Position in Critically Ill Trauma Patients; A Randomized Clinical Trial. *Bulletin of emergency and trauma, 8*(3), 156–162.

Öztürk, R., Sevil, Ü., Sargin, A., & Yücebilgin, M. S. (2018). The effects of reflexology on anxiety and pain in patients after abdominal hysterectomy: a randomized controlled trial. *Complementary Therapies in Medicine*, 36, 107-112. Retrieved from https:// doi. org/ 10. 1016/ j. ctim.2017.12.005

Papathanassoglou, E., & Park T. (2016). To put the patient in the best condition: integrating integrative therapies in critical care. *Nursing in Critical Care, 21*(3), 123-6.

Payen, J., Bru, O., Bosson, J., Lagrasta, A., Novel, E., & Deschaux, I. et al. (2001). Assessing pain in critically ill sedated patients by using a behavioral pain scale. *Critical Care Medicine, 29*(12), 2258-2263. Retrieved from:https:// doi. org/ 10. 5772/ intechopen. 78708.

Russo, M. A., Santarelli, D. M., & O'Rourke, D. (2017). The physiological effects of slow breathing in the healthy human. *Breathe*, 13(4), 298–309.

Salvo, S. G. (2015). *Massage Therapy-E-Book: Principles and Practice*. Elsevier Health Sciences.

Severgnini, P., Pelosi, P., Contino, E., Serafinelli, E., Novario, R., & Chiaranda, M. (2016). Accuracy of Critical Care Pain Observation Tool and Behavioral Pain Scale to assess pain in critically ill conscious and unconscious patients: prospective, observational study. *Journal of Intensive Care, 4*(1).

Shaikh, N., Tahseen, S., Haq, Q. Z. U. , Al-Ameri, G., Ganaw, A., Chanda, A., & Kazi, M. Z. L. a. (2018). Acute Pain Management in Intensive Care Patients: Facts and Figures. In (Ed.), Pain Management in Special Circumstances. IntechOpen. Retrieved from: https:// doi. org/ 10. 5772/intechopen.78708.

Stillerman, E. (2016). Modalities for Massage and Bodywork (2nd Edition), Elsevier Health Sciences, St. Louis, Missouri,ISBN-13: 978-0323239318.

Thibaut, F. A., Chatelle, C., Wannez, S., Deltombe, T., Stender, J., Schnakers, C., Laureys, S., & Gosseries, O. (2015). Spasticity in disorders of consciousness: a

behavioral study. European *Journal of Physical and Rehabilitation Medicine, 51*(4), 389–397.

Wagner, J., Thompson, S. U. S. A. N., Kreitzer, M., & Koithan, M. (2014). Integrative nursing management of pain. Integrative nursing, 11, 286.

Walusis, F., Keister, K. J., & Russell, A. C. (2010). Massage therapy for stress management: implications for nursing practice. *Orthopaedic Nursing*, *29*(4), 254-257.doi:10.1097/NOR.0b013e3181e517c6

Wang, H. L., & Keck, J. F. (2004). Foot and hand massage as an intervention for postoperative pain. *Pain Management Nursing*, *5*(2), 59-65.. Retrieved from https://doi.org/10.1016/j.pmn.2004.01.002

Yaghoubinia, F., Navidian, A., Sheikh, S., Safarzai, E., & Tabatabaei, S.M. (2016). Effect of music therapy and reflexology on pain in unconscious patients: A randomized clinical trial. *International Journal of Medical Research and Health Sciences*, 5, 288-295.

YekeFallah, L., Azimian, J., Aghae, F., Alipour Heidari, M., & Hasandoost, F. (2018). Effect of hand tactile stimulation on the vital signs of brain injury patients hospitalized in Qazvin intensive care units, Iran. *The Journal of Qazvin University of Medical Sciences*, *22*(4), 13-21.