

Aromatherapy massage versus reflexology on female elderlies with the acute coronary syndrome

Abstract

Aim: The present study compared the effects of aromatherapy massage and reflexology on fatigue and cardiovascular parameters in older female patients with acute coronary syndrome.

Background: Fatigue and abnormalities in cardiovascular parameters are recognized as major problems for patients with acute coronary syndrome. Non-pharmacological nursing interventions are useful for controlling this fatigue and reducing patients' suffering during hospitalization.

Design: A randomized clinical trial.

Method: The study was conducted with 135 older female patients with acute coronary syndrome who were hospitalized on a cardiac care unit in 2014. They were invited to participate in the study and then were randomly divided into three groups: 'aromatherapy massage', 'reflexology', and 'control'. The fatigue severity and cardiovascular parameters were assessed through the Rhoten fatigue scale and a checklist. Measurements in the groups were performed before and immediately after the intervention. Data analysis was performed using descriptive and analytical statistics via the SPSS software.

Results: Aromatherapy massage significantly decreased fatigue, systolic blood pressure, mean arterial pressure and O₂ saturation more than the reflexology intervention. However, reflexology reduced patients' heart rates more than an aromatherapy massage ($P < 0.05$). Moreover, no significant changes were observed in patients' diastolic blood pressures when compared to the control group ($P = 0.37$).

Conclusions: Implementation of both aromatherapy massage and reflexology has positive effects on the fatigue and cardiovascular parameters of patients with acute coronary syndrome. However, aromatherapy massage can be more beneficial to apply as a supportive approach in coronary diseases.

Relevance to clinical practice: The need for reducing fatigue in ACS patients on a cardiac care unit is evident. The implementation of aromatherapy massage and reflexology had positive effects on patients' fatigue as related to both physical and mental health.

Key words: acute coronary syndrome, aromatherapy, alternative therapies, cardiovascular parameters, fatigue, reflexology,

INTRODUCTION

1 Fatigue is one of the most common and distressing symptoms in patients with acute coronary syndrome
2 (ACS), often impeding patients' active lifestyle (Pelletier et al., 2015; Shlomei et al., 2015). The
3 progression of fatigue may negatively affect the ACS and exaggerate this disease (Franssen et al., 2003;
4 Eckhardt et al., 2014). Moreover, fatigue alters patients' autonomic nervous activities and may lead to
5 abnormalities in cardiovascular parameters (Silverman et al., 2010; Fagundes et al., 2011). In addition,
6 fatigue is a poorly understood phenomena in healthcare settings that often requires a multidisciplinary
7 approach for management (Ozdemir et al., 2013).

8 Despite the use of various medications for symptom relief in patients with ACS, pharmacologic
9 modalities may not be able to comprehensively address these symptoms, including fatigue
10 (Peuckmann-Post et al., 2010; Fake et al., 2016). Complementary and alternative medicine (CAM)
11 services may be the most powerful therapeutic interventions in patients with cardiovascular diseases (Yeh
12 et al., 2006).

13 Aromatherapy is a holistic intervention applied through inhalation or massage (Bikmoradi et al., 2015;
14 Karadag et al., 2015; Seyyed-Rasooli et al., 2016). Aromatherapy massage consists of the use of essential
15 oil, extracted from the vapor of the volatile essence of plants, through massage. Lavender (*Lavandula*
16 *angustifolia*) is widely used in different contexts (Field et al., 2007; Hosseini et al., 2016). Previous
17 studies have confirmed the sedative effects of Lavender on the parasympathetic system. Also, it has been
18 found that lavender promotes the heart function and coronary blood flow (Shiina et al., 2008; Lytle et al.,
19 2014; Bikmoradi et al., 2015). Tisserand (1988) suggested lavender may have a similar function to the
20 benzodiazepines, and can promote the effects of gamma-amino-butyric acid in the amygdala (Tisserand.,
21 1988).

22 Several studies reported that lavender resulted in reduced fatigue in different groups (Kang and Kim.,
23 2002; Bahraini et al., 2011). For instance, in randomized controlled studies, Balouchi et al. (2016) and
24 Chen et al. (2015) found that aromatherapy with lavender significantly decreased fatigue (Balouchi et al.,
25 2016; Chen and Chen 2015). Tahmasebi et al. (2014) in a quasi-experimental clinical trial also stated that
26 lavender alleviated cardiovascular parameters in cardiovascular patients (Tahmasebi., 2015).

27 Another complementary therapy approach with a potential beneficial effect for reducing fatigue is
28 reflexology (Özdemiret al., 2013). Reflexology is an ancient practice using the thumb and fingers on
29 hands, feet and ears via stimulating some areas called reflex zones. A reflex zone corresponds with an
30 organ, gland or body parts and is proposed to help with the body's self-improvement (Pitman and
31 Mackenzie., 2002; Wang et al., 2008; Ozdemiret al., 2013). Reflexologists claim that massage pressure on
32 the reflex zone increases blood supply to the corresponding organ associated with the area being
33 massaged (Jones et al., 2013). Reflexology is useful for managing the adverse physical and psychological
34 symptoms of a disease and its treatment process, and reducing fatigue (Yang., 2005; Wang et al., 2008).
35 A randomized controlled trial reported that reflexology significantly decreased patients' fatigue after
36 eight reflexology sessions (Unal and Balci Akpinar., 2016). However, another randomized controlled trial
37 study, with healthy volunteers, demonstrated that reflexology did not affect cardiovascular parameters
38 (Jones et al., 2012) .

1 A review of the literature identified a lack of research investigating the effects of these modalities on
2 patients with ACS. The aim of this study was to compare the effects of aromatherapy massage and
3 reflexology on fatigue and cardiovascular parameters in female older patients with ACS.

4 **MATERIALS AND METHODS**

5 Design

6 This randomized controlled trial involved 135 female older patients with an acute coronary syndrome
7 who were assigned to one of three groups: 1) reflexology (n=45), 2) aromatherapy massage (n=45) and 3)
8 a control group (n= 45). The primary outcome measures were the effects of reflexology and aromatherapy
9 massage on patient-reported fatigue and their cardiovascular parameters before treatment and after the
10 treatments (Figure 1).

11 Setting

12 The participants were recruited from high turnover coronary care units (CCU) of a large tertiary referral
13 teaching hospital in an urban area of Iran, between from July 2014 to December 2015.

14 Sample

15 All patients with ACS, hospitalized in the CCU, were invited to take part in the study on the first day of
16 their admission.

17 *Sample size*

18 In order to demonstrate a significant difference between the aromatherapy massage and reflexology
19 groups, the sample size was determined through the following process. given the sample size in a
20 previous study, $\alpha = 0.05$ $\beta = 90\%$ p =Time correlation in this study was intended= 0.5, $\sigma = 8.73$, n = the
21 number of group's=3, s^2/x = variance, the time intervention=0.06 hours, d = Three estimated mean
22 difference before and after the intervention=6.01. $N = 2 * (1.96 + 1.28)^2 * ((1 - 0.5) * 8.73^2) / (3 * 0.06 * 6.01^2)$
23 = 133.05 \approx 135. Therefore, the number of patients in each group was 45 patients (Mahmoudirad et al.,
24 2014).

25 *Randomization*

26 Following receipt of a university's ethical committee approval, and obtaining the healthcare
27 organization's permission to conduct the study on the CCU, the nurse manager was informed of the
28 study's purpose and inclusion criteria to help with the identification of eligible participants. A
29 convenience sample of older female patients, meeting the inclusion criteria, was chosen with no patient
30 declining to participate. The allocation of the patients to the groups was done randomly through a system
31 of sealed envelopes with each envelope assigned to a specific group. The sampling process continued
32 until the required number of the participants were recruited into each group (Figure1). In order to avoid
33 bias, one researcher generated the random allocation process and a different researcher enrolled the
34 patients and assigned the patients to groups.

1 It was noted that the second author generated the random allocation sequence, the first author enrolled the
2 patients and assigned participants to interventions.

3 *Blinding*

4 It was impossible to control the patients or nurses' awareness of the group assignment due to the nature of
5 the intervention (aromatherapy massage) and lavender smell. Nevertheless, the data analyst was unaware
6 of the group assignment. In addition, the randomization code was available only to a research fellow who
7 was not connected to this study. The code was disclosed to the researchers after the statistical data
8 analysis was completed.

9 *Eligibility criteria*

10 *Inclusion criteria*

11 The inclusion criteria were patients who: were female; were diagnosed with ACS; were 60 years or older
12 (Zaninotto et al. 2016); had received no anxiolytics or sedative drugs in the last four hours; had received
13 no alternative or complementary healthcare services in the last 48 hours; did not have foot ulcers; had no
14 history of drug addiction, asthma, eczema or allergy; and had passed the olfactory test and the abbreviated
15 mental test (score ≥ 7).

16 *Exclusion criteria*

17 Patients who had severe hemodynamic instability (according to physicians' orders) during the
18 intervention or unwillingness to continue with the study were excluded from the study.

19 Interventions and control groups

20 *Control group*

21 The patients in the control group received the usual care in the CCU.

22 *Reflexology group*

23 Reflexology, the stimulation of specific zones on the feet associated with different organs, based on the
24 Ingham method of reflexology, was administered to the reflexology intervention group (Byers., 2004).
25 The researcher, qualified to administer reflexology, performed the intervention in the morning shift once
26 the patients were comfortable in a bed in the supine position. Nursing and medical professionals were
27 instructed not to disturb the patient during the intervention or the rest period unless it was necessary.
28 Furthermore, the patients were asked to refrain from speaking during the intervention unless it was
29 necessary, and focus on feeling the sensations of their body and expressing those feelings as this process
30 could help the intervention. A pillow was placed under the patients' knees to facilitate the massage. The
31 investigator washed her hands with warm water and performed general foot massage with six drops of
32 almond oil dropped in each foot. Relaxation techniques used for loosening the foot and preparing it for
33 reflexology included effleurage movements (ten times), stretching toes by holding them between thumbs

1 and other fingers (five times in both directions) and moderate rotational movements around the ankle
2 (five times).

3 Afterward, systematic reflexology focusing on the reflex zones corresponding to the patients' solar plexus
4 (14 seconds), pituitary gland (40 seconds), brain (5 seconds), heart (10 seconds), intestines (5 seconds),
5 vertebral column (5 times), adrenal gland and kidney (5 times) were performed. These actions were
6 performed using a firm downward pressure of the thumb and rubbing movements for stimulating the
7 intestines and kidneys. Prior to, and after, the reflexology intervention, the patient's levels of anxiety,
8 depression, and cardiovascular parameters were assessed. The total duration of the reflexology
9 intervention was 20 minutes. The timing of the intervention was flexible. However, the intervention was
10 conducted during the morning as the patients collaborated more easily and the visit did not appear to
11 disturb them.

12 *Aromatherapy massage group*

13 The aromatherapy massage, using lavender essential oil, was consisted of Linalool (27.11 %) and Linalyl
14 acetate (23.33%) acetate. Essential oil was formulated in the ratio of 3:3:2:2 ml. in 100 ml. of coconut
15 carrier oil. Lavender essential oil was chosen through consultation with a Department of Pharmacognosy.
16 Reflexology, with ten drops of the essential lavender oil, formed the aromatherapy massage. The massage
17 was applied to each foot (total 20 drops) on the same reflex zones as the reflexology group. The total
18 duration of the aromatherapy massage lasted for 20 minutes. It should be noted that no identified side
19 effects or risk factors with regard to the intervention and lavender oil were reported (Molavi Vardanjani
20 et al., 2013, Hashemi et al., 2015).

21 Measures

22 *The demographic and medical information form*

23 The demographic questionnaire included items related to age, marital status, employment status,
24 educational level, living status and history of hospitalization.

25 *Cardiovascular parameters*

26 The systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MBP), heart
27 rate (HR), respiratory rate (RR) and O₂ saturation (SpO₂) data were measured using a standard and
28 calibrated monitoring machine.

29 *The Rohten fatigue scale (RFS).*

30 The RFS consisted of a 10 cm. line with extremely positive statements on one end and extremely negative
31 statements on the other end. The most positive and negative fatigue statements were scored 0 and 10,
32 respectively. Based on the use of a visual analogue scale (VAS), the ratings of this line included 0 (lack of
33 fatigue), 1-3 (low fatigue), 4-6 (moderate fatigue), 7-9 (high fatigue) and 10 (severe fatigue) (Adaryani et
34 al., 2007).

35 *Abbreviated mental test (AMT).*

1 The AMT enabled the researchers to rapidly identify patients with cognitive disorders. Patients with a
2 score of greater than seven out of ten were considered normal. Patients with a score lower than seven
3 were identified as having a cognitive impairment (Faraji et al., 2013). In terms of reliability, the
4 Cronbach's alpha coefficient of the AMT was reported as 0.76 (Bakhtiyari et al., 2014).

5 Data collection

6 After patients were allocated to one of the three research groups (aromatherapy massage, reflexology or
7 control), the RFS and the cardiovascular parameters checklist were completed by a nurse before and
8 immediately after the intervention for all groups.

9 Data analysis

10 *Statistical procedures*

11 Data analysis used descriptive statistics (frequency, percentage, mean and standard deviation) and
12 inferential statistics (one-way ANOVA, Chi-squared test, Tukey's, Cramer's and Phi test and Cohen's d
13 test). A chi square test was used to assess whether there were any significant differences between the
14 fatigue reported by the patients in each group. Cardiovascular parameters, using one-way ANOVA and
15 LSD, were assessed for determining the between the group effects of the interventions. The Eta
16 correlation ratio was used to examine the relationship between the rating scale and the interventions, but
17 the pair wise comparisons were performed by using the Cohen's d test. The Cramer's and phi correlation
18 ratio examined the relationship between the interventions and fatigue. In addition, the Kolmogorov-
19 Smirnov test examined the normal distribution of the data while the Leven's test was used to report the
20 homogeneity of the variance. The alpha was set at $p < 0.05$. Data was analyzed using the SPSS software
21 (SPSS Inc., Chicago, IL).

22 **RESULTS**

23 The demographic characteristics of the participants

24 One hundred thirty five patients met the inclusion criteria and were randomized into the three groups
25 ($n=45$ per group). The study population had a mean age of 72.78 ± 7.65 years. The ANOVA and Chi-
26 square test showed no statistically significant differences between the groups in terms of age, marital
27 status, employment status, educational level, living status and history of hospitalization (Supplementary
28 Table 1).

29 Fatigue

30 Significant differences were reported in the levels of fatigue between the patients in the control and the
31 intervention groups ($\chi^2 = 51.262$, $p = 0.001$). Most of the patients (63%, $n=85$) reported severe levels of
32 fatigue. However, after the interventions, 42.2% ($n=57$) reported only moderate fatigue. The pair wise
33 comparison of the groups revealed that both intervention groups showed a reduction of the levels of
34 fatigue ($p = 0.001$). However, the Crammer's and Phi test indicated a larger effect of aromatherapy
35 massage on the reduction of the level of fatigue as compared with the reflexology intervention ($\Phi = 0.67$)
36 (Table 1).

1 Cardiovascular parameters

2 *Systolic blood pressure*

3 The results of the ANOVA test showed a significant reduction of the SBP ($p = 0.01$). There was a direct
4 correlation between the SBP and the interventions ($\eta^2_p = 0.065$). The result of Tukey's test revealed that
5 aromatherapy massage was responsible for this SBP reduction ($p = 0.005$) and Cohen's d identified a
6 medium effect for this intervention ($d = 0.58$).

7 *Diastolic blood pressure*

8 The results of the ANOVA test showed that there was no significant reduction in DBP ($p < 0.98$).

9 *Heart rate*

10 An ANOVA test identified a significant reduction in patients' HRs ($p = 0.01$). Also, there was a direct
11 correlation between the patients' HRs and the interventions ($\eta^2_p = 0.062$). A Tukey's test revealed that
12 the reflexology intervention was responsible for the HR reduction ($P = 0.01$), with Cohen's d identifying
13 a medium effect for this intervention ($d = 0.65$). (Table 2)

14 *Respiration rate*

15 Based on an ANOVA test, a significant reduction was identified in the patients' RRs ($p = 0.04$).
16 Moreover, there was a direct correlation between the patients' RRs and the interventions ($\eta^2_p = 0.079$). A
17 Tukey's test revealed that both the aromatherapy massage and the reflexology intervention decreased the
18 patients' RRs ($p < 0.05$), with Cohen's d identifying a medium effect of this reduction ($d = 0.62$, $d =$
19 0.50). (Table 2)

20 *Oxygen saturation*

21 A significant reduction in the patients' SpO_{2s} ($p = 0.001$) was identified through an ANOVA test. Also,
22 there was a direct correlation? between the patients' RRs and the interventions ($\eta^2_p = 0.107$). A Tukey's
23 test identified that the aromatherapy massage intervention could decrease the patients' SpO_{2s} ($p = 0.01$),
24 with Cohen's d identified the associated large effect ($d = 1.04$). (Table 2)

25 *Mean arterial pressure*

26 An ANOVA identified a significant reduction in the patients' MAPs ($p = 0.04$). There was also a direct
27 correlation between the patients' MAPs and the interventions ($\eta^2_p = 0.080$). Based on the results of a
28 Tukey's test, the aromatherapy massage intervention was responsible for the patients' MBPs reduction (P
29 $= 0.01$), with a Cohen's d identifying a medium effect ($d = 0.58$). (Table 2)

30 **DISCUSSION**

31 This study was conducted with the aim of comparing the effects of aromatherapy massage and
32 reflexology on the fatigue and cardiovascular parameters in female older patients with the acute coronary
33 syndrome. The results of this study demonstrated that aromatherapy massage and reflexology had more

1 effects on fatigue and cardiovascular parameters, with the exception of DBPs, as compared with a control
2 group. Moreover, both interventions decreased fatigue severity in patients with ACS, but this reduction
3 was greater with the aromatherapy massage group. The combination of aromatherapy massage and
4 lavender essential oil appeared to accelerate the removal of catabolites and fortified the heart (Nunes et
5 al., 2016).

6 Similar to the current study, a previous study also identified that aromatherapy massage, administered to
7 middle-aged female patients, also reduced their fatigue (Kim and Kim., 2012). In addition, Fellowes et al.
8 (2008) stated that aromatherapy massage reduced fatigue in patients with cancer (Fellowes et al., 2004).
9 In contrast, findings of a long-term randomized controlled trial by Metin and et al. (2016) demonstrated
10 that reflexology reduced fatigue earlier than aromatherapy massage. This postponement may be due to the
11 time required for essential oil absorption in inflamed joints (Gorji et al., 2015; Gok Metin., 2016 and
12 Ozdemir., 2013).

13 The comparison of the patients' cardiovascular parameters before and after the intervention demonstrated
14 that aromatherapy massage reduced patients' RRs and had a greater effect on controlling patients' SpO₂s.
15 However, patients' DBPs showed no changes with either of the intervention groups. Reflexology seemed
16 to have a greater effect on reducing patients' HR, while aromatherapy massage better controlled patients'
17 SBP, MAP and SpO₂ rather than reflexology.

18 Eguchi et al. (2016) reported that aromatherapy foot massage decreased patients' SBPs and DBPs.
19 Furthermore, Hur et al. (2007) achieved the same results among climacteric women (Hur et al., 2007;
20 Eguchi, et al., 2016). Yi et al. (2002) reported that patients' SBPs, DBPs, and HRs differed significantly
21 between the aromatherapy massage and control groups in pre-surgical patients.

22 Kaur et al. (2012) suggested that three reflexology sessions could significantly decrease patients' SBPs,
23 increase DBPs, reduce HRs and improve SpO₂s. However, no statistically significant differences were
24 found in patients' BPs and HRs (Yi 2002).

25 Such cardiovascular contradictions may be due to differential response times among individuals and the
26 reflexology locations used, making it difficult for the methods and findings to be reproduced. Possibly,
27 nonspecific effects such as the sympathy, verbal and psychological content of the communications
28 between the researcher and the patients, during a massage, could also have affected the hemodynamic
29 status of an individual organ (Jones et al., 2013).

30 This study supported the distinction between the effect of aromatherapy massage with the use of essential
31 oil from only massage by using reflexology for both intervention groups. As a result, a more useful
32 intervention has been identified.

33 **Limitation**

34 The difficulty in blinding data collector and patients' to the type of intervention being used could be a
35 potential bias. Also, the homogeneous nature of the samples makes the generalizability of the findings
36 difficult to all patients with ACS.

37 **Recommendation for further research**

1 Few studies have compared the effects of aromatherapy massage and reflexology interventions on
2 patients' fatigue and cardiovascular parameters. Therefore, further studies are needed to identify
3 additional effective non-pharmacologic interventions.

4 Replication research, using the same outcome measures and scales, could lend support to the current
5 findings. Moreover, longitudinal studies could further describe the full impact of the interventions.

6 Further research could explore the effects of aromatherapy massage and reflexology interventions on the
7 physiologic and psychological symptoms (anxiety, depression and sleep disturbance), following
8 hospitalization for patients with ACS, when providing holistic nursing care.

9 **CONCLUSION**

10 The findings of this study confirmed that aromatherapy massage and reflexology interventions could be
11 used as non-pharmacologic interventions for managing the fatigue and cardiovascular parameters in older
12 female patients with ACS. Along with routine care, critical care nurses can independently use these non-
13 pharmacologic alternative interventions for improving the quality of care delivered to patients.

14 **ETHICAL CONSIDERATIONS**

15 This study was approved by the Ethical Commission affiliated with a University, Tehran, Iran. In
16 addition, the study was registered in the Iranian Registry of Clinical Trials (code:
17 IRCT201512027529N8). The study was conducted in accordance with the ethical principles provided by
18 the Declaration of Helsinki and the guidelines of the Iranian Ministry of Health and Medical Education.
19 The aim and the method of the study were explained to each patient and an informed verbal consent form
20 was signed by those who agreed to take part in this study. The confidentiality and anonymity of the
21 participants were ensured by using code numbers instead of names. Patients could also withdraw from the
22 study at any time without penalization.

23

1

WHAT IS KNOWN ABOUT THIS TOPIC

- Coronary diseases are considered the main cause for death across the world.
- Acute coronary syndrome (ACS) is a stressful condition, and patients may suffer from fatigue, stress and tension, resulting in a decreased quality of life.

WHAT THIS PAPER ADDS

- Implementation of both aromatherapy massage and reflexology interventions have positive effects on fatigue and cardiovascular parameters in patients with ACS.
- Aromatherapy massage can be more beneficial than reflexology when applied as a supportive approach in patients with ACS.
- Critical care nurses can use aromatherapy massage and reflexology interventions as alternative therapies for relieving ACS patients' fatigue and improving their physiologic parameters.

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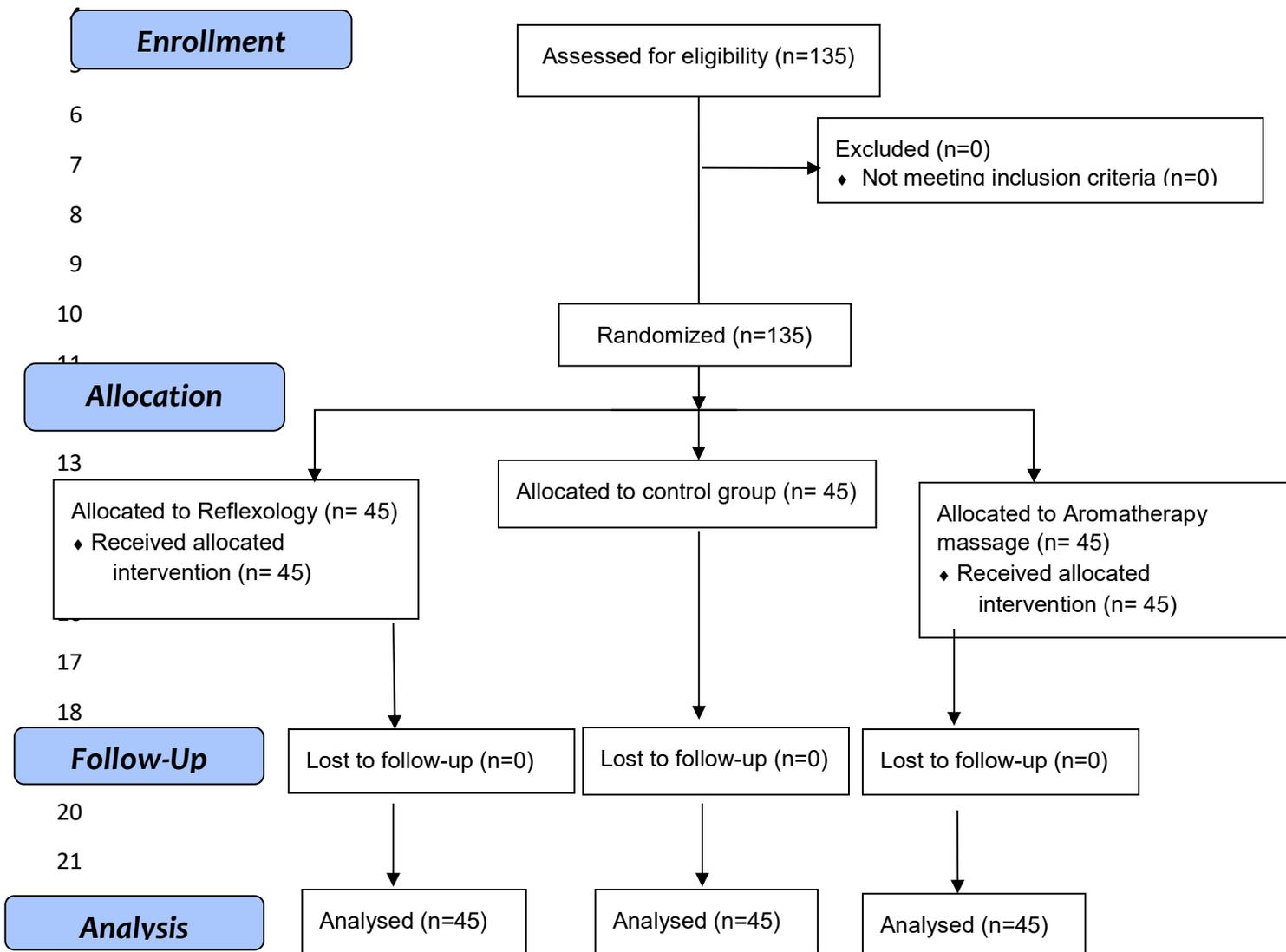
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1 Figure 1. The process of the study according to the Consort flow diagram (2010)

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1 Supplementary table 1. The demographic characteristics of the samples

Demographic	Groups	Mean \pm SD	df	F	Sig			
Age	1	72.62 \pm 7.93	2	0.379	0.685			
	2	72.86 \pm 7.98	132					
	3	73.97 \pm 7.69	134					
Education level		Illiterate	Elementary	Diploma	Total	4.96	4	0.29
	1	30 (66.7%)	12 (26.7%)	3(6.7%)	45 (100%)			
	2	38 (84.4%)	5 (11.1%)	2 (4.4%)	45 (100%)			
	3	36 (80%)	8 (17.8%)	1(2.2%)	45 (100%)			
	Total	104 (77%)	25 (18.5%)	6 (4.5%)	135 (100%)			
Marital status		Married	Single	Widow	Total	4.44	4	0.34
	1	15 (33.3%)	1 (2.2%)	29 (64.4%)	45 (100%)			
	2	12 (26.7%)	0 (0%)	33 (73.3%)	45 (100%)			
	3	11(24.4%)	3 (6.7%)	31 (68.9%)	45 (100%)			
	Total	38(28.1%)	4 (3%)	9 (68.9%)	135 (100%)			
Occupation		Housewife	Retired	Out of Work	Total	5.08	4	0.27
	1	35 (77.8%)	2 (4.4%)	8(17.8%)	45 (100%)			
	2	32 (71.1%)	7 (15.6%)	6(13.3%)	45 (100%)			
	3	35 (77.8%)	2 (4.4%)	8(17.8%)	45 (100%)			
	Total	102 (75.6%)	11(8.1%)	22(16.3%)	135 (100%)			
Living condition		Alone	Spouse	With child	Total	2.25	4	0.689
	1	19 (42.2%)	15 (33.3%)	11 (24.4%)	45 (100%)			
	2	23 (51.1%)	11 (24.4%)	11 (24.4%)	45 (100%)			
	3	19 (42.2%)	11 (24.4%)	15 (33.3%)	45 (100%)			
	Total	61 (45.2%)	37 (27.4%)	37 (27.4%)	135 (100%)			
Housing condition		Rental	Personal	Total	0.94	2	0.62	
	1	4 (8.9%)	41 (91.1%)	45 (100%)				
	2	7 (15.6%)	38 (84.4%)	45 (100%)				
	3	6 (13.3%)	39 (86.7%)	45 (100%)				
	Total	17 (12.6%)	118 (87.4%)	135 (100%)				
Hospital stay		Yes	No	Total	4.46	2	0.10	
	1	32 (71.1%)	13 (28.9%)	45 (100%)				
	2	37 (82.2%)	8 (17.8%)	45 (100%)				
	3	28 (62.2%)	17 (37.8%)	45 (100%)				
	Total	97 (71.9%)	38 (28.1%)	135 (100%)				

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3 P-values indicated significance of the differences between the intervention and control groups
4 using the one-way ANOVA (quantitative variable) given the equality of variance.

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6 The Chi-square test was used to evaluate the qualitative parameters.

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8 Control group = 1; Reflexology intervention group = 2; Aromatherapy massage intervention
9 group = 3

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2 Table 1. The comparison of the fatigue severity before and after the interventions.

Parameters	Group	Low	Moderate	High	Severe	Total	X ²	df	Sig	Cramer's phi	
Fatigue Before the intervention	1	2 (4.4%)	10 (22.2%)	8 (17.8%)	25 (55.6%)	45 (100%)	4.061	6	0.668		
	2	1 (2.2%)	9 (20%)	6 (13.3%)	29 (64.4%)	45 (100%)					
	3	0 (0)	10 (22.2%)	4 (8.9%)	31 (68.9%)	45 (100%)					
	Total	3 (2.2%)	29 (21.5%)	18 (13.3%)	85 (63%)	135 (100%)					
Fatigue After the intervention		No fatigue	Low	Moderate	High	Severe	Total	X ²	df	Sig	
	1	3(6.7%)	9(20%)	8 (17.8%)	9 (20%)	16 (35.6%)	45 (100%)	51.262	8	0.001	Φ=0.62 ΦC=0.44
	2	2(4.4%)	11 (24.4%)	24 (53.3%)	6 (13.3%)	2 (4.4%)	45 (100%)				
	3	0(0%)	20 (44.4%)	25 (55.6%)	0 (0%)	0 (0%)	45 (100%)				
Total	5(3.7%)	40 (29.6%)	57 (42.2%)	15 (11.1%)	18 (13.3%)	135 (100%)					
Fatigue After the intervention	1	3 (6.7%)	9 (20%)	8 (17.8%)	9(20%)	16 (35.6%)	19.889	4	0.001	Φ=0.47 Φc=0.47	
	2	2 (4.4%)	11 (24.4%)	24 (53.3%)	6 (13.3%)	2 (4.4%)					45 (100%)
Fatigue After the intervention	1	3(6.7%)	9(20%)	8 (17.8%)	9(20%)	16(35.6%)	40.930	4	0.001	Φ= 0.67 Φc= 0.67	
	3	0(0%)	20 (44.4%)	25 (55.6%)	0(0%)	0(0%)					45(100%)

3

4 P-values indicated significant of the differences between the groups using the Chi-square test.
5 Also, the pair wise comparison was performed using the Tukey's LSD test.

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7 The Cramer's Phi correlation ratio was used to report correlations between interventions and
8 fatigue severity.

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10 Control group = 1; Reflexology intervention group = 2; Aromatherapy massage intervention
11 group = 3

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1 Table 2. The comparison of the cardiovascular parameters before and after the interventions.

Cardiovascular indicators	group	Baseline M \pm SD	Post interventions M \pm SD	Baseline p-value (between groups)	Post interventions p-value (between groups)	ES η^2_p	Post test (LSD)	Cohen's d Effect size
SBP	1	128.42 \pm 18.83	126.89 \pm 19.15	0.85	0.01	0.065	(1,2) 0.510 (1,3) 0.005	(1, 3) d=0.58 r=0. 28
	2	127.76 \pm 12.99	124.80 \pm 13.89					
	3	129.51 \pm 11.66	117.78 \pm 10.76					
DBP	1	75.67 \pm 12.10	76.20 \pm 12.23	0.05	0.37			
	2	75.87 \pm 12.15	73.76 \pm 11.72					
	3	81.20 \pm 11.76	73.13 \pm 8.65					
MAP	1	94.33 \pm 16.34	93.78 \pm 16.42	0.57	0.04	0.080	(1,2) 0.94 (1,3) 0.01	(1, 3) d=0.64 r=0. 31
	2	97.11 \pm 15.34	94.69 \pm 16.25					
	3	94.63 \pm 7.94	85.60 \pm 7.18					
H.R	1	80.36 \pm 8.80	79.96 \pm 8.96	0.07	0.01	0.062	(1,2) 0.01 (1,3) 0.25	(1, 2) d=0.65 r=0. 31
	2	77.16 \pm 13.72	73.60 \pm 10.47					
	3	74.82 \pm 11.74	76.53 \pm 11.19					
R.R	1	15.18 \pm 4.06	15.18 \pm 3.64	0.19	0.04	0.079	(1,2) 0.005 (1,3) 0.03	(1, 2) d=0.62 r=0. 30 (1, 3) d=0.50 r=0. 25
	2	15.64 \pm 1.81	17.04 \pm 2.17					
	3	18.00 \pm 2.34	16.69 \pm 2.29					
SpO ₂	1	89.80 \pm 4.11	89.82 \pm 4.14	0.10	0.001	0.107	(1,2) 0.06 (1,3) 0.01	(1, 3) d=0.50 r=0. 25
	2	91.22 \pm 4.01	92.09 \pm 3.90					
	3	91.20 \pm 2.40	92.51 \pm 1.81					

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3 Data were presented as means \pm standard deviation. P-values indicated the difference between
4 the groups using the one-way ANOVA using the equality of variance. The pair wise comparison
5 of the groups was conducted using the Tukey's LSD test.

6
7 The Eta correlation ratio was used to report the correlation between interventions and
8 cardiovascular parameters.

9 The Cohen's d represented the effect size of the interventions on cardiovascular parameters
10 SBP = systolic blood pressure; DBP = diastolic blood pressure; MAP = mean arterial pressure;
11 HR = heart rate; RR = respiratory rate; SpO₂ = O₂ saturation
12 Control group = 1; Reflexology intervention group = 2; Aromatherapy massage intervention
13 group = 3

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