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Effect of Isometric Exercise versus Hand Reflexology on Fatigue among Patients with Acute Myocardial Infarction: A Randomized Clinical Trial

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ABSTRACT

Objective: This study aimed to compare the effectiveness of isometric exercise versus hand reflexology on hemodynamic parameters and anxiety in patients with acute myocardial infarction (AMI).

Methods and Materials: A parallel-group randomized controlled design was used. A total of 88 participants were randomly allocated to three groups: the isometric exercise group (n = 26), the hand reflexology group (n = 29), and the control group (n = 33). Patients with AMI underwent a 25- to 30-minute isometric exercise session and a 10-minute hand reflexology session for 3 consecutive days. Demographic data and clinical variables were collected. Participants' anxiety was assessed in the three groups using the STAI scale, with three pretests and posttests. Data were analyzed using SPSS v26 and a parametric one-way ANOVA (Analysis of Variance) test, as well as non-parametric tests (Mann-Whitney U, Kruskal-Wallis, and Spearman correlation).

Findings: A statistically significant difference between the groups was reported in terms of all hemodynamic parameters ($P < 0.001$) after applying isometric exercise and hand reflexology. Also, a statistically significant difference between the groups was reported in relation to anxiety ($P < 0.001$).

Conclusion: The researchers concluded that isometric exercise and hand reflexology improve hemodynamic parameters significantly and reduce anxiety levels in patients with AMI. Therefore, nurses can use this easy, non-pharmacological, non-invasive, and low-cost method.

Keywords: Isometric exercise, hand reflexology, acute myocardial infarction, coronary care.

Introduction

Cardiovascular diseases (CVDs) relate to a variety of circulatory and cardiac conditions (Ahmad et al., 2020; Faleh & AL-Fayyadh, 2022). 90% of deaths from CVDs occur in middle- and low-income countries (Heidaranlu et al., 2021; Naghavi et al., 2024). Coronary artery disease (CAD), commonly referred to as ischemic heart disease, is the most common kind of CVD (AL-Mussawi & Baqer, 2024; Vaduganathan et al., 2022). In many nations, CAD is still a major cause of illness and mortality (Albadry & Hassen, 2024; Amini et al., 2021; Jasim et al., 2020; Salman & Salman, 2024).

According to current studies, ischemic heart disease (IHD) is a serious public health risk that is expected to rise globally (Al-zuhairy & Al-Jubouri, 2024; Shu et al., 2024). The 2019 Global Burden of Disease, Injuries, and Risk Factors Study estimated that there were 197 million cases of IHD (Albadry & Hassen, 2024). In China, IHD caused 9.14 million deaths and 182 million disability-adjusted life years in 2019. From 1990 to 2021, IHD was the leading cause of death in North Africa, the Middle East, high-income countries, Central Europe, and Central Asia (Naghavi et al., 2024). Iraqi teenagers between the ages of 15 and 17 may be experiencing an increase in CAD. Hospital stays, therapeutic interventions, revascularization procedures, outpatient consultations, emergency care, and prescription drugs are all included among the costs associated with IHD (Gheorghie et al., 2018; Khan et al., 2019).

A reduction in coronary blood flow brings on Acute Myocardial Infarction (AMI). It may result in myocardial damage and ischemia, which can show up as a flattened and inverted T-wave and a rising or falling ST segment on the electrocardiogram (ECG). Arrhythmia and alterations in physiological indices, including fever, tachypnoea, hypertension, and hypotension, are among the problems that patients with AMI face (Pasyar et al., 2024). Some CAD patients report anxiety in addition to alterations in physiological markers (Rambod et al., 2020). As previously stated, patients with AMI who are admitted to the Cardiac Care Unit (CCU) may have a bad prognosis due to their numerous comorbidities and issues. As a result, it's critical to monitor these issues and offer solutions closely. Aromatherapy is one of the complementary and integrative health (CIH) treatments that have gained popularity recently (Rambod et al.,

2020). Reflexology has also been thought to enhance health outcomes (Rambod et al., 2019). Hand reflexology and isometric exercise (IE), a CIH therapy, have been considered in this study.

According to a study, IE enhances hemodynamic parameters (Patel et al., 2022) and reduces anxiety (Shakoor et al., 2025). Reflexology reduces pain and fatigue in long-term illnesses such as cancer (Rambod et al., 2019). However, it remains to be seen whether IE and hand reflexology can be useful during the acute stage of CVDs such as AMI. Reflexology decreased anxiety, according to a review of the research (Vardanjani et al., 2013) carefully controlled physiological metrics like blood pressure (BP) (Moeini et al., 2011) respiration, (Abbaszadeh et al., 2018; Khalili et al., 2016) heart rate, (Elsayed et al., 2019) Saturation Level (SPO2) (Elsayed et al., 2019) and pain (Kardan et al., 2020) in patients with acute coronary syndrome who are having coronary angiography and coronary artery bypass graft (CABG) surgery. Nevertheless, research has shown that reflexology does not affect physiological markers in individuals undergoing CABG surgery (Ebadi et al., 2015).

The efficiency of reflexology in physiological parameters was the subject of conflicting findings in this research. Furthermore, they did not address the current study question, which was centered on AMI, and they showed that only a small number of studies have examined the efficacy of reflexology and IE in AMI patients. Reflexology for three consecutive days decreased chest pain in AMI, according to a study (Sayari et al., 2021). Furthermore, no research has examined the impact of IE and hand reflexology on hemodynamic parameters and anxiety in AMI patients. Therefore, the current study assessed the impact of IE and hand reflexology on hemodynamic parameters and anxiety in patients with AMI to enhance evidence-based treatment regarding their efficacy.

Methods and Materials

Study Design

A parallel-group randomized controlled design. The researcher can use this design to find the best cause-and-effect relationship between the independent variable (IE and hand reflexology) and the dependent variable (hemodynamic parameters and anxiety). They can also see how the IE and hand reflexology affect hemodynamic

parameters and anxiety among AMI patients and figure out which intervention works best.

The study was conducted at Al-Diwaniyah government hospital, which includes Al-Diwaniyah Teaching Hospital and Cardiac Catheterization and Surgery Center. The study sample will consist of AMI patients inside the CCU.

Participants

Study sample collected from patients present at Al-Diwaniyah government hospital in Al-Diwaniyah city with AMI and receiving care. Inclusion criteria were as follows: patients with AMI who could speak and understand Arabic and were over 18 years of age. Exclusion criteria were the AMI patient with complications requiring cardiopulmonary resuscitation,

such as a pulse rate below 60, a hearing defect, a visual problem, a decreased level of consciousness, diabetic peripheral neuropathy, drug addiction, and hepatitis C and B.

Sampling method

The procedure involves a simple random sampling of patients with AMI. The envelope should contain two colors: white for the intervention and black for the control. Minimum sample size: -26 for each group, anticipated effect size (Cohen's d) 0.8, which is considered a large effect size, desired statistical power level (0.8), and probability level 0.05. Because of the randomization process, the total sample size was 88 for the IE, hand reflexology, and control groups Figure 1.

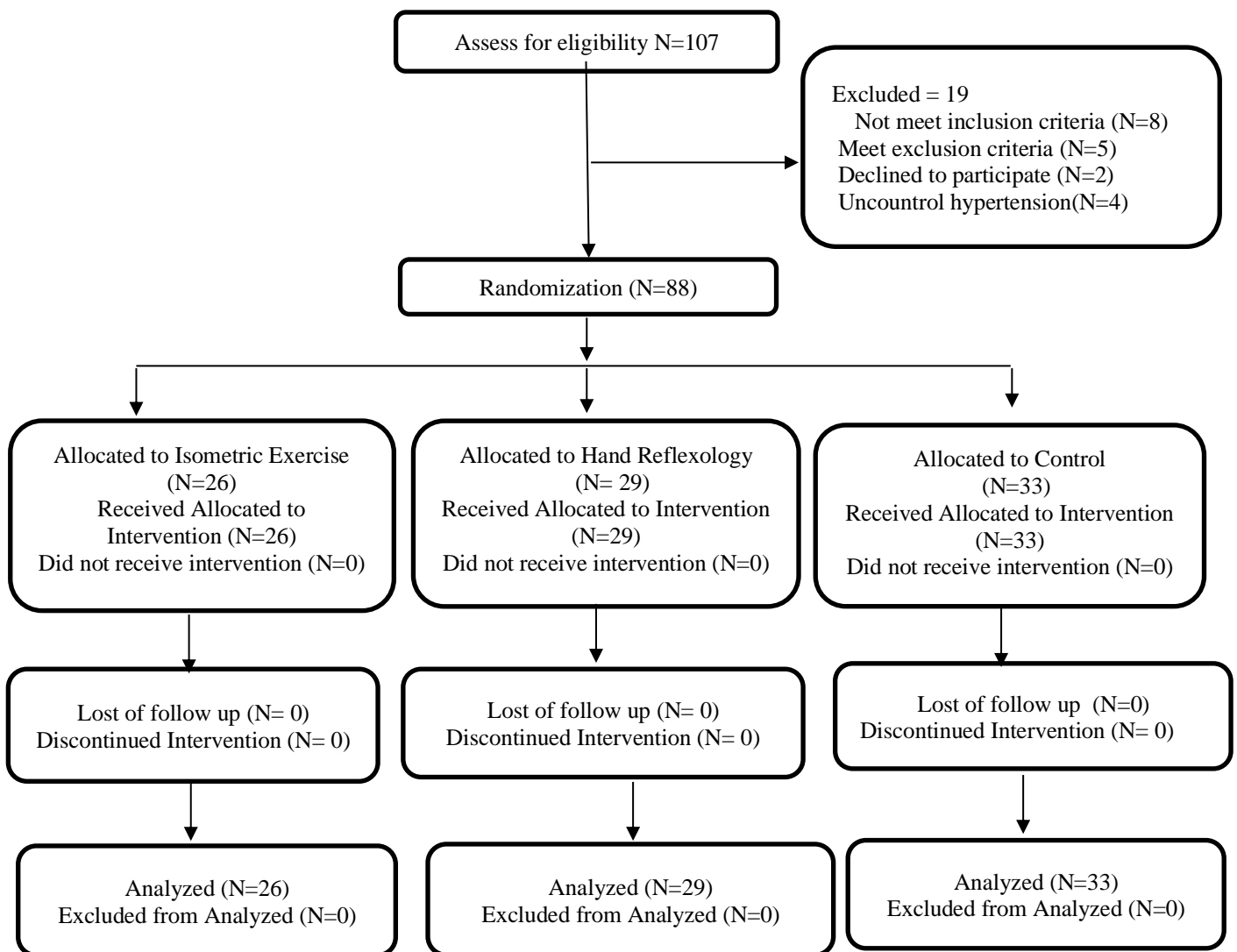


Figure 1.

CONSORT Flow Diagram of Participants in the Study

Instruments

Demographic and clinical data: -first section contains the participant's age, sex, educational level, occupation, marital status, and economic status. The second section contains items from [Naghavi et al. \(2024\)](#), including systolic BP, diastolic BP, HR, and blood oxygen saturation (Spo2). The third section, the State-Trait Anxiety Inventory, was developed by [Spielberger et al. \(1983\)](#). Several studies have used self-report STAI for adults to evaluate the level of anxiety ([Amiri et al., 2020](#); [Ferede et al., 2022](#)). The STAI has been used in more than 8,000 research studies across different disciplines and has been translated into more than 60 languages and dialects ([Bahammam, 2016](#)). The STAI scale is a reliable and valid tool, with internal consistency coefficients ranging from 0.86 to 0.95 ([Amiri et al., 2020](#)). This tool consists of 40 items in two parts: Form Y-1 (20 items; assessing state anxiety) and Form Y-2 (20 items; assessing trait anxiety).

Procedure

The researcher obtains consent from all participants to gather the research data. The researcher engages with study participants admitted to the CCU to obtain their consent and explain the study's objectives. The study started in September 2024, with data collection initiated on June 13, 2025. Patients with AMI are randomly assigned to three groups: the IE group, the hand reflexology group, and the control group. The researcher used hemodynamic parameters and the STAI for all patients to evaluate anxiety levels and assess the objective completion of study procedures.

Isometric Exercise Intervention Protocol

Each participant in the IE group performs the isometric neck exercise; the AMI patient lies supine and applies a downward force to a pillow with the back of the head. An isometric back exercise involves a hook-lying position, in which the AMI patient presses the lower back downward onto a towel roll placed beneath it. For the isometric hip exercise, the AMI patient lies supine and alternately presses both heels downward onto a towel roll placed under the heels. Isometric knee exercise is performed in a long-sitting position, in which the AMI patient alternately applies downward pressure to a towel roll placed under both knees. Each contraction lasted 10 seconds, with 10 repetitions and two IE sessions over three days. Each IE session lasted between 25 and 30 minutes.

Hand Reflexology Intervention Protocol

To prepare for the reflexology intervention, the researcher first performs a general warm-up massage on both hands to stimulate overall blood circulation, relax the tissues, and help the volunteer feel more physically and mentally at ease. After the overall massage, the researcher applies a concentrated reflexology treatment to specific reflex areas. With the help of a standardized reflexology chart, the researcher identifies and maps out the reflex areas for the solar plexus, pituitary gland, heart, and groin areas (hip joint). These areas are generally on the palm, based on hand reflexology. Each reflex point is stimulated for a period of about two minutes through the use of a thumb-walking technique. This involves bending the first knuckle of the researcher's thumb to form a firmer contact surface, and then using the thumb in a caterpillar-like motion over the reflex point. The researcher uses consistent, moderate pressure, and the thumb is slowly and steadily moved in an up-and-down or circular motion. The pressure must be sufficient to stimulate the reflex point but not be so strong as to be uncomfortable for the participant. During the session, care is taken to listen to the participant's feedback, paying attention to comfort and the correct application of pressure.

Ethical Considerations

The proposal was initially examined by the scientific committee of the adult nursing department before being authorized by the council of the College of Nursing/University of Baghdad. The study's protocol will be examined by members of the University of Baghdad's College of Nursing research ethics committee. The Declaration of Helsinki serves as our ethical framework for this study. Registered on 2025-8-6, the protocol was submitted to the Registry in clinicaltrials.gov with the ID (NCT07109960). The Ministry of Planning was also given a thorough overview and protocol for the study. A comprehensive statistical evaluation is also necessary to secure permission from the Al-Diwaniyah government hospital, which includes Al-Diwaniyah Teaching Hospital and Cardiac Catheterization and Surgery Center. When individuals volunteer to participate in this study, the researcher obtains their verbal or written consent. All information, including name, occupation, and residence, will remain confidential.

Findings and Results

The study's findings show that, for the majority of groups, over half of the participants were within the (48-60) age group with mean age (58 ± 10 , 53 ± 2 , 57 ± 8) in

the IE group, hand reflexology group, and control group, respectively.

Table 1

Comparison between Isometric Exercise, Hand Reflexology, and Control Groups in relation to patients' demographic data

Demographic Variables	Groups	Isometric Exercise Group		Hand Reflexology Group		Control Group		Significant test	P. value
		F.*	%	F.	%	F.	%		
Age Groups	35-47	2	7.7	8	27.6	5	15.2	$\chi^2= 8.615$	0.013
	48-60	14	53.8	14	48.3	16	48.5		
	≥ 60	10	38.5	7	24.1	12	36.4		
	Total	26	100.0	29	100.0	33	100.0		
	M.± SD	58.27±9.82		53.62±2.16		57.67± 8.20			
Sex	Male	14	53.8	20	69.0	25	75.8	$\chi^2= 0.154$	0.695
	Female	12	46.2	9	31.0	8	24.2		
	Total	26	100.0	29	100.0	33	100.0		
Educational level	Read and write	8	30.8	9	31.0	12	36.4	$\chi^2= 7.385$	0.287
	Primary school	4	15.4	3	10.3	4	12.1		
	Intermediate school	3	11.5	3	10.3	1	3.0		
	Preparatory school	3	11.5	1	3.4	7	21.2		
	Diploma	3	11.5	4	13.8	3	9.1		
	Bachelor	4	15.4	6	20.7	5	15.2		
	Postgraduate studies	1	3.8	3	10.3	1	3.0		
	Total	26	100.0	29	100.0	33	100.0		
Occupation	Free job	5	19.2	9	31.0	11	33.3	$\chi^2= 2.615$	0.455
	Retired	4	15.4	5	17.2	10	30.3		
Social status	Governmental	8	30.8	7	21.2	8	24.2	$\chi^2= 24.769$	0.000
	Privat	1	3.8	2	6.9	0	0.00		
	Mixed	0	0.00	1	3.4	0	0.00		
	Housewife	8	30.8	5	17.2	4	12.1		
	Total	26	100.0	29	100.0	33	100.0		
	Single	2	7.7	0	0.00	0	0.00		
	Married	17	65.4	23	79.3	27	81.8		
	Divorced	1	3.8	2	6.9	1	3.0		
Monthly income	Widow	6	23.1	0	0.00	4	12.1	$\chi^2= 12.077$	0.002
	Separated	0	0.00	4	13.8	1	3.0		
	Total	26	100.0	29	100.0	33	100.0		
	Sufficient	5	19.2	9	31.0	5	15.2		
	Insufficient	17	65.4	16	55.2	17	51.5		
Barely sufficient	4	15.4	4	13.8	11	33.3			
	Total	26	100.0	29	100.0	33	100.0		

F= frequency, %= percent, M. = Mean, SD= standard deviation, X2= A Chi-square test, P. value= probability value

As shown in Table 1, the three groups were broadly similar in sex, educational level, and occupation, as no statistically significant differences were found across these variables ($p > .05$). However, significant between-group differences were observed for age group ($\chi^2 = 8.615$, $p = .013$), marital status ($\chi^2 = 24.769$, $p < .001$),

and monthly income ($\chi^2 = 12.077$, $p = .002$). Most participants in all groups were aged 48–60 years, most were male, and the majority were married. Insufficient monthly income was the most frequently reported economic category across the groups.

Table 2

Differences Between Isometric Exercise, Hand Reflexology, and the Control Group in Relation to Systolic Blood Pressure

Days	SBP	Isometric Exercise Mean rank	Hand Reflexology Mean rank	Control Mean rank	Kruska-Wallis H	Df	P.value
1 st day	Before Intervention	39.29	45.59	47.65	1.654	2	0.437
	After Intervention	38.31	45.34	48.64	2.443	2	0.295
2 nd day	Before Intervention	34.27	39.05	57.35	13.934	2	0.001
	After Intervention	33.19	38.98	58.26	16.108	2	0.001
3 rd day	Before Intervention	28.19	34.48	66.15	38.873	2	0.001
	After Intervention	27.35	32.60	68.47	47.413	2	0.001

N= number of participants, DF= Degree of Freedom, P. value= probability value

As presented in Table 2, no significant differences were found among the isometric exercise, hand reflexology, and control groups in systolic blood pressure (SBP) on the first day, either before or after the intervention ($p > .05$). In contrast, significant between-group differences emerged on the second and third days,

both before and after the intervention (all $p = .001$). The control group consistently showed the highest mean ranks, whereas the isometric exercise group showed the lowest mean ranks, indicating better SBP improvement in the intervention groups over time.

Table 3

Mann-Whitney Test of Differences for Each Group of Intervention with Control Group in relation to Systolic Blood Pressure

Groups	SBP	
	Before	After
1 st day		
Isometric Exercise and Control	.219	.155
Hand Reflexology and Control	.733	.583
Isometric Exercise and Hand Reflexology	.347	.247
2 nd day		
Isometric Exercise and Control	.001	.001
Hand Reflexology and Control	.003	.001
Isometric Exercise and Hand Reflexology	.356	.241
3 rd day		
Isometric Exercise and Control	.000	.001
Hand Reflexology and Control	.000	.001
Isometric Exercise and Hand Reflexology	.268	.235

According to Table 3, pairwise Mann-Whitney tests showed no significant differences among the groups on the first day for SBP. On the second and third days, both intervention groups differed significantly from the control group before and after intervention, with p-values ranging from .003 to .000/.001. However, no

significant difference was observed between the isometric exercise and hand reflexology groups at any time point, suggesting that both interventions were similarly effective in reducing SBP compared with routine care.

Table 4

Differences Between Isometric Exercise, Hand Reflexology, and Control Groups Related to Diastolic Blood Pressure

Days	DBP	Isometric Exercise Mean rank	Hand Reflexology Mean rank	Control Mean rank	Kruska-Wallis H	Df	P.value
1 st day	Before Intervention	35.85	50.22	46.29	4.650	2	0.98
	After Intervention	34.62	46.62	50.42	5.900	2	0.52
2 nd day	Before Intervention	30.54	44.50	55.50	14.007	2	0.001
	After Intervention	29.8	42.24	58.64	19.884	2	0.000
3 rd day	Before Intervention	27.44	39.47	62.36	29.004	2	0.000
	After Intervention	27.10	39.28	62.80	30.735	2	0.000

N= number of participants, DF= Degree of Freedom, P. value= probability value

As shown in Table 4, diastolic blood pressure (DBP) did not differ significantly among the three groups on the first day before or after intervention ($p > .05$). Significant differences appeared on the second day and remained on the third day, both before and after intervention

($p \leq .001$). The control group had the highest mean ranks, while the isometric exercise group generally had the lowest, indicating lower DBP values in the intervention groups over the study period.

Table 5

Mann-Whitney Test of Differences for Each Group of Intervention with Control Group in relation to Diastolic Blood Pressure

Groups	DBP	
	Before	After
1st day		
Isometric Exercise and Control	.125	.033
Hand Reflexology and Control	.561	.424
Isometric Exercise and Hand Reflexology	.034	.046
2nd day		
Isometric Exercise and Control	.001	.001
Hand Reflexology and Control	.048	.004
Isometric Exercise and Hand Reflexology	.018	.020
3rd day		
Isometric Exercise and Control	.000	.001
Hand Reflexology and Control	.000	.001
Isometric Exercise and Hand Reflexology	.024	.050

As indicated in Table 5, the first-day pairwise analysis showed limited differences in DBP, although significant differences were already found after intervention between the isometric exercise and control groups ($p = .033$) and between the two intervention groups themselves ($p = .046$). On the second and third days, both intervention groups differed significantly from the

control group in most comparisons, and significant differences were also found between the isometric exercise and hand reflexology groups on several occasions. These findings suggest that both interventions improved DBP, with some variation in the magnitude of effect between them.

Table 6

Differences Between Isometric Exercise, Hand Reflexology, and the Control Group Related to Heart Rate

Days	HR	Isometric Exercise Mean rank	Hand Reflexology Mean rank	Control Mean rank	Kruska-Wallis H	Df	P.value
1st day	Before Intervention	45.25	49.34	39.65	2.261	2	0.323
	After Intervention	44.94	44.05	44.55	0.17	2	0.992
2nd day	Before Intervention	40.4	39.60	52.32	4.967	2	0.083
	After Intervention	37.94	39.17	54.35	7.892	2	0.019
3rd day	Before Intervention	36.60	37.81	56.61	77.918	2	0.003
	After Intervention	29.73	35.81	63.77	30.998	2	0.001

N= number of participants, DF= Degree of Freedom, P. value= probability value

As reported in Table 6, heart rate (HR) was not significantly different among the three groups on the first day, either before or after intervention ($p > .05$). On the second day, no significant difference was found before intervention ($p = .083$), but a significant difference appeared after intervention ($p = .019$). On the

third day, significant differences were observed both before and after intervention ($p = .003$ and $p = .001$, respectively). These findings indicate that the interventions had a progressive effect on HR, which became more evident over time.

Table 7*Mann-Whitney Test of Differences for Each Group of Intervention with the Control Group in relation to Heart Rate*

Groups	HR	
	Before	After
1st day		
Isometric Exercise and Control	.860	.346
Hand Reflexology and Control	.854	.164
Isometric Exercise and Hand Reflexology	.478	.980
2nd day		
Isometric Exercise and Control	.047	.011
Hand Reflexology and Control	.069	.026
Isometric Exercise and Hand Reflexology	.820	.953
3rd day		
Isometric Exercise and Control	.003	.001
Hand Reflexology and Control	.004	.001
Isometric Exercise and Hand Reflexology	.859	.296

According to Table 7, pairwise comparisons showed no significant HR differences among the groups on the first day. On the second day, the isometric exercise group differed significantly from the control group both before and after the intervention ($p = .047$ and $p = .011$). In contrast, the hand reflexology group differed from the control group only after the intervention ($p = .026$). By

the third day, both intervention groups differed significantly from the control group before and after intervention (all $p \leq .004$), whereas no significant difference was found between the two intervention groups. This pattern suggests that both interventions were comparably effective in improving HR relative to the control condition.

Table 8*Differences Between Isometric Exercise, Hand Reflexology, and the Control Group Related to Oxygen Saturation*

Days	SPO2	Isometric Exercise Mean rank	Hand Reflexology Mean rank	Control Meanrank	Kruska-Wallis H	Df	P.value
1st day	Before Intervention	38.40	42.52	51.05	3.965	2	0.138
	After Intervention	40.27	46.57	46.02	1.057	2	0.589
2nd day	Before Intervention	47.35	50.40	37.08	4.729	2	0.094
	After Intervention	47.83	50.72	36.41	5.545	2	0.063
3rd day	Before Intervention	50.06	52.62	32.98	11.071	2	0.004
	After Intervention	50.29	53.83	31.74	14.002	2	0.001

N= number of participants, *DF*= Degree of Freedom, *P. value*= probability value

As presented in Table 8, oxygen saturation (SpO_2) did not significantly differ among the three groups on the first day or on the second day, either before or after intervention ($p > .05$). Significant between-group differences appeared only on the third day, both before

intervention ($p = .004$) and after intervention ($p = .001$). On that day, the intervention groups showed higher mean ranks than the control group, indicating better oxygen saturation outcomes among patients who received isometric exercise or hand reflexology.

Table 9*Mann-Whitney Test of Differences for Each Group of Intervention with Control Group in relation to Oxygen Saturation*

Groups	SPO2	
	Before	After
1st day		
Isometric Exercise and Control	.409	.057
Hand Reflexology and Control	.966	.175
Isometric Exercise and Hand Reflexology	.525	.326
2nd day		
Isometric Exercise and Control	.064	.065
Hand Reflexology and Control	.075	.038

Isometric Exercise and Hand Reflexology	.430	.556
3 rd day		
Isometric Exercise and Control	.009	.004
Hand Reflexology and Control	.003	.001
Isometric Exercise and Hand Reflexology	.656	.526

As shown in Table 9, no significant pairwise differences in SpO₂ were found on the first day. On the second day, a significant difference was detected only between the hand reflexology and control groups after intervention ($p = .038$). On the third day, both the isometric exercise and hand reflexology groups differed

significantly from the control group before and after intervention (all $p \leq .009$). At the same time, no significant difference was found between the two intervention groups. Overall, the findings indicate that both interventions improved SpO₂ by the end of the three days.

Table 10

Differences Between Isometric Exercise, Hand Reflexology, and the Control Group Related to Anxiety

Days	Anxiety	Isometric Exercise		Hand Reflexology	Control	F	Df	P.value
		Mean \pm SD		Mean \pm SD	Mean \pm SD			
1 st day	Before Intervention	112.12 \pm 24.401		106.45 \pm 17.870	106.42 \pm 20.126	.683	2	.508
	After Intervention	104.77 \pm 23.175		101.45 \pm 16.483	103.09 \pm 12.184	.249	2	.780
2 nd day	Before Intervention	96.73 \pm	23.523	93.48 \pm 14.884	102.36 \pm 8.514	2.391	2	.098
	After Intervention	86.23 \pm 18.945		83.79 \pm 15.296	101.94 \pm 8.573	14.355	2	.001
3 rd day	Before Intervention	78.04 \pm 18.512		75.66 \pm 14.756	100.94 \pm 8.430	30.398	2	.001
	After Intervention	66.73 \pm 23.518		66.55 \pm 15.983	100.88 \pm 8.912	43.697	2	.001

N= number of participants, Sd= stander deviation, DF= Degree of Freedom, P. value= probability value

As indicated in Table 10, anxiety levels did not differ significantly among the three groups on the first day before or after the intervention ($p = .508$ and $p = .780$, respectively), nor on the second day before the intervention ($p = .098$). However, significant between-group differences were found on the second day after the intervention ($F = 14.355$, $p = .001$), the third day before

the intervention ($F = 30.398$, $p = .001$), and the third day after the intervention ($F = 43.697$, $p = .001$). Mean anxiety scores declined markedly over time in both intervention groups, while the control group remained relatively stable, indicating that both isometric exercise and hand reflexology were associated with substantial reductions in anxiety.

Table 11

Mann-Whitney Test of Differences for Each Group of Intervention with the Control Group in relation to anxiety

Groups	Anxiety	
	Before	After
1 st day		
Isometric Exercise and Control	.344	.296
Hand Reflexology and Control	.996	.655
Isometric Exercise and Hand Reflexology	.327	.548
2 nd day		
Isometric Exercise and Control	.207	.006
Hand Reflexology and Control	.007	.000
Isometric Exercise and Hand Reflexology	.514	.075
3 rd day		
Isometric Exercise and Control	.000	.001
Hand Reflexology and Control	.000	.001
Isometric Exercise and Hand Reflexology	.598	.974

According to Table 11, there were no significant pairwise differences in anxiety on the first day. On the second day after intervention, both the isometric

exercise group and the hand reflexology group showed significantly lower anxiety than the control group ($p = .006$ and $p = .000$, respectively). In contrast, the two

intervention groups did not differ from each other. On the third day, both intervention groups again differed significantly from the control group before and after intervention (all $p = .000$ or $.001$), with no significant difference between isometric exercise and hand reflexology. These results suggest that both interventions were similarly effective in reducing anxiety compared with the control group.

Discussion and Conclusion

The study's findings show that, for the majority of groups, over half of the participants were within the (48-60) age group with mean age (58 ± 10 , 53 ± 2 , 57 ± 8) in the IE group, hand reflexology group, and control group, respectively. Gu et al.'s (2016) research on PCI patients revealed a mean age of 58 (range: 50–62 years).

Concerning patients' sex, the study findings showed that a high percentage of 14(53.8), 20(69.0), and 25(75.8) of the studied samples for the IE group, hand reflexology group, and control group, respectively, were male. The researcher explains the result of the study, because males are at a higher risk of heart attacks than females, Gao et al. (2019) reported that the incidence of CVD is more prevalent in males than in females. Mousa & Mansour (2020) stated that the majority of the study sample of patients undergoing PCI was male.

Regarding education level, most groups in the current study were within the "read and write" category, as follows: the IE group, the hand reflexology group, and the control group: 8 (30.8), 9 (31.0), and 12 (36.4), respectively. The researcher believed this was due to the lack of interest in education in the past decades. Concerning occupation, most of the study groups were in the free job category, as follows: the Hand Reflexology Group and the Control group, with high percentages of 9 (31.0%) and 11 (33.3%), respectively. However, the IE group participants recorded a high percentage of 8 (30.8) in the governmental employee category. Mansour et al. (2019) showed that most patients are unemployed.

According to Social status, the findings reported that the vast majority of study participants were married, as follows: 17 (65.4%), 23 (79.3%), and 27 (81.8%) in the IE group, hand reflexology group, and control group, respectively. The study of Isam & Hassan (2023) indicated that (70%) of the study sample was married. Finally, with respect to monthly income, most participants in the

groups were at an insufficient level, as follows: 17 (65.4%), 16 (55.2%), and 17 (51.5%) for the IE, hand reflexology, and control groups, respectively. The researcher explained this because the majority of the study sample could only read and write and were unemployed, and because of the lack of private-sector activity. Omar et al. (2021) reported that the monthly income level of patients was insufficient (63.6%) for their monthly needs.

AMI is still one of the most prevalent cardiac emergencies treated globally and a very serious condition (Vogel et al., 2021). Regardless of the particular reperfusion technique used, delivering the best possible specialized care within the CCU is crucial to achieving excellent clinical outcomes. The management quality and monitoring procedures put in place during the CCU's initial phase have been directly connected to a large percentage of avoidable complications and adverse events that occur after myocardial infarction (Thygesen et al., 2007).

Every AMI patient must have their hemodynamic parameters and anxiety assessed by coronary care nurses to provide the necessary care to avoid complications and lessen impairments (Byrne et al., 2024). According to current research, there are two approaches: pharmacological and non-pharmacological. In the CCU, non-pharmacological methods are increasingly used to reduce anxiety, stabilize physiological parameters, and improve patient outcomes (Pasyar et al., 2024). Hence, the current study was conducted to examine the effect of IE versus hand reflexology on hemodynamic parameters and anxiety among AMI patients.

According to the current study's findings, both the IE and hand reflexology groups showed significant decreases in systolic and diastolic blood pressure, pulse, and SpO₂ after each intervention from the first to the third day compared with the control group. Additionally, a significant difference was observed between the three groups during the first two days. This can be explained by Barbosa et al. (2025), who evaluated how isometric resistance training affects blood pressure in persons with normotension, demonstrating decreases in systolic and diastolic blood pressure, heart rate, and mean arterial pressure, and an increase in SpO₂. Although acute exercise raises blood pressure, they suggested potential causes such as the release of vasodilatory

chemicals, reduced oxidative stress, and improved autonomic balance.

The result is validated by [Harshini et al. \(2021\)](#), who examined the acute effects of prolonged isometric and isotonic exercise on blood pressure and heart rate variability. It was found that isometric exercises dramatically reduced systolic and diastolic blood pressure during the post-exercise phase, whereas HR increased significantly compared with the resting condition.

From the researchers' perspective, IE requires no specialized knowledge or tools and can be completed quickly and easily. Additionally, patients with AMI can benefit from this strategy. Therapeutic methods to regulate sympathetic activity and prevent the negative effects of an overactive sympathetic nervous system in patient populations.

Similar findings were reported in the investigation by [Golitaleb et al. \(2025\)](#), which examined the effects of foot and hand reflexology on anxiety and physiological indices (including SBP, DBP, HR, and SpO₂). Post-intervention evaluations showed that SBP and HR varied significantly between the groups, with both reflexology groups exhibiting lower values than the control. DBP and SpO₂, however, did not differ significantly between the groups.

Achieved comparable results in the investigation carried out by [Kandemir & Oztekin \(2019\)](#), who said that the hands, feet, and ears of every organ, gland, and body portion have reflected points. Reflexology massage improves the physiological signs in AMI patients by relieving tension and stress and fostering a sense of safety and security.

Similarly, the study by [Khaledifar et al. \(2017\)](#), which examined how reflex treatment and massage therapy affected vital signs and tension before cardiac angiography, found that key indicators, such as diastolic blood pressure, heart rhythm, and breathing rate, improved significantly. They discovered, however, that there was no discernible difference in systolic blood pressure.

The study's findings agree with research carried out by [Rahmani Vasokolaei et al. \(2019\)](#) that examined the effects of acupressure and hand reflexology on anxiety and vital signs in female patients with coronary artery disease. The results showed that both techniques had beneficial effects on vital signs, with statistically

equivalent reductions at immediate and 30-minute post-intervention time points. The idea that hand reflexology is a useful technique for adjusting hemodynamic parameters in a stressed population is supported by this investigation.

According to the researchers, these results may be related to reflexology coactivating two branches of the autonomic nervous system, which may be advantageous for improving physiological parameters, reducing anxiety, and enhancing hemostasis.

In relation to the mean anxiety score, the present results showed a statistically significant difference among the mean anxiety scores in IE, hand reflexology, and the control group after applying each intervention. The study shows a decrease in the mean anxiety score between the intervention groups exposed to IE and hand reflexology, compared with the control group.

The result is validated by [Shakoor et al. \(2025\)](#), who examined how a 10-week regimen of isometric handgrip exercises affected women with hypertension while they were under quarantine. The substantial psychological improvement attained with a straightforward isometric regimen offers concrete proof that isometric exercise can successfully lessen anxiety symptoms.

In agreement with the research carried out by [Ali et al. \(2023\)](#), the study demonstrated how hand reflexology might help patients undergoing coronary angiography with their worry, pain, and weariness. After using hand reflexology for two hours and three days, the study group's moderate anxiety scores dramatically dropped, demonstrating its efficacy in a particular high-stress clinical setting.

From the researchers' point of view, given the unique challenges faced by AMI patients (significant hemodynamic and musculoskeletal instability and positional needs), we support the performance of IE and hand reflexology-guided relaxation by coronary care nurses within the CCU, which may be particularly beneficial for this group of patients.

Isometric exercise and hand reflexology helped patients with AMI feel less anxiety and have better hemodynamic values. It is a low-cost intervention that doesn't require specialized tools unless nurses receive detailed instructions on how to use it and integrate it into their regular nursing practice. Using supplementary and integrative therapies can enhance nurses' autonomy in decision-making and their confidence in providing

patient care through safe, nonpharmacologic approaches that reduce the need for invasive procedures. Consequently, it is recommended that its instruction be integrated into both on-the-job training in coronary care units and academic nursing education. It is suggested that this study be repeated on patients with chronic illnesses and in additional healthcare settings.

Based on the findings, it is recommended that a training program be implemented for coronary care nurses in IE and hand reflexology techniques, and that these techniques be used as part of the usual routine nursing care for patients with AMI. An illustrated guide to IE and hand reflexology techniques should be available in each coronary care unit—future studies and repeating this study on a large sample size for generalization.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Declaration of Helsinki, which provides guidelines for ethical research involving human participants. Ethical considerations in this study were that participation was entirely optional.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contribute to this study.

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