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Hemodynamic Changes and Anxiety-Related Outcomes Following Hand Reflexology in Patients with Acute Myocardial Infarction: A Randomized Controlled Trial

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ABSTRACT

Objective: This study examined hemodynamic changes and anxiety-related outcomes following hand reflexology among patients with acute myocardial infarction.

Methods and Materials: A parallel-group randomized trial was conducted at Al-Diwaniya Teaching Hospital, Iraq. Of 104 patients assessed, 88 were allocated to hand reflexology (n = 47) or usual care (n = 41). Reflexology comprised 15-minute sessions on three consecutive days. Systolic and diastolic blood pressure, heart rate, oxygen saturation, and anxiety-related scores were assessed before and after intervention. Within-group differences were analyzed using Wilcoxon signed-rank and paired t tests.

Findings: In the reflexology group, systolic blood pressure decreased from 134.91 to 133.49 mmHg (p = .045), diastolic pressure from 81.92 to 80.79 mmHg (p = .010), and heart rate from 78.34 to 71.75 beats/min (p = .003). Oxygen saturation increased from 95.77% to 96.48% (p = .041). Corresponding within-group changes in controls were nonsignificant (all p > .05). Anxiety-related scores increased from 2.5552 to 2.6371 in the intervention group (reported p = .024), although scoring direction was unclear. No between-group treatment-effect estimates were reported.

Conclusion: Hand reflexology was associated with within-group hemodynamic changes, but comparative efficacy and anxiety reduction remain unestablished. Verified scoring and direct between-group analyses are required.

Keywords: Hand Reflexology, Acute Myocardial Infarction, Hemodynamic Parameters, Anxiety, Randomized Controlled Trial.

Introduction

Acute myocardial infarction (AMI) requires urgent medical assessment, treatment, and close monitoring. Psychological distress can accompany the acute illness and hospitalization, making symptom assessment and supportive communication relevant components of care. Research in coronary artery disease has documented anxiety around percutaneous coronary intervention, although such findings do not by themselves establish the effects of a relaxation intervention in AMI (Gu et al., 2016). Psychosocial assessment should be integrated with cardiovascular treatment and individualized to the patient's clinical condition (Goli et al., 2024).

Reflexology involves manual pressure to selected areas of the hands or feet. Traditional explanations associate these areas with particular organs, but these proposed mappings should not be treated as established anatomical pathways. Reviews distinguish possible relaxation or touch-related effects from evidence for a specific reflex-point mechanism (Embong et al., 2015; Jones et al., 2013). Changes in blood pressure or heart rate after a session can also reflect rest, medication, spontaneous recovery, or nonspecific attention.

Studies have investigated reflexology in several cardiac settings. A trial of hand reflexology during coronary angiography reported changes in anxiety, pain, and fatigue, and a systematic review examined anxiety during cardiovascular interventional procedures (Ali et al., 2023; Chandrababu et al., 2019). Foot-reflexology studies have also examined anxiety after coronary bypass surgery and physiological outcomes during AMI care (Abbaszadeh et al., 2018; Pasyar et al., 2024). These settings and interventions differ, so findings cannot be assumed to transfer directly to hand reflexology in acute infarction.

The present study examined pretest–posttest hemodynamic measures and anxiety-related outcomes in patients with AMI allocated to hand reflexology or usual care at Al-Diwaniya Teaching Hospital. The report describes the observed outcomes and the limitations of the available statistical comparisons. It does not assume that a significant within-group change establishes superiority over usual care.

Methods and Materials

Design, Setting, and Participants

A parallel-group, pretest–posttest randomized trial was described in the coronary care unit of Al-Diwaniya Teaching Hospital, Al-Diwaniyah, Iraq. Study activities began in November 2025, and data collection commenced in April 2026. The reported participant flow included 104 people assessed for eligibility, 16 excluded, and 88 allocated: 47 to hand reflexology and 41 to usual care (Figure 1). The exclusions comprised eight who did not meet inclusion criteria, five who met exclusion criteria, and three who declined participation.

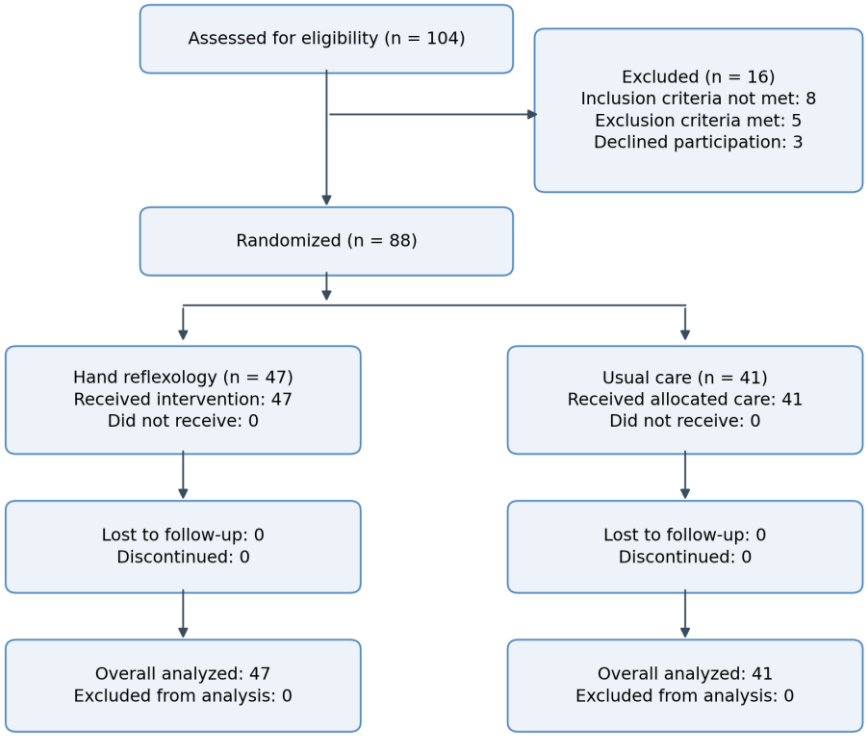


Figure 1

Overall allocation and participant flow.

The diagram shows overall analysis numbers; the outcome-specific anxiety denominator is discussed in Table 4. Eligibility required an AMI diagnosis, age over 18 years, and ability to speak and understand Arabic. Exclusions included complications requiring resuscitation, a pulse rate below 60 beats/min, impaired hearing or vision, reduced consciousness, diabetic peripheral neuropathy, substance addiction, and hepatitis B or C. These criteria describe the enrolled clinical population and should not be interpreted as a general safety rule for reflexology.

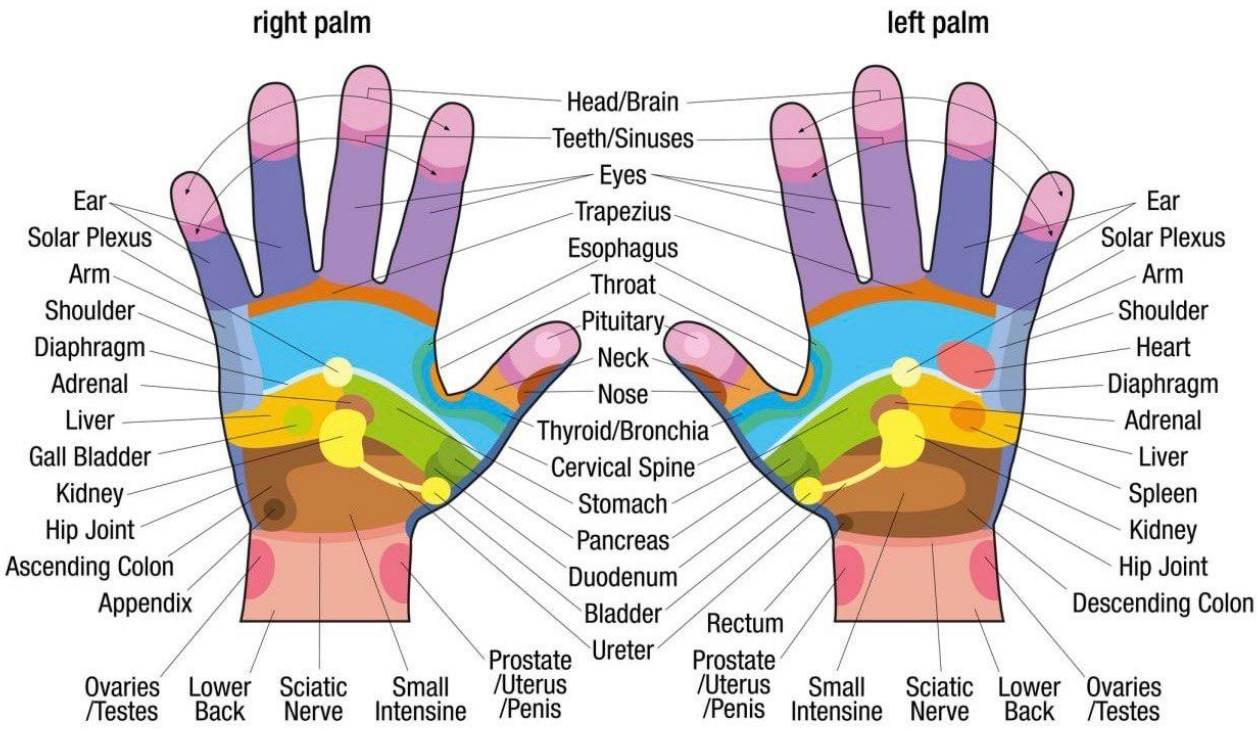
Allocation used sealed envelopes containing color codes: white for reflexology and black for control. The method for generating the sequence, envelope preparation, and implementation of concealment were not fully specified. Envelope allocation does not establish probability sampling from the wider AMI population. The sample-size rationale stated a minimum of 26 participants per group with an anticipated standardized effect of 0.8, power of .80, and significance level of .05.

Intervention and Usual Care

The intervention group was scheduled to receive a 15-minute hand-reflexology session on each of three consecutive days. The described procedure began with approximately five minutes of gentle warming massage of the hands, including gliding strokes from the wrist toward the fingertips and light kneading. The practitioner then applied moderate, comfort-adjusted thumb-walking pressure to selected palmar areas traditionally labeled the solar plexus, pituitary, heart, and hip-joint reflex areas, for approximately two minutes per selected area. The illustrative map is shown in Figure 2. These labels describe the reflexology convention rather than demonstrated organ-specific physiological connections (Embong et al., 2015).

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Figure 2



Traditional hand reflexology map illustrating proposed target areas. Organ labels reflect reflexology terminology and do not establish anatomical or physiological connections.

The control group received the hospital's usual medical and nursing care, including vital-sign monitoring, rest, and hygiene assistance, without reflexology. The protocol described post-intervention assessment approximately 15 minutes after a session. The reported outcome tables contain one pretest and one posttest summary per group rather than day-specific repeated measurements.

Measures

Demographic measures included age, sex, education, occupation, marital status, and income adequacy. Physiological measures were systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate, and peripheral oxygen saturation (SpO_2). The clinical summaries are reported in their stated units, with blood pressure in mmHg, heart rate in beats/min, and SpO_2 as a percentage.

Anxiety was assessed using the State-Trait Anxiety Inventory (STAI), which comprises separate 20-item state and trait scales (Spielberger et al., 1983). The reported anxiety values were approximately 2.5 rather than conventional scale totals. The subscale used, item aggregation, reverse scoring, and interpretation of these values were not sufficiently defined to determine whether an increase represents greater or lesser anxiety. Consequently, these values are presented as anxiety-related scores without assigning severity categories or claiming symptom reduction.

Statistical Analysis

Analyses were conducted in SPSS version 26. Frequencies, percentages, means, and standard deviations summarized the data. The reported hemodynamic comparisons used Wilcoxon signed-rank tests within each group, and anxiety comparisons used paired t tests. Exploratory demographic associations were labeled as Spearman correlations or chi-square tests. Statistical significance was set at $p < .05$. Within-group tests do not estimate a between-group intervention effect; a significant

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result in one group and a nonsignificant result in another is not itself evidence that the groups differ (Gelman & Stern, 2006).

Ethical Considerations

Participants received information about the study's purpose, procedures, potential risks, and possible benefits before providing oral and written informed consent. Participation was voluntary, and withdrawal was permitted without penalty. Responses were used for research, and confidentiality protections were described. Participants were not offered financial compensation.

Findings and Results

Participant Flow and Characteristics

The flow diagram reports that all 88 allocated participants received their assigned care, with no loss to follow-up or discontinuation and 47 and 41 included in the overall analyses. The anxiety table separately lists 40 control participants, so the outcome-specific denominator is uncertain. Participant characteristics are shown in Table 1. Men accounted for 68.1% of the reflexology group and 75.6% of controls; 70.2% and 75.6%, respectively, were married. The largest reported income category in both groups was sufficient income (44.7% and 46.3%). The age summaries contain internal inconsistencies and cannot establish baseline comparability.

Table 1

Reported participant characteristics by allocated group

Characteristic	Category	Reflexology n	Reflexology %	Control n	Control %
Age (years)	35-47	13	27.7	14†	14.6
	48-60	23	48.9	15	36.6
	≥ 60†	11	23.4	20	48.8
Sex	Male	32	68.1	31	75.6
	Female	15	31.9	10	24.4
Educational level	Read and write	15	31.9	15	36.6
	Primary school	5	10.6	5	12.2
	Intermediate school	5	10.6	1	2.4
	Preparatory school	2	4.3	9	22.0
	Diploma	6	12.8	4	9.8
	Bachelor	10	21.3	6	14.6
	Postgraduate studies	4	8.5	1	2.4
Occupation	Self-employed / casual work	15	31.9	14	34.1
	Retired	8	17.0	12	29.3
	Employee – Governmental	10	21.3	10	24.4
	Employee – Private	3	6.4	0	0.0
	Employee – Mixed	2	4.3	0	0.0
	Housewife	9	19.1	5	12.2
Marital status	Single	5	10.6	4	9.8
	Married	33	70.2	31	75.6
	Divorced	2	4.3	4	9.8
	Widowed	7	14.9	2	4.9
	Separated	0	0.00	0	0.00
Monthly income	Sufficient	21	44.7	19	46.3
	Insufficient	18	38.3	17	41.5

Barely sufficient	8	17.0	5	12.2

Note. Allocated n = 47 for reflexology and 41 for control. Reported age M ± SD: 54.64 ± 3.26 and 59.69 ± 9.70 years, respectively. †Control age frequencies sum to 49; the 35–47-year cell (14) does not match 14.6% of 41. The age bands overlap at 60, and the reflexology age SD is incompatible with the stated categories and counts. Age summaries require verification. Other counts and percentages are retained at their reported precision.

Hemodynamic Measures

In the reflexology group, SBP changed from 134.91 to 133.49 mmHg, DBP from 81.92 to 80.79 mmHg, and heart rate from 78.34 to 71.75 beats/min. SpO_2 changed from 95.77% to 96.48%. The reported within-group p values were .045, .010, .003, and .041, respectively (Table 2). These findings describe pretest–posttest differences within the intervention group.

Table 2

Within-group hemodynamic comparisons: hand reflexology

Measure	Pre M ± SD	Post M ± SD	Reported |Z|	Reported p
SBP (mmHg)	134.91 ± 12.241	133.49 ± 9.588	2.000	.045
DBP (mmHg)	81.92 ± 12.025	80.79 ± 8.1127	2.564	.010
Heart rate	78.34 ± 10.188	71.75 ± 8.396	2.987	.003
SpO_2	95.77 ± 1.766	96.48 ± 1.635	2.040	.041

Note. n = 47. M = mean; SD = standard deviation; SBP = systolic blood pressure; DBP = diastolic blood pressure; SpO_2 = peripheral oxygen saturation. Heart rate is in beats/min and SpO_2 in %. Statistics and p values are reported for within-group Wilcoxon signed-rank comparisons. They do not estimate a between-group treatment effect.

Control-group SBP changed from 141.30 to 138.24 mmHg, DBP from 84.36 to 82.58 mmHg, heart rate from 75.64 to 73.67 beats/min, and SpO_2 from 95.39% to 96.82%. Reported within-group p values exceeded .05 (Table 3). No between-group comparison of change or baseline-adjusted treatment estimate was reported, so comparative efficacy cannot be established from these tests.

Table 3

Within-group hemodynamic comparisons: usual care

Measure	Pre M ± SD	Post M ± SD	Reported |Z|	Reported p
SBP (mmHg)	141.30 ± 19.073	138.24 ± 24.245	1.070	.285
DBP (mmHg)	84.36 ± 12.023	82.58 ± 11.793	1.122	.262
Heart rate	75.64 ± 15.384	73.67 ± 27.995	1.334	.182
SpO_2	95.39 ± 2.290	96.82 ± 2.007	1.034	.301

Note. n = 41. M = mean; SD = standard deviation. Heart rate is in beats/min and SpO_2 in %. Statistics and p values are reported for within-group Wilcoxon signed-rank comparisons.

Anxiety-Related Scores

The reported mean score increased from 2.5552 to 2.6371 in the reflexology group and from 2.4871 to 2.5076 in controls (Table 4). The listed paired-test results were t = 2.384, df = 46, p = .024 for reflexology and t = 1.011, df = 40, p = .312 for controls. The control sample size, degrees of freedom, and some test–p combinations are not internally consistent. The scoring direction is also uncertain; these summaries therefore do not demonstrate a reduction in anxiety or a between-group benefit.

Table 4

Reported anxiety-related scores and within-group paired tests

Group	Time	n	Reported M ± SD	Reported t	Reported df	Reported p
Reflexology	Pretest	47	2.5552 ± .13748	2.384	46	.024
Reflexology	Posttest	47	2.6371 ± .15391	2.384	46	.024
Control	Pretest	40†	2.4871 ± .16191	1.011	40	.312
Control	Posttest	40†	2.5076 ± .12907	1.011	40	.312

Note. STAI = State-Trait Anxiety Inventory. The subscale, score aggregation, and reverse-scoring procedure were not sufficiently defined for these values. †Control n is listed as 40, whereas df = 40 would imply 41 complete pairs and the overall flow shows 41 controls. Some t–p combinations also require verification. These summaries do not establish anxiety reduction.

Exploratory Demographic Associations

The reported p values for demographic associations with hemodynamic measures and posttest anxiety-related scores all exceeded .05 (Table 5; Table 6). However, several coefficient–p or chi-square–p combinations are inconsistent with the stated sample size or degrees of freedom. These exploratory summaries cannot establish absence of association or uniform intervention effects across demographic groups.

Table 5

Reported demographic associations with hemodynamic measures

Measure	Age: reported ρ	Reported p	Sex: reported χ^2	Reported p
Systolic BP	...318	.217	12.773	.435
Diastolic BP	...130	.455	11.983	.253
HR	...243	.352	17.751	.511
SpO_2	...154	.327	4.741	.524

Note. Statistics and p values are retained as reported. ρ denotes a coefficient labeled as Spearman correlation; χ^2 denotes a statistic labeled as chi-square. Analysis-specific sample sizes and sex-test degrees of freedom were not supplied. Coefficient–p combinations require verification before interpretation.

Table 6

Reported demographic associations with posttest anxiety-related scores

Characteristic	Reported test	Statistic	Reported df	Reported p
Age	Spearman ρ	.042	2	.794
Sex	χ^2	1.004	1	.371
Educational level	Spearman ρ	.091	6	.596
Occupation	χ^2	4.639	5	.231
Marital status	χ^2	.737	4	.617
Monthly income	Spearman ρ	.115	2	.283

Note. The allocated reflexology group comprised 47 participants. Statistics, degrees of freedom, and p values are retained as reported. Degrees of freedom are not applicable to Spearman correlations. Several chi-square–p combinations do not align with the listed degrees of freedom; inference requires verified statistical output.

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Discussion and Conclusion

Hemodynamic Changes and Comparative Interpretation

The intervention-group summaries showed lower blood pressure and heart rate and higher oxygen saturation after the intervention. The absolute blood-pressure differences were small, and their clinical relevance was not established. A statistically significant within-group change may reflect several influences, including usual treatment, time, rest, measurement variability, and nonspecific therapeutic attention. The absence of a significant change in controls does not isolate a reflexology effect (Gelman & Stern, 2006).

The control group also showed lower mean blood pressure and higher oxygen saturation at posttest. In particular, the mean control SBP decrease and SpO_2 increase were numerically larger than the corresponding intervention-group changes, although uncertainty about paired changes prevents a valid comparison of these contrasts from means alone. A prespecified between-group analysis with confidence intervals is needed before claiming superiority or improved cardiovascular stability.

Existing research provides a rationale for further investigation, rather than confirmation of a specific mechanism. Studies in bypass surgery, angiography, and AMI differ in the treated body area, comparison condition, assessment timing, and outcomes (Abbaszadeh et al., 2018; Ali et al., 2023; Pasyar et al., 2024). A review of hemodynamic effects highlights the importance of controlling nonspecific massage and attention effects (Jones et al., 2013). The present data did not measure autonomic activity, myocardial perfusion, infarct size, or other mechanisms and cannot establish effects on those processes.

Anxiety and Patient-Centered Support

The anxiety-related means increased, and the reporting does not explain how these values map to state or trait anxiety. Interpretation must therefore remain separate from the claim that reflexology reduced anxiety. Evidence from other populations cannot repair an unresolved scoring problem. Research in AMI has also found that reflexology-related effects on chest pain need not be accompanied by significant effects on anxiety, underscoring the importance of examining each outcome separately (Sayari et al., 2021).

Anxiety assessment remains important in cardiac care even when an intervention effect is uncertain. Supportive communication, attention to the patient's experience, and coordination of psychological and medical care are consistent with a broader psychosocial approach to cardiovascular illness (Goli et al., 2024). Such care should complement appropriate AMI management and be responsive to clinical stability and patient preferences (Seyed Alitabar, 2025). These principles do not establish the efficacy or safety of this specific reflexology protocol.

Limitations and Future Research

The single-center sample and incomplete documentation of allocation concealment limit assessment of selection bias and generalizability. Blinding, practitioner training, concurrent medication changes, standardized measurement conditions, adherence to all sessions, and adverse-event monitoring were not characterized sufficiently. No sham-touch or attention-matched control was described, so specific reflexology effects cannot be distinguished from rest, touch, and interpersonal attention.

Important measurement and reporting limitations include inconsistent age summaries, overlapping age-category boundaries, an uncertain control denominator for anxiety, undefined STAI aggregation and score direction, and incompatible statistical entries in exploratory analyses. These issues limit reproducibility and interpretation. Without participant-level data or verified statistical output, the reliability of the relevant comparisons cannot be established. Lack of reported adverse events cannot be interpreted as evidence that the intervention is harmless.

Future trials should prespecify a clinically meaningful primary outcome, define state and trait anxiety separately, report validated scale scores and timing, document participant flow for each outcome, and compare randomized groups using appropriate baseline-adjusted or repeated-measures models. Effect estimates with confidence intervals and explicit harms assessment are needed. Evidence

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syntheses support investigating anxiety outcomes while also emphasizing variation in trial methods and populations (Chandrababu et al., 2019).

Conclusion

The reported hand-reflexology group showed pretest–posttest changes in blood pressure, heart rate, and oxygen saturation. These within-group findings do not establish superiority over usual care. The direction and magnitude of an anxiety effect cannot be determined reliably because score interpretation and statistical reporting remain uncertain. The findings do not support a definitive clinical recommendation for hand reflexology in AMI; adequately reported comparative analyses and further controlled research are required.

Acknowledgments

The authors express their gratitude and appreciation to all participants.

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 Helsinki Declaration, 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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