Effect of Acupressure Sessions on Joint Mobility, Pain Intensity, and Disability in Patients with Diabetes Adhesive Capsulitis

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Abstract

Diabetes mellitus is a common condition that is becoming even more common with the passage of time. One of the most prevalent consequences of diabetes is adhesive capsulitis, a "frozen shoulder. " This debilitating condition diminishes one's quality of life due to its progressive pain, limited range of motion of the glenohumeral joint, and tiger point physical inactivity. One of the most important non-pharmacological approaches to symptom relief and functional improvement is acupressure. This study aimed to evaluate the effect of acupressure sessions on joint mobility, pain intensity, and disability in patients with diabetes adhesive capsulitis. This study was quasi-experimental and involved concurrent groups. Sixty diabetes adhesive capsulitis patients were enrolled in the study. They were followed in the outpatient rehabilitation clinic of Damanhur General Hospital. There were 30 patients in each of the two groups, appointed randomly and equally, the control and the intervention groups. The data collection instrument is patients' socio-demographic and clinical data, Visual Analogue Pain Scale (VAS), shoulder mobility measurement, and Disabilities of the Arm, Shoulder, and Hand (DASH) score. The current study findings demonstrated that there were substantial differences between the study groups concerning their joint mobility, pain intensity, and disability after the application of acupressure sessions. The study concluded that acupressure may be beneficial as a complementary therapy to conventional methods for patients with diabetes adhesive capsulitis to improve joint mobility, pain intensity, and disability. This study recommended that patients with adhesive capsulitis could benefit from distributing illustrated handouts that teach them how to perform self-administered acupressure interventions. Furthermore, Complementary therapy is appropriately and safely integrated into patient care in nursing education programs. It not only improves the quality and position of nursing but also emphasizes the vital function of nurses in assisting patients in managing symptoms that cannot be fully controlled alone by medicine.

Keywords: Acupressure, diabetes, frozen shoulder, DASH, inclinometer application.

Introduction

One of the most prevalent consequences in diabetic patients is musculoskeletal disease, which unfortunately does not get nearly enough attention. Even though musculoskeletal issues aren't as commonly known for their severity and hazards as cardiovascular complications, the linked ailments nonetheless cause physical and psychological pain to diabetics (**Abd ELHalim et al.,2022)**. Shoulder pain ranks high among the most prevalent complaints related to musculoskeletal disease. It is generally characterized by pain and limited mobility in one or both shoulders. Shoulder pain has multiple adverse effects, including a decline in quality of life, inability to carry out everyday tasks, and potential interference with the control of metabolic processes. Adhesive capsulitis and rotator cuff disease are among the greatest prevalent shoulder disorders (**Imagama et al.,,2020)**.

Frozen shoulder, or adhesive capsulitis of the shoulder joint, is defined by the diminution of the range of motion, both passive and active in the affected shoulder and the spontaneous onset of shoulder pain **(Durall, C. J., & SCS, L. (2017)**. The exact cause of adhesive capsulitis is not yet known; prolonged high blood sugar levels, as observed in diabetes, can cause an accumulation of AGEs (advanced glycation end products) in collagenous tissues such as ligaments, tendons, and joint capsules, which can lead to tissue thickening, stiffening, and increased vulnerability to injury of these tissues. Elevated levels of AGEs have been directly linked to musculoskeletal

shoulder problems and could potentially exert a direct impact on the processes of inflammation and pain. These metabolic factors probably play a role in the progressive and continuous development of limited shoulder joint mobility, leading to pain and functional limitations. Common indications of prolonged high blood glucose levels, noted in clinical settings and recorded in this study, include the extent of disease and the percentage of glycated hemoglobin (A1C value), which measures the average blood glucose levels over three months (A1C > 6.5% consistent with diabetes) **(Zreik et al.,.2016& Struyf,2022).**

Moderate evidence suggested that poorly understood painful diabetic adhesive capsulitis, with 10-36% incidence, is defined as a disability-leading issue with remarkable socioeconomic impacts that consumed huge healthcare costs **(Page et al.,2019 & Spinnato et al.,2023)**. The estimated prevalence of adhesive capsulitis in individuals with type I Diabetes Mellitus (DM) is 10.3%, whereas, in those with type II DM, it is 22.4%. These individuals have worse functional outcomes compared to those non diabetes, mainly if their glycemic status is poorly maintained for an extended period **(Thasni et al., 2018)**.

Adhesive Capsulitis (AC) often has a pathophysiological process with three well-defined consecutive clinical stages" Freezing, Frozen, and Thawing". The first stage, known as the phase of freezing, is marked by both pain and restricted range of motion in the shoulder. In the second stage, known as the frozen stage, patients experience a significant reduction in all glenohumeral joint movement, with the most prominent decrease observed in external rotation. The final stage of recovery, the thawing phase, involves spontaneous improvement in the range of movement **(Le Hiet al., 2017)**.AC is classified as a primary idiopathic sort that occurs spontaneously without any particular inciting event or secondary adhesive capsulitis that may represent severe manifestations **(Ryan et al. 2016).** Recently identified evidence estimated that 70% of AC sufferers were females, although males did not respond well in the same manner as women **(Le Hiet al., 2017)**. Almost all diabetic populations have repeated complaints recognized clinically as D-AC, which overloads those who were exhausted with multiple co-morbidities **John B, Wexler A, David C, et al. (2018).**

A number of therapy plans have been put forth to address adhesive capsulitis. Unfortunately, there is a lack of conclusive evidence about the efficacy of any routinely used treatments (Ghillodia A, Gandhi B (2020). Physical therapy programs, analgesics, intra-articular corticosteroid injections, anesthetic-assisted joint manipulation, and capsular release, and other similar treatments are usually recommended (Kliegel E (2018). A one-size-fits-all treatment for adhesive capsulitis has not been proven to increase the range of motion and reduce pain indicators. Non-pharmacological interventions, such as acupressure, massage, hydrotherapy, and acupuncture, have effectively relieved symptoms and enhanced the functional capacity of patients. (Ali et al.,2024).

Acupressure is a crucial non-pharmacological method in traditional Chinese medicine (TCM). It originated in ancient China and has been shown to have substantial therapeutic advantages in treating different diseases. It is categorized as a variant of acupuncture since both techniques are based on the same fundamental concepts. In acupuncture, acupoints are often stimulated by exerting pressure with fingers, palms, and elbows or using acupressure devices instead of needles **(Mehta et al., 2017)**.

In Chinese traditional medicine, the preservation of optimal health is contingent upon attaining equilibrium between the free flow of energy and yin and yang, usually identified as qi or chi. Should there be any imbalance of qi occurs, it has the potential to lead to the onset of illness. Qi flows along channels known as meridians. There are twelve primary meridians and eight secondary meridians in the human body. The organs of the body might be yang (fu) or yin (zang). The kidneys, liver, spleen, lungs, and heart are regarded as yin organs; the gallbladder, stomach, small intestine, large intestine, and bladder are seen as yang organs **(Matos et al., 2021).**

Acupressure rectifies the imbalance of qi flow through channels, effectively treating various diseases. Restoring qi homeostasis improves the biological performance of body organs or Zang-fu organs, which declares medicinal effects. With its several acting mechanisms, it is especially useful for pain

management, especially in diabetic adhesive capsulitis (DIC). Its efficacy is created on the idea of stimulating the meridians' acupoints **(Mehtaa et al., 2017 & Ranasinghe et al.,2022).** The molecular mechanism of acupressure is based on stimulating specific acupoints, which trigger intricate neuro-hormonal reactions. This phenomenon occurs when the hypothalamic-pituitary-adrenocortical axis interacts in a way that causes the excess cortisol production and a calming effect. Enhancing the transport of endorphins and serotonin to particular organs and the brain also affects physiological reactions. As a result, endorphins' calming and analgesic effects boost patients' functional capacity and reduce symptoms **(Cui et al.,2021).**

Integrating complementary therapy into nursing care is a prevalent practice in clinical settings. Complementary therapy refers to a non-pharmacological approach that is employed to assist in managing symptoms that cannot be completely relieved by medicine. These complementary therapies frequently have distinct aims, and nurses are the optimal choice for providing them because of their expertise in patient care. However, before applying any complementary therapy, it is crucial to comprehend the potential medical safety ethical, and legal issues associated with the therapeutic procedure. **(Lee, R. P. (2023).** Therefore, the inherent benefits of the nursing profession can be utilized to improve and implement the professional nursing process and maximize the roles and capacities of nurses; acupressure alleviates physical symptoms and enhances the quality of patients life suffering from adhesive capsulitis.

Aim of the Study:

To evaluate the effect of acupressure sessions on joint mobility, pain intensity, and disability in patients with diabetes adhesive capsulitis

Research Hypothesis:

Diabetic patients who receive acupressure sessions experience less pain, regain a normal range of motion in their shoulders, and have improved functional abilities compared to those who do not.

Materials and methods

Research Design

The current study employed a time series quasi-experimental research approach to accomplish its goal.

Setting:

This study was carried out in the outpatient rehabilitation clinic of Damanhour General Hospital, ElBeheria governorate, Egypt.

Subjects:

This study included a convenience sample of sixty diabetes adhesive capsulitis patients eligible for inclusion. They showed up for their follow-up appointments at the abovementioned clinic and were selected as the research subjects. **Calculation of the sample size**: G*POWER statistical software ensured the study sample size with the assistance of the paper of **Balci *et al.* (13)** via t-test, assuming a double-sided 5% type I error and 80% power plus 0.458 effect size. Thus, the required sample size was 30 diabetic patients with adhesive capsulitis in each group. Two equal groups were formed out of the study participants after being recruited randomly. Thirty patients comprised each group. The control group (G1) received standard hospital care, whereas the experimental group (G2) participated in acupressure sessions in addition to standard hospital care.

Inclusion criteria:

- Adult patients of both genders ranged from 40-60 years old.
- Each participant had 5-10 years diagnosed with type II-DM.
- Mean postprandial blood glucose ≥290 mg/dl, with 3-9 months earlier adhesive capsulitis.

Exclusion Criteria:

- All patients with signs of acute infection, inflammation, serious diseases, i.e., tumors, thrombosis, perforated ulcers, enlarged axillary lymph nodes, aneurysm or cardiac disorders,
- Patients underwent shoulder surgeries or had other associated disorders such as mastectomy, serious orthopedic diseases,

pre-existing neuromuscular diseases, i.e., myasthenia gravis
- Patients who had open fractures, or fractures associated with nerve or vascular compromise

Tools: This study used four tools to gather data after a thorough evaluation of pertinent sources.

Tool I: " Socio-demographic and Clinical Data Structured Questionnaire."

The inquiry team created this tool and included questions regarding the demographic attributes of the participants, such as age, gender, level of education, occupation, marital status, and place of residence, and additionally questions regarding clinical data, including medical history and disease duration, and anthropometric measurements, such as their weight, height, and body mass index.

Tool II: Visual Analogue Pain Scale (VAS):

Melzack and Katz developed the scale in 1994. The tool was made to allow users to self-report, assess, and gauge their subjective perception of pain as well as its intensity. After being accepted, it was translated into Arabic. A horizontal line is employed as the pain assessment technique to determine the patient's subjective pain threshold. The degree of pain is measured using a 10-point numerical rating scale, where zero represents no discomfort and ten represents the worst conceivable suffering. Mild, moderate, severe, and intolerable are terms used to describe values that fall in the center. On a numerical scale with ten points, the patient was asked to select a number representing their degree of pain. The terms mild, moderate, severe, and intolerable are used to describe values in the center. The patient was asked to choose a number on a ten-point numerical scale that indicated their level of pain. The scale categorized pain as follows: no pain (zero), mild pain (1 up to 3), moderate pain (4 up to 6), severe pain (7 up to 9), and the worst extreme pain(10).

Tool III: Shoulder mobility measurement:

These measurements were assessed via a smartphone inclinometer application developed by the plain code application **Mejia et al., 2018,** used for objective shoulder mobility evaluation. It's well-supported in adequate clothes for participants with a straight erected back and an armband attached to the distal part of the targeted arm. The smartphone device was positioned with a screen facing away for the researchers. The researchers evaluated shoulder flexion, abduction, and internal and external rotation, where his assistant recorded measured values. Valid and reliable follow-up for determining the effectiveness of therapeutic interventions

Tool IV: Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire.

The DASH Arabic version was utilized; Hudak et al. developed it in 1996. The 30-item patient-reported outcome measure is used to evaluate symptoms and functionality of the entire upper extremity, as well as the capacity to perform specific activities. It comprises twenty-one physical functions, six symptoms, and three items related to social-role function. Each question includes a 5-point Likert scale that measures the patient's reported capacity to do activities or tasks, ranging from "1" (lowest difficulty or severity) to "5" (highest difficulty or severity). The functional score spans from 30 for the highest overall score to 150 for the lowest. After dividing the score by the total number of questions answered, multiplying by 25, deducting 1. Then, The score percent fell into the following categories:
- Low disabilities (30-79)
- Moderate disabilities (80-119)
- Higher disabilities (120-150).

Methods:

- Approval was granted by the Research Ethics Committee of the Faculty of Nursing at Damanhour University. Formal permission from the Faculty of Nursing at Damanhour University was also directed to the relevant authorities for the study area to get their agreement to carry out the study after clarifying its purpose.
- The study tools underwent examination of content validity carried out by a panel of five medical-surgical nursing specialists. This was done to ensure the content was valid, the items were clear, and any necessary corrections were made.

- Reliability of tool II was (0.84) while The inclinometer application showed good test-retest reliability with a standard error of measurement of between 6° and 10° and ICC scores between 0.84 and 0.93. The Cronbach's alpha coefficient for the Arabic Q-DASH questionnaires was 0.88, indicating high internal consistency. Test-retest reliability was found to be satisfactory, with an ICC of 0.84 for intra-class correlation.
- Prior to the data collection, a pilot study involving six patients from the experimental group was carried out to evaluate the tools' application, viability, and clarity used to detect impediments during data collection. In addition, the time required to complete the assessment tools must be determined. Based on the results, the necessary adjustments were made.
- Data was gathered between December 2023 and April 2024.
- To accomplish the aim of the study, patients were interviewed in the outpatient rehabilitation clinic. Individualized sessions were carried out by the researchers with the following study instruments: one prior acupressure session to assess and explain the study aims, as well as obtain their consent, then three additional sessions, 4 times (one/week) for one month, were conducted for acupressure massage and to reinforce their adherence to the sessions.

The acupressure session was conducted in four distinct phases: assessment, planning, implementation, and evaluation.

Assessment Phase

- During this phase, each patient in the control and experimental groups underwent an individualized initial assessment. It involves attentively listening to the patient, noting their medical history, and calculating their body mass index.
- Researchers communicated with patients to obtain initial data and attain the patients' phone numbers for ongoing contact.
- Tools I (Part I and II) were utilized once in the first phase. Tools II, III, and IV were used three times: prior to the acupressure session, as well as at the second, third-, and fourth-week intervals. Each patient's assessment session was lasted between 30 and 60 minutes.

Planning phase:

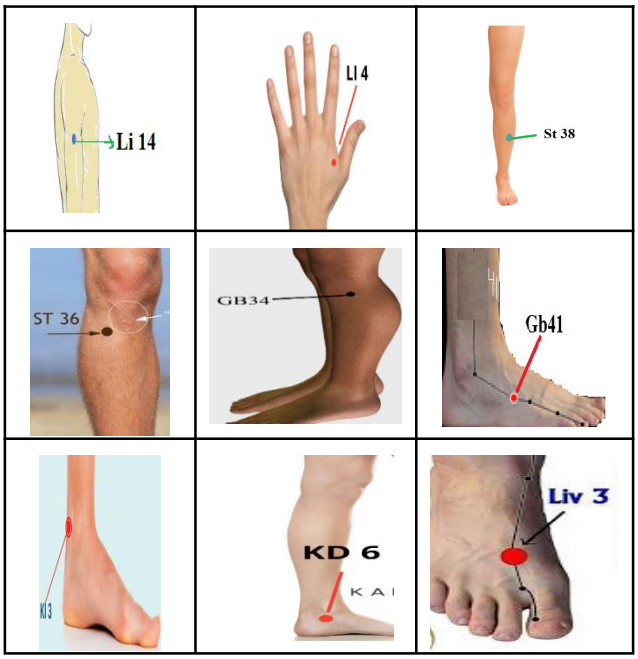
The Faculty of Physical Education at Alexandria University provided the researchers with specialized training in acupressure therapy.

Implementation phase (Acupressure sessions):

- Preparation was made for both the study group patients and their surroundings. The environment is carefully prepared, free of any distractions such as visitors and accompanying persons, well-ventilated, dimly lit, well-clean, and equipped with curtains to maintain privacy. The participants in the experimental group were greeted and instructed to empty their bladder, remove any constricting clothing, and sit in a relaxed position with their legs uncrossed. They were then advised to lightly close their eyes, focus on a specific point, clear their mind, and concentrate on breathing.
- The patient was advised to refrain from eating for at least two hours prior to the sessions, as applying acupressure on an empty stomach can limit blood flow and cause nausea. Also drinking cold drinks could have a negative effect on the body's physiological systems and counteract the therapeutic benefits of acupressure, which he was also advised against.
- Patients were instructed to perform deep breathing exercises before the session. This entailed taking four deep breaths through the nose, holding them for two counts, and then letting go of the breath through pursed lips for four counts.. Engaging in deep breathing facilitates the relaxation of acupressure points and promotes the circulation of healing energy throughout the entire body.
- To alleviate any discomfort for the patient, the researchers kept their nails short and their hands warm by rubbing against each other.
- Both the yin and yang meridians were stimulated by a massage technique that involved rubbing both hands in a specific sequence. The massage began at the

shoulders and progressed towards the fingers along the arms' inner surface, and then along the arm's outer surface from the fingers in the direction of the shoulder. This process was repeated twice.

- Assigning acupressure points accurately required placing a thumb or index finger on each point. As a result of its length and strength, the middle finger is ideal for self-acupressure. The following acupoints were stimulated by pressure applied using slow, rhythmic finger massage in a counter-clockwise circular motion to enhance energy flow and correct any imbalances; Strong lifting and thrusting stimulation were applied to taner point, LI 4, LI 14St38 (Tiaokou), St36 (Zusanli), Gb34 (yanglinquan), Gb41 (Foot-linqi), K6 (Zhaohai), K3 (Taixi), and Liv3 (Taichong).
- These acupoints were chosen in the treatment of AC based on TCM principles.
- The acupressure points utilized in this study were subjected to twice-daily acupressure sessions for four weeks. Each session lasted approximately 30-35 minutes for each patient



Evaluation phase:

- The control group of patients received standard unit care only and were re-evaluated four times (one every week) for a month. In the experimental group, acupressure massage with tools II, III, and IV was followed by re-evaluation four times (one per week) for a month.
- Comparisons were done between two groups to evaluate the effect of acupressure sessions on joint mobility, pain intensity, and disability in patients with diabetes adhesive capsulitis.

Ethical consideration

- Written informed consent was collected from patients after clearly explaining the study's aim after their voluntary engagement,
- They were allowed to withdraw at any moment.
- Data confidentiality and patient privacy were ensured.

Statistical analysis

We used IBM SPSS software package version 23.0 to examine the data fed into the computer. (New York: IBM Corp., Armonk)

Numeric and percentage descriptions were provided for the qualitative data. The quantitative data were described using the mean and standard deviation. The outcomes were considered statistically significant at the 5% level.

The statistical analysis metrics listed below were applied:

- Chi-square test is used to compare different groups when categorical variables are analyzed.
- The chi-square test is adjusted using Fisher's Exact or Monte Carlo adjustment when more than 20% of the cells have an expected count of less than 5.
- When comparing two examined groups using normally distributed quantitative data, the student t-test is employed. Additionally, when the data is normally distributed, the F-test for repeated measures ANOVA can be used to compare data across more than two periods.

Results

Table 1 shows no statistically significant difference in demographic or baseline characteristics between the experimental and control groups. Obviously, more than three-quarters of the control group (76.7%) and two-thirds of the experimental group (63.3%) had ages ranging from 50 to 60 years. The highest percentage of patients, 86.7%, were females. Furthermore, most control group (86.7%) and experimental group (80.0%) were married. The results cleared more than one-third of the patients were illiterate, representing 43.4% and 36.7% in both control and study groups respectively. Additionally, more than two-thirds of the studied patients, 66.7% and 76.7% in the two groups, respectively, came from urban areas. Finally, (46.6%) of the controls and (66.7%) of the experimental group were housewives.

According to medical history, over two thirds of the patients in both control and study groups (63.3%) and 70%) had the duration of their illness from five years to less than 10 years. Additionally, between the control and study groups, over half of them (56.7% and 53.3%, respectively) were overweight. Furthermore, the average postprandial blood sugar level was higher in the experimental group than in the control group without statistical significance ($p = 0.38$).

Table 2 shows that pain intensity is the most experienced severe pain among the control groups during the first, second, and third sessions. However, following four weeks of routine care, the percentage of control group members experiencing this pain decreased to 60.0%, 66.7%, 53.3%, and 43.3%. With respect to the experimental group,70% of patients experienced severe pain, while 46.7% reported moderate pain. Additionally, 36.7% of participants had mild pain, while 53.3% did not experience any pain. Statistically significant differences were seen between them at a significance level of $p < 0.01$ in the post-second, third, and fourth acupressure sessions. Additionally, there were substantial variations between the experimental and control groups' mean pain scores.

Table 3 shows that the mean of overall score Hand, shoulder, and arm disabilities (DASH) was greater in the control group prior to the acupressure session compared to the experimental group without statistical significance (p=0. 78). Moreover, the results of the marginal homogeneity test indicated a statistically significant difference regarding DASH before and after acupressure session in the experimental group (P<0.00). Noticeably, the parentage of limitations of the Arm, Shoulder, and Hand (DASH) among the experimental group was high before the acupressure session (63.3%) and decreased to (50%, 43.3%,76.7%) after the second, third, and fourth weeks respectively. However, after implementing the acupressure session, Overall mean scores of Disabilities of the Arm, Shoulder, and Hand (DASH) were (63.30±17.34) in the experimental group after acupressure sessions compared with the control group(97.53±27.11), indicating a statistically significant difference among the two groups after acupressure sessions (<0.001)*.

The mean score for shoulder range of motion for both groups improved noticeably from the initial evaluation to the second, third, and fourth weeks of acupressure treatments, as **Table 4** illustrates. The experimental group

showed a substantial enhancement in shoulder flexion, abduction, and internal and external rotation compared to the control group after receiving acupressure sessions over a period of four weeks. This improvement was statistically significant, with a p-value = (<0.001*).

Table 5 shows that the mean difference for each variable, regarding pain intensity, Following the second, third, and fourth acupressure sessions, there was a significant improvement in the experimental group's pain intensity, DASH, and shoulder range of motion, with the effect size (78%,71%,96,94%,87%). In addition, the scores for all domains of pain intensity, DASH score, and shoulder range of motion subscale of the control group showed a slight increase immediately after receiving conventional treatment at the unit. However, there were noticeable differences in the level of improvement observed between the two groups following the acupressure session in all variables (P< 0.00).

Table (1): Percentage distribution of the studied groups regarding their -demographic and clinical data (n=60).

Demographic and clinical data	Control Group		Experimental group		Total		Significance Test
	N= 30	%	N= 30	%	N= 60	%	
Age (years):							$\chi2$=1.270
40-50	7	23.3	11	36.7	18	30.0	P= 0.260
50 ≤ 60	23	76.7	19	63.3	42	70.0	
Total	30	100	30	100	60	100	
Gender:							$\chi2$=0.480
Male	6	20.0	4	13.3	10	16.7	P= 0.49
Female	24	80.0	26	86.7	50	83.3	
Total	30	100	30	100	60	100	
Marital status:							$\chi2$=0.480
Married	26	86.7	24	80.0	50	83.3	P= 0.49
Widowed	4	13.3	6	20.0	10	16.7	
Total	30	100	30	100	60	100	
Level of education:							
Illiterate	13	43.3	11	36.7	24	40.0	
Primary +Preparatory	5	16.7	7	23.3	12	20.0	$\chi2$=4.696
Secondary	4	13.3	9	30.0	13	21.7	
University	8	26.7	3	10.0	11	18.3	P = 0.195
Total	30	100	30	100	60	100	
Place of residence:							$\chi2$=3.929
Urban	20	66.7	23	76.7	43	71.8	P= 0.14
Rural	10	33.3	7	23.3	17	28.2	
Total	30	100	30	100	60	100	
Occupation:							$\chi2$=0.077
Manual	7	23.3	5	10.0	12	68.3	P= 0.78
Professional	9	30.0	7	23.3	16	31.7	
Housewife	14	46.7	18	66.7	32	58.3	
Total	30	100	30	100	60	100	
Clinical data							
Disease duration (years)	19	63.3	21	70.0	40	63.3	$\chi2$=5.767
5-10 years							P= 0.12
10-15 years	11	36.7	9	30.0	20	36.7	
Total	30	100	30	100	60	100	
Total body mass index							
Normal	4	13.3	2	6.7	6	13.3	
Overweight	17	56.7	16	53.3	33	50.0	$\chi2$=1.126
Obese	9	30.0	12	40.0	21	36.7	P= 0.57
Total	30	100	30	100	60	100	
Mean Postprandial blood glucose level	339 .06± 45.10			341.23±34.60			T=0.209 P= 0.38

Table (2): Comparison between patients of both studied groups according to pain intensity level pre and post-acupressure sessions throughout four weeks.

Pain level	Control Group		Experimental Group		P		
	N= 30	%	N= 30	%	M/D	t	Sig
First session							
Mild pain	3	10.0	2	6.7			
Moderate pain	9	30.0	7	23.3			
Severe pain	18	60.0	21	70.0	0.53	1.10	0.27
Mean ±SD	6.96±1.93		7.50±1.79				
Second session							
No pain	0	0.0	3	10.0			
Mild pain	3	10.0	4	13.3			
Moderate pain	7	23.3	14	46.7	1.56	2.82	0.006
Severe pain	20	66.7	9	30.0			
Mean ±SD	6.86±1.79		5.30±2.45				
Third session							
No pain	0	0.0	7	23.3			
Mild pain	4	13.3	11	36.7			
Moderate pain	10	33.3	7	23.3	3.06	5.34	0.000
Severe pain	16	53.3	5	16.7			
Mean ±SD	6.46±1.85		3.40±2.54				
Fourth session							
No pain	0	0.0	16	53.3			
Mild pain	6	20.0	9	30.0			
Moderate pain	11	36.7	5	16.7	4.26	8.51	0.000
Severe pain	13	43.3	0	0.0			
Mean ±SD	5.93±1.91		1.66±1.97				

*: Statistically significant at P ≤ 0.05 M/D: mean differences

Table (3): Comparison between patients of both studied groups according to a total score of Disabilities of the Arm, Shoulder, and Hand (DASH) pre and post-acupressure sessions throughout four weeks.

DASH score	Control Group		Experimental Group		P		
	N= 30	%	N= 30	%	M/D	t	Sig
First session							
Low disabilities (30-79)	2	6.7	3	10.0			
Moderate disabilities (80-119)	7	23.3	8	26.7			
higher disabilities (120-150)	21	70.0	19	63.3	2.00	0.27	0.78
Mean ±SD	117.0±26.54		115.0±29.56				
Second session							
Low disabilities (30-79)	2	6.7	6	20.0			
Moderate disabilities (80-119)	9	30.0	9	30.0			
higher disabilities (120-150)	19	63.3	15	50.0	7.56	0.93	0.35
Mean ±SD	116.73±28.22		109.16±34.16				
Third session							
Low disabilities (30-79)	4	13.3	13	43.3			
Moderate disabilities (80-119)	11	36.7	11	36.7			
higher disabilities (120-150)	15	50.0	6	20.0	18.96	2.13	0.03
Mean ±SD	109.16±29.39		90.30±38.64				
Fourth session							
Low disabilities (30-79)	7	23.3	23	76.7			
Moderate disabilities (80-119)	13	43.4	7	23.3			
higher disabilities (120-150)	10	33.3	0	0.0	34.23	5.82	0.00
Mean ±SD	97.53±27.11		63.30±17.34				

*: Statistically significant at P ≤ 0.05 M/D: mean differences

Table (4): Comparison between patients of both studied groups in relation to a range of motion of the affected shoulder pre and post-acupressure sessions throughout four weeks.

Range of motion of the affected shoulder	Control Group	Experimental Group	P		
	Mean ±SD	Mean ±SD	M/D	t	Sig
First session Flexion	74.00±2.88	75.73±5.27	1.73	1.57	0.12
Abduction	53.10±2.26	54.40±2.91	1.30	1.92	0. 95
External rotation	38.43±4.14	36.90±3.85	1.53	1.48	0.14
Internal rotation	38.56±3.53	37.80±3.11	0.766	0.892	0.37
Second visit flexion	75. 53±2.73	117.16±5.34	41.63	37.97	0.00
Abduction	54.93±3.13	67.06±4.02	21.13	22.67	0.00
External rotation	41.23±5.06	53.40±9.55	12.16	6.16	0.00
Internal rotation	41.03±4.23	48.70±7.25	7.66	5.00	0.00
Third visit flexion	75.76±3.26	131.60±11.70	55.83	25.16	0.00
Abduction	55.93±4.63	81.40±7.41	25.46	15.95	0.00
External rotation	41.96±6.37	63.60±3.92	21.63	15.83	0.00
Internal rotation	42.30±5.23	55.50±5.40	13.20	9.60	0.00
Fourth visit Flexion	76.86±3.83	165.00±5.98	88.13	67.90	0.00
Abduction	54.70±10.98	98.50±5.75	43.80	19.35	0.00
External rotation	44.33±7.56	67.40±3.38	23.06	15.24	0.00
Internal rotation	43.40±7.30	61.33±5.61	17.93	10.65	0.00

*: Statistically significant at $P \leq 0.05$ M/D: mean difference

Table (5): Comparison between Mean difference of pain intensity, DASH score, and range of motion of the affected shoulder in patients of both studied groups pre and post-acupressure sessions throughout four weeks.

(I)Factor 1		Factor (J) 1	Control group (NO=30)				Experimental group (NO=30)			
			MD(IJ)	Sig	F/ P	Effect size	MD (IJ)	Sig	F/ p	Effect size
Pain level	**1**	**2**	0.100	0.74	6.32 p= 0.01	0.17	2.200*	0.00	105.39 p= 0.000	0.78
		3	0.500	0.70			4.100*	0.00		
		4	1.033*	0.04			5.833*	0.00		
	2	**3**	0.400	0.02			1.900*	0.00		
		4	0.933*	0.00			3.633*	0.00		
	3	**4**	0.533*	0.01			1.733*	0.00		
DASH score	**1**	**2**	.267	0.96	5.09 p= 0.00	0.14	5.833*	0.40	90.62 p= 0.00	0.71
		3	7.733	0.25			24.700*	0.00		
		4	19.467*	0.00			51.733*	0.00		
	2	**3**	7.467	1.10			18.867*	0.00		
		4	19.200*	0.00			45.867*	0.00		
	3	**4**	11.733	0.03			27.00	0.00		
Flexion	**1**	**2**	1.533*	0.04	4.123 p= 0.00	0.12	41.433*	0.00	777.87 p= 0.00	0.96
		3	1.767*	0.03			55.867*	0.00		
		4	2.867	0.00			89.267	0.00		
	2	**3**	0.333	0.71			14.433	0.00		
		4	1.333	0.11			47.833	0.00		
	3	**4**	1.100	0.28			33.400*	0.00		
Abduction	**1**	**2**	1.833*	0.00	0.976 p= 0.40	0.03	21.667*	0.00	456.43 p= 0.00	0.94
		3	2.833*	0.00			27.000*	0.00		
		4	1.600	0.47			44.100*	0.00		
	2	**3**	1.000	0.19			5.333*	0.00		
		4	0.233	0.91			22.433*	0.00		
	3	**4**	1.233	0.595			17.100	0.00		
External rotation	**1**	**2**	2.800*	0.05	10.29 p= 0.00	0.26	16.500	0.00	202.56 p= 0.00	0.87
		3	3.533*	0.00			26.700	0.00		
		4	5.900*	0.00			30.500	0.00		
	2	**3**	0.733	0.15			10.200	0.00		
		4	3.100*	0.00			14.000	0.00		
	3	**4**	2.367*	0.01			3.800	0.00		
Internal rotation	**1**	**2**	2.467*	0.05	11.530 p= 0.002	0.28	10.900	0.00	5.17.92 p= 0.00	.94
		3	3.733*	.002			17.700	0.00		
		4	4.833*	00.2			23.533	0.00		
	2	**3**	1.267	0.125			6.800	0.00		
		4	2.367	0.116			12.633	0.00		
	3	**4**	1.100	0.364			5.833	0.00		

P: P-value for Repeated measure ANOVA test for comparing between before intervention and each other period for every items in each group.

*: Statistically significant at $P \leq 0.05$ M/D: Mean Difference (Ij) between each other session for every item in every group.

(1): First session (2): Second session (3): Third session

(4): Fourth session

F value = variance of the group means

Discussion

Current clinical diabetic adhesive capsulitis features incidence is estimated around 2-3% worldwide population. Compared to people without diabetes, The risk ratio for people with diabetes is between 5.0 and 5.9 for developing idiopathic frozen shoulder. According to these research, shoulder issues are common in patients with diabetes, and the symptoms typically get worse over time **Mustafa KN et al (2016**). Frozen Shoulder is a condition that severely impairs a person's quality of life. Patients must suffer for a very long time with this excruciating ailment due to a lack of effective therapy and a lack of knowledge about its origins, which necessitates further study into alternative therapies and thus there is an actual need to determine an efficient approach for management of AC that maximize rehabilitation response to improve adequate quality of life **Nakandala P (2021).** Therefore, the current study aims were to investigate the effect of acupressure sessions on joint mobility, pain intensity, and disability in patients with diabetes adhesive capsulitis

In respect of socio-demographic aspects, the curent study displayed that more than three-quarters of the studied patients' age was 50 ≤ 60 and the majority of them were female; this finding may be attributed to the higher exposure of females to physical activity and female loading with many household activities and tasks which in turn put another load on their arms and shoulders and this shown in the study results as most of the research participants were married and more than two fifth were housewife also more than one-third of the patients were illiterate. This finding is in line with **Wolf J et al (2018) who studied** 'Impact of comorbidity on self-assessment scores of individuals suffering from idiopathic adhesive capsulitis' and mentioned that Adhesive capsulitis, often known as frozen shoulder, primarily affects people in the 40–60 age group and affects 2-5% of the population overall and Women make up around 70% of patients with frozen shoulder. But men who have frozen shoulders are more likely to require more time to heal and be more disabled. Also in line with **Jain N and Sharma K (2014)** who conducted a comprehensive study on the "effectiveness of physiotherapeutic interventions in the treatment of frozen shoulder/adhesive capsulitis" and found that women are 58% more likely than men to develop this ailment. Also is congruent with **Zuckerman J and Rokito A. (2011)** who studied frozen shoulder: a consensus definition and stated that the fifth and sixth decades of life are the most typical times for frozen shoulder, with a mid-50s peak age for the syndrome. Rarely begins before the age of 40, and women are more likely than males to be impacted. However, these findings contradict with **Mahsa et al (2016)** who studied the Acupuncture's Therapeutic Effectiveness of Frozen Shoulders and they mentioned that women are affected fewer than men.

In the first, second, third, and fourth acupressure sessions, A statistically significant difference was observed in pain levels between the control and study groups (P-Value < 0.05). Also, the results of this study revealed that the acupuncture group's VAS mean scores decreased significantly from 7.50 (SD 1.7) at baseline to 1.66 (SD 1.9) in the fourth session following acupressure ($p < 0.000$). In contrast, the control group's VAS scores did not significantly variation between the baseline and the fourth week (with a mean improvement of 1.03%).

These results supported the research hypothesis (H1) which indicated that; Diabetic individuals involved in acupressure sessions experience less pain, compared to those who do not. These findings could be justified by improvement post acupressure sessions taught to the effectiveness of pleasurable impulses are transmitted to the brain by acupressure at a certain place, and they do so at a rate four times faster than painful stimuli. These continuous im-pulses enhance or increase our body's pain threshold by releasing, closing, and blocking the neural "GATES" that slow down and block pain signals from reaching the brain **Mehta P et al (2017**). These results are congruent with **Gladys L et al (2018)** who studied "Interferential electrotherapy and acupuncture are effective in treating frozen shoulder". The study found that the acupuncture group's VAS mean scores reduced significantly in the post-treatment session ($p < 0.001$), from 6.5 (SD 2.1) at baseline to 3.5 (SD 1.9). In contrast, the control group's VAS scores did not

significantly change from baseline to the fourth week (the mean improvement was 1.3%). Also, in line with **Mahsa et al (2016)** who state that, When comparing the test group to the control group, the VAS index decreased significantly (P-Value < 0.05). Also in line with **Kleinhenz et al (2015)** who "researched a randomized clinical trial comparing the effects of a newly designed placebo needle and acupuncture in treating rotator cuff tendinitis and reported that the VAS scores for the groups differed significantly, according to the statistical analysis where (P=0.00 1).

Moreover, the current study portrayed that, the mean of DASH scores were reduced in the acupressure group from 115 (SD 29.5) at baseline measurement to 63.30 (SD 17.3) after four weeks of acupressure sessions with significant differences between control and study groups in the third and fourth session of acupressure sessions. These results supported the research hypothesis (H1) which indicated that; Diabetic individuals involved in acupressure sessions experience improved functional abilities compared to those who do not. This may be justified by acupressure has a positive effect on pain levels and this in turn affect joint mobility and its range of motion which help patient to perform many tasks. These findings are contradicted by **Mahsa et al (2016)** who reported that following treatment, improvement was observed; however, the acupuncture group experienced a greater degree of this reduction; however, there was no discernible difference between the acupuncture and control groups on this item.

The current study results portrayed that, after four weeks of acupressure sessions their was increasing and improvement of mean score Regarding the afflicted shoulder's flexion and abduction range of motion, external and internal rotation and the average of these movements of the affected shoulder in the experimental group was meaningfully higher than control group meanwhile, such improvement was not observed between the control group after received routine care with a highly significant difference between control and experimental groups starting from second session (P-value<0.05). These results supported the research hypothesis (H1) which indicated that; Diabetic individuals involved in acupressure sessions regain a normal range of motion in their shoulders, compared to those who do not. These results may be due to the effect of acupressure on pain level which in turn enhances the range of motion of the affected joint. This finding matched with **Shah KM (2015),** he conducted research on " joint reduced movement in individuals with diabetes mellitus" and found that individuals with the disease have less strength and motion in their shoulders than healthy individuals. Also, in line with **Mahsa et al (2016)** enhancement of all shoulder motions, yet with regard to flexion and abduction, the enhancement was deemed to be more active and inactive motions. when compared to previous motions, there was a noticeable improvement in the flexion and abduction directions.

Acupressure provides additional analgesia that allows other therapeutic modalities i.e., active range of motion exercise training to be conducted comfortably, thus facilitating regaining shoulder musculature strength and minimizing functional limitations. Therefore, acupressure seemed to be more effective in the management of diabetic adhesive capsulitis **(Ali, et al.,2024)**. Lastly, The results acquired have provided proof that acupressure has a positive effect on experiencing less pain, regaining a normal range of motion in their shoulders, and improving functional abilities. As part of their focus on caring and healing, nurses are increasingly delivering complementary and alternative medicine (CAM) in an endeavor to offer pain relief, symptom management, and comfort measures for comprehensive patient care.

From the findings of the present study, it can be concluded that:

The experimental group experienced much superior therapeutic outcomes from acupressure treatments compared to the control group in terms of pain severity, range of motion, and functional abilities. This difference was statistically significant.

Recommendations

The study's conclusions led to the following recommendations:

1. In the early stages of the illness, patients with adhesive capsulitis require education on

how to apply acupressure in order to reduce discomfort and increase vitality.
2. More research may be required to examine the various acupressure spots for pain management, regain a normal range of motion in their shoulders, and have improved functional abilities among patients with Adhesive Capsulitis.
3. Acupressure intervention booklets with illustrations that patients with adhesive capsulitis can self-administer may be beneficial.
4. It is recommended that acupressure training programs be developed and implemented for nurses, medical staff, and caregivers.

References

Ali,. K., Serri,. M., El Dein, G., & Ali, S. M(2024). Effect of Reflexology on Pain and Disability in Patients with Diabetic Adhesive Capsulitis. The Egyptian Journal of Hospital Medicine,, 94, 480-485.

Cui, J., Song, W., Jin, Y., Xu, H., Fan, K., Lin, D., ... & Lin, J. (2021). Research progress on the mechanism of the acupuncture regulating neuro-endocrine-immune network system. Veterinary sciences, 8(8), 149.

Durall, C. J., & SCS, L. (2017). Adhesive Capsulitis (Frozen Shoulder). Clinical Orthopaedic Rehabilitation: A Team Approach E-Book; Elsevier: Amsterdam, The Netherlands, 158.

Ghillodia A, Gandhi B (2020): Effect of visceral manipulation on pain, mobility and functional disability in subjects with right shoulder adhesive capsulitis. Recv Pesqui Fisioter., 10(4): 715-723.

Gladys L. Y. Cheing,D, Eric M. L. So, Clare Y. L. Chao (2018). Effectiveness of acupuncture and interferential electrotherapy in the management of frozen shoulder J Rehabil Med; 40: 166–170

Hudak, P. L., Amadio, P. C., Bombardier, C., Beaton, D., Cole, D., Davis, A., ... & Wright, J. (1996). Development of an upper extremity outcome measure: the DASH (disabilities of the arm, shoulder, and head). American journal of industrial medicine, 29(6), 602-608.

Imagama, S., Ando, K., Kobayashi, K., Seki, T., Hamada, T., Machino, M., ... & Hasegawa, Y. (2020). Shoulder pain has most impact on poor quality of life among various types of musculoskeletal pain in middle-aged and elderly people: Yakumo study. Modern rheumatology, 30(3), 568-572.

Jain and N. K. Sharma (2014)., "The effectiveness of physiotherapeutic interventions in treatment of frozen shoulder/adhesive capsulitis: a systematic review," Journal of Back and Musculoskeletal Rehabilitation, vol. 27, no. 3, pp. 247–273,

John B, Wexler A, David C et al. (2018): Management of hyperglycaemia in type II diabetes. A consensus report by the American Diabetes Association (ADA): and the European Association for the study of Diabetes (EASD): Diabetologia, 61(12): 2461-2498.

Kleinhenz J, Streitberger K, Windeler J, Gussbacher A, Mavridis G,Martin E. (2015) Randomized clinical trial comparing the effects of acupuncture and a newly designed placebo needle in rotator cuff tendinitis. Pain ;83(2):235–41.

Kliegel E (2018): Holistic Reflexology: Essential Oils and Crystal Massage in Reflex Zone Therapy. 1st ed. Healing Arts Press, Simon and Schuster; Rochester, NY, USA, pp. 2s55. https:// www. simonandschuster. com. au/books/Crystal-Wands/Ewald-Kliegel/9781620556481

Le Hai. V., Lee, S. J., Nazarian, A., & Rodriguez, E. K. (2017). Adhesive capsulitis of the shoulder: review of pathophysiology and current clinical treatments. Shoulder & elbow, 9(2), 75-84.

Lee, R. P. (2023). Storing Complementary Therapy Knowledge to Expand Nursing Roles. Hu Li Za Zhi, 70(6), 4-5.

Mahsa Asheghan, Amidoddin Khatibi Aghda, Ebrahim Hashemi (2016), Investigation of the Effectiveness of Acupuncture in the Treatment of Frozen Shoulder Aug; 28(4): 253-257 http:// creativecommons. org/ licenses/ by nc/4.0/)DOI: 10. 5455/ msm. 2016. 28. 253-257

Matos, L. C., Machado, J. P., Monteiro, F. J., & Greten, H. J. (2021). Understanding traditional Chinese medicine therapeutics: an overview of the basics and clinical applications. In Healthcare (Vol. 9, No. 3, p. 257). MDPI.

Mehta Piyush, Dhapte Vishwas, Kadam Shivajirao, Dhapte Vividha. Contem- porary acupressure therapy (2017): adroit cure for painless recovery of therapeutic ailments. J Trad Comp Med;7(2):251e63

Mehta, P., Dhapte, V., Kadam, S., & Dhapte, V. (2017). Contemporary acupressure therapy: Adroit cure for painless recovery of therapeutic ailments. Journal of traditional and complementary medicine, 7(2), 251-263.

Mejia-Hernandez K, Chang A, Eardly-Harris N et al. (2018): Smartphone applications for the evaluation of pathologic shoulder range of motion and shoulder scores: a comparative study. JSES Open Access, 2: 109-114.

Melzac R, Katz J (1994). Pain measurement in persons in pain. In Wall PD, Melzac R (eds). Text book of pain. London: Churchill living stone: 337-51.

Mustafa KN, Khader YS, Bsoul AK, Ajlouni K (2016). Musculoskeletal disorders of the hand in type 2 diabetes mellitus: prevalence and its associated factors. Int J Rheum Dis.;19:730-735.

N Abd ELHalim, M., H Kazem, G., & M Karamany, M. (2022). Arthroscopic Management of Rotator Cuff and Other Shoulder Pathology in Diabetics. Benha Journal of Applied Sciences, 7(7), 125-130.

Nakandala P, Nanayakkara I, Wadugodapitiya S et al. (2021): The efficacy of physiotherapy interventions in the treatment of adhesive capsulitis: A systematic review. J Back Musculoskel Rehabil., 34(2021): 195- 205.

Page R, McGee S, Eng K et al. (2019): Adhesive capsulitis of the shoulder: protocol for the adhesive capsulitis biomarker (AdCaB) study. BMC Musculoskelet Disord., 20(1): 145-152.

Ranasinghe. D., Hemasinghe. N., Samaranada A.,* Indrapala C(2022). Acupuncture for treating adhesive capsulitis (frozen shoulder): A Case report International. International Journal of KIU, , 3 (2), 151-154 Journal of KIUJournal home page : https: //ij.kiu.ac.lk/ DOI: https://doi. org/ 10.37966/ijkiu2022032035 International Journal of KIU

Ryan V, Brown H, Minns Lowe C et al. (2016): The pathophysiology associated with primary (idiopathic) frozen shoulder: a systematic review. BMC Musculoskelet Disord., 17:340.

Shah KM, Clark BR, McGill JB, Lang CE, Mueller MJ (2015). Shoulder limited joint mobility in people with diabetes mellitus. Clin Biomech.;30:308-313.

Spinnato P, Masuzzo O, Tue G et al. (2023): A novel ultrasound guided interventional procedure for the combined treatment of rotator cuff calcific tendinopathy complicated with adhesive capsulitis: The Rizzoli Technique. Acad Radiol., 30: 2437-2438.

Struyf, F., Mertens, M. G., & Navarro-Ledesma, S. (2022). Causes of shoulder dysfunction in diabetic patients: a review of literature. International journal of environmental research and public health, 19(10), 6228.

Thasni A, Parappil S, Manjalavil M et al. (2018): Prevalence of adhesive capsulitis in diabetic patients in a tertiary care centre: An observational study. JMSCR., 6(12): 652-658.

Wolf JM, Green A (2018). Influence of comorbidity of self-assessment instrument scores of patients with idiopathic adhesive capsulitis. J Bone Joint Surg Am;84:1167-72

Zreik, N. H., Malik, R. A., & Charalambous, C. P.(2016). Adhesive capsulitis of the shoulder and diabetes: a meta-analysis of prevalence. Muscles Ligaments Tendons J; 6: 26-34.

Zuckerman JD, Rokito A (2011). Frozen shoulder: a consensus definition. J Shoulder Elbow Surg;20:322e5.