



Original Research

Effect of auricular acupressure on neuropathy symptoms and quality of life in patients with type 2 diabetes: A double-blind, randomized clinical trial

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ABSTRACT

Background: Diabetic peripheral neuropathy (DPN) is a common complication of diabetes, often leading to pain, disability, and reduced quality of life (QoL). Complementary medicine practices, such as acupressure, are increasingly used by patients with diabetes. This study aimed to investigate the effects of auricular acupressure (AA) on neuropathic symptoms and QoL in patients with type 2 diabetes.

Methods: In this double-blind randomized clinical trial, 41 participants with type 2 diabetic neuropathy meeting the inclusion criteria were randomly assigned to either the intervention group ($n = 20$) or the sham group ($n = 21$). The intervention group received auriculotherapy by applying pressure to labels containing five plant seeds placed on the foot reflex area of the external ear three times daily for six weeks. The sham group received pressure on labels containing five plant seeds placed on the cardiac reflex area of the external ear for the same duration. Data collection tools included a demographic questionnaire, the Neuropathy Symptom Score (NSS) questionnaire, and the Neuropathy-Specific Quality of Life (Neuro-QoL) questionnaire, administered before and after the intervention. Data were analyzed using SPSS version 21, employing independent t -tests, paired t -tests, Mann-Whitney U, Wilcoxon, and chi-square tests, with a significance level set at $p < 0.05$.

Results: Before the intervention, no significant differences were observed between the two groups in terms of neuropathy symptom severity. After the intervention, the intervention group demonstrated a significant reduction in neuropathy symptoms ($p < 0.001$), while the reduction in the sham group was not statistically significant ($p = 0.17$). Additionally, QoL scores improved significantly in the intervention group post-intervention ($p < 0.001$).

Conclusion: Auriculotherapy appears to be a cost-effective, non-invasive, and practical approach for reducing neuropathic symptoms and improving QoL in individuals with type 2 diabetes.

Trial Registration: This study was registered at the Iranian Registry of Clinical Trials (IRCT20220413054530N1), Registration date: 2022–05–02.

List of abbreviations

AA	Auricular Acupressure
DM	Diabetes Melitus
NSS	Neuropathy symptom score
QoL	Quality of life
DPN	Diabetic peripheral neuropathy
TCNS	Toronto Clinical Neuropathy Score

Neuro-QoL Neuropathy Specific Quality of Life

Introduction

Type 2 diabetes is a prevalent metabolic disorder globally, characterized by elevated blood sugar levels due to impaired insulin secretion or resistance of body cells to insulin^{1,2}. It affects approximately 90 % of diabetic patients and is the most common type of diabetes worldwide³.

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According to 2021 statistics, about 10 % of the Iranian population aged 20 years and older have diabetes, with type 2 diabetes being more prevalent than type 1 diabetes⁴. Diabetes can affect various body systems, leading to complications such as nephropathy, neuropathy, retinopathy, peripheral vascular issues, myocardial infarction, diabetic foot ulcers, and amputations, which can result in disability, high treatment costs, and increased mortality. Among these, neuropathy is the most significant neurological complication in diabetic patients⁵.

At the onset of diabetes, approximately 10 % of patients are diagnosed with diabetic neuropathy, a statistic that increases to 50 % after 25 years of the disease⁶. The prevalence of diabetic peripheral neuropathy rises with age and is estimated to range from 2.4 % to 75.1 % among youth and adult patients⁷. A study by Taheri et al. estimated the overall prevalence of neuropathy in diabetic patients to be 42.1 %⁵. Diabetic neuropathy is one of the most common microvascular complications of diabetes⁸, with complications including severe pain, loss of sensation, and increased risk of leg ulcers and amputations^{8, 9}. Distal peripheral neuropathy and polyneuropathy are the most common forms of diabetic neuropathy and can lead to significant disability¹⁰.

Diabetic distal peripheral neuropathy contributes significantly to diabetic foot ulcers, which can also result from foot deformities, inappropriate footwear, and peripheral vascular disease. However, diabetic neuropathy remains the leading cause of these ulcers¹¹. Peripheral neuropathy manifests with various sensory symptoms, including tingling, pins-and-needles sensations, numbness, stiffness, burning, itching, sensory ataxia, and pain¹². The specific symptoms depend on the type of sensory fibers involved—small fiber involvement often causes pain, while large fiber involvement leads to numbness, tingling, and loss of protective sensation¹³.

Research indicates that 47–53 % of patients with diabetic neuropathy experience neuropathic pain¹⁴. Over half report burning pain, electric shock sensations, numbness, hypersensitivity, and deep pain, which often worsen at night and during rest, disrupting sleep and restfulness. These symptoms can reduce patients' ability to perform daily activities¹⁵. The profound and often irreversible complications of diabetic neuropathy significantly diminish patients' quality of life^{14, 16}. Symptoms primarily affect the lower limbs, particularly the soles and toes, leading to discomfort and negatively impacting mood, sleep, mobility, workability, social interactions, self-worth, and independence¹⁷.

A comprehensive review by Kiadaliri et al. demonstrated that individuals with diabetes have a lower quality of life compared to healthy individuals, although the specific contributing factors remain unclear¹⁸. Enhancing the quality of life is a critical aspect of caring for patients with type 2 diabetes. Improving quality of life is one of the primary objectives of diabetes management¹⁹. Educational and therapeutic interventions aimed at reducing disease complications have yielded mixed results in improving patients' quality of life²⁰, underscoring the need for further research into effective strategies.

Symptomatic treatments are the mainstay for managing diabetic peripheral neuropathy, but their efficacy is limited to 40–60 %¹⁷. While classical pharmacological therapies, including antidepressants, anti-convulsants, anti-inflammatories, and opioids, provide some benefit, they are often associated with significant side effects and limited success. Consequently, there is a growing need to explore safe and effective non-pharmacological alternatives for managing neuropathic pain^{21–23}.

Patients often appreciate the holistic care provided by complementary medicine techniques, which have been integral to medical practices for centuries. Integrating complementary methods into nursing care aligns with this tradition^{24, 25}. Non-pharmacological treatments such as phototherapy with infrared radiation, laser therapy, static magnetic field therapy, electrotherapy, and acupuncture are increasingly recommended^{17, 26}.

Acupressure, derived from acupuncture and rooted in traditional Chinese medicine, involves applying physical pressure to acupuncture points with the hands to treat various ailments, including diabetic

neuropathy²⁷. Auricular point acupressure (AA), also known as auriculotherapy or ear acupressure, is a specialized form of acupressure that targets specific points on the external ear²⁸. Techniques such as needles, electric currents, lasers, heat, seeded labels (e.g., magnetic seeds or Vaccaria plant seeds), and manual pressure are used to stimulate these points and alleviate symptoms²⁹.

Auricular acupressure is similar to reflexology, as it targets specific points on the ear that correspond to internal organs^{29, 30}. According to this theory, stimulating specific ear points can influence the function of other organs³¹. Compared to body acupuncture, auricular acupressure is less invasive and more acceptable to patients^{32, 33}.

The ear has extensive connections with the central nervous system, and auricular acupressure can positively affect this system³¹. In addition to improving general health, AA offers various benefits such as enhanced blood circulation, relaxation, brain stimulation, and immune system support³⁴. Çakici et al. demonstrated that therapies such as opioids, botulinum toxin, reflexology, and foot massage effectively alleviate peripheral neuropathy symptoms³⁵. Hong et al. reported positive outcomes using vibration therapy to reduce pain caused by peripheral neuropathy³⁶. Studies on acupressure for various types of pain—including migraines, tension headaches, labor pain, post-operative pain, hip fractures, back pain, and dysmenorrhea—have also shown promising results³⁷. However, the researcher did not find any studies that investigated the effect of ear acupressure on diabetic neuropathy.

Given the increasing global and national prevalence of diabetes and its complications, and the lack of studies specifically examining the effect of ear acupressure on the clinical signs of neuropathy, this study was conducted to determine the effect of auricular acupressure on neuropathy symptoms and quality of life in patients with type 2 diabetes. It is hoped that the results of this study will contribute to health planning at the macro level by reducing healthcare costs and improving the overall health of individuals with diabetes, thereby enhancing community health.

Methods

Aim, design, and setting of the study

This study aimed to investigate the impact of auriculotherapy on the clinical symptoms of neuropathy and the quality of life (QoL) in patients with type 2 diabetes. The research was designed as a randomized, double-blind, placebo-controlled trial to ensure robust and unbiased results. It was conducted at Shafa Hospital in Boshroeyeh, Razavi Khorasan, Iran. The trial adhered to ethical research standards, receiving approval from the Ethics Committee of Gonabad University of Medical Sciences (Approval Code: IR.GMU.REC.1401.002). Additionally, the study was registered with the Iranian Registry of Clinical Trials (Registration Code: IRCT20220413054530N1, Registration date: 2022–05–02).

Characteristics of participants and description of materials

Based on the results of the Masoudi Alavi study³⁸, and considering a test power of 90 %, a confidence interval of 99 %, and the average and standard deviation of pain scores in the two groups, the estimated sample size was 20 participants per group. To account for a 20 % dropout rate, 24 patients were assigned to each group.

Inclusion criteria

The inclusion criteria for this study were as follows:

- Patient's willingness to participate and provision of written informed consent.
- A Toronto Clinical Neuropathy Score (TCNS) of at least 6.

- Age between 18 and 60 years.
- No history of diseases or conditions affecting neuropathy, including multiple sclerosis, spinal cord injury, Parkinson's disease, stroke, gout, Guillain-Barré syndrome, rheumatic diseases, thrombosis, vascular disorders, vitamin B12 deficiency, triglyceride levels exceeding 500 mg/dL, or a glomerular filtration rate (GFR) below 30.
- Ability to remain alert and communicate effectively to report the severity of clinical symptoms during the examination.
- Absence of complications or other medical problems causing pain.
- Normal earlobes with no lesions or skin problems in the ear area or at the acupressure site.

Exclusion criteria

The exclusion criteria included:

- Unwillingness to continue participation during the study.
- The need for pharmacological or non-pharmacological interventions affecting pain.
- Any clinical condition rendering the intervention or continued participation in the research impossible.
- Use of drugs or strong painkillers during the study.
- Failure to undergo acupressure for two weeks or more.

Randomization process

Eligible patients with type 2 diabetic neuropathy were randomly assigned to either an intervention or sham group using the quadruple permuted block method. Six blocks (AABB, BBAA, ABAB, BABA, ABBA, BAAB) were generated, and each block was assigned a number from 1 to 6 by randomly rolling dice. The blocks were then selected, and allocation was made accordingly. This process continued until the desired sample size was reached, with group A representing the intervention group and group B representing the sham group.

Both patients and researchers were blinded to the intervention. A research assistant conducted the randomization process and instructed patients on performing the acupressure technique.

Intervention

In the intervention group, patients received routine medical care in addition to auriculotherapy with acupressure. Pressure was applied to adhesive labels containing five plant seeds positioned in the foot adaptation area (TF4) of the external ear. This was performed for 1 min, three times a day (every 8 h), over a 6-week period. Patients were trained on the acupressure technique and subsequently performed it independently after proper instruction.

In the sham group, patients received routine medical care alongside placebo auriculotherapy. Pressure was applied to adhesive labels containing five plant seeds positioned in the cardiac compliance area of the external ear. The procedure was performed for 1 min, three times a day (every 8 h), over a 6-week period. Similar to the intervention group, patients were trained on the placebo acupressure technique and subsequently administered it themselves after receiving appropriate training.

It should be noted that prior to the intervention, the researcher completed a training course in ear acupressure at the Acupuncture Clinic of Mashhad University of Medical Sciences, under the supervision of a Chinese medicine specialist. The accuracy of the technique used for both the intervention and control groups was subsequently confirmed by an acupuncture specialist. After selecting the participants and assigning them to the respective groups, the researcher provided in-person, face-to-face training on how to use the acupressure stickers.

Additionally, to address participants' questions, resolve potential issues, ensure adherence to the acupressure protocol throughout the six-week intervention period, and follow up on progress, three telephone calls (one every ten days) were made to patients in both groups.

Outcome measures

To evaluate the symptoms of peripheral neuropathy, the **Neuropathy Symptoms Score (NSS)** questionnaire was used. The NSS assesses various symptoms, including burning, numbness, paresthesia, weakness (such as fatigue and exhaustion), cramps, pain, localization of symptoms on the feet or elsewhere, exacerbation at night or during the day, and waking from sleep due to these symptoms. It also evaluates symptom improvement based on activities such as walking, standing, or sitting. Scores range from 0 to 16, with the following interpretations:

- 3–4: Mild neuropathic symptoms
- 5–6: Moderate symptoms
- ≥ 7 : Severe neuropathic symptoms

The validity and reliability of the NSS have been confirmed in several studies^{39, 40}, including a study by Mohammadpour et al. in 2023, which reported a Cronbach's alpha coefficient of 0.98⁴¹.

To assess the **quality of life (QoL)** in individuals with diabetic peripheral neuropathy, the **Neuropathy Quality of Life (NeuroQoL)** questionnaire was used. This tool focuses on evaluating the emotional and physical challenges related to diabetic neuropathy that affect daily life and overall health. The NeuroQoL includes five subscales:

- Painful symptoms
- Paresthesia
- Walking or standing instability
- Emotional distress
- Interpersonal problems and limitations in daily activities

The reliability of the NeuroQoL subscales ranged from 0.86 to 0.95. The total score ranges from 31 to 155, with higher scores indicating greater impairment and reduced QoL^{42, 43}.

Statistical analysis

The data were analyzed using both descriptive and inferential statistical methods. Descriptive statistics were employed to summarize the demographic and baseline characteristics of the participants. For inferential analysis, the following statistical tests were used:

- **Independent t-test:** To compare the means between the intervention and sham groups.
- **Chi-square test:** To evaluate the association between categorical variables.
- **Fisher's exact test:** Applied when expected frequencies in contingency tables were low.
- **Mann-Whitney U test:** Used for comparing non-normally distributed continuous variables between the two groups.
- **Paired t-test:** To compare within-group changes before and after the intervention.

The Kolmogorov-Smirnov test was used to assess the normality of data distribution. All statistical analyses were conducted using **SPSS software version 20**, and the significance level was set at $p < 0.05$.

Results

Participant flow

Out of the 56 participants initially evaluated, 48 met the inclusion criteria, while 7 were excluded due to withdrawal. Ultimately, the study was conducted with a total of 41 participants (see Fig. 1).

Enrollment

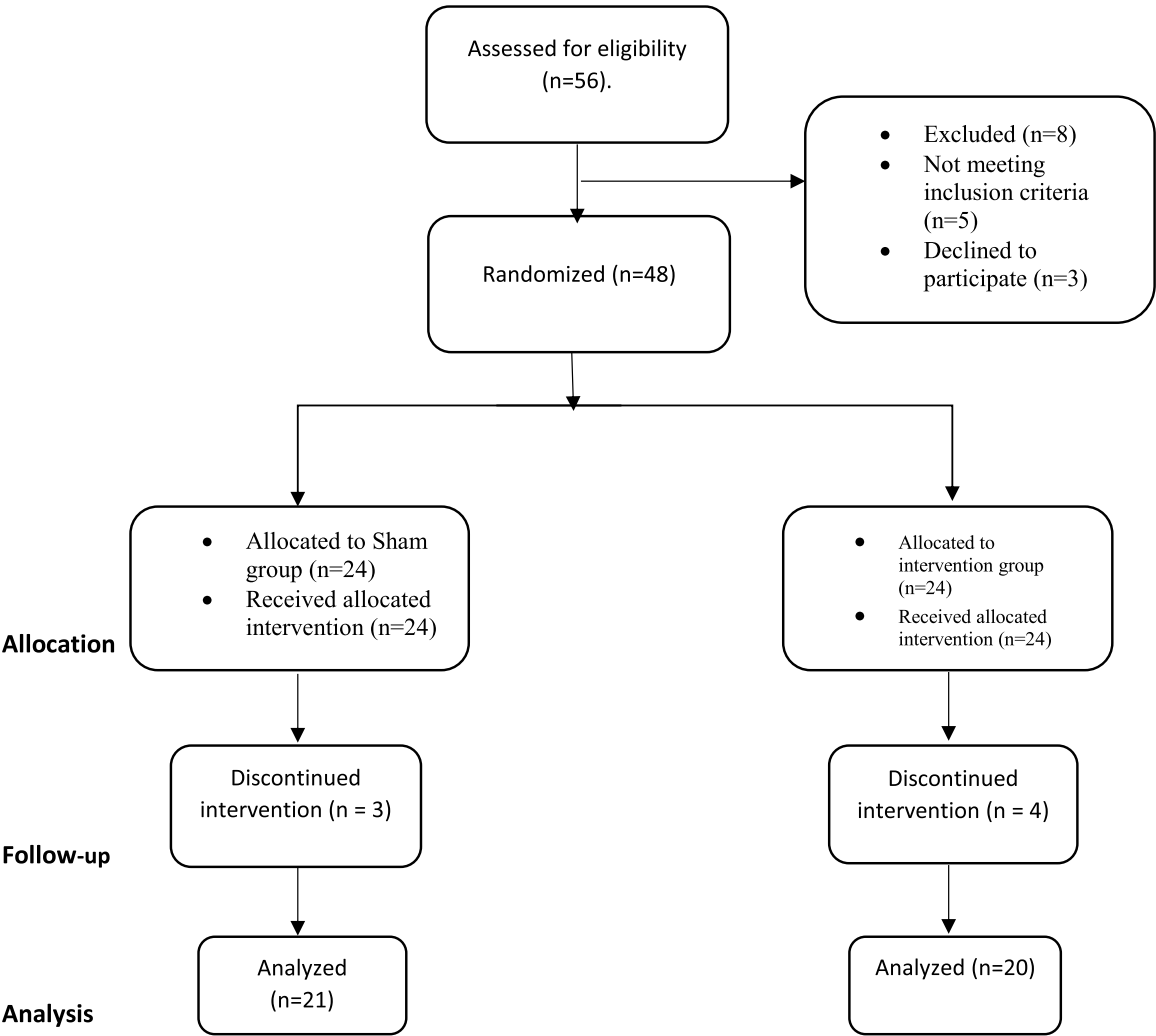


Fig 1. Participant flow diagram.

Baseline data

The mean age in the intervention group was 54.55 ± 5.02 years, while in the sham group, it was 52.76 ± 5.7 years. There were no significant differences between the two groups regarding demographic and clinical characteristics (see Table 1).

Outcomes

Neuropathy symptom score (NSS)

The comparison of the mean NSS within and between the two groups at baseline and after treatment is presented in Table 2. The intervention group demonstrated a significant decrease ($P < 0.001$) in mean neuropathy symptom scores from baseline to post-treatment. In contrast, the sham group showed no significant difference ($P = 0.17$) over the same period. The frequency of neuropathy symptoms, including burning, paresthesia, and feelings of weakness (fatigue and exhaustion), significantly decreased in the intervention group after the intervention compared to baseline, whereas no such changes were observed in the sham group (see Tables 3 and 4).

Quality of life (QoL)

The average quality of life scores before and after the intervention showed no statistically significant difference between the two groups.

However, the change in quality of life scores post-intervention was significantly greater in the intervention group compared to the sham group (see Table 4). The results indicated an improvement in quality of life in the intervention group at the end of the sixth week compared to the sham group.

Adverse outcomes

No complications were observed during the course of the study.

Discussion

In recent years, patients have shown increasing interest in non-pharmacological approaches, known as complementary therapies. According to our study results, auricular acupressure (AA) may have a positive effect on the symptoms of diabetic neuropathy and quality of life (QoL). The high prevalence of diabetes and its associated neuropathy, along with the challenges, complications, and high costs of managing the disease, highlight the importance of identifying simple, low-cost, and low-risk strategies for controlling diabetes. Our study's findings align with previous research, which has reported positive effects of acupressure on various health conditions.

While diabetic neuropathy cannot be prevented in many cases, appropriate preventive measures, timely treatment, and adequate

Table 1
Comparison of demographic and clinical characteristics between both groups.

Variable group		Intervention (n = 20)	Sham (n = 21)	P- value
Sex, n(%)	Males	5(25)	6(28.6)	0.79 [†]
	Females	15(75)	15 (71/ 4)	
Marital Status n(%)	Single/ spouse deceased	4(20)	1(4.8)	0.18 [†]
	Married	16(80)	20(95.2)	
Education Level n(%)	Lower of diploma	14(70)	14(66.7)	0.81 [†]
	Diploma and higher	6(30)	7(33.3)	
Profession n(%)	employed	7(35)	7(33.3)	0.9 [†]
	unemployed	13(65)	14(66.7)	
Income level n(%)	Less than adequate	8(42.9)	9(43)	0.85 [†]
	Adequate and more	12(57.1)	12(57)	
Smoking history, n(%)	yes	1(5)	3(14.3)	0.6 ^{††}
	no	19(95)	18(85.7)	
Age in years (Mean± SD)		54.55±5.02	52.76 ±5.7	0.29 [*]
BMI (kg/ m2)		26.74±4.31	26.2 ± 2.85	0.83 ^{^^}
Duration of exercise per week (hours) (Mean ± SD)		4.55±4.54	2.95 ±2.61	0.14 ^{^^}
Duration of diabetes (years) (Mean± SD)		10.4 ± 5.63	8.71 ±6.52	0.15 ^{^^}
Duration of diabetic neuropathy (years) (Mean± SD)		4.15±3.54	3.57 ±3.05	0.56 ^{^^}
FBG (mg/dL)		191.45 ±59.64	185.04 ±63.53	0.48 ^{^^}

SD, standard deviation; P-value, probability value; BMI, body mass index; FBG, fasting blood glucose.
† Chi square test.
†† fisher's exact test.
^ independent *t*-test.
^^ Man-whitney U test.

Table 2
Comparison of intergroup and intragroup mean scores of severity of neuropathy symptoms in two groups before and after the intervention.

Outcome measure		Intervention Mean ± SD	Sham Mean±SD	P value
NSS	Before	11.45 ± 2.5	10 ± 2.42	0.067 [*]
	After	7.25 ± 2.78	9.38 ± 2.83	0.02 [*]
P value		<0.001 [*]	0.17 [*]	

^ independent *t*-test.
* Paired *t*-test.

patient education can significantly reduce its complications⁴⁴. Our findings support the hypothesis that AA significantly reduces neuropathy symptoms and enhances the quality of life for patients with diabetic neuropathy. A study by Yu et al. (2024) found that AA helps improve glycemic indices by decreasing blood glucose, blood lipids, and body mass index in patients with type 2 diabetes, and it can prevent diabetic complications. They also reported that AA reduces Hamilton anxiety and depression scores and improves patients' quality of life, suggesting that improving sleep quality in diabetic patients is a benefit of AA. Poor sleep quality in these patients is associated with an increased risk of diabetes complications, and improving sleep can help prevent these issues⁴⁵. Wang (2024) also demonstrated in a study that AA combined with herbal medicines can reduce the symptoms of diabetic neuropathy and improve quality of life. Furthermore, Wang et al. (2014) concluded that AA was effective and safe for improving quality of life in diabetic patients with chronic kidney disease⁴⁶. Although no study has specifically

Table 3
Frequency of neuropathy symptoms in both groups before and after the intervention.

Outcome measure		Before	After
Intervention(n = 20) n (%)	Burning	18(90)	8(40)
	Numbness	18(90)	11(55)
	Paresthesia	19(95)	6(30)
	Feeling of weakness (fatigue, exhaustion)	18(90)	7(35)
	Cramps	15(75)	10(50)
	Pain	19(95)	14(70)
	Awakened from sleep	13(65)	8(40)
	Burning	19(90/ 5)	17(81)
	Numbness	15(71/ 4)	15(71/ 4)
	Paresthesia	20(95/ 2)	18(85/ 7)
Sham(n = 21) n (%)	Feeling of weakness (fatigue, exhaustion)	18(85/ 7)	15(71/ 4)
	Cramps	12(57/ 1)	13(61/ 9)
	Pain	20(95/ 2)	18(85/ 7)
	Awakened from sleep	10(47/ 6)	9(42/9)
	P value		
	Burning	1.00	0.01
	Numbness	0.23	0.34
	Paresthesia	1.00	<0.001
	Feeling of weakness (fatigue, exhaustion)	1.00	0.02
	Cramps	0.32	0.53
	Pain	0.97	0.22
	Awakened from sleep	0.35	1.00

Table 4
Comparison of the quality of life score difference before and after the intervention in two groups.

Outcome measure		Intervention Mean ± SD	Sham Mean±SD	P value
NeuroQol	before	69.95±14.19	65.38±12.1	0.27 [*]
	after	60.9 ± 14.05	63.95 ±13.21	0.47 [*]
The difference in NeuroQol		9.05 ± 6.59	1.42 ± 5.2	< 0/ 001 ^{^^}

^ independent *t*-test.
^^ Man-whitney U test.

examined the effect of AA on diabetic neuropathy, the results of our study suggest that even after neuropathy develops, AA still positively impacts neuropathy symptoms and enhances the quality of life. Other studies have explored the effect of AA on pain and neuropathy in non-diabetic patients. For example, studies by Viel et al. (2021) and Lukkahatai et al. (2024) indicated the effectiveness of auricular acupuncture for chemotherapy-induced peripheral neuropathy^{47, 48}. Yeh et al. (2019) also reported improvement in chemotherapy-induced neuropathy after four weeks of AA treatment⁴⁹. Lim and Park (2023) found that AA improved neuropathy in patients with persistent spinal pain syndrome over six weeks⁴⁹. Additionally, Yeh et al. (2020) showcased the effectiveness of auriculotherapy in alleviating neuropathic symptoms, such as pain and tingling, and improving overall activity levels in cancer patients undergoing chemotherapy⁵⁰. Mohammadpour et al. (2017) revealed the beneficial effects of auriculotherapy in reducing pain intensity prior to surgery in appendectomy candidates³⁷. The study by Kim et al. examined the impact of auriculotherapy on pain levels and quality of life in lung cancer patients. Their results suggest that auriculotherapy can be an effective approach for managing pain and improving quality of life in these patients⁵¹. In another study, Cen et al. investigated the therapeutic effects of

auriculotherapy in patients recovering from pterygoid surgery and found improvements in postoperative pain and faster regeneration of the corneal epithelium⁵². Çevik et al. demonstrated that administering acupressure three times a week for 3 min at specific points over 6 weeks resulted in reduced upper limb pain and improved quality of life among dialysis patients⁵³. Similarly, Lee et al. found that auriculotherapy using mustard-containing stickers at six specific points over four weeks led to improvements in pain levels, neck disability, and neck range of motion⁵⁴. Although there are some differences in acupressure points and methods used in these studies compared to ours, the findings suggest that AA can be beneficial for a variety of neuropathy-related conditions.

From other complementary methods, Agustini et al., Goma et al., and Cicek et al. concluded that foot reflexology positively impacts symptoms associated with diabetic neuropathy^{55–57}. Jin et al. showed that administering 90 min of acupressure therapy 4 to 6 times per week over 3 years positively impacted fasting glucose levels, blood lipids, heart and kidney function, and neuropathy in patients with type 2 diabetes⁵⁸. While Jin et al. applied acupressure therapy to the whole body, our study focused specifically on acupressure therapy applied to the ear for a shorter duration, targeting neuropathy symptoms.

Mensah and colleagues found that AA can alleviate peripheral neuropathy caused by chemotherapy, resulting in a 38 % decrease in tingling and a 49 % decrease in numbness. These therapeutic effects were maintained for up to a month following the intervention. Based on their findings, acupressure may benefit nerve repair, reduce local inflammation, and enhance nerve transmission by modulating hormone secretion that affects nerve function⁵⁹. Studies have also shown that acupuncture and auricular acupressure have beneficial effects, particularly in diabetic neuropathy, through mechanisms such as neuro-modulation⁶⁰, improved blood flow⁶¹, anti-inflammatory functions⁶², and improved sensory function⁶³. One mechanism underlying the effects of AA on diabetes is the direct stimulation of the auricular branch of the vagus nerve, which regulates the autonomic nervous system and increases insulin sensitivity and secretion. AA may also activate insulin secretion by stimulating glucose- and insulin-sensitive neurons in the nucleus of the tractus solitarius, which activates sympathetic-adrenal and vagal insulin pathways in the thalamus⁴⁵.

Systemic diseases can be treated through reflex points on the outer ear, which influence the entire body. Numerous human and animal studies emphasize that ear stimulation improves disease by facilitating physiological processes and changes⁶⁴. Unlike acupuncture, which is passive, AA is a non-invasive, low-cost method that allows patients to apply pressure to ear points for self-managed pain relief and other complications anytime, anywhere. AA is also more accessible than acupuncture because it requires minimal training for healthcare practitioners and is easier to scale up⁴⁵. AA shows promise in positively affecting behaviors related to neuropathy, especially diabetic neuropathy, potentially reducing diabetes-related complications and improving quality of life.

One potential limitation of our research is the difficulty in ensuring that both study groups consistently applied acupressure, despite our efforts to follow up with participants over the phone.

Conclusions

This non-pharmacological nursing intervention can effectively alleviate symptoms such as burning, paresthesia, and weakness, while also enhancing the quality of life for patients with diabetic neuropathy. Traditional pharmaceutical treatments and painkillers, which are commonly used to manage neuropathic symptoms, can be costly and often require a doctor's prescription and specialized personnel. In contrast, auriculotherapy (AA) is a simple, non-invasive, and affordable method that can be easily learned and applied by patients and their families. This approach enables patients with type 2 diabetes to manage neuropathy-related complications independently. According to our study, none of the participants discontinued the acupressure

intervention during the 6 weeks due to any adverse effects, which supports the safety of acupressure as a nursing intervention. Based on our findings, we recommend that additional studies be conducted to further assess the efficacy of AA. Long-term follow-up evaluations of participants who underwent this treatment are also necessary to determine any sustained effects.

Declarations

Statement of Ethics: The study was approved by the Gonabad University of Medical Sciences Ethics Committee (approval number: IR.GMU.REC.1401.002).

Consent for publication: Not applicable.

Data Availability and Materials Statement: The data used to support the findings of this study are included in the article. Further inquiries can be directed to the corresponding author.

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CRediT authorship contribution statement

Ali Mohammadalinia: Writing – original draft, Software, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Hosein Ajamzibad:** Writing – review & editing, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Formal analysis. **Seyed Javad Mojtavavi:** Supervision, Project administration, Methodology. **Tahereh Baloochi Beydokhti:** Writing – review & editing, Validation, Supervision, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

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