



Reflexology: Golden Foot Massage on Leg Cramps for Hemodialysis Patients

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ABSTRACT

Leg cramps have been listed by dialysis patients as one of the major stressors that might cause a variety of psychological and physiological issues. A complementary and alternative therapy called foot reflexology can be utilized in addition to more mainstream medical procedures. **Aim:** To evaluate the effectiveness of reflexology foot massage on leg cramps for hemodialysis patients. **Design:** A quasi-experimental design was applied. **Setting:** The hemodialysis units are affiliated with Mansoura International Hospital. **Results:** There was a significant improvement with a highly statistically significant difference in all A novel muscle cramp scale (MCS) items scores, which measure the frequency of reported muscle spasms for hemodialysis patients during the sessions of dialysis pre- and post-application of reflexology foot massage at a P-value <0.001. **Conclusion:** This study found that reflexology foot massage significantly reduced the frequency, intensity, and length of leg cramps in hemodialysis patients. As a result, it is more successful at reducing leg cramps in these patients. **Recommendation:** This study recommends introducing reflexology foot massage as routine care in dialysis units, which in turn creates a new area and a new trend in the nursing field, which sequentially increases the value of nursing.

***Keywords:** Hemodialysis Patients, Leg cramps, Reflexology foot massage.*

1. Introduction

Chronic kidney disease is a progressive disorder that affects more than 10 percent of the general population worldwide, amounting to more than 800 million individuals (Kovesdy, 2022). Hemodialysis is considered the main mode of treatment for this disease, as well as, one of the most high-tech procedures and a life-saving

treatment for those patients (Levey, Becker, and Inker, 2015; Urquhart-Secord, et al., 2016).

According to Flythe et al. (2019), more than half of hemodialysis patients experience fatigue, cramps, and disturbed sleep. Patients claim that symptoms have a significant impact on their quality of life because they interfere with their capacity to maintain healthy social interactions,

financial security, and general well-being (Cox, et al., 2017; Flythe, et al., 2018).

Leg cramps are defined as an abrupt onset, excruciating, and continual involuntary muscle contraction that primarily affects the lower limbs and occurs toward the end of dialysis sessions. Although the exact cause of cramping in dialysis patients is unknown, several frequent triggers have been noted, including electrolyte imbalances, hypovolemia, hypotension, the dialysis prescription (including blood flow rate and ultrafiltration), and dialysate composition (Mastnardo, et al., 2016).

Intravenous fluids, oral medicines, and modifications in the dialysis setting are examples of therapeutic actions to treat muscle cramps. Despite the fact that medications have significant results, chemical drugs are costly and have serious adverse effects, particularly for patients with end-stage renal disease (ESRD) (Mastnardo, et al., 2016). As a result, medical professionals are looking for alternative treatments with fewer side effects in order to lower patients' symptom burden, which has led to a significant rise in the use of complementary and alternative medicine (CAM) globally (Najafi, et al., 2016).

Massage therapy is the most popular used form of treatment in CAM and one of the most common CAMs in the nursing specialty because it is easy, safe, non-invasive, and relatively inexpensive to apply (Kemppainen, et al., 2018). Massage comes in a variety of forms; the most common type is reflexology (Chen, et al., 2019; Smith, et al., 2018).

Reflexology is the oldest medical treatment

in existence. It was created in ancient China and Egypt and is based on a scientific massage method. According to reflexology, the feet represent a miniature map of the body, reflecting all of the organs and bodily components. During that procedure, the therapist applied pressure with his fingers, particularly the thumbs, to specific reflex spots or centers on both feet that were thought to work in conjunction with the internal organs, glands, as well as other body parts in order to renovate health and create balance throughout the entire body (El-Deeb, et al., 2017).

This method helps in the healthy release of energy in numerous organs and cells, which are connected to pressure points, and aids the body in healing itself (Ghanbari et al., 2022; Song et al., 2018). It also provides physiological comfort, speeds up blood circulation, and enables the body to maintain equilibrium. Unquestionably, nursing disciplines like midwifery, orthopedics, neuroscience, and palliative care have made substantial use of reflexology massage. However, most CAM therapies lack scientific proof to support their efficacy and safety. While anecdotal research suggests that reflexology massage is valuable for a variety of health problems, including pain, migraines, chronic obstructive pulmonary disease (COPD), pre-and postnatal discomfort, and so forth (El-Deeb et al., 2017).

Overall, nursing care is very important due to the high prevalence of chronic kidney diseases and the noticeable increase in hemodialysis patients, as well as the need these patients have for physical and mental care. Additionally, reducing the complications associated with dialysis can improve the quality of life for these patients. Reflexology

massage can be regarded as part of nursing care because it is easy and non-intrusive (Lightfoot, et al., 2022).

Significance of the study

Leg cramps are one of the most frequent complications of hemodialysis treatment, encountered by 33 - 86% of patients (Takahashi, 2021). Recurrent muscle cramps during dialysis frequently result in many consequences, such as noncompliance with the prescribed hemodialysis sessions and early hemodialysis session termination, which is regarded as a major factor in chronic fluid overload, hypertension, and cardiovascular disease (Mastnardo, et al., 2016). Additionally, repeated episodes of muscle cramps contribute to chronic pain, insomnia, and a decline in the patient's physical as well as social activities (El-Deeb, et al., 2017).

As reflexology grows in popularity in nursing practice, it may be an effective treatment for hemodialysis-related leg cramps in carefully selected patients (Takabashi, 2021). Therefore, this study aims to evaluate the effectiveness of foot reflexology massage on leg cramps in hemodialysis patients. For all patients undergoing hemodialysis, the procedure is expected to help alleviate some of the unpleasant physical and mental symptoms associated with this condition and its treatment.

2. Aim of the Study

To evaluate the effectiveness of reflexology foot massage on leg cramps for hemodialysis patients.

2.1. Research Hypothesis

Reflexology foot massage will reduce the occurrence of leg cramps among hemodialysis patients after applying reflexology techniques.

3. Method

3.1. Study Design

A quasi-experimental research design was applied using a pre and post-test.

3.2. Settings

This study was conducted at the hemodialysis units of Mansoura International Hospital.

3.3. Subjects

A purposive sample of 45 male and female adult patients with chronic kidney disease undergoing hemodialysis was enrolled in this study in the above-mentioned setting based on the following criteria: patients aged between 18 and 60years, who have received hemodialysis three times a week for at least 6 months and have a marked level of leg cramp. Fully conscious and oriented, willing to participate in the study, and cooperative, with the ability to communicate verbally.

On the other hand, Patients with open foot wounds, suspicious fractures, burns, deep vein thrombosis, peripheral neuropathy, peripheral vascular diseases in the lower limbs, skin problems including eczema or acute psoriasis, and patients who underwent surgery in the leg were excluded.

Sample size: Based on data from the literature (Ghasemi, et al., 2018), considering the level of significance of 5%, and power of study of 80%, the sample size can be calculated using the following formula (Charan & Biswas, 2013):

$$n = \frac{(Z_{\alpha/2} + Z_{\beta})^2 \times 2(SD)^2}{d^2}$$

Where, SD = standard deviation obtained from the previous study; $Z_{\alpha/2}$, for 5% this is 1.96; Z_{β} , for 80% this is 0.84; and d is the expected mean difference. Therefore,

$$n = \frac{(1.96 + 0.84)^2 \times 2(4.91)^2}{(2.9)^2} = 44.9$$

Based on the above formula, the sample size required is 45.

3.4. Tools of Data Collection

Three tools were used in this study:

Tool I: Structured interview questionnaire

It was constructed by the researchers and written in simple, plain Arabic after reviewing various relevant literature (El-Deeb, et al. 2017; Ghanbari, et al., 2022). It is composed of three parts:

Part (1): Was concerned with patients' characteristics, which included, age, gender, marital status, educational level, occupation, and residence.

Part (2): Consists of the patient's present medical history involving; the beginning of hemodialysis treatment, duration of the dialysis session, type of venous access, and manner of treating leg cramps.

Part (3): Included factors that potentially increase the incidence of leg cramps among studied patients include the incidence of renal failure in years, chronic diseases, dry weight, and inter-dialytic weight gain.

Tool II: A novel Muscle Cramp Scale (MCS):

This tool was developed by Mitsumoto, et al., (2019) to assess the frequency, severity, and clinically meaningful information related to cramps among patients with amyotrophic lateral sclerosis (ALS). This scale includes 5-point subdomains that were included as follows:

- (1) **Triggering factors** include; no cramps with any muscle activity, rare with unusual or strenuous muscle activity, frequently with strenuous muscle activity, almost always with strenuous muscle activity, and almost always with any muscle activity.
- (2) **Frequency** involving; none a week, less than three in a week, on average once a day, less than five a day, and more than five a day.
- (3) **Location** ranging from one area, two areas, three areas, four areas, and everywhere among six body regions (both legs, both arms, torso, and neck).
- (4) **Severity** including the unrecognized or trivial sensation of cramps, Minor discomfort, and easily aborted, a massage or a special maneuver can be used to abort or stop cramps and pains, a massage or special maneuver cannot easily abort or stop cramps that last less than a few minutes, and nearly continuous cramps, pains, or discomfort.
- (5) **The degree to which cramps affect overall daily living** through using a visual analog scale which contains 10- point ranges from 0 representing (no pain effects on overall daily living) to 10 representing (extreme pain effects on overall daily living).

Scoring system: Each item was included in the measurement and assigned a 5-6 point Likert scale ranging from 'none' to 'most severe', whereas a visual analogue scale (10 point subscales). Patient's responses on each item of this part of the tool were calculated and presented as numbers and percentages.

Tool III: Effectiveness of Foot Reflexology Questionnaire:

It was developed by the researchers and concerned with additional questions asking about the effectiveness of foot reflexology from the patients' point of view, it includes 2 responses ranging from 0 for not effective to 2 for effective after a review of relevant literature (Çeçen, & Lafci, 2021; Shraida, Abd-Ali, & Mohammad, 2021).

Content validity and reliability:

- Tool I and Tool III were developed by researchers in Arabic and English. The content validity of both the English and Arabic versions was verified by five experts in the field of medical and surgical nursing from the Faculty of Nursing at Mansoura University and two experts in the field of nephrology from the Faculty of Medicine at Mansoura University. Necessary modifications were made accordingly, and the final form of the tool was developed.
- The reliability of the tools was determined using Cronbach's Alpha. Reliability of tool I was 0.787. Whereas for tool II internal reliability of the scale, a Cronbach's coefficient value of 0.75 or higher was considered

acceptable and finally reliability of tool III was 0.893.

3.5. Pilot Study

Conducted on 10% (5) patients in a research setting to test the clarity, applicability, and relevance of the developed tools and to identify problems that may arise during the application of massage and the estimated time required for data collection. Subjects who participated in the pilot study were not included in the sample for this study.

3.6. Field Work

Data collection for the current study was carried out over three months, from the beginning of March 2023 till May 2023. The researchers attended to the earlier mentioned setting three days/ week from 8.30:00 Am to 3:30 Pm. The study was conducted in three phases, that is, assessment, implementation then evaluation.

3.6.1. Assessment phase:

- This phase began at the hemodialysis unit, interviewing patients who met the study criteria to explain the purpose and aim of the study, explain in detail the benefits of the foot reflexology process and expected results, and obtain consent to participate in the study.
- The researchers were present in the clinical setting three days per week during morning and afternoon shifts to interview each patient to collect baseline data on the studied patients' characteristics through Tool I Part 1. In addition, assess patients' present medical history using Tool I Part 2, factors that potentially

increase the incidence of leg cramps using Tool I Part 3, and assess frequency, severity, and clinically significant meaningful information interrelated to cramps among patients using Tool II.

- These interviews took about 20 to 30 minutes for each patient.

3.6.2. The implementation phase:

- The researchers observed every patient during hemodialysis sessions and when leg cramps occurred during them.
- The researchers, who received a certificate after completing a 30-hour theoretical and practical education in foot reflexology, performed reflexology techniques.
- The general sole reflexology, which is performed on 21 points of reflexology in the sole, was used.
- Preceding the performance of a massage, the masseur would ensure a short evaluation to verify the patient was free from any new skin issues on the legs or feet such as redness, heat, rashes and sores, blood clots in legs, or vascular access in the lower extremities, to be suitable for treatment on the same day.
- Each session began with a minute of relaxation techniques to reduce body tension and muscle spasms before moving on to the main massage session. These techniques involved back-and-forth movements of the reflexologist's palm on the outer edge of the patient's foot from the lateral ankle (metatarsals) to the little toe.

- First, the masseuse supported the toe with one hand and, with the index finger phalanx of the other hand, massaged the sole from the toe junction to the heel (top to bottom). The masseuse then massaged the inner edge of the foot from the big toe to the inner ankle using light pressure with the edge of the hand.
- The masseuse placed the heel of one foot in the left hand and used the thumb of the right hand to apply massage in a reciprocating motion on the appropriate reflex sites. The masseur moved the outer edge of the patient's foot back and forth with the palm of his hand. The masseur massaged all the relevant reflex points on the outside of the big toe with gentle fast-paced movements with acceptable pressure.
- Finally, the general relaxation technique of massage was performed for 1 minute to relax and cool the muscles.
- This technique was performed immediately after the hemodialysis session for 30 minutes on both legs (15 minutes on each leg), 3 times per week (every other day) for 4 consecutive weeks, for a total of 12 sessions for each patient.

3.6.3. The evaluation phase:

After the twelfth session for each patient, an evaluation was conducted for the study sample. By comparing leg cramps pre and post-reflexology was implemented, tool II was used to estimate the effect of the intervention in order to determine whether the study's aim had been achieved, and tool III was used to assess how well the intervention affected the study participants' leg cramps.

3.7. Ethical Considerations and Human Rights:

- Ethical approval was obtained from the Research Scientific Ethical Committee of the Faculty of Nursing, Mansoura University (Ref. No. P. 0436).
- A formal approval for conducting the study was obtained once the responsible administrative staff members were made aware of its aim.
- Participants were informed that their participation in the study was voluntary and that they might withdraw at any time without facing any repercussions.
- After listing the objectives, advantages, and reflexology techniques of the study, each patient verbally consented to take part.
- The data's confidentiality and anonymity were assured, and they were solely utilized for the study.

3.8. Statistical Analysis

The data were collected, coded, entered on a personal computer, and analyzed with the statistical package for social science (SPSS). Qualitative data were presented as frequencies (n) and percentages (%). Quantitative data were described using the mean and standard deviation. The chi-square test and Fisher's exact test were used. The significance level was standardized to be Non-significant (NS) at $P > 0.05$; Significant (S) at $P < 0.05$ and Highly Significant (HS) at $P < 0.001$.

4. Results

Table (1); Showed the characteristics of the studied hemodialysis patients, 55.6% of them were

males, and 42.2% were in the age group (>50 years). The same table illustrated that 35.6% of them had a bachelor's degree, while 77.8% of those patients were not working. According to the training program regarding reflexology, this table reflected that about 82.2% did not attend any training program.

Table (2); Demonstrated that 31.1% and 40.0% of the participants had kidney failure and had started dialysis 4 –7 years ago, respectively. In addition to 44.4% of the patients spending about 3 hours and a half in the dialysis session and 82.2% of them performing dialysis through a fistula, the same table showed 77.6% of the participants had chronic illnesses, with the largest percentage, which was 58.8%, being represented by anemia. While 40.0% of the hemodialysis patients gain weight between the dialysis sessions (approximately 1 – 2 kg), 31.1% of them gain 3 – 4 kg. On the other hand, 31.4% of the participants used drugs only to overcome leg cramps.

Table (3); Showed that there was an improvement with a highly statistically significant difference between all A novel muscle cramp scale (MCS) items scores that measure the frequency of reported muscle spasms for hemodialysis patients during the sessions of dialysis pre and post-application of reflexology foot massage at P-value < 0.001 .

Fig. (1); Illustrated that 73.3% of the participants approved of the effectiveness of the foot reflexology technique in improving leg cramps, which occur during sessions of dialysis.

Table (4); Revealed that there was no

statistically significant association between all A novel muscle cramp scale (MCS) items and the effectiveness of the foot reflexology score at P-value >0.05 before applying the foot reflexology technique. On the other hand, the same table illustrated that there was a statistically significant association between a novel muscle cramp scale (MCS) items, which are represented in the Location of muscle cramps and Visual analog

scale, and the effectiveness of foot reflexology score at P-value ≤ 0.05 . In addition, there was a highly statistically significant association between both of them at the point of triggering muscle cramps (P-value <0.001) after applying the foot reflexology technique, which reflected the effectiveness of the reflexology technique in improving leg cramps that occur during sessions of dialysis.

Table 1. Number and distribution of the Demographic characteristics of the patients On Hemodialysis With leg Cramps (n=45)

| | No. | % |
|--|-----|-------|
| Age | | |
| 20 – 30 | 6 | 13.33 |
| 30 – 40 | 9 | 20.0 |
| 40 – 50 | 11 | 24.44 |
| >50-60 | 19 | 42.22 |
| Gender | | |
| Male | 25 | 55.6 |
| Female | 20 | 44.4 |
| Marital Status | | |
| Single | 5 | 11.1 |
| Married | 27 | 60.0 |
| Divorced | 6 | 13.3 |
| Widow | 7 | 15.6 |
| Educational Level | | |
| Illiterate | 7 | 15.6 |
| Read and write | 10 | 22.2 |
| Diploma | 12 | 26.7 |
| Bachelor's degree | 16 | 35.6 |
| Occupational Status | | |
| Work | 10 | 22.2 |
| Don't work | 35 | 77.8 |
| Residence | | |
| Countryside | 10 | 22.2 |
| City | 35 | 77.8 |
| Did you attend training before? | | |
| Yes | 8 | 17.8 |
| No | 37 | 82.2 |

Table 2. Number and distribution of the factors affecting leg cramps of the hemodialysis patients (n=45)

| | N | % |
|---|----|------|
| Period of renal failure (Years) | | |
| 1 – 3 | 9 | 20.0 |
| 4 – 7 | 14 | 31.1 |
| 8 – 11 | 11 | 24.4 |
| <11 | 11 | 24.4 |
| The dialysis period (Years) | | |
| 1 – 3 | 7 | 15.6 |
| 4 – 7 | 18 | 40.0 |
| 8 – 11 | 12 | 26.7 |
| < 11 | 8 | 17.8 |
| Duration of dialysis session (Hours) | | |
| 2 hours and half | 6 | 13.3 |
| 3 hours | 2 | 4.4 |
| 3 hours and half | 20 | 44.4 |
| 4 hours | 17 | 37.8 |
| Type of venous access | | |
| Fistula | 37 | 82.2 |
| Graft | 2 | 4.4 |
| Central venous catheter(CVP) | 6 | 13.3 |
| Chronic Illness | | |
| Yes | 34 | 77.6 |
| No | 11 | 24.4 |
| Types of chronic illness? (n=34) | | |
| Diabetes | 5 | 14.7 |
| Hypertension | 19 | 55.9 |
| Inflammation of urinary system | 3 | 8.8 |
| Anemia | 20 | 58.8 |
| Intradialytic weight gain | | |
| 0 – 1 | 8 | 17.8 |
| 1 – 2 | 18 | 40.0 |
| 3 – 4 | 14 | 31.1 |
| < 4 | 5 | 11.1 |
| Action taken to overcome leg cramps (n=35) | | |
| Drugs only | 11 | 31.4 |
| Exercises only | 10 | 28.6 |
| Drugs and exercises | 10 | 28.6 |
| Nothing | 4 | 11.4 |

Table 3. Number and distribution of the A novel muscle cramp scale (MCS) score of the patients On Hemodialysis With leg Cramps (n=45)

| | Pre-Intervention | | Post-Intervention | | Chi-Square | |
|--|------------------|------|-------------------|------|------------|----------|
| | n | % | N | % | X2 | P |
| Triggering of muscle cramps | | | | | | |
| No cramps with any muscle activity | 0 | 0.0 | 22 | 48.9 | 36.657 | <0.001** |
| Rare with unusual or strenuous muscle activity | 19 | 42.2 | 17 | 37.8 | | |
| Frequently with strenuous muscle activity | 16 | 35.6 | 6 | 13.3 | | |
| Almost always with strenuous muscle activity | 6 | 13.3 | 0 | 0.0 | | |
| Almost always with any muscle activity | 4 | 8.9 | 0 | 0.0 | | |
| Frequency of muscle cramps | | | | | | |
| None | 0 | 0.0 | 20 | 44.4 | 38.038 | <0.001** |
| Less than 3 in a week | 14 | 31.1 | 18 | 40.0 | | |
| On average once a day | 19 | 42.2 | 7 | 15.6 | | |
| Less than 5 a day | 8 | 17.8 | 0 | 0.0 | | |
| More than 5 a day | 4 | 8.9 | 0 | 0.0 | | |
| Location of muscle cramps | | | | | | |
| No areas | 0 | 0.0 | 16 | 35.6 | 44.267 | <0.001** |
| One area | 1 | 2.2 | 13 | 28.9 | | |
| Two areas | 10 | 22.2 | 7 | 15.6 | | |
| Three areas | 22 | 48.9 | 9 | 20.0 | | |
| Four areas | 7 | 15.6 | 0 | 0.0 | | |
| Everywhere | 5 | 11.1 | 0 | 0.0 | | |
| Severity of most cramps | | | | | | |
| No pain | 0 | 0.0 | 17 | 37.8 | 54.143 | <0.001** |
| Unrecognized sensation of cramps | 0 | 0.0 | 9 | 20.0 | | |
| Minor discomfort and easily aborted | 4 | 8.9 | 10 | 22.2 | | |
| A massage or special maneuver can be used to stop cramps | 19 | 42.2 | 9 | 20.0 | | |
| A massage or special maneuver cannot easily stop cramps | 18 | 40.0 | 0 | 0.0 | | |
| Nearly continuous cramps | 4 | 8.9 | 0 | 0.0 | | |
| Visual analog scale | | | | | | |
| None | 0 | 0.0 | 19 | 42.2 | 52.596 | <0.001** |
| Mild | 0 | 0.0 | 13 | 28.9 | | |
| Moderate | 14 | 31.1 | 4 | 8.9 | | |
| Severe | 22 | 48.9 | 3 | 6.7 | | |
| Very severe | 9 | 20.0 | 6 | 13.3 | | |

Chi-Square test

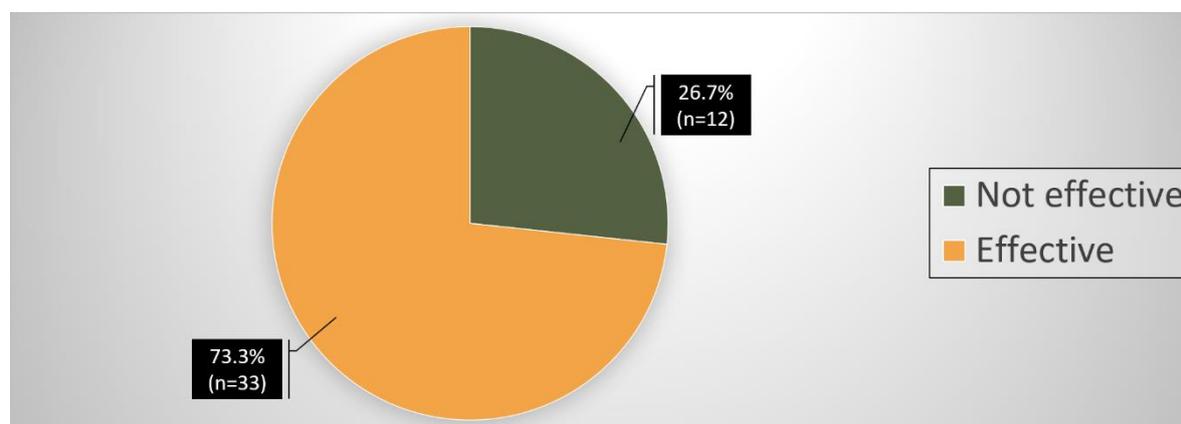
** Highly statistically significant at $p \leq 0.001$.**Figure 1. Distribution of effectiveness of foot reflexology score**

Table 4. Association between A novel muscle cramp scale (MCS) and effectiveness of foot reflexology score

| | Pre-Intervention | | | | Post-Intervention | | | |
|--|--------------------------------|------|-----------|------|-----------------------------------|------|-----------|------|
| | Not Effective | | Effective | | Not Effective | | Effective | |
| | N | % | n | % | n | % | n | % |
| Triggering of muscle cramps | | | | | | | | |
| No cramps with any muscle activity | 0 | 0.0 | 0 | 0.0 | 1 | 8.3 | 21 | 63.6 |
| Rare with unusual or strenuous muscle activity | 3 | 25.0 | 16 | 48.5 | 10 | 83.3 | 7 | 21.2 |
| Frequently with strenuous muscle activity | 6 | 50.0 | 10 | 30.3 | 1 | 8.3 | 5 | 15.2 |
| Almost always with strenuous muscle activity | 3 | 25.0 | 3 | 9.1 | 0 | 0.0 | 0 | 0.0 |
| Almost always with any muscle activity | 0 | 0.0 | 4 | 12.1 | 0 | 0.0 | 0 | 0.0 |
| Fischer's exact test | X ² =5.235, P=0.155 | | | | X ² =14.801, P<0.001** | | | |
| Frequency of muscle cramps | | | | | | | | |
| None | 0 | 0.0 | 0 | 0.0 | 1 | 8.3 | 19 | 57.6 |
| Less than 3 in a week | 0 | 0.0 | 14 | 42.4 | 6 | 50.0 | 12 | 36.4 |
| On average once a day | 8 | 66.7 | 11 | 33.3 | 5 | 41.7 | 2 | 6.1 |
| Less than 5 a day | 2 | 16.7 | 6 | 18.2 | 0 | 0.0 | 0 | 0.0 |
| More than 5 a day | 2 | 16.7 | 2 | 6.1 | 0 | 0.0 | 0 | 0.0 |
| Fischer's exact test | X ² =8.532, P=0.036 | | | | X ² =12.382, P=0.002* | | | |
| Location of muscle cramps | | | | | | | | |
| No areas | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 16 | 48.5 |
| One area | 0 | 0.0 | 1 | 3.0 | 5 | 41.7 | 8 | 24.2 |
| Two areas | 0 | 0.0 | 10 | 30.3 | 3 | 25.0 | 4 | 12.1 |
| Three areas | 8 | 66.7 | 14 | 42.4 | 4 | 33.3 | 5 | 15.2 |
| Four areas | 2 | 16.7 | 5 | 15.2 | 0 | 0.0 | 0 | 0.0 |
| Everywhere | 2 | 16.7 | 3 | 9.1 | 0 | 0.0 | 0 | 0.0 |
| Fischer's exact test | X ² =5.525, P=0.238 | | | | X ² =9.136, P=0.028* | | | |
| Severity of most cramps | | | | | | | | |
| No pain | 0 | 0.0 | 0 | 0.0 | 1 | 8.3 | 16 | 48.5 |
| Unrecognized sensation of cramps | 0 | 0.0 | 0 | 0.0 | 3 | 25.0 | 6 | 18.2 |
| Minor discomfort and easily aborted | 0 | 0.0 | 4 | 12.1 | 4 | 33.3 | 6 | 18.2 |
| A massage or special maneuver can be used to stop cramps | 4 | 33.3 | 15 | 45.5 | 4 | 33.3 | 5 | 15.2 |
| A massage or special maneuver cannot easily stop cramps | 6 | 50.0 | 12 | 36.4 | 0 | 0.0 | 0 | 0.0 |
| Nearly continuous cramps | 2 | 16.7 | 2 | 6.1 | 0 | 0.0 | 0 | 0.0 |
| Fischer's exact test | X ² =3.283, P=0.350 | | | | X ² =6.324, P=0.097 | | | |
| Visual analog scale | | | | | | | | |
| None | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 19 | 57.6 |
| Mild | 0 | 0.0 | 0 | 0.0 | 5 | 41.7 | 8 | 24.2 |
| Moderate | 3 | 25.0 | 11 | 33.3 | 2 | 16.7 | 2 | 6.1 |
| Severe | 7 | 58.3 | 15 | 45.5 | 1 | 8.3 | 2 | 6.1 |
| Very severe | 2 | 16.7 | 7 | 21.2 | 4 | 33.3 | 2 | 6.1 |
| Fischer's exact test | X ² =0.586, P=0.746 | | | | X ² =13.925, P=0.008* | | | |

Fisher's exact test * statistically significant at p ≤ 0.05.

** Highly statistically significant at p ≤ 0.001

5. Discussion

Foot reflexology is a type of complementary medicine that works on the reflex points on the feet by applying pressure and massage. They serve as miniature mirrors, reflecting all of the body's organs. Reflexology massage's exact mechanism of action is still unknown. Nevertheless, the results of numerous studies show that foot reflexology massage has favorable and helpful benefits in lowering pain, improving sleep quality, and relieving weariness. Although reflexology cannot be used as a substitute for medical care, it can be a calming and enjoyable adjuvant therapy (Kotruchin et al., 2021).

According to the results of the concurrent study, nearly two-fifths of the studied sample were over fifty years old, and more than half of them were male. Additionally, slightly more than three-quarters of the studied group were unemployed, and around one-third of them had a bachelor's degree. Moreover, the majority of the studied group reported not receiving any training regarding foot reflexology.

These findings were supported by El-Deeb, et al. (2017), who showed that more than half of the research groups were men, where nearly half of them were in their 50s to 60s, and nearly one quarter had college degrees. Furthermore, Shahriari, et al. (2021), revealed that more than two-fifths of the participants aged 50 years and older, half of the participants were male, the majority were married, more than half were housewives (unemployed), but more than half of the participants were illiterate, and most of the

patients reported not having any reflexology training before.

Additionally, the results elaborated that two-fifths of the studied group had kidney failure and had been undergoing dialysis for four to seven years. Slightly more than two-fifths of the participants underwent dialysis for roughly three and a half hours, with the majority of them utilizing a fistula as the recommended optimal form of vascular access for patients with CKD. Nearly three-quarters of the participants had a chronic illness, with the largest percentage (more than half) being represented by anemia, as CKD affects erythropoietin production, which plays an important role in bone marrow stimulation to produce red blood cells.

These findings were supported by Elezi, et al. (2023), who clarified that nearly one-third of the patients originated from renal disease caused by chronic kidney disease. More than half of the patients had more than four years of dialysis, and two-fifths had less than four years. For the frequency of dialysis, more than three-quarters of them attended the dialysis units three or more times during the week, and only one-fifth of them attended the dialysis center two times a week. Three-quarters of the patients reported four hours of hemodialysis each time. This is a well-known treatment protocol in Egypt in terms of the number of days of dialysis and the average number of session hours, and it follows the patient's condition.

The results indicate that two-fifths of the

studied group gained between one and two kilograms of weight between dialysis treatments (intradialytic weight gain). Moreover, around one-third of the participants in the study exclusively used medications to treat leg cramps. Similar results have also been reported by Elezi et al. (2023), who clarified that all patients had allied problems with some comorbidities, where more than two-thirds presented cardiovascular diseases (Anemia), two-fifths of the patients had diabetes mellitus (DM), and only one-tenth had rheumatoid arthritis.

Also, Naylor et al. (2019) adduced that slightly more than half of the patients had kidney graft failure. In addition, Shady and Ali (2019) demonstrated that around two-fifths of the studied sample reported four to six years as the duration of hemodialysis and two-thirds stated that they gained between 1.5 to 2.5 kg during inter-dialysis. Furthermore, Razavi, et al. (2022) stated that the entire studied group had a history of chronic diseases.

In the same vein, results of the present study showed that around one-third of the studied group were using drugs only to overcome leg cramps. This finding was matched with Panchiri, Joshi, and Dumbre's 2017 conclusion that, among the samples, half of them took medications as an alternative therapy for muscle cramps. Moreover, Suprapti, et al. (2019) elaborated that Muscle cramps were overcome with 40% dextrose, normal saline, methampyrone, and calcium gluconate.

The present study's findings revealed an

improvement with a highly statistically significant difference between all of the items on a novel muscle cramp scale score that evaluates the frequency of reported muscle spasms for hemodialysis patients during dialysis sessions before and after the use of a reflexology foot massage technique. In addition, there was a statistically significant correlation between the effectiveness of the foot reflexology score and the novel muscle cramp scale items representing the Location of muscle cramps and Visual analog scale, as well as a highly statistically significant correlation between the two of them at the point of muscle cramp onset after using the reflexology foot massage technique.

According to the researchers, all of these results show how effective the reflexology treatment is at easing leg cramps that might occur during dialysis sessions. The proprioceptor reflexology theory may also be able to explain these findings. This idea states that each foot has about 7,200 nerve terminals. They provide the brain with information, and the brain then produces the proper response to ease tight muscles, promote relaxation, and increase endorphin levels in the brain.

Zone reflexology theory also explains how reflexology foot massage reduced hemodialysis cramps. In accordance with this theory, energy is constantly carried through the body's ten invisible channels, which run from head to foot in a straight line and end at the tips of all toes. Certain reflex spots on these 10 energy routes, when pushed with the thumbs or fingers, bring energy into balance

where there was previously an unbalance. Hence, applying pressure to the leg reflex points will reduce cramping.

These results were in agreement with Razavi, et al. (2022), who pointed to the significant effect of foot reflexology on pain intensity during fistula needle insertion during three reflexology sessions over time. Additionally, the result of the present research was supported by, Sayari, Nobahar, and Ghorbani (2021), who performed a study on 90 patients with acute myocardial infarction (MI) and determined that the severity of myocardial infarction after twenty minutes of foot reflexology declined significantly immediately after its completion.

In addition, the findings of the study by Koraş and Karabulut (2019) showed that foot massage helped patients who had undergone laparoscopic cholecystectomy experience less pain and anxiety. In the research mentioned, foot massage over time had a more significant impact on the reduction of pain, which is consistent with the findings of the current study. In their meta-analysis titled "Impact of foot reflexology on pain and physiological indicators in postoperative patients," Tian, Li, and Yan (2021) referred to the impact of foot reflexology on the abatement of postoperative pain.

Furthermore, El-Deeb, et al. (2017) concluded that hemodialysis patients who received foot reflexology had significantly reduced leg cramp intensity, frequency, and duration. Also, the results of this study support those of Ozdemir,

Ovayolu, and Ovayolu (2013), who found that patients receiving reflexology foot massage experienced a reduction in the severity of cramps while undergoing hemodialysis.

According to a 2015 study by Bozan and Anadolu, reflexology treatments given to hemodialysis patients after their treatments resulted in a reduction in foot pain and cramps. Anne, et al. (2015) conducted a study to support their findings. They assessed the effectiveness of a 20-minute foot massage given before each hemodialysis treatment for two weeks, resulting in up to six massage sessions. Our findings demonstrated that foot massage was a nursing intervention that effectively reduced the severity of leg cramps.

In the same speech, Kishore et al. (2021) came to the conclusion that foot reflexology is a safe and efficient tool that aids in hemodialysis patients' pain reduction. This study emphasizes the necessity for foot reflexology to be accepted as an efficient therapy in hospital settings.

Lastly, findings of the present study showed that around three-quarters of the studied group approved of the effectiveness of the foot reflexology technique in improving leg cramps, which occur during dialysis sessions. This result was agreed upon by Mastnardo, et al. (2016), who stated that intradialytic foot reflexology appears to be an effective way to address muscle cramping. Besides, Shahgholian, Karimian, and Valiani (2016), found that reflexology and stretching exercises can diminish the severity of restless leg

syndrome. These two methods of treatment are recommended to the patients. Though, foot reflexology massage had been more effective.

6. Conclusion

The findings of the current study support the effectiveness of reflexology foot massage as a method for reducing leg cramps in hemodialysis patients by showing that: Patients who received a course of reflexology foot massage on all reflex points on both feet following a hemodialysis session experienced a significant reduction in intensity levels, frequency, and duration of leg cramp.

7. Recommendation

- Introducing foot massage as routine care in dialysis units, which in turn creates a new area and a new trend in the nursing field, which sequentially increases the value of nursing.
- Talking to administrative leaders of the hemodialysis units to conduct training courses on the importance of reflexology foot massage for patients receiving hemodialysis and how to apply it correctly.
- Further studies must focus on reflexology foot massage to make Nursing practice with hemodialysis patients supported by scientific research and the possibility of its application in other areas.

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