

## Effect of Reflexology Foot Massage on Fatigue level for Patients Undergoing Hemodialysis

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### Abstract

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**Background:** Fatigue is common problems in patients undergoing hemodialysis. It often results in the early termination of a hemodialysis session. **Objectives:** This study aimed to evaluate the effect of reflexology foot massage on fatigue level for patients undergoing hemodialysis. **Methods:** It was conducted at the hemodialysis units of Mansoura University Hospital and Esalam El-Dawly Hospital. The sample included 72 adult patients undergoing hemodialysis, divided equally into study and control groups, 36 patients each. Three tools were used to collect necessary data, hemodialysis patient's assessment, fatigue intensity scale and fatigue assessment. **Results:** The findings of the study revealed that there was no statistical significant difference between the study and control groups in relation to fatigue intensity, duration, alleviating factors, and frequency before interventions. While, patients on hemodialysis experienced significantly decreased fatigue intensity, duration and frequency throughout the nine massage sessions among the studied patients over the control groups. **Conclusion:** This study concluded that hemodialysis patients who receive reflexology foot massage had significant decrease in fatigue intensity. In addition to the improvement of physical activities, emotional wellbeing, sleeping pattern and social activities. **Recommendation:** This study recommended that reflexology foot massage should be used as evidence base for nursing practice with patients on hemodialysis.

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**Keywords:** Hemodialysis fatigue level, Reflexology foot massage

### • Introduction

Fatigue is one of the most common symptoms that patients with chronic illness experience <sup>(1)</sup>. It is under – recognized and under –treated by providers, most likely due to its insidious, invisible nature. Patients with end stage renal disease identify fatigue as one of the most troubling symptoms, with a prevalence ranging from 60% to 97% <sup>(2-5)</sup>. Fatigue in patients on hemodialysis has been associated with lower survival rates .Unfortunately, untreated fatigue in ESRD patients may lead to increased dependency on others, weakness, loss physical and psychological comfort that may lead to social isolation and depression. Non pharmacological interventions as nutritional therapy, sleep disorder management, stress management and sport .Yoga, massage therapy, acupressure and depression treatment are used to aid pharmacological therapy of patients fatigue.

Previous study done by Davison & Jhangri (2018) <sup>(6,7)</sup>concluded that stress management intervention including relaxation training, mediation, psycho-education, communication and social support improve overall quality of life and fatigue level. Similarly, study of Pagan & Pauly (2017)<sup>(8)</sup> stated that exercises and Yoga are also effective measures in improving fatigue level and quality of life, according to those researchers nursing intervention is essential in this area and must take proactive role in assisting the patient to find measures that may ease and relive their sensation of fatigue. The use of complementary and alternative medicines (CAM) has increased in conventional health care settings. New approaches considered the nurse as a healing agent and has independent role in patient's care. The term holistic nursing arose from this approach. To enhance complementary medicine, nurses can develop their professional practices. Complementary and alternative medicine is the most commonly used term to cover health care practices and products used primarily outside the formal health care system <sup>(9-11)</sup>.

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Usually, the fear of medication side effects and desire for symptom relief are possible reasons for the increasing use of CAM by patients. So, nurses incorporated CAM into their practice<sup>(9,10)</sup>. Reflexology is the oldest treatment in the world, based on scientific massage technique and has been developed since ancient Chinese and Egyptian times. The most primary scientific images of reflexology massage were discovered in Ankhmahor tomb in Egypt in 2500 B.C<sup>(12)</sup>. Reflexologists, as Dr. Fitzgerald and Eunice Ingham, believed that feet are a small map of the whole body on which all organs and body parts are reflected. In that intervention, the therapist using his fingers – specially the thumbs – with pressurizing on certain reflex points or centers on the feet that have been claimed to correspond to the internal organs, glands and body parts lead to restore health and had made a balance throughout the whole body<sup>(13-15)</sup>.

No doubt that, reflexology massage has been widely used in nursing specialties which include midwifery, orthopedics, neuroscience and palliative care. However, many CAM modalities lack scientific evidence to support their efficacy and safety. While, anecdotal evidence has shown that reflexology massage is beneficial in many conditions such as pre- and postnatal discomfort, pain, migraine and chronic obstructive pulmonary disease (6,8,13). As reflexology massage has become popular in nursing practice, so this study aims to evaluate the effectiveness of reflexology foot massage on fatigue for patients undergoing hemodialysis. Hopefully this intervention will be a contribution towards resolving some of the adverse physical and psychological symptoms associated with the illness and its treatment, for all patients undergoing hemodialysis.

- **Aim of the study:**

The aim of the study is to evaluate the effectiveness of reflexology foot massage on fatigue level for patients undergoing hemodialysis.

- **Research hypothesis:**

Research hypothesis is: Hemodialysis patients who receive reflexology foot massage experience less fatigue than those who do not receive such intervention.

- **Materials and method:**

**Materials:**

**Design:**

A quasi experimental design was used in the present study.

- **Setting:**

The study was conducted at the hemodialysis units of Mansoura University Hospital and Eslam El-Dawly Hospital.

- **Subjects:**

The study subjects comprised a convenience sample of 72 adult patients of both sexes with chronic renal failure undergoing hemodialysis, in the above mentioned settings. The total number of subjects was randomly divided into two equal groups: 36 patients in each of the study and the control group.

- **The subject inclusion criteria were: Adult patients:** (Age from 21 to 60 years ,Willing to participate in the study and cooperate ,Able to communicate verbally ,Being dialyzed 3 times weekly ,**Free from any of the following:** ("Peripheral neuropathy , Injury on the foot including severe bruises, ulceration, open wound or recent burn , Peripheral vascular diseases in the lower limbs , Skin diseases including acute psoriasis or eczema. , Recent fracture or surgery in the leg.

- **Tools:**

Three tools were used in this study.

- **Tool I: Hemodialysis Patients Assessment Tool:**

It was constructed by the researcher after review of relevant literature <sup>(16,17)</sup> and it included sociodemographic characteristics include; age, sex, educational level and clinical characteristics include: duration of hemodialysis in years, and inter-dialytic weight gain.

- **Tool II: Visual Analog Fatigue Scale (VAFS):**

It was adopted from Benjamin et al. (2010) <sup>(18)</sup> it was developed to assess fatigue severity. It is a horizontal line, 10cm in length, anchored by word descriptors at each end; left end No fatigue and right end Very severe fatigue. The patient marked on the line the point that he/she felt representing his/her perception and current state. The VAFS score are determined by measuring in centimeter from left hand end of the line to the point that the patient marked. The measured value are illustrated as (0) indicated no fatigue (1-3cm) illustrated mild fatigue, (4-6 cm) indicated moderate fatigue and (7-9cm) indicated severe fatigue, (10) indicated very severe fatigue.

- **Tool III: Multidimensional Fatigue Scale:**

It was developed by the researcher after review of relevant literature. It aims to assess fatigue related to 4 dimensional (physical, psychological, mental, social). It is assessed on a 4 point rating scale ranging from (0) never experience fatigue, (1)=Rarely experience fatigue, (2) =often experience fatigue and (3)=Almost always experience fatigue (severe and continuous) <sup>(19,20-22)</sup>.

**Part 1: fatigue physical dimension subscale:** this included 8 items related to physical discomfort, ability to complete physical tasks that require physical effort in the home, ability to do things away from home, ability to maintain physical effort for long periods. Muscle weakness, need to rest more or for longer periods. Ability to engage in enjoyable activities and feeling sleepy.

**Part 2: fatigue mental dimensional subscale:** It consisted of 8 items related to paying attention for long periods of time, clumsy and un coordination, forgetful, ability to finish tasks that require thinking, ability to recognize thoughts when doing thing at home or at work, thinking, ability to concentrate and slips of the tongue with speaking.

**Part 3: fatigue psychological dimensional subscale:** this part composed of 10 items related to irritability, stress, ability to provide emotional issues, ability to provide emotional support to family, minor difficulties seem like major difficulties, feeling distress, description of fatigue as destructive feeling, worry about other people looking, and feeling listless.

**Part 4: fatigue social dimensional subscale:** this part included 5 items related to workload or responsibilities, increase need for others help, social contacts outside home, ability to plan activities ahead of time and absent seem from work.

## Method

- An official letter from Mansoura Faculty of Nursing was submitted to the general director of (Mansoura university hospital and Eslam Eldawly hospital) and to the head of the department of hemodialysis unit. Permission to carry out the study was obtained after complete explanation of the study aim.

- Study tools were developed; Tool I and Tool III were developed by the researcher and were translated into Arabic. Content validity for both English and Arabic versions were tested by 5 experts in the field of medical surgical nursing and 4 experts in nephrology medicine. The required corrections and modifications were carried out accordingly.

- Reliability of the tools was done using Cronbach's Alpha for tools items related to physical fatigue dimension reliability was 1.000, mental fatigue dimension reliability was 0.976, psychological fatigue dimension reliability was 1.000 and reliability of tool social dimension related items was low and modification of some items was done. After that, the alpha coefficient for social fatigue dimension was 0.948, suggesting that the multidimensional fatigue scale items have very high internal consistency.

- A pilot study was carried out on 7 patients from the study settings to ensure the clarity, applicability, relevance, and feasibility of the tools, to identify the difficulties that may be faced during massage application, and to estimate the time needed for data collection. Subjects who participated in the pilot study were not included in the main study sample.

- Subject selection, patient who fulfilled the sample selection criteria was contacted and the researcher introduced herself to every patient included in the study, the aim of the study and the process of reflexology foot massage and its expected outcome benefits were explained in details. After that informed patient's written consent for participation in the study was obtained. Every patient was informed that the researcher would assure their anonymity, privacy and confidentiality throughout the caring process. Voluntary participation and right to withdraw from the study was emphasized to every subject.

- Data collection was carried out in two phases: data related to the control group and data related to the study group. The total period of data collection for both groups was 8 months. The researcher observed every patient in both groups during the whole period of hemodialysis session. The patient sociodemographic and clinical data were obtained from the patient and from patients hospital record using tool I. In the control group fatigue intensity assessment was measured two times after every hemodialysis session for 9 sessions as follow: First assessment of fatigue intensity was carried out immediately after every hemodialysis session using tool II: Visual Analog Fatigue Scale. Second assessment of fatigue intensity, every patient in control group waits for 40 minutes from the first assessment of fatigue intensity without receiving any intervention from researcher. During this time the patient's was either allowed to talk with other patients, nurses, doctors about her / his condition, or to have their vital signs or weight measured by nurse or by the researcher or to sleep. These actions were carried out to fill the time (40 minutes) required for doing the second assessment. After that the researcher used the same tool (Tool II; Visual Analog Fatigue Scale ) for doing the second assessment of fatigue intensity. Fatigue dimension of control group was also assessed 4 times for one month, once per week using tool III: Multidimensional Fatigue Scale. First assessment: the researcher assessed patient fatigue during the week before the first contact of researcher with patient. Second assessment: the researcher assessed patient fatigue after one week from first assessment (the patients received three hemodialysis sessions after the first assessment). Third assessment the researcher assessed patient fatigue after one week from the second assessment (the patients received six hemodialysis sessions after the first assessment). Fourth assessment the researcher assessed patient fatigue after one week from third assessment (the patients received nine hemodialysis sessions after the first assessment ).

- In the study group fatigue intensity assessment was measured two times after every hemodialysis session for 9 sessions first assessment of fatigue intensity; immediately after every hemodialysis session and before application reflexology message using tool II (Visual Analog Fatigue Scale). second assessment of fatigue intensity immediately after application of message session, after 0 minutes from the first assessment of fatigue intensity using same tool (Tool II: Visual Analog Fatigue Scale). Fatigue dimension of control group was also assessed 4 times for one month, once per week using tool III: Multidimensional Fatigue Scale. First assessment: the researcher assessed patient fatigue during the week before starting reflexology foot message sessions. Second assessment: the researcher assessed patient fatigue after one week from first assessment (the patients received three hemodialysis sessions and three message sessions after the first assessment). Third assessment the researcher assessed patient fatigue after one week from the second assessment (the patients received six hemodialysis sessions and six message sessions after the first assessment). Fourth assessment the researcher assessed patient fatigue after one week from third assessment (the patients received nine hemodialysis sessions and nine message sessions after the first assessment).

#### • **Statistical Analysis**

After data collection, data were fed to the computer using Statistical Package for Social Sciences (SPSS version 18.0). The 0.05 level was used as the cut off value for statistical significance and the following statistical measures were used. Descriptive Statistics: frequency distribution, means and standard deviations. Analytical statistics which include: Kolmogorov – Smirnov test, t-test and Mann Whitney test ,Chi-Square test, Monte Carlo test and Fisher's Exact test.

**Results**

**Table (1):** Frequency Distribution and Significance of Differences of Socio-Demographic and Clinical Characteristics among the Study and Control Groups of Patients on Hemodialysis (No=72).

Socio-demographic and Clinical characteristics	Study group (n=36)		Control group (n=36)		Significance level
	No.	%	No.	%	
<b>Age (years)</b>					
• 20-	15	36.4	5	15.1	$\chi^2=6.86$ P=0.07
• 30-	7	21.2	4	12.1	
• 40-	7	21.2	9	27.3	
• 50-≤60	7	21.2	18	45.5	
<b>Gender</b>					
• Male	23	60.6	23	60.6	$\chi^2=0.0$ P=1.0
• Female	13	39.4	13	39.4	
<b>Educational level</b>					
• Illiterate/read and write	4	12.1	7	21.2	$\chi^2=4.7$ P=0.31
• Primary	3	9.1	4	12.1	
• Secondary	9	27.3	3	9.1	
• Diploma	15	36.4	14	33.3	
• University	5	15.2	8	24.3	
<b>Duration of hemodialysis in years</b>					
• <1	0	0.0	5	15.1	$\chi^2=8.673$ MC=0.07
• 1-	14	33.4	9	27.3	
• 3-	8	24.2	15	36.4	
• 6-	8	24.2	3	9.1	
• 9≤	6	18.2	4	12.1	
<b>Inter- dialytic weight gain (kg)</b>					
• 0.5-<1.5	3	9.1	7	21.2	$\chi^2=3.481$ MC=0.37
• 1.5-<2.5	25	66.7	19	48.5	
• 2.5-<3.5	6	18.2	9	27.3	
• ≥3.5	2	6.1	1	3.0	

-  $\chi^2$ : Chi-Square test - FE: Fisher’s Exact test -MC: Monte Carlo test  
 - \*level of significance = ≤0.05

**Table (2):** Frequency distribution of fatigue intensity among the study and control groups and significance of differences before and after reflexology foot massage sub sessions of patients on hemodialysis. (No=72)

Fatigue intensity		Study group		Control group		Significance level
Before first session	Moderate	4	12.1	5	15.2	FE=1.0
	Severe	32	87.9	28	84.8	
After first session	Mild	27	72.7	0	0.0	$\chi^2=54.932$ P=<0.0001*
	Moderate	9	27.3	4	12.1	
	Severe	0	0.0	32	87.9	
Before second session	Moderate	5	15.2	5	15.2	$\chi^2=0.0$ P=<1.0
	Severe	31	84.8	31	84.8	
After second session	Mild	32	87.9	0	0.0	$\chi^2=59.143$ P=<0.0001*
	Moderate	4	12.1	3	9.1	
	Severe	0	0.0	33	90.9	
Before third session	Moderate	7	21.2	7	21.2	$\chi^2=0.0$ P=1.0
	Severe	29	78.8	29	78.8	
After third session	Mild	33	90.9	0	0.0	MC<0.0001*
	Moderate	3	9.1	5	15.2	
	Severe	0	0.0	31	84.8	

Before fourth session	Moderate	10	30.3	5	15.2	$\chi^2=2.157$ P=0.142
	Severe	26	69.7	31	84.8	
After fourth session	Mild	34	93.9	0	0.0	$\chi^2=61.2$ MCP<0.0001*
	Moderate	2	6.1	3	9.1	
	Severe	0	0.0	33	90.9	
Before fifth session	Mild	1	3.0	0	0.0	$\chi^2=8.4$ MC<0.007*
	Moderate	12	36.4	3	9.1	
	Severe	23	60.6	33	90.9	
After fifth session	Mild	34	93.3	0	0.0	$\chi^2=62.0$ MC<0.0001*
	Moderate	2	6.1	2	6.1	
	Severe	0	0.0	34	93.9	
Before six session	Moderate	9	27.3	1	3.0	$\chi^2=7.543$ P=0.006*
	Severe	27	72.7	35	97.0	
After six session	Mild	36	100.0	0	0.0	$\chi^2=66.0$ P<0.0001*
	Moderate	0	0.0	36	100.0	
Before seven session	Moderate	9	27.3	1	3.0	$\chi^2=13.055$ P<0.0001*
	Severe	27	72.7	35	97.0	
After seven session	Mild	36	100.0	0	0.0	$\chi^2=66.0$ p<0.0001*
	Moderate	0	0.0	1	3.0	
	Severe	0	0.0	35	97.0	
Before eighth session	Moderate	16	48.5	1	3.0	$\chi^2=17.827$ p<0.0001
	Severe	20	51.5	35	97.0	
After eighth session	Mild	36	100.0	0	0.0	$\chi^2=66.0$ MC<0.0001*
	Moderate	0	0.0	1	3.0	
	Severe	0	0.0	35	97.0	
Before nine session	Moderate	20	51.5	1	3.0	$\chi^2=20.009$ MC<0.0001*
	Severe	16	48.5	34	93.0	
	Very severe	0	0.0	1	3.0	
After nine session	None	1	3.0	0	0.0	$\chi^2=66.0$ MC<0.0001*
	Mild	35	97.0	0	0.0	
	Moderate	0	0.0	1	3.0	
	Severe	0	0.0	34	93.9	
	Very severe	0	0.0	1	3.0	

-  $\chi^2$ : Chi-Square test - FE: Fisher's Exact test -MC: Monte Carlo test

- \*level of significance =  $\leq 0.05$

**Table (3):** frequency distribution of physical fatigue among the Study and Control Groups and Significance of Differences Before and After Reflexology Foot Massage Sessions of Patients on Hemodialysis(No=72)..

Effect of fatigue on sleep pattern	1 <sup>st</sup> assessment				Sig. Chi-Square test	2 <sup>nd</sup> assessment				Sig. Chi-Square test	3 <sup>rd</sup> assessment				Sig. Chi-Square test	4 <sup>th</sup> assessment				Sig. Chi-Square test	
	Study group (n=36)		Control group (n=36)			Study group (n=36)		Control Group(n=36)			Study group(n=36)		Control group (n=36)			Study group (n=36)		Control group (n=36)			
	No.	%	No.	%		No.	%	No.	%		No.	%	No.	%		No.	%	No.	%		
Physical discomfort increase	Never	0	0.0	0	0.0	0.196	0	0.0	0	0.0	<0.0001*	1	3.0	0	0.0	<0.0001*	10	30.3	0	0.0	<0.0001*
	Rarely	0	0.0	0	0.0		8	24.2	0	0.0		26	69.7	0	0.0		25	66.7	0	0.0	
	Often	9	27.3	14	42.4		27	72.7	13	39.4		9	27.3	15	45.5		1	3.0	13	39.4	
	Always	27	72.7	22	57.6		1	3.0	23	60.6		0	0.0	21	54.5		0	0.0	23	60.6	
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.802, P2=0.804, P3 =0.802																					
Ability to complete tasks that require physical comfort in the home was decreased	Never	0	0.0	0	0.0	0.604	0	0.0	0	0.0	<0.0001*	1	3.0	0	0.0	<0.0001*	11	33.3	0	0.0	<0.0001*
	Rarely	0	0.0	1	3.0		9	27.3	1	3.0		28	75.8	0	0.0		22	57.6	0	0.0	
	Often	11	33.3	13	39.4		27	72.7	14	42.4		7	21.2	15	45.5		3	9.1	12	36.3	
	Always	28	66.7	25	57.6		0	0.0	21	54.5		0	0.0	21	54.5		0	0.0	24	63.6	
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.968, P2=0.557, P3 =0.566																					
Ability to do things away from home was limited	Never	0	0.0	0	0.0	0.186	0	0.0	0	0.0	<0.0001*	1	3.0	0	0.0	<0.0001*	7	21.2	0	0.0	<0.0001*
	Rarely	3	9.1	0	0.0		9	27.3	0	0.0		33	90.9	0	0.0		28	75.8	0	0.0	
	Often	11	33.3	14	42.4		27	72.7	15	45.5		2	6.1	15	45.5		1	3.0	12	36.4	
	Always	22	57.6	22	57.6		0	0.0	21	54.5		0	0.0	21	54.5		0	0.0	24	63.3	
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.804, P2=0.621, P3 =0.614.																					
Ability to maintain physical effort for long periods was limited	Never	0	0.0	0	0.0	0.186	0	0.0	0	0.0	<0.0001*	1	3.0	0	0.0	<0.0001*	7	21.2	0	0.0	<0.0001*
	Rarely	3	9.1	0	0.0		9	27.3	0	0.0		33	90.9	0	0.0		28	75.8	0	0.0	
	Often	11	33.3	14	42.4		27	72.7	15	45.5		2	6.1	15	45.5		1	3.0	12	36.4	
	Always	22	57.6	22	57.6		0	0.0	21	54.5		0	0.0	21	54.5		0	0.0	24	63.6	
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.804, P2=0.804, P3 =0.614.																					
Muscle were felt weak	Never	0	0.0	0	0.0	0.085	1	3.0	0	0.0	<0.0001*	3	9.1	0	0.0	<0.0001*	11	33.3	0	0.0	<0.0001*
	Rarely	5	15.2	0	0.0		10	30.3	0	0.0		53	90.9	0	0.0		24	63.3	0	0.0	
	Often	11	33.3	14	42.4		25	66.7	15	45.5		0	0.0	15	45.5		1	3.0	11	33.3	
	Always	20	51.5	22	57.6		0	0.0	21	54.5		0	0.0	21	54.5		0	0.0	25	66.7	
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.804, P2=0.804, P3 =0.447.																					
Need to rest more often or longer periods	Never	0	0.0	0	0.0	0.804	0	0.0	0	0.0	<0.0001*	2	6.1	0	0.0	<0.0001*	11	33.3	0	0.0	<0.0001*
	Rarely	0	0.0	0	0.0		9	27.3	0	0.0		53	90.9	0	0.0		24	63.6	0	0.0	
	Often	15	45.5	14	42.4		27	72.7	15	45.5		1	3.0	14	42.4		1	3.0	11	33.3	
	Always	21	54.5	21	57.6		0	0.0	21	54.5		0	0.0	22	57.6		0	0.0	25	66.7	
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.804, P2=1.0, P3 =0.447.																					
Ability to engage in kind of enjoyable activities was limited	Never	0	0.0	0	0.0	1	0	0.0	0	0.0	<0.0001*	0	0.0	0	0.0	<0.0001*	7	21.2	0	0.0	<0.0001*
	Rarely	1	3.0	0	0.0		9	27.3	0	0.0		35	97.0	0	0.0		28	75.8	0	0.0	
	Often	13	39.4	14	42.4		27	72.7	15	45.5		1	3.0	13	39.4		1	3.0	11	33.3	
	Always	22	57.6	22	57.6		0	0.0	21	54.5		0	0.0	23	60.0		0	0.0	25	66.7	
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.804, P2=0.802, P3 =0.447.																					
Feeling sleepy	Never	0	0.0	0	0.0	1.0	0	0.0	0	0.0	<0.0001*	1	3.0	0	0.0	<0.0001*	5	15.2	0	0.0	<0.0001*
	Rarely	0	0.0	0	0.0		8	24.2	0	0.0		53	90.9	0	0.0		30	81.8	0	0.0	
	Often	14	42.4	14	42.4		27	72.7	15	45.5		2	6.0	13	39.4		1	3.3	11	33.3	
	Always	22	57.6	22	57.6		1	3.0	21	54.5		0	0.0	23	60.6		0	0.0	25	66.7	
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.804, P2=0.802, P3 =0.447.																					

1<sup>st</sup> assessment: the week before first contact, 2<sup>nd</sup> assessment: after 3 sessions, 3<sup>rd</sup> assessment: after 6 sessions & 4<sup>th</sup> assessment: after 9sessions  
 - -sig. for each group: p-value for Marginal Homogeneity test or Mac Nemar test - \*level of significance p= ≤0.05  
 - ∞P1:significancebetween1<sup>st</sup>assessmentand2<sup>nd</sup>assessment= P2:significancebetween1<sup>st</sup>assessmentand3<sup>rd</sup> assessment, □P3: significance between 1<sup>st</sup> assessment and 4<sup>th</sup>assessment

**Table (4):** frequency distribution of Mental fatigue among the Study and Control Groups and Significance of Differences Before and After Reflexology Foot Massage Sessions of Patients on Hemodialysis. (No=72).

Effect of fatigue on sleep pattern	1 <sup>st</sup> assessment					Sig. Chi-Square test	2 <sup>nd</sup> assessment					Sig. Chi-Square test	3 <sup>rd</sup> assessment					Sig. Chi-Square test	4 <sup>th</sup> Assessment					Sig. Chi-Square test
	Study group (n=36)		Control group (n=36)		No.		Study group (n=36)		Control group (n=36)		No.		Study Group (n=36)		Control group (n=36)		No.		Study group (n=36)		Control group (n=36)		No.	
	No.	%	No.	%			No.	%	No.	%			No.	%	No.	%			No.	%	No.	%		
Paying attention for long periods of time was limited	Never	0	0.0	0	0.0	0.772	0	0.0	0	0.0	<0.0001*	6	18.2	0	0.0	<0.0001*	20	51.5	0	0.0	<0.0001*			
	Rarely	4	12.1	3	9.1		16	48.5	2	6.1		26	69.7	2	6.1		16	48.5	1	3.0				
	Often	20	51.5	23	60.6		19	51.5	25	66.7		4	12.1	24	63.3		0	0.0	23	60.6				
	Always	12	36.4	10	30.3		0	0.0	9	27.3		0	0.0	10	30.3		0	0.0	12	36.4				
	Sig. before and after for each group: study group *P1=<0.0001*,P2<0.0001* P<0.0001* control group P1=0.84, P2=0.894, P3 =0.554																							
Clumsy and uncoordinated	Never	0	0.0	0	0.0	0.611	0	0.0	0	0.0	<0.0001*	6	18.2	0	0.0	<0.0001*	20	51.5	0	0.0	<0.0001*			
	Rarely	6	18.2	3	9.1		22	57.6	2	6.1		27	72.7	2	6.1		16	48.5	1	3.0				
	Often	22	57.6	24	63.3		14	42.4	26	69.7		3	9.1	25	66.7		0	0.0	23	60.6				
	Always	8	24.2	9	27.3		0	0.0	8	24.2		0	0.0	9	27.3		0	0.0	12	36.4				
	Sig. before and after for each group: study group *P1=<0.0001*,P2<0.0001* P<0.0001* control group P1=0.839, P2=0.894, P3 =0.484																							
Forgetful	Never	0	0.0	0	0.0	0.733	0	0.0	0	0.0	<0.0001*	5	15.2	0	0.0	<0.0001*	13	39.4	0	0.0	<0.0001*			
	Rarely	2	6.1	3	9.1		20	51.5	2	6.1		25	66.7	2	6.1		21	54.5	1	3.0				
	Often	21	54.5	23	60.6		16	48.5	25	66.7		6	18.2	24	63.6		2	6.1	23	60.6				
	Always	13	39.4	10	30.3		0	0.0	9	27.3		0	0.0	10	30.3		0	0.0	12	36.4				
	Sig. before and after for each group: study group *P1=<0.0001*,P2<0.0001* P<0.0001* control group P1=0.84, P2=0.894, P3 =0.554																							
Ability to finishing tasks that require thinking was limited	Never	0	0.0	0	0.0	0.645	1	3.0	0	0.0	<0.0001*	6	18.2	0	0.0	<0.0001*	20	51.5	0	0.0	<0.0001*			
	Rarely	5	15.2	3	9.1		21	54.5	2	6.1		27	72.7	2	6.1		16	48.5	1	3.0				
	Often	19	48.5	24	63.6		14	42.4	25	66.7		3	9.1	24	63.6		0	0.0	23	60.6				
	Always	12	36.4	9	27.3		0	0.0	9	27.3		0	0.0	10	30.3		0	0.0	12	36.4				
	Sig. before and after for each group: study group *P1=<0.0001*,P2<0.0001* P<0.0001* control group P1=0.84, P2=0.894, P3 =0.554																							
Ability to organizing thoughts when doing things at home or at work was limited	Never	0	0.0	0	0.0	0.436	1	3.0	0	0.0	<0.0001*	27.3	0	0.0	<0.0001*	20	51.5	0	0.0	<0.0001*				
	Rarely	5	15.2	3	9.1		10	54.5	2	6.1		24	63.6	2		6.1	16	48.5	1		3.0			
	Often	18	45.5	24	63.6		17	42.4	25	66.7		3	9.1	24		63.6	0	0.0	22		57.6			
	Always	13	39.4	9	27.3		0	0.0	9	27.3		0	0.0	10		30.3	0	0.0	13		39.4			
	Sig. before and after for each group: study group *P1=<0.0001*,P2<0.0001* P<0.0001* control group P1=0.894, P2=0.881, P3 =0.401.																							
Thinking slowed down	Never	0	0.0	0	0.0	0.298	2	6.1	0	0.0	=<0.0001*	9	27.3	0	0.0	<0.0001*	20	51.5	0	0.0	=<0.0001*			
	Rarely	6	18.2	3	9.1		22	57.6	2	6.1		24	63.6	2	6.1		16	48.5	1	3.0				
	Often	18	45.5	24	63.6		12	36.4	25	66.7		3	9.1	25	66.7		0	0.0	23	60.6				
	Always	12	36.4	9	27.3		0	0.0	9	27.3		0	0.0	9	27.3		0	0.0	12	36.4				
	Sig. before and after for each group: study group *P1=<0.0001*,P2<0.0001* P<0.0001* control group P1=0.894, P2=0.894, P3 =0.484.																							
Ability to concentrate	Never	0	0.0	0	0.0	0.521	2	6.1	0	0.0	=<0.0001*	10	30.3	0	0.0	=<0.0001*	21	54.5	0	0.0	<0.0001*			
	Rarely	5	15.2	3	9.1		21	54.5	2	6.1		24	63.6	2	6.1		15	45.5	1	3.0				
	Often	19	48.5	24	63.6		13	39.4	25	66.7		2	6.1	24	63.6		0	0.0	22	57.6				
	Always	12	36.4	9	27.3		0	0.0	9	27.3		0	0.0	10	30.3		0	0.0	13	39.4				
	Sig. before and after for each group: study group *P1=<0.0001*,P2<0.0001* P<0.0001* control group P1=0.894, P2=0.881, P3 =0.401.																							
Slips of the tongue with speaking	Never	0	0.0	0	0.0	0.858	1	3.0	0	0.0	=<0.0001*	8	24.2	0	0.0	=<0.0001*	14	42.4	0	0.0	<0.0001*			
	Rarely	3	9.1	3	9.1		20	51.5	2	6.1		25	60.6	2	6.1		20	51.5	1	3.0				
	Often	21	54.5	24	63.6		15	45.5	25	66.7		5	15.2	24	63.6		2	6.1	22	57.6				
	Always	12	36.3	9	27.3		0	0.0	9	27.3		0	0.0	10	30.3		0	0.0	13	39.4				
	Sig. before and after for each group: study group *P1=<0.0001*,P2<0.0001* P<0.0001* control group P1=0.894, P2=0.881, P3 =0.401																							

1<sup>st</sup> assessment: the week before first contact, 2<sup>nd</sup> assessment: after 3 sessions, 3<sup>rd</sup> assessment: after 6 sessions & 4<sup>th</sup> assessment: after 9sessions

-sig. for each group: p-value for Marginal Homogeneity test or Mac Nemar test - \*level of significance p=

≤0.05

∞ P1:significancebetween1<sup>st</sup>assessmentand2<sup>nd</sup>assessment; P2:significancebetween1<sup>st</sup>assessmentand3<sup>rd</sup> assessment, P3: significance between 1<sup>st</sup> assessment and 4<sup>th</sup>assessment



**Table (5):** frequency distribution of psychological fatigue among the Study and Control Groups and Significance of Differences Before and After Reflexology Foot Massage Sessions of Patients on Hemodialysis. (No=72).

Effect of fatigue on sleep pattern	1 <sup>st</sup> assessment					2 <sup>nd</sup> assessment					3 <sup>rd</sup> assessment					4 <sup>th</sup> Assessment				Sig. Chi-Square test	
	Study group (n=36)		Control group (n=36)		Sig. Chi-Square test	Study group (n=36)		Control group (n=36)		Sig. Chi-Square test	Study Group (n=36)		Control group (n=36)		Sig. Chi-Square test	Study group (n=36)		Control group (n=36)			
	No.	%	No.	%		No.	%	No.	%		No.	%	No.	%		No.	%	No.	%		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%			
Irritability and easily angered	Never	0	0.0	0	0.0	0.421	0	0.0	0	0.0	<0.0001*	0	0.0	0	0.0	<0.0001*	8	24.2	0	0.0	<0.0001*
	Rarely	6	18.2	3	9.1		5	15.2	0	0.0		32	87.9	0	0.0		27	72.7	0	0.0	
	Often	18	45.4	24	63.6		30	81.8	22	57.6		4	12.1	22	57.6		1	3.0	14	42.4	
	Always	12	36.4	9	27.3		1	3.0	14	42.4		0	0.0	14	42.4		0	0.0	22	57.6	
<b>Sig. before and after for each group: study group</b> <sup>a</sup> P1=<0.0001*,P2<0.0001* P3<0.0001* <b>control group</b> P1=0.447, P2=0.447, P3 =0.068.																					
Normally day to day events are stressful for you	Never	0	0.0	0	0.0	0.626	0	0.0	0	0.0	<0.0001*	0	0.0	0	0.0	<0.0001*	10	30.3	0	0.0	<0.0001*
	Rarely	0	0.0	0	0.0		6	18.2	0	0.0		32	87.9	0	0.0		25	66.7	0	0.0	
	Often	16	48.5	23	60.6		30	78.8	22	57.6		4	12.1	22	57.6		1	3.0	42.4		
	Always	20	51.5	13	39.4		1	3.0	14	42.4		0	0.0	14	42.4		0	0.0	57.6		
<b>Sig. before and after for each group: study group</b> <sup>a</sup> P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=1.0, P2=1.0, P3 =0.218																					
Avoidance of stressful situation	Never	0	0.0	0	0.0	0.08	0	0.0	0	0.0	<0.0001*	0	0.0	0	0.0	<0.0001*	10	30.3	0	0.0	<0.0001*
	Rarely	0	0.0	0	0.0		7	21.2	0	0.0		31	84.8	0	0.0		24	63.6	0	0.0	
	Often	14	42.4	42.4	60.6		28	75.8	22	57.6		5	15.2	22	57.6		1	3.0	14	42.4	
	Always	22	57.6	57.4	39.4		1	3.0	14	42.4		0	0.0	14	42.4		0	0.0	21	57.6	
<b>Sig. before and after for each group: study group</b> <sup>a</sup> P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.802, P2=0.802, P3 =0.139.																					

You are less able to deal with emotional issues	Never	0	0.0	0	0.0	0.06	0	0.0	0	0.0	<0.0001*	0	0.0	0	0.0	<0.0001*	11	33.3	0	0.0	<0.0001*		
	Rarely	1	3.0	1	3.0			9	27.3	0	0.0		34	93.9	0		0.0		25	66.7		0	0.0
	Often	11	33.3	23	60.6			26	69.7	21	57.6		2	6.1	21		54.5		0	0.0		13	39.4
	Always	24	63.6	12	36.4			1	3.0	14	42.4		0	0.0	15		45.5		0	0.0		20	60.6
<b>Sig. before and after for each group: study group</b> <sup>a</sup> P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.555, P2=0.487, P3 =0.106.																							
Ability to provide emotional support to family was limited	Never	0	0.0	0	0.0	0.217	0	0.0	0	0.0	<0.0001*	2	6.1	0	0.0	<0.0001*	12	36.4	0	0.0	<0.0001*		
	Rarely	1	3.0	0	0.0		9	27.3	0	0.0		32	87.9	0	0.0		24	63.6	0	0.0			
	Often	15	45.5	24	63.6		26	69.7	22	57.6		2	6.1	21	54.5		0	0.0	13	39.4			
	Always	20	51.5	12	36.4		1	3.0	14	42.4		0	0.0	15	45.5		0	0.0	23	60.6			
<b>Sig. before and after for each group: study group</b> <sup>a</sup> P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.614, P2=0.453, P3 =0.491																							
Minor difficulties seem like major difficulties	Never	0	0.0	0	0.0	0.215	0	0.0	0	0.0	=<0.0001*	2	6.1	0	0.0	<0.0001*	14	42.4	0	0.0	=<0.0001*		
	Rarely	0	0.0	0	0.0		9	27.3	0	0.0		32	87.9	0	0.0		22	57.6	0	0.0			
	Often	16	48.5	24	63.6		26	69.7	22	57.6		1	3.0	16	48.5		0	0.0	13	39.4			
	Always	20	51.5	12	36.4		1	3.0	14	42.4		0	0.0	20	51.5		0	0.0	23	60.6			
<b>Sig. before and after for each group: study group</b> <sup>a</sup> P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.614, P2=0.215 , P3 =0.494.																							
Feeling distress	Never	0	0.0	0	0.0	0.138	0	0.0	0	0.0	=<0.0001*	3	9.1	0	0.0	=<0.0001*	15	45.5	0	0.0	=<0.0001*		
	Rarely	0	0.0	0	0.0		8	24.2	0	0.0		33	90.9	0	0.0		21	54.5	0	0.0			
	Often	15	45.5	24	63.6		27	72.7	22	57.6		0	0.0	16	48.5		0	0.0	13	39.4			
	Always	21	54.5	12	36.4		1	3.0	14	42.4		0	0.0	20	51.5		0	0.0	23	60.6			

<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.614, P2=0.215, P3 =0.494.																					
Fatigue described as destructive feeling	Never	0	0.0	0	0.0	0.322	0	0.0	0	0.0	=<0.0001*	3	9.1	0	0.0	=<0.0001*	14	42.4	0	0.0	=<0.0001*
	Rarely	2	3.0	0	0.0		9	27.3	0	0.0	32	87.9	0	0.0	22	57.6	0	0.0			
	Often	17	48.5	24	63.6		26	69.7	22	57.6	1	3.0	16	51.5	0	0.0	14	42.4			
	Always	17	48.5	12	36.4		1	3.0	14	42.4	0	0.0	20	48.5	0	0.0	22	57.6			
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.614, P2=0.319, P3 =0.084																					
W 11 worry about other people looking	Never	0	0.0	0	0.0	0.413	1	3.0	0	0.0	=<0.0001*	4	12.1	0	0.0	=<0.0001*	15	45.5	0	0.0	=<0.0001*
	Rarely	6	18.2	0	0.0		11	33.3	0	0.0	31	84.8	0	0.0	21	54.5	0	0.0			
	Often	13	39.4	24	63.6		23	60.6	22	57.6	1	3.0	21	54.5	0	0.0	14	42.4			
	Always	17	42.4	12	36.4		1	3.0	1	42.4	0	0.0	15	45.5	0	0.0	22	57.4			
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.614, P2=0.453, P3 =0.084.																					
Feeling listless a	Never	0	0.0	0	0.0	0.083	1	3.0	0	0.0	=<0.0001*	3	9.1	0	0.0	=<0.0001*	14	42.4	0	0.0	=<0.0001*
	Rarely	1	3.0	0	0.0		8	24.2	0	0.0	32	87.9	0	0.0	22	57.6	0	0.0			
	Often	13	39.4	24	63.6		26	69.7	22	57.6	1	3.0	21	54.5	0	0.0	13	39.4			
	Always	22	57.6	12	36.4		1	3.0	14	42.4	0	0.0	15	45.5	0	0.0	32	60.6			
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.614, P2=0.453, P3 =0.054																					

1<sup>st</sup> assessment: the week before first contact, 2<sup>nd</sup> assessment: after 3 sessions, 3<sup>rd</sup> assessment: after 6 sessions & 4<sup>th</sup> assessment: after 9 sessions  
 - sig. for each group: p-value for Marginal Homogeneity test or Mac Nemar test - \*level of significance p=  
 ≤0.05  
 ∞ P1:significancebetween1<sup>st</sup>assessmentand2<sup>nd</sup>assessment□ P2:significancebetween1<sup>st</sup>assessmentand3<sup>rd</sup> assessment, □ P3:  
 significance between 1<sup>st</sup> assessment and 4<sup>th</sup>assessment

You are less able to deal with emotional issues	Never	0	0.0	0	0.0	0.06	0	0.0	0	0.0	<0.0001*	0	0.0	0	0.0	<0.0001*	11	33.3	0	0.0	<0.0001*
	Rarely	1	3.0	1	3.0		9	27.3	0	0.0	34	93.9	0	0.0	25		66.7	0	0.0		
	Often	11	33.3	23	60.6		26	69.7	21	57.6	2	6.1	21	54.5	0		0.0	13	39.4		
	Always	24	63.6	12	36.4		1	3.0	14	42.4	0	0.0	15	45.5	0		0.0	20	60.6		
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.555, P2=0.487, P3 =0.106.																					
Ability to provide emotional support to family was limited	Never	0	0.0	0	0.0	0.217	0	0.0	0	0.0	<0.0001*	2	6.1	0	0.0	<0.0001*	12	36.4	0	0.0	<0.0001*
	Rarely	1	3.0	0	0.0		9	27.3	0	0.0	32	87.9	0	0.0	24	63.6	0	0.0			
	Often	15	45.5	24	63.6		26	69.7	22	57.6	2	6.1	21	54.5	0	0.0	13	39.4			
	Always	20	51.5	12	36.4		1	3.0	14	42.4	0	0.0	15	45.5	0	0.0	23	60.6			
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.614, P2=0.453, P3 =0.491																					
Minor difficulties seem like major difficulties	Never	0	0.0	0	0.0	0.215	0	0.0	0	0.0	=<0.0001*	2	6.1	0	0.0	<0.0001*	14	42.4	0	0.0	=<0.0001*
	Rarely	0	0.0	0	0.0		9	27.3	0	0.0	32	87.9	0	0.0	22	57.6	0	0.0			
	Often	16	48.5	24	63.6		26	69.7	22	57.6	1	3.0	16	48.5	0	0.0	13	39.4			
	Always	20	51.5	12	36.4		1	3.0	14	42.4	0	0.0	20	51.5	0	0.0	23	60.6			
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.614, P2=0.215, P3 =0.494.																					
Feeling distress	Never	0	0.0	0	0.0	0.138	0	0.0	0	0.0	=<0.0001*	3	9.1	0	0.0	=<0.0001*	15	45.5	0	0.0	=<0.0001*
	Rarely	0	0.0	0	0.0		8	24.2	0	0.0	33	90.9	0	0.0	21	54.5	0	0.0			
	Often	15	45.5	24	63.6		27	72.7	22	57.6	0	0.0	16	48.5	0	0.0	13	39.4			
	Always	21	54.5	12	36.4		1	3.0	14	42.4	0	0.0	20	51.5	0	0.0	23	60.6			
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.614, P2=0.215, P3 =0.494.																					
Fatigue described as destructive feeling	Never	0	0.0	0	0.0	0.322	0	0.0	0	0.0	=<0.0001*	3	9.1	0	0.0	=<0.0001*	14	42.4	0	0.0	=<0.0001*
	Rarely	2	3.0	0	0.0		9	27.3	0	0.0	32	87.9	0	0.0	22	57.6	0	0.0			
	Often	17	48.5	24	63.6		26	69.7	22	57.6	1	3.0	16	51.5	0	0.0	14	42.4			
	Always	17	48.5	12	36.4		1	3.0	14	42.4	0	0.0	20	48.5	0	0.0	22	57.6			
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.614, P2=0.319, P3 =0.084																					
W 11 worry about other	Never	0	0.0	0	0.0	0.413	1	3.0	0	0.0	=<0.0001*	4	12.1	0	0.0	=<0.0001*	15	45.5	0	0.0	=<0.0001*
	Rarely	6	18.2	0	0.0		11	33.3	0	0.0	31	84.8	0	0.0	21	54.5	0	0.0			
	Often	13	39.4	24	63.6		23	60.6	22	57.6	1	3.0	21	54.5	0	0.0	14	42.4			

people looking	Always	17	42.4	12	36.4		1	3.0	1	42.4		0	0.0	15	45.5		0	0.0	22	57.4	
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.614, P2=0.453, P3 =0.084.																					
Feeling listless a	Never	0	0.0	0	0.0	0.083	1	3.0	0	0.0	=<0.0001*,	3	9.1	0	0.0	=<0.0001*,	14	42.4	0	0.0	=<0.0001*,
	Rarely	1	3.0	0	0.0		8	24.2	0	0.0		32	87.9	0	0.0		22	57.6	0	0.0	
	Often	13	39.4	24	63.6		26	69.7	22	57.6		1	3.0	21	54.5		0	0.0	13	39.4	
	Always	22	57.6	12	36.4		1	3.0	14	42.4		0	0.0	15	45.5		0	0.0	32	60.6	
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.614, P2=0.453, P3 =0.054																					

1<sup>st</sup> assessment: the week before first contact, 2<sup>nd</sup> assessment: after 3 sessions, 3<sup>rd</sup> assessment: after 6 sessions & 4<sup>th</sup> assessment: after 9sessions

- -sig. for each group: p-value for Marginal Homogeneity test or Mac Nemar test - \*level of significance p=

≤0.05

□P1:significancebetween1<sup>st</sup>assessmentand2<sup>nd</sup>assessment □P2:significancebetween1<sup>st</sup>assessmentand3<sup>rd</sup> assessment, □P3: significance between 1<sup>st</sup> assessment and 4<sup>th</sup>assessment

**Table (6):** frequency distribution of social fatigue among the Study and Control Groups and Significance of Differences Before and After Reflexology Foot Massage Sessions of Patients on Hemodialysis. (No=72).

Effect of fatigue on sleep pattern	1 <sup>st</sup> assessment				Sig. Chi-Square test	2 <sup>nd</sup> assessment				Sig. Chi-Square test	3 <sup>rd</sup> assessment				Sig. Chi-Square test	4 <sup>th</sup> Assessment				Sig. Chi-Square test	
	Study group (n=36)		Control group (n=36)			Study group (n=36)		Control group (n=36)			Study group (n=36)		Control group (n=36)			Study group (n=36)		Control group (n=36)			
	No.	%	No.	%		No.	%	No.	%		No.	%	No.	%		No.	%	No.	%		
Reducing workload or responsibilities	Never	0	0.0	0	0.0	0.415	0	0.0	0	0.0	<0.0001*	0	0.0	0	0.0	<0.0001*	21	54.5	0	0.0	<0.0001*
	Rarely	0	0.0	0	0.0		9	27.3	0	0.0		29	78.8	0	0.0		15	45.5	0	0.0	
	Often	8	24.2	11	33.3		25	66.7	9	27.3		7	21.2	10	30.0		0	0.0	10	30.3	
	Always	28	75.8	25	66.7		2	6.1	27	72.7		0	0.0	27	69.7		0	0.0	27	69.7	
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.592, P2=0.792, P3 =0.792																					
Need for others help	Never	0	0.0	0	0.0	0.786	0	0.0	0	0.0	<0.0001*	2	6.1	0	0.0	<0.0001*	21	54.5	0	0.0	<0.0001*
	Rarely	1	3.0	0	0.0		11	33.3	0	0.0		30	81.8	0	0.0		15	45.5	0	0.0	
	Often	9	27.3	11	33.3		22	66.7	9	27.3		4	12.1	10	30.3		0	0.0	10	30.3	
	Always	27	69.7	25	66.7		0	0.0	27	72.7		0	0.0	26	69.7		0	0.0	26	69.7	
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.592, P2=0.792, P3 =0.792																					
Social contacts outside home was limited	Never	0	0.0	0	0.0	1.0	0	0.0	0	0.0	<0.0001*	1	3.0	0	0.0	<0.0001*	15	45.5	0	0.0	<0.0001*
	Rarely	0	0.0	0	0.0		9	27.3	0	0.0		31	84.4	0	0.0		21	54.5	0	0.0	
	Often	11	33.3	11	33.3		27	72.7	9	27.3		4	12.1	10	30.3		0	0.0	11	33.3	
	Always	25	66.7	25	66.7		0	0.0	27	72.7		0	0.0	26	69.7		0	0.0	25	66.7	
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.592, P2=0.792, P3 =1.0																					

Planning activities ahead of time was limited	Never	0	0.0	0	0.0	0.607	0	0.0	0	0.0	<0.0001*	2	6.1	0	0.0	<0.0001*	15	45.5	0	0.0	<0.0001*
	Rarely	0	0.0	0	0.0		11	33.3	0	0.0		28	75.8	0	0.0		21	54.5	0	0.0	
	Often	13	39.4	11	33.3		25	66.7	9	27.3		6	18.2	10	30.3		0	0.0	11	33.3	
	Always	23	60.6	25	66.7		0	0.0	27	72.7		0	0.0	23	69.7		0	0.0	25	66.7	
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.592, P2=0.792, P3 =1.0																					
Absentisem from work increase	Never	0	0.0	0	0.0	0.112	0	0.0	0	0.0	<0.0001*	5	22.7	0	0.0	<0.0001*	11	50.0	0	0.0	<0.0001*
	Rarely	1	4.5	0	0.0		7	31.8	0	0.0		19	72.7	0	0.0		11	50.0	0	0.0	
	Often	9	40.9	3	15.8		18	68.3	2	10.5		1	4.6	3	15.8		0	0.0	4	21.1	
	Always	15	54.6	19	84.2		0	0.0	20	89.5		0	0.0	19	84.2		0	0.0	18	78.9	
<b>Sig. before and after for each group: study group</b> *P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=1.0, P2=1.0, P3 =1.0																					

1<sup>st</sup> assessment: the week before first contact, 2<sup>nd</sup> assessment: after 3 sessions, 3<sup>rd</sup> assessment: after 6 sessions & 4<sup>th</sup> assessment: after 9 sessions

-sig. for each group: p-value for Marginal Homogeneity test or Mac Nemar test -\*level of significance p = ≤0.05

∞P1: significance between 1<sup>st</sup> assessment and 2<sup>nd</sup> assessment □P2: significance between 1<sup>st</sup> assessment and 3<sup>rd</sup> assessment, □P3: significance between 1<sup>st</sup> assessment and 4<sup>th</sup> assessment

**Table (7):** Total score of physical ,mental ,psychological and social fatigue among the Study and Control Groups and Significance of Differences Before and After Reflexology Foot Massage Sessions of Patients on Hemodialysis (No=72)..

Effect of fatigue on sleep pattern	1 <sup>st</sup> assessment			2 <sup>nd</sup> assessment			3 <sup>rd</sup> assessment			4 <sup>th</sup> Assessment		Sig. Chi-Square test		
	Study group (n=36)	Control group (n=36)	Sig. Chi-Square test	Study group (n=36)	Control group (n=36)	Sig. Chi-Square test	Study group (n=36)	Control group (n=36)	Sig. Chi-Square test	Study group (n=36)	Control group (n=36)			
Physical fatigue score	50.0-100.0	62.5-100.0	0.05	29.2-100.0	62.5-100.0	<0.0001*	8.3-50.0	66.7-100.0	<0.0001*	4.2-62.5	62.5-100.0	<0.0001*		
Min -Max														
Mean ±SD	81.5±16.5	85.9±16.7		55.6±13.5	84.7±16.8		33.9±7.5	85.6±15.6		32.8±13.2	86.6±14.8			
<b>Sig. before and after for each group: study group</b> ∞P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.357, P2=0.721, P3 =0.680														
Mental fatigue score	33.3-95.8	33.3-100.0	0.058	8.3-66.7	33.3-100.0	<0.0001*	0.0-62.5	33.0-100.0	<0.0001*	8.3-45.8	37.5-100.0	<0.0001*		
Min -Max														
Mean ±SD	70.9±19.9	73.1±18.8		44.6±16.1	73.8±17.9		27.6±16.5	74.9±17.8		26.9±13.9	78.2±16.4			
<b>Sig. before and after for each group: study group</b> ∞P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.673, P2=0.325, P3 =0.123														
Psychological fatigue score	56.7-100.0	63.3-100.0	0.953	33.3-93.3	63.3-100.0	<0.0001*	13.3-46.7	66.7-100.0	<0.0001*	6.7-40.0	66.7-100.0	<0.0001*		
Min -Max														
Mean ±SD	82.7±13.1	79.2±15.9		56.5±14.0	80.6±16.3		32.5±6.6	82.5±15.9		27.7±12.5	86.7±15.4			
<b>Sig. before and after for each group: study group</b> ∞P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.469, P2=0.131, P3 =0.061														
Social fatigue score	46.7-100.0	53.3-100.0	0.052	26.7-66.7	53.3-100.0	<0.0001*	6.7-53.3	53.3-100.0	<0.0001*	0.0-33.3	40.0-100.0	<0.0001*		
Min -Max														
Mean ±SD	75.9±13.1	83.2±16.5		49.5±11.9	84.4±16.9		29.9±9.4	83.6±17.1		14.7±14.2	76.6±22.2			
<b>Sig. before and after for each group: study group</b> ∞P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.109, P2=0.593, P3 =0.066														
Total scores	51.6-97.8	57.0-100.0	0.672	30.1-66.7	58.1-98.9	<0.0001*	14.0-43.0	59.1-100.0	<0.0001*	5.4-38.7	60.2-98.9	<0.0001*		
Min -Max														
Mean ±SD	78.3±12.5	79.9±11.1		52.1±9.4	80.5±10.4		31.2±7.1	81.5±10.6		26.7±9.1	82.8±10.8			
<b>Sig. before and after for each group: study group</b> ∞P1=<0.0001*,P2<0.0001* P<0.0001* <b>control group</b> P1=0.410, P2=0.248, P3 =0.053														

1<sup>st</sup> assessment: the week before first contact, 2<sup>nd</sup> assessment: after 3 sessions, 3<sup>rd</sup> assessment: after 6 sessions & 4<sup>th</sup> assessment: after 9 sessions

-sig. for each group: p-value for Marginal Homogeneity test or Mac Nemar test -\*level of significance p = ≤0.05

∞P1: significance between 1<sup>st</sup> assessment and 2<sup>nd</sup> assessment □P2: significance between 1<sup>st</sup> assessment and 3<sup>rd</sup> assessment, □P3: significance between 1<sup>st</sup> assessment and 4<sup>th</sup> assessment

**Table (1):** Shows frequency distribution and significance of differences of socio-demographic and clinical characteristics among the study and control groups of patients on hemodialysis. This table revealed that (36.4%) in the study group were between (20 - > 30 years), while for the control group less than half (45.5%) were between (50 ->60 years). (60.6%) was males in both groups. Nearly one third (36.4%) and (33.3%) respectively of the study and control groups hold a diploma degree. Regarding duration of hemodialysis in years, it was between (1-> 3 years) in one third (33.4%) of the study group and between (3-> 6 years) in slightly more than one third (36.4%) of the control group. In relation to inter- dialytic weight gain the highest percentage (66.7%, 48.5%) respectively in the study and the control

groups, gained (1.5-<2.5Kg). There was no statistical significant difference between both study and control groups regarding any of the above mentioned characteristics.

**Table (2):** Reveals frequency distribution of fatigue intensity among study and control groups and significance of differences before and after reflexology foot massage sessions of patients on hemodialysis in relation to fatigue intensity before the first session in the study and control groups the majority (87.9%) and (84.8%) respectively, experienced severe fatigue. Whereas fatigue intensity after the first session less than three quarters (72.7%) of the study group had mild fatigue compared to highest percentage (87.9%) of the control group had severe fatigue. As for fatigue intensity before the second session, it showed equal percentage (84.8%) of both groups had severe fatigue. While fatigue intensity after second session, the majority (87.9%) of study group experienced mild fatigue compared to the highest percentage (90.0%) of control group who experienced severe fatigue.

Regarding fatigue intensity before the third session, the table showed that equal percentage (78.8%) of both groups had severe fatigue. While fatigue intensity after the third session the majority (90.9%) of the study group experienced mild fatigue compared to highest percentage (84.8%) of the control group who experienced severe fatigue. The table revealed that fatigue intensity before the fourth session, more than two thirds (69.7%) of study group and the majority (84.8%) of control group experienced severe fatigue. While fatigue intensity after fourth session, the majority (93.9%) of study group experienced mild fatigue compared to the highest percentage (90.9%) of control group who experienced severe fatigue.

The table exhibited that, less than two third (60.6%) of the study group and the majority (90.9%) of the control group had severe fatigue before fifth session. while fatigue intensity after the fifth session, the majority (93.9%) of the study group experienced mild fatigue and the same percentage in control group experienced severe fatigue. In relation to fatigue intensity before the sixth session less than three quarters (72.7%) of the study group and the majority (97.0%) of the control group had severe fatigue. While fatigue intensity after sixth session, all (100.0%) of study group experienced mild fatigue and same percentage in control group experienced severe fatigue.

As for fatigue intensity before the seventh session, less than two third (60.6%) of the study group and the majority (97.0%) of the control group had severe fatigue .While fatigue intensity after the seventh session, all (100.0%) of study group as compared with majority (97.0%) in control group who experienced severe fatigue. from the same table it was noticed that fatigue intensity before the eighth session, more than half (51.5%) of the study group compared to majority (97.0%) of the control group had severe fatigue. While, fatigue intensity after the eighth session, all (100.0%) of study group experienced mild fatigue as compared with the majority (97.0%) of control group who experienced severe fatigue .

Finally, before the ninth session less than half (48.5%) of the study group and the majority (93.9%) of the control group had severe fatigue. Whereas, fatigue intensity after the ninth session, the majority (97.0%) of the study group experienced mild fatigue as compared with majority (93.9%) in the control group who had severe fatigue. there was no statistical significant differences before the first, second, third and fourth reflexology foot massage sessions between both groups. Whilst, the fifth and sixth sessions moreover, before the seventh eighth and ninth sessions and after all ninth sessions significance was ( $p = <0.0001^*$ ) in the study group over control .

**Table (3):** Shows frequency distribution of physical fatigue among the study and control groups and significance of differences before and after reflexology foot massage sessions of patients on hemodialysis. It was noticed that there was no statistical significance difference among both study and control groups in the first assessment in all subscale items related to decrease physical discomfort, ability to complete tasks in the home, ability to do things away from home, ability to maintain physical effort for long periods, decrease muscle weakness, decrease the need to rest, ability to engage in enjoyable activities and decrease need to sleep. There was statistical significant difference ( $P=<0.0001^*$ ) in all physical subscale items between both groups in the second, third and fourth assessment, while all these subscale items were statistically better among the study group than control one .

Data from the same table revealed that there was statistical significant decrease ( $P=<0.0001^*$ ) of physical fatigue in the study group between the first and second assessment, between first and third assessment and between first and fourth assessment as for significance in the control group there was no statistical significant difference between first and second assessment, between first and third assessment and between first and fourth assessment. As for significance in the control group there was no statistical significant difference between first and second assessment, between first assessment and third assessment and between first assessment and fourth assessment.

**Table (4):** Shows frequency distribution of mental fatigue among the study and control groups and significance of differences before and after reflexology foot massage sessions of patients on hemodialysis. As for mental fatigue the table revealed that there was no statistical significant difference between both study and control groups in the first assessment in all the subscale items related to paying attention for long periods of time, decrease clumsy and un coordination, decrease forgetful, ability to finishing tasks that require thinking, ability to organizing thoughts when doing things at home or at work, ability to concentrate and decrease slips of tongue with speaking. There was statistical significant improvement ( $P < 0.0001^*$ ) in all mental subscale items in the study group over control in the second assessment, between the third assessment and fourth assessment. The same table showed that there was statistical significant ( $P < 0.0001^*$ ) of mental fatigue in the study group between the first and second assessment, between the first and the third assessment and between the first and fourth assessment. Regarding significance for control group there was no statistical significant difference between the first and second assessment, between the first and the third assessment and between the first and fourth assessment.

**Table (5):** Shows frequency distribution of psychological fatigue among the study and control groups and significance of differences before and after reflexology foot massage sessions of patients on hemodialysis. As for psychological fatigue the table showed that there was no statistical significant difference between both study and control groups in the first assessment in all the subscale items including decreases irritability, decrease stress, ability to deal with emotional issues, ability to provide emotional support to family, minor difficulties don't seem like major difficulties, decrease feeling distress, decrease description of fatigue as destructive feeling, decrease worry about other people looking, decrease feeling listless. on the other hand there was statistical significant difference ( $P = < 0.0001^*$ ) in all psychological subscale items between both groups in second, the third and fourth assessment, whilst all these subscale items were statistically better among the study group than the control one. The table also clarified that there was significant ( $P = < 0.0001^*$ ) in the study group between first and second assessment, between the first and the third assessment and between the first and fourth assessment, regarding the same subscale items. finally the table showed that in the control group there was no statistical significant difference between the first and second assessment, between the first and the third assessment and between the first and fourth assessment, as for the same subscale items

**Table (6):** Shows frequency distribution of social fatigue among the study and control groups and significance of differences before and after reflexology foot massage sessions of patients on hemodialysis. As for social fatigue the table revealed that there was no statistical significant difference between both study and control groups in the first assessment in all the subscale items including workload or responsibilities, decrease need for others help, social contacts outside home, planning activities ahead of time, absenteeism from work. There was statistical significant improvement ( $P < 0.0001^*$ ) in all social subscale items in the study group over control in the second assessment, between the third assessment and fourth assessment. The table revealed that there was statistical significant ( $P < 0.0001^*$ ) in the study group between the first and second assessment, between the first and the third assessment and between the first and fourth assessment. Finally the table illustrates that in control group there was no statistical significant difference between the first and second assessment, between the first and the third assessment and between the first and fourth assessment as for the same subscale items.

**Table (7):** Total score of physical, mental, psychological and social fatigue among the study and control groups and significance of differences before and after reflexology foot massage sessions of patients on hemodialysis. As for physical, mental, psychological and social fatigue, it was noticed that there was no statistical significant difference between both study group and control group in the first assessment before applying any reflexology foot massage sessions. However, there was statistical significant difference ( $P < 0.0001^*$ ) Between study and control groups in the second, third, fourth assessment. In relation to significance for study group, there was statistical significant improvement ( $P < 0.0001^*$ ) between the first and second assessment, between the first and the third assessment and between the first and fourth assessment. Regarding significance for control group there was no statistical significant difference between the first and second assessment, between the first and the third assessment and between the first and fourth assessment.

## Discussion

The results of the present study revealed that there were no statistical significant differences in socio demographic and clinical data between the study and control groups which included age, sex, level of education, and duration of hemodialysis and/or inter- dialytic weight gain. These findings roll out the extraneous factors that might confuse the effect of reflexology foot massage. In relation to fatigue intensity among patients on hemodialysis the present study revealed that there was no statistical significant difference between the study and the control groups

before first reflexology foot message session. This may be attributed to the fact that patients on both groups are relatively similar due to the frequency of dialysis which was three sessions per week and chronicity of their dialysis treatments as evidenced by no difference between both groups regarding duration of dialysis, so both groups exposed nearly to the same degree of disruption that these treatments cause.

Hence, they gave the same description of their experienced fatigue. In line with this results previous study by **Holley et al. (2018)** and **Mehta et al. (2015)** who reported that fatigue is one of the most common symptoms that patients with chronic illness experience <sup>(23,24)</sup>. Another study to **Mohamed et al. (2017)** <sup>(25)</sup>, stated that patients with ESRD identify fatigue as one of the most troubling symptoms with which they contend with a prevalence ranging from 60% to 97%.

Moreover, there was no statistical significant difference between the study and the control groups in relation to fatigue intensity among patients on hemodialysis before first, second, third and fourth application of reflexology foot message sessions. These findings denote that three reflexology foot message sessions are not enough to reach to subtle and cumulative reflexology foot message effect whilst, three sessions or more are needed to give cumulative effect. It is worth to mentioning that cumulative effect of regular reflexology message means that less tension likely to build up between message sessions so, that subsequent message can be deeper, more effective and benefits longer lasting **Karag (2016)** <sup>(26)</sup>. The current study findings are supported by **Ozdemir et al. (2018)** <sup>(27)</sup> their study suggested that foot reflexology have beneficial effects on decreasing the scores of fatigue in experimental group but not in control group especially after three message sessions in patients suffering from pneumoconiosis. In addition **Bozan and Anadolu (2016)** <sup>(28)</sup> revealed that nausea, vomiting and fatigue were decreased in breast cancer patients receiving chemotherapy after application of foot reflexology and added that more than three sessions needed to give statistical significant improvement before and after message sessions .

Findings of the present study also revealed that there was statistical significant improvement in fatigue intensity in study group over control before application of reflexology foot message session from fifth to ninth session. This may be attributed to subtle and cumulative effects of reflexology foot message that usually takes 3 to 4 sessions to see noticeable improvement between message sessions. the findings explained that, during third assessment for study group after applications of 6 message sessions, 40 minutes for every sessions; patients stated that their needs to rest immediately after their dialysis session decreased. Moreover, at the same time they can go to the dialysis session alone without friend or family member while, in the control group there was no improvement and the participants stated that they usually sleep during their rest time due to fatigue <sup>(28)</sup>.

This study are consistent with **Anne et al. (2018)** <sup>(29)</sup> who reported that there was a significant decrease in anxiety and pain level after 3 reflexology massage sessions among patients with breast and lung cancer .this study emphasized that reflexology massage takes 3 sessions to give significant improvement between message sessions in the study subjects. This evidenced by most of researchers in the field of nursing practice which revealed that reflexology foot massage more than 3 sessions gave statistical significant improvement in fatigue intensity.

This congruent with **Diroll (2017)** <sup>(30)</sup> who investigated the effect of self-foot reflexology on fatigue in woman nurses, in this research the nurses performed self-reflexology for 40 minutes, 2times per week during 4 weeks on the right and left feet. The findings showed that the score of fatigue in the study group was significantly lower than in the control group. Furthermore, the current study showed that, there was statistical significant improvement in the study group than the control group after implementation of nine reflexology foot message sessions. This may be attributed to application of reflexology foot message which stimulates the nerve pathways to release congestion and promote relaxation response for the entire body. Moreover, reflexology message activates the life force in the body, creates a balance of energy and allowing energy to flow freely <sup>(31)</sup>. According to this theory the fatigue experienced among the studied group had been decreased which indicates a balanced flow of energy. This findings is in line with **Jones et al. (2016)** <sup>(32)</sup> who found that foot message interventions were effective noninvasive techniques and explained that this could be due to release of congestion and promotion of relaxation among the massage group.

The results of the present study in congruent with **Jones et al. (2018)** <sup>(33)</sup>. Who revealed that the fatigue severity decreased in patients on hemodialysis who received reflexology foot massage. In addition, these results are in line with **Khojandi et al. (2016)** <sup>(34)</sup>, Who stated that reflexology foot massage is useful nursing intervention to relive patients fatigue after coronary artery bypass graft and showed significant differences in fatigue levels after reflexology massage intervention among both groups, where the studied subjects, fatigue level were less than control group. Also, they recommended that this intervention was easy to apply and had an effect on relieving fatigue in patients after coronary artery bypass graft. In addition **Ondo et al. (2018)** <sup>(35)</sup> pointed out that, the techniques of reflexology and

relaxation caused a decrease in fatigue severity in women with multiple sclerosis and that fatigue severity decreased in two groups of reflexology and relaxation compared to control group, but the effects of reflexology on reducing fatigue were more than those of relaxation.

Similar finding come from **Kanaan et al. (2019)** <sup>(36)</sup> where foot reflexology massage was applied in study of coal workers suffering from pneumoconiosis. The intervention group received sixty –minutes reflexology session, twice –weekly for five weeks, with no treatment for control group. The study results revealed a significant decrease in fatigue intensity by using visual analog scale for the intervention group, while the control group showed no improvement in fatigue intensity. Moreover, **Culebras, (2017)** <sup>(37)</sup> conducted a systemic review and meta-analysis using electronic database and manual searches on all published studies reporting the effect of foot reflexology on fatigue, including 15 studies. This meta-analysis indicates that reflexology foot massage is a useful nursing intervention to relieve fatigue, the results of present study were in accordance with the results of studies conducted by **Walgreens, (2016)** <sup>(38)</sup> ,**Williamson et al. (2018)** <sup>(39)</sup> to evaluate the effect of reflexology foot massage on fatigue severity, the results showed that foot reflexology massage had effect on fatigue severity, the results showed that foot reflexology massage had effect on fatigue intensity so that the amount of fatigue after massage had been less than fatigue before it which is consistent with the present study finding.

Regarding fatigue dimensions among hemodialysis patients, the current study revealed that there was no statistical significant difference between both study and control groups in first assessment before applying any reflexology foot massage sessions in relation to physical fatigue dimension. The current study demonstrated that subjects in both groups complaint from increasing physical discomfort, decreasing ability to complete tasks that require physical effort in the home or things away from home, their muscles felt weak they needed rest for longer periods, decreasing ability to engage in the kind of enjoyable activities and they felt sleepy . The current study finding is supported by **Song and Kim, (2019)** <sup>(40)</sup> their study participants reported that fatigue resulting from hemodialysis give rise to difficult participation in physical activities, not only to enjoy activities with others outside of the house, but it was difficult to keep up with activities and chores in the house. There was a sense of not being able to accomplish a simple task and so activities were prioritized and only the necessities were accomplished. In addition **Xavier, (2016)** <sup>(41)</sup> **Siev-Ner et al. (2018)** <sup>(42)</sup> showed that fatigue was worse after hemodialysis and lead to role limitation, inability to carry out daily activities, made patients feel exhausted, lacking physical energy, and having a decrease in strength and ability to do physical activities. Similar to those findings, participants in the current study reported feeling "washed out" and "drained" physically.

The findings of the present study showed that there was high statistical significant difference between both groups regarding physical fatigue dimension; in second assessment after applying three reflexology foot massage sessions, in third assessment after applying six reflexology foot massage sessions and in fourth assessment after applying nine reflexology foot massage sessions. Also, there was statistical significant improvement in the study group between the first and second assessment.

Whereas, there was no statistical significant improvement in the control group between the first and second assessment, between the first and third assessment and between the first and fourth assessment. These findings support the therapeutic effects and usefulness of reflexology foot massage, as it is based on principles that the effect are mirrors of the body and they have reflex points that correspond to each of the body's gland, structure and organs. It is believed that when a reflex area is massaged in any zone, it stimulated the corresponding organs in that zone. So, massage has mechanical effects that improve circulation. Remove waste products from the body, improve joint mobility, relive pain and reduce muscle tension. It has psychological benefits including relaxation and improving sense of well-being by stimulating the release of endorphins that act as natural painkillers and mood elevators . Moreover, reflexology is an avenue for increasing human touch, which is a basic human need all these improve physical activities <sup>(43)</sup>

A study conducted by **Chokroverty et al .; (2018)** <sup>(44)</sup> showed the effect of five minutes foot massage on physiological parameters of critically ill patients to overcome fatigue and help recovery. Results indicated that foot massage had the potential effect of increasing relaxation as there were physiological changes after the intervention of reflexology foot massage, decrease fatigue levels and increase recover rate. Moreover, **Won et al. (2019)** <sup>(240)</sup> found that there was significant difference in systolic blood pressure, diastolic blood pressure, pulse rate, physical fatigue, and mood status after applying reflexology foot massage. So, they recommended using foot reflexology as an effective nursing intervention in cancer patients receiving chemotherapy. **Claman et al. (2017)** <sup>(45)</sup> added that reflexology foot



massage contribute to improvements in physical function and fatigue levels on patients with advanced –stage breast cancer. **Quattrin et al . (2019)** <sup>(46)</sup> reported that foot reflexology is effective in improvement of physical symptoms of premenstrual syndrome.

The current study revealed that there was no statistical significant difference between both study and control groups in first assessment before applying any reflexology foot massage sessions in relation to mental fatigue dimension. This result is in line with **Ross et al . (2018)** <sup>(47)</sup> who indicated that fatigue affected mental fatigue affected patient's ability to remember conversations and names of people they had known for years especially in the hours following their hemodialysis session. This fatigue specifically accompanied the physical exhaustion that came after dialysis sessions. **Wright et al. (2017)** <sup>(48)</sup> reported that patients on hemodialysis experience mental fatigue, so feel difficulty with their cognitive abilities to remember and keep their attention and affecting their abilities to concentrate and participate in activities.

The findings of present study showed that there was high statistical significant improvement between both groups regarding mental fatigue dimension in second assessment after applying three reflexology foot massage sessions, in third assessment after applying six reflexology foot massage sessions and in fourth assessment after applying nine reflexology foot massage sessions. Moreover, there was statistical significant improvement in study group between first and second assessment, between the first and third assessment and between the first and fourth assessment. Whereas, there was no statistical significant improvement in control group between the first and third assessment and between the first and fourth assessment.

Participants of the present study demonstrated that improvement in physical and psychological fatigue lead to increase of their social contact outside home, decrease absenteeism from work and increase praying in mosque. **Hodgson, (2018)** <sup>(49)</sup> supported this findings and reported that reflexology improved patients independent involvement in personal and self –care, as well as social functioning, reduced sick leave and absenteeism and with further positive impact on self -esteem all functions are improved.

In contrary previous systematic review by **Stephenson et al. (2019)** <sup>(50)</sup> failed to show concrete evidence to the effect of reflexology massage on fatigue related to any conditions including migraine, sinus colic, menopause, constipation /diarrhea, back pain, neck pain, stroke and asthma .Unfortunately, this systematic review included 18 studied which represented less than 50% of the available reflexology studies in Australia. Moreover, ten studies of them were out dated and most of the included randomized controlled trials (RCT) had extremely low sample size 30 or fewer participants. Also all these studies used reflexology massage as an alternative therapy and not complementary. In addition, there were limitation in information related to duration and techniques of reflexology massage used in these studies. This result may be attributed to the effect of reflexology on decreasing physical fatigue, and improving sleeping pattern all of this may increase patients ability to perform physical activities as some patients from the current study participants reported that reflexology massage relieve physical fatigue. This findings is harmony with **Gamble et al . (2017)** <sup>(51)</sup> **Lee, (2016)** <sup>(52)</sup> and **Paula, (2019)** <sup>(50)</sup> studies which revealed that reflexology massage improve physical activities.

It is clear from the previous discussion that patients who underwent hemodialysis and were managed with reflexology foot massage had a decrease in fatigue level, and an improvement in physical activities, psychological status and social activities. In addition, reflexology foot massage improved their sleeping pattern. It is time that health care organizations strive towards evidence-based reflexology massage, educate their staff on reflexology technique, determine the barriers to its application in nursing practice and plan for strategies to overcome those barriers in order to ensure the best patient's management outcome. Physicians, nurses and administrators must collaborate to ensure that evidence-based practices are implemented and enforced in the clinical settings.

## **I. Conclusion**

- **It can be concluded from the present study results that:**

Patients on hemodialysis who underwent a course of 40 minutes reflexology massage after the hemodialysis session on all reflex points on both feet, 3 times per week, for 3 consecutive weeks with a total of 9 massage sessions; had significant decrease of fatigue intensity level, improvement of physical activities, emotional wellbeing and sleeping patterns and social activities.

## Recommendations

### The findings of this study lead to the following recommendations:

Reflexology foot massage should be used as evidence base for nursing practice with patients on hemodialysis through the following:

1. Incorporate the technique in clinical nursing curricula, so that students will be trained to use it as an integral part of the care of patients on hemodialysis.
2. Teach the technique to faculty teaching staff and their assistants in order to be proficient in demonstrating it to their students.
3. Approach the administrative personnel of hemodialysis unit, in order to raise their awareness about the benefits of reflexology to patients on hemodialysis, and encouraging its use as an integral part of patient's care.

### Recommendation for further research:

- Compare reflexology foot massage with other complementary medicine methods in relieving fatigue of patients on hemodialysis.
- Research on cost-effectiveness, gender and aging differences associated with reflexology.
- Evaluate the effects of foot reflexology on outcome variables other than fatigue

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