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RESEARCH ARTICLE

EFFECT OF FOOT MASSAGE ON PHYSIOLOGICAL AND PSYCHOLOGICAL PARAMETERS AMONG PATIENTS UNDERGOING CARDIAC CATHETERIZATION

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ABSTRACT

Background: The rate of anxiety and pain in coronary artery patients before angiography is significantly higher. ***Aim:*** This study aimed to examine the effect of foot massage on physiological and psychological parameters among patients undergone cardiac catheterization. ***Design:*** A quasi-experimental research design was utilized. ***Setting:*** The current study was conducted in cardiac catheterization unit of Menoufia University Hospital. Subjects: 120 patients undergone cardiac catheterization assigned randomly into two equal groups, 60 patients for each group: Studied group (I) received foot massage therapy besides the routine hospital care while control group (II) received routine hospital care only .Three tools were used by the researcher for collecting the necessary data; Structured Interview Questionnaire, State Anxiety Inventory (SAI) and Visual Analogue pain scale (VAS). ***Results:*** There was a statistically significant difference related to pain level between study and control groups post-intervention with p-value =0.02, also there was a highly statistically significance difference related to anxiety level between study and control groups post-intervention with p-value ≤ 0.001 and a highly statistically significance difference related to systolic and diastolic blood pressure as well as heart rate between study and control groups post-intervention. ***Conclusions:*** Foot massage has a positive effect in reducing anxiety and pain level as well as heart rate and blood pressure among patients undergone cardiac catheterization. ***Recommendations:*** Foot massage should be applied for patients before cardiac catheterization.

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INTRODUCTION

Cardiac catheterization is an invasive diagnostic procedure, recommended in high-risk patients with cardiac disease and unstable angina for providing information on the valves and the function of the heart ventricles. It is also used to measure the internal heart pressure and the cardiac output. Every year the number of patients undergo cardiac catheterization is increasing. Although, it is one of the most reliable methods in the diagnosis of cardio-vascular diseases, it can produce a high rate of pain and anxiety that leads to tachycardia and palpitations (Foji *et al.,* 2015; McEnroe-Petitte, 2015). Acute pain can lead to psychological and physical prognosis and outcomes of the disease and surgery. Also, it can increase the sympathetic response which changes the normal cell function and hemodynamic (Barnett and Akhtar, 2013; Gélinas *et al.,* 2013). Persistent acute pain which is not relieved can be changed to emotional, psychological and physical distresses that negatively affect the prognosis and outcome of the disease and surgery. Pain causes the patients to have less mobility and try to reduce their pain through shallow breathing and less movement of the chest, so they are going to have hypoxemia and pulmonary dysfunction, the patient's recovery is going to be delayed and even his/her life is threatened (Radpey, 2008). Furthermore, inadequate pain relief also can increase sympathetic response which stimulates cardiac function and increases myocardial oxygen consumption, so patients with limited cardiac reserve and ventricular dysfunction perhaps are not able to increase oxygen supply for keeping appropriate balance between demand and supply of oxygen that leads to tissues deprivation of oxygen, changes in normal cell function and hemodynamic changes, so lack of pain controlling can leave negative effects on individuals' health (Maire and Daebitz, 2007; Yeganeh *et al.,* 2007). Fear, anxiety and other unpleasant emotional experiences are common before coronary angiography and other cardiovascular interventions. Anxiety may concern the anesthesia process, the fear of death, of being cut, of bad prognosis, of pain and of no access to pain medications after completion of the surgery, as well as the effects of postoperative nausea and vomiting constitute components of surgical experience (Fitzgerald, 2008). The provoked anxiety stimulated the sympathetic system, increased indices such as heart rate, blood pressure, respiratory rate and

can be one of the risk factors for atrial fibrillation. Anxiety can also delay the healing of wound site, weaken immune system response, decrease tolerance to pain before, during and after the catheterization and has a negative effect on a patient's prognosis and recovery (Korkmaz *et al.,* 2017; Delewi *et al.,* 2017). However, the use of medications for relieving pain may cause complications such as respiratory depression, gastrointestinal problems including nausea, vomiting, gastrointestinal reflux, reduced bowel movement and constipation, dependence, addiction, cognitive disorders, prolongation of the length of ICU stay, and a higher chance of mortality (Abbaszadeh *et al.,* 2018).

Non-pharmacological strategies should be implemented by nurses or physiotherapist to control anxiety in patients undergoing cardiac catheterization to prevent the negative effects on patients' clinical outcomes, as tachycardia and chest pain. Non-pharmacological methods comprise a wide range of techniques that are relatively simple, noninvasive, and low-cost with fewer side effects than pharmacological methods (Zakerimoghadam, 2010). Nowadays, complementary and alternative therapies including acupuncture, herbal medicine, chiropractic, homeopathy, reflexology and massage may be used to reduce anxiety and its adverse effects on physiological reactions, stabilizing vital signs, and managing pain (Tan *et al.,* 2007). Massage is considered a complementary medicine used by millions to relieve pain, reduce stress and anxiety. Foot reflexology involves applying pressure to specific points on the feet to affect various parts of the body. Massaging key reflex points on feet result in releasing energy blocks within the human body stimulating the immune system and dislodge toxins to be eliminated naturally by the body (Covelli, 2014). Foot reflexology stimulates the flow of energy within the body from the feet to the head that decreases the sympathetic nervous system arousal, relieve anxiety and promote relaxation. Foot massage is independent nursing intervention that reduces patients' anxiety and the sympathetic response to reduces heart rate, pain and other symptoms related to ischemia. Some studies confirmed the effect of reflexology on anxiety and physiological parameters (Gunnarsdottir, 2007; Torabi, 2012; Abdou *et al.,* 2015).

Aim of the Study: This study aimed to examine the effect of foot massage on physiological and psychological parameters among patients undergone cardiac catheterization.

Operational definitions

Foot massage: In the present study, at the same day before angiography all subjects in the study group received a reflexology treatment for 30 minutes of general foot massage and the stimulation of three reflex points including Solar plexus, Pituitary gland, and Heart to decrease patient anxiety and pain before angiography.

Physiological parameters are measured by Pain, Blood pressure and Heart rate.

Psychological parameters are measured by Anxiety.

Research Hypotheses

- There will be difference of anxiety level between the study and control group.
- There will be difference of pain level between the study and control group
- There will be difference of blood pressure and heart rate between the study and control group.

Subjects: A convenience sample of 120 patients undergone cardiac catheterization at Shebin El-Kom and Menoufia University Hospitals, were assigned randomly into two equal groups, 60 patients for each group: Study group (I) received foot massage therapy and Control group (II) received routine hospital care only.

Inclusion criteria included: Adult patients aged 19 to 65 years old, both males and females, all patients had normal lower limbs (no varicose veins, peripheral neuropathy or deep vein thrombosis), no previous history of depression, anxiety disorders or consumption of anti-anxiety drugs 48 hours before the study. Emergency angiography cases and patients with the symptoms of myocardial infarction were excluded from this study as delaying cardiac catheterization may affect patients' prognosis**.**

METHODS:

Three tools were used for data collection: Structured Interview Questionnaire**,** State Anxiety Inventory (SAI) **and** Visual Analogue Pain scale (VAS).

Tool I: Structured Interview Questionnaire: It was developed and used by the researchers to assess patients' sociodemographic and medical data and included three parts as the following**:**

- **Part one**: Patient's socio-demographic data including age, sex, level of education, occupation, marital status, smoking, etc.
- **Part two**: Medical data including patient's past, present medical history, duration of cardiac disease, other associated diseases, type of cardiac catheterization and if it's first time for catheterization or not.
- **Part three**: Clinical data including monitored blood pressure and heart rate.

Tool II- State Anxiety Inventory (SAI)*:* This instrument contained 20 items rated on a four point scale from one to four where 1(Not at all), 2 (Somewhat), 3 (Moderately so) and 4 (Very much so). The maximum score was 80 points, and the minimum was 20, the higher the score, the higher the anxiety. A cut point of 39–40 has been suggested to detect clinically significant symptoms for the State Anxiety scale **(Kvaal ,Ulstein, Nordhus and Engedal 2005).**

Tool III – Visual Analogue Pain scale (VAS):
VAS was used to assess pain intensity. The total score is from zero to ten, where zero (No pain), a score from 1 to 3 (Mild pain), a score from 4 to 6 (Moderate pain) and a score from 7 to 10 (Worst pain) (Weheida, 2011).

Methods: The study was extended over a period of five months from February 2018 to the end of July 2018. A written approval from ethical committee and the responsible authorities was obtained before the study in addition to a written consent was obtained from each patient for agreement to participate in this study after explanation of the purpose of the study. Patients who agreed to participate in the study and fulfilled the inclusion criteria were divided randomly and

alternatively into study and control group 60 patients each. Study group on a week and the control group on another week to avoid the contamination of the sample. Study group (I) received foot massage therapy besides the routine hospital care and control group (II) received routine hospital care only. The study group received a reflexology treatment at the same day before angiography in a supine lying position in a quiet room of cardiac catheterization. At the beginning the researchers applied a lubricating cream on the patient' feet and provide general foot massage at both feet for one minute. Foot was held with one hand and the other hand rotated the foot at the ankle. Foot massage was done for each patient for 30 minutes, first for the left foot and then for the right foot (15 minutes each). Foot was massaged from ankle to toe with moderate pressure using both hands for 10 times. This procedure was repeated eight times. After general foot massage, the three reflexology areas of solar plexus, pituitary gland, and heart were used for stimulation. The researcher applied a firm downward pressure with her thumb on each area for two minutes in every area. Then circular massage was applied to the specific points. The massage was finished with light manual compression.

Each patient in the study group (I) and control groups (II) were assessed by researcher for the clinical data (blood pressure and heart rate), anxiety and pain level using tool I (part three), tool II and III respectively before intervention, post intervention, after catheterization and before discharge. A comparison between both groups (study group I and control group Π) were done four times interval: 1) on admission (pre intervention),2) immediately after performing foot massage for study group and for control group immediately before entering cardiac catheterization, 3) after performing cardiac catheterization and 4) before discharge for both groups to examine the effect of foot massage on anxiety and pain level among patients undergone cardiac catheterization.

Statistical Analysis: The collected data were tabulated and analyzed by SPSS (statistical package for the social science software) statistical package version 20 on IBM compatible computer**.** Descriptive statistics were expressed as mean and standard deviation (X+SD) for quantitative data or number and percentage (No and %) for qualitative data, in addition to Analytic statistics including; Pearson Chi-square test ($\chi 2$), Student t- test, and Repeated-Measures.

RESULTS

Table (1): showed that, the mean age was between the (57.31 ± 7.54 yrs) and (57.50 ±6.07 yrs) of the study and control group respectively. Also (56.7%) and (60%) of study and control group respectively were males. Moreover, (50%) and (56.7%) of the study and control group were smokers. Table (2): showed that (100%) of study and control group had a history of cardiac disease. Also, (31.7%) of the study group and (40%) of the control group suffered from DM and HTN. Fig (1): showed a non-statistically significant difference related to systolic and diastolic blood pressures between the studied groups pre-intervention. But, there was a highly statistically significant difference related to systolic and diastolic blood pressures between studied groups post-intervention, after catheterization and before discharge with (P-value ≤ 0.001), Table (3): showed a non-statistically significant difference related to heart rate between studied groups pre-intervention (P-value=0.17). But, there was a highly statistically significance difference related to heart rate between studied groups post-intervention (P-value≤0.001) in addition to a statistically significant difference related to heart rate between studied groups after catheterization and before discharge (P-value=0.01). Table (4): showed that there was no statistically significant difference related to pain level between studied groups pre-intervention p-value=0.84, but there was a statistically significance difference related to pain level

Table 1.Socio-demographic characteristics of the studied groups

Socio-demographic characteristics	Studied groups				χ^2	P value
	Group I (Study)(n=60)		Group II (Control)(n=60)			
	No.	%	No.	%		
Age (years): Mean±SDRange	57.31 ± 7.54 30.0 – 65.0		57.50 ±6.07 39.0 – 65.0		t=0.14	0.88 NS
Age (years):						
19-29	0	0.0	1	1.7	1.44	0.83
30-39	2	3.3	1	1.7		NS
40- 49	5	8.3	6	10.0		
50-59	28	46.7	27	45.0		
60-65	25	41.7	25	41.7		
Gender:						
Male	34	56.7	36	60.0	0.13	0.71
Female	26	43.3	24	40.0		NS
Education:						
Illiterate	18	30.0	15	25.0	3.60	0.46
Read & write	12	20.0	11	18.3		NS
Primary & Prep	3	5.0	9	15.0		
Secondary	19	31.7	19	31.7		
University	8	13.3	6	10.0		
Occupation:						
Working	28	44.0	26	43.3	1.71	0.42
Not work	12	20.0	18	30.0		NS
Housewife	20	36.0	16	26.7		
Marital status:						
Married	51	85.0	54	90.0	0.68	0.40
Widower	9	15.0	6	10.0		NS
Residence:						
Urban	13	21.7	22	36.7	3.26	0.07
Rural	47	78.3	38	63.3		NS
Smoking:						
Yes	30	50.0	34	56.7	0.53	0.46
No	30	50.0	26	43.3		NS

Table 2.Medical history of the studied groups

Medical history	Studied groups				χ^2	P value
	Group I (Study)(n=60)		Group II (Control)(n=60)			
	No.	%	No.	%		
History of cardiac disease:						
Yes	60	100.0	60	100.0	NA	NA
No	0	0.0	0	0.0		
Duration of cardiac disease:						
<1 yr	29	48.3	32	53.3	4.83	0.18
1—5 yrs	18	30.0	20	33.3		NS
6—10 yrs	6	10.0	7	11.7		
> 10 yrs	7	11.7	1	1.7		
Other co-morbidities:						
Diabetes Mellitus(DM)	10	16.7	8	13.3	6.92	0.22
Hypertension(HTN)	18	30.0	24	40.0		NS
DM & HTN	19	31.7	24	40.0		
Chest diseases	1	1.7	0	0.0		
Others	4	6.7	2	3.3		
No other co-morbidity	8	13.3	2	3.3		
Type of cardiac catheterization:						
Diagnostic	55	1.7	54	90.0	0.10	0.75
Therapeutic	5	8.3	6	10.0		NS
Is it first time to have cardiac catheterization:					3.16	0.07
Yes	37	61.7	46	76.7		NS
No	23	38.3	14	23.3		

Table 3.Changes in heart rate of the studied groups pre-intervention, post intervention, after catheterization and before discharge

Heart rate	Studied groups		Student`s t test	P value
	Group I (Study) (n=60)	Group II (Control) (n=60)		
	Mean±SD Range	Mean±SD Range		
Heart rate pre intervention	88.66 ± 8.88 65.0 – 102.0	86.58 ±7.72 70.0 – 100.0	1.37	0.17 NS
Heart rate post intervention	83.45 ± 9.06 60.0 – 98.0	90.33 ±7.85 73.0 – 105.0	4.44	≤0.001 HS
Heart rate after catheterization	81.88 ± 9.01 60.0 – 95.0	85.46 ±7.45 67.0 – 96.0	2.37	0.01 S
Heart rate before discharge	79.26 ± 8.55 60.0 – 92.0	82.71 ±7.23 65.0 – 100.0	2.38	0.01 S
Repeated measured ANOVA	F=432.30	F=146.56		
P value	≤0.001 HS	≤0.001 HS		
Pairwise comparisons	P1=≤0.001 HS P2=≤0.001 HS P3=≤0.001 HS P4=≤0.001 HS P5=≤0.001 HS P6=≤0.001 HS	P1=≤0.001 HS P2=0.005 S P3=≤0.001 HS P4=≤0.001 HS P5=≤0.001 HS P6=≤0.001 HS		

P1: Pre-intervention versus post-intervention
P2: Pre-intervention versus after catheterization
P3: Pre-intervention versus before discharge
P4: Post-intervention versus after catheterization
P5: Post-intervention versus before discharge
P6: After catheterization versus before discharge

Table 4. Pain levels of the studied groups pre-intervention, post intervention, after catheterization and before discharge

Pain level	Studied groups				χ^2	P value
	Group I (Study) (n=60)		Group II (Control) (n=60)			
	No.	%	No.	%		
Pain level pre intervention						
Moderate	22	36.7	21	35.0	0.03	0.84
Severe	38	63.3	39	65.0		NS
Pain level post intervention						
Moderate	33	55.0	21	35.0	4.84	0.02
Severe	27	45.0	39	65.0		S
Pain level after catheterization						
Mild	29	48.3	15	25.0	8.40	0.01
Moderate	31	51.7	43	71.7		S
Severe	0	0.0	2	3.3		
Pain level before discharge						
Mild	29	48.3	15	25.0	7.03	0.008
Moderate	31	51.7	45	75.0		S

Table 5. Anxiety scores of the studied groups pre-intervention, post intervention, after catheterization and before discharge

Anxiety score	Studied groups		Student`s t test	P value
	Group I (Study) (n=60)	Group II (Control) (n=60)		
	Mean±SDRange	Mean±SDRange		
Anxiety score pre intervention	66.86 ± 3.52 60.0 – 70.0	67.68 ±3.03 60.0 – 72.0	1.35	0.17 NS
Anxiety score post intervention	57.11 ± 3.30 50.0 – 62.0	69.60 ±2.53 60.0 – 75.0	23.20	≤0.001 HS
Anxiety score after catheterization	44.45 ± 4.20 37.0 – 56.0	55.48 ±5.38 45.0 –70.0	12.51	≤0.001 HS
Anxiety score before discharge	35.66 ± 5.98 25.0 – 48.0	43.25 ±6.68 30.0 – 70.0	6.54	≤0.001 HS
Repeated measured ANOVA	F=1195.15	F=674.75		
P value	≤0.001 HS	≤0.001 HS		
Pairwise comparisons	P1=≤0.001 HS P2=≤0.001 HS P3=≤0.001 HS P4=≤0.001 HS P5=≤0.001 HS P6=≤0.001 HS	P1=≤0.001 HS P2=≤0.001 HS P3=≤0.001 HS P4=≤0.001 HS P5=≤0.001 HS P6=≤0.001 HS		

P1: Pre-intervention versus post-intervention
P2: Pre-intervention versus after catheterization
P3: Pre-intervention versus before discharge
P4: Post-intervention versus after catheterization
P5: Post-intervention versus before discharge
P6: After catheterization versus before discharge

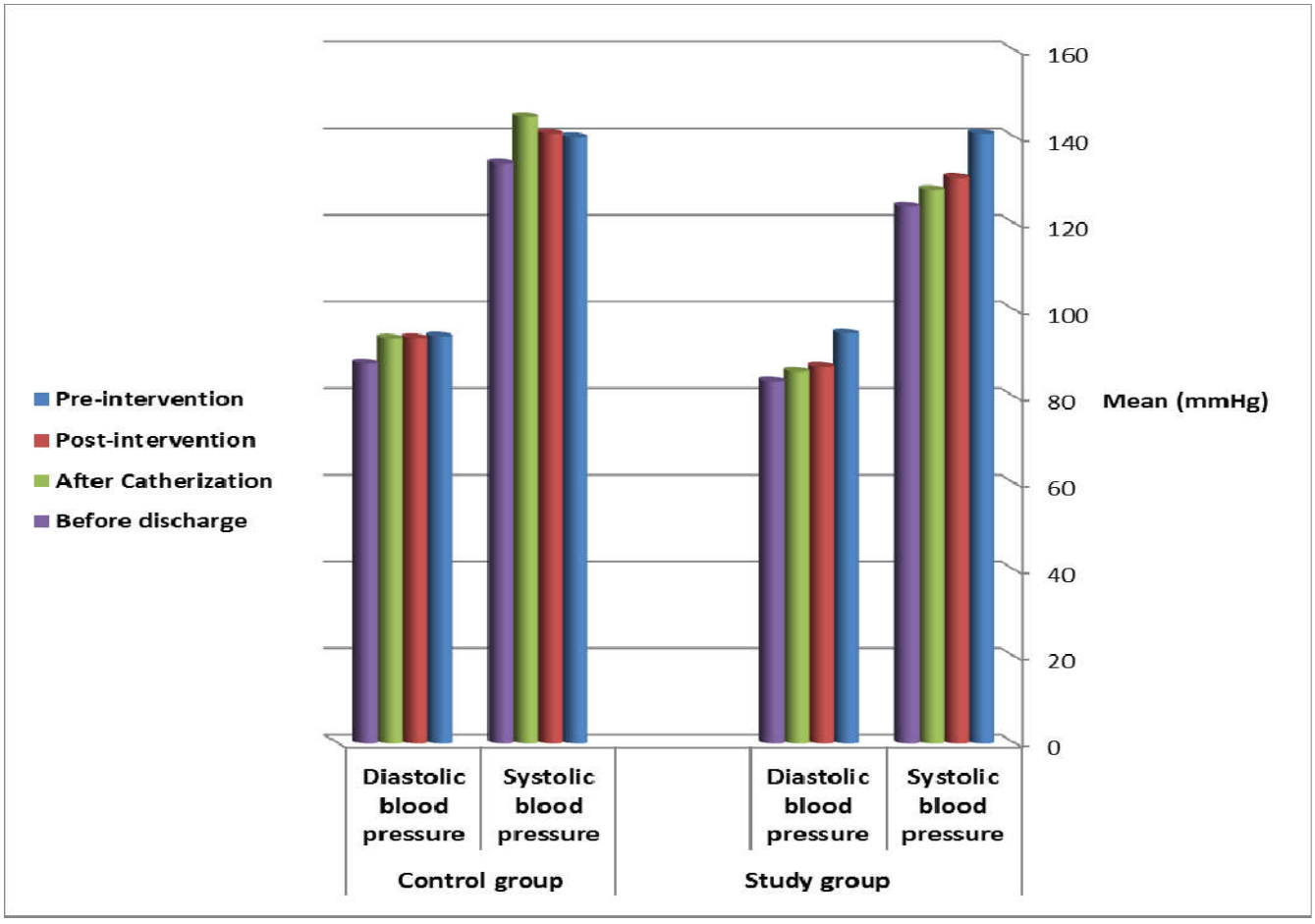

Fig. 1. Mean Systolic and diastolic blood pressure among studied groups

between studied groups post-intervention, after catheterization as well as before discharge with P-value =0.02,0.01 and 0.008 respectively. Table (5): showed a none statistically significant difference related to anxiety scores between studied groups pre-intervention. But, there was a highly statistically significant difference related to anxiety scores between studied groups post-intervention and after catheterization as well as before discharge (p-value≤0.001).

DISCUSSION

Cardiac catheterization is used for patients with cardiac disease or unstable angina and usually associated with pain and anxiety. High levels of anxiety are associated with worse outcomes in coronary artery disease' patients. Acute pain which is not relieved can be changed to emotional, psychological and physical distresses that leave negative

effects on the outcomes of the disease and surgery (Delewi, *et al.,* 2017). McCaffrey and Taylor (2005)**,** suggested that the reduction in preoperative anxiety and tensions of patients are highly important in improving patient's comfort, relieving stress that affect the myocardial blood supply.

Regarding to socio-demographic characteristics and medical data of the studied sample: The result of the present study revealed that married men aged between 30 to 65 years who were secondary educated, smokers, suffering from hypertension and/or diabetes were more susceptible to cardiovascular disease. These results were consistent with many studies (Aboalizm *et al.,* 2016; Haddad *et al.,* 2018; Pouyesh *et al.,* 2018).

Regarding to blood pressure and heart rate of the studied groups, there was a highly statistically significant decrease in blood pressure and heart rate between the study group and control group post-intervention and after catheterization as well as before discharge in relation to pre-intervention. This may be due to the effect of foot massage on the physiologic responses. This was in line with Jamali *et al.* (2016), who showed the beneficial effects of massage therapy on the physiologic responses of hospitalized patients by balancing systolic and diastolic blood pressures and heart rate. Also, Hernandez-Reif *et al.,* (2000) found that the massage group showed a significant reduction in systolic and diastolic blood pressure. This may be owed to that the massage can induce a sense of comfort and relaxation so the blood flow increases within the superficial blood vessels of body along with the reduction of blood pressure (Tamparo and Lewis 2011). While, Park and Cho, (2004) and McVicar *et al.,* (2007) indicated a significant decrease in the systolic blood pressure and heart rate, but not in diastolic blood pressure after reflexo therapy. Moreover, Moeini *et al.,* (2011), showed that the average heart rate and respiratory rate per minute had slightly decreased after reflex therapy. Massage therapy had an observed alteration in vital signs which can be related to its impact on autonomic system that would reduce the myocardial oxygen demand (Buttagat *et al.,* 2011). Moreover, results of Fritz (2017), showed that massage therapy promotes a significant decrease in cortisol level from the baseline and increases active neurotransmitters such as serotonin and dopamine. Furthermore, the present study revealed a statistically significant decrease of pain scores between studied group and control group post-intervention in relation to pre-intervention. This result was in the same line with Wang and Keck, (2004)**;** Chanif *et al.,* (2013); Shehata *et al.* (2016) who reported a statistically significant decrease in subjective pain scores after foot massage which stimulates non painful nerve fibers, releases endorphins that has the potential assist in pain relief. Regarding to anxiety score of the studied groups, the findings of the current study revealed that all patients experienced high levels of anxiety before the intervention. This result was in line with, Trotter *et al.* (2014); Aboalizm *et al.,* (2016), Ayasrah and Ahmad, (2016) who reported that most cardiac catheterization patient' anxiety increased before and during the procedure and causes symptoms of irritability, restlessness, insomnia, and anorexia. Reflexology is a systematic practice where applying some pressure on any particular points on feet and hands gives impacts on the health of the related parts of the body. When a reflex point or zone is stimulated, the body cells react by generating a reflex effect on the corresponding nerves, tissues muscles and organs. Reflexology effects are well-known to liberate the symptoms of stress by increasing blood flow, decreasing tension, calming the mental state, maintaining homoeostasis, accelerating immunity and promoting a sense of well-being. As well, endorphin is a body's natural pain-relieving chemical released as a response to reflexology (Wang *et al.,* 2008; Embong *et al.,* (2017)**.** Moreover, the present study perceived a highly statistically significant difference related to anxiety score between the study and control groups post-intervention and after catheterization as well as before discharge .This may be due to the effect of foot massage provided by the researcher to the study group. This finding was supported by Moradi &, Hajbaghery, (2015); Elsay *et al.,* (2016) who assessed the state of anxiety in patients before coronary angiography and reported a relatively high level of patients' anxiety before invasive procedures, while post intervention the anxiety level was reduced among the study group compared to the control group. This results was supported by Rodrigues and Sams**,** (2018) who demonstrated foot and hand massage as an effective non-pharmacological methods to reduce pain and anxiety in postoperative open heart surgery' patients.

Conclusion

The study concluded that foot massage has a positive effect in reducing anxiety and pain levels as well as heart rate and blood pressure among patients undergone cardiac catheterization.

Recommendations: The study recommended the using foot massage for patients before cardiac catheterization.

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