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Effectiveness of reflexology related interventions on physiological and biochemical parameters of metabolic syndrome among women

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ABSTRACT

The purpose of the study was First to evaluate the effectiveness of reflexology related interventions on biochemical and physiological parameters of metabolic syndrome among women; Second to find out the association between physiological and biochemical parameters of metabolic syndrome among women with socio-demographic variables. The study used a true experimental design with one experimental group and one control group. Data were collected from 40 self-help group women who were the members of Kudumbashree from a selected area in South India. Samples were collected by using multistage sampling. Reflexology related intervention was given to the experimental group for 12 weeks. The control group did not receive an intervention. Repeated measures ANOVA and t-test were used for data analysis. The study found there is a significant change in the physiological and biochemical parameters of metabolic syndrome among the experimental group as compared to the control group ($p<0.001$). Even if there is no statistically significant difference between the different groups, the observed difference is clinically significant. The study concludes that reflexology related intervention was effective in improving the parameters of metabolic syndrome. It can be implemented in the clinical setting for patients with metabolic syndrome and related lifestyle disorders.

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INTRODUCTION

Metabolic syndrome is a disorder that involves a combination of three or more of the health issues like abdominal obesity, high blood sugar, high triglyceride levels, high blood pressure, or low HDL cholesterol. It is becoming more and more prevalent due to a rise in obesity rates among children and adults. It is a significant burden on healthcare, and its prevalence is increasing worldwide. The prevalence varies considerably in different parts of the world and even in the same country. Over the past two decades, a striking increase in the number of people with metabolic syndrome worldwide has taken place. This increase is associated with the global epidemic of obesity and diabetes.

There are several factors unique to women that can impact the prevalence and characteristics of the metabolic syndrome in women. Pregnancy is a significant contributor to weight gain in women.

Data reveal that 42% of women gain more than the recommended amount of weight during pregnancy. Lactation can decrease a woman's risk for the development of metabolic syndrome. The odds ratio for metabolic syndrome was decreased by 22% (95% CI 1–39%) among women with a history of breastfeeding for more than one month compared with women who did not breastfeed or breastfed for less than one month. Approximately 7% of all pregnancies are complicated by GDM, defined as glucose intolerance with onset or first recognition during pregnancy. Women with a GDM history were more likely to have elevated C-reactive protein (a marker of inflammation) and triglyceride levels, even after adjusting for BMI, which placed them at greater risk for developing T2DM and CVD. GDM can, furthermore, unmask pre-pregnancy metabolic syndrome. Women with a history of preeclampsia have greater insulin resistance and an increased incidence of hypertension when examined several years postpartum. There are also data suggesting an increased CVD risk in women with a history of preeclampsia. The prevalence of the metabolic syndrome in PCOS is approximately 43–47%, which is twice as high as the prevalence in the age matched the general population, even after adjusting for BMI. Combined oral contraceptive pills can decrease insulin sensitivity and glucose tolerance, affect lipoprotein levels, and increase blood pressure. The menopause has been associated with an increased incidence of hypertension, lower HDL, and higher LDL levels (Bentley-Lewis *et al.*, 2007).

The prevalence of metabolic syndrome increases with menopause and may partially explain the apparent acceleration in CVD after menopause. The transition from pre- to post menopause is associated with the emergence of many features of the metabolic syndrome, including 1) increased central (intra-abdominal) body fat; 2) a shift toward a more atherogenic lipid profile, with increased low-density lipoprotein and triglycerides levels, reduced high-density lipoprotein, and small, dense low-density lipoprotein particles; 3) and increased glucose and insulin levels. The emergence of these risk factors may be a direct result of ovarian failure or an indirect result of the metabolic consequences of central fat redistribution with estrogen deficiency. The major ways for effective management and prevention are changes in lifestyle through a multifaceted intervention like education, moderate-intensity exercises, dietary modification, as well as pharmacological management (Carr, 2003).

Studies to estimate the burden of metabolic syndrome and its associated risk factors shows that 10% of males and 20.3% of females were diagnosed with metabolic syndrome. Older people being overweight (BMI>23KG/M2) had a higher probability of developing metabolic syndrome irrespective of sex. Low physical activity among women found to be a major risk factor for m**e**tabolic syndrome (Barik *et al.*, 2018).

The prevalence of metabolic syndrome in South Asian varies according to the region, lifestyle pattern, and socio-cultural factors. The data reveals that about $1/3^{rd}$ of the urban population in large cities in India has metabolic syndrome. The prevalence among females is very high(48.2%) as compared to males(16.3%). (Pandit *et al.*, 2012).

Reflexology increases the blood supply to the body. It is one of the emerging trends in nursing and medicine, and there are many trained nurse reflexologists also. Studies show that reflexology foot massage has a significant effect on blood pressure, lipoproteins, and blood sugar levels. It is done by stimulating the various reflex zones in the foot.

There are very few studies done on the effect of reflexology related interventions on metabolic syndrome. Hence, the investigator decided to test the effectiveness of reflexology related responses in the reduction of biochemical and physiological parameters of metabolic syndrome among women. By reducing metabolic syndrome, the risk for developing cardiovascular diseases, and type 2 diabetes can be reduced. It will help improve the quality of life of people in a rapidly developing country like India.

Statement of the Problem

A study to assess the effectiveness of Reflexology related interventions on Physiological and biochemical parameters of Metabolic Syndrome among women.

Objectives

To evaluate the effectiveness of reflexology related interventions on biochemical and physiological parameters of metabolic syndrome among women.

To find out the association between physiological and biochemical parameters of metabolic syndrome among women with selected socio-demographic variables.

MATERIALS AND METHODS

Study design

The research approach was a Quantitative approach. Design adapted for the study was a true Experimental design with one control group and one experimental group.

Setting and Sampling

The study was conducted among self-help group women from two area development societies of a selected municipality at Ernakulam district. The data collection period was from 01/03/2019 to 30/05/2019. 40 self-help group women who meet the inclusion criteria were selected as the sample. Samples were selected using a multistage sampling technique. From the 36 area development societies of Thripunithura Municipality, randomly selected 2 area development societies. In the first phase, 200 women were assessed for eligibility by checking the weight, height, waist circumference, blood pressure. 100 women who did not meet any one of the eligibility criteria were excluded. The serum triglycerides, HDL, and FBS were checked for the remaining 100 women. 56 Women met the inclusion criteria. Among them, 40 women were selected randomly by using a random table. Inclusion Criteria for the study were Women belong to the age group of 35 to 55 years and meet any three of the following five criteria of metabolic syndrome,

1. Waist circumference>88cm
2. High Blood pressure: SBP>130mmHg or DBP >85mmHg or on treatment for hypertension
3. High Fasting blood sugar >100mg/dl or on treatment for DM
4. HDL<50mg/dl
5. triglycerides >150mg/dl

Exclusion Criteria

Women reported with any other disease like cardiac disease, renal disease, cancer, ligament injury, surgery in the leg, and neurovascular problems. Women who are pregnant Women with psychiatric disorders and severe cognitive impairment.

Ethical consideration

The Institutional Ethical Committee approved this study of Saveetha Medical college Hospital (003/02/2029/Institutional Ethical Committee/Saveetha Medical College Hospital).

Setting permission was obtained from the State Kudumbashree Mission. To ensure anonymity, no name was written in the socio-demographic datasheet. At the beginning of the study, participant information sheet was provided, and informed consent was taken from the study participants.

Instruments

Participants were asked to provide Socio-demographic characteristics such as age, marital status, education, occupation, monthly income, type of Family, preferred food groups, lifestyle Habits, and menstruation. Clinical parameters were collected, such as the history of gestational diabetes or pregnancy-induced hypertension, history of the polycystic ovarian syndrome, history of oral contraceptive pill use, history of diabetes mellitus, history of hypertension, etc.

The physiological parameters assessed were weight, height, waist circumference, and blood pressure. Weight was measured by weighing scale, and Height was measured by using non-stretching inch tape without shoes heals touching the walls with back in straight position and heads to their normal anatomic position. Waist circumference was measured with nonstretching tape placed on a horizontal line above the top of the iliac bone when the person is standing with arms hanging down freely following a normal expiration. Systolic and diastolic BP was measured by using a calibrated sphygmomanometer and stethoscope from the left arm in sitting position.

Biochemical parameters assessed were FBS (mg/dl), HDL (mg/dl), and Triglycerides(mg/dl).They were done by collecting 10 ml of blood from the participants at 9 am after 12 hours overnight fast.

Reflexology related intervention includes reflexology foot massage, dietary modification, and moderate-intensity exercises.

Reflexology was applied to the participants 30 minutes once a week by a certified investigator who attended the reflexology course. It was given to the areas designed for metabolic syndromes such as lungs, thyroid, liver, gall bladder, stomach from right foot and small and large intestine from the left foot, spinal cord, and solar plexus, hypophysis from both feet.

Moderate intensity exercises: It includes walking 30 minutes per day (between 5 pm to 7 pm) for 5 days in a week. Before beginning the exercises, the participants are instructed to warm-up exercises for 10 minutes, followed by brisk walking 30 minutes and cool down after the walking.

Dietary modification**:** 24-hour nutritional recall was done. Based on the body mass index, Blood sugar, BP and Cholesterol, and activity individualized diet plan were given to the participants as per the directions of a dietician. The food exchange list was provided to the participants. The daily diary was maintained to monitor the intake of prescribed diet

Data collection

Data collection was done from February 2019 to April 2019 after obtaining permission from the State Kudumbashree Mission. Women who meet the

Table 1: Demographic characteristics of participants (n=40)

Sl No	Variables	Catagory	Frequency	Percentage
1	Age(Yrs)	35-40	10	25
		41-45	8	25
		46-50	12	30
		50-55	10	30
2	Marital status	Married	32	80
		Single	2	5
		Widow	6	15
3	Education	Graduate and above	10	25
		Higher secondary	4	10
		Secondary	20	50
		Primary	6	15

Table 2: Demographic characteristics of participants (n=40)

Sl No	Variables	Category	Frequency	Percentage
1	Occupation	Professional	6	15
		Semi-professional	2	5
		Skilled worker	26	65
		Unskilled worker	6	15
2	Monthly Income	Less than Rs. 6,000 per month	15	37.5
		Rs. 6,000 - 10,000 per month	8	20
		Rs. 10,000 - 20,000 per month	6	15
		Rs. 20,000 - 50,000 per month	11	27.5
3	Type of family	Nuclear family	9	22.5
		Joint family	29	72.5
		Extended family	2	5
4	Preferred food groups	Vegetarian	2	5
		Mixed food habits	38	95
5	Lifestyle Habits	Exposed to cigarette smoke at home	3	7.5
		Exposed to cigarette smoke at work	6	15
		Nil	31	77.5
6	Menstruation	Regular periods	22	55
		Irregular	5	12.5
		Menopause	13	32.5

inclusion criteria were randomly assigned into two groups, one control group, and one experimental group. The pre-test was done. After the assessment, reflexology related intervention was given to the Experimental group. The control group did not receive any response. The post-test was done after 12 weeks of intervention among two groups.

Data analysis

Data were entered into a master data sheet. Categorical variables were summarized using frequency and percentage. Quantitative variables are summarized using mean and standard deviation if data follows normality else median and interquartile range. To assess the effectiveness of reflexology related interventions on physiological and biochemical parameters of metabolic syndrome, repeated-measures ANOVA was used. To study the association of physiological and biochemical variables with selected socio-demographic variables, t-test, and Kruskal-Wallis test was performed. P<0.05 is considered as statistically significant. Complete data analysis was performed using R software (EZR version1.35).

RESULTS AND DISCUSSION

The demographic characteristics of the participants are described in terms of frequency and percentage. Among 40 participants, more than $1/4^{th}$ (25%)of women were between 35 to 40 years and 51 to 55years, the majority (32) were married, half of them studied up to secondary level Table 1 and most of the workers (26) were skilled. The majority of participants (15) had a monthly income of less than 6000/ per month. Most of them (29) belongs to a joint family, and the majority (31) did not have any exposure to cigarette smoke at home or workplace. More than half of them (55%) had regular menstrual periods Table 2.

Considering the clinical characteristics, among 40 participants, 6 had a history of gestational diabetes, and 6 had a history of hypertension during pregnancy. 2 reported the history of oral contraceptive pill use. 8 participants had diabetes, 3 were hypertensive, and 2 were hyperlipidemic Table 3.

Physiological parameters

The repeated measures ANOVA performed to study the effectiveness of reflexology related interventions on weight, BMI, systolic and diastolic BP, and waist circumference, It was observed that there is a significant difference in the average of all physiological parameters in the experimental group as compared to control group. The mean body weight was decreased from 57 kg to 51kg in the experimental group, whereas in the control group it was increased from 61kg to 62 kg. The average BMI was reduced from 27 to 24 in the experimental group, but no change was observed in the control group. The mean systolic BP in the experimental group decreased from 146 mm Hg to 138mm Hg, whereas in the control group, it was increased from 148 mm Hg to 149 mm Hg. The mean diastolic BP in the experimental group was significantly reduced (91 mm Hg to 86 mm Hg and 90 mm Hg to 88 mm Hg, respectively) as compared to the control group. The mean waist circumference of the experimental group was reduced from 98 cm to 93cm, whereas no change was observed in the control group (p<0.001). Even if there is no statistically significant difference in physiological parameters between the experimental group and control group, the observed difference is clinically significant Table 4.

Biochemical parameters

Repeated-measures ANOVA assessed the effectiveness of reflexology related interventions on FBS, HDL, and Triglycerides. The mean value of FBS among the experimental group reduced from 104 to 94 mg/dl in the experimental group, but in the control group, it was increased from 98 to 99mg/dl. Only a slight improvement was noted in HDL in the experimental group. The mean triglycerides were decreased from156mg/dl to 148mg/dl in the experimental group, whereas in the control group, it was increased from 155 to 158mg/dl. It was observed that there is a significant difference in the average of biochemical parameters in the reflexology related intervention group during pre-test and post-test as compared to the control group (p<0.001). Even though there is no statistically significant difference in biochemical parameters between the two groups, the observed difference is clinically significant Table 5.

Association between socio-demographic variables and selected parameters of metabolic syndrome

ANOVA and independent-sample t-test were performed to find the association between demographic and clinical variables with weight, BMI, systolic and diastolic BP, waist circumference, FBS, HDL, and triglycerides. It was observed that there is no significant association between these variables.

In the present study, changes were noted in the physiological and biochemical parameters of the participants in the experimental group after completion. The experimental group shows a significant decrease in the means of body weight, BMI, waist circumference, systolic blood pressure, diastolic blood pressure, fasting blood sugar, and triglyc-

Table 3: Clinical characteristics of the participants (n=40)

Sl No	Variables		Frequency	Percentage
1	H/O Gestational Diabetes	Present	6	15
		Absent	34	85
2	H/o of Hypertension during pregnancy	Present	6	15
		Absent	34	85
3	H/O Oral contraceptive pill use	Present	2	5
		Absent	38	95
4	H/o Diabetes Mellitus	Present	8	20
		Absent	32	80
5	H/O Hypertension	Present	3	7.5
		Absent	37	92.5
6	H/O Increased Blood cholesterol	Present	2	5
		Absent	38	95

Table 4: Mean and Standard deviation of physiological parameters of metabolic syndrome among Reflexology related intervention group and control group (n=40)

Parameters	Group	Mean and SD		P-Value
		Pretest	Post-test	
Weight	Reflexology related intervention group	57(7.99)	51(6.93)	P<0.001
	Control group	61(9.58)	62.(11.20)	
BMI	Reflexology related intervention group	27(3.13)	24(2.61)	P<0.001
	Control group	26(3.07)	24(3.02)	
SBP	Reflexology related intervention group	146(16.94)	138(14.79)	P<0.001
	Control group	148(17.13)	149(16.35)	
DBP	Reflexology related intervention group	91(7.59)	86(6.55)	P<0.001
	Control group	92(7.96)	91(7.21)	
Waist circumference	Reflexology related intervention group	98(7.15)	93(10.2)	P<0.001

Table 5: Mean and Standard deviation of biochemical parameters of metabolic syndrome among Reflexology related intervention group and control group (n=40)

Parameters	Group	Mean and SD		P-Value
		Pretest	Pretest	
FBS	Reflexology related intervention group	104(18.98)	94(18.82)	P<0.001
	Control group	98(17.06)	99(16.23)	
HDL	Reflexology related intervention group	42(5.27)	43(5.05)	P<0.001
	Control group	41(4.78)	41(4.74)	
TRIGLYCERIDES	Reflexology related intervention group	156(13.19)	148(10.28)	P<0.001
	Control group	155(12.98)	158(12.57)	

erides after 12 weeks of intervention. The mean body weight was decreased from 57 kg to 51k g in the experimental group, whereas in the control group, it was increased from 61kg to 62 kg. The average BMI was reduced from 27 to 24 in the experimental group, but no change was observed in the control group. The mean systolic BP in the experimental group decreased from 146 mm Hg to 138mm Hg, whereas in the control group, it was increased from 148 mm Hg to 149 mm Hg. The mean diastolic BP in the experimental group was significantly reduced (91 mm Hg to 86 mm Hg and 90 mm Hg to 88 mm Hg, respectively) as compared to the control group. The mean waist circumference of the experimental group was reduced from 98 cm to 93cm, whereas no change was observed in the control group ($p<0.001$). Even if there is no statistically significant difference in physiological parameters between the experimental group and control group, the observed difference is clinically significant. A similar study also found a significant difference in FBS, SBP, DBP, triglycerides, and waist circumference among exercise intervention as well as reflexology intervention (Arslan *et al.*, 2018). Another study found that lifestyle intervention significantly reduced the prevalence of central obesity, hypertriglyceridemia and the incidence of diabetes (Simona *et al.*, 2007).

The mean value of FBS among the experimental group reduced from 104 to 94 mg/dl in the experimental group, but in the control group, it was increased from 98 to 99mg/dl. Only a slight improvement was noted in HDL in the experimental group. The mean triglycerides decreased from156 mg/dl to 148 mg/dl in the experimental group, whereas in the control group, it was increased from 155 to 158mg/dl. It was observed that there is a significant difference in the average of biochemical parameters in the reflexology related intervention group during pre-test and post-test as compared to the control group ($p<0.001$). Even though there is no statistically significant difference in biochemical parameters between the two groups, the observed difference is clinically significant. A similar study on the Effect of Reflexology on Lipoproteins in Women with Type 2 Diabetes Mellitus was conducted among thirty obese diabetic women from Dar El-Salam Public Hospital. The patients were assigned to two equal groups. Each group included 15 patients. The patients in both groups were matched in age ranged from 45-55 years old, and body mass index ranged from 30 to 34.9 Kg/m2, and blood glucose level (>200 mg/dl) with measuring lipoproteins level pre and post-treatment for both groups. For both groups, the patients received medications according to their physicians, while Group A received a program of foot reflexology for 4 weeks with frequency 3 times/week with their medications. The data revealed a statistically decrease in lipoproteins level in Group A than in Group B after treatment ($p<0.05$), total cholesterol decreased by 5.99% in Group A while Group B decreased by 1.69%. Low-density lipoproteins in Group A decreased by 7.37%; Group B decreased by 2.46%. High-density lipoproteins decreased by 0.61% in Group A and decreased by 1.8% in Group B. Triglycerides in Group A decreased by 12.95 %, while Group B decreased by 3.77% (Rana *et al.*, 2017). A study done to determine the effect of diet and physical activity in the treatment of metabolic syndrome during a 6 month period also shows significant decrease metabolic syndrome parameters with dietary modification and medium intensity walking of 4.5 km/hour (Dragusha *et al.*, 2010).

The present study observed that there is a significant difference in the average of all physiological and biochemical parameters of metabolic syndromes, such as weight, BMI, blood pressure, waist circumference, FBS, HDL, and triglycerides among reflexology related intervention group during pretest and posttest ($P<0.001$). These findings are similar to another study that was done to evaluate the effects of foot reflexology on blood pressure, serum lipids level, and life satisfaction in essential hypertension patients. Thirty-four subjects were assigned to an experimental group (18) and the control group (16). Foot Reflexology was administered twice a week for 6 weeks, and self foot Reflexology was administered twice a week for 4 weeks on the experimental group. There was a significant decrease in systolic blood pressure but no significant decrease in diastolic pressure in the experimental group compared to the control group. The total cholesterol level in the experimental group compared to the control group was not significantly decreased after foot reflexology. However, the triglyceride level in the experimental group compared to the control group was significantly decreased after foot reflexology. On the other hand, high-density lipoprotein and low-density lipoprotein levels in the experimental group were not significantly decreased after foot reflexology. Life satisfaction in the experimental group compared to the control group was significantly improved after foot reflexology (sook park and Cho, 2004) .

A comparative study on the effectiveness of foot reflexology on glycemic levels among people with diabetes with oral hypoglycemic agents and insulin therapy from a selected nursing home at Mangalore also found in their study that Foot Reflexology was

very effective in reducing the serum glycemic levels among the Diabetics (Mariam, 2016).

Implications

Nursing Practice

This reflexology can be implemented along with lifestyle interventions in the clinical setting for patients with metabolic syndrome

Nursing Education

The nursing students can be given training on reflexology by including it in the primary nursing curriculum.

Nursing Administration

The nurse administrators can plan in-service education to the staff nurses on reflexology, its advantages, etc.

Nursing Research

The finding of the present study is a significant contribution to the body of nursing knowledge. This reflexology related interventions can be studied for other lifestyle disease also.

CONCLUSIONS

The pilot study was conducted among middle-aged women between 35 and 55 years. The survey results depict that three months of reflexology related interventions significantly improved the metabolic syndrome parameters among women. The results of the study conclude that there is a significant change in metabolic syndrome parameters after the intervention. Reflexology, along with lifestyle intervention, is a practical and economically feasible strategy to control the metabolic syndrome parameters.

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