

## A quasi experimental study to evaluate the effectiveness of stretching exercise on heel pain among people with diabetes mellitus in selected settings.

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### ABSTRACT

*A Quasi experimental study was conducted to evaluate the effectiveness of stretching exercise on heel pain among 60 people with diabetes mellitus. The study adopted a quasiexperimental non randomised control group design. A convenient sampling technique was used to select 30 participants for the study group and 30 participants for the control group.*

*Preintervention assessment was done for both the study group and the control group using the Modified Foot Function Index. Stretching exercise was given in 12 minutes duration on alternative days. Postintervention assessment was done for both the study group and the control group on the 12<sup>th</sup> day using the same tool. An unpaired 't' test was performed and the obtained 't' value was 24.19 which was significant at  $p \leq 0.001$ . The mean value for the study group was*

*24.10 and for the control group was 57.33. The mean difference was 33.33. The study findings revealed that stretching exercise was effective in reducing heel pain among people with diabetes mellitus.*

**Key words:** *Stretching exercise, Heel pain, People with diabetes mellitus.*

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### I. INTRODUCTION

Globally, non-communicable diseases (NCDs) are the leading cause of death and disability. A few of these conditions include cancer, cardiovascular disease, diabetes, and chronic lung disease.<sup>1</sup> Today, diabetes is one of the most common chronic diseases in the country and around the world.<sup>2</sup> The most common is type II Diabetes, usually in adults, which occurs when the body becomes resistant to insulin or doesn't make enough insulin. The prevalence of type II diabetes has risen dramatically in countries of all income levels.<sup>3</sup>

The heel is a padded cushion of fatty tissue that holds its shape despite the pressure of body weight and movement.<sup>5</sup> Plantar heel pain occurs when too much pressure on the feet damages the plantar fascia ligament, leading to heel pain and stiffness.<sup>6</sup> Plantar heel pain affects 4% to 7.0% of the people in the community. It is associated with decreased health related quality of life, including social isolation, a negative perception of one's own health, and reduced functional abilities. Plantar heel pain predominantly affects sedentary middle aged and older adults.<sup>4</sup>

Diabetes patients are particularly at risk of heel pain due to the presence of common risks and comorbidities such as obesity and a sedentary lifestyle. Individuals between the ages of 40 and 60 have the highest incidence.<sup>7</sup> People usually feel heel pain under the foot or towards the front of the heel. The pain typically starts gradually and becomes more severe.<sup>8</sup>

People with diabetes mellitus may have foot discomfort and heel pain regardless of the onset of

diabetes mellitus. Heel pain can get in to an unbearable point. Fortunately there are exercises for diabetics such as calf raises, grab and go, and washcloth exercise that can help manage and find relief from heel pain.<sup>12</sup> Stretching the calves and the plantar fascia helps to loosen the muscles and reduces heel pain. Stretching exercises can help relieve and even prevent plantar heel pain.<sup>6</sup>

**Jasneet S. Chawla, et. al., (2020)** conducted a quasi experimental study to evaluate the effectiveness of calf stretching versus plantar fascia stretching exercise in plantar fasciitis among 60 participants were randomly assigned to one of two groups. 30 participants were made to do calf stretching exercises, and 30 did plantar fascia stretching exercises. The stretches mainly consisted of eight repetitions of 20 seconds each, twice a day and three times a week for four weeks. Both stretching exercises were assessed with the visual analog scale, foot function index, and American orthopaedic foot and ankle society (AOFAS) at day 0 and every follow-up for the 1<sup>st</sup> week, 2<sup>nd</sup> week, and at the end of the 4<sup>th</sup> week. The results showed more improvement and a better satisfactory outcome in the plantar fascia stretching exercises than in the calf stretching exercises. The study concluded that the benefits of stretching include a marked decrease in pain and a high rate of satisfaction.<sup>9</sup>

During the community visit, the investigator identified that most of the patients with diabetes mellitus suffered from heel pain, disrupting their normal daily activities, and it was also noted that the people restrained themselves from going out of the house. Hence, the investigator developed an interest in implementing stretching exercises on heel pain among people with diabetes mellitus.

### **Statement of the problem**

A quasi experimental study to evaluate the effectiveness of stretching exercise on heel pain among people with diabetes mellitus in selected settings.

### **Objectives of the study**

1. To assess and compare the preintervention and postintervention score on heel pain among people with diabetes mellitus in study group and control group.
2. To evaluate the effectiveness of stretching exercise on heel pain among people with diabetes mellitus in study group.
3. To find out the association between selected demographic and clinical variables among people with diabetes mellitus with their preintervention score on heel pain in study group and control group.

### **Hypotheses**

H1: There was a significant difference between preintervention and postintervention score on heel pain among people with diabetes mellitus in study group and control group.

H2 : There was a significant difference between postintervention score on heel pain among people with diabetes mellitus in study group and control group.

## **II. RESEARCH METHODOLOGY**

**Research approach:** The investigator has utilized quantitative research approach.

**Research design:** Quasi experimental non randomized control group design was adopted for the study.

**Independent variable:** Stretching exercise

**Dependent variable:** Heel pain

**Research setting:** The setting adopted for this study consists of two selected areas comes under Urban Primary health centre Padmanabhapuram such as Arasuvelai for the study group and Poliyoor kurichi for control group. The setting was chosen on the basis of feasibility, practicability and availability of participants.

### **Population**

**Target Population:** The population of the study includes all the people with diabetes mellitus between the age of 46 and 65 years.

**Accessible population:** The accessible population of the study includes all the people with diabetes mellitus between the age group of 46 and 65 years residing in selected areas who have fulfilled the criteria for sample selection.

**Sample:** The sample consists of people with diabetes mellitus between the age group of 46 and 65 years who have fulfilled the criteria for sample selection residing in selected community settings.

**Sample size:** 30 people with diabetes mellitus suffering from heel pain for the study group and 30 people with diabetes mellitus suffering from heel pain for the control group were selected.

**Sampling technique:** Convenient sampling technique was used to select the people with diabetes mellitus for the study group and control group.

**Criteria for sample selection**

**Inclusion criteria:** People with diabetes mellitus

- both males and females with type II diabetes mellitus
- between the age group of 46 – 65 years who were willing to participate in this study.
- who has moderate to severe heel pain assessed with modified foot function index and scored above 26.
- who were available at the time of data collection.
- who were able to walk with normal range of motion at the lower extremities.
- residing in selected areas.

**Exclusion criteria:** People with diabetes mellitus

- who has any foot or other orthopedic pathology and surgical intervention.
- who were on any other interventional therapy for heel pain.
- who was on any pain medications like analgesics.
- with any prosthetics on the lower extremities.

**Description of the tool**

The tool used in this study consists of two parts Part – I:

Section A: Demographic variables Section B: Clinical variables

Part – II: Modified foot function index

### **III. RESULT AND DISCUSSION**

The findings were analysed and discussed based on the objectives of the study

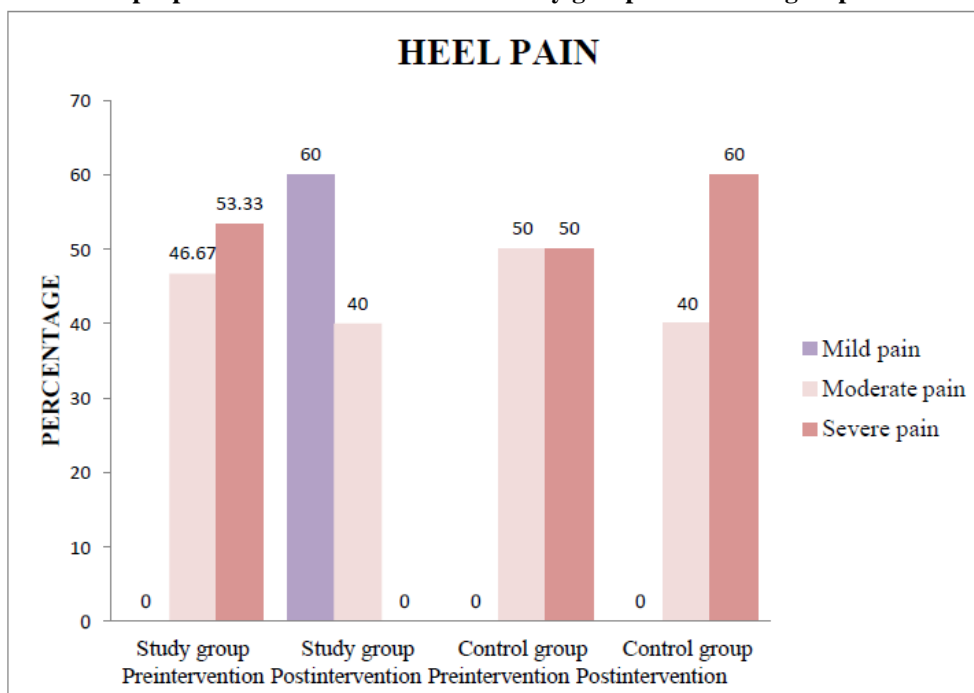
**Demographic and clinical variables among people with diabetes mellitus in study group and control group**

Frequency and percentage distribution of demographic variables among people with diabetes mellitus revealed that majority of them 10 (33.33) belonged to 55 to 60 years in study group and 11 (36.67%) belonged to 55 to 60 years in control group. Regarding gender, in study group majority of them 17 (56.67%) were females and in control group 15 (50.00%) were males and 15 (50.00%) were females. According to the educational status, in study group majority of them 12 (40.00%) had undergone higher secondary education and in control group 13 (43.33%) had undergone higher secondary education. Regarding the occupational status, in study group 13 (43.33%) were sedentary workers and in control group 13 (43.33%) were sedentary workers. Assessing the marital status, in study group and control group 30 (100%) were married. According to the type of family, in study group 16 (53.33%) were belonged to joint family and in control group 17 (56.67%) were belongs to joint family. Regarding the type of diet, in study group and control group 16 (53.33%) of them takes mixed diet.

Frequency and percentage distribution of clinical variables among people with diabetes mellitus revealed that the duration of heel pain in study group majority of them 10 (33.33%) had heel pain for 4 to 6 years and in control group 12 (40.00%) had heel pain for 4 to 6 years. Regarding heel pain induced by physical activity, in study group 22 (73.33%) had heel pain induced by physical activity and in control group 21 (70.00%) had heel pain induced by physical activity. According to the duration of diabetes mellitus, in study group 13 (43.33%) had diabetes mellitus for 0 to 5 years and in control group 12 (40.00%) had diabetes mellitus for 0 to 5 years. Regarding the latest blood sugar value, in study group 15 (50.00%) had blood sugar value 251 to 350 mg/dl and in control group 14 (46.67%) had blood sugar value 351 to 450 mg/dl. According to the treatment for diabetes mellitus, in study group 23 (76.67%) are on oral hypoglycemic medications and in control group 24 (80.00%) are on oral hypoglycemic medications. Based on the Body Mass Index (BMI), in study group 16 (53.33%) had healthy weight and in control group 14 (46.67%) had healthy weight.

The first objective was to assess and compare preintervention and postintervention score on heel pain among people with diabetes mellitus in study group and control group

Figure 1: Percentage distribution of preintervention and postintervention score on heel pain among people with Diabetes Mellitus in study group and control group.



During preintervention among study group, 14 (46.67%) had moderate pain, 16 (53.33%) had severe pain and no one had mild pain. In control group 15 (50.00%) of them had moderate pain, 15 (50.00%) had severe pain, and no one had mild pain,

In postintervention 18 (60.00%) had mild pain, 12 (40.00%) had moderate pain and no one had severe pain. In control group 12 (40.00%) had moderate pain, 18 (60.00%) had severe pain and no one had mild pain.

The study findings were supported by the study conducted by **Muhammad Asad Arif., Sohail Hafeez (2022)** to evaluate the efficacy of a Gastrocnemius-Soleus stretching programme as a treatment for plantar fasciitis. Patients with chronic plantar fasciitis aged 30-70 years were included and randomly assigned as two groups. The gastrocnemius-soleus stretching programme was used in group A, while the tendo Achilles stretching exercises were used in group B. The pain score was calculated before the stretching program and after eight weeks. The results showed that the mean difference of pain score in group A was 2.57, while it was 1.77 in group

B. The difference in both groups was statistically significant at  $p < 0.05$ . The study concluded that stretching exercises for the gastrocnemius and soleus muscles are more effective in reducing the symptoms of plantar fasciitis in adults.<sup>8</sup>

The second objective was to evaluate the effectiveness of stretching exercise on heel pain among people with diabetes mellitus in study group and control group.

Table 1: Comparison of mean standard deviation and paired 't' value of preintervention and postintervention score on heel pain among people with diabetes mellitus in study group and control group.

N = 60

Sl.No	Group	Assessment	Mean	SD	df	Paired 't' test
1.	Studygroup (n=30)	Preintervention	58.56	6.66	29	27.77***p = 3.66
		Postintervention				

		Postintervention	24.10	4.66		
2.	Controlgroup (n-30)	Preintervention	56.83	6.33	29	2.34* P = 3.66
		Postintervention	57.73	6.12		

Significant at \*  $p \leq 0.05$ , \*\*  $p \leq 0.01$  \*\*\*  $p \leq 0.001$

Table 1 showed the mean score on heel pain among people with diabetes mellitus in studygroup was 58.56 in preintervention and, 24.10 in postintervention. The paired ‘t’ value was 27.77\*\*\*. The p value was 3.66 which is less than the calculated value. So it was significant at  $p \leq 0.05$ , highly significant at  $p \leq 0.01$ , and very highly significant at  $p \leq 0.001$ . The findings showed that stretching exercise was effective in reducing heel pain among people with diabetes mellitus. In control group the mean score on heel pain among people with diabetes mellitus was

56.83 in preintervention and 57.73 in postintervention. The estimated paired ‘t’ value was 2.34. It was not significant at  $p \leq 0.05$ . Comparing both values, it shows that stretching exercise was more effective in reducing heel pain among people with diabetes mellitus.

Table 2: Comparison of mean, standard deviation and unpaired ‘t’ test on postinterventionscore on heel pain among people with diabetes mellitus in study group and control group.

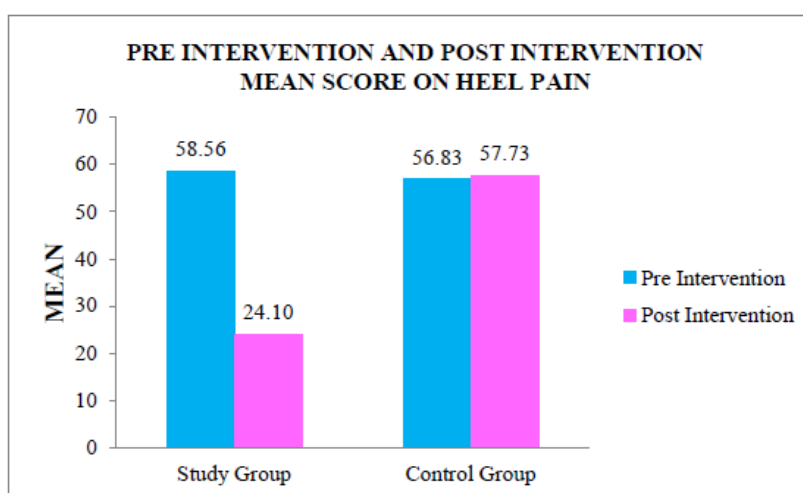
N = 60

Variable	Study group (n=30)		Control group(n=30)		Unpaired ‘t’ test value
	Mean	SD	Mean	SD	
Heel pain	24.10	4.66	57.33	6.12	24.19***P=3.46

Significant at \*  $p \leq 0.05$ , \*\*  $p \leq 0.01$  \*\*\*  $p \leq 0.001$

Table 2 represents in study group the post intervention mean score was 24.10 with the standard deviation 4.66. In control group the post intervention mean score was 57.33 with the standard deviation 6.12. The estimated unpaired ‘t’ test value is 24.19\*\*\*. The p-value was 3.46 which is less than the ‘t’ value. So it was significant at  $p \leq 0.05$ , highly significant at

$p \leq 0.01$  and very highly significant at  $p \leq 0.001$ . It shows that, stretching exercise was effective in reducing heel pain among people with diabetes mellitus.



The second objective was supported with the study conducted by Nezar Al Toriri 2016, compared the effectiveness of plantar fasciitis treatment with ultrasound versus exercise alone. 40 patients with plantar heel pain were randomly assigned into two groups. Group A received ultrasound and exercise combined, and group B received exercise alone including plantar specific stretching, heel raise, ball rolling, and towel curl. For four

weeks, the intervention was given three times per week. Plantar heel pain was assessed by visual analogue scale (VAS) and Mc Gill pain questionnaire before and after the intervention. The result showed that the mean reduction in VAS in pretest and posttest in group A was 6.51 with 't' value 13.75 with  $p=0.003$ , which was statistically significant at  $p<0.050$  and in group B the pretest and posttest mean score was 2.97 with 't' value 10.77 with  $p=0.020$  which was statistically significant at  $p<0.050$ . The study concluded both interventions were effective in reducing plantar heel pain but patients received ultrasound and exercise showed greater improvement.<sup>10</sup>

**The third objective was to find out association between selected demographic variables and clinical variables with their preintervention score on heel pain among people with diabetes mellitus in study group and control group.**

In study group the calculated value of the demographic variable age ( $\chi^2=14.2$ ) is greater than the table value which indicates that there is a significant association at  $p\leq 0.05$ ,  $p\leq 0.01$ , with the preintervention score on heel pain among people with diabetes mellitus. In control group the calculated value of the demographic variable age ( $\chi^2=12.619$ ) is greater than the table value which indicates that there is a significant association at  $p\leq 0.05$ ,  $p\leq 0.01$ , with the preintervention score on heel pain among people with diabetes mellitus. On the other hand in study group and control group the calculated value of the demographic variables such as gender, education, occupation, marital status, type of family and type of diet are lesser than the table value which indicating no association with their preintervention score on heel pain among people with diabetes mellitus at  $p\leq 0.05$ .

In study group the calculated value of the clinical variables such as duration of heel pain ( $\chi^2=13.52$ ), duration of diabetes mellitus ( $\chi^2=9.30$ ), latest blood sugar value ( $\chi^2=8.83$ ) and body mass index ( $\chi^2=8.152$ ) are greater than the table value which indicates that there is a significant association at  $p\leq 0.05$ ,  $p\leq 0.01$ , with the preintervention score on heel pain among people with diabetes mellitus. In control group the calculated value of the clinical variables such as duration of heel pain ( $\chi^2=9.190$ ), duration of diabetes mellitus ( $\chi^2=13.47$ ), latest blood sugar value ( $\chi^2=6.26$ ) and body mass index ( $\chi^2=8.838$ ) are greater than the table value which indicates that there is a significant association at  $p\leq 0.05$ ,  $p\leq 0.01$ , with the preintervention score on heel pain among people with diabetes mellitus. On the other hand in study group and control group the calculated value of the clinical variable such as heel pain induced by certain physical activity, and treatment for diabetes mellitus are lesser than the table value which indicates that there is no significant association at  $p\leq 0.05$  with their preintervention score on heel pain among people with diabetes mellitus.

The third objective is supported by the study conducted by **Suthasinee Thong-On., et al., (2019)** to investigate the effects of physical therapy interventions using strengthening and stretching exercise programs on heel pain. The stretching exercise program constituted of stretching the gastrocnemius muscle, soleus muscle, and plantar fascia. The result reveals in the demographic data there were no significant difference ( $p>0.05$ ) in age, gender, weight, height, worst pain, pain characteristics and underlying disease between groups at the baseline<sup>11</sup>.

#### **IV. IMPLICATIONS**

- Nurses should develop skills in implementing stretching exercises.
- Nurse shall educate the people with diabetes mellitus who has heel pain about the effectiveness of stretching exercise to reduce heel pain.
- Nurses working in hospitals and community areas can implement stretching exercise for the management of heel pain among people with diabetes mellitus.
- Nurse as a researcher should promote more research in reducing heel pain among people with diabetes mellitus.
- Nurses shall conduct research for further clarification on the benefits of stretching exercise among people with diabetes mellitus.

#### **Limitations**

Randomization was not done to select the sample

#### **V. CONCLUSION**

The aim of the study is to evaluate the effectiveness of stretching exercise among people with diabetes mellitus on heel pain. The conceptual framework used in this study was based on the Modified General System Theory Ludwig Von Bertalanffy (1968). Quantitative research approach was used in this study. A quasi experimental non-randomized control group design was adopted. Convenient sampling technique was used to select the participants.

Based on the collected data the mean, standard deviation and unpaired 't' test score on heel pain

among people with Diabetes Mellitus. In study group the postintervention mean score was 24.10 with the standard deviation 4.66. In control group the postintervention mean score was 57.33 with the standard deviation 6.12. The estimated unpaired 't' test value was 24.19\*\*\* which was significant at  $p \leq 0.05$  highly significant at  $p \leq 0.01$ , and very highly significant at  $p \leq 0.001$ . Hence Stretching exercise is more effective in reducing heel pain among people with diabetes mellitus.

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