



## A study to assess the effectiveness of Buerger Allen exercise on lower extremity perfusion among patients with type 2 diabetes mellitus in Saveetha Medical College and Hospital in Chennai

Bhuvaneshwari S<sup>1</sup>, Tamilselvi S<sup>2</sup>

<sup>1</sup>Student, Saveetha College of Nursing, SIMATS, Thandalam, Chennai

<sup>2</sup>Assistant Professor, Saveetha College of Nursing, SIMATS, Thandalam, Chennai

### ABSTRACT

*Diabetes mellitus is a metabolic disorder that is characterized by an increased level of glucose in the blood resulting from defects in insulin secretion, insulin action or both. Diabetes mellitus has increased the risk of peripheral vascular diseases by causing endothelial and smooth muscle cell dysfunction in peripheral arteries. The risk of developing lower extremity peripheral vascular disease is proportional to the severity and duration of diabetes. Most of the complications are preventable. It requires a lifelong commitment to staying healthy, maintaining weight, exercising, taking medications, as prescribed by the doctor. The research approach was the quantitative approach. The true experimental research design was used. 60 samples were selected using non-probability purposive sampling technique. 30 patients in the experimental group and 30 patients in the control group. Pre-test used to assess the demographic variable and Angle Brachial Index scale for both groups. After the intervention, the post-test was done on the sixth day by using the same scale. The data were analyzed using mean and standard deviation for descriptive statistics and chi-square was used for inferential statistics. And paired t-test was done.*

**Keywords**— Diabetes mellitus, Metabolic disorder, Effectiveness of Buerger Allen Exercise, Diabetes mellitus

### 1. INTRODUCTION

Diabetes mellitus is a metabolic disorder that is characterized by increased levels of glucose in the blood resulting from defects in insulin secretion, insulin action or both. This high blood sugar produced the classical symptoms of polyuria, polyphagia, and polydipsia.

Diabetes is a major metabolic disorder worldwide. The global burden and prevalence of diabetes are rapidly increasing in many countries. The documents in the **World Health organization (WHO)** revealed the dramatic increase of diabetes in low and middle economic status country, like India. Mostly 90 % of people are affected with type 2 diabetes, unlike type 1 diabetes who can't produce insulin at all, type 2 diabetes patients can produce insulin but that is not adequate to break down all the glucose molecule.

Diabetes mellitus has increased the risk of peripheral vascular diseases by causing endothelial and smooth muscle cell dysfunction in peripheral arteries. The risk of developing lower extremity peripheral vascular disease is proportional to the severity and duration of diabetes. Most of the complications are preventable. It requires a lifelong commitment to staying healthy, maintaining weight, exercising, taking medications, as prescribed by a doctor.

Exercise is the fundamental principle for preventing the peripheral vascular diseases among diabetes patients. One of the exercises is Buerger Allen exercise is an active postural exercise of the feet and legs for preventing peripheral vascular disease and promoting collateral circulation in lower extremities.

### 2. STATEMENT OF THE PROBLEM

The effectiveness of Buerger Allen exercise on lower extremity perfusion among patients with type 2 diabetes mellitus in Saveetha Medical College and Hospital.

### 3. NEED FOR THE STUDY

Globally, an estimated 422 million adults are living with diabetes mellitus, according to the latest 2016 data from the World Health Organization. Diabetes prevalence is increasing rapidly; previous 2013 estimates from the International Diabetes Federation put the number at 381 million people having diabetes. The number is projected to almost double by 2030. Type 2 diabetes makes up about 85-90% of all cases.

Diabetes mellitus has become a common disease that leads to chronic complications like neuropathy, nephropathy, retinopathy, CVA and cardiac diseases. Development of chronic complications is related to the number of year of diabetes mellitus.

Diabetes mellitus has increased the risk of Peripheral Vascular Diseases (PVD) occurs earlier and is often more severe and diffuse. Endothelial dysfunction, vascular smooth cell dysfunction, inflammation, and hypercoagulability are the key factors in diabetic arteriopathy. The presence of PVD apart from its increased risk of claudication, ischemic ulcers, gangrenes and possible amputation is also a marker for generalized atherosclerosis and a strong predictor of the cardiovascular ischemic event.

Approximately 15-40 % people with PVD are having a diminished ability to perform daily activities. A Study was conducted among 14 patients showing that the subcutaneous blood flow is an increase in seven patients temporarily within 24 hours by doing Buerger’s Allen exercise. Buerger’s Allen exercises an active postural exercise (gravity alternatively fills and empties the blood vessels) for preventing PVD and promoting collateral circulation in lower extremities.

Exercise training Buerger’s Allen exercise for improving lower extremity perfusion among diabetic patient helps in potential mechanisms like the formation of collateral circulation and increased blood flow, changes microcirculation and endothelial functions, changes in muscle metabolism and oxygen extraction, prevention of inflammation and muscle injury, cost-effective, and preventing atherosclerosis.

The burden of diabetes mellitus is increased and its risk factors and complication is more. Thus the investigator was interested to conduct the study to assess the effectiveness of Buerger’s Allen exercise on improving the lower extremity perfusion among patients with Diabetes mellitus.

**4. OBJECTIVES OF THE STUDY**

- To assess the pre and post level of lower extremity perfusion among patients with type 2 diabetes mellitus in the experimental and control group.
- To determine the effectiveness of Buerger Allen exercise on lower extremity perfusion among patients with type 2 diabetes mellitus.
- To associate the post-test level of lower extremity perfusion with selected demographic variables and among patients with type 2 diabetes mellitus in both experimental and control group.

**5. RESEARCH METHODOLOGY**

The investigator used a quantitative approach, true experimental pre, and post-test design. The study was conducted among 60 type 2 diabetes mellitus patient (30 patient in experimental group and 30 patients in control group) selected using non probability purposive sampling technique by including patient with diabetes mellitus both male and female, under the age 31-65years old present in medical ward, who are willing to participate and able to speak English or Tamil and by excluding patient who are not willing to participate and diabetes patient who are critically ill with food ulcer at in general medical wards at Saveetha Medical College and Hospital, Chennai. The study was conducted on 18.12.2017 to 23.12.2017. Data was collected using demographic variables and ABI scale was used to assess pre-test scores among experimental and control group. Buerger’s Allen Exercise was administered on same day among the experimental group for 5 days. The duration of exercise was 15 minutes three times a day. Post-test was conducted on the sixth day by using the same scale for both the group. The collected data were analyzed using descriptive and inferential statistics.

**Selection and Development of Study Instruments**

**Section-A:** Demographic Variables

**Section-B:** Level of lower extremity perfusion is assessed by the Ankle Brachial Index Scale, Score Interpretation of ABI

>1: Normal lower extremity perfusion.

1.0-0.8: Mild lower extremity perfusion.

0.7-0.6: Moderate lower extremity perfusion.

0.5 and <0.5: Severe lower extremity perfusion.

**6. RESULT**

**Table 1: Frequency and percentage distribution of demographic variables and lower extrimity perfusion among patient with diabetes mellitus in pre-test experimental group**

S. no.	Demographic Variables	Sample		Lower Extrimity Perfusion								
				Normal		Mild		Moderate		Severe		
		N	%	F	%	F	%	F	%	F	%	
1.	<b>Age</b>											
	a) 31-40years	5	16.67	-	-	2	6.67	3	10	-	-	
	b) 41-50years	6	20	-	-	4	13.33	2	6.67	-	-	
	c) 51-60 years	7	23.33	-	-	3	10	4	13.33	-	-	
	d) Above 60 years	12	40	-	-	6	20	5	16.67	1	3.33	
2.	<b>Gender</b>											
	a) Male	11	36.67	-	-	6	20	5	16.67	-	-	
	b) Female	19	63.33	-	-	9	30	9	30	1	3.33	

3.	<b>Education</b> a) Illiterate b) Primary education c) Secondary education d) Graduate	12 7 8 3	40 23.33 26.67 10	- - - -	- - - -	4 3 6 2	13.33 10 20 6.67	7 4 2 1	23.33 13.33 6.67 3.33	1 - - -	3.33 - - -
4.	<b>Occupation</b> a) Unemployed b) Unskilled labour c) Skilled labor	10 9 11	33.33 30 36.67	- - -	- - -	3 5 7	10 16.67 23.33	6 4 4	20 13.33 13.33	1 - -	3.33 - -
5.	<b>Diet pattern</b> a) Vegetarian b) Mixed	6 24	20 80	- -	- -	2 13	6.67 43.33	4 10	13.33 33.33	- 1	- 3.33
6.	<b>Bad habits</b> a) Smoking b) Alcohol c) Both d) None	4 3 5 18	13.33 10 16.67 60	- - - -	- - - -	2 2 2 9	6.67 6.67 6.67 30	2 1 2 9	6.67 3.33 6.67 30	- - 1 -	- - 3.33 -
7.	<b>Duration of type 2 diabetes mellitus</b> a) <5 years b) 6-10 years c) 11-15 years d) >15 years	7 6 8 9	23.33 20 26.67 30	- - - -	- - - -	5 4 4 2	16.67 13.33 13.33 6.67	2 2 4 6	6.67 6.67 13.33 20	- - - 1	- - - 3.33

Frequency and distribution of demographic variables among type 2 diabetes mellitus patients among 30 samples in pre-test experimental group, that the most of the diabetes patients 12 (40%) were between the age group of above 60 years, 7(23.33%) between the age group of 51-60 years, 6(20%) between the age group of 41-50 years, 5(16.67%) between the age group of 31-40 years. The majority of the diabetes patients 19(63.33%) were females, 11(36.67%) were males. The 12(40%) of patients were illiterate, 8(26.67%) of patients were studied in secondary education, 7(23.33%) of patients were studied in primary education. 3(10%) of the patient were studied in graduate. The 11(36.67%) patients belong to skilled labour, 10(33.33%) were unemployed, 9(30%) were unskilled labour. The 6(20%) patients were vegetarian and the majority of the patients 24(80%) belongs to a mixed diet pattern. The majority of the patients 18(30%) did not have any bad habits, 5(16.67%) were smoker and alcoholic, 4(13.33%) had only smoking habits and 3(10%) were had only alcohol. The most of the patients were 9(30%) of patients were the duration of diabetes mellitus is >15 years, 8(26.67%) were the duration of diabetes is 11-15 years, 7(23.33%) were the duration of diabetes is <5 years, 6(20%) were the duration of diabetes is 6-10 years.

This shows that the pre-test level of lower extremity perfusion in experimental group that 15(50%) patients had that mild level of lower extremity perfusion, 14(46.67%) of patients have moderate level of lower extremity perfusion, 1(3.3%) of patient with severe level of lower extremity perfusion, none of them there is no normal level of lower extremity perfusion.

**Table 2: Frequency and percentage distribution of selected demographic variables and lower extremity perfusion among patient with diabetes mellitus in pre-test control group**

S. no.	Demographic variable	Sample		Lower extremity perfusion							
				Normal		Mild		Moderate		Severe	
		N	%	N	%	N	%	N	%	N	%
1.	<b>Age</b> a) 31-40 years b) 41-50 years c) 51-60 years d) Above 60 years	4 5 8 13	13.33 16.67 26.67 43.33	- - - -	- - - -	2 3 5 7	6.67 10 16.67 23.33	2 2 3 6	6.67 6.67 10 20	- - - -	- - - -
2.	<b>Gender</b> a) Male b) Female	12 18	40 60	- -	- -	7 10	23.33 33.33	5 8	16.67 26.67	- -	- -
3.	<b>Education</b> a) Illiterate b) Primary education c) Secondary education d) Graduate	9 9 9 3	30 30 30 10	- - - -	- - - -	3 5 6 3	10 16.67 20 10	6 4 3 -	20 13.33 10 -	- - - -	- - - -
4.	<b>Occupation</b> a) Unemployed b) Unskilled labour c) Skilled labour	9 9 12	30 30 40	- - -	- - -	4 5 8	13.33 16.67 26.67	5 4 4	16.67 13.33 13.33	- - -	- - -

5.	<b>Diet pattern</b>										
	a) Vegetarian	4	13.33	-	-	3	10	1	3.33	-	-
	b) Mixed	26	86.67	-	-	14	46.67	12	40	-	-
6.	<b>Bad habits</b>										
	a) Smoking	3	10	-	-	3	10	-	-	-	-
	b) Alcohol	3	10	-	-	2	6.67	1	3.33	-	-
	c) Both	4	13.33	-	-	2	6.67	2	6.67	-	-
	d) None	20	66.67	-	-	10	33.33	10	33.33	-	-
7.	<b>Duration of type 2 diabetes mellitus</b>										
	a) <5 years	3	10	-	-	2	6.67	1	3.33	-	-
	b) 6-10 years	9	30	-	-	6	20	3	10	-	-
	c) 11-15 years	8	26.67	-	-	5	16.67	3	10	-	-
	d) >15 years	10	33.33	-	-	4	13.33	6	20	-	-

Frequency and distribution of demographic variables among type 2 diabetes mellitus patients among 30 samples in pre-test control group, that the most of the diabetes patients 13 (43.33%) were between the age group of above 60 years, 8 (26.67%) between the age group of 51-60 years, 5 (16.67%) between the age group of 41-50 years, 4 (13.33%) between the age group of 31-40 years. The majority of the diabetes patients 18(60%) were females, 12 (40%) were males. The 9 (30%) of patients were illiterate, 9(30%) of patients were studied in secondary education, 9 (30%) of patients were studied in primary education. 3 (10%) of the patient were studied in graduate. The 12(40%) patients belong to skilled labour, 9 (30%) were unemployed, 9 (30%) were unskilled labour. The 4 (13.33%) patients were vegetarian and the majority of the patients 26(86.67%) belongs to a mixed diet pattern. The majority of the patients 20 (66.67%) did not have any bad habits, 4 (13.33%) were smoker and alcoholic, 3 (10%) had only smoking habits and 3 (10%) were had only alcohol. The most of the patients were 10 (33.33%) of patients were the duration of diabetes mellitus is >15 years, 8 (26.67%) were the duration of diabetes is 11-15 years, 3 (10%) were the duration of diabetes is <5 years, 9 (30%) were the duration of diabetes is 6-10 years.

This shows that the pre-test level of lower extremity perfusion in control group that 17 (56.66%) had a mild level of lower extremity perfusion, 13 (43.33%) have moderate level of lower extremity perfusion, none of them there is no severe level of lower extremity perfusion, and none of them there is no normal level of lower extremity perfusion

**Frequency and percentage distribution of selected demographic variables and lower extremity perfusion among patient with diabetes mellitus in post-test experimental group:** This revealed that the after the intervention of Buerger Allen Exercise in experimental group 7 (23.33%) had a normal level of lower extremity perfusion in type 2 diabetes patients, 14 (46.67%) had a mild level of lower extremity perfusion, 9(30%)had a mild level of lower extremity perfusion and none of them had a severe level of lower extremity perfusion.

**Frequency and percentage distribution of selected demographic variable and lower extremity perfusion among patients with diabetes mellitus in post-test control group:** This has described that post-test level of lower extremity perfusion in control group none of them there is no normal lower extremity perfusion in control group, 17 (56.67%) of patient with mild level of lower extremity perfusion, 13 (43.33%) of patient with moderate level of lower extremity perfusion, and none of them there is no severe lower extremity perfusion.

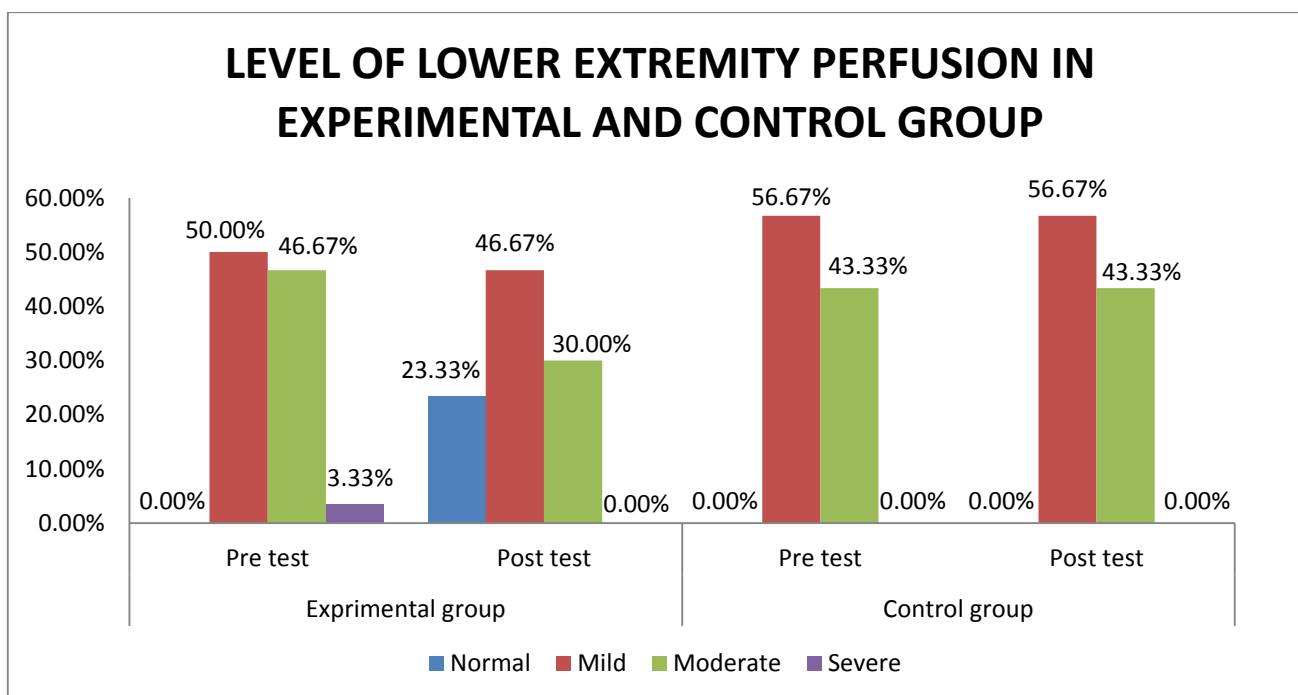


Fig. 1: Level of lower extremity perfusion in experimental and control group

This figure shows that the pre-test level of lower extremity perfusion in experimental group that 15(50%) patients had that mild level of lower extremity perfusion, 14(46.67%) of patients have moderate level of lower extremity perfusion, 1(3.3%) of patient with severe level of lower extremity perfusion, none of them there is no normal level of lower extremity perfusion. and the pre-test level of lower extremity perfusion in control group that 17(56.66%) had a mild level of lower extremity perfusion, 13(43.33%) have moderate level of lower extremity perfusion, none of them there is no severe level of lower extremity perfusion, and none of them there is no normal level of lower extremity perfusion.

This figure revealed that the post-test after the intervention of Buerger Allen Exercise in experimental group 7(23.33%) had a normal level of lower extremity perfusion in type 2 diabetes patients, 14(46.67%) had a mild level of lower extremity perfusion, 9(30%) had a moderate level of lower extremity perfusion and none of them had a severe level of lower extremity perfusion. And the post-test level of lower extremity perfusion in control group none of them there is no normal lower extremity perfusion in control group, 17(56.67%) of patient with mild level of lower extremity perfusion, 13(43.33%) of patient with moderate level of lower extremity perfusion, and none of them there is no severe lower extremity perfusion.

**Table 3: Association between the selected demographic variables and lower extremity perfusion among patients with diabetes mellitus in post-test experimental group (N=30)**

S. No.	Demographic variable	Sample		Lower extremity perfusion								Chi Square
				Normal		Mild		Moderate		Severe		
		N	%	N	%	N	%	N	%	N	%	
1. <b>Age</b>	a) 31-40 years	5	16.67	1	3.33	2	6.67	2	6.67	-	-	X <sup>2</sup> =4.594 DF=9 P=16.92 Significant
	b) 41-50 years	6	20	2	6.67	2	6.67	2	6.67	-	-	
	c) 51-60 years	7	23.33	3	10	2	6.67	2	6.67	-	-	
	d) Above60 years	12	40	1	3.33	8	26.67	3	10	-	-	
2. <b>Gender</b>	a) Male	11	36.67	3	10	4	13.33	4	13.33	-	-	X <sup>2</sup> =0.71 DF=3 P=7.82 Significant
	b) Female	19	63.33	4	13.33	10	33.33	5	16.67	-	-	
3. <b>Education</b>	a) Illiterate	12	40	2	6.67	4	13.33	6	20	-	-	X <sup>2</sup> =7.38 DF=9 P=16.92 Significant
	b) Primary education	7	23.33	2	6.67	4	13.33	1	3.33	-	-	
	c) Secondary education	8	26.67	3	10	3	10	2	6.67	-	-	
	d) Graduate	3	10	-	-	3	10	-	-	-	-	
4. <b>Occupation</b>	a) Unemployed	10	33.33	2	6.67	3	10	5	16.67	-	-	X <sup>2</sup> =7.894 DF=6 P=12.59 Significant
	b) Unskilled labour	9	30	2	6.67	3	10	4	13.33	-	-	
	c) Skilled labour	11	36.67	3	10	8	26.67	-	-	-	-	
5. <b>Diet pattern</b>	a) Vegetarian	6	20	2	6.67	3	10	1	3.33	-	-	X <sup>2</sup> =0.753 DF=3 P=7.82 Non-Significant
	b) Mixed	24	80	5	16.67	11	36.67	8	26.67	-	-	
6. <b>Bad habits</b>	a) Smoking	4	13.33	1	3.33	1	3.33	2	6.67	-	-	X <sup>2</sup> =7.124 DF=9 P=16.92 Significant
	b) Alcohol	3	10	1	3.33	1	3.33	1	3.33	-	-	
	c) Both	5	16.67	3	10	2	6.67	-	-	-	-	
	d) None	18	60	2	6.67	10	33.33	6	20	-	-	
7. <b>Duration of type 2 diabetes mellitus</b>	a) <5 years	7	23.33	2	6.67	3	10	2	6.67	-	-	X <sup>2</sup> =4.008 DF=9 P=16.92 Significant
	b) 6-10 years	6	20	2	6.67	2	6.67	2	6.67	-	-	
	c) 11-15 years	8	26.67	1	3.33	3	10	4	13.33	-	-	
	d) >15 years	9	30	2	6.67	6	20	1	3.33	-	-	

The association between the demographic variables and lower extremity perfusion patients with type 2 diabetes mellitus in the post-test experimental group. The table shows that there is a significant variation between the demographic variables such as age, gender, education, occupation, bad habit, duration of diabetes mellitus and non-significant variable between demographic variable is diet pattern.

**Table 4: Comparison of mean and standard deviation on lower extremity perfusion among patients with diabetes mellitus in control and experimental group**

Pre test	Mean score	SD	Post test	Mean score	SD
Experimental group	0.7	0.11	Experimental group	0.9	0.18
Control group	0.8	0.12	Control group	0.8	0.12

The table shows that the pre-test Mean value 0.7 in the experimental group and 0.8 in the control group. Standard deviation value of pre-test experimental group 0.11 and control group 0.12. After practicing Buerger Allen Exercise the post-test Mean value 0.9 in the experimental group and the post-test control group means the value is 0.8. Standard deviation value of post-test experimental group 0.18 and control group 0.12.

**Table 5: To compare the effectiveness of Buerger Allen exercises among patient with type 2 diabetes mellitus between the experimental group and control group**

Post test	Mean score	SD	t-test
Experimental group	0.9	0.18	2.583
Control group	0.8	0.12	

The table shows that the effectiveness of Buerger Allen Exercise on lower extremity perfusion among patients with type 2 diabetes mellitus between the post-test experimental and control group the mean score value 0.9 in the experimental group and 0.8 in control group. The 't' value is (2.583). This shows that Buerger Allen Exercise is effective in improving lower extremity perfusion among patients with type 2 diabetes mellitus. Hence the hypothesis is accepted.

## 7. DISCUSSION

The present study is to evaluate the Effectiveness of Buerger's Allen Exercise on levels of lower extremity perfusion among patients with type 2 diabetes mellitus at saveetha medical college and hospital, Chennai. The study was conducted in 60 samples in type 2 diabetes mellitus.

## 8. CONCLUSION

The findings of the study showed that the post-test level of lower extremity perfusion on Buerger's Allen exercise was statistically significant at  $p < 0.05$  in the experimental group. Hence it could be concluded that there will be an association between diabetes mellitus and Buerger's allen exercise.

## 9. REFERENCES

- [1] Brunner and Suddharth, Medical and Surgical Nursing" Lippincott publication Ltd, Philadelphia, 13<sup>th</sup> edition, 2012.
- [2] Vascular Risk Assessment of the Older Cardiovascular Patient: The Ankle-Brachial Index (ABI), November SP4, 2010.
- [3] Kreines K, Johnson E, Albrink M, Knatterud GL, Levin ME, Lewitan A, Newberry W, Rose FA: The course of peripheral vascular disease in non-insulin dependent diabetes. Diabetes Care 8:235-43, 1985.
- [4] Kerry.J.Stewart, Ed.D, William.R.Hiatt, Exercise training for claudication, The new England journal of medicine, vol:347:1941-1951,2002 <http://cintent.nejm.org/cgi/content/short>.
- [5] Adam J, Ogola G, Stafford, High intensity interval training for intermittent claudication in a vascular rehabilitation programme. Available from URL <http://www.ncbi.nlm.nih.gov/PMC>.
- [6] Faris,l.et al.,(2005). Increased subcutaneous flow for 24 hours. European journal of nuclear medicine and molecular imaging, 8(4), 15-17.retrievd from <http://www.sringerlinkcom/content>.
- [7] Brunner and Siddhartha, [2014] Text book of Medical-Surgical Nursing. Published by Wolters Kuluwer (India) Pvt. Ltd, New Delhi. Volume 2, 13<sup>th</sup> edition, pp 1825.
- [8] Park.k, [2015] Textbook of Preventive and social medicine, Published by M/s Banarsidas Bhanot, 23<sup>rd</sup> edition pp. 652.
- [9] Tamilselvan.T, [ 7,2017]Prevalence of diabetic foot ulcer and quality of life of type 2 diabetes mellitus patients in a Multi-Specialty Hospital, Tamil Nadu, Published by world journal of pharmacy and pharmaceutical science, volume 6.
- [10]Rajabharan, y.et al., (2008). Risk factors and complications of type 2 diabetes mellitus. Retrieved from <http://www.niper.ac.in/riskfactors>.
- [11]Sharma, R. (2009). The methodology of education research. (3rded). New Delhi: Vero publishers.
- [12]Williams, Y.T& Wang, S.S. (2010). Effects of Buergerallen exercises on peripheral vascular function in patients with peripheral vascular function in patients with peripheral arterial insufficiency, national science council report, Taipei, 1-15.
- [13] World health organization (2012) the prevalence of diabetes mellitus, global health estimates.
- [14]Zimmermann, W.M et al., (2011) course of occlusive arterial disease in diabetes, diabetes care, 13, 143-52.
- [15]Premalatha, S.et al.,(2009). Prevalence and risk factors of peripheral and risk factors of peripheral vascular disease in the south Indian population, diabetes care, 23(9), 1295-1299.