International Journal of Community Medicine and Public Health
Parihar N et al. Int J Community Med Public Health. 2026 Feb;13(2):775-786
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20260306

Original Research Article

A pre-experimental study to assess the effectiveness of Buerger Allen exercise to improve lower extremity perfusion among patients with diabetes mellitus type 2 admitted to selected hospitals, Jalandhar, Punjab

Neha Parihar[1], Jophy E. George[2]*

[1]Department of Medical Surgical Nursing, MHR DAV Institute of Nursing, Jalandhar, Punjab, India
[2]Department of Child Health Nursing, MHR DAV Institute of Nursing, Jalandhar, Punjab, India

Received: 03 November 2025
Revised: 20 December 2025
Accepted: 28 December 2025

***Correspondence:**
Dr. Jophy E. George,
E-mail: jophyegeorge5@gmail.com

ABSTRACT

Background: God consider good health one of his greatest gifts. A healthy individual may live a healthy and prosperous life, but many people in the current world cannot owe heart disease, neurological diseases, orthopaedic injuries, and metabolic illnesses, the greatest of which is diabetes. The World Health Organization defines diabetes as a chronic metabolic illness that damages the blood vessels, eyes, kidneys, and nerves due to high blood glucose levels.
Methods: This study employed a quantitative research approach with a pre-experimental design (one group pre-test post-test) to evaluate the impact of Buerger Allen Exercise (BAE) on lower extremity perfusion in 60 patients with type 2 diabetes mellitus from selected hospitals. Data collection utilized the Modified Ankle Brachial Index and a self-structured lower extremity perfusion scale.
Results: Pre-test mean lower extremity perfusion scores using the Modified Ankle Brachial Index were 1.73 (±0.54) for the right limb and 1.70 (±0.497) for the left limb. Post-test scores significantly improved to 0.53 (±0.72) for the right limb and 0.50 (±0.70) for the left limb, with‘t’ values of 13.59 and 14.69, respectively ($p<0.05$). Similarly, pre-test scores using the self-structured scale were 14.28 (±3.44) for the right leg and 14.08 (±2.71) for the left leg, improving to 6.88 (±3.26) and 6.98 (±3.01) post-test, with 't' values of 16.36 and 15.86, respectively ($p<0.05$).
Conclusions: The study concludes that Buerger Allen Exercise significantly improves lower extremity perfusion in patients with type 2 diabetes mellitus.

Keywords: Lower extremity perfusion, Buerger allen exercise, Modified ankle brachial index

INTRODUCTION

According to the World Health Organization, diabetes is a chronic and metabolic disorder characterized by elevated levels of blood glucose (or blood sugar), leading to substantial damage to the heart, blood vessels, eyes, kidneys, and nerves over a period of time. Type 2 diabetes is the most common form of diabetes, often occurring in adults. It is characterized by the body's resistance to insulin or inadequate production of insulin. In the last three decades, the prevalence of type 2 diabetes has markedly risen in countries across various economic strata. Diabetes affects almost 422 million people worldwide, with the majority living in low- and middle-income countries. Moreover, diabetes is directly accountable for causing 1.5 million deaths each year. The occurrence and the overall number of people affected by diabetes have been steadily increasing over the last several decades.[1]

The prevention of type 2 diabetes is often attainable. Obesity, inadequate physical exercise, and genetic susceptibility are all factors that contribute to the development of type 2 diabetes. Early identification is essential to minimize the most severe repercussions of type 2 diabetes. In order to detect diabetes in its early stages, it is recommended to undergo regular check-ups and blood tests under the guidance of a healthcare practitioner. The symptoms of type 2 diabetes may manifest with a mild intensity. It might potentially need many years for them to get acknowledgment. The symptoms may bear resemblance to those of type 1 diabetes, but they are often less apparent. As a result, the disease may not be identified until many years after it has started, by which time the implications have already become apparent. Approximately 95% of patients diagnosed with diabetes have Type 2 diabetes. Type 2 diabetes was formerly known as non-insulin dependent or adult onset. In the past, this kind of diabetes was only seen in adults, but it is becoming more common among young individuals.[2]

Long-term sufferers of Diabetes mellitus are susceptible to acquiring Peripheral Arterial Disease (PAD) as a consequence. Peripheral Arterial Disease may lead to serious consequences, such as gangrene, in the lower limbs. A common symptom is muscle pain in the lower limbs after physical exertion. Diabetic peripheral neuropathy may cause a decrease in the ability to feel pain. PAD refers to any conditions or illnesses that impact the circulatory system outside of the brain and heart. PAD is a medical illness marked by the constriction or obstruction of arteries caused by the accumulation of fatty deposits and plaque, a process referred to as atherosclerosis. This disorder is often known as peripheral vascular disease, which is characterized by inadequate blood flow to the arms and legs. Peripheral arterial disease is a comprehensive term that includes any ailment that affects the blood arteries. Nevertheless, it is sometimes used synonymously with the term "Peripheral Vascular Disease". Usually, the ailment that impacts the lower limb. Type 2 diabetes mellitus has a major role in causing PAD by increasing peripheral vascular resistance. It is a condition often known as a "*silent killer*".[3]

The Buerger-Allen Exercise is a set of activities that include raising, moving, and resting the lower extremities. A thorough examination and meta-analysis were conducted to assess the effect of Buerger Allen Exercise on foot perfusion in individuals diagnosed with diabetes mellitus. This meta-analysis demonstrates that the use of below-the-ankle angioplasty (BAE) significantly improves blood circulation in the feet of individuals with diabetes mellitus, as assessed by the ankle-brachial index (ABI). BAE is a straightforward, safe, and cost-free non-pharmacological method to improve blood circulation in the foot. BAE may be used into the standard therapy for persons with diabetes mellitus. Healthcare personnel may easily give it at medical facilities due to its high efficacy in managing foot perfusion in relation to the Ankle-Brachial Index.[4]

We also investigated whether persons with diabetes who are at an elevated risk for complications may potentially avert such outcomes by timely intervention. Therefore, we analyze the effect of the Buerger Allen Exercise on the blood circulation to the lower limbs in patients who have been diagnosed with diabetes. Nurses significantly enhance blood flow to the lower extremities in persons diagnosed with type 2 diabetes mellitus. Given its simplicity and low cost, it is not unexpected that Buerger Allen Exercise improves blood circulation to the legs.[5]

After conducting a comprehensive literature review and considering the previously discussed factors, the researchers determined that nurses have a crucial role in implementing the Buerger Allen Exercise to improve lower limb perfusion in patients with Type II diabetes mellitus who are at risk for peripheral vascular disease. Therefore, it is crucial to examine the efficacy of the BAE in reducing the likelihood of peripheral vascular disease in individuals with type II diabetes mellitus.

Objectives

To assess the pre-test level of lower extremity perfusion among patients with Diabetes Mellitus type 2.

To plan and implement the Buerger Allen Exercise on lower extremity perfusion among patients with Diabetes Mellitus type 2.

To assess the post-test level of lower extremity perfusion among patients with Diabetes Mellitus type 2.

To compare the pre-test and post-test level of lower extremity perfusion among patients with Diabetes Mellitus type 2.

To find out the association between pre-test level of lower extremity perfusion among patients with Diabetes Mellitus type 2 with their selected socio-demographic variables.

METHODS

The current study used a quantitative research technique to evaluate the efficiency of the Buerger Allen Exercise in improving lower extremities perfusion among patients with type 2 diabetes mellitus.

A total of 60 participants diagnosed with type 2 diabetes mellitus for at least two years were recruited from Civil, Hospital, Jalandhar, Punjab, using a non-probability purposive sampling technique. Inclusion criteria required patients with a confirmed diagnosis of type 2 diabetes mellitus and who were willing to participate. Exclusion criteria included patients who were critically ill,

diagnosed with foot gangrene or foot ulcer, deep vein thrombosis, severe peripheral artery disease.

The independent variable of the study was independent variable is Buerger Allen Exercise. While Lower Extremity Perfusion were the dependent variable. Socio-demographic and clinical variables such as age, gender, area of residence, marital status, type of family, education, occupation, family income, dietary pattern, life style, type of activity, family history of diabetes mellitus, duration of diagnosis with type 2 diabetes mellitus, history of co-morbidity, diabetes treatment were also recorded. The primary tools for data collection were the Modified Ankle Brachial Index Scale and self-structured lower extremity perfusion scale. Modified Ankle Brachial Index Scale above 1.0-1.4 (indicating normal perfusion), 0.8–0.9 (indicating mildly impaired perfusion), 0.5-0.7 (indicating substantially impaired perfusion), and less than 0.5 (indicating severely impaired perfusion). Self-structured lower extremity perfusion scale was classified as normal was scored as 00, mild to severe impairment was scored as 1 and 2.The maximum score of lower extremity perfusion scale was 24 and minimum score was 00.Both tools were validated by 6 nursing and research experts, and their reliability was established using the test-retest method, with correlation coefficients of reliability of 0.8 for the ABI and 0.9 for the self-structured perfusion scale.

A pilot study was conducted at the same hospital with 6 patients to refine the study procedure, test feasibility, and ensure accuracy in data collection methods. The pilot results indicated no major issues, except for the challenge of retaining patients for three consecutive days due to hospital discharge policies.

This intervention will be carried out for 15 minutes each session for 3 days, with a three-hour break between each session (9 a.m., 12 p.m., and 3 p.m.). It will be supervised during the whole process, which will last for 3 days. On the third day after exercise, Modified Ankle Brachial Index and self-structured lower extremity perfusion scale will be carried out to determine how well the lower extremities were perfused and the modified ankle brachial index comparing the blood pressure in the ankle with the blood pressure in the arm to assess peripheral artery blood flow.

The main data collection phase was carried out between March 1st, 2024 to April 15th, 2024, after obtaining approval from the ethics committee of MHR DAV Institute of Nursing, Jalandhar, and permission from the authorities of Civil, Hospital. Written informed consent was obtained from each participant, and confidentiality of personal data was maintained throughout the study. Between five and seven participants were assessed daily until the target of 60 participants was achieved.

Data analysis was performed using both descriptive and inferential statistics. Frequency and percentage distributions were used to describe socio-demographic and clinical variables. Mean, standard deviation, and mean differences were calculated for pre-test and post-test scores. Paired test was used for comparison between pre-test and post-test group. Additionally, chi-square tests were used to assess associations between socio-demographic variables and type 2 diabetes mellitus.

The findings of the study revealed a statistically significant improvement in lower extremity perfusion among patients with diabetes mellitus type ($p < 0.05$). These results demonstrate that Buerger Allen Exercise is an effective, non-invasive, and low-cost technique that can complement traditional diabetes mellitus management strategies.

RESULTS

Based on Table 1 Most hypertensive patients were aged 61–70 years, male, and lived in rural areas.

Secondary education and employment were common, with many earning Rs. 21,000–30,000 monthly, Vegetarian diets, less than 8 hours of sleep, and no family history of hypertension were frequently reported. A large portion had hypertension for over 8 years, were on antihypertensive medication, and had co-morbidities like cardiovascular disease and diabetes. No significant association was found between socio-demographic/clinical variables of hypertensive patients among experimental and control group ($p>0.05$).

Table 1: Frequency and percentage distribution of patients with diabetes mellitus type 2 according to socio demographic variables and clinical variables (n=60).

Socio demographic and clinical variables of patients	Frequency (f)	Percentage (%)
Age (in years)		
31-40	05	8.33
41-50	05	8.33
51-60	10	16.60
61-70	25	41.67
71 and above	15	25.00

Continued.

Socio demographic and clinical variables of patients	Frequency (f)	Percentage (%)
Gender		
Male	25	41.67
Female	35	58.33
Area of Residence		
Rural	40	66.67
Urban	16	26.67
Slum	04	06.66
Marital status		
Married	52	86.67
Unmarried	00	00.00
Widow/Divorced	08	13.33
Types of family		
Joint	10	16.67
Nuclear	50	83.33
Extended	00	00.00
Education		
Illiterate	35	58.33
Primary Education	12	20.00
Secondary Education	07	11.67
Graduate	06	10.00
PG and Above	00	00.00
Occupation		
Unemployed	38	63.33
Employed	12	20.00
Retired	10	16.67
Family income		
Below 5000 Rs	10	16.67
5001-10,000 Rs	19	31.67
10,001-20,000 Rs	28	46.67
20,001 Rs and above	03	05.00
Dietary pattern		
Vegetarian	05	08.33
Non-vegetarian	52	86.67
Eggetarian	03	05.00
Life style		
Smoker/Non-alcoholic	18	30.00
Non-smoker/alcoholic	20	33.33
Smoker/alcoholic	02	03.33
Non-smoker/Non-alcoholic	20	33.33
Type of activity		
Sedentary work	15	25.00
Moderate work	28	46.67
Heavy work	17	28.33
Family history of diabetes mellitus		
Yes	38	63.33
No	22	36.67
Duration of diagnosis with type 2 diabetes mellitus		
1-5 years	22	36.67
6-10 years	30	50.00
More than 10 years	08	13.33
History of co-morbid		
Cardiac disorders		
Yes	15	25.00
No	45	75.00

Continued.

Socio demographic and clinical variables of patients	Frequency (f)	Percentage (%)
Neurological disorders		
Yes	00	00.00
No	60	100.00
Renal Disorder		
Yes	00	00.00
No	60	100.00
Respiratory disorder		
Yes	02	03.33
No	58	96.67
Diabetes Treatment		
Oral Hypoglycaemic agents	36	60.00
Insulin	22	36.67
Insulin and oral hypoglycaemic agent	02	03.33
Any other	00	00.00

Table 2: Mean and mean percentage of pre-test level of lower extremity perfusion score of right limb among patients with diabetes mellitus type 2 by means of modified ankle brachial index.

Lower extremity perfusion score of right limb	Range	Mean	Mean percentage (%)	SD
Pre-test	02	1.73	57.67	±0.54

Maximum score= 03; Minimum score= 00.

Table 3: Mean and mean percentage of pre- test lower extremity perfusion score of left limb among patients with diabetes mellitus type 2 by means of modified ankle brachial index.

Lower extremity perfusion score of left limb	Range	Mean	Mean percentage (%)	SD
Pre- test	2	1.7	56.7	±0.497

Maximum score= 03; Minimum score= 00.

Table 4: Comparison of the mean pre-test and mean post-test level of lower extremity perfusion among patients with diabetes mellitus type 2 by means of modified ankle brachial index.

Lower extremity perfusion score	pre- test		post- test		paired t-test			
	Mean	SD	Mean	SD	df	Mean difference	't'	P value
Right limb	1.73	±0.540	0.53	±0.72	59	1.2	13.59	0.000
Left limb	1.70	±0.497	0.50	±0.70	59	1.2	14.69	0.000

Maximum score= 03; Minimum score= 00.***=highly significant at p<0.05.

Table 2 displays the pre-test lower extremity perfusion score of the right limb in individuals with Type 2 Diabetes Mellitus, using the Modified Ankle Brachial Index. The data reveals that the average pre-intervention level of lower extremity perfusion in individuals with type 2 diabetes mellitus was 1.73, with a standard deviation of ±0.54, and a mean percentage of 57.67%. Therefore, it was discovered that the patients had a slight to moderate amount of blood flow to their lower extremities.

Table 3 displays the pre-test lower extremity perfusion score of the left limb among patients diagnosed with Type 2 Diabetes Mellitus, using the Modified Ankle Brachial Index. The data reveals that the average pre-test level of lower extremity perfusion in patients with type 2 diabetes mellitus was 1.7, with a standard deviation of ±0.497, and the average percentage was 56.7%. Therefore, it was discovered that the patients had a slight to moderate degree of lower extremity perfusion.

The findings reveal a significant improvement in lower-extremity perfusion among individuals with type 2 diabetes mellitus following the intervention. The average perfusion level in the right leg decreased from 1.73 pre-test to 0.53 post-test, with a t-value of 13.59 ($p < 0.05$). Similarly, the left leg showed a reduction from 1.70 to 0.50, with a t-value of 14.69 ($p < 0.05$). These results confirm that the change in perfusion levels was statistically significant and not due to random chance, thereby supporting the research hypothesis (H1).

Table 5: Mean and Mean Percentage of pre- test lower extremity perfusion score of right leg among Patients with Diabetes Mellitus Type 2 by Means of self-structured lower extremity perfusion scale.

Lower Extremity Perfusion Score of right leg	Range	Mean	Mean percentage (%)	SD
Pre-test	13-18	14.28	59.50	±3.4

Maximum score= 24; Minimum score= 00.

Table 6: Mean and mean percentage of pre- test lower extremity perfusion score of left leg among patients with diabetes mellitus type 2 by means of self-structured lower extremity perfusion scale.

Lower extremity perfusion score of left leg	Range	Mean	Mean percentage (%)	SD
Pre-test	13-18	14.08	58.67	±2.71

Maximum score= 24; Minimum score= 00.

Table 7: Comparison of pre-test and post-test score level of lower extremity perfusion among patients with diabetes mellitus type 2 by means of self-structured lower extremity perfusion scale.

Lower Extremity Perfusion Score	Pre-test		Post-test		Paired t-Test			
	Mean	SD	Mean	SD	df	Mean Difference	t	P value
Right leg	14.28	±3.44	6.88	±3.26	59	7.4	16.36	0.000
Left leg	14.08	±2.71	6.98	±3.01	59	7.1	15.86	0.000

Maximum score= 24 Minimum score= 00 ***=highly significant at p<0.05.

Table 5 displays the pre-test lower extremity perfusion score of the right leg in patients with Type 2 Diabetes Mellitus, using a self-structured lower extremity perfusion scale. The data reveals that the average value was 14.28, the standard deviation was ±3.4, and the average percentage was 59.5%. Therefore, it was discovered that the patients had a slight to moderate amount of blood flow to their lower extremities.

Table 6 displays the pre-test lower extremity perfusion score of the left leg in patients with Type 2 Diabetes Mellitus, using a self-structured lower extremity perfusion scale. The data reveals that the average value was 14.08, the standard deviation was ±2.71, and the average percentage was 58.67%. Therefore, it was discovered that the patients had a slight to moderate degree of lower extremity perfusion.

Table 7 shows a significant reduction in lower extremity perfusion levels among patients with type 2 diabetes mellitus following the intervention. The mean perfusion value in the right leg decreased from 14.28 to 6.88 ($t= 16.36$, $p<0.05$), and in the left leg from 14.08 to 6.98 ($t= 15.86$, $p<0.05$). These results confirm that the observed changes were statistically significant, supporting the research hypothesis.

Table 8 shows the relationship between baseline lower-extremity blood flow and socio-demographic variables in individuals with type 2 diabetes. A significant association was found only with place of residence ($\chi^2=9.53$, $p<0.05$), indicating that dwelling area influences lower-extremity perfusion. No significant relationships were observed for age, sex, marital status, family type, occupation, income, diet, lifestyle, physical activity, family history of diabetes, duration of diagnosis, co-morbidities, or type of diabetes treatment.

Table 9 shows the relationship between lower-extremity blood flow in individuals with type 2 diabetes and selected socio-demographic variables. The analysis revealed that type of exercise (11.93) and diabetes treatment (15.76) had a statistically significant association with lower-extremity perfusion ($p < 0.05$), indicating their influence on blood flow. However, no significant correlation was found between lower-extremity perfusion and other variables such as age, gender, residence, marital status, family type, occupation, income, diet, lifestyle, family history of diabetes, duration of diabetes, and co-morbidities ($p > 0.05$). Thus, only exercise and treatment type were shown to significantly affect lower-extremity perfusion in individuals with type 2 diabetes.

Table 8: Association of pre-test right leg level of lower extremity perfusion among patients with diabetes mellitus type 2 by means of self-structured lower extremity perfusion scale with their selected socio demographic variables by using chi-square test.

Socio-demographic and clinical variables	Level of LEP in right leg				Chi-square	P value	Df	Table value	Result
	Normal	Mild	Moderate	Severe					
Age (in years)									
31-40	0	02	2	1					
41-50	0	2	3	0	13.42	0.098	8	15.50	Not significant
51-60	0	3	5	2					
61-70	0	10	15	0					
71 and above	0	2	13	0					
Gender									
Male	0	8	16	1	00.09	0.956	2	05.99	Not significant
Female	0	11	22	2					
Area of residence									
Rural	0	12	26	2					
Urban	0	4	12	0	09.53	0.049	4	09.49	Significant
Slum	0	3	0	1					
Marital status									
Married	0	17	32	3					
Unmarried	0	0	0	0	0.789	0.674	2	05.99	Not significant
Widow/ divorced	0	2	6	0					
Type of family									
Joint	0	4	6	0					
Nuclear	0	15	32	3	0.884	0.643	2	05.99	Not significant
Extended	0	0	0	0					
Education									
Illiterate	0	10	24	1					
Primary education	0	4	7	1	3.167	0.788	6	12.59	
Secondary education	0	3	3	1					Not significant
Graduate	0	2	4	0					
Post graduate and above	0	0	0	0					
Occupation									
Unemployed	0	13	24	1	1.830	0.767	4	09.49	Not significant
Employed	0	4	7	1					
Retired	0	2	7	1					
Family income									
Below 5,000 Rs.	0	2	8	0					
5001-10,000 Rs.	0	7	12	0	4.630	0.590	6	12.59	Not significant
10,001-20,000 Rs.	0	9	16	3					
20,001 Rs and above	0	1	2	0					
Dietary pattern									
Vegetarian	0	0	4	1	5.940	0.203	4	09.49	Not significant
Non-vegetarian	0	17	33	2					
Eggetarian	0	2	1	0					
Life style									
Smoker/non-alcoholic	0	5	12	1					
Non-smoker/alcoholic	0	6	13	1	0.629	0.996	6	12.59	Not significant
Smoker/alcoholic	0	1	1	0					
Non-smoker/non-alcoholic	0	7	12	1					

Continued.

Socio-demographic and clinical variables	Level of LEP in right leg				Chi-square	P value	Df	Table value	Result
	Normal	Mild	Moderate	Severe					
Type of activity									
Sedentary work	0	7	7	1	6.050	0.195	4	09.49	Not significant
Moderate work	0	9	19	0					
Heavy work	0	3	12	2					
Family history of diabetes mellitus									
Yes	0	11	26	1	1.820	0.401	2	05.99	
No	0	8	12	2					Not significant
Duration of diagnosis with type 2 diabetes mellitus									
1-5 years	0	8	14	0	2.460	0.652	4	09.49	Not significant
6-10 years	0	9	19	2					
More than 10 years	0	2	5	1					
History of co-morbid									
Cardiac disorders									
Yes	0	5	9	1	0.164	0.921	2	05.99	Not significant
No	0	14	29	2					
Neurological disorders									
Yes	0	0	0	0	-		-	-	-
No	0	19	38	3					
Renal disorders									
Yes	0	0	0	0	-		-	-	-
No	0	19	38	3					
Respiratory disorders									
Yes	0	0	2	0	1.198	0.549	2	05.99	Not significant
No	0	19	36	3					
Diabetes treatment									
Oral hypoglycaemic agents	0	12	23	1	2.350	0.672	4	09.49	Not significant
Insulin	0	7	13	2					
Insulin and oral hypoglycaemic agent	0	0	2	0					

Significant at $p<0.05$.

Table 9: Association of pre-test left leg level of lower extremity perfusion among patients with diabetes mellitus type 2 by means of self-structured lower extremity perfusion scale with their selected socio demographic variables by using chi-square test.

Socio-demographic and clinical variables	Level of LEP in left leg				Chi-square	P value	Df	Table value	Result
	Normal	Mild	Moderate	Severe					
Age (in years)									
31-40	0	3	2	0					
41-50	0	2	3	0	7.83	0.450	8	15.5	Not Significant
51-60	0	2	7	1					
61-70	0	6	19	0					
71 and above	0	2	12	1					
Gender									
Male	0	8	17	0	2.35	0.309	2	05.99	Not Significant
Female	0	7	26	2					
Area of Residence									
Rural	0	8	31	1					
Urban	0	4	11	1	6.45	0.168	4	09.49	Not Significant
Slum	0	3	1	0					

Continued.

Socio-demographic and clinical variables	Level of LEP in left leg				Chi-square	P value	Df	Table value	Result
	Normal	Mild	Moderate	Severe					
Marital Status									
Married	0	14	36	2					
Unmarried	0	0	0	0	1.21	0.547	2	05.99	Not Significant
Widow/ Divorced	0	1	7	0					
Type of family									
Joint	0	5	5	0					
Nuclear	0	10	38	2	4.18	0.123	2	05.99	Not Significant
Extended	0	0	0	0					
Education									
Illiterate	0	10	24	1					
Primary education	0	2	10	0	4.44	0.618	6	12.59	Not Significant
Secondary education	0	1	5	1					
Graduate	0	2	4	0					
Post graduate and above	0	0	0	0					
Occupation									
Unemployed	0	11	26	1	02.99	0.559	4	09.49	Not Significant
Employed	0	3	8	1					
Retired	0	1	9	0					
Family Income									
Below 5,000 Rs.	0	1	8	1					
5001-10,000 Rs.	0	8	11	0	07.07	0.315	6	12.59	Not Significant
10,001-20,000 Rs.	0	6	21	1					
20,001 Rs and above	0	0	3	0					
Dietary Pattern									
Vegetarian	0	1	3	1	07.58	0.108	4	09.49	Not Significant
Non-vegetarian	0	12	39	1					
Eggetarian	0	2	1	0					
Life style									
Smoker/Non-alcoholic	0	4	14	0					
Non-smoker/alcoholic	0	4	15	1	02.34	0.886	6	12.59	Not Significant
Smoker/alcoholic	0	1	2	0					
Non-smoker/ Non-alcoholic	0	6	13	1					
Type of activity									
Sedentary Work	0	5	10	0	11.93	0.018	4	09.49	Significant
Moderate work	0	10	18	0					
Heavy work	0	0	15	2					
Family history of diabetes mellitus									
Yes	0	9	27	2	01.24	0.539	2	05.99	Not Significant
No	0	6	16	0					
Duration of diagnosis with type 2 diabetes mellitus									
1-5 years	0	5	17	0	03.80	0.432	4	9.49	Not Significant
6-10 years	0	9	20	1					
More than 10 years	0	1	6	1					
History of co-morbid									
Cardiac disorders									
Yes	0	4	11	0	0.697	0.710	2	05.99	Not Significant
No	0	11	32	2					

Continued.

Socio-demographic and clinical variables	Level of LEP in left leg				Chi-square	P value	Df	Table value	Result
	Normal	Mild	Moderate	Severe					
Neurological disorders									
Yes	0	0	0	0	-		-	-	-
No	0	15	43	2					
Renal disorders									
Yes	0	0	0	0	-		-	-	-
No	0	15	43	2					
Respiratory disorders									
Yes	0	0	2	0	0.818	0.664	2	5.99	Not Significant
No	0	15	41	2					
Diabetes treatment									
Oral hypoglycaemic agents	0	11	24	1	15.76	0.003	4	9.49	Significant
Insulin	0	4	18	0					
Insulin and oral hypoglycaemic agent	0	0	1	1					

Significant at $p<0.05$.

DISCUSSION

The pre-test findings revealed that the mean Modified Ankle Brachial Index score for lower extremity perfusion was 1.73 ± 0.54 for the right leg and 1.70 ± 0.49 for the left leg, with corresponding mean percentages of 57.67% and 56.67%, respectively. Using this index, 63.33% of participants had a moderate level of perfusion in the right leg and 66.67% in the left leg. On the self-structured lower extremity perfusion scale, the mean scores were 14.28 ± 3.40 (59.50%) for the right leg and 14.08 ± 2.71 (58.67%) for the left leg, with 63.33% and 71.67% showing moderate perfusion, respectively. Similar studies have also reported predominantly mild to moderate impairment in peripheral perfusion among diabetic patients prior to intervention, indicating a consistent baseline reduction in lower extremity circulation.

The post-test findings showed a marked improvement in lower extremity perfusion following the intervention. The mean Modified Ankle Brachial Index score increased to 0.53 ± 0.72 for the right limb and 0.50 ± 0.17 for the left limb, with corresponding mean percentages of 17.67% and 16.67%. Based on the index, 60.00% of participants demonstrated normal perfusion in the right leg and 61.67% in the left leg, while no participants showed severe impairment. Similarly, on the self-structured lower extremity perfusion scale, mean post-test scores were 6.88 ± 3.26 (28.67%) for the right leg and 6.98 ± 3.01 (29.18%) for the left leg, with 61.67% and 65% of participants, respectively, exhibiting normal perfusion. Comparable studies have also reported improved peripheral circulation following Buerger Allen Exercises, confirming the intervention's effectiveness in enhancing lower extremity blood flow among diabetic patients.The results of the present study revealed a significant improvement in lower extremity perfusion following the implementation of Buerger Allen Exercise. The mean post-test scores measured by the Modified Ankle Brachial Index showed a statistically significant increase, with paired t-values of 13.59 for the right limb and 14.69 for the left limb, confirming the effectiveness of the intervention. Similarly, on the self-structured lower extremity perfusion scale, the paired t-values were 16.36 and 15.86 for the right and left legs, respectively, indicating a highly significant improvement at ($p < 0.05$). Comparable research findings also reported a marked enhancement in lower extremity perfusion and reduction of peripheral neuropathy symptoms among diabetic patients following Buerger Allen Exercise, thereby supporting the present study's findings and reinforcing its effectiveness in improving peripheral circulation.

The present study found a significant association between certain socio-demographic variables and lower extremity perfusion among patients with type 2 diabetes mellitus. Specifically, region of residency in the right leg ($\chi^2=9.53$) and type of exercise ($\chi^2=11.93$) and diabetes treatment ($\chi^2=15.67$) in the left leg were statistically significant at $p<0.05$, indicating their influence on blood flow to the lower extremities. Other variables, including age, gender, occupation, education, marital status, family type, family history of diabetes, duration of diagnosis, and comorbidities, showed no significant association ($p>0.05$). Similar findings from related studies also reported that certain lifestyle and treatment-related factors significantly affect lower extremity perfusion among diabetic patients, while most socio-demographic factors do not show a notable correlation.

Overall, the findings of this study align with existing literature and provide strong evidence that Buerger Allen Exercise is a cost-effective, non-pharmacological strategy for managing improve lower extremity perfusion among patients with diabetes mellitus type 2.

Limitations

The main limitation of the present study was its relatively small sample size of 60 diabetes mellitus type 2 which restricts the extent to which the findings can be generalized to larger populations. Conducted only in selected hospitals in Jalandhar, the study setting may not fully capture the diversity of socio-demographic and clinical profiles of diabetes mellitus type 2 in other regions. These factors limit the external validity of the results; therefore, future research with larger, more diverse, and multi-centre samples is recommended to validate and strengthen the applicability of the findings.

CONCLUSION

This study demonstrated that Buerger Allen Exercise improve lower extremity perfusion among patients with diabetes mellitus type 2. The findings establish Buerger Allen Exercise as a safe, simple, and non-pharmacological intervention that can complement standard care in diabetes mellitus type 2 management. By highlighting the immediate and sustained benefits of a low-cost, nurse-led practice, the study advances understanding in the field by providing evidence that structured Buerger Allen Exercise can improve cardiovascular outcomes and psychological well-being. These results contribute to growing evidence supporting lifestyle-based interventions and emphasize the important role of nursing professionals in integrating such strategies into routine patient care.

ACKNOWLEDGEMENTS

The author expresses sincere gratitude to the divine for constant blessings, strength, and guidance throughout the course of this work, and humbly acknowledges Chandi Mata for providing courage and direction during this academic journey.

The author is deeply indebted to Dr. Veena Williams, Principal, MHR DAV Nursing Institute, Jalandhar, for her invaluable guidance, constant encouragement, and academic support. Heartfelt thanks are extended to Mrs. Jophy George Elezabeth, Professor, for her expert advice, constructive feedback, and kind cooperation. The author also gratefully acknowledges Mrs. Kulwinder Kaur, Assistant Professor, for her practical guidance, motivation, and valuable insights that significantly refined this work.

The author extends sincere appreciation to the Ethical Committee members for their valuable suggestions, to the nursing experts for validating the research tool, and to Mr. C. S. Aggarwal for statistical assistance. Special thanks are also due to Mr. Jagraj Singh for support with the plagiarism report, the Chief Medical Officer for granting permission to conduct the study, and all participants for their willing cooperation.

The author owes the deepest gratitude to her parents, Mr. Rattan Chand and Mrs. Anju Parihar, for their unconditional love, support, and sacrifices. Special appreciation is extended to her brother, Mr. Himanshu Parihar, for his constant motivation and care, and to her sister and friend, Miss Neetika Raina, for her unwavering encouragement and affection.

With profound love and respect, this work is dedicated to the author's parents.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Receiving from MHR DAV ION

REFERENCES

1. WHO. Diabetes. Available at: https://www.who.int/health-topics/diabetes. Accessed on 03 October 2025.
2. WHO. Diabetes fact sheet. Available at: https://www.who.int/news-room/fact-sheets/detail/diabetes#:~:text=Factors%20that%20contribute%20to%20developing,tests%20with%20a%20healthcare%20provider. Accessed on 03 October 2025.
3. Basavanthappa BT. A Textbook of Medical Surgical Nursing. 2nd ed. Bangalore: Jaypee Brothers Medical Publishers; 2009.
4. Sinha R, Priya A, Sinha A, Hifz Ur Rahman M. Prevalence of diabetes distress among type 2 diabetes mellitus patients in India: a systematic review and meta-analysis. Health Psychol Behav Med. 2024;12(1):2324091.
5. Atre S, Deshmukh S, Kulkarni M. Prevalence of type 2 diabetes mellitus (T2DM) in India: A systematic review (1994-2018). Diabetes Metab Syndr. 2020;14(5):897-906.
6. Jenyfer Renu M, Tamilselvi S, Christy Mekala V. A Study to Evaluate the Effectiveness of Buerger Allen Exercise on improving lower Extremity perfusion among patients with Type II Diabetes Mellitus in selected Hospitals at Erode. Asian J Nurs Educ Res. 2022;12(4):431-4.
7. Basmallah CN, Farida I, Badriyah FL. Literature Review; The Effect of Buerger Allen Exercise in Ankle Brachial Index (ABI) Values in Diabetes Mellitus Type 2 Patients. J Med Res Health Educ. 2022;17(1):44-54.
8. International Journal of Research and Development. Effectiveness of Buerger Allen exercise on lower extremities perfusion among patients with type 2 diabetes mellitus. Available at: https://www.ijares.com/effectiveness-of-buerger-

allen-exercise-on-lower-extremities-perfusion-among-patients-with-type-2-diabetes-mellitus. Accessed on 03 October 2025.
9. Thomas B, Sharma L. A study to assess the effectiveness of buerger allen exercise on lower extremity perfusion and reducing peripheral neuropathy symptoms among diabetes mellitus patient in selected community areas of Bhopal, M.P. EPRA Int J Res Dev. 2023;8(9):s1-12.
10. Pareek B, Kalia R. Text book Nursing research and biostatistics for undergraduate and postgraduate nursing students. Vision health sciences publishers. 2020:117-81.
11. Kaur K, Samra AS, Kaur N. Journal of Nursing Science and Practice. 2021;11(2).
12. Gavit PV. Effectiveness of Buerger Allen exercise on Lower extremity perfusion among patients with type 2 Diabetes mellitus admitted at selected Hospitals of City. Int J Nurs Educ Res. 2021;9(3):305-9.
13. Thakur A, Sharma R, Sharma SK, Thakur K, Jelly P. Effect of buerger allen exercise on foot perfusion among patients with diabetes mellitus: A systematic review and meta-analysis. Diabetes Metab Syndr. 2022;16(2):102393.
14. Srivastava J, John RP, Reddy DH. Effectiveness of Buerger Allen's Exercise on Foot Perfusion Among Type 2 Diabetes Mellitus Patients. Ann Rom Soc Cell Biol. 2022;26(1):2721-32.
15. Latha H, Gifty FV. A Study to Assess the Effectiveness of Buerger Allen Exercise on Lower Extremity Perfusion among Patients with Type 2 Diabetes Mellitus in selected hospitals at Kanyakumari District. Asian J Nurs Educ Res. 2019;9(3):305-11.
16. Miskin VM. A Study to Assess the Effectiveness of Buerger Allen Exercise on Lower Extremity Perfusion Among Diabetes Mellitus Patients Admitted in Selected Hospitals. Int J Nurs Care. 2022;10(2):18-25.
17. Victoria Ms, Biswal A, Pillai S, Hemavati G. A study to assess the effectiveness of Buerger Allen Exercise on lower extremity perfusion among patients with type 2 diabetes mellitus. Int J Trend Sci Res Dev. 2021;6(1):1119-23.
18. Chang CF, Chang CC, Chen MY. Effect of Buerger's exercises on improving peripheral circulation: A systematic review. Open J Nurse. 2015;5(2):120-8.
19. Tresierra-Ayala A, Rojas AG. Association between peripheral arterial disease and diabetic foot ulcers in patients with diabetes mellitus type II. Medicina Universitaria. 2017;19(76):123-6.

Cite this article as: Parihar N, George JE. A pre-experimental study to assess the effectiveness of Buerger Allen exercise to improve lower extremity perfusion among patients with diabetes mellitus type 2 admitted to selected hospitals, Jalandhar, Punjab. Int J Community Med Public Health 2026;13:775-86.