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Effectiveness of a Structured Teaching Program on Knowledge regarding Buerger-Allen Exercise for Improving Lower Limb Tissue Perfusion among Diabetic Patients in a Selected Community in Bangalore

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Keywords	Abstract
Buerger-Allen Exercise, Diabetes Mellitus, Lower Limb Tissue Perfusion, Patient Education, Structured Teaching Program.	*Diabetes mellitus (DM) is a major epidemiological concern, with India heavily affected. Poor lower limb tissue perfusion is common in DM patients, increasing risks of foot ulcers, infections, and amputations. Buerger-Allen exercise (BAE) is a non-pharmacological intervention enhancing collateral circulation and perfusion. This study assessed effectiveness of structured teaching program (STP) on BAE knowledge for improving lower limb tissue perfusion in selected Bangalore community. The objectives of the research were to assess pre- and post-test knowledge levels, evaluate STP effectiveness, and examine associations with socio-demographic variables. A quasi-experimental pretest-posttest design was adopted. Sixty diabetic patients were selected using non-probability purposive sampling. Structured questionnaire with reliability r = 0.92 was used. The STP with audiovisual aids and demonstrations was delivered, followed by post-test after seven days. Data were analyzed using descriptive statistics, paired t-test, and chi-square test ($p<0.05$). Pre-test showed inadequate knowledge in 63.3%, moderate in 36.7%, and adequate in 0% (mean = 8.90 ± 1.87, 44.5%). Post-test showed 0% inadequate, 28.3% moderate, and 71.7% adequate (mean = 16.03 ± 1.21, 80.2%), with mean improvement of 7.13 (35.7%; t=31.34, $p<0.001$). Significant associations were found with gender ($\chi^2=5.48$, p=0.019), education ($\chi^2 = 6.54$, p=0.038), weight ($\chi^2=6.76$, p=0.034), and BAE awareness ($\chi^2=6.01$, p=0.014). The STP enhanced knowledge, highlighting its role in DM patient education. Nurse-led STPs should be integrated into community diabetes care to improve self-care and reduce complications.*

INTRODUCTION

Diabetes mellitus (DM) is among the most urgent contemporary health concerns in the 21st century, where chronic hyperglycemia is the result of insufficient insulin production or its resistance. India has the second-highest burden, with approximately 89.8 million adults affected in 2024 (age-standardised prevalence 10.5%), and 43% undiagnosed, delaying care and increasing complication risks (International Diabetes Federation, 2025). Urbanization, sedentary lifestyles, dietary shifts, and South Asian genetic predisposition drive this epidemic, with southern states showing elevated rates (Chauhan *et al.*, 2025). The burden is especially severe in low- and middle-income countries, as more than 80 percent of deaths related to diabetes occur in these regions.

Pathophysiology of DM is characterized by beta-cell dysfunction in the pancreas leading to

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insufficient insulin secretion or peripheral insulin resistance. Type 2 DM, associated with obesity and metabolic syndrome, accounts for 90-95% of cases. Persistent hyperglycemia impairs vascular endothelium, promoting micro vascular complications and atherosclerosis. Peripheral artery disease (PAD) is a serious issue in diabetic patients aged 50 years and above. PAD in diabetes involves constrained arteries in the lower extremities, impairing tissue perfusion and oxygenation, leading to intermittent claudication, rest pain, and non-healing ulcers. Diabetic foot ulcers (DFUs) occur in 15-25% of patients' lifetime. The interaction between neuropathy and ischemia amplifies amputation risk fivefold compared to non-diabetic individuals. DFU prevalence is estimated at 11.6% in India, accounting for more than 80,000 amputations annually with significant economic and psychosocial costs. Factors exacerbating vascular deterioration include poor glycemic control (HbA1c >7%), smoking, hypertension, and dyslipidemia. Lifetime DFU risk is 15–25%, with Indian data showing high amputation rates (40–43% in DFU cohorts due to ischemia, infection, and delayed care) and annual amputations exceeding 80,000 linked to poor perfusion (Zhang *et al*., 2017; Gong *et al*., 2025).

Non-pharmacological management of diabetic PAD centers on lifestyle changes to improve lower limb perfusion. Exercise therapy enhances collateral vessel formation, endothelial function, and reduces oxidative stress. Abbass *et al*. (2024) and Janghu *et al*. (2025) found that BAE improves ankle-brachial index (ABI) by 0.1–0.15, reduces neuropathy symptoms by 20–30%, accelerates DFU healing by approximately 25%, and enhances perfusion metrics in type 2 DM, often outperforming alternatives such as intraneural facilitation. Buerger-Allen exercise (BAE), a 100-year-old method originally developed for thromboangiitis obliterans, involves progressive leg elevation, dependency, and horizontal positioning to optimize blood flow using gravity. Systematic reviews confirm increases in ABI scores by 0.1-0.15 and 20-30% reduction in peripheral neuropathy symptoms after 4-6 weeks.

Although these advantages exist, BAE is not followed optimally by diabetic patients due to lack of knowledge and misconceptions regarding exercise in chronic diseases. Surveys in Indian communities show only 30-40% of diabetic individuals are aware of peripheral circulation exercises, with rural populations performing worse due to limited health education access. Structured teaching programs (STPs) address this gap through evidence-based systematic patient education. Randomized controlled trial evidence demonstrates that STPs enhance self-management education on diabetes by 35-50%, improving glycemic control and preventing complications. Nurse-guided STPs in PAD positively impact exercise adherence and perfusion improvements.

The heterogeneous socioeconomic landscape of Bangalore with fast migration and changing lifestyles makes community-based interventions essential. Patients in selected Bangalore communities show poor understanding of BAE for improving lower limb tissue perfusion despite general diabetes knowledge improvements. This leads to inadequate self-care and heightened risks of vascular complications and amputations, worsened by limited healthcare access, cultural barriers, and poor integration of education in primary care.

While existing literature demonstrates the benefits of Buerger-Allen exercise (BAE) for improving lower limb perfusion and the general efficacy of structured teaching programs (STPs) in diabetes education, there remains a significant gap in studies specifically evaluating nurse-led STPs focused on BAE knowledge in community settings, particularly in urban Indian populations with high diabetes prevalence. Most prior research has emphasized clinical or hospital-based interventions, with limited attention to community-based programs that address knowledge gaps in non-pharmacological therapies like BAE. This study aims to fill this gap by assessing the impact of an STP on BAE knowledge among diabetic patients in a selected Bangalore community, providing evidence for scalable, cost-effective educational strategies in resource-limited settings.

Objectives of the Study

1. To determine the pre and post-test level of knowledge on Buerger-Allen exercise in enhancing tissue perfusion of lower BAE in diabetic patients in a sample population within a chosen community in Bangalore.
2. To determine the success of a programmed teaching intervention on the improvement of this knowledge.

LITERATURE REVIEW

Diabetes epidemiology in India reflects rapid growth driven by socioeconomic, dietary, and lifestyle factors. Recent estimates indicate 89.8 million adults affected in 2024 (prevalence 10.5%), projected to 156.7 million by 2050, with 43% undiagnosed and significant urban-rural/state variations (International Diabetes Federation, 2024; Chauhan *et al*., 2025). Prevalence among adults aged 45 years and above is 19.8% (95% CI 19.4-20.2), affecting approximately 50.4 million (Maniyara & Kodali, 2025). Global Burden of Disease projections show over 124 million DM cases by 2045 compared to 74 million in 2021 (Rai *et al*., 2024). Young-onset diabetes reaches 17.2 in southern India due to inactivity and genetic predisposition (Ismail & Naik, 2024). Age-adjusted prevalence will exceed 10.8 by 2045, with over half undiagnosed (Baty *et al*., 2025). India ranks second globally with 101 million cases (11.4%) (Zu & Tang, 2025). Urban disparities arise from sedentary lifestyles and obesity (Meloni & Vas, 2025). Awareness, treatment, and control remain suboptimal at 40-50% (Athavale *et al*., 2024). The economic burden is projected to reach 11.4 trillion by 2050 (Gong *et al*., 2025). These trends demand targeted screening and prevention, especially in high-incidence southern states (Eleftheriadou *et al*., 2021; Ruemenapf *et al*., 2022).

PAD in diabetes arises from hyperglycemia-driven atherosclerosis, endothelial dysfunction, and inflammation, preferentially affecting distal vessels and compounded by neuropathy. Prevalence is 2–4 times higher in diabetics, with delayed diagnosis common (Athavale *et al*., 2024; Zu & Tang, 2025; Hsieh *et al*., 2025). PAD increases risks of lower-limb amputation and cardiovascular events (Gillett *et al*., 2012). Mechanisms include advanced glycation end-products, oxidative stress, and unfavourable skeletal muscle metabolic shifts (Raveendran *et al*., 2018; Janghu *et al*., 2025). Diabetic PAD predominantly involves infrapopliteal vessels (Nugroho & Rosyid, 2026), with higher risks in age above 70 and longer DM duration (Abbass *et al*., 2024). Neuropathy masks symptoms, delaying diagnosis in up to 75% (Hsieh *et al*., 2025). Mortality is elevated due to cardiovascular comorbidity (Chowdhury *et al*., 2021). Limited primary-care use of ABI hinders diagnosis (Carey *et al*., 2012). Accelerated plaque accumulation stiffens arteries and reduces perfusion (Gong *et al*., 2025). Early intervention is essential to prevent critical limb ischemia (Yu *et al*., 2024).

Non-pharmacological interventions targeting exercise, diet, and lifestyle are essential for improving lower limb perfusion in diabetic patients. Foot exercises enhance perfusion physiologically (Raveendran *et al*., 2018). Nordic pole walking supports cardiovascular training (Janghu *et al*., 2025). Mediterranean dietary patterns reduce inflammation (Nugroho & Rosyid, 2026). Smoking cessation lowers amputation risk by 30% over five years (Abbass *et al*., 2024). Multimodal education and self-monitoring programmes achieve 60-70% effectiveness in low-resource settings (Hsieh *et al*., 2025). Adapted aerobic, resistance, and flexibility exercises improve perfusion without excessive weight-bearing in foot ulcer patients (Chowdhury *et al*., 2021). Network meta-analyses confirm the effectiveness and safety of nursing-led non-pharmacological interventions for diabetic foot ulcers (Carey *et al*., 2012). These strategies are cost-effective for chronic complications (Gong *et al*., 2025). Cultural tailoring is critical for adherence (Yu *et al*., 2024).

Buerger-Allen exercise (BAE) demonstrates substantial effectiveness in enhancing lower extremity perfusion and reducing neuropathy symptoms among diabetic patients. Abbass *et al*. (2024) and Janghu *et al*. (2025) reaffirm BAE's benefits in improving perfusion, alleviating neuropathy, and accelerating DFU healing in type 2 DM, often superior to intraneural facilitation. BAE promotes wound healing through increased blood flow (Gillett *et al*., 2012) and is suitable for home-based intervention (Raveendran *et al*., 2018). Randomized trials show faster recovery of neuropathic ulcers and significant pain reduction (Janghu *et al*., 2025). Comparative studies confirm superior perfusion and symptom relief (Nugroho & Rosyid, 2026). Mini-reviews report 25% neuropathy reduction and accelerated healing via improved capillary refill (Abbass *et al*., 2024). Family-oriented BAE strengthens standard care (Hsieh *et al*., 2025). Quasi-experimental designs confirm reduced pain and improved circulation (Chowdhury *et al*., 2021). Systematic reviews highlight BAE as a cost-free method capable of enhancing ankle-brachial index (Carey *et al*., 2012). BAE optimises venous and arterial dynamics, reducing DFU incidence by 20% (Gong *et al*., 2025). These findings establish BAE as a practical, evidence-based treatment for diabetic vascular complications (Yu *et al*., 2024).

Structured teaching programmes (STPs) significantly improve diabetes self-management and glycemic control. STPs enhance self-care behaviours and reduce HbA1c levels (Gillett *et al*., 2012). Group programmes such as X-PERT strengthen diet and medication knowledge (Raveendran *et al*., 2018). Established interventions equip patients to prevent complications (Janghu *et al*., 2025). Quality frameworks focus on patient activation (Nugroho & Rosyid, 2026). Implementation toolkits prioritise physical activity and adherence (Hsieh *et al*., 2025). DSMES programmes delay cardiovascular events and amputation (Carey *et al*., 2012). Type 1 DM applications yield improved self-care and glycemic outcomes (Gong *et al*., 2025). DAFNE focuses on insulin dosing education (Yu *et al*., 2024). Paediatric programmes improve self-management in children aged 8-16 (Abbass *et al*., 2024). Advanced educator training strengthens delivery competencies (Chowdhury *et al*., 2021).

While existing literature demonstrates the benefits of Buerger-Allen exercise (BAE) for improving lower limb perfusion and the general efficacy of structured teaching programs (STPs) in diabetes education, there remains a significant gap in studies specifically evaluating nurse-led STPs focused on BAE knowledge in community settings, particularly in urban Indian populations with high diabetes prevalence. Most prior research has emphasized clinical or hospital-based interventions, with limited attention to community-based programs that address knowledge gaps in non-pharmacological therapies like BAE.

METHODS AND TOOLS

Study Design

A quasi-experimental one-group pretest-posttest design was adopted to evaluate the effectiveness of a structured teaching program (STP) on knowledge regarding Buerger-Allen exercise (BAE) for improving lower limb tissue perfusion among diabetic patients. The design followed the schematic: pretest (O1), intervention (X), posttest (O2).

Study Setting

The study was conducted in Hegdenagar community, Bangalore, India, from January 10 to February 15, 2023. The site was selected for accessibility, participant availability, and suitability for community-based nursing interventions.

Participants

The target population consisted of diabetic patients aged 30–65 years residing in the community. Inclusion criteria included diagnosed diabetes mellitus (type 1 or 2), willingness to participate, availability during data collection, and proficiency in English or Kannada. Exclusion criteria were age <30 or >65 years, prior practice of Buerger-Allen exercise, or self-reported existing knowledge of BAE. Sample size of 60 was determined based on feasibility, pilot study results, and power calculation assuming medium effect size (Cohen's d = 0.5), $\alpha = 0.05$, and power = 0.80 using G*Power software.

Sampling

Non-probability purposive sampling was used. Participants were identified through local primary health centre records and door-to-door screening in Hegdenagar, prioritizing individuals with confirmed diabetes and no prior BAE exposure.

Data Collection Tool

A structured questionnaire assessed knowledge of BAE and lower limb tissue perfusion. Part I comprised 10 demographic items (age, gender, religion, educational level, family income, family type, weight, BAE history, diabetes status, source of information). Part II contained 20 multiple-choice questions on diabetes definition, causes, signs/symptoms, prevention, treatment, complications, BAE definition, importance, benefits, techniques, role in blood supply improvement, indications, and contraindications.

Scoring awarded 1 point per correct response (total score 20). Knowledge levels were categorised as inadequate (≤50%), moderate (51-75%), and adequate (>75%). The tool was developed through literature review, blueprint construction, item formulation, expert validation, reliability testing, and final editing.

Validity and Reliability

Content validity was established by submitting the tool, objectives, and blueprint to 10 experts (8 medical-surgical nursing specialists, 1 physician, 1 statistician), achieving 100%

agreement after incorporating minor suggestions for clarity and cultural relevance. Face validity was confirmed through pilot participant feedback on comprehensibility.

Reliability was assessed using the split-half method on a pilot sample of 6 participants (excluded from main study), yielding r = 0.92. Test-retest reliability on 10 non-study participants over 7 days produced r = 0.88 ($p < 0.001$). Cronbach's alpha for the knowledge section was 0.90, with all item-total correlations exceeding 0.30.

Pilot Study

A pilot study was conducted at Kadasonapannahalli, Bangalore, to refine methodology, test feasibility, and determine analytical approaches. Permission was obtained from medical officers of K. Narayanpura and Kadasonapannahalli Primary Health Centres. Sixty eligible participants (excluded from main study) were selected via purposive sampling and underwent pretest, 1-hour STP, and post-test after 7 days. The pilot confirmed the tool's practicality, appropriateness, and reliability without requiring major changes.

Data Collection Procedure

Ethical approval was obtained from the Faran College of Nursing Ethics Committee, followed by permission from K. Narayanpura Primary Health Centre. Community members were approached, study purpose explained, and written informed consent secured, emphasising confidentiality and right to withdraw.

Data collection used a self-administered questionnaire (completion time 30–45 minutes). Pretest measured baseline knowledge. The 1-hour STP was delivered in small groups of 5–10 participants using audiovisual aids, charts, flashcards, and live demonstrations. Session structure: DM and PAD introduction (15 min), BAE benefits and techniques with demonstration (30 min), Q&A and reinforcement (15 min). A standardised scripted module ensured consistency. Post-test was administered after 7 days using the identical questionnaire.

Data Analysis

Data were analysed using SPSS version 25. Descriptive statistics (frequency, percentage, mean, standard deviation) summarised demographic variables and knowledge scores. Paired t-tests compared pre- and post-test scores, while chi-square tests examined associations between knowledge levels and demographic variables. Statistical significance was set at $p < 0.05$.

Ethical Considerations

The study adhered to ethical principles. Institutional ethics committee approval was secured, and written permissions were obtained from community authorities. Participants received detailed information and provided informed consent, with assurances of anonymity, confidentiality, voluntary participation, and right to withdraw without repercussions. No physical or psychological harm was anticipated, and data were used exclusively for research purposes.

RESULTS

Demographic profile of the participants, pre- and post-test knowledge levels, effectiveness of the structured teaching program (STP), and correlations among pre-test knowledge and the chosen demographic variables are covered in the results of this quasi-experimental study provided below. Statistical analysis of data was done by descriptive and inferential statistics using SPSS version 25. The tables are combined in a stepwise manner, and immediate analysis and repetitive discussion to point out major patterns, statistical significance, and clinical relevance. Sixty patients were involved in the study; 60 diabetics and none dropped out.

Table 1: Frequency and Percentage Distribution of Participants by Age, Gender, and Religion

Variable	Category	Frequency (n)	Percentage (%)
Age (Years)	20-29	12	20.0
	30-39	18	30.0
	40-49	19	31.7
	50-59	11	18.3
Gender	Male	31	51.7
	Female	29	48.3
Religion	Hindu	38	63.3
	Muslim	14	23.3
	Christian	8	13.3

Table 1 shows the demographic profile of the individuals per age, gender, and religion. Most of them fell within the 40-49 age bracket (31.7%), with the next age group being 30-39 (30.0), signifying the presence of a middle-aged population concerning the onset of type 2 diabetes. The proportion of males was a little higher than that of females (51.7% to 48.3%), which indicated the possibility of gender differences in terms of community accessibility or the prevalence of diabetes. The Hindus were the majority (63.3%), which is in line with the demographic profile of Bangalore.

Table 2: Frequency and Percentage Distribution of Participants by Education, Occupation, and Income

Variable	Category	Frequency (n)	Percentage (%)
Education	Primary	7	11.7
	Secondary	22	36.7
	Higher Secondary+	31	51.7
Occupation	Employed	24	40.0
	Unemployed	18	30.0
	Self-Employed	18	30.0
Family Income (Rs/Month)	10,000-15,000	14	23.3
	16,000-20,000	20	33.3
	21,000-30,000	17	28.3
	>30,000	9	15.0

Table 2 describes education, occupation and income. More than half (51.7) had higher secondary education or higher and 36.7% had secondary meaning moderate levels of literacy. Distribution of employment was at 40% employed, 30% not employed, and self-employed. The highest income was 16,000-20, 000 Rs (33.3%), which is indicative of a lower-middle-class sample. The correlation between higher education and better potential in the baseline knowledge was analyzed, and the correlation proved to be high since educated people have a possibility of becoming more informed about their health. There is a recurring debate on the socioeconomic factors; low income (23.3% in 10,000-15,000 Rs) might have impediments to self-care, which aligns with the literature on SES-diabetes management disparities. This distribution is helpful in the generalizability of the results to the urban low-middle-income communities, and no extreme skews influence the validity.

Table 3: Frequency and Percentage Distribution of Participants by Family Type, Weight, and Duration of Diabetes

Variable	Category	Frequency (n)	Percentage (%)
Family Type	Nuclear	24	40.0
	Joint	24	40.0
	Extended	12	20.0
Weight (kg)	40-50	11	18.3
	51-60	27	45.0
	61-70	22	36.7
Duration of Diabetes (Years)	<5	28	46.7
	5-10	20	33.3
	>10	12	20.0

Table 3 shows the family type, weight, and diabetes duration. There was an even distribution (40-40-20) between nuclear and joint family as well as extended family. Most weights were 51-60 kg (45%), which is a symptom of overweight as is typical in diabetes. Duration had less than 5 years 46.7 and this indicates early stage patients. They include joint family support as better supporting exercise adherence and overweight (81.7% >50 kg) to highlight the risk of perfusion. Time and again, less time (05 years and below) means that the person is more receptive to education because complications are not developed so much. Such a profile will increase the focus of the study on preventive interventions, and the balanced categories reduce the bias.

Table 4: Frequency and Percentage Distribution of Participants by Awareness of BAE and Source of Information

Variable	Category	Frequency (n)	Percentage (%)
Heard of BAE	Yes	26	43.3
	No	34	56.7
Prior Knowledge of BAE	Yes	29	48.3
	No	31	51.7
Source of Information	Health Professionals	12	20.0
	Print Media	17	28.3
	None	31	51.7

Table 4 present awareness and sources of information. More than half (56.7) had never heard of BAE and 51.7% had no source of information and 51.7% had previous hearing. Analysis has shown that there are gap in knowledge as the healthcare professionals taught only 20 per cent of them. The repeated areas of discussion are the deficiencies of the healthcare system in educating patients, with 28.3% being contributed by the print media. This highlights the importance of STP since a low awareness (56.7% no) is associated with the insufficiency of the knowledge basis, which confirms the relevance of the intervention.

Table 5: Distribution of Pre-Test Knowledge Levels on BAE and Lower Limb Perfusion

Knowledge Level	Frequency (n)	Percentage (%)
Inadequate (≤10)	38	63.3
Moderate (11-15)	22	36.7
Adequate (>15)	0	0.0

Table 5 shows the knowledge of pre-test, 63.3% of which are inadequate, 36.7% moderate, and none adequate. Mean score was 8.90 (SD = 1.87, 44.5%). There is an analysis showing serious shortcomings especially in BAE techniques (mean 36.3%). This is echoed over and over again in the larger educational deficits in diabetes care whereby community patients are not exposed to the non-pharmacological interventions. The zero sufficient scores mark the urgency of specific education establishment as a determining level of STP influence.

Table 6: Distribution of Post-Test Knowledge Levels on BAE and Lower Limb Perfusion

Knowledge Level	Frequency (n)	Percentage (%)
Inadequate (≤10)	0	0.0
Moderate (11-15)	17	28.3
Adequate (>15)	43	71.7

Post-test levels can be seen in table 6 (71.7 percent adequate, 28.3 percent moderate, none inadequate). Mean score was 16.03 (SD = 1.21, 80.2%). Marked improvement is seen in terms of analysis (in particularly perfusion benefits) (85.8%). The efficacy of STP to change the categories is recurrently discussed, and the chi-square comparison of the post-and pre-levels $\chi^2 = 81.64$, $p < 0.001$) proves that the results are statistically significant. This implies temporary knowledge storage, which is essential in behavior change.

Table 7: Comparison of Mean Pre- and Post-Test Knowledge Scores and Effectiveness of STP

Parameter	Pre-Test Mean (SD)	Post-Test Mean (SD)	Mean Difference (SD)	T-Value	*P*-Value
Overall Knowledge	8.90 (1.87)	16.03 (1.21)	7.13 (1.76)	31.34	<0.001
Aspect: DM	5.14 (1.02)	7.92 (0.85)	2.78 (0.94)	22.85	<0.001
Aspect: BAE	3.63 (0.78)	7.75 (0.62)	4.12 (0.89)	35.92	<0.001
Aspect: Perfusion	0.13 (0.07)	0.36 (0.04)	0.23 (0.06)	29.67	<0.001

Note: SD = Standard Deviation; Mean Difference = Post-Test – Pre-Test; T-Value from Paired T-Test; $P < 0.05$ = Statistically Significant

Table 7 presents results of the comparison of the scores with the overall improvement of 35.7% (t = 31.34, $p < 0.001$). Aspect-wise, BAE made the biggest improvement (4.12 mean differences). Evaluation of STP results is effective, with paired t-tests showing that there has been a significant gain in domains. Consistently, the low t-values indicate weak intervention effect especially of the practical dimension such as BAE techniques, which conforms to the education theory of active learning.

DISCUSSION

The STP produced significant knowledge improvement (35.7%, $p<0.001$), shifting from 63.3% inadequate to 71.7% adequate. This aligns with nurse-led education efficacy and BAE's role in perfusion enhancement amid India's growing diabetes burden (approximately 89.8 million in 2024, projected 156.7 million by 2050 (Ahn *et al.*, 2024; Gong *et al.*, 2025).

The results of this study confirm the effectiveness of the STP in improving knowledge of BAE about lower limb perfusion in diabetic patients, and pre-test lack of efficacy (63.3) was changed to post-test efficacy (71.7%). It has been improved 35.7% ($p<0.001$), which is higher than the findings on comparable nurse-led initiatives (25-30% improvement (Ahn *et al.*, 2024). This is recurrently a reminder of the role of educational interventions in the bridging of knowledge gaps since baseline deficits reflect global DM education deficits (50-70% of people are unaware of vascular self-care) (Ghimire, & Ojha, 2023).

Middle-aged, moderately educated, and lower-middle-income individuals constitute the demographic analysis, which is consistent with the DM epidemiology of India (Anjana *et al.*, 2023). Repeated gender, education, weight, and awareness ($p<0.05$) associations indicate weaknesses; females and low-educated were more inadequate, which is consistent with the gender differences in health literacy (Maiti *et al.*, 2023). The correlation between weight implies that the issue of obesity intensifies cognitive obstacles, and this has been common in PAD research (Jadon *et al.*, 2025). The impact of awareness ($p=0.014$) is consistent and it frequently emphasizes the importance of prior exposure as unaware groups rated 20% lower which favors community outreach.

STP multimodal methodology is reiteratively proved aspect-wise, especially in perfusion (53.7%), which is reminiscent of BAE efficacy trials (Radhika *et al.*, 2020). The t=31.34 denotes a strong change, which is more than meditation-yoga interventions (20-25% blood sugar changes; University of Southern California, 2022, according to abstract). This would have clinical benefits of reducing DFU by 15-20 percent because educated patients would use the BAE (Pendsey, 2010).

Shortcomings are small sample (n=60), quasi-experimental (no use of control) and short 7-day follow-up which predisposes to recall bias. The knowledge that is self-reported might not be reflected in behavior, frequent educational research.

CONCLUSION

The results of this quasi-experimental research study are conclusive on the effectiveness of structured teaching program (STP) in improving knowledge about the Buerger-Allen exercise (BAE) in improving tissue perfusion of lower limb in diabetic patients within a selected community within Bangalore. Considering that there is a drastic improvement of 63.3% poor level of pre-test knowledge to 71.7% of sufficient knowledge (mean improvement = 35.7, t = 31.34, $p = 0.001$), the intervention will tackle the essential gaps in patient education, especially non-pharmacological methods of peripheral vascular complications management. The linkage to demographic factors like gender, education, weight and previous BAE awareness ($p< 0.05$) highlights the necessity of using customized educational means to reduce differences in health literacy. These findings are consistent with the results of larger evidence on the role of nurse-led interventions, which were found to increase self-management behaviors and decrease the incidence of diabetic foot ulcers up to 20-30%. The STP helps to decrease the socioeconomic load of amputations caused by diabetes by enabling patients to engage in preventive self-management, as well as in less developed areas such as urban India.

Although the study has its strengths, such as high tool reliability (r = 0.92) and community-based applicability, the limitations of the study are a small sample size (n = 60), the lack of a control group, and a follow-up that was conducted in the short term, which may restrict the generalizability and fail to account for any long-term retention or behavioral results.

Implications

The findings highlight nurses' pivotal role in community-based DM education, with potential to lower DFU incidence, amputations, and healthcare costs in resource-limited settings.

Recommendations

Integrate nurse-led BAE-focused STPs into routine primary care and national DM programs. Further studies are recommended to use randomised controlled trials on larger and heterogeneous cohorts using objective parameters such as ankle-brachial index to assess long-term perfusion changes. Policymakers should embed such programs in diabetes guidelines to advance health equity and NCD prevention.

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