

Research Article

Effectiveness of Lifestyle Modification Education on Knowledge and Practices Regarding Type 2 Diabetes Mellitus Among Diabetic Patients: A Cross-Sectional Study

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A B S T R A C T

Background: Type 2 Diabetes Mellitus (T2DM) is one of the fastest-growing non-communicable diseases worldwide, and lifestyle modification is central to its management. Structured patient education is widely recommended, yet is inconsistently delivered in routine care, and its real-world effect on patients' knowledge and self-care practice is not well described in Indian outpatient settings.

Objectives: To assess the level of knowledge and lifestyle practice among patients with T2DM, to describe blood glucose monitoring behavior and self-perceived glycemic control, to document self-reported change following a lifestyle modification education program, and to examine the association of knowledge and practice with selected demographic and clinical variables.

Methods: A cross-sectional descriptive survey was conducted among 61 adults with T2DM attending the Medical OPD/IPD of a tertiary care hospital in Greater Noida, Uttar Pradesh, selected by purposive non-probability sampling. A structured, expert-validated questionnaire (content validity $\geq 80\%$ expert consensus; knowledge tool reliability $r = 0.89$) covering demographic and clinical profile, a 15-item knowledge scale, an 8-item lifestyle-practice scale, glucose-monitoring behaviour and self-reported post-education change was administered. Data were analysed using descriptive statistics, the chi-square test/Fisher's exact test, and Pearson correlation, with significance set at $p < 0.05$.

Results: The mean knowledge score was 9.49 ± 3.29 of 15 (63.3%), with 47.5% of participants at a moderate level and 26.2% each at adequate and inadequate levels. The mean lifestyle-practice score was 26.15 ± 4.59 of 32 (81.7%), with 86.9% in the good-practice band; however, physical activity was the weakest item (mean 2.54/4), with 50.8% exercising rarely or never. Only 63.9% could state their most recent blood glucose value, and of the values reported, 65.8% exceeded behavior. Self-reported outcomes after the education programme were almost unanalyzed positive (mean 4.89 ± 0.41 of 5). Knowledge

was significantly associated with age ($\chi^2 = 21.52$, $df = 4$, $p < 0.001$) and with the presence of a co-existing chronic illness ($\chi^2 = 10.27$, $df = 2$, $p = 0.006$); no variable was significantly associated with practice, and knowledge and practice scores were only weakly correlated ($r = 0.21$, $p = 0.110$).

Conclusion: Patients receiving lifestyle modification education reported near-universal satisfaction and high adherence to clinician-directed behaviours, but this was not matched by adequate disease-specific knowledge, self-initiated behaviours such as exercise, or objectively favourable glucose values. The findings indicate that current education achieves compliance without comprehension, and that programmes should verify understanding and be evaluated against measured glycaemic outcomes rather than self-report alone.

Keywords: Type 2 Diabetes Mellitus, Lifestyle Modification, Patient Education, Glycaemic Control, Knowledge, Self-Care Practice; Nursing

Introduction

Type 2 Diabetes Mellitus (T2DM) is among the fastest-growing chronic, non-communicable diseases worldwide and is a major contributor to illness burden among individuals, households, health systems, and national economies.¹ It arises when tissues become progressively resistant to insulin and the pancreas can no longer meet the resulting demand, leading to sustained hyperglycemia; unlike Type 1 Diabetes, it develops gradually under the combined influence of genetic predisposition, physical inactivity, excess body weight, unhealthy dietary patterns, chronic stress, and aging. Sustained hyperglycemia damages the vasculature through cellular stress, chronic inflammation, endothelial dysfunction, and the accumulation of advanced glycation end-products, culminating in retinopathy, nephropathy, neuropathy, cardiovascular disease, stroke, and premature mortality.⁴

Lifestyle modification—encompassing a healthy diet, regular physical activity, weight reduction, smoking cessation, alcohol restriction, stress management, adequate sleep, medication adherence, and self-monitoring of blood glucose—remains one of the most consistently effective means of improving glycemic control.¹⁵ Because medication alone cannot achieve adequate control without corresponding behavior change, structured patient education is essential to build the knowledge, motivation, and self-efficacy needed to sustain these behaviors.¹⁷ Systematic reviews report that combined nutritional and exercise counselling produces greater reductions in HbA1c than either component alone.¹² and that good glycaemic control substantially reduces both microvascular and macrovascular complications.⁶

In India, the burden of poor glycaemic control is compounded by late presentation, limited awareness of dietary

and activity recommendations, misconceptions about medication, and irregular follow-up.² In a high-volume, resource-constrained state such as Uttar Pradesh, heavy patient loads often leave little time for individualized lifestyle counseling, so that many patients receive prescriptions with minimal structured education on nutrition, exercise, stress management, or self-monitoring.¹⁶ This gap motivated the present study, which was undertaken to assess the level of knowledge and lifestyle practice among patients with T2DM attending a tertiary hospital in Greater Noida and to examine whether these were reflected in favorable glucose-monitoring behavior and glycemic status following a structured lifestyle modification education program.

The specific objectives were (1) to describe the socio-demographic and clinical profile of the study participants; (2) to assess, item-wise and overall, participants' knowledge of T2DM and its lifestyle management; (3) to assess, item-wise and overall, participants' lifestyle practices; (4) to describe blood glucose monitoring behavior and self-perceived glycemic control; (5) to describe self-reported change in diet, activity, medication adherence and perceived control following lifestyle modification education; and (6) to examine the association between selected demographic/clinical variables and the levels of knowledge and practice and the relationship among knowledge, practice and reported blood glucose values.

Materials and Methods

Study Design and Setting

A cross-sectional descriptive survey design was used. The study was conducted in the Medical Outpatient Department (OPD) and Medical Inpatient Department (IPD) of Sharda Hospital, Greater Noida, Uttar Pradesh, India, among patients who had already received a structured lifestyle modification education program delivered by the researchers as part of routine patient care.

Population, Sample, and Sampling Technique

The target population comprised adults diagnosed with T2DM attending the study setting. A sample of 61 patients meeting the eligibility criteria was recruited using purposive, non-probability sampling.

Inclusion criteria

patients diagnosed with T2DM; aged 30 years or older; attending the Medical OPD/IPD of the study hospital; HbA1c above 7% at enrollment; able to understand Hindi or English; and providing written informed consent.

Exclusion criteria

Type 1 or gestational diabetes; diabetes-related emergencies requiring acute admission; severe mental illness or cognitive impairment affecting communication;

critically ill or bedridden status; and participation in another structured lifestyle modification program within the preceding six months.

Instruments

Data were collected using a structured, self-administered questionnaire in electronic format, comprising five parts: Part A recorded socio-demographic and clinical background (age, gender, marital status, education, occupation, monthly income, duration of diabetes, type of treatment, family history of diabetes, and co-existing chronic illness). Part B assessed knowledge through 15 multiple-choice items covering the nature of the disease, normal blood glucose values, causative factors, diet, exercise, medication, monitoring, tobacco, alcohol, and long-term complications (each item scored 1 for a correct response and 0 for an incorrect or 'don't know' response; classified as inadequate 0–7, moderate 8–11, and adequate 12–15). Part C assessed lifestyle practice through 8 statements rated on a four-point frequency scale (Always = 4 to Never = 1; classified as poor 8–15, moderate 16–23, good 24–32). Part D recorded blood glucose monitoring behaviour, the most recently known value, and self-perceived glycaemic control. Part E recorded self-reported change in diet, exercise, medication adherence, and perceived control following the education program (5 yes/no items).

The tool was developed with reference to a review of the published literature, guidance from the American Diabetes Association and the International Diabetes Federation, expert input, and the researchers' clinical experience. Content validity was established through review by 10 experts drawn from medical-surgical, community health, mental health, child health, and obstetric/gynecological nursing, with an acceptable consensus threshold of 80%. Test-retest reliability of the knowledge questionnaire, assessed among 6 patients with T2DM using Karl Pearson's correlation, was $r = 0.89$. A pilot study was conducted with 6 eligible participants (subsequently excluded from the main study) to establish feasibility, refine the tools, and estimate the time required for data collection.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee of Sharda University, and administrative permission was obtained from the Medical Superintendent and Nursing Administration of Sharda Hospital. Written informed consent was obtained from each participant after explaining the study's purpose, procedure, potential benefits, and confidentiality safeguards. Participation was voluntary, and participants could withdraw at any stage without any effect on their clinical care.

Statistical Analysis

Data were coded, tabulated, and analyzed using SPSS version 26.0. Descriptive statistics (frequency, percentage, mean, median, standard deviation, and range) were used

to summarize the sample characteristics and scale scores. Inferential statistics comprised the chi-square test of independence (with Fisher's exact test where expected cell counts fell below 5) to examine associations between demographic/clinical variables and the levels of knowledge and practice, and Pearson correlation to examine the relationship among knowledge score, practice score, and reported blood glucose value. A p-value below 0.05 was considered statistically significant.

Results

Socio-Demographic and Clinical Profile

Of the 61 participants, just over half (52.5%) were aged 30–35 years, and 59.0% were women. Most were married (63.9%), and educational attainment was relatively high, with 54.1% graduates or above and only 4.9% illiterate. Half (50.8%) were in private employment, and 31.1% were unemployed. Nearly half (45.9%) had been diagnosed for less than one year and a further 47.5% for one to five years; oral medication alone was the commonest treatment (42.6%), followed by a combination of oral medication and insulin (27.9%). A family history of diabetes was reported by 39.3%, and a coexisting chronic illness by 29.5% (Table 1).

Knowledge Regarding Type 2 Diabetes Mellitus

The mean knowledge score was 9.49 ± 3.29 of a maximum of 15 (63.3% of the maximum obtainable score; median 9; range 2–15). Nearly half of participants (47.5%) fell in the moderate band, with the adequate and inadequate bands each accounting for 26.2%. Item-level analysis showed a clear split: broad lifestyle messages were well understood—90.2% knew alcohol intake should be avoided or limited, 85.2% knew smoking worsens diabetes, 85.2% recognised the importance of regular medication, 83.6% identified sugary foods as restricted items, and 82.0% knew exercise helps control blood sugar. In contrast, items requiring a specific numerical or clinical fact were poorly answered: only 31.1% knew that alcohol on an empty stomach may cause hypoglycaemia, only 37.7% identified 70–110 mg/dl as the normal fasting range, and fewer than half recognised the full spectrum of long-term complications (41.0%), the dual cardiovascular/cerebrovascular risk of smoking (45.9%), or the recommended 30-minute exercise duration (47.5%).

Lifestyle Practice

The mean lifestyle-practice score was 26.15 ± 4.59 of 32 (81.7%; median 27; range 8–32), and 86.9% of participants fell in the good-practice band. However, item-level scores revealed that clinician-directed behaviours were performed best—medication adherence recorded the highest mean (3.54/4), followed by avoidance of smoking/alcohol and adherence to follow-up advice (both 3.51)—while self-initiated behaviours lagged: regular physical activity recorded the lowest mean (2.54/4), with only 13.1%

reporting this as a consistent habit and 50.8% reporting it rarely or never, and stress management through relaxation/yoga/meditation was the second-weakest item (mean 3.00).

Blood Glucose Monitoring, Self-Perceived Control, and Post-Education Response

Monitoring intention was reasonable (52.5% weekly, 36.1% monthly, 9.8% daily), but only 63.9% could state their most recent blood glucose value. Among the 38 participants (62.3%) who reported a numeric value, the mean was 165.00 ± 35.50 mg/dl, and 65.8% of reported values exceeded 140 mg/dl. Self-perceived glycaemic control was affirmative in only 39.3% of participants, negative in 31.1%, and 29.5% were unsure. Self-reported outcomes following the lifestyle modification education were almost uniformly positive: all 61 participants reported understanding the education and taking medicines as advised, 98.4% reported dietary change and perceived better control, and 91.8% reported exercising more regularly (mean post-education score 4.89 ± 0.41 of 5) (Table 2).

Association Between Demographic/Clinical Variables and Knowledge/Practice

Chi-square analysis (with Fisher's exact test where indicated) showed that the level of knowledge was significantly

associated with age ($\chi^2 = 21.52$, $df = 4$, $p < 0.001$)—nearly all participants classified as having adequate knowledge were aged 30–35 years—and with the presence of a co-existing chronic illness ($\chi^2 = 10.27$, $df = 2$, $p = 0.006$), in which none of the 18 participants with an additional chronic condition reached the adequate band. No other variable (gender, marital status, education, occupation, income, duration of diabetes, type of treatment, family history) was significantly associated with knowledge, and no variable was significantly associated with the level of practice, a finding consistent with 86.9% of participants being concentrated in a single practice category (Table 3).

Relationship Among Knowledge, Practice and Reported Blood Glucose

None of the three examined relationships reached statistical significance. Knowledge and practice scores were weakly and positively correlated ($r = 0.21$, $p = 0.110$). Knowledge score and reported blood glucose showed a negligible correlation ($r = 0.04$, $p = 0.828$, $n = 38$), and practice score and reported blood glucose showed a weak negative correlation in the expected direction but without statistical significance ($r = -0.12$, $p = 0.478$, $n = 38$) (Table 4).

Table 1. Socio-demographic and clinical profile of participants (n = 61)

Variable	Category	f	%
Age (years)	30–35	32	52.5
	36–45	14	23
	46–60	14	23
	>60	1	1.6
Gender	Female	36	59
	Male	25	41
Marital status	Married	39	63.9
	Single	17	27.9
	Widow/Widower	5	8.2
Education	Illiterate	3	4.9
	Primary	11	18
	Secondary	14	23
	Graduate & above	33	54.1
Occupation	Unemployed	19	31.1
	Private job	31	50.8
	Government job	2	3.3
	Self-employed	9	14.8
Duration of diabetes	<1 year	28	45.9
	1–5 years	29	47.5
	6–10 years	4	6.6
Treatment type	Diet control only	8	13.1
	Oral medication	26	42.6
	Insulin	10	16.4
	Both	17	27.9

Variable	Category	f	%
Family history of diabetes	Yes	24	39.3
	No	37	60.7
Co-existing chronic illness	Yes	18	29.5
	No	43	70.5

Table 2. Summary of scores across the three assessed domains (n = 61)

Domain	Items	Max score	Mean $\pm$ SD	% of max	Predominant category, f (%)
Knowledge	15	15	9.49 $\pm$ 3.29	63.3	Moderate, 29 (47.5%)
Lifestyle practice	8	32	26.15 $\pm$ 4.59	81.7	Good, 53 (86.9%)
Post-education response	5	5	4.89 $\pm$ 0.41	97.7	Affirmative (≥ 4 items), 56 (91.8%)

Table 3a. Association between selected variables and level of knowledge (n = 61)

Variable	Category	Level of knowledge, f (%)			Total (n)	χ^2	df	p-value	Inference
		Inadequate (0–7)	Moderate (8–11)	Adequate (12–15)					
Age (years)	30–35	10 (31.3)	7 (21.9)	15 (46.9)	32	21.52	4	<0.001*	Significant
	36–45	2 (14.3)	11 (78.6)	1 (7.1)	14				
	46 & above†	4 (26.7)	11 (73.3)	0 (0.0)	15				
Gender	Female	8 (22.2)	16 (44.4)	12 (33.3)	36	2.40	2	0.300	Not significant
	Male	8 (32.0)	13 (52.0)	4 (16.0)	25				
Marital status	Married	8 (20.5)	21 (53.8)	10 (25.6)	39	2.27	2	0.322	Not significant
	Single / widowed	8 (36.4)	8 (36.4)	6 (27.3)	22				
Education	Illiterate / primary	5 (35.7)	7 (50.0)	2 (14.3)	14	4.77	4	0.311*	Not significant
	Secondary	3 (21.4)	9 (64.3)	2 (14.3)	14				
	Graduate & above	8 (24.2)	13 (39.4)	12 (36.4)	33				
Occupation	Employed‡	12 (28.6)	21 (50.0)	9 (21.4)	42	1.64	2	0.441*	Not significant
	Unemployed	4 (21.1)	8 (42.1)	7 (36.8)	19				
Monthly family income	$\leq$ ₹30,000	5 (21.7)	10 (43.5)	8 (34.8)	23	1.44	2	0.486	Not significant
	> ₹30,000	11 (28.9)	19 (50.0)	8 (21.1)	38				
Duration of diabetes	<1 year	7 (25.0)	14 (50.0)	7 (25.0)	28	0.13	2	0.939	Not significant
	≥ 1 year	9 (27.3)	15 (45.5)	9 (27.3)	33				
Type of treatment	Pharmacological§	15 (28.3)	26 (49.1)	12 (22.6)	53	2.84	2	0.242*	Not significant
	Diet control only	1 (12.5)	3 (37.5)	4 (50.0)	8				
Family history of diabetes	Yes	8 (33.3)	13 (54.2)	3 (12.5)	24	3.97	2	0.137	Not significant
	No	8 (21.6)	16 (43.2)	13 (35.1)	37				
Co-existing chronic illness	Yes	8 (44.4)	10 (55.6)	0 (0.0)	18	10.27	2	0.006*	Significant
	No	8 (18.6)	19 (44.2)	16 (37.2)	43				

Table 3b. Association between selected variables and level of lifestyle practice (n = 61)

Variable	Category	Level of practice, f (%)		Total (n)	χ^2	df	p-value	Inference
		Good (24–32)	Poor/moderate (8–23)					
Age (years)	30–35	28 (87.5)	4 (12.5)	32	1.41	2	0.495*	Not significant
	36–45	11 (78.6)	3 (21.4)	14				
	46 & above†	14 (93.3)	1 (6.7)	15				
Gender	Female	32 (88.9)	4 (11.1)	36	0.03 ^a	1	0.706 ^b	Not significant
	Male	21 (84.0)	4 (16.0)	25				
Marital status	Married	35 (89.7)	4 (10.3)	39	0.24 ^a	1	0.443 ^b	Not significant
	Single / widowed	18 (81.8)	4 (18.2)	22				
Education	Illiterate / primary	13 (92.9)	1 (7.1)	14	1.32	2	0.518*	Not significant
	Secondary	11 (78.6)	3 (21.4)	14				
	Graduate & above	29 (87.9)	4 (12.1)	33				
Occupation	Employed‡	35 (83.3)	7 (16.7)	42	0.66 ^a	1	0.415 ^b	Not significant
	Unemployed	18 (94.7)	1 (5.3)	19				
Monthly family income	≤₹30,000	19 (82.6)	4 (17.4)	23	0.14 ^a	1	0.461 ^b	Not significant
	>₹30,000	34 (89.5)	4 (10.5)	38				
Duration of diabetes	<1 year	26 (92.9)	2 (7.1)	28	0.80 ^a	1	0.269 ^b	Not significant
	≥1 year	27 (81.8)	6 (18.2)	33				
Type of treatment	Pharmacological	45 (84.9)	8 (15.1)	53	0.38 ^a	1	0.581 ^b	Not significant
	Diet control only	8 (100.0)	0 (0.0)	8				
Family history of diabetes	Yes	21 (87.5)	3 (12.5)	24	0.00 ^a	1	1.000 ^b	Not significant
	No	32 (86.5)	5 (13.5)	37				
Co-existing chronic illness	Yes	16 (88.9)	2 (11.1)	18	0.00 ^a	1	1.000 ^b	Not significant
	No	37 (86.0)	6 (14.0)	43				

Table 4. Correlation among knowledge score, practice score and reported blood glucose value

Variables compared	n	r	p-value	Interpretation
Knowledge score vs. practice score	61	0.21	0.110	Weak positive, not significant
Knowledge score vs. reported blood glucose	38	0.04	0.828	Negligible, not significant
Practice score vs. reported blood glucose	38	-0.12	0.478	Weak negative, not significant

Discussion

This study examined knowledge, lifestyle practice and glycaemic status among 61 adults with T2DM following a structured lifestyle modification education programme. The most important finding is that the three domains did not move together: knowledge occupied only 63.3% of the maximum obtainable score, reported practice occupied 81.7%, and post-education self-report occupied 97.7%. This divergence suggests behaviour that is being followed on instruction rather than on understanding, a pattern likely to be less durable once close clinical supervision is reduced.

The knowledge pattern itself was informative: participants readily retained broad, repeatedly emphasised messages

(avoid alcohol, avoid smoking, take medicines, restrict sugar, exercise), but performed poorly on items requiring a specific numerical or clinical fact, such as the normal fasting glucose range, the recommended duration of exercise, or the risk of hypoglycaemia from alcohol on an empty stomach. This is consistent with reviews indicating that generic health messaging reaches patients more readily than technical self-management content (Ji et al., 2025).

The gap between reported practice and objective status was equally notable. Although 86.9% of participants were classified as having good lifestyle practice, more than a third could not state their most recent blood glucose value, and of those who could, nearly two-thirds exceeded 140 mg/dl. Physical activity—the behaviour most consistently linked

to improved glycaemic control in the literature (Umpierre et al., 2021)—was the weakest self-reported practice, with half of participants exercising rarely or never. Because the practice measure was self-reported, some inflation due to social desirability cannot be excluded, and the item-level detail should be weighed more heavily than the composite score.

Age and the presence of a co-existing chronic illness were the only variables significantly associated with knowledge, while no variable was associated with practice. The association between comorbidity and poorer knowledge is counter-intuitive, since patients managing multiple conditions might be expected to receive more, not less, health education; this may reflect competing informational demands or shorter counselling time per condition and warrants further study. The absence of significant associations for practice is consistent with the highly skewed distribution of that variable (86.9% in one category), which limits the statistical power of any test applied to it.

These findings should be interpreted in light of the study design. As a cross-sectional survey conducted after the education programme had already been delivered, without a pre-education baseline or a control group, the study can describe the status of knowledge, practice and glycaemic indicators at a single time point, but cannot establish that the education programme caused any specific change, nor rule out that self-selected, more health-literate patients were more likely to complete the survey. The sample was also drawn from a single tertiary hospital using non-probability sampling, and reliance on self-reported blood glucose (rather than measured HbA1c) for most glycaemic analyses limits precision. These are acknowledged as limitations of the present analysis, consistent with the original protocol's stated need for future comparative and longitudinal designs.

Conclusion

Patients with T2DM who had received structured lifestyle modification education reported near-universal satisfaction with the programme and high adherence to clinician-directed behaviours such as medication-taking, but this was not matched by adequate disease-specific knowledge, consistent self-initiated behaviour such as regular exercise, or favourable objective glucose values. The central conclusion is that the education examined here achieved compliance without full comprehension. Closing this gap requires education that explicitly verifies patient understanding of numerical targets and hypoglycaemia recognition, negotiated and reviewed activity plans rather than general exercise advice, and evaluation that is anchored to measured glycaemic outcomes—ideally HbA1c within a pre-test/post-test or controlled design—rather than to self-report alone.

Recommendations

- (1) Diabetes education should routinely verify specific knowledge—normal glucose ranges, hypoglycaemia recognition, the full spectrum of complications—rather than assuming that treatment adherence implies understanding.
- (2) Structured teaching on the causes, warning signs and management of hypoglycaemia should be a defined component of every education session.
- (3) Patients should be taught to record and interpret their own blood glucose readings.
- (4) General exercise advice should be replaced with a negotiated, written and reviewed activity plan.
- (5) Additional educational input should be prioritised for older patients and those managing a co-existing chronic condition.
- (6) Future evaluations should adopt a pre-test/post-test design with an objective glycaemic measure such as HbA1c and, where feasible, a control group.

Conflict of Interest: None

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