

Correlation Between Knowledge of Diabetes Mellitus, Level of Physical Activity and Glycemic Control in Patients with Type II Diabetes Mellitus

Hemlata¹, Gitanjali Sikka², Shaveta Dahiya³, Indu Bhola¹, Sheetal¹

¹MPT-Cardiopulmonary, College of Physiotherapy, Pt. B.D. Sharma University of Health Sciences, Rohtak, Haryana, India

²Associate Professor, College of Physiotherapy, Pt. B.D. Sharma University of Health Sciences, Rohtak, Haryana, India.

³Associate Professor, Department of Medicine, Pt. B.D. Sharma University of Health Sciences, Rohtak, Haryana, India.

Corresponding Author: Hemlata

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ABSTRACT

Background: Diabetes knowledge plays a critical role in self-management and glycemic control among patients with type II diabetes mellitus. Diabetes knowledge influence by Socio-demographic, clinical, and behavioral factors, but research across different populations is still limited.

Objective: To examine the correlation between diabetes knowledge, self-care management, physical activity, and glycemic control among patients with type II diabetes mellitus.

Methods: A cross-sectional study was conducted among 200 patients with type II diabetes mellitus. Diabetes knowledge was assessed using the Diabetes Knowledge Questionnaire-Revised (DKQ-R), self-care behaviors using the Diabetes Self-Management Questionnaire-Revised (DSMQ-R), and physical activity with the International Physical Activity Questionnaire (IPAQ). Glycemic control and biochemical parameters were measured. Associations between variables were analyzed using independent t-tests, Pearson's correlation, and multiple linear regressions. Statistical significance was set at $p < 0.05$.

Results: Higher diabetes knowledge scores were significantly associated with higher education, employment, income, longer disease duration, and better self-management behaviors ($p < 0.01$). Knowledge was inversely correlated with HbA1c levels ($r = -0.515$, $p < 0.01$), total cholesterol, triglycerides, and LDL, and positively correlated with HDL, DSMQ-R subtotal, and IPAQ scores. Multiple regression analysis indicated that education, disease duration, HbA1c, DSMQ-R physical activity, and IPAQ scores were significant predictors of diabetes knowledge, collectively explaining a substantial proportion of variance.

Conclusion: Diabetes knowledge in patients with type II diabetes mellitus is influenced by socio-demographic, clinical, and behavioral factors and is significantly correlated with self-care management, physical activity, and glycemic control. Structured educational interventions targeting high-risk groups are recommended to enhance knowledge, self-management, and long-term glycemic outcomes.

Keywords: Type II diabetes mellitus, Diabetes knowledge, Self-management, Physical activity, Glycemic control

INTRODUCTION

Diabetes is a "group of metabolic disorders characterized by hyperglycemia which result from defects either in insulin function or insulin action, secretion, or both" defined by American diabetes association.^[1]

Diabetes is a chronic illness with complications like neuropathy, nephropathy, retinopathy and foot ulcers.^[1] Based on etiology, Type I diabetes occurs when the immune system destroys insulin-making cells, causing the pancreas to become less responsive. Type II diabetes mellitus occurs when muscle cells don't respond well to insulin and affects 90-95% of people.^{[5][28]}

Globally, the prevalence of T2DM is increasing at an alarming rate, with projections indicating that 366 million people will be affected by 2030. In India, approximately 77 million adults were living with diabetes in 2019, and this number is expected to reach 134 million by 2045.^[2] nearly 57% of these cases remain undiagnosed. The northern Indian states of Punjab and Haryana report particularly high prevalence rates of 14% and 15.5%, respectively—both higher than the global average of 9%.^[2]

The management of diabetes requires a multidisciplinary approach involving pharmacological treatment, lifestyle modification, and structured education programs.^[3] Physiotherapy plays an important role through diabetes self-management education and rehabilitation interventions aimed at improving functional capacity and quality of life.^[3]

Knowledge about diabetes and optimum self-care behaviors such as maintaining a dietary control, regular physical activity, medication adherence, and glucose monitoring—are crucial for effective glycemc control.^[3,5,12,13] Studies consistently show that patients with adequate diabetes knowledge achieve better glycemc outcomes and demonstrate better diseases outcomes.^[5,7,9] Conversely, inadequate knowledge often leads to poor self-management and inadequate disease control.

Socio-demographic and clinical factors, including age, gender, education, occupation, duration of diabetes, body mass index, and co-morbidities such as hypertension and dyslipidemia, have been shown to influence diabetes knowledge and self-care management.^[6-7] Individuals with higher education levels tend to have better understanding and greater adherence to self-management practices.^[8,10,21,23] Targeted educational interventions are therefore vital to empower patients and improve outcomes. There is dearth of studies exploring the relationship between diabetes knowledge, self-management practices, and glycemc control (HbA1c) in Indian populations. Understanding these associations, along with the role of socio-demographic variables, is essential to design effective educational and rehabilitative strategies. Hence, the present study tested the hypothesis that whether there is any significant correlation of diabetes mellitus knowledge with level of physical activity, glycemc control and diabetes self management in patients with type 2 diabetes mellitus. Also, correlation was cried out between diabetes mellitus knowledge and various socio-demographic factors. In order to identify the modifiable risk factors that could affect diabetes mellitus disease knowledge.

MATERIALS & METHODS

Study design: This study was a prospective cross-sectional study conducted in a tertiary care teaching hospital from July 2024 to June 2025. Participants clinically diagnosed with Type II diabetes mellitus while waiting to see their physician on clinical days were recruited in study. The ethical clearance was taken from the institutional biomedical research ethical committee of Pandit Bhagwat Dayal Sharma University of Health Sciences, Rohtak with reference to letter No. BREC/24/737.

Sample size: 200

The prospective cross-sectional study was conducted in a tertiary care hospital.

Participants clinically diagnosed with T2DM while waiting to see their physician on clinical days were recruited in study. Sample size was determined using the single population proportion formula, sample size = $Z_{(1-\alpha/2)}^2 \times p(1-p)/d^2$; where $Z_{(1-\alpha/2)}$ = standard normal variate (at 95% Confidence interval=1.96) and d (absolute error in precision for the current study)=0.05, prevalence was taken based on the prevalence of diabetes among Haryana to be 15.1% taken from a previous study [8] with power of study 80% ($p = 15.1\%$), resulting in a minimum required sample size of 196. Thereby, sample size of 200 was determined for present study^{5, 8, 24}.

Participants:

A total of 200 clinically diagnosed patients with T2DM were enrolled in study using convenience sampling. A patient was recruited with age group of above 18 years old and Patients having latest laboratory reports of HbA1c and lipid profile. Participants were excluded with Type I diabetes mellitus and gestational diabetes patients,⁵ Severely ill patients or patients need to be transfer to emergency. Study participants were explained about the purpose and procedure of study.^[5] Following this, written informed consent was obtained from willing participants.

Outcome measures: Detailed demographic information of all participants was collected. Participants enrolled in study were asked to first fill out diabetes knowledge questionnaire revised (DKQ-R) for diabetes knowledge level. Every correct answer was scored as “1” and incorrect was scored as “0”. then diabetes self management questionnaire revised (DSMQ-R)²⁶ were used to measure diabetes self care management and level of physical activity was measured through international physical activity questionnaire (IPAQ)²⁷ measured in met/mints. Glycemic index and lipid profile

were assessed through HbA1c lab reports and lipid profile lab Reports.

Statistical Analysis

A statistical analysis was performed using IBM SPSS Statistics version 26. Descriptive statistics were expressed as mean \pm standard deviation (SD) for continuous variables and as frequency (percentage) for categorical variables.

Pearson’s correlation coefficient (Pearson’s correlation test) was used to determine the correlation of DKQ-R scores with biochemical parameters (HbA1c, total cholesterol, triglyceride, HDL, and LDL), (DSMQ-R scores and IPAQ scores.

Correlation was done with various socio-demographic factors with DKQ-R to identify significant and non significant correlation. Also, for socio-demographic factors with multiple category including education, occupation, duration of diseases and annual income, further analysis was done using one way ANOVA.

Multiple linear regression analysis was conducted to identify predictors of diabetes knowledge (DKQ-R correct and incorrect scores) using education level, duration of disease, HbA1c, DSMQ-R physical activity, and IPAQ scores as independent variables. Statistical significance was set at $p < 0.05$, with $p < 0.01$ considered highly significant.

RESULT

A total of 200 participants with type II diabetes mellitus were included in the study. Table 1 demonstrating correlation between biochemical parameters and diabetes knowledge. DKQ-R correct scores were negatively correlated with HbA1c ($r = -0.515$, $p < 0.01$), total cholesterol ($r = -0.254$, $p < 0.01$), triglycerides ($r = -0.192$, $p < 0.01$), and LDL ($r = -0.156$, $p < 0.05$), whereas a positive correlation was found with HDL ($r = 0.153$, $p < 0.05$). These findings indicate that better diabetes knowledge is associated with improved glycemic and lipid control.

Table: 1 Correlation of Biochemical, Diabetes Self-Management (DSMQ-R), and Physical Activity (IPAQ) Parameters with Diabetes Knowledge (DKQ-R)

Category	Variable	DKQ-R Correct r (p)	DKQ-R Incorrect r (p)
Biochemical Parameters	HbA1c	-0.515** (0.000)	0.517** (0.000)
	Total Cholesterol	-0.254** (0.000)	0.250** (0.000)
	Triglyceride	-0.192** (0.007)	0.189** (0.007)
	HDL	0.153* (0.031)	-0.158* (0.026)
	LDL	-0.156* (0.027)	0.157* (0.026)
DSMQ-R	Eating Behavior	0.408** (0.000)	-0.406** (0.000)
	Medication Taking	0.102 (0.149)	-0.097 (0.173)
	Glucose Monitoring	0.354** (0.000)	-0.350** (0.000)
	Physical Activity	-0.117 (0.100)	0.117 (0.099)
	Cooperation with Team	0.294** (0.000)	-0.300** (0.000)
	DSMQ-R Subtotal	0.458** (0.000)	-0.455** (0.000)
IPAQ	IPAQ (MET-min/week)	0.451** (0.000)	-0.449** (0.000)

*p<0.05, **p<0.01; negative correlation indicates higher biochemical values associated with better diabetes related knowledge. Diabetes self-management behaviors (DSMQ-R domains) and physical activity levels (IPAQ) were positively correlated with diabetes knowledge. Significant correlations were found between DKQ-R correct scores and eating behavior ($r = 0.408, p < 0.01$), glucose monitoring ($r = 0.354, p < 0.01$), cooperation with healthcare team ($r = 0.294, p < 0.01$), DSMQ-R subtotal ($r = 0.458, p < 0.01$), and IPAQ ($r = 0.451, p < 0.01$).

FIGURES

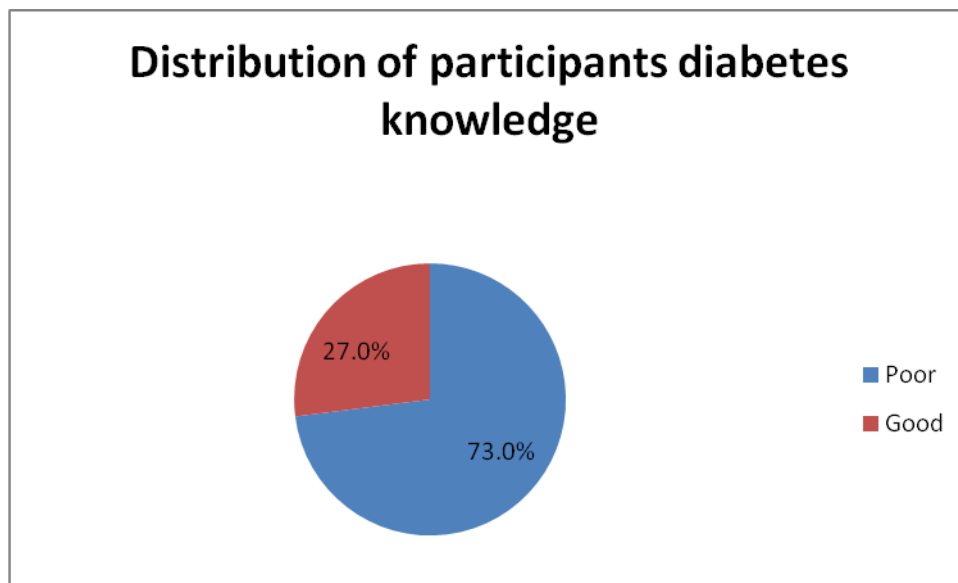


Figure 1: Distribution of participant’s diabetes knowledge.

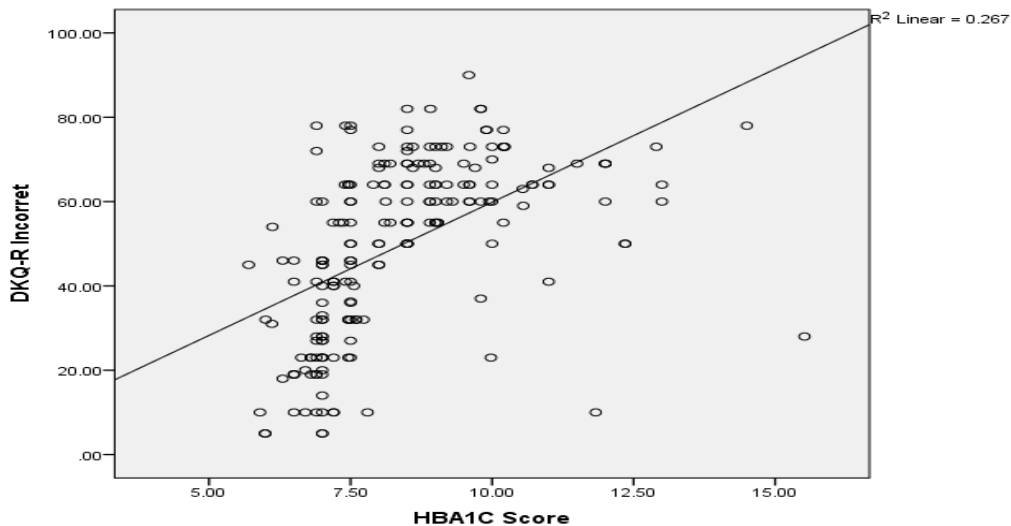


Figure 2 correlation between diabetes knowledge (DKQ-R correct) and HBA1c level

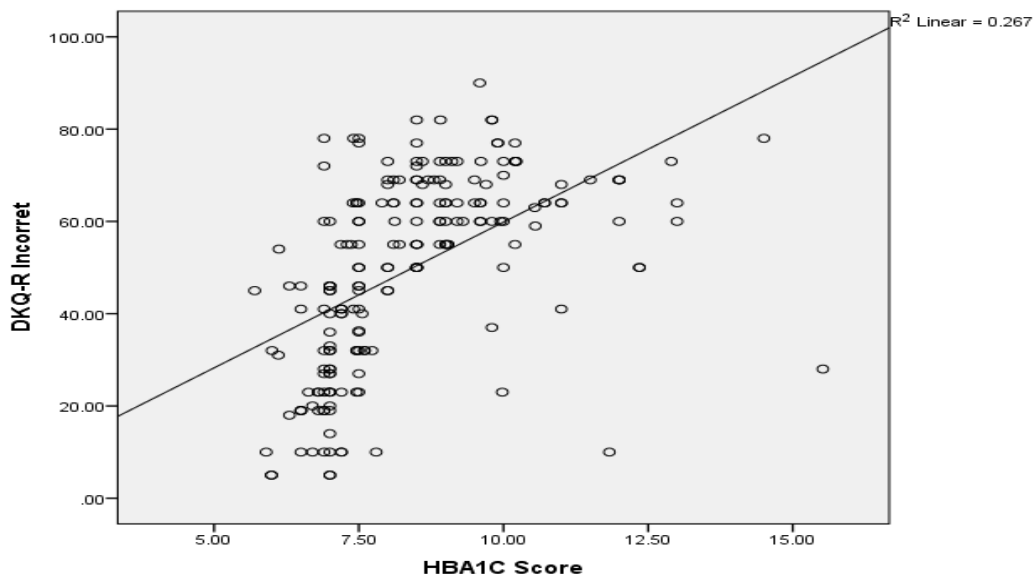


Figure 3 correlation between diabetes knowledge (DKQ-R incorrect) and HBA1c

Table 2 demonstrating the association between socio-demographic characteristics and diabetes knowledge scores (DKQ-R) by using ANOVA. A statistically significant difference in knowledge scores was observed across educational levels ($p = 0.0001$), with participants holding higher education demonstrating the highest mean

correct score (74.54 ± 14.71), while uneducated participants had the lowest (37.54 ± 14.09). Similarly, occupation showed a significant association ($p = 0.0001$), with government employees reporting the highest DKQ-R correct scores (73.47 ± 16.60) and unemployed participants the lowest (33.38 ± 20.76).

Table 2: Participant Characteristics and Diabetes Knowledge (DKQ-R)

Variable	Category	N	DKQ-R Correct Mean \pm SD	DKQ-R Inccorret Mean \pm SD	p-value
Education	Uneducated	80	37.54 \pm 14.09	62.45 \pm 14.08	0.0001**
	Primary	36	45.33 \pm 17.00	54.67 \pm 17.00	
	Up to Secondary	56	60.02 \pm 18.02	39.88 \pm 17.92	
	Higher Education	28	74.54 \pm 14.71	25.46 \pm 14.71	

Occupation	Govt	19	73.47 ± 16.60	27.05 ± 16.64	0.0001**
	Private	56	52.75 ± 19.33	47.16 ± 19.35	
	Farmer	15	42.87 ± 13.51	57.13 ± 13.51	
	Housewife	85	43.31 ± 16.73	56.67 ± 16.73	
	Retired	17	67.18 ± 22.22	32.24 ± 22.12	
	Unemployed	8	33.38 ± 20.76	66.63 ± 20.76	
Annual Income	<1 Lakh	138	43.96 ± 17.09	55.93 ± 17.20	0.0001**
	1–5 Lakh	51	63.78 ± 21.55	36.4 ± 21.55	
	6–10 Lakh	11	69.45 ± 17.50	30.55 ± 17.50	
Duration of DM	<10 yrs	154	44.86 ± 17.79	55.16 ± 17.71	0.0001**
	≥10 yrs	46	69.02 ± 18.89	30.76 ± 18.83	

*p<0.01 significant difference across categories. DKQ-R correct = higher knowledge; DKQ-R incorrect = lower knowledge. Participants with an annual income above 1 lakh exhibited higher knowledge scores compared to those earning less than 1 lakh ($p = 0.0001$). Duration of diabetes mellitus was also significantly related to knowledge, with patients having disease duration ≥ 10 years scoring higher (69.02 ± 18.89) than those with < 10 years (44.86 ± 17.79).

Multiple regression analysis (Table 3) identified education level ($B = 6.208$, $p = 0.0001$), duration of disease ($B = 7.396$, $p = 0.009$), HbA1c ($B = -2.085$, $p = 0.005$), DSMQ-R physical activity ($B = -1.915$, $p = 0.006$), and IPAQ score ($B = 0.001$, $p = 0.016$) as significant predictors of diabetes knowledge. These results suggest that participants with higher education, longer disease duration, lower HbA1c, and better self-management and physical activity practices had significantly greater diabetes knowledge.

Table 3: Regression Analysis Predictors of DKQ-R Correct and Incorrect Scores

Predictor	DKQ-R Correct B (p)	DKQ-R Incorrect B (p)
Education Level	6.208 (0.0001**)	-6.340 (0.0001**)
Duration of Disease	7.396 (0.009**)	-7.730 (0.006**)
HbA1c	-2.085 (0.005**)	2.120 (0.004**)
DSMQ-R Physical Activity	-1.915 (0.006**)	1.895 (0.007**)
IPAQ MET-min/week	0.001 (0.016*)	-0.001 (0.016*)

*, **p<0.01, p<0.05; B = Unstandardized coefficient.

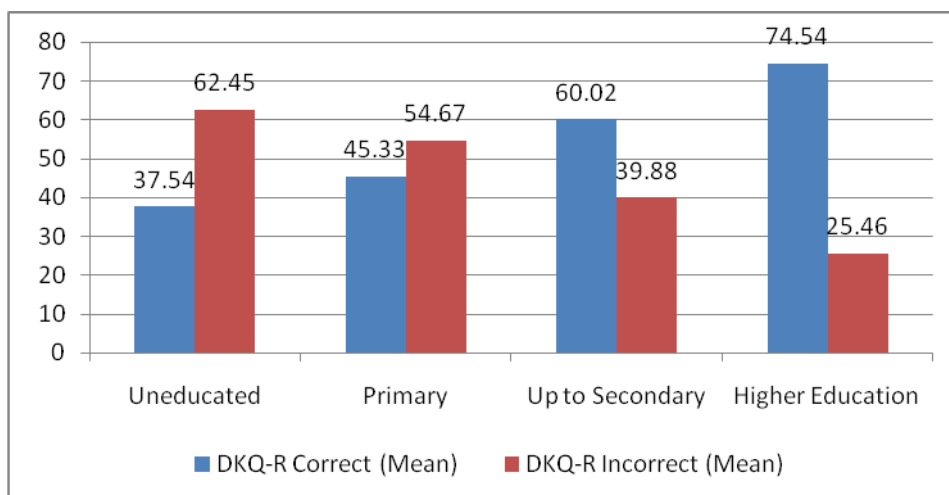


Figure 3: comparison between diabetes knowledge score of participants with different level of education

DISCUSSION

This study evaluated diabetes knowledge among patients with type II diabetes mellitus (T2DM) and explored its

relationship with socio-demographic, clinical, and behavioral factors. The findings revealed that diabetes knowledge was influenced by education, occupation,

income, age, duration of disease, and glycemic control, as well as diabetes self-management.

Socio-demographic and educational factors: Most participants were male (57.5%) with a mean age of 54.1 years, consistent with studies by López et al. a strong positive correlation with diabetes knowledge ($F = 47.06$, $p < 0.001$), indicating that literacy significantly improves disease understanding.^[4] These findings align with Fekadu et al. (2019)^[10] and Borba et al. (2019)^[11], Indra et al. (2024)^[12], Mehrotra et al.^[13], Lema et al. (2025)^[14], Moraes et al (2024)^[15] and Pakpour et al. (2024)^[16] all of whom confirmed that lower educational attainment associated with poor diabetes knowledge and suboptimal glycemic control.

Age, occupation, and income: Older participants exhibited lower knowledge scores ($r = -0.196$, $p = 0.006$), possibly due to reduced exposure to health information and generational differences. Participants with lower income or unemployment demonstrated poorer knowledge compared with government employees and higher-income groups ($p < 0.001$). Similar trends were observed by Ilyan et al. (2025)^[17] and Girma et al. (2025), emphasizing that socioeconomic status and employment enhance access to healthcare resources and education.^[14]

Clinical parameters (HbA1c): A strong negative association was found between diabetes knowledge and HbA1c levels ($B = -3.616$, $p < 0.001$), indicating that better-informed patients achieved improved glycemic control. Comparable findings were reported by Wang et al. (2023)^[20] and Velázquez Lopez et al. (2023), who demonstrated that inadequate knowledge increases the risk of poor glycemic outcomes ($HbA1c \geq 7\%$)^[4,18,19]. Lipid parameters showed no significant association with knowledge levels,

reinforcing the critical role of patient education in glycemic improvement.

Self-management: Higher diabetes knowledge was positively correlated with dietary adherence ($B = 2.669$, $p = 0.027$) but inversely related to reported physical activity ($B = -2.041$, $p = 0.007$), possibly reflecting limited awareness of recommended exercise practices. Similar findings were documented by Chen et al. (2025) Kifle et al. (2022)^[21] Popoviciu et al. (2022)^[22] and Kifle et al. (2022)^[23] who reported that structured education enhances self-care behaviors, especially dietary control and medication adherence.^[25]

Duration of disease and behavioral factors: Participants with diabetes for ≥ 10 years showed better knowledge ($F = 7.97$, $p = 0.001$), likely due to repeated healthcare exposure and self-learning over time. Smoking (11.5%) and alcohol use (3.5%) were associated with lower knowledge scores, consistent with prior reports linking poor lifestyle habits to limited disease understanding.

Multivariate analysis explained nearly half of the variance in diabetes knowledge, with education, HbA1c, disease duration, and self-management emerging as significant predictors. These results underscore that diabetes awareness is multifactorial, requiring comprehensive strategies addressing both behavioral and clinical dimensions.

CONCLUSION

This study demonstrated that diabetes knowledge among patients with type II diabetes mellitus is influenced by a complex interplay of socio-demographic, clinical, and behavioral factors. Older age was associated with lower knowledge scores, while higher education, employment, and income were positively correlated with greater diabetes awareness. Knowledge levels were inversely associated with poor glycemic control (elevated HbA1c) and positively associated with longer disease

duration and enhanced self-management behaviors.

Strengthening patient education programs, promoting lifestyle modifications, and improving access to healthcare resources can enhance diabetes knowledge, optimize glycemic control, and reduce long-term disease burden.

Based on these results, the alternate hypothesis is accepted, demonstrating a significant correlation between diabetes knowledge, self-care management, physical activity levels, and glycemic control in patients with type II diabetes mellitus.

Declaration by Authors

Ethical Approval: Biomedical research committee, Pt. B. D. Sharma

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