ORIGINAL ARTICLE

Impact of socio-economic status on Diabetes Mellitus knowledge and hemoglobin A1c control

Malick Maria Alvi [1✉], Sumerah Jabeen [1], Faisal Zahid [1], Ayesha Jabeen [1], Ahmed Raheem Buksh [1]

1. Patel Hospital, Karachi, Pakistan

   Cell #: +92-336-3230240
   Email✉: dr.mariamalick@gmail.com

ABSTRACT

OBJECTIVES: To assess the impact of socioeconomic status (SES) on Diabetes Mellitus (DM) knowledge and glycemic control among diabetic patients in Pakistan, considering the rising prevalence of DM and its associated economic burden.

METHODS: This cross-sectional study was conducted over three months at a tertiary care hospital in 2020, involving 235 DM patients aged 20 to 75 years. The Diabetes Knowledge Questionnaire (DKQ) and modified Kuppuswamy index were employed to evaluate diabetes knowledge and SES, respectively. Glycemic control was assessed using hemoglobin A1c (HbA1c) levels, and statistical analyses were performed.

RESULTS: Among 230 analyzed participants, 121 (52.4%) were females and 109 (47%) were males. Majority were type-2 DM (n=207; 90%). Mean age was 57.1±13.61 years, mean duration of DM was 14.07±9.54 years and mean Body Mass Index was 29.64±6.1 kg/m². Majority of participants were from the upper-middle (n=93; 40.4%) and lower-middle class (n=93; 40.4%); 20 (8.7%) were from lower class and 24 (10.4%) from upper class. The study revealed a strong impact of SES on diabetes knowledge (p=0.000*), with a gradual improvement from lower to upper classes. Similarly, SES significantly influenced glycemic control (p=0.005*), demonstrating a pattern of increased knowledge and improved glycemic control with higher socioeconomic status.

CONCLUSION: This study underscores the significant relationship between socioeconomic status, diabetes knowledge, and glycemic control among Pakistani diabetic patients. Improved disease knowledge and better glycemic control were associated with higher socioeconomic classes, emphasizing the need for tailored educational interventions and healthcare strategies to mitigate the impact of diabetes in diverse socioeconomic groups.

KEYWORDS: Diabetes Mellitus (MeSH); Diabetes Knowledge (Non-MeSH); Social Class (MeSH); Pakistan (MeSH); Glycated Hemoglobin (MeSH)

INTRODUCTION

There are 573 million people living with diabetes worldwide making it a disease of 1 in every 10 individuals.[1] It imposes a great challenge to the health authorities as growing urbanization, sedentary lifestyle with massive surge in obesity are all contributing factors to this "diabetes epidemic".

Recent years have shown a rapid rise of diabetes among South Asian population, which inflicts a significant health concern with more aggressive progression compared to other ethnic groups.[2,3] As per International Diabetes federation figures, in Pakistan there are 33 million adults living with diabetes which is a 70% rise in prevalence since 2019, ranking Pakistan 3rd in the world for having the highest number of diabetic patients[1]. This high prevalence of diabetes among countries is a source of significant economic burden, rising medical expenditures, and treatment of complications.[4,5] Studies have shown that improved diabetes knowledge is related to better glycemic control, disease outcomes, and prevention of diabetes complications.[6,7]

The disease knowledge can be pivotal in achieving the targeted outcomes by utilizing the gaps in knowledge. It can further assist in formulating innovative tools, educational models and health education programs leading to better compliance and practices among diabetic patients.[7] On the contrary, in lower socioeconomic populations because of lack of provision of health facilities and education, insufficient diabetes knowledge and its related complication prevail.[8,9]

Multiple studies have been conducted in Pakistan documenting the diabetes knowledge in general population and diabetic patients but according to our knowledge there has been no study to date which has determined the impact of socioeconomic status (SES) on diabetes knowledge and glycemic control among diabetic patients.

This study would be helpful to determine if an association exists between better SES leading to improved diabetes awareness and disease outcome i.e. hemoglobin A1c (HbA1c) levels in a developing country like Pakistan. This knowledge can have far-reaching implications on how a stable economy can lead to a healthier population, reducing disease burden, and improving quality of life. Also, the need for designing educational programs and interventions as per the

Table I: Demographic characteristics of the study participants

Descriptive Statistics	Mean ± SD	Range (Min – Max)
Age (years)	57.14 (±13.61)	(21 - 85)
Duration of Diabetes Mellitus (years)	14.07 (±9.54)	(0.15 - 40)
Body Mass Index (kg/m^2)	29.64 (±6.1)	(16.6 - 47.84)
Education score	4.55 (±1.68)	(1 - 7)
Occupation Score	5.89 (±2.36)	(1 - 10)
Monthly Income Score	6.03 (±2.81)	(2 - 12)

Table II: Percentage of correct answer of diabetes knowledge questionnaire

S.No.	Diabetes Knowledge Questionnaire for assessing diabetes knowledge (n=230)	Correct responses
1	Eating too much sugar and other sweet foods is a cause of diabetes.	31.7%
2	The usual cause of diabetes is lack of effective insulin in the body.	49.6%
3	Diabetes is caused by failure of the kidneys to keep sugar out of the urine.	25.2%
4	Kidneys produce insulin	0.0%
5	In untreated diabetes, the amount of sugar in the blood usually increases.	92.6%
6	If I am diabetic, my children have a higher chance of being diabetic.	60.4%
7	Diabetes can be cured	37.0%
8	A fasting blood sugar level of 210 is too high.	73.5%
9	The best way to check my diabetes is by testing my urine	45.2%
10	Regular exercise will increase the need for insulin or other diabetic medication.	54.3%
11	There are two main types of diabetes: Type 1 (insulin-dependent) and Type 2 (non-insulin-dependent).	33.0%
12	An insulin reaction is caused by too much food.	28.7%
13	Medication is more important than diet and exercise to control my diabetes.	58.7%
14	Diabetes often causes poor circulation	51.3%
15	Cuts and abrasions on diabetics heal more slowly	90.0%
16	Diabetics should take extra care when cutting their toenails.	65.2%
17	A person with diabetes should cleanse a cut with iodine and alcohol.	19.6%
18	The way I prepare my food is as important as the foods I eat.	32.2%
19	Diabetes can damage my kidneys.	71.7%
20	Diabetes can cause loss of feeling in my hands, fingers, and feet	73.5%
21	Shaking and sweating are signs of high blood sugar.	0.0%
22	Frequent urination and thirst are signs of low blood sugar	46.5%
23	Tight elastic hose or socks are not bad for diabetics.	31.3%
24	A diabetic diet consists mostly of special foods.	33.5%

socioeconomic classes for better diabetes knowledge and practice.

METHODS

After Internal Board Review approval, this is a cross-sectional study which was conducted at our institute during a period of three months from June 2020 to September 2020. The total study participants were 235 which was calculated using the Open Epi program (version 3), by keeping a two-sided confidence interval of 95%. All the patients diagnosed as diabetes mellitus type 1 and type 2, on insulin therapy or oral hypoglycemic, with age limit between 20 to 75 years of age with or without complication of diabetes mellitus with any economic status were included in the study. Mentally challenged, psychiatric patients and dementia patients, Unconscious patients excluded from the study and patients with communication / language barrier were excluded from the study.

All diabetic patients who had either one or two visits to the medical and diabetic OPD of Patel hospital or those who got admitted with diabetic complications were incorporated in the study after getting written informed consent. Data was collected by consecutive purposive sampling. Study participants were assessed for knowledge regarding

diabetes mellitus. The socioeconomic status was evaluated by a predefined questionnaire, including details of demography, Diabetes knowledge test questions, questions related to education, profession and household income of individual. Questionnaire in Urdu language was also provided. Diabetes knowledge was assessed by using the Diabetes Knowledge Questionnaire (DKQ). It is a 24-item questionnaire, designed by Starr County Diabetes Education Study, to get the information about patients' understanding of the cause, complications and symptoms as well as treatment of disease. Glycemic control was assessed by HbA1C taken within 3 months, less than 7.5% was taken to be statistically significant glycemic control. Socio-economic status was assessed by modified Kuppuswamy index 2019. For illiterate participants, questions were explained to participants, by the investigators.

Diabetes knowledge: Diabetes Knowledge in this study has been described as the understanding of information regarding diabetes on 24 items which is given in the questionnaire. The Diabetes Knowledge Questionnaire (DKQ) comprises of 24-item questionnaire, which is designed by Starr County Diabetes Education Study, to get the information of patient's knowledge regarding understanding of etiology of disease, its related complications, importance of physical activity, target blood glucose levels, and also knowledge of diabetic diet. This DKQ has been translated into the local language of Pakistan, Urdu and validated. It has three response options for each question "yes", "no", and "don't know". One point is given for each correct option, whereas, no point for the incorrect option. By summing up the points the total score is estimated for each patient. A higher score represents better disease knowledge. In this study score of less than 10 was regarded as poor knowledge. The score between 11 and 17 taken as average knowledge and more than 17 was taken as good knowledge.

Kappuswammy score: This is a composite score of socioeconomic

Table III: Comparison of diabetic knowledge among different demographics, clinical, socioeconomic class, and HbA1c level

Demographics & Clinical Characteristics		Diabetes Knowledge			p-value
		Poor Knowledge [n=99]	Average Knowledge [n=127]	Good Knowledge [n=4]	
Age in (years)		58.9 ± 12.6	56 ± 14.4	50.5 ± 7.5	0.175
Duration of Diabetes Mellitus (in years)		14.6 ± 8.8	13.7 ± 10.1	13.8 ± 11	0.799
Body mass index (BMI) kg/m^2		30.3 ± 5.9	29 ± 6.2	31.7 ± 8.3	0.21
Gender of patients	Male	49 (49.5%)	59 (46.5%)	1 (25%)	0.599
	Female	50 (50.5%)	68 (53.5%)	3 (75%)	
Type of diabetes	Type 1 diabetes	6 (6.1%)	17 (13.4%)	0 (0%)	0.152
	Type 2 diabetes	93 (93.9%)	110 (86.6%)	4 (100%)	
HbA1c levels checked within 3 months period	Less than 7.5%	27 (27.3%)	78 (61.4%)	0 (0%)	0.000*
	7.6% to 8.9%	36 (36.4%)	33 (26%)	2 (50%)	
	9% and more than 9%	36 (36.4%)	16 (12.6%)	2 (50%)	
	Total	99 (100%)	127 (100%)	4 (100%)	
Socioeconomic class	Upper class	5 (5.1%)	19 (15%)	0 (0%)	0.000*
	Upper middle class	34 (34.3%)	58 (45.7%)	1 (25%)	
	Lower middle class	42 (42.4%)	48 (37.8%)	3 (75%)	
	Upper lower class	18 (18.2%)	2 (1.6%)	0 (0%)	
	Lower class	0 (0%)	0 (0%)	0 (0%)	
Education of head of family	Not educated / illiterate	5 (5.1%)	1 (0.8%)	0 (0%)	0.025*
	Primary level education	19 (19.2%)	7 (5.5%)	0 (0%)	
	Secondary level education	19 (19.2%)	18 (14.2%)	1 (25%)	
	High school education	21 (21.2%)	30 (23.6%)	1 (25%)	
	Graduate degree	30 (30.3%)	58 (45.7%)	2 (50%)	
	Professional degree	5 (5.1%)	13 (10.2%)	0 (0%)	

Fisher exact/Chi-square, Parametric anova test was applied. at 95% Confidence interval (C.I),

Table IV: Comparison of socioeconomic status with hemoglobin A1c levels

Socioeconomic class	HbA1c levels checked within 3 months period			Total	p-value#
	Less Than 7.5%	7.6% to 8.9%	More Than 9%		
Upper Class	16	4	4	24	0.005*
Upper Middle Class	52	22	19	93	
Lower Middle Class	32	38	23	93	
Upper Lower Class	5	7	8	20	
Total	105	71	54	230	

Chi-square test applied for estimating association between socio-economic status and HbA1c levels; HbA1C hemoglobin A1c

scale which is used to measure socioeconomic status in urban and rural areas. It includes education of the head of family, its occupation as well as the monthly income of family. It divides the socioeconomic status in to five classes namely, upper class, upper middle class, lower middle class, upper lower class, and lower class with scores from 1 to 29. Lower class scores 1 to 4, upper lower-class scores 5 to 10, lower middle-class scores 11 to 15 and upper middle-class scores 16 to 25-, and upper-class scores 26 to 29.

Most of the public health and medical research include economic and social status as one of the pertinent predictors for health-related variables at the individual or family level. This score is originated from India. Because of its comprehensive scoring technique, we included this score in our research as Pakistan is also a developing country of Southeast Asia with similar socioeconomic challenges as in India. Only monthly income of heads of family is modified according to the Pakistani income.

Education of head of family was divided into professional degree, graduate or postgraduate degree, intermediate school, education till high school, middle school education, primary school education or illiterate, all parts were given specific scores accordingly, similarly profession of head of family comprised of different parts namely professional, semiprofessional, clerical, skilled worker, unskilled worker and unemployed, likely all parts were given separate scores. Monthly income of head of family was modified according to the Pakistani currency. It was divided into different income ranges. Monthly household income taken in Rupees, less than 15000 were given scores of 1, 16,000 to 30,000 were given score of 2, 31,000 to 50,000 scored as 3, 51,000 to 70,000 scored 4,71,000 to 100,000 score of 6,100,001 to 150,000 score of 10 and more than 150,000 score of 12. These three factors scores were combined to set a socioeconomic status of a person.

Socioeconomic status: According to American Psychological Association, socioeconomic status is described as the social status, rank or position of an individual or group. It is often measured as a blend of education, monthly income, and occupation. For assessment of socioeconomic status modified Kuppuswamy scale was used and adjusted according to Pakistani currency.

Statistical analysis: SPSS version 22 was used for the analysis of participant's data. Data was stratified quantitatively and descriptively. Quantitative variables (such as age, duration of diabetes) were calculated by mean and standard deviation. Independent variables are age, gender, duration of diabetes and socioeconomic status, while dependent variables are diabetes knowledge and HbA1c levels. Qualitative variables (gender, socioeconomic status, education or treatment taken for diabetes and glycemic control) were depicted as frequencies and percentages. SES, glycemic control are qualitative variables as they are shown in categories so they are ordinal qualititative variables. For the estimation of association of SES with diabetes knowledge, and HbA1c levels
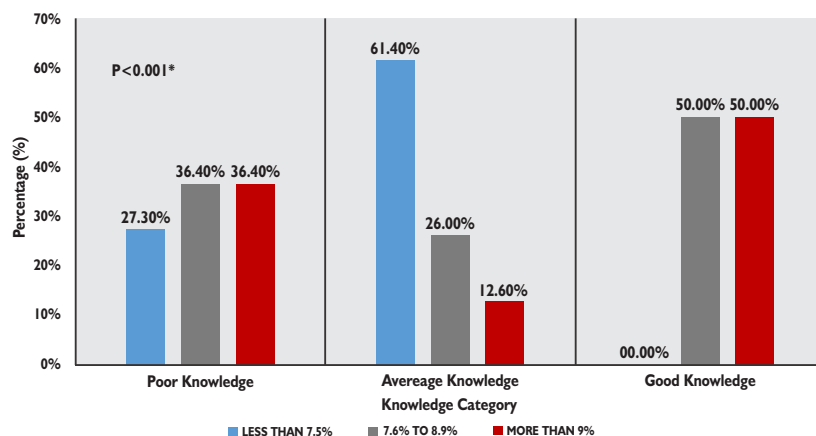
Figure 1: Association of Diabetes Mellitus knowledge score with categories on HbA1c checked within 3 months of duration

chi –square test was used. Association of diabetes knowledge with age and duration of diabetes Anova test was used. P-value of < 0.05 has been taken as statistically significant.

RESULTS

In our study, 235 diabetic patients were enquired about their knowledge of diabetes and their socioeconomic status by a pre-specified questionnaire. For assessing diabetes knowledge DKQ questionnaire was used and for assessing the socioeconomic status of the patient Kuppuswamy score was used which was modified according to the value of Pakistani currency. Data of 5 participants were not included due to incomplete information. HbA1C levels within 3 months' duration were also recorded. Two hundred and thirty participants were analyzed. In our study mean age of participants was 57.1 years (±13.61), 52.4% [n=121] were female, and 47% [n=109] were male. The calculated mean duration of diabetes mellitus was 14.07±9.54 years with a range (2 months to 40 years), the mean BMI of the patients was 29.64 with a range of (16.6 to 47.84). Most of the participants [90% (n=207)] were type-2 diabetic while 10% [n=23] were type-1 diabetics. Half of the patients (50%) had a family history of diabetes in the close relatives while 10% of participants had no family history of diabetes. Moreover, 23% had a positive family history of diabetes mellitus in both first and second-degree relatives.

Demographic characteristics of the participants are shown in table I.

In our study, participants from the middle class were found to be in the highest percentage 40.4% [n=93] from upper middle class and 40.4% [n=93] from lower middle class. The majority 39% [n=90] of participants had a graduate degree while only 2.6% [n=6] were illiterate, 25.7% [n=59] were semi-professionals followed by skilled workers 23.9% [n=55] and professionals 21.1% [n=49]. Majority of participants 33% [n=76] had the monthly household income of 51000 to 70000 rupees followed by 30% [n=70] of participants with a monthly income of 70,000 to 1 lac rupees. Percentage of correct answer of different diabetes knowledge question is shown in table II.

Table III shows Strong impact of socioeconomic status [SES] of diabetic patients on diabetes knowledge, suggesting a significant relationship between them with a p-value of 0.000* by applying chi-square test. It was found that among the lower class, 90% [n=18] had poor knowledge (from upper lower socioeconomic class) and only 10% had average knowledge. Among middle class participants, the knowledge improved gradually as the interclass status ascended, 37.8% [n=48] had average knowledge from lower middle class which was improved to 45.7% [n=58] in the upper middle-class. It was found that upper class had the highest ratio of disease knowledge i.e., from overall 24 participants from

this class 74% [n=19] had average knowledge and only 20% (n=5) had poor knowledge. Duration of diabetes was not having significant impact on knowledge of participants (p-value 0.799), Age of participants were not associated with good knowledge of diabetes (p-value=0.179).

Similarly, significant impact of socioeconomic status was observed on HbA1C levels of diabetic patients with p-value of 0.005* by applying chi-square test. Only 25% [n=5] patients from lower class had good glycemic control (HbA1c of less than 7.5%) while 75% of patients from this class had uncontrolled HbA1C levels, similarly 34% [n=32] and 55% [n=52] of participants showed good glycemic control from lower middle and upper middle class respectively, while 66% [n=16] of participants from upper class showed improved glycemic control. So, this indicates a gradual pattern of increase in knowledge and improved glycemic control as the socioeconomic status improves. Table IV shows comparison of SES with HbA1c levels.

Our study showed that knowledge of diabetes etiology, diabetes inheritance, correct fasting blood sugars and impact of exercise on the improving diabetes control was significantly related to the socioeconomic status of patients.

Association of diabetes knowledge score with HbA1c categories (<7.5%, 7.6% to 8.9% & >9%), checked within 3 months of duration is given in figure 1.

DISCUSSION

Diabetes Mellitus (DM) has reached epidemic levels around the world due to an alarming rise in numbers. In the last few decades, it has become an emerging health problem in developing countries.[12] The objective of this study was to define the impact of socio-economic status on diabetes mellitus knowledge and HbA1c control.

Our data favors better diabetes control and diabetes knowledge with improving socioeconomic status.

This is the first study in Pakistan evaluating the impact of socioeconomic status on DM knowledge and diabetes control. The majority of participants

included in the study were from the upper and lower middle class with the mean modified Kuppuswamy score of 16. Comparing the diabetes knowledge and glycemic control results among various socioeconomic classes, participants with higher incomes showed better diabetes awareness knowledge and HbA1C control compared to those with lower incomes. Our study findings resonate with data from other studies conducted in different countries. Cowie et al., in describing the socio demographic characteristics of patients with diabetes showed that people with lower SES had a greater prevalence of diabetes along with the increased burden of morbidity and mortality compared with people with better SES.[13] Among the various factors causing this co-relation, depression has been proven to be a significant arbitrator in the relationship between SES and glycemic control. People living in poverty have been shown to interpret their futile efforts to control their diabetes as a sign of the unpredictable nature of the disease rather than the lack of efforts on their part.[14] There are also studies suggesting lower SES to higher stress levels which in turn can cause endocrine perturbations leading to type 2 DM.[15,16] A study conducted by Tahirovic et al., assessing the association between glycemic control in children with Type 1DM and socioeconomic status of the family showed lower SES was associated with higher HbA1c levels suggesting diabetes care has both direct and indirect costs.[17] The EuroDiab IDDM complications study has also shown that men and women from lower SES classes had higher Hba1c levels.[18]

The socioeconomic impact on diabetes control in a developing country like Pakistan could be the result of the overall financial cost the disease carries with expenses ranging from medications to maintain glucose charts and frequent laboratory testing since diabetes care is not free in our country. Also people with better income have access to better diabetes care programs being run individually in bigger hospitals compared to those patients who due to financial constraints are deprived of basic medical facilities and diabetes

education. Our study also showed that diabetes knowledge and control were better among participants with a graduate degree compared to those with secondary level education and below, implicating that education also has an impact on diabetes knowledge and control. Studies have validated that in diabetic population with ethnical diversity and low-income, literacy can partially bridge this gap, mediated by the practical relationship between good education and glycemic control. The demands of self-management in diabetes care can be a little overwhelming for an individual with inadequate literacy suggesting implications on education and health policy.[19] Individuals with inadequate literacy are shown to face problems with both the written and an oral form of communication in the clinical context.[20]

American Diabetes Association (ADA) recommends a comprehensive diabetes self-management education and support (DSMES) since it plays an important role in improving patient self-management, satisfaction, and glucose outcomes.[21] The majority of the participants in our study irrespective of class difference had good knowledge regarding target blood glucose levels and diabetes-related complications including neuropathy, nephropathy, and poor wound healing and proper nail cutting techniques. One probable reason for this widespread knowledge could be a high prevalence of such diabetes-related complications in our part of the world due to lack of proper follow-up system leading to delayed diagnosis and related complications. Although the above interpretation in our study is in alignment with the local study findings conducted by Shams et al where the majority of participants were well aware of diabetes complications but this contradicts with a study conducted in another province of Pakistan where most of the participants had poor knowledge regarding diabetes complications, pointing towards the additional demographic differences with bigger cities having more awareness compared to smaller cities of the country.[22,23]

Overall our study participants had poor

knowledge regarding the pathophysiology and autonomic dysfunction related to hypo and hyperglycemia which could be interpreted as a limited transfer of knowledge between diabetes educators and the patients about the nature of the disease and its more prolonged complications, emphasizing the importance of a more comprehensive diabetes self-management and education programs among the general population and most important among patients with DM. .

One of the limitations of our study is that most of the participants were from the middle class which could have affected the results. Also, our study participants were a limited number of diabetic patients attending outdoor clinics and inpatients at a tertiary care hospital therefore our findings might not be generalized to the diabetic population in Karachi/Pakistan and requires reinforcement through further work.

CONCLUSION

This research highlights the significant interplay among socioeconomic status, diabetes knowledge, and glycemic control within the Pakistani diabetic population. The study underscores the considerable influence of SES on disease awareness and HbA1c levels, accentuating the necessity for targeted educational interventions tailored to diverse socioeconomic classes. Higher socioeconomic status is linked to enhanced disease knowledge and improved glycemic control, reinforcing the importance of customized educational initiatives and healthcare strategies. Elevating socioeconomic status, coupled with accessible diabetes care programs, has the potential to enhance metabolic control, mitigate acute and chronic complications, and ultimately enhance overall quality of life.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

MMA & FZ: Conception, acquisition, analysis and interpretation of data, drafting the manuscript, approval of the final version to be published

SJ: Study design, critical review, approval of the final version to be published

AJ: Acquisition, analysis and interpretation of data, drafting the manuscript, approval of the final version to be published

ARB: Analysis and interpretation of data, drafting the manuscript, approval of the final version to be published

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST
Authors declared no conflict of interest

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KMUJ web address: www.kmuj.kmu.edu.pk
Email address: kmuj@kmu.edu.pk