

The Prevalence and Management of Diabetes Mellitus Among Educated and Uneducated Populations in Pakistan. A comparative study

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ABSTRACT

Background: Diabetes mellitus (DM) is a growing public health challenge globally, particularly in developing countries like Pakistan. Education plays a crucial role in DM management and awareness.

Objective: The aim of this work was to compare the rate and the treatment of diabetes mellitus (DM) in educated and uneducated people of Pakistan.

Methodology: This comparative study was conducted on 500 participants out of which 300 has been given formal education that is at least secondary education whereas 200 has no formal education that is they have dropped out at least at primary level. Diabetes prevalence, awareness, and management and lifestyle practices data were collected using structured questionnaires and blood glucose measurements. Data analysis was done with SPSS v 25.0, where chi-squared tests and logistic regression were used to assess the relationship of educational status with DM prevalence and its management.

Results: The result showed that DM was higher among the uneducated group which was 32% compare to the educated group which was 18%. The participants who were educated had better understanding of DM, better compliance with the prescribed drug regimen and improved life style changes. On the other hand, the uneducated group had poor disease knowledge and worst management hence poor management of their disease condition. **Conclusion:** Education has a great effect on the incidence and control of DM. The study implies that there is a significant lack of knowledge about DM among the uneducated population hence the need to conduct health education to create awareness and ensure proper management of DM.

Keywords: Diabetes mellitus, prevalence, management, education, glycemic control, awareness, Pakistan, biomarkers, lifestyle modifications, public health.



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INTRODUCTION

Diabetes mellitus (DM) is becoming a more and more severe health problem in the world, which has become a major challenge for health care systems. This is a long-term metabolic disease which is marked with high blood glucose levels due to the problems in insulin production or functioning or both[1]. DM has become a common ailment affecting the world's population and has been on the rise in the recent past decades. According to WHO, the population

of diabetic patients has increased from 108 million in the year 1980 to 422 million in the year 2024 and the major part of this increase is in the developing countries. This is due to change in life style, increased urbanization, increase in population age and shift from traditional diets to the western diets[2]. Pakistan, for instance, is reporting high incidence of DM and is among the countries with high prevalence of the disease. This increase can be attributed to the following factors; genetic marker, obesity, sedentary lifestyles and even lack of information on the existence of

the disease[3]. Considering the fact that DM is a long-term condition and can lead to devastating complications including cardiovascular diseases, nephropathy, neuropathy and retinopathy, it is very essential to prevent and control the disease[4]. Education plays a central role in enhancing the health of the people and reducing the chances of getting an illness. It has a significant role in helping people to learn their health status, change their lifestyles and make proper choices regarding their health. Education standards have been found to be positively correlated with the health literacy which is required for the proper management of chronic diseases such as DM. They are in a position to identify signs and symptoms on early stages, follow up with the doctors, follow prescriptions and other necessary measures which include change of diet and exercise regimes[5, 6]. On the other hand, patients with low levels of education are likely to be ignorant of how they can properly deal with DM. This gap in knowledge may result in late diagnosis, inability to manage blood sugar levels and greater risk of complications[7]. Especially in Pakistan, the educational differences are very prevalent and they reflect the needs to understand the connection between the education level and the DM management in order to create efficient strategies in the field of public health[8]. A number of papers have indicated that people with education are well informed of DM risk factors and signs, competent in taking prescribed medication, and willing to undergo constant check-ups and modifications to their diet and physical activity. Nevertheless, there are few published study which aims to compare the rate of DM and its treatment between educated and uneducated people in Pakistan[9]. This study intends to do so by analyzing the influence of educational status on DM prevalence, awareness, management practices and health outcomes[10]. Therefore, through this cross-sectional study, this paper aims at comparing the two populations in order to understand the impact of education on DM management and the importance of developing specific strategies to enhance DM knowledge and management in the uneducated group[11]. Knowledge of these differences would be vital in decision-making pertaining to the formulation of policies in public health as well as the creation of awareness campaigns in efforts to minimize the prevalence of DM and its subsequent effects.

MATERIALS AND METHODS

Study Design: This was a comparative study designed to compare the prevalence and control of diabetes mellitus (DM) in educated and uneducated population of Pakistan.

Place of study: Study was conducted in teaching hospitals of Lahore, Pakistan,

Study Duration: present study was conducted from March 2022 to July 2023. Therefore, the study aimed at comparing these two groups in order to determine the effect of educational status on the awareness, management practices, and health outcomes of DM.

Study Population: The study involved a total of 500 participants divided into two groups: In the educated group, 250 participants had attained at least secondary education while in the uneducated group 250 participants had never been to school. Both the groups of the respondents comprised of those who were 18 years old and above and from different regions of Pakistan.

Inclusion and Exclusion Criteria: The participants were selected based on the criteria of being 18 years and older, diagnosed or without diagnosed DM but willing to undergo screening for blood glucose level. Women with gestational diabetes or specific other types of diabetes were excluded, as were those with a chronic disease that would affect glucose metabolism. The research only included the participants who had given their informed consent to participate in the research.

Sampling Technique: To increase the chances of getting participants from different urban and rural areas, a stratified random sampling was adopted. This approach kept things fair when selecting the participants so that there was a better comparison between the educated and the uneducated people. Power analysis was used to establish the sample size so as to obtain a 95% confidence interval and 5% margin of error.

Data Collection: The raw data collection was done over 17 months using structured interview and clinical evaluation.

- **Structured Interview and Questionnaire:** Part of data collection process was the administration of a structured questionnaire through face-to-face interviews. The questionnaire obtained the demographic data (age, gender, occupation) and the knowledge (risk factors, symptoms, complications) of DM; the management practices of DM (consumption of drugs, frequency of blood glucose level checks, changes in lifestyle). As a way of avoiding any misunderstandings, the interviews were conducted in the participants' local languages.
- **Clinical Assessment and Blood Glucose Testing:** Fasting blood glucose analysis was performed by glucometer for all the participants. Participants were classified as diabetic based on the ADA criteria which are: fasting blood glucose level of 126 mg/dl or more, pre-diabetic based on fasting blood glucose level of 100-125 mg/dl and non-diabetic participants having fasting blood glucose level of less than 100 mg/dl.

Ethical Considerations: All the participants provided written informed consent and were told the rationale for the study, what would be done to them, possible harm that might come about, and that they could withdraw at any one time. All the participants' identities were kept anonymous in the study and their information was kept confidential, all ethical considerations were strictly followed.

Statistical Analysis: Statistical analysis was done by the use of SPSS version 25. Data on demographics and

baseline characteristics were described using frequency tabulations. In this study, chi-square test was used to determine the relationships between educational status and DM prevalence, awareness and management practices. The assessment of the predictors of DM management including medication adherence and blood glucose monitoring was determined using logistic regression analysis. To analyse the difference of a continuous variable like mean blood glucose level, independent t-tests was used to compare the two groups. A p-value of (<0.05) was considered as statistically significant for all the tests carried out.

RESULTS

A total of 500 participants were recruited for this study, 250 of whom were educated while 250 were uneducated. The mean age of the educated group was 44. The variance of the age of the educated group was 12. 2 years ($\pm 10. 5$) and the uneducated group was slightly older than the educated group with the mean age of 47 years. 6 years (± 11.3). The gender distribution was almost equal, 54% males and 46% females were in educated category and 52% males and 48% females in uneducated category. In terms of the socioeconomic status, 65% of the educated group were in middle to high income earners' group while 80% of the uneducated group fell in the low income earners' group.

The level of education also influenced the percentage of the patients with diabetes; 32% of the uneducated group and 18% of the educated group. This difference was statistically supported by the chi-square test result ($\chi^2 = 15. 8$, $p < 0.001$). Furthermore, the mean fasting blood glucose was also lower in educated people ($124.5 \text{ mg/dL} \pm 15.2$) than the uneducated one ($138. 3 \text{ mg/dL} \pm 20.1$); this finding was more significant ($t = -8. 23$, $p < 0. 001$). Likewise HbA1c level was significantly lesser in the educated group (mean = $6.8\% \pm 1.2$) as compared to the uneducated group (mean = $7.5\% \pm 1.5$), showing better long-term glycemic control among educated population ($t = -5. 61$, $p < 0.001$). Other confirmed biomarkers were also taken to determine the general health condition of the

respondents. The educated group recorded a mean systolic blood pressure of 128 and had a better control of blood pressure than the less educated. $4 \text{ mmHg} (\pm 12.6)$ compared with $138. 7 \text{ mmHg} (\pm 15.3)$ in the uneducated group ($t = -6.25$, $p < 0.001$).

The mean diastolic blood pressure of the educated group was $82.3 \text{ mmHg} \pm 8.5$ while that of the uneducated group was $88.9 \text{ mmHg} \pm 9.2$, this difference was statistically significant ($t = -7. 12$, $p < 0. 001$). A comparison of the lipid profiles showed that the educated group had a mean total cholesterol of $190. 5 \text{ mg/dL} \pm 35.2$ while the uneducated group's mean total cholesterol was $210. 8 \text{ mg/dL} \pm 40. 5$ ($t = -5. 02$, $p < 0. 001$) and the educated group had a mean LDL cholesterol of $110. 2 \text{ mg/dL} \pm$ On the other hand, educated group had a higher level of HDL cholesterol $50. 4 \text{ mg/dL} \pm 12. 3$ than uneducated group $42. 3 \text{ mg/dL} \pm 10. 7$ $t = 5. 72$, $p < 0. 001$. BMI was another parameter in which there were differences only in the mean, the educated group had mean BMI of $26. 2 \text{ kg/m}^2 (\pm 4. 3)$ and the mean BMI was $29. 4 \text{ kg/m}^2 (\pm 5. 1)$ in the uneducated group ($t = -8. 03$, $p < 0.001$). This implies a general downward trend of body weight status of the educated participants. (Table 1) below shows the results of analysis of demographic data, clinical markers, and treatment approaches between the groups of educated and uneducated participants.

Logistic Regression Analysis: The logistic regression was used to determine the factors influencing diabetes self-management and medication compliance as well as blood glucose testing as shown in table-2. In this case, the results showed that education level was statistically significant for both the parameters under study. The educated group's medication adherence odds ratio was 3. 2 (95% CI: 2. 1-4. 9) which showed that educated people were more than three times of likely, to be adherent to medication as compared to the uneducated people. For other types of blood glucose monitoring regimens, the OR was 2. 8 (95% CI: The results are as follows: (mean 1. 9-SD 4. 3) indicating that the educated group is more likely to be monitored.

Table-1: Comparative Analysis of Demographics, Biomarkers, and Management Practices

Parameter	Educated Group (Mean $\pm$ SD / %)	Uneducated Group (Mean $\pm$ SD / %)	Test Statistic	p-value
Age (years)	44.2 $\pm$ 10.5	47.6 $\pm$ 11.3	$t = -3.45$	<0.001
Gender (Male %)	54%	52%	$\chi^2 = 0.18$	0.672
Gender (Female %)	46%	48%	$\chi^2 = 0.18$	0.672
Socioeconomic Status (Middle/High %)	65%	20%	$\chi^2 = 85.7$	<0.001
Diabetes Prevalence (%)	18%	32%	$\chi^2 = 15.8$	<0.001
Fasting Blood Glucose (mg/dL)	124.5 $\pm$ 15.2	138.3 $\pm$ 20.1	$t = -8.23$	<0.001
HbA1c (%)	6.8 $\pm$ 1.2	7.5 $\pm$ 1.5	$t = -5.61$	<0.001
Systolic Blood Pressure (mmHg)	128.4 $\pm$ 12.6	138.7 $\pm$ 15.3	$t = -6.25$	<0.001
Diastolic Blood Pressure (mmHg)	82.3 $\pm$ 8.5	88.9 $\pm$ 9.2	$t = -7.12$	<0.001
Total Cholesterol (mg/dL)	190.5 $\pm$ 35.2	210.8 $\pm$ 40.5	$t = -5.02$	<0.001
LDL Cholesterol (mg/dL)	110.2 $\pm$ 22.8	125.6 $\pm$ 25.4	$t = -4.81$	<0.001
HDL Cholesterol (mg/dL)	50.4 $\pm$ 12.3	42.3 $\pm$ 10.7	$t = 5.72$	<0.001
BMI (kg/m ²)	26.2 $\pm$ 4.3	29.4 $\pm$ 5.1	$t = -8.03$	<0.001
Awareness of Risk Factors (%)	82%	38%	$\chi^2 = 46.3$	<0.001
Awareness of Symptoms (%)	78%	40%	$\chi^2 = 40.5$	<0.001

Medication Adherence (%)	88%	48%	$\chi^2 = 51.4$	<0.001
Regular Glucose Monitoring (%)	72%	28%	$\chi^2 = 62.3$	<0.001
Physical Activity (%)	60%	30%	$\chi^2 = 33.6$	<0.001
Balanced Diet (%)	65%	35%	$\chi^2 = 29.2$	<0.001

* Independent t-tests were used for continuous variables and chi-square tests for categorical variables.

Table-2: Logistic Regression Analysis for Predictors of Diabetes Management

Predictor	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Medication Adherence	3.2	2.1 - 4.9	<0.001
Regular Glucose Monitoring	2.8	1.9 - 4.3	<0.001
Awareness of Risk Factors	2.5	1.6 - 3.9	<0.001
HbA1c Control	2.2	1.5 - 3.4	<0.001

($p \leq 0.001$)

*Logistic regression analysis showing education level as a predictor for better diabetes management practices.

DISCUSSION

Based on the results of this study, the importance of education in the occurrence and control of diabetes mellitus (DM) in Pakistan can be seen. The education group has recorded a very low incidence of DM as compared to the other group and this has been attributed to increased awareness and preventive measures[12]. Education levels also distinguished the patients' awareness of DM risk factors and symptoms, which probably led to the earlier diagnosis and treatment. This is in concordance with other studies that have shown that there is a direct relationship between level of education and improvement in health literacy as well as disease control and outcome[13]. Our findings also corroborate other research studies done in other countries especially developing countries where education level has emerged as a significant determinant of chronic disease management. For example, comparable research in the vicinity with low literacy levels has noted that illiteracy is linked with poor DM control, late diagnosis and more complications[14]. The biomarkers such as fasting blood glucose, HbA1c levels, blood pressure and lipid profiles were significantly better controlled among the educated group and this is in agreement with the hypothesis that education enables individuals to live healthier and adhere to medical prescriptions[15]. It also highlights this aspect, which reiterates the need to have a more comprehensive DM management. The educated group not only complied more with the prescription of medication but they also practiced more of the lifestyle changes including exercising and balanced diet. This probably helped to improve their general health status and consequently lower their probability of developing complications from DM[16]. The variations in BMI and blood pressure indicate the possibility of education in affecting other aspects of health that are vital in the management of DM and its complications. However, it is important not to overlook the limitations in the present study as follows; The study employed objective measures and a comparative cross-sectional study design. The study design used in the current study is cross-sectional, which limits the ability to find out if education has a causal effect on DM outcomes[17]. Lifestyle practices were self-reported and

this could have introduced recall bias in the study hence possibly compromising the results. Further, other cultural and socioeconomic factors which were beyond the scope of this study may also affect DM management and awareness among people and such avenues for future study should be encouraged[18]. Further research should be directed toward the use of longitudinal studies in order to assess the long-term effectiveness of education for DM control and its consequences. Further, the assessment of the efficacy of these educational interventions in populations that are devoid of formal education may help in formulating specific approaches to minimize the DM prevalence[19]. Mass education interventions focused on increasing DM knowledge and literacy, especially amongst the population groups with low SES and education levels may be highly effective in improving DM control and decreasing prevalence and morbidity of DM in Pakistan and similar countries[20]. The study also revealed the fact that education has a role to play in the understanding as well as the control of the condition in patients suffering from diabetes. The awareness of the disease is higher in the educated persons; they also have a better control over their blood glucose level and therefore less complications are seen in them. This highlights the importance of intervention in educational level among people with diabetes especially those with low level of education in order to have better control of the disease.

CONCLUSION

This study was concluded that in Pakistan, education has a major impact on the prevalence and treatment of diabetes mellitus. Better awareness, control, and treatment of diabetes mellitus (DM) are exhibited by educated people, highlighting the necessity of focused educational initiatives to enhance health outcomes among groups with lower levels of education. One of the most important approaches to lessening the overall impact of DM and improving the lives of those impacted may be to address educational inequality.

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Authors' Contributions:

- **MYA, MAJ:** Study conceptualization and manuscript drafting.
- **MAJ, MAA:** Data collection and statistical analysis.
- **MAA, MAR:** Literature review and manuscript editing.
- **MAR, MI:** Data analysis and critical revision.
- **MI, NZ:** Clinical insights and study supervision.

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