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Average HbA1c in Diabetic Patients in Southern KPK-Pakistan

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Abstract

Diabetes mellitus is a complex metabolic syndrome characterized by either insulinopenia or insulin resistance. This study is focused on the ever-growing prevalence of diabetes mellitus and its poor glycemic control in southern KPK This descriptive cross-sectional study was conducted at the outdoor unit, Department of medicine DHQ hospital Bannu, over six months, extending from 30th December 2021 to 30th June 2022. The sample size was 91 and was calculated using the standard WHO formula. The confidence interval used was 95%, with a 5% margin of error. P value <0.05 was taken as statistically significant. Consecutive non-probability sampling technique was applied. Diabetic patients under treatment below 70 years were included in the study. HbA1c was used as an assessment tool for glycemic control and divided into three categories: good glycemic control with HbA1c <7%, poor glycemic control with HbA1c >9%, and very poor glycemic control with HbA1c >10%. Data was entered and analyzed using SPSS version 19.0. About 18.6% diabetic patients had HbA1c >6%, 25.6% patients had HbA1c between6-8%, 26.7 % patients had HbA1c between 8-10% and 29.6 % had HbA1c >10%. This study revealed that the majority (55%) of diabetic patients belonging to southern KPK had poor glycemic control, as revealed by HbA1c, more than 8%.

Keywords Diabetes mellitus, HbA1c, Glycemic control.

1. Introduction

Diabetes mellitus is a metabolic syndrome characterized by increased blood glucose either due to decreased production or decreased response of body tissues to insulin, a hormone that helps in effectively utilizing glucose along with other functions (1,2). There are two types of DM: type I and type II Gestational diabetes is a separate entity occurring in pregnant women, but type I & II have got more emphasis (1,3). Despite great improvements in health care facilities and efforts to prolong life in diabetic patients, it is still the 5th leading cause of mortality worldwide.

According to the statistics of the International Diabetes Association (IDA) in 2017, Pakistan is the 10th leading country in terms of diabetes prevalence. In between the age group 21 and 79 years, Pakistan has 75 million cases (4,5).

Random blood glucose levels, fasting blood glucose levels, and HbA1c levels are usually used as diagnostic tools, but HbA1c is considered a standard gold test (6).

For decades HbA1c measurement has been considered one of the vital laboratory medical advances in diabetes care since its recommendation by the American Diabetes Association (ADA) in 1988 (7). Before HbA1c, glucose criteria, either random or fasting or 75g oral glucose tolerance, were used. Still, in 2010 after assay improvement, ADA validated its use (7) as a Diabetes diagnostic criterion with cutting-off values of ≥48mmol/mol (6.5%). Normal <5.6%, and pre-diabetics between 5.7% and 6.4%. and the target value should be below 42mmol/mol (6%) (6).

Hemoglobin is the Fe-containing oxygen-transport metalloprotein present in RBCs. Normal adult hemoglobin (HbA) consists of haem and four globin chains, the α and β globin chains (α2β2), making up to 97% of adult human hemoglobin (8,9). Within hemoglobin A, approximately 6% is glycated, HbA1c (5%) is the main component, and HbA1a and HbA1b are minor components, comprising the remaining 1% (13). HbA1c results from glycation, a non-enzymatic formation of a covalent bond between serum glucose and N-Terminal amino acid valine of beta-chains of hemoglobin A (12).

HbA1c depends on the interaction between the concentration of serum glucose and the lifespan of the red blood cells (8). As the mean erythrocyte lifespan is approximately 120

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days, HbA1c acts as a surrogate marker of glucose concentration during the preceding 8–12 weeks (11).

Measuring HbA1c for diagnosis of diabetes carries Advantages of its convenience because it does not need pre-test preparation, sample stability when collected and low day-to-day variability. However, it is limited by greater cost, low sensitivity (7), and some conditions which falsely elevate of lowers the HbA1c values such as acute and chronic blood loss, hemolytic diseases, hypersplenism, hemoglobin variants and iron, vitamin B12, folate deficiency, asplenia and blood transfusions etc (10-12). Measurements of HbA1c work by separating non glycated and glycated by structural differences and isoelectric point differences (10,11). The National Glycohemoglobin Standardization Program (NGSP) shows values in %, and International Federation of Clinical Chemistry (IFCC) shows in mmol/mol. The conversion equation is NGSP= 0.0915×IFCC (6).

Point-of-care devices which quantify HbA1c on structural differences from non-glycated Hb use is increasing, and give immediate results. Based on studies it is indicated that HbA1c cannot solely explain complications of diabetes because it does not show day-to-day variations in blood glucose (6,13).

Self-Monitoring Blood Glucose (SMBG) and Continuous Glucose Monitoring (SGM) provide alternate methods for HbA1c measurement (11,14). Fructosamine is another alternative to HbA1c, giving a clue about the past 2 to 3 weeks of glycemic control. Fructosamine is formed by glycation of proteins specially albumin, but there are limitations to fructosamine, such as hypoproteinaemia and hypoalbuminemia, as in renal failure and liver diseases (9,15).

In pregnancy, 75g OGTT rather than HbA1c should be used for medication adjustments. Glucose monitoring methods such as SMBG and CGM are particularly effective for young and type 1 diabetic patient (9).

Incidence and prevalence of DM in Pakistan are increasing very rapidly in line with many developed countries across the world, to an alarming level, placing a heavy burden on the health care system socially and economically (17). The govt, along with the general public, share a huge responsibility in terms of adopting and implementing preventive measures amid the rising prevalence. In Khyber Pakhtunkhwa (KPK) province of Pakistan, prevalence ranges from 9% to 12% of the population (16). There are no studies conducted regarding glycemic control of diabetic patients residing in Southern KPK. This study is aimed to assess the glycemic control of patients with diabetes in southern KPK using HbA1c laboratory reports.

2. Methodology

This descriptive cross-sectional study was conducted at the outdoor unit, Department of medicine DHQ hospital Bannu over 6 months, extending from 30th December 2021 to 30th June 2022. The sample size was 91 and was calculated using standard WHO formula. The confidence interval used was 95% with 5% margin of error. P value <0.05 was taken as statistically significant. Consecutive non-probability sampling technique was applied. Diabetic patients under treatment below 70 years were included in the study. Demographic data was obtained from all patients on the designed Performa. All the patients were interviewed in details regarding glycemic control and worsening of hyperglycemia symptoms including frequency of urination at nights and peripheral neuropathy. HbA1c was used as an assessment tool for glycemic control and divided into 4 categories: good glycemic control with HbA1c <6%, reasonable glycemic control with HbA1c 6-8 %, poor glycemic control with HbA1c 8-10% and very poor glycemic control with HbA1c >10%. Data was entered and analyzed using SPSS version 19.0. Mean + SD were calculated for quantitative variables like age, duration of diabetes, HbA1c. Frequencies and percentages were calculated for sex, education, and dietary habits. All results were presented as tables and graphs.

3. Results

The study included 86 patients. Forty-three were males, and 43 were females. The mean age of our studied population was 46.9 ± 12.4 years, while the mean HbA1c was 8.6 ± 2.3 mg/dl (Table 1). About 11.6% of patients were below the age of 50 years, 51.2% in the age group 51-70 years and 37.2% above the age of 70 years. About 18.6% patients had HBA1C <6%, 25.6% HAD HbA1c between 6-8%, 26.7% had HbA1c between 8-10% and 29.1 % had HbA1c >10% (Table 2). HBA1C correlated with age had a significant p value (<0.001), while it was insignificant when correlated with gender (0.173) (Table 3). The distribution of patients' glycemic control based on HbA1c values was: 18.6% diabetic patients had HbA1c >6% manifesting good glycemic control, 25.6% patients had HbA1c between6-8% manifesting reasonable glycemic control, 26.7 % patients had HbA1c between 8-10% manifesting poor glycemic control, and 29.6 % had HbA1c >10% manifesting very poor glycemic control (Fig 1).

Table 1: Mean and standard deviation of numerical variables.

Variable	Minimum	Maximum	Mean	Standard Deviation
Age (years)	8	70	46.9	12.4
HbA1c (mg/dl)	5.1	14.1	8.6	2.3

Table 2: Frequency distribution of numerical variables.

Variable	Distribution	Frequency (n)	Percentage (%)
Age (years)	Less than 50 years	10	11.6
	51-70 years	44	51.2
	More than 70 years	32	37.2
HbA1c (mg/dl)	Less than 6	16	18.6
	6.1-8	22	25.6
	8.1-10	23	26.7
	More than 10	25	29.1

Table 3: Correlation of HbA1c with age and gender.

Variable 1	Variable 1	P value
HbA1c (mg/dl)	Age (years)	<0.001*
	Gender	0.173
**P value calculated using Pearson Square Test*		

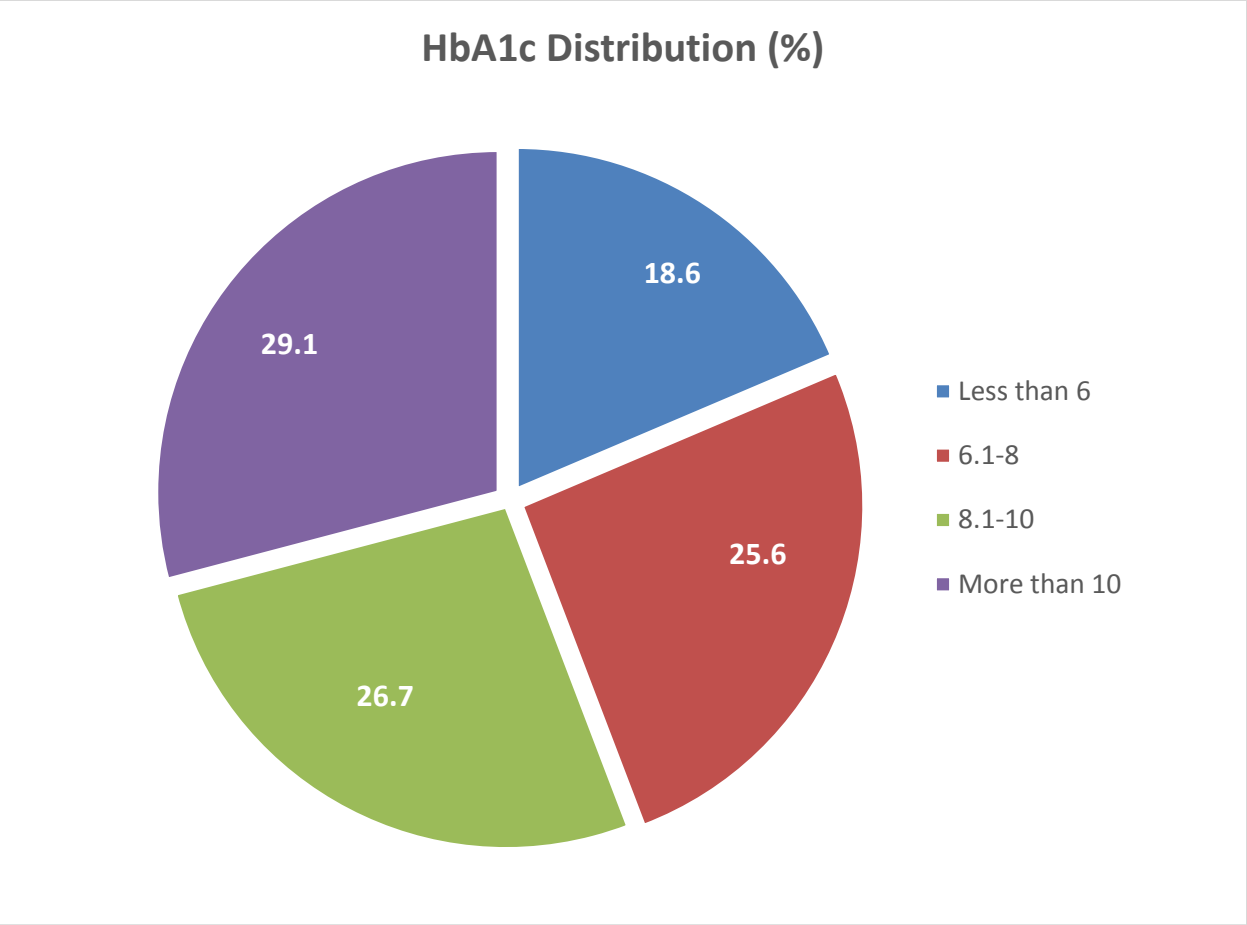

Figure 1: Patient glycemic control based on HbA1c values.

4. Discussion

Due to the high prevalence of diabetes mellitus in Pakistan, optimal glycemic control is paramount to prevent the catastrophic complications linked with prolonged, persisting hyperglycemia. To achieve this purpose, not only dietary and lifestyle modifications are needed, but also effective and regular pharmacotherapy is the need of the day.

In the current study, most patients (29.1%) had very poor glycemic control with HbA1c >10%. About 26.7% had HbAIC between 8-10% while only 25% patients had HbA1c <8%. Almost similar results were reported from other cities of Pakistan (Peshawar and Rawalpindi), about 31% and 30%, respectively (18). The prevalence of poor glycemic control in other regions of Asia is even more alarming, with Iran 20 showing 58.3% people with suboptimal glycemic control (20) and India with 65.4% (21). Our results seem compatible with a Thailand study conducted by Aekplakorn et al., where 30% of patients had suboptimal glycemic control (21). This difference might be due to cultural differences and dietary patterns observed in Thailand.

In the current study, suboptimal glycemic control was observed more in the younger population than in the elderly population. Age was found to be associated with suboptimal glycemic control. This finding coincided with another study from Pakistan, which revealed that the younger population was more at risk for poor glycemic control (22). However, a study from Ghana contradicted this finding (23). Similar contradiction was observed in a study from eastern Sudan. According to a study from Saudi Arabia, old age had a significant relationship with poor glycemic control (24).

No gender discrimination was observed in our present study, with 43 patients being male and 43 females. However, most of the diabetic patients having suboptimal glycemic control in China's Chiang Rai Province (26) were observed to be female having poor socioeconomic conditions. A large number of the diabetic population had poor self-esteem and disease awareness. Compliance with diet and medications was frequently observed.

Like all studies, this study was not without limitations. It was mainly focused on the prevalence of poor glycemic control in the local population of southern KPK, ignoring the key factors and contributors to the phenomenon. Secondly, the duration of diabetes was not taken into consideration which could impact glycemic control in the long run.

5. Conclusion

This study revealed that 26% of diabetic patients belonging to southern KPK had poor glycemic control with HbA1c, more than 8% necessitating either triple-drug therapy or insulin. In comparison, 29% of patients had poor glycemic control, with HBA1C >10% necessitating insulin initiation.

Conflict of Interest The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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