Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com/journal/sjams/home

OPEN ACCESS

Physiology

To study Fasting Blood Sugar and Glycated Haemoglobin Levels (HbA1C) in Diabetes Patients and in Non-Diabetic Subjects of the Patients Visiting Jhalawar Medical College Hospital

Babita Garhwal[1], Dr. M Hamid[2], Bharti Maan[3*], Dr. Priyanka Kumari Mandia[4]

[1]Senior Demonstrator, Department of Physiology Pacific Institute of Medical Science Umarda, Ambua Road, RJ SH 32, Village-Umarda, Udaipur, Rajasthan, India
[2]Head & Professor, Department of Physiology, Jhalawar Medical College, NH12, Kota Rd, Mansarowar Colony, Gayatri Nagar, Jhalawar, Rajasthan, India
[3]Senior Demonstrator, Department of Physiology, JLN Medical College, JLN Marg Near, Jln Medical College Cir, Kala Bagh, Ajmer, Rajasthan, india
[4]Senior Demonstrator, Department of Biochemistry, Churu Medical College, Churu, Shekhawat Colony, Churu, Rajasthan, India

***Corresponding author:** Bharti Maan
| **Received:** 05.01.2019 | **Accepted:** 14.01.2019 | **Published:** 30.01.2019
DOI: 10.36347/sjams.2019.v07i01.043

Abstract | **Original Research Article**

Diabetes is a global disease with rapid increase in both developed and developing countries. Hyperglycaemia is one remarkable feature of diabetes patients. As an important indicator of long-term blood glucose control, glycated haemoglobin (HbA_1C) can reflect cumulative blood glucose for 2-3 months. The aim of this study was to find out association between on fasting blood sugar level and glycaemic control (HbA_1C as a marker) in local type 2 diabetic patients and effect of the antidiabetic treatments. Selected patients were divided randomly in two groups each comprised of 50 patients. 50 were non-diabetic and 50 were diabetes mellitus patients. Fasting blood sugar and glycated haemoglobin (HbA_1C) had shown a significant in study group. Improving medication adherence among type 2 diabetes patients is essential to achieve good glycaemic control.

Keywords: (IDF) International Diabetic Fedration, (T1DM) Type-1 Diabetes Mellitus, (T2DM) Type-2 Diabetes Mellitus, (ADA) American Diabetes Association, Glycated haemoglobin (HbA_1C).

INTRODUCTION

In 2014, the IDF (International diabetic federation) estimated that 8.2% of adults aged 20–79 (387 million people) were living with diabetes; this compares with 382 million people in 2013, and the number of people with the disease was projected to rise beyond 592 million in 2035.

Diabetes was responsible for the deaths of an estimated 4.9 million people worldwide in 2014. There are two major forms of diabetes mellitus, type 1 (T1DM) and type 2 (T2DM). T1DM is a result of absolute insulin deficiency whereas insulin resistance and relative insulin deficiency are the key elements of T2DM. T2DM is often considered as chronic inflammatory disease and preceded or accompanied by the presence of metabolic syndrome. T2DM, which represents the majority of DM cases globally, is now among the most prevalent of all non-communicable diseases [1].

Glycated haemoglobin (HbA_1C) is routinely used marker for long term glycemic control. The formation of glycohemoglobin, especially the hemoglobin A1c (HbA_1C) fraction, occurs when glucose becomes coupled with the amino acid valine in the β-chain of haemoglobin this reaction is dependent on the plasma concentration of glucose [2, 3].

Apart from classical risk factors like dyslipidemia, elevated HbA_1C has now been regarded as an independent risk factor for CVD in subjects with or without diabetes. In accordance with its function as an indicator for the mean blood glucose level, HbA_1C predicts the risk for the development of diabetic complication in diabetes patients.

Estimated risk of CVD has shown to be increased by 18% for each 1% increase in absolute HbA_1C value in diabetic. Positive relationship between HbA_1C and CVD has been demonstrated in non-diabetic cases even within normal range of HbA_1C [4].

The aim of this study was to find out association between on fasting blood sugar level and glycaemic control (HbA_1C as a marker) in local type 2

diabetic patients and effect of the antidiabetic treatments.

MATERIALS AND METHODS

This study was conducted in the Department of Physiology and laboratory of Clinical Biochemistry of S.R.G Hospital attached with Jhalawar Medical College. The subjects in our study groups were selected from outpatient visiting at Department of Medicine, S.R.G. Hospital, Jhalawar.

This study was designed to evaluate a study of association between on fasting blood sugar and glycemic control in type 2 diabetic patient among local Jhalawar population. The present study includes 100 subjects of either sex among them.

- 50 non-diabetic control.
- 50 type 2 diabetic mellitus patient.

Procedure

1) Estimation of fasting blood sugar

Blood glucose in the venous blood was determined by glucose oxidase-peroxidase method using the enzymatic kits (GOD- POD).

Composition

Concentration of ready to use solutions:-

- 2N Sodium hydroxide (NaOH)
- Sodium Sulphate- Zinc sulphate reagent
- Phosphate buffer
- Glucose oxidase reagent

2) Estimation of glycated haemoglobin

The concentration of both glycosylated haemoglobin and total hemoglobin were determined. The HbA_1C / Total hemoglobin ratio is expressed as percentage HbA_1C (% HbA_1C).

RESULTS

In all, 100 subjects (50 control healthy and 50 type 2 diabetic patients) were recruited for the study of which 56 were males and 44 were females. The mean age of the diabetic subjects (50.84±1.32) were not statistically different (p=0.1536) from that of the control subjects (48.14±1.33).

Table-1 Subjects with desirable HbA_1C levels ($HbA_1C \leq 6.0\%$ of Hb) had a lower mean blood glucose (105.62±8.61) as compared with those of higher HbA_1C levels (11.58±3.39 % of Hb) which is highly statistically significant (p<0.001).

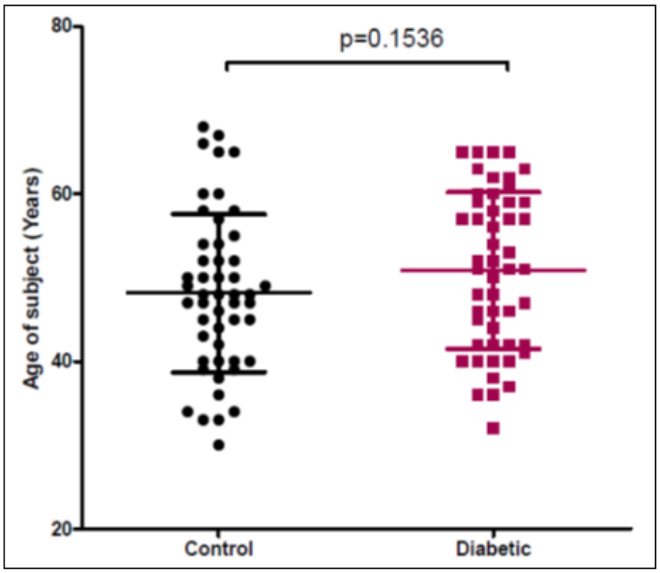

Fig-1: Age of control and diabetic subject (line represented the mean age of respective group ± SD). Data are compared using unpaired t test. p<0.05 was considered as significant

Table-1: Demographics and clinical variables of the study population

Parameters	Cases (n=100)	Control (n=50)	Diabetic (n=50)	p-value
Age (Years)	49.49±0.95	48.14±1.33	50.84±1.32	p=0.1536
Weight (Kg)		64.72±11.41	67.12±12.95	p=0.327
Female (%)	44%	42%	46%	-
Height (CM)	161.54±8.51	162.56±8.62	160±8.37	p=0.135
BMI (Kg/m^2)	26.41±4.02	24.29±2.44	26.01±4.30	p=0.015
Fasting Blood glucose (mg/dl)		105.62±8.61	258.68±83.37	p<0.001
HBA1c		5.27±0.33	11.58±3.39	p<0.001

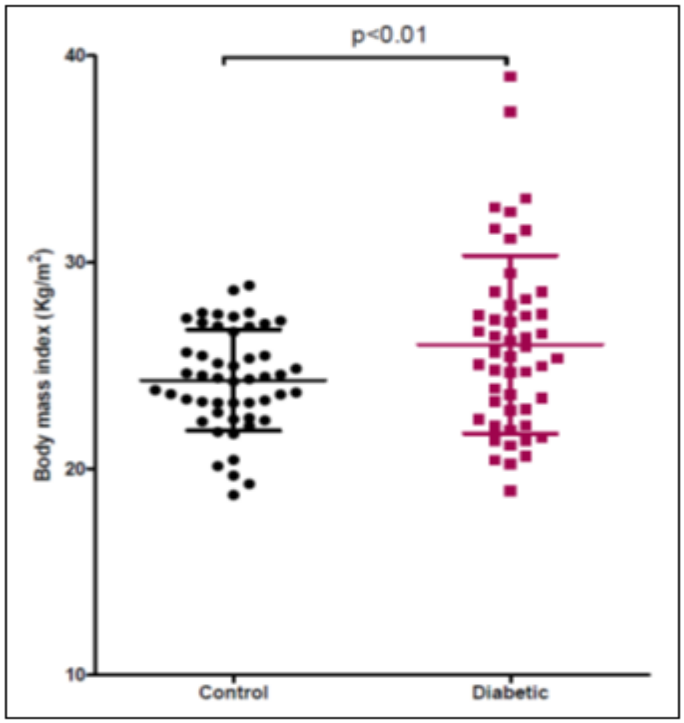

Fig-2: Body mass index distribution in control and diabetic subject groups. Data are plotted as scatter point with mean (Horizontal line) ± S.D. (vertical line below and above of mean) and analysed using unpaired t-test .p<0.05 considered as significance level

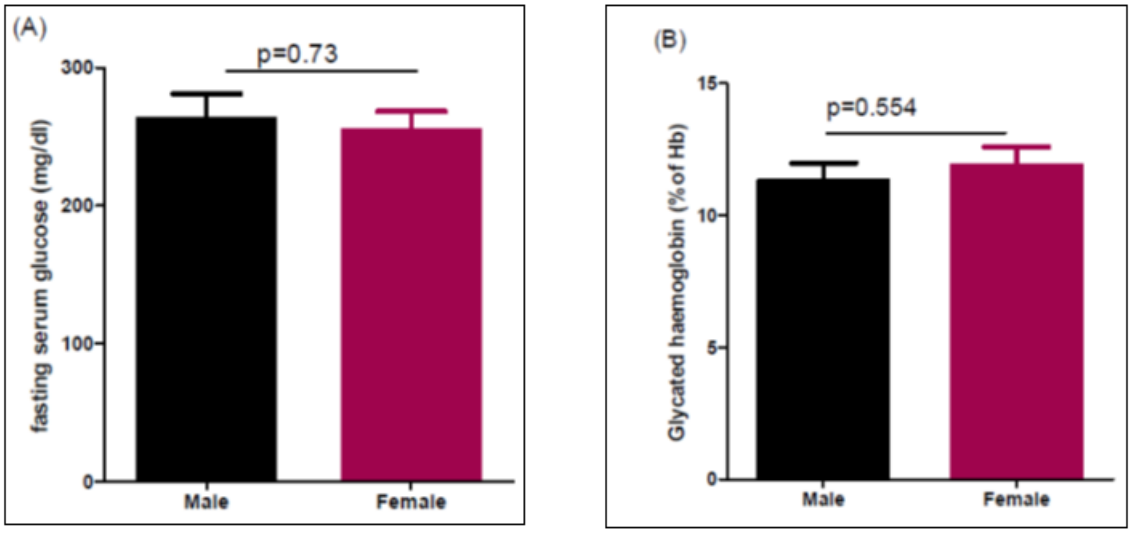

Fig-3: Distribution of clinical parameter fasting glucose and glycated haemoglobin between male and female in diabetic subject group. Data are represented as mean ± S.D. and analysed using unpaired t-test .p<0.05 considered as significance level

DISCUSSION

In this study, 100 subjects (50 control and 50 type 2 diabetic patients attending the diabetic clinic at the Jhalawar Medical College and Hospital, Jhalawar Rajasthan) were randomly selected for the study.

It was observed that fasting blood sugar levels in type 2 diabetic patients had a positive correlation with glycated haemoglobin. A significant correlation between HbA_1C and FBS in this study is similar with various previous studies [5-7]. This is because consistent high levels of glucose leads to more amount of carbohydrate attached to the HbA_1C [8, 9].

Subjects with higher HbA_1C levels also had significantly higher in mean body mass index (BMI) as compared with those of desirable HbA_1C levels. Diabetic patients showed significant higher BMI compared to control in current study (Fig-3). However, we did not observe significant correlation between the BMI and glycated haemoglobin levels in the diabetic subject. BMI also did not show any correlation with fasting sugar levels (FBS).

Body mass index appears to be associated with metabolic risk factors, incident CVD events, and death. The metabolic and cardiovascular risks associated with obesity are attributed to the presence of visceral adipose tissue (VAT), which promotes insulin resistance and dyslipidaemia. Studies have also established a relationship between HbA_1C levels and BMI [10, 11].

CONCLUSION

Diabetes is a global disease with rapid increase in both developed and developing countries. Hyperglycaemia is one remarkable feature of diabetes patients. As an important indicator of long-term blood glucose control, glycated haemoglobin (HbA_1C) can reflect cumulative blood glucose for 2-3 months. Diabetes Complications and Control Trial has established HbA_1C as the gold standard for glycaemic control, and proposes HbA_1C at <7% as critical value for reducing the risk of vascular complications.

The HbA_1C can be used as a potential biomarker for predicting dyslipidaemia in type 2 diabetic patients in addition to glycaemic control hence early diagnosis can be accomplished through relatively inexpensive blood testing and may be utilized for screening high-risk diabetic patients for timely intervention with lipid lowering drugs.

Improving medication adherence among type 2 diabetes patients is essential to achieve good glycaemic control.

REFERENCES

1. American Diabetes Association. Diagnosis and classification of diabetes mellitus, 2014.
2. Shapiro R, McManus MJ, Zalut C, Bunn HF. Sites of nonenzymatic glycosylation of human hemoglobin A. Journal of Biological Chemistry. 1980 Apr 10;255(7):3120-7.
3. Trivelli LA, Ranney HM, Lai HT. Hemoglobin components in patients with diabetes mellitus. New England Journal of Medicine. 1971 Feb 18;284(7):353-7.
4. Selvin E, Marinopoulos S, Berkenblit G, Rami T, Brancati FL, Powe NR, Golden SH. Meta-analysis: glycosylated hemoglobin and cardiovascular disease in diabetes mellitus. Annals of internal medicine. 2004 Sep 21;141(6):421-31.
5. Khaw KT, Wareham N, Bingham S, Luben R, Welch A, Day N. Association of hemoglobin A1c with cardiovascular disease and mortality in adults: the European prospective investigation into cancer

in Norfolk. Annals of internal medicine. 2004 Sep 21;141(6):413-20.
6. Masram SW, Bimanpalli MV, Ghangle S. Study of lipid profile and glycated hemoglobin in Diabetes mellitus. Indian Medical Gazette. 2012;145(7):257-65.
7. VinodMahato R, Gyawali P, Raut PP, Regmi P, Singh P, Raj D, Gyawali P. Association between glycaemic control and serum lipid profile in type 2 diabetic patients: Glycated haemoglobin as a dual biomarker. Biomedical research. 2011;22(3).
8. Kilpatrick ES, Rigby AS, Atkin SL. The effect of glucose variability on the risk of microvascular complications in type 1 diabetes. Diabetes care. 2006 Jul 1;29(7):1486-90.
9. Verma M, Paneri S, Badi P, Raman PG. Effect of increasing duration of diabetes mellitus type 2 on glycated hemoglobin and insulin sensitivity. Indian Journal of clinical biochemistry. 2006 Mar 1;21(1):142.
10. Patiakas S, Charalampous C. Correlation Between The Glycated Hemoglobin (Hba1c) Level, The Arterial Blood Pressure (AP) And The Body Mass Index (BMI) In Diabetic Patients, And Evaluation Of Its Utility As AC: Pp. 17.170. Journal of Hypertension. 2010 Jun 1;28:e300.
11. Webster CR, Mahaffy PR, Atreya SK, Flesch GJ, Mischna MA, Meslin PY, Farley KA, Conrad PG, Christensen LE, Pavlov AA, Martín-Torres J. Mars methane detection and variability at Gale crater. Science. 2015 Jan 23;347(6220):415-7.