eISSN:2413-6096 ljmr.ly

Original Article

Correlation between glycated haemoglobin level and hypertension in Libyans with type- II diabetes mellitus

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Abstract

Objective: Hypertension and diabetes are closely related morbidities. There is research examining the correlation between blood pressure (BP) and glycated haemoglobin (HbA1c) levels in diabetes mellitus. The objective of the current study was to investigate the correlation between high BP and glycated haemoglobin (HbA1c) levels.

Materials and methods: In a cross-sectional study, 47 diabetic patients in (Diabetes & Endocrinology Center Tripoli – Libya) were chosen. Blood pressure was measured using a mercury sphygmomanometer, and Serum HbA1c and Lipids were measured by enzymatic method Cobas Integra. HbA1c was measured by immunoturbidimetrically COBAS INTEGRA. Correlation (Pearson) analysis was used to explore the association between hypertension and hyperglycemia. Independent risk factors for systolic and diastolic BP were analyzed using correlation.

Results: Subjects in HbA1c group type-II diabetes mellitus (n = 47), as compared with healthy control HbA1c (n = 23). There were strong significant correlations between glycated haemoglobin (HbA1c) and Systolic blood pressure (SBP) (r=0.436**, P=0.001), significant correlations between glycated haemoglobin and Diastolic blood pressure (DBP) (r=0.133, P=0.269), had a significantly higher risk for hypertension, respectively. correlation analysis revealed that HbA1c was an independent factor of systolic and diastolic BP.

Conclusions: The study presents a correlation between hyperglycemia and hypertension in type-II diabetes, our findings suggest that hyperglycemia as well as higher HbA1c within the type-II diabetes range is associated with a higher prevalence of hypertension independent of other cardiovascular risks.

Keywords:diabetes mellitus, glycated haemoglobin HbA_{1c}, diabetes, hypertension.

eISSN:2413-6096 ljmr.ly

Citation.; Elhegagi Akram. M:, Correlation between glycated haemoglobin level and hypertension in Libyans with type- II diabetes mellitus 16(2):https://doi.org/10.54361/ljmr.16210

Received: 05/010/22**accepted**: 11/11/22; **published**: 31/12/22

Introduction

According to WHO global health estimates, chronic non-communicable diseases (NCDs) are the second leading cause of death in Africa. In 2011, within the broad category of NCDs, stroke, hypertensive heart disease, diabetes mellitus (DM), and chronic kidney disease have been identified to account for 30% of the 9.5 million deaths, and 25.8% of the 675.4 million disability-adjusted life years (DALYs) recorded[1].

According to the Annual Statistical Report 2016. In 2016, cardiovascular diseases were estimated to account for 35% of deaths in Libya [2].

The stepwise survey by the Libyan Cardiac Society (LCS), National Center for Disease Control (NCDC), and Ministry of Health-Libya (2009) reported that the percent-age of hypertension was 40.6% [2].

The percentage of people suffering from high diabetes in Libya, according to the results of the risk factors survey for chronic diseases that was conducted in 2009, was 16.4%, and the percentage reaches 23.7% if an impaired diabetic metabolism is added to it, and this represents nearly a quarter of the adult population [3].

Hypertension and type-II diabetes are common comorbidities. Hypertension is twice as frequent in patients with diabetes compared with those who do not have diabetes[4].

hypertension (HTN or HT), also known as high blood pressure (HBP), is a long-term medical condition in which the blood pressure in the arteries is persistently elevated. High blood pressure typically does not cause symptoms.[5].

High blood pressure is classified as primary (essential) hypertension or secondary hypertension. About 90–95% of cases are primary, defined as high blood pressure due to nonspecific lifestyle and genetic factors [5].

Diabetes mellitus is a chronic disease that affects the lives of millions

around the world. It is a metabolic disease characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. classification of diabetes mellitus Type-I and type-II[6].

In health, insulin maintains glucose homeostasis by integrated actions on carbohydrate, protein, and lipid metabolism. Loss of sensitivity to aspects of insulin action (insulin resistance) principally affects the liver, muscle, and adipose tissues and is selective for glucose and lipid metabolism, eg, sparing insulin's action to retain sodium in the distal tubule. Reduction in insulin-mediated glucose disposal leads to compensatory hypersecretion of insulin to maintain homeostasis: Glucose intolerance ensues if this endocrine pancreas response is inadequate, although some obese individuals avoid type II by a supranormal B-cell response.

Recently, the role of adipose tissue in these associations has been increasingly appreciated[4].

Diabetes is associated with both macrovascular (involving large arteries such as conduit vessels) and microvascular (involving small arteries and capillaries) disease. Chronic hyperglycemia and insulin resistance play an important role in the initiation of vascular complications of diabetes and involve several mechanisms including one increased formation of advanced glycation end products (AGEs) and activation of the receptor for advanced glycation end products (RAGE) AGE-RAGE axis, tow oxidative stress, and three inflammation. In addition, emerging evidence suggests a role for microRNAs (miRNAs) in the vasculopathy of diabetes (see further on). Hypertension is an important risk factor for diabetes-associated vascular complications because hypertension itself is characterized by vascular dysfunction and injury [4].

Some a study had shown that there is a significant positive correlation between glycated haemoglobin and High blood pressure

The goal of the study is to add supportive evidence about the implication of high serum levels of HbA1c in the development of Hypertension in type-II diabetic patients. This research may partially participate in solving the existing conflict and controversial opinions about this issue.

Material and methods

Blood samples were collected from 47 type-II diabetic patients and 23 controls. Patients and controls were matched for age. The aged 30- 84 years from diabetes and endocrinology centers in Tripoli - Libya. Fasting overnight venous blood samples (about10 ml) were

drawn by the researcher himself into vacutainer plane tubes from all individuals. The blood was left for a while without anticoagulant to allow blood to clot. Then, serum samples were obtained by centrifugation at room temperature at 5000 rpm/ 5 minutes.

Determination of serum Glucose, HbA1c, and lipid profile by Cobas Integra 400 plus

The Roche Cobas Integra 400 plus

The Roche Cobas Integra 400 plus chemistry analyzer is used for diagnostic clinical chemistry testing. Classic chemistry, electrolytes, specific proteins, therapeutic drug monitoring, drugs of abuse, and thyroid hormone testing are consolidated into one system with one reagent cassette design.

BP Measurements: BP was measured using a mercury sphygmomanometer by an experienced physician. Subjects were in a seated position with an arm flexed at the level of the heart. After the cuff was wrapped around the upper arm with the cuff's lower edge one inch above the antecubital fossa, the cuff was rapidly inflated to 180 mmHg. Then the air was released from the cuff at a rate of 3 mm/s. During this period, the physician listened carefully with a stethoscope while simultaneously observing the sphygmomanometer. The first knocking sound (Korotkoff) was the subject's systolic pressure. When the knocking sound disappeared, that was the diastolic pressure. BP was measured in either the right upper or left upper arm after each subject had been seated for at least 10 min. [7]

The arm with the higher blood pressure would be measured twice. The average was used for analysis. If the difference of SBP or DBP between the twice was over 5 mmHg, it would be measured for the third time, and then the average of three times was used for analysis.[7]

Hypertension was defined as systolic blood pressure (SBP) ≥140 mmHg and/or diastolic blood pressure (DBP) ≥ 90 mmHg or reported receiving antihypertensive medication. [7]

Results

A total (of 70) subjects comprising 47 diabetic and 23 controls were included in the present study. Measurement of blood pressure and HbA1c, blood glucose, and lipid profile were done in all the groups. Who attended (Diabetes & Endocrinology Center Tripoli – Libya).

Table-1. Sample characteristics of group A and group B.

Age in years		Group A	Group B
25 - 49		16	15
50 - 69		5	21
70 +		2	11
Total N (70)		23	47
Age mean (years)		46.86 ± 12.77	56.59 ± 14.60
Gender (Male/Female)		14/9	28/19
Hypertension	No	20	19
	Yes	3	28

Group A: non- diabetic, Group B: diabetic

Serum analysis:

Table 2: Comparison of mean values of variables in Type-II Diabetes Mellitus and healthy control groups

Sl.No.	Parameter mg/dl	Group	N	Mean ±SD	t	*P*-Value
1.	FBS	Group A	23	91.67±13.85	6.35	0.001
		Group B	47	227.42±101.65		
2.	HbA_{1c}	Group A	23	5.36±0.37	10.77	0.001
		Group B	47	9.83±1.96		
3.	Systolic blood pressure	Group A	23	118.69±9.19	4.24	0.001
		Group B	47	136.61±19.13		
4.	Diastolic blood pressure	Group A	23	77.39±6.88	2.63	0.13
		Group B	47	83.21±11.47		
5.	LDL– cholesterol	Group A	23	128.74±32.72	1.19	0.12
		Group B	47	110.74±31.83		
6.	Triglyceride	Group A	23	160.34±84.94	2.18	0.66
		Group B	47	132.84±67.51		
7.	Cholesterol	Group A	23	183.17±29.30	2.45	0.13
		Group B	47	161.31±44.29		

(Reference range of FBS =70-110 mg/dl. Reference range of HbA_{1c} = 4-6 mg/dl. Reference range of Cholesterol = 50-200mg/dl. Reference range of Triglycerides = 50-200 mg/dl. Reference range of LDL-C = 10-100 mg/dl. Group A: non- diabetic, Group B: diabetic

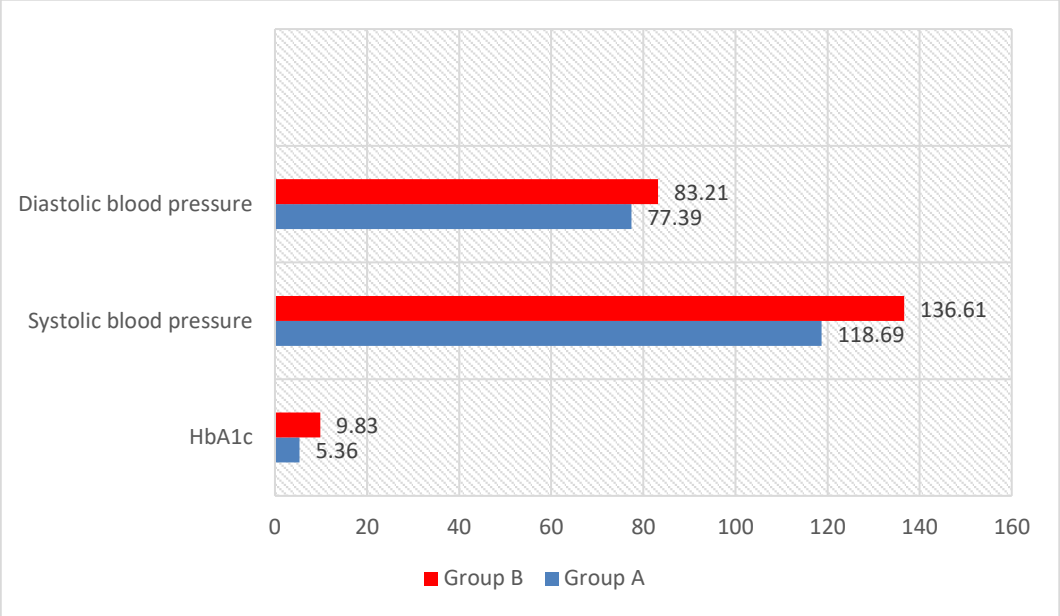

Figure 1: Comparisons of HbA_{1c} level & blood pressure in diabetic and healthy control

Table 3: Correlation of HbA_{1c} values with blood pressure parameters

Sl.No.	Parameter mg/dl	HbA_{1c}	
		Pearson correlation(r)	*P*-value
1.	Systolic blood pressure	0.436**	0.001
2.	Diastolic blood pressure	0.133	0.269
3.	LDL-C	-0.176	0.142
4.	Triglyceride	-0.169	0.161
5.	Cholesterol	-0.145	0.228

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Discussion

The age and gender-wise distribution of the study subjects are given as shown in Table 1. They were in the age group of 30 - 84 years. The mean age of diabetic subjects was 56.59± 14.60 years whereas the controls were in the age group of 30 - 84 and the mean age was 46.86± 12.77 years. Out of 47diabetic28 were males and 19 were females and in the case of 23 controls 14 were males and 9 were females.

The blood pressure was measured separately as systolic blood pressure and diastolic blood pressure. The results of blood pressure measurement are shown in Table 2. and Figure 1. The mean systolic blood

pressure (SBP) of diabetic subjects was 136.61±19.13mmHg and that of controls was 118.69±9.19 mmHg. The mean systolic blood pressure was found to be higher significant in diabetic subjects than in controls ($p < 0.05$). The mean diastolic blood pressure (DBP) of diabetics was 83.21±11.47 mmHg and that of controls was 77.39±6.88 mmHg. The mean diastolic blood pressure of diabetics was not found significant to controls ($p>0.05$). The mean HbA1c in diabetics was 9.83±1.96% and that of among normal healthy controls was 5.36±0.37 %. The mean HbA1c in diabetics was higher than in normal healthy controls and the difference between the two groups was found to be statistically higher significant ($p < 0.001$) in diabetic subjects. The results of HbA1c levels are shown in Table 2 and Figure 1. This study showed a weak significant (0.133) correlation between HbA1c with Systolic blood pressure in type-II diabetic subjects. And the present study in type-II diabetic subjects shows a highly positive significant (0.436) correlation of HbA1c levels with Systolic blood pressure.

This study showed observed a highly positive significant correlation between HbA1c and Systolic blood pressure in type-II diabetic subjects; but, in there was a weak correlation between HbA1c and Diastolic blood pressure in type-II diabetic subjects.

Conclusion

The result of this case study presents a correlation between type-II DM in patients with blood pressure. There is a highly positive significant correlation between the levels of HbA1c concentration and blood pressure of type-II diabetes individuals.

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