Measurement of Glycated Hemoglobin and Levels of Depression in Diabetic Patients in Kirkuk City, Iraq

Jalank Hameed Mahmoud

Department of Community Health Techniques ,Technical Institute of Kirkuk ,
Northern Technical University , Iraq.

Abstract

Laboratory tests use percentage of glycated hemoglobin (% HbA1c) to check diabetes control. Worldwide, Diabetes is the most dramatic disease of all current human health problems. The objectivity of this study is to assess the relationship amongst hemoglobin which is glycated and levels of depression in volunteer participants . 90 participants were divided into three categories according to their glycated hemoglobin measured level (Hb A1c) as follows: normal (4 - 5.6 %) , risky (5.7 - 6.4 %) , and DM ($6.5 \geq$ %) .participants were assessed using the Likert depression scale. The evidence for the relation between high Hb A1c and depression was clear. A high significant level of mild depression was observed among the diabetic ($6.5 \geq$ %) category 44 (71.0%) of the rest. DM category also showed 14 cases of moderate depression 2(3.2%) , while not found in the rest (0.0%).Thus, it was concluded that high glucose levels and depression are interrelated .

Key words : *Laboratory tests , Diabetes , glycated hemoglobin*

Introduction

Diabetes Mellitus (DM) becomes a continuing concern for public health in the continent of Asia, in which over than 110 mls people suffer from diabetes, with large numbers of them dying, reaching more than a million people annually [1,2]. According to the International Diabetes Federation, "Diabetes is one of the biggest global health emergencies of the 21st century."[3-5] . It is a metabolic disorder is renowned for increasing glucose of blood due to impaired for each insulin groping or secretion, or all [6,7].Also, it has been seen as a lifestyle disorder. Having diabetes makes the patient suffer from stress and tension (depression), which makes the disease worse for him[8]. Glycated hemoglobin (Hb A1c) is a kind of hemoglobin which can be testified primarily to determine normal amount of condensation of plasma glucose for long times. Previously, diabetes was diagnosed with plasma glucose measurement ,and recently has been relying on the level of Hb A1c level of $\geq$ 6.5 % in the diagnosis of DM[9,10]. It is a result of the mixture of drates that are found basically in serum and hemoglobin in erythrocytes[11] . It is treated as the golden standard measure of blood sugar regulation for diabetics, which reflects exposure to glucose during the previous 2 to 3 months [12-14]. There is an association between Hb A1c and depression, and this has been seen in previous studies but has not been adequately followed up[15.] The results and evidence of the previous studies were not uniform and fixed

regarding the relationship between Hb A1c and depression[16-20], therefore the relationship between them will be evaluated in this study.
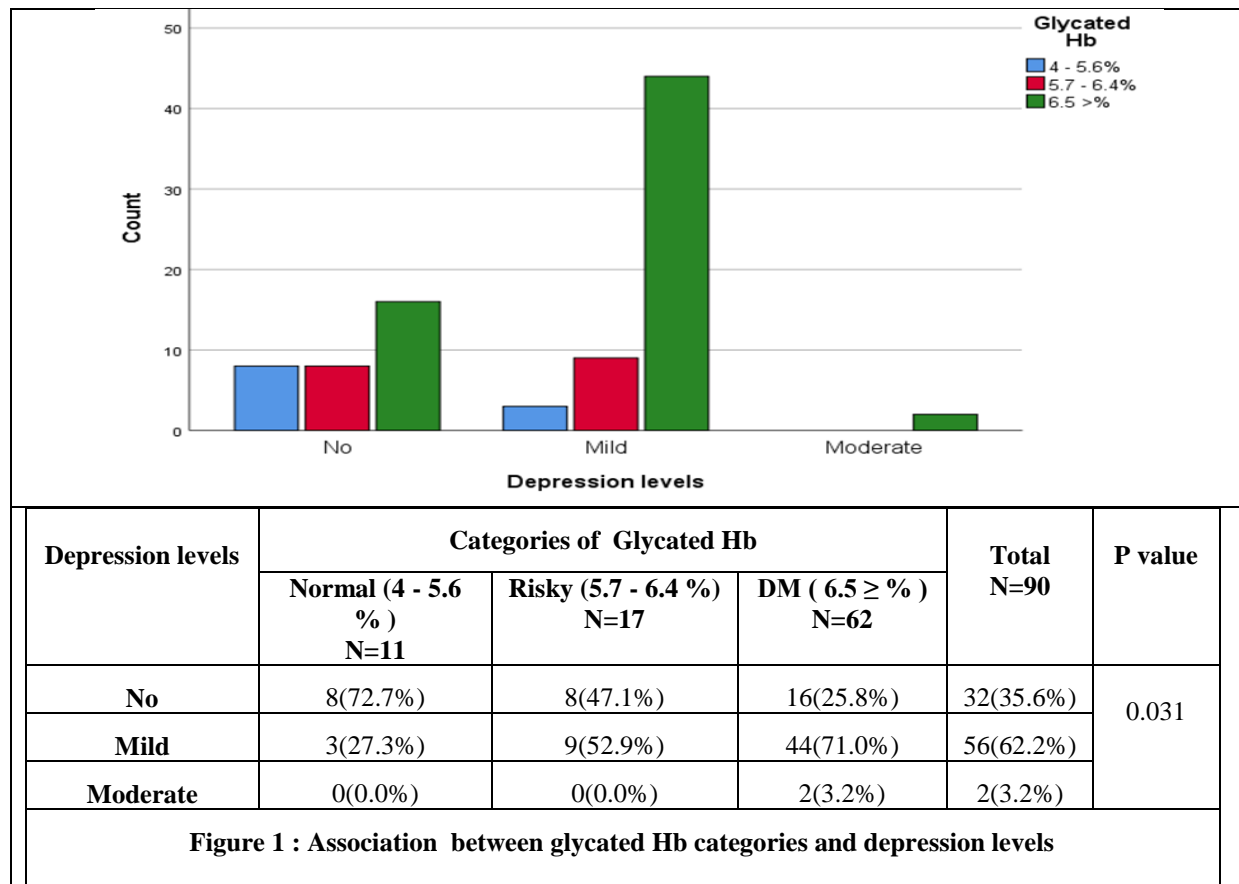
Methods

This cross-sectional study was conducted from 1st, January till 20th March 2021 among 90 participants. It was conducted in private laboratories located in the city of Kirkuk, Iraq. The number of males was 41(45.6%) while the number of females was 49(54.4%) of different ages. Participating individuals completed the survey and gave the data and information for this study . Glycated Hemoglobin (HbA1c) levels were measured between 8-10 in the morning after a fast that lasted between 10-12 hours. AFIAS-1 HbA1c was used for evaluation HbA1c (fluorescence immunoassay for the quantitative determination of HbA1c). In order to recognize and distinguish symptoms and levels of depression, patients completed the Likert Depression Scale Score (previously validated (.The questionnaire consists of 9 items , score obtained by adding scores for each item .the study classified those who participated in the incidence of depression, who scored as follows: a- normal (no depression) : 0 point ,b- minimum to mild:1-9 points , and c-moderate : 10-19 points. A test known as chi − square was employed for clear-cut variables. Data were analyzed by using IMB SPSS version 26, and statistical importance was well-thought-out at a p-value of <0.05.

Results

The main feature of this investigative groups are shown in (Table-1). The highest glycated hemoglobin was restricted to the age group (61 ≥) years 28 (45.2%).While, there was no statistically significant differences between the participants with respect to gender, check glucose , and the period of diagnosis of DM. Cross-tabulation was performed to describe the relationship of glycated Hb categories with levels of depression. Results showed more depression evidences in DM category, 44 (71.0%) in comparison with 9 (52.9%); 3(27.3%) in normal and risky categories . In addition, there was 2(3.2%) as moderate level of depression , while no depression was recorded in the other categories . As shown in figure 1.

Table 1 : Distribution of Categories of Glycated Hb according to: age / year, gender , and check glucose levels

Baseline characteristics		Categories of Glycated Hb				p value
		Normal (4 - 5.6 %) N=11	Risky (5.7 - 6.4 %) N=17	DM (6.5 ≥ %) N=62	Total N=90	
Age	21-40	6(54.5%)	4(23.5%)	14(22.6%)	24(26.7%)	0.034
	41-60	3(27.3%)	10(58.8%)	20(32.3%)	33(36.7%)	
	61 >	2 (18.2%)	3 (17.6%)	28 (45.2%)	33(36.7%)	
Gender	Female	7(63.6%)	10(58.8%)	32(51.6%)	49(54.4%)	0.702
	Male	4(36.4%)	7(41.2%)	30(48.4%)	41(45.6%)	
Check Glucose Levels	No	1(9.1%)	2(11.8%)	4(6.5%)	7(7.8%)	0.252
	Sometimes	4(36.4%)	3(17.6%)	30(48.4%)	37(41.1%)	
	Always	6(54.5%)	12(70.6%)	28(45.2%)	46(51.1%)	

Depression levels	Categories of Glycated Hb			Total N=90	P value
	Normal (4 - 5.6 %) N=11	Risky (5.7 - 6.4 %) N=17	DM (6.5 ≥ %) N=62		
No	8(72.7%)	8(47.1%)	16(25.8%)	32(35.6%)	0.031
Mild	3(27.3%)	9(52.9%)	44(71.0%)	56(62.2%)	
Moderate	0(0.0%)	0(0.0%)	2(3.2%)	2(3.2%)	

Figure 1 : Association between glycated Hb categories and depression levels

Discussion

HbA1c is an important glycemic marker in diabetes management, and its benefit cannot be utilited enough [21]. HbA1c can directly correlate with glucose levels , and it is formed by taking glucose molecules together with hemoglobin. With an increase in the average amount of glucose in the plasma, the fraction of glycated hemoglobin increases in a predictable manner[22]. Patient health and risk of developing glycemic disorders requires consideration of relevant factors disruption of the normal HbA1c level . According to previous studies, it has been determined that older people without diabetes appear to have higher HbA1c values than younger individuals, even after setting it on fasting and glucose for two hours[23] .

There has been a large great literature dealing with the association amongst diabetes and higher symptoms of depression [24-27]. However, research on the association between HbA1c and the occurrence of depressive symptoms could be restricted. The outcomes revealed baseline HbA1c was related with an increase in and elevation of depression. That's where those results were not affected by further adjustment in the socio-demographic level, timely occurrence of diabetes, fasting glucose, and other confounding factors correlated to depression . In addition, symptoms of depression and cognitive decline coexisted in late life [28] . The mechanisms underlying HbA1c's relationship to high post-risk of depressive symptoms remain unclear. "Vascular depression" may be a hypothesis that provides an explanation for the relationship [29] , HbA1c reverses the glycemic control of diabetics, and the cerebral blood vessels and the practical area could be prone to often controlling the glycemic level worse. On the other hand, risk factors were associated with later life, increased HbA1c levels and symptoms of depression[30,31] .

Conclusions

The outcomes of this study clarified that there is a significant relationship amongst higher Hb A1c level and the presence of symptoms of depression.

References

1- Niraula K, Kohrt BA, Flora MS, Thapa N, Mumu SJ, Pathak R, Stray-Pedersen B, Ghimire P, Regmi B, MacFarlane EK, Shrestha R. Prevalence of depression and associated risk factors among persons with type-2 diabetes mellitus without a prior psychiatric history: a cross-sectional study in clinical settings in urban Nepal. BMC psychiatry. 2013 Dec;13(1):1-2.

2- Sami W, Ansari T, Butt NS, Ab Hamid MR. Effect of diet on type 2 diabetes mellitus: A review. International journal of health sciences. 2017 Apr;11(2):65.

3- SIBA PN. Reversing Type 2 Diabetes Through Functional Medicine. Indian Journal of Clinical Practice. 2021 Feb;31(9).

4- Maladkar M, Patil S, Viswanathan H. Redefining the Therapeutic Wheel of Diabetes Management. Journal of Cardiology & Cardiovascular Therapy. 2018;12(2):28-34.

5- Puppalwar G, Sawant S, Silgiri B, Shukla K, Barkate H. Evaluation of Safety and Efficacy of Glaritus® versus Lantus® in Combination with Insulin Lispro among Adults with Type 1 Diabetes Mellitus-Phase IV Study. Open Journal of Endocrine and Metabolic Diseases. 2017 Apr 30;7(04):111.

6- Bawadi H, Al-Shahwani A, Arafeh D, Al-Asmar D, Moawad J, Shi Z, Daher-Nashif S. Depressive Symptoms among Patients with Diabetes in Qatar: Frequency and Potential Determinants. InHealthcare 2021 Mar (Vol. 9, No. 3, p. 302). Multidisciplinary Digital Publishing Institute.

7- Punthakee Z, Goldenberg R, Katz P. Definition, classification and diagnosis of diabetes, prediabetes and metabolic syndrome. Canadian journal of diabetes. 2018 Apr 1;42:S10-5.

8- Krishna P. Depression, anxiety, and stress levels in patients with type 2 diabetes mellitus. National Journal of Physiology, Pharmacy and Pharmacology. 2018;8(11):1570-2.

9- Bansal P, Nayak P, Sharma BD. Understanding glycosylated haemoglobin. JIACM. 2014;15(3-4):220-1.

10- Ghosal S, Sinha B, Majumder M, Misra A. Estimation of effects of nationwide lockdown for containing coronavirus infection on worsening of glycosylated haemoglobin and increase in diabetes-related complications: a simulation model using multivariate regression analysis. Diabetes & Metabolic Syndrome: Clinical Research & Reviews. 2020 Jul 1;14(4):319-23.

11- Huang Y, Xu Y, Liu A. Increased Levels of Serum Glycosylated Hemoglobin are Associated with Depressive Symptoms in a Population with Cancer (≥ 49 Years): An Antidepressant-Stratified Analysis. Clinical Interventions in Aging. 2021;16:205.

12- Kohata Y, Ohara M, Nagaike H, Fujikawa T, Osaka N, Goto S, Fukase A, Kushima H, Hiromura M, Terasaki M, Mori Y. Association of hemoglobin A1c, 1, 5-anhydro-D-glucitol and glycated albumin with oxidative stress in type 2 diabetes mellitus patients: a cross-sectional study. Diabetes Therapy. 2020 Mar;11(3):655-65.

13- Radin MS. Pitfalls in hemoglobin A1c measurement: when results may be misleading. Journal of general internal medicine. 2014 Feb 1;29(2):388-94.

14- Ketema EB, Kibret KT. Correlation of fasting and postprandial plasma glucose with HbA1c in assessing glycemic control; systematic review and meta-analysis. Archives of Public Health. 2015 Dec;73(1):1-9.

15- Gibbons CH. Treatment-induced neuropathy of diabetes. Current diabetes reports. 2017 Dec;17(12):1-6.

16- Lee SY, Wang TY, Chen SL, Chang YH, Chen PS, Huang SY, Tzeng NS, Wang LJ, Lee IH, Chen KC, Yang YK. Combination of dextromethorphan and memantine in treating bipolar spectrum disorder: a 12-week double-blind randomized clinical trial. International journal of bipolar disorders. 2020 Dec;8(1):1-2.

17- Zhu L, Chandran SR, Tan WB, Xin X, Goh SY, Gardner DS. Persistent Anxiety Is Associated with Higher Glycemia Post-Transition to Adult Services in Asian Young Adults with Diabetes. Korean Diabetes Journal. 2020 Jun 15.

18- Indelicato L, Calvo V, Dauriz M, Negri A, Negri C, Trombetta M, Bonora E. Depressive symptoms and glycaemic control in adults with type 1 diabetes: an exploratory study on the role of family functioning. Acta diabetologica. 2020 Jan;57(1):23-30.

19- Maraldi C, Volpato S, Penninx BW, Yaffe K, Simonsick EM, Strotmeyer ES, Cesari M, Kritchevsky SB, Perry S, Ayonayon HN, Pahor M. Diabetes mellitus, glycemic control, and incident depressive symptoms among 70-to 79-year-old persons: the health, aging, and body composition study. Archives of internal medicine. 2007 Jun 11;167(11):1137-44.

20- Hamer M, Batty GD, Kivimaki M. Haemoglobin A1C, fasting glucose and future risk of elevated depressive symptoms over 2-years follow up in the English Longitudinal Study of Ageing. Psychological medicine. 2011 Sep;41(9):1889.

21- Kovatchev BP. Metrics for glycaemic control—from HbA 1c to continuous glucose monitoring. Nature Reviews Endocrinology. 2017 Jul;13(7):425-36.

22- Nathan DM, Turgeon H, Regan S. Relationship between glycated haemoglobin levels and mean glucose levels over time. Diabetologia. 2007 Nov;50(11):2239-44.

23- Hempe JM, Gomez R, McCarter Jr RJ, Chalew SA. High and low hemoglobin glycation phenotypes in type 1 diabetes: a challenge for interpretation of glycemic control. Journal of diabetes and its complications. 2002 Sep 1;16(5):313-20.

24- Golden SH, Lazo M, Carnethon M, Bertoni AG, Schreiner PJ, Roux AV, Lee HB, Lyketsos C. Examining a bidirectional association between depressive symptoms and diabetes. Jama. 2008 Jun 18;299(23):2751-9.

25- Rotella F, Mannucci E. Diabetes mellitus as a risk factor for depression. A meta-analysis of longitudinal studies. Diabetes research and clinical practice. 2013 Feb 1;99(2):98-104.

26- Maraldi C, Volpato S, Penninx BW, Yaffe K, Simonsick EM, Strotmeyer ES, Cesari M, Kritchevsky SB, Perry S, Ayonayon HN, Pahor M. Diabetes mellitus, glycemic control, and incident depressive symptoms among 70-to 79-year-old persons: the health, aging, and body composition study. Archives of internal medicine. 2007 Jun 11;167(11):1137-44.

27- Chen H, Mui AC. Factorial validity of the Center for Epidemiologic Studies Depression Scale short form in older population in China. International psychogeriatrics. 2014;26(1):49.

28- Aarts S, Van den Akker M, van Boxtel MP, Jolles J, Winkens B, Metsemakers JF. Diabetes mellitus type II as a risk factor for depression: a lower than expected risk in a general practice setting. European journal of epidemiology. 2009 Oct 1;24(10):641-8.

29- Ganguli M, Du Y, Dodge HH, Ratcliff GG, Chang CC. Depressive symptoms and cognitive decline in late life: a prospective epidemiological study. Archives of general psychiatry. 2006 Feb 1;63(2):153-60.

30- Taylor WD, Aizenstein HJ, Alexopoulos GS. The vascular depression hypothesis: mechanisms linking vascular disease with depression. Molecular psychiatry. 2013 Sep;18(9):963-74.

31- Wrighten SA, Piroli GG, Grillo CA, Reagan LP. A look inside the diabetic brain: Contributors to diabetes-induced brain aging. Biochimica et Biophysica Acta (BBA)- Molecular Basis of Disease. 2009 May 1;1792(5):444-53.