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Relationship between HbA1c and Continuous Glucose Monitoring in Jordanian Population: Two Centre Study

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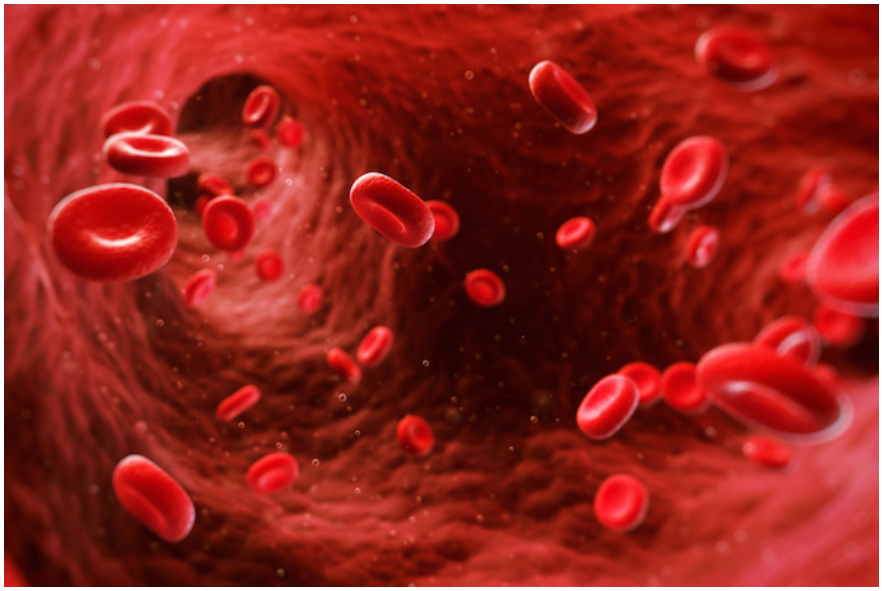


Abstract:
Objectives: The purpose of this study was to discover the relationship between the continuous glucose monitoring and HbA1c in two medical centers in Jordan.

Method: A method-comparison design was used. The analysis applied on 567 patients. The entire sample completed testing for HbA1c levels and 24 hours glucose level; the results were analyzed using regression analysis tools.

Results: The analysis results shows that HbA1c level was strongly correlated with 24 hours continuous glucose monitoring (r = 0.627).

Conclusion: Regression analysis shows a very strong positive relation (Pearson correlation r =0.627) between the values of the blood glucose level and the HbA1c levels which may be an added value to the Jordanian researcher's data bases.

Key Words: HbA1c, Blood Glucose, Accuracy, Regression Analysis.

1. Introduction:

Hemoglobin (Hb) consists of four protein subunits, each containing a hememoity, and is the red –pigmented protein located in the erythrocytes. Its main function is to transport oxygen and carbon dioxide in blood. Each Hb molecule is able to bind four oxygen molecules. Hb consists of variety of subfractions and derivatives. Among this heterogeneous group of hemoglobins HbA1c is one of the glycated hemoglobins(1) , a subfraction formed by the attachment of various sugars to the Hb molecule. HbA1c is formed in two steps by the nonenzymatic reaction of glucose with the N-terminal amino group of the B-chain of normal adult Hb(HbA) . The first step is reversible and yields labile HbA1c. This is rearranged to form stable HbA1c in a second reaction step.

In the erythrocytes, the relative amount of HbA converted to stable HbA1c increases with the average concentration of glucose in the blood (2). The conversion to stable HbA1c is limited by the erythrocyte's life span of approximately 100 to 120 days. As a result, HbA1c reflects the average blood glucose level during the preceding 2 to 3 months. HbA1c is the thus suitable to monitor long-term blood glucose control in individuals with diabetes mellitus. Glucose levels closer to the time of the assay have a greater influence on the HbA1c level.

The risk of diabetic complications such as diabetic nephropathy and retinopathy, increases with poor metabolic control .In accordance with it is function as an indicator for the mean blood glucose level, HbA1c predicts the development of diabetic complications in diabetes patients (3),(4).

For monitoring of long term glycemic control, testing every 3 to 4 months is generally sufficient. In certain clinical situations, such as gestational diabetes, or after a major change in therapy, it may be useful to measure HbA1c in 2 to 4 week intervals.

Glucose is the major carbohydrate present in the peripheral blood. Oxidation of glucose is the major source of cellular energy in the body. Glucose derived from dietary sources is converted to glycogen for storage in the liver or to fatty acids for storage in adipose tissue. The concentration of glucose in blood is controlled within narrow limits my many hormones, the most important of which are produced by the pancreas.

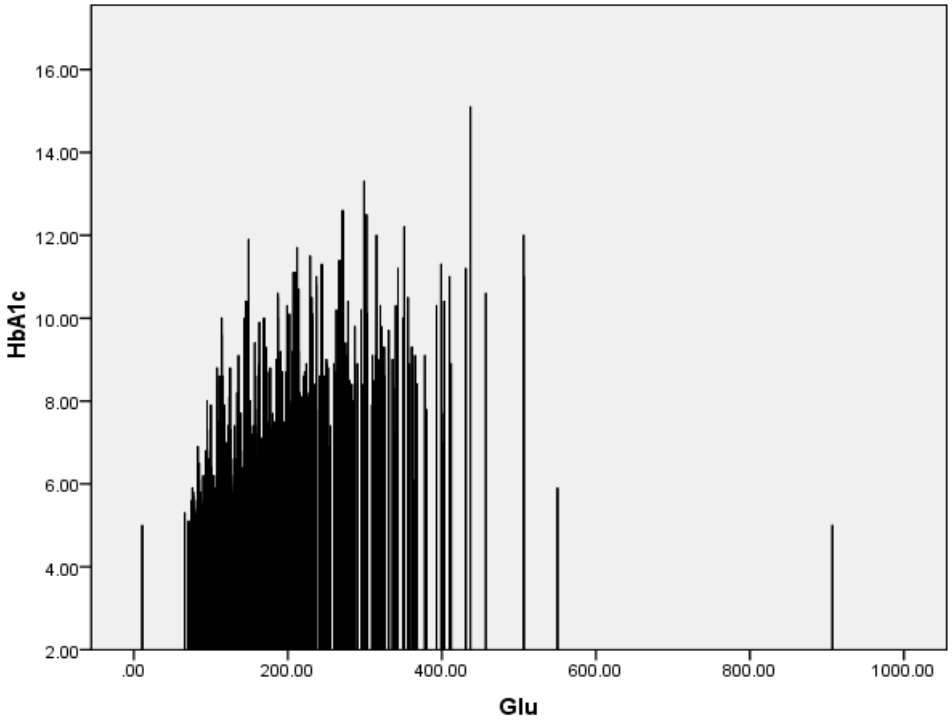
The most frequent cause of hyperglycemia is diabetes mellitus resulting from a deficiency in insulin secretion or action. A number of secondary factors also contribute to elevated blood glucose levels. These include pancreatitis, thyroid dysfunction, renal failure, and liver disease.

Hypoglycemia is less frequently observed. A variety of conditions may cause low blood glucose levels such as insulinoma, hypopituitarism, or insulin induced hypoglycemia. Glucose measurements are used in the diagnosis and treatment of carbohydrate metabolism disorders including diabetes mellitus and idiopathic hypoglycemia. Glucose measurement in urine is used as a diabetes screening procedure and to aid in the evaluation of glucosuria, to detect renal tubular defects, and in the management of diabetes mellitus. Glucose measurement in cerebrospinal fluid is used for evaluation of meningitis, neoplastic involvement of meninges, and other neurological disorders.

Diabetes has become a major public health problem in Jordan, some Jordanian officials said that about 31% of the populations are suffering from this disease, and in some years the cost of the treatment of this disease raise to about 1.6 trillion Jordanian dinars.

1.1 Materials and Methods:

A total of 576 patients from two medical centers in Jordan were enrolled in this study between 2016 and 2017. This study was approved by the ethics committee in the Royal medical services. Criteria for selecting patients based on no history of diabetes, where we collect the following data:



2. Results and Discussion

The analysis results shows that HbA1c level was strongly correlated with 24 hours continuous glucose monitoring (r = 0.627).

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Glu[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: HbA1c

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.627[a]	.393	.392	1.50992

a. Predictors: (Constant), Glu Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.469	.158		22.005	.000
	Glu	.016	.001	.753	21.235	.000

a. Dependent Variable: HbA1c

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.753[a]	.567	.565	1.19169

a. Predictors: (Constant), Glu

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.627[a]	.393	.392	69.41132

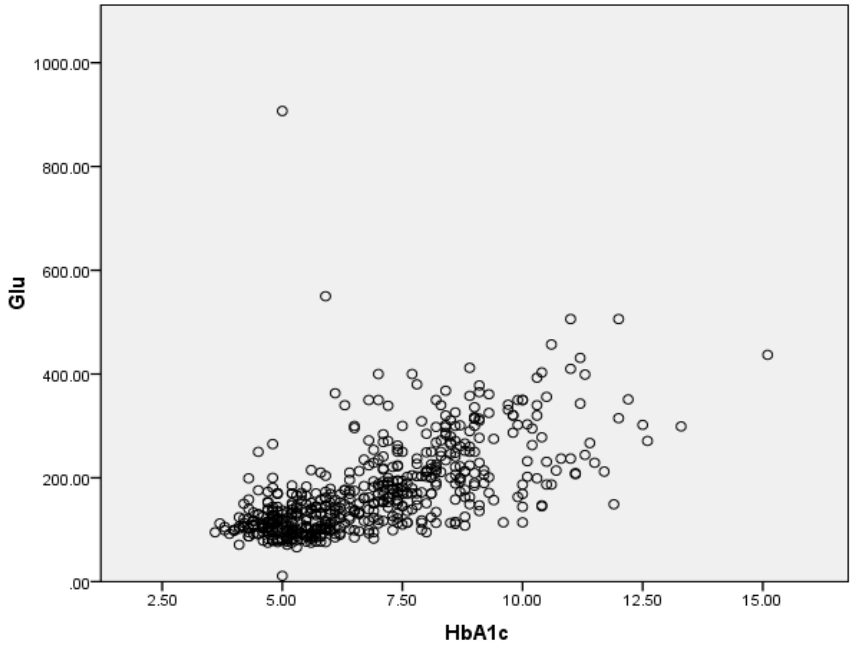
a. Predictors: (Constant), HbA1c

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	834.139	1	834.139	365.873	.000[a]
	Residual	1288.120	565	2.280		
	Total	2122.259	566			

a. Predictors: (Constant), Glu

b. Dependent Variable: HbA1c



Conclusion:

Regression analysis shows a very strong positive relation (Pearson correlation r =0.627) between the values of the blood glucose level and the HbA1c levels which may be an added value to the Jordanian researcher's data bases.

In the future studies we might shift the normal range of blood glucose level to 125, as we can see that as the values of blood glucose level reach as maximum 125, when HbA1c scattered around 5.0 which is normal.

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