Original Article

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Correlation of Glycated Albumin with Glycated Hemoglobin as a Marker for Assessment of Beta Cell Function in Type 2 Diabetes

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Author`s Contribution

[1,6]Substantial contributions to the conception or design of the work or the acquisition, methodology, analysis, Final approval of the version to be published. [2,3,5]Active Participation in active, [4]Drafting the work or revising it critically for important intellectual content

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ABSTRACT

Objective: To evaluate a relationship between Glycated Albumin and Hba1c in comparison to Serum as predictor for Beta Cell Function in and type-2 diabetes population.

Methodology: A descriptive cross-sectional study was conducted among 163 diabetic patients, aged 30 to 70 years and both genders who presented at the LUMHS Civil/Jamshoro OPD and wards with diagnosis of Diabetes Mellitus for at least 6 months or more. A 5cc blood sample was collected from each participant using EDTA tubes for the analysis of glycated albumin and glycated hemoglobin. All data collection procedures were conducted with utmost regard for participant privacy and confidentiality using study proforma and spss version 26 was used for analysis.

Results: The mean age of the participants was 62.06±11.03 years. Out of 163 patients 50.3% were male and 49.6% were female. Correlation analyses of the findings had revealed that a significant correlations p<0.001was present between HbA1C levels and glycated hemoglobin levels whereas a significant relation was also found between Body Mass Index and HbA1C and glycated hemoglobin levels.

Conclusion: The study concludes that both glycated albumin were recorded high among diagnosed type 2 diabetic mellitus patients, with a strong correlation between HbA1C levels and glycated hemoglobin levels whereas a significant relation was also found between Body Mass Index and HbA1C and glycated hemoglobin levels.

Key words: Glycated Albumin and Hba1c, Diabetes mellitus

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Introduction

Type 2 Diabetes Mellitus (T2DM) is a common metabolic illness that affects people all over the world. The global prevalence of Type 2 Diabetes (T2D) has increased dramatically, notably in the second half of the twentieth century, with instances among youngsters becoming increasingly common.[1] Diabetes accounted for nearly 12% of total health expenditures in 2010, totaling at least $376 billion. This expenditure is expected to climb to roughly $490 billion by 2030.[2] According to the International Diabetes Federation (IDF) diabetes atlas of 2017, Pakistan ranks 10th out of 221 nations in terms of diabetes cases, with an estimated 7.5 million people aged 20 to 79 afflicted.[3] Unfortunately, as the World Health Organization (WHO) highlighted in 2016, Pakistan has considerable hurdles in its national response to diabetes.[4]

Diabetes emergence is essentially due to the interaction of two major factors: reduced insulin production by pancreatic -cells and decreased responsiveness of insulin-sensitive tissues to insulin[5]. It is critical to maintain a

careful balance between insulin release and action in order to fulfil metabolic needs. As a result, it is critical to precisely regulate the molecular pathways involved in insulin production, release, and tissue response. Any deviations from these complicated mechanisms might disturb metabolic balance, contributing to the etiology of T2DM. Insulin, a hormone generated by pancreatic -cells, is critical in controlling blood glucose levels. -cells efficiently sense glucose levels and produce insulin in response to enable glucose absorption by diverse tissues under normal conditions[6]. However, in those with T2DM, -cells may not secrete insulin properly. Impaired insulin release can be caused by hereditary causes, environmental conditions, or a mix of the two.[7] Furthermore, insulin-sensitive tissues such as muscle, liver, and adipose tissue play an important role in glucose homeostasis. Insulin signaling is required for these tissues to absorb glucose from the circulation and use it for energy or storage. In people with T2DM, these tissues may become resistant to insulin's effects, resulting in decreased glucose absorption and utilization. The complex molecular processes controlling insulin production, release, and tissue response are highly regulated.[8] Changes in any of these systems can upset the delicate balance between insulin supply and demand, eventually leading to the development of T2DM.

A thorough knowledge of these pathways is required for the development of focused therapy approaches to successfully manage T2DM. Assessing glycemic control accurately is critical for improving the results and survival of diabetic patients on hemodialysis.[9] The best accurate glycemic measure for glucose management in these individuals, however, is still being debated. This is because a variety of clinical and pharmacological variables might affect the accuracy with which accessible biomarkers represent a patient's glycemic state. The precision of glycosylated hemoglobin (HbA1c%) as a measure for mean blood glucose levels in diabetic patients on hemodialysis remains debatable.[10] Glycated albumin (GA%), on the other hand, has emerged as a viable alternative that indicates glycemic control over a shorter time period.[11] GA% may be more useful in predicting clinical outcomes in hemodialysis patients and might be used to evaluate glycemic control in diabetics. In our study the objective is to establish a relationship between Glycated Albumin and Hba1c in comparison to Serum as predictor for Beta Cell Function in and type-2 diabetes population. With our expected outcomes clinicians will inch closer to long term issue of glycemic control and insulin dependency in population of diabetes, and with this their outcome can be monitored efficiently to avoid massive complications.

Methodology

This descriptive cross-sectional study was carried out at LUMHS, Jamshoro/Hyderabad, in conjunction with the Department of Physiology and the Medical Unit and Diagnostic Research Laboratory. Study was lasted for six months after the summary was approved. The sample size was derived using the prevalence of diabetes in Pakistan, which is about 26.7%, yielding a sample size of 163 people. The non-probability purposive sampling approach was used to pick samples. Individuals with Type-2 diabetes who presented at the LUMHS Civil/Jamshoro OPD and wards with diagnosis of Diabetes Mellitus for at least 6 months or more were eligible for the study. Patients with diabetic diagnosed less than 6 months before, patients having known co-morbidities specifically related to liver and kidney diseases and patients having other co-morbidities like cardiac or blood related issues were excluded. Study was done after receiving approval from the LUMHS Jamshoro ethics committee. Prior to participation, each subject provided informed permission.

Participants were requested to complete thorough questionnaires in order to collect the necessary data. These questionnaires were particularly created to collect key demographic information and research characteristics such as age, gender, length of diabetes diagnosis, and any current co-morbidities. A 5cc blood sample was collected from each participant using EDTA tubes for the analysis of glycated albumin and glycated hemoglobin. These tubes contain an anticoagulant to prevent clotting and maintain sample stability. The levels of glycated albumin and glycated hemoglobin were assessed in the laboratory following standard procedures. Glycated albumin serves as a marker for short-term blood sugar management, while glycated hemoglobin reflects long-term blood sugar levels. Both indicators are useful for evaluating beta cell activity in individuals with Type 2 diabetes. Blood samples for serum analysis were collected in gel tubes. Centrifugation was employed to separate serum from blood cells in these tubes. The isolated serum samples were then subjected to a series of laboratory tests to analyze specific research criteria. It's important to note that the volunteers incurred no financial obligations for participating in the study. All data collection procedures were conducted with utmost regard for participant privacy and confidentiality. The data collection approach was meticulously planned to ensure relevance and specificity to the study objectives, and

appropriate exclusion criteria were applied to minimize potential bias.

The statistical software tool SPSS version 26.0 was used for data analysis. For quantitative data, the mean and standard deviation (SD) were determined, whereas frequency and percentage (%) were calculated for categorical variables. Statistical significance was defined as a p-value of 0.05. The Pearson correlation coefficient was used to investigate the relationship between glycated albumin and glycated hemoglobin as indicators for evaluating beta cell activity in Type 2 diabetes.

Results

The demographic characteristics of the participants had revealed that the mean age of the participants include in the study were 62.06±11.03 years. Male participants were 50.3% and female participants were 49.6% in the study population. Average body mass index of the participants was estimated as 29.3±3.14kg/m^2. The average values of both glycated hemoglobin levels and glycated albumin levels were recorded as 8.13±1.06% and 17.18±1.59 respectively. The demographic description was illustrated in table I

To determine a correlation between glycated albumin and glycated hemoglobin levels Pearson correlation test was applied at 95% of Confidence Interval. The analyses of the findings had revealed that a significant correlations p<0.001was present between HbA1C levels and glycated hemoglobin levels whereas a significant relation was also found between Body Mass Index and HbA1C and glycated hemoglobin levels. a significant correlation was found between age and glycated hemoglobin levels p=0.00, similarly a correlation between BMI and glycated hemoglobin and BMI and glycated hemoglobin was also found significant p<0.05. However, the correlation between glycated hemoglobin and glycated albumin was also significant p=0.001. The details regarding the correlation between the variables were demonstrated in table II

Graphical representation illustrating the correlation between the variables are illustrated in figure 2 a and b as under.

Discussion

The results showed that glycated haemoglobin and glycated albumin levels were both higher among the patients. The patients had an average glycated haemoglobin level of 8.13±1.06. Glycated albumin was 17.18 ±1.59. To explore the relationship between glycated albumin and glycated hemoglobin levels, a Pearson correlation test was conducted at a 95% confidence interval. The results of this analysis demonstrated a significant correlation (p<0.001) between HbA1C levels and glycated hemoglobin levels. This indicates that as the levels of glycated hemoglobin increase, the levels of HbA1C also tend to rise. Additionally, the study investigated the association between body mass index (BMI) and both HbA1C and glycated hemoglobin levels.

The analysis revealed a significant relationship between BMI and HbA1C as well as glycated hemoglobin levels. This suggests that higher BMI values may be associated with elevated levels of both HbA1C and glycated hemoglobin. There is strong evidence that persistent hyperglycemia, as measured by glycated haemoglobin (HbA1c), increases the risk of diabetic complications, including both microvascular and macrovascular events.

Table I: Demographic Characteristics of Participants included in the study.

Variables	Mean age	BMI	Gender		Glycated Hemoglobin	Glycated Albumin
			Male	Female		
Values	62.06±11.03 years	29.3±3.14kg/m^2	82(50.3%)	81(49.6)	8.13±1.06	17.18±1.59

Table II: Correlation between variables. (Pearson Correlation test)

Variables		Age	Gender	BMI	HbA1C	Glycated Albumin
Age	**Pearson Correlation**	1	0.123	0.150	0.89	0.283**
	Sig (2-tailed)	-	0.115	0.055	0.256	0.00
Gender	**Pearson Correlation**	0.123	1	-0.17	-0.183*	0.085
	Sig (2-tailed)	0.115	-	0.826	0.018	0.28
BMI	**Pearson Correlation**	0.15	-0.17	1	0.209**	0.325**
	Sig (2-tailed)	0.055	0.826	-	0.007	0.000
HbA1C	**Pearson Correlation**	0.089	-0.183*	0.209**	1	0.258**
	Sig (2-tailed)	0.256	0.018	0.007	-	0.001
Glycated Albumin	**Pearson Correlation**	0.283**	0.085	0.325**	0.258**	1
	Sig (2-tailed)	0.00	0.280	0.000	0.001	-

***Correlation is significant at the 0.01 level (2-tailed)n*Correlation is significant at the 0.05 level (2-tailed)*

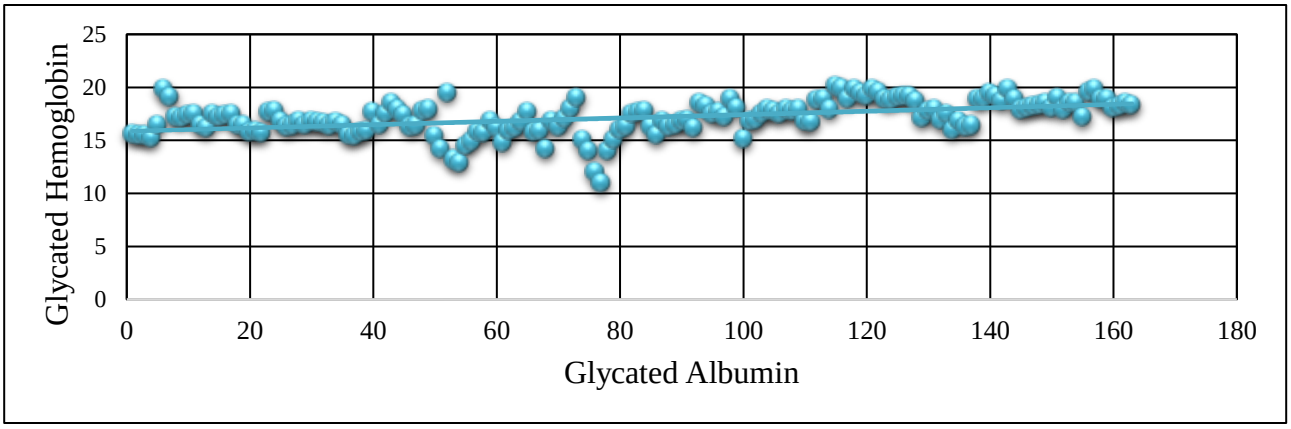

Figure 2a Correlation between HbA1C and Glycated Albumin

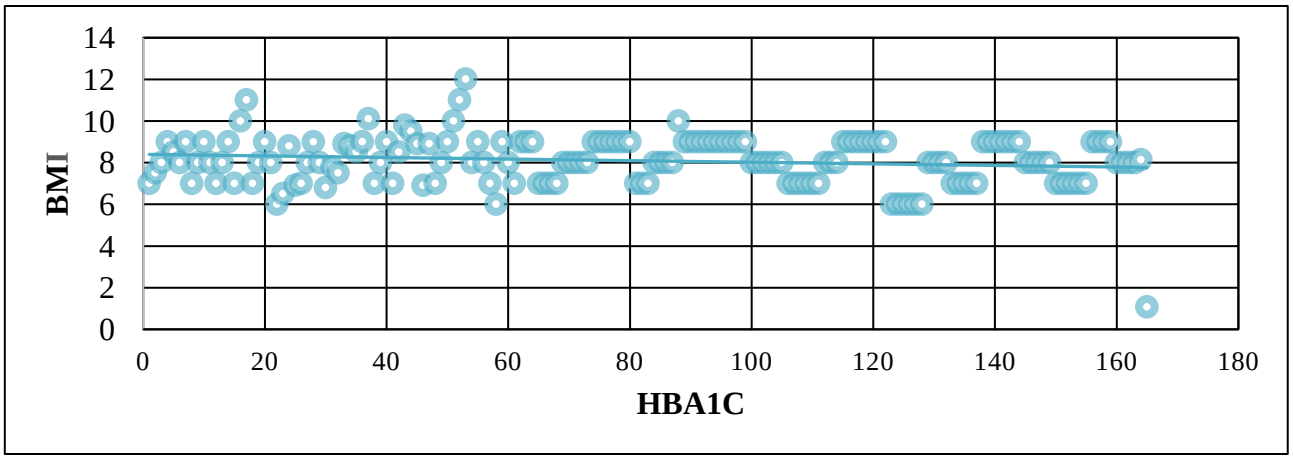

Figure 2a. Correlation between HbA1C and Glycated Albumin.

Higher levels of average hyperglycemia, as evidenced by elevated HbA1c readings, have consistently been related to an increased risk of diabetic complications.[12] The risk is especially high when HbA1c levels are significantly higher, such as when they approach 8% (64 mmol/mol). Several randomized controlled trials (RCTs) have shown that lower HbA1c levels are related with a decreased risk of microvascular problems.[13-15] The data on the influence of HbA1c on all-cause mortality and cardiovascular disease (CVD) risk, on the other hand, has been less consistent or persuasive. It should be noted that average HbA1c levels may not entirely explain the risk variance reported across individuals. Additional parameters, such as HbA1c fluctuation across time, have been demonstrated to enhance microvascular event prediction. Recent studies using latent growth modelling have emphasized the significance of HbA1c trends across time. In both type 1 and type 2 diabetes populations, a systematic review of observational studies published in 2015 found some evidence supporting an association between HbA1c variability and an increased risk of cardiovascular events, all-cause mortality, and certain microvascular outcomes (such as retinopathy and neuropathy).[16] Higher fluctuation in HbA1c levels was related with an increased risk of complications among the T2DM patients included in the study. This demonstrates the potential use of HbA1c as a diagnostic tool for T2DM, as well as its utility in predicting the risk of numerous diabetes-related comorbidities.[17] Overall, while average HbA1c values give crucial information about glycemic management in T2DM, it is becoming clear that HbA1c fluctuation over time may also play a role in determining the risk of complications. More study is required to understand the processes behind the link between HbA1c fluctuation and diabetes outcomes, as well as the therapeutic implications for diabetes care.

Conclusion

The study concludes that both glycated albumin were recorded high among diagnosed type 2 diabetic mellitus patients, with a strong correlation between HbA1C levels and glycated hemoglobin levels whereas a significant relation was also found between Body Mass Index and HbA1C and glycated hemoglobin levels.

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