Interrelationship between glycated hemoglobin and fasting blood sugar on status of diabetic retinopathy among type 2 diabetic patients at a tertiary hospital in northwestern Nigeria

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Introduction: Diabetic retinopathy (DR) is the most common cause of preventable blindness in the world's adult working population.[1] More than 60% of patients with type 2 diabetes mellitus (DM) will develop some degree of retinopathy after 20 years with the disease.[2] DR is the most common complication of DM and is expected to increase substantially by 2045.[3]

Glycated hemoglobin (HbA1c) reflects the average blood glucose level over about three months, but may mask clinically significant glycemic fluctuations.[4] Current screening methods may be missing those at highest risk of DR. Glycemic gap refers to the difference between the estimated average glucose derived from HbA1c and the measured fasting blood sugar (FBS). Glycemic gap can act as a useful surrogate marker of glycemic fluctuation.[5]

Methods: The study was a hospital-based observational cross-sectional study involving 329 patients selected consecutively. The study population were type 2 diabetic patients attending routine diabetic clinic at Aminu Kano Teaching Hospital (AKTH). Patients with chronic kidney disease and media opacities were excluded.

All participants underwent:

- Fasting blood samples for HbA1c and FBS, collected at the same time
- Comprehensive ophthalmic examination including dilated fundoscopy and fundus photography
- Early Treatment Diabetic Retinopathy Study (ETDRS) grading of DR
- Calculation of Glycemic Gap = FBS - [(28.7 × HbA1c) – 46.7][5]

Results: The participants' ages ranged from 26 to 77 years with a mean of 53.78 ± 11.58 years. The prevalence of diabetic retinopathy was 28.9%. The mean glycemic gap for the entire study population was 10.0 mg/dl, with a range of -63.5 mg/dl to +52.8 mg/dl. Among the participants, 187 (56.8%) had a positive glycemic gap and 142 (43.2%) had a negative glycemic gap. There was a significant association between the level of glycemic gap and the presence of diabetic retinopathy (p = 0.015). Patients with positive glycemic gap were significantly more likely to have diabetic retinopathy compared to those with negative glycemic gap (Table 1).

Table 1: Association between glycemic gap and presence of Diabetic Retinopathy

	Diabetic Retinopathy			
Glycemic gap	Yesn = 94	Non = 232	$\chi 2$	P value
Positive	79 (42.2%)	108 (57.8%)	37.714	<0.001
Negative	16 (11.3%)	126 (88.7%)		

Discussion: The prevalence of DR in this study is comparable to the global prevalence[6] and the prevalence figures from a pooled analysis of various hospital-based studies in Africa[7] and in Enugu[8] and Katsina[9] states. The mean glycemic gap was lower than that reported by Sonoda[10] and slightly higher than that reported by Caprnda[11]. This may be due to differences in the study design. A significant association was found between glycaemic variability (GV) measured as glycemic gap and diabetic retinopathy, aligning with findings from several recent studies. [5,12,13,14] However, studies by Sonoda[10] and Caprnda[11] reported no association. This discrepancy may be attributed to differences in the methods used to evaluate GV, as both studies utilized the mean amplitude of glycemic excursions index. A positive glycemic gap drives DR through repetitive oxidative stress and endothelial dysfunction, triggering pericyte loss, VEGF upregulation and blood-retinal barrier breakdown.

Conclusion: This study showed a significant association between glycemic gap as a marker for glycemic variability and diabetic retinopathy.

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