Comparison of HbA1c and FPG for the diagnosis of type 2 diabetes- A population based study from urban and rural Delhi, India

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Background

Glycated Hemoglobin (HbA1c) has been introduced as a complementary diagnostic test for type 2 diabetes and pre-diabetes. However, its performance as a screening test has not been well characterized in many ethnic groups including Asian Indians.

Aim

This study evaluated the concordance between HbA1c and Fasting Plasma Glucose (FPG) in the diagnosis of pre-diabetes and diabetes in Indian population.

Methods

- ❖ A representative cross-sectional survey was carried out in urban and rural areas of the National Capital Region of Delhi, India among adults aged 30 years and above using a multistage cluster random sampling method.
- ❖ Individuals with medical history of diabetes and those who have not provided blood samples were excluded from data analysis.
- ❖ An individual was diagnosed to have diabetes, if the HbA1c value was $\geq 6.5\%$. Pre-diabetes was defined as HbA1c value between 5.7% and 6.4%.
- ❖ In addition and for comparison, diabetes was also diagnosed as individuals with FPG ≥ 126 mg/dl, and pre-diabetes was classified as FPG between 100mg/dl and 125 mg/dl.

Results

- ❖ The study included 3878 individuals (1729 males and 2149 women) with mean (SD) age of 47.2(13.5) years.
- ❖ Based on HbA1c, the prevalence of newly diagnosed diabetes and pre-diabetes was 6.1 % [95%CI: 5.4 %-6.9%] and 16.9% [95%CI: 15.8%-18.1%] respectively.
- ❖ Using FPG based criteria, the prevalence of diabetes and pre-diabetes was 7.2% [95%CI: 6.4%-8.0%] and 38.7% [95%CI: 37.1%-40.3%].
- ❖ There is significant discordance in the diagnosis of diabetes and pre-diabetes between FPG and HbA1c measurements (Table 1).
- ❖ Those with isolated high HbA1c were significantly inactive, overweight/obese, hypertensive with unfavourable total cholesterol compared to isolated high FPG group (Table 2).
- ❖ Those who were categorised as 'diabetes' by both FPG and HbA1c criteria were predominantly males with poor cardiovascular risk compared to isolated high FPG, isolated high HbA1c and normoglycemic groups.

Table-1: Diagnostic classifications by HbA1c and FPG

Diagnosis based on FPG	Diagnosis based on HbA1c		
	Normoglycemic	Pre-diabetes	Diabetes
Normoglycemic	1749 (60.5%)	233 (37.5%)	31 (14.5%)
Pre-diabetes	1058 (36.6%)	327 (52.7%)	59 (27.6%)
Diabetes	83 (2.9%)	61 (9.8%)	124(57.9%)

Numbers in brackets are percentages of column-wise total. This analysis was based on data from 3725 individuals whose data were available for both HbA1c and FPG

Table -2: Characteristics of study population according to glycemic status

	Normo-glycemic n(%) n-3367	Isolated high FPG n(%) n-144	Isolated high HbA1c n(%) n-90	Both high FPG and HbA1c n(%) n-124	P value for trend
Age (in years), mean (SD)	45.7 (12.8)	51.5 (14.4)	51.8(13.5)	50.8 (10.8)	<0.001
Gender: <i>Female</i>	1897 (56.3%)	67 (46.5%)	52(57.8%)	47 (37.9%)	<0.001
Location: <i>Urban</i>	1835 (54.5%)	72 (50.0%)	49 (54.4%)	76 (61.3%)	0.32
BMI: 23-24.99kg/m ²	540 (16.1%)	21 (14.6%)	11 (12.2%)	17 (13.7%)	<0.001
BMI ≥ 25 kg/m ²	1334 (39.8%)	78 (54.2%)	53 (58.9%)	91 (73.4%)	
Abdominal Obesity: Waist-Hip-Ratio >0.90 cm for men and >0.85 cm for women	2286 (68.3%)	121 (84.0%)	75 (83.3%)	114(91.9%)	<0.001
Total Cholesterol (TC) ≥ 200 mg/dl	1035 (30.8%)	50 (34.7%)	32 (35.6%)	66 (53.2%)	<0.001
HDL <40 mg/dl for men and <50 mg/dl for women	1507 (44.8%)	71 (49.3%)	44 (48.9%)	77 (62.1%)	<0.001
Dyslipidaemia: High TC or High LDL or Low HDL or on Lipid lowering medications	1940 (57.8%)	104 (72.2%)	64 (71.1%)	114(91.9%)	<0.001
Hypertension: SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg or on medications	1090 (32.4%)	69 (48.3%)	45 (50.0%)	74(59.7%)	<0.001
Sedentary Behaviour : Based on GBD 2013 recommendations	303 (10.0%)	15 (13.2%)	12 (15.8%)	13(12.4%)	0.017
Current smoking	860 (25.5%)	47(32.6%)	23 (25.6%)	36 (29.0%)	0.24
Current alcohol use	807 (24.0%)	41 (28.5%)	19 (21.1%)	44 (35.5%)	0.015

Conclusions

- ❖ The observed discordance in the diagnosis of diabetes and pre-diabetes between FPG and HbA1c measurements could have significant impact on their prevalence estimation as these tests identify two different but overlapping subsets of people with hyperglycemia.
- ❖ Combined screening with FPG and HbA1c may identify individuals with high cardiovascular risk.

➤ The study was funded by the Indian Council of Medical Research, New Delhi, India