

Fasting Glucose Versus Oral Glucose Tolerance Testing in the Diagnosis of Diabetes Mellitus

To the Editor,

The relationship between diabetes mellitus (DM) and cardiovascular disease is well recognized.^{1,2} The oral glucose tolerance test (OGTT) (World Health Organization [WHO] 1985 and 1999)^{3,4} and fasting plasma glucose (FBG) (American Diabetes Association [ADA] 1997 and 2003)⁵ are both methods for diagnosing DM. The agreement between these methods has been questioned in several epidemiological studies,⁶ and it is not clear whether they both detect the same pathophysiologic alteration. In this regard, the OGTT appears to be more able to determine the cardiovascular risk.⁷ The Burriana study⁸ allowed us to compare the diagnostic efficacy of these methods.

This randomized, cross-sectional study was conducted among 317 persons (46.1% men) between 30 and 80 years of age and stratified by decade of age. After ruling out diabetics, 293 of the participants underwent protocolled OGTT (WHO)⁹ with 75 g and blood draw at fasting and at 120 min.

The criteria used to define impaired carbohydrate metabolism were those of the WHO 1985 (diabetes: blood glucose after 2 h of OGTT ≥ 200 mg/dL; impaired glucose tolerance [IGT]: blood glucose after OGTT 140-199 mg/dL; normal: blood glucose < 140 mg/dL) and the ADA 1997 diagnostic criteria (diabetes: fasting plasma glucose [FPG] ≥ 126 mg/dL; impaired fasting glucose [IFG]: 110-125 mg/dL; normal: < 110 mg/dL). Lastly, the ADA 2003 modification⁵ was considered, in which the concept of impaired fasting glucose was expanded to include plasma glucose between 100 and 125 mg/dL.

Groups were established according to the FPG values obtained (< 100 , 100-109, 110-125 and 126-139 mg/dL) and according to age group by decade. For each FPG and age group, the prevalence of impaired carbohydrate metabolism (DM-IGT) was determined according to the WHO 1999 standards. The degree of consistency between the two diagnostic standards was calculated by Cohen's kappa. The probability of being

TABLE 1. Probability of a Diabetes Diagnosis When Performing the Oral Glucose Tolerance Test, According to Fasting Plasma Glucose and age Group (%)

mg/dL	30-39	Years 50-59	60-69	70-79
< 100	0.41	0.82	0.35	0.56
100-109	6.06	11.54	5.21	8.24
110-125	24.53	39.66	21.70	31.15
126-140	89.49	94.51	87.90	92.22

$P < .01$.

TABLE 2. Coinciding Diagnoses Between ADA and WHO 1998 Criteria

			WHO (OGTT)		Total
			No	Yes	
DM according to ADA	No	No.	277	9	286
		Percentage of total	94.4	3.6	98.0
	Yes	No.	1	6	7
		Percentage of total	0.3	1.7	2.0
Total		No.	278	15	293
		Percentage of total	94.7	5.3	100.0

ADA: American Diabetes Association; DM: diabetes mellitus; OGTT: oral glucose tolerance test; WHO: World Health Organization.
 $P < .01$.

diagnosed with diabetes by the OGTT, whether according to age group or FPG group (Table 1), is the direct result of the multiple logistic regression equation (diabetes f [FPG, age]). In the 40-49 year age group, no cases of DM were diagnosed.

The clinical sensitivity and specificity of IFG 1997 (110-125 mg/dL) to diagnose DM (OGTT) were calculated, and the data were compared to the equivalents for IGT 2003 (100-125 mg/dL).

The number of persons included in each of the fasting plasma glucose groups was 197, 54, 28, and 14; among these, 15 new diabetics (1, 4, 4, and 6 in each group, respectively) were diagnosed following OGTT. The consistency for DM diagnosis between the two models (ADA 1997 and WHO 1998) was fair ($K=0.53$) although significant ($P < .001$) (Table 2). The IFG 1997 showed a sensitivity of 67% and a specificity of 88%. In the case of IFG 2003, the sensitivity improved to 93%, but the specificity dropped to 70%.

Table 1 shows that when the OGTT is done according to WHO criteria, FPG levels considered normal until 2003 (100-109 mg/dL) may hide DM at a percentage that, in at least one age group (50-59 years), exceeded 10%. Likewise, it was observed that IFG (ADA 1997) already indicates DM for 20% to 40% of cases according to age, when the WHO criteria are applied. In this regard, the EuroHeart Survey data revealed that up to 66% more individuals with impaired carbohydrate metabolism were diagnosed by OGTT than by simple FPG determination.²

The ADA's attempt in 2003 to improve the detection of carbohydrate intolerance (DM + IFG) by lowering the cut-

point for FPG to 100 mg/dL, results in increased sensitivity for the diagnosis of DM, but a decrease in specificity.

This has meant that even in the United States, there are some who disagree with this change, since this measure would classify 25 million (!) individuals at risk.¹⁰

Based on our results and the literature review, we are inclined to use the OGTT for a specific individual. For serial examinations and population-based screening, FPG is shown to be effective.

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REFERENCES

1. Palma Gámiz JL, Hernández Madrid A, Bertomeu Martínez V, González-Juanatey JR, López García-Aranda V, Calderón Montero A, et al. La diabetes mellitus en la práctica de la cardiología en España. Encuesta del grupo de trabajo de corazón y diabetes sobre la importancia de la diabetes mellitus en las enfermedades cardiovasculares. *Rev Esp Cardiol*. 2004;57:661-6.
2. Bartnik M, Ryden L, Ferrari R, Malmberg K, Pyörälä K, Simoons M, et al. The prevalence of abnormal glucose regulation in patients with coronary artery disease across Europe. The Euro Heart Survey on diabetes and the Heart. *Eur Heart J*. 2004;25:1880-90.
3. Masiá R, Sala J, Rohlfs I, Piulats R, Manresa JM, Marrugat J; Investigadores del estudio REGICOR. Prevalencia de diabetes mellitus en la provincia de Girona, España: el Estudio REGICOR. *Rev Esp Cardiol*. 2004;57:261-4.
4. World Health Organization. Definition, diagnosis and classification of Diabetes Mellitus and its complications: Report of a WHO consultation. Part 1. Diagnosis and classification of Diabetes Mellitus. Geneva: World Health Organization; 1999.
5. The expert committee on the diagnosis and classification of Diabetes Mellitus. Follow up report on the diagnosis of Diabetes Mellitus. *Diabetes Care*. 2003;26:3160-7.
6. DECODE Study Group on behalf of the European Diabetes Epidemiology Study Group. Will new diagnostic criteria for diabetes mellitus change phenotype of patients with diabetes? Reanalysis of european epidemiological data. *BMJ*. 1998;317:371-5.
7. Conget I. Diagnóstico, clasificación y patogenia de la diabetes mellitus. *Rev Esp Cardiol*. 2002;55:528-35.
8. Pallarés V, Piñón F, Diago JL. Diabetes mellitus y otros factores de riesgo cardiovascular mayores en un apoblación del Mediterráneo español. Estudio Burriana. *Endocrinol Nutr*. 2006;53:158-67.
9. World Health Organization. Prevention of Diabetes Mellitus: Report of a WHO Study Group. Second Report of the WHO Expert committee on Diabetes Mellitus Technical Report Series n.º 844. Geneva: World Health Organization; 1994.
10. Schriger DL, Sorber B. Lowering the cut-point for impaired fasting glucose. Where is the evidence? Where is the logic? *Diabetes Care*. 2004;27:592-5.