The Sensitivity and Specificity of the Glucose Challenge Test in a Universal Two-Step Screening Strategy for Gestational Diabetes Mellitus Using the 2013 World Health Organization Criteria

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The International Association of Diabetes and Pregnancy Study Groups (IADPSG) recommends a universal one-step screening strategy with the 75-g oral glucose tolerance test (OGTT) for gestational diabetes mellitus (GDM) (1). Since the adoption of the IADPSG recommendation by the World Health Organization (WHO), the IADPSG criteria are commonly referred to as the 2013 WHO criteria (2). The IADPSG recommendation remains controversial due to the significant increase in GDM prevalence, increased workload, the need for a fasting test, and the risk for increased medicalization of care (3). Several professional associations therefore still recommend a universal two-step screening strategy, using a nonfasting 50-g glucose challenge test (GCT) to determine whether an OGTT should be performed (3). The GCT is easier to perform and is generally better tolerated than an OGTT. In addition, a two-step screening strategy with a GCT could limit the number of OGTTs. The GCT has been used in combination with the 100-g OGTT or the 75-g OGTT with various diagnostic criteria, but data are lacking on the sensitivity and specificity of the GCT in conjunction with the 2013 WHO criteria for GDM.

We performed a multicentric prospective cohort study, the Belgian Diabetes in Pregnancy Study (BEDIP-N), between 2014 and 2017, enrolling 2,006 women between 6 and 14 weeks of pregnancy (4). Participants without prediabetes or diabetes in early pregnancy (defined by the American Diabetes Association criteria) received both a GCT and 75-g OGTT between 24 and 28 weeks of pregnancy. Participants and health care providers were blinded for the result of the GCT (4). The GCTs were analyzed centrally at the laboratory of the university hospital of Leuven. Because the GCT has not yet been validated in conjunction with the 2013 WHO criteria and the result of the GCT was not used to treat patients, GCT thresholds were not prespecified. The diagnosis of GDM was based on the 2013 WHO criteria (1,2). Of all participants, 1,811 (90.3%) received both a GCT and OGTT between 24 and 28 weeks of pregnancy. The receiver operating characteristic curve showed an area under the curve of 0.77 (95% CI 0.74–0.81) for the GCT. Based on the 75-g OGTT, GDM prevalence was 12.5% ($n = 231$). By using a universal two-step screening strategy with the commonly used GCT thresholds 140 mg/dL (7.8 mmol/L) and 130 mg/dL (7.2 mmol/L), GDM prevalence varied from 7.5 to 9.1% (Table 1). The GCT threshold of 140 mg/dL (7.8 mmol/L) only had a sensitivity of 59.6%. To achieve sensitivity rates ≥70%, the threshold of the GCT would need to be reduced to at least 130 mg/dL

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Table 1—Sensitivity and specificity of the GCT across different thresholds

Threshold GCT	Abnormal GCTs, % (*n*)	Prevalence of GDM, % (*n*)	Sensitivity, % (95% CI), *n/N*	Specificity, % (95% CI), *n/N*	LR+ (95% CI)	LR− (95% CI)	Positive posttest probability, % (95% CI)	Negative posttest probability, % (95% CI)
≥140 mg/dL	23.9 (441)	7.5 (136)	59.6 (53.0–66.1), 136/228	81.0 (79.0–82.9), 1,282/1,583	3.1 (2.7–3.6)	0.50 (0.42–0.58)	31.7 (26.1–37.5)	6.9 (5.7–8.2)
≥135 mg/dL	29.1 (537)	8.3 (151)	66.2 (59.7–72.3), 151/228	76.1 (73.9–78.1), 1,204/1,583	2.8 (2.4–3.1)	0.44 (0.37–0.53)	29.1 (23.9–34.3)	6.2 (5.1–7.4)
≥130 mg/dL	34.9 (645)	9.1 (165)	72.4 (66.1–78.1), 165/228	70.2 (67.9–72.4), 1,111/1,583	2.4 (2.2–2.7)	0.39 (0.32–0.49)	26.4 (21.7–31.2)	5.5 (5.6–6.6)
≥125 mg/dL	40.8 (754)	9.8 (177)	77.6 (71.7–82.9), 177/228	64.2 (61.8–66.5), 1,016/1,583	2.2 (2.0–2.4)	0.35 (0.27–0.45)	24.3 (20.0–28.7)	4.9 (4.0–6.0)
≥120 mg/dL	48.4 (895)	10.3 (187)	82.0 (76.4–86.8), 187/228	56.0 (53.5–58.4), 886/1,583	1.9 (1.7–2.0)	0.32 (0.24–0.43)	21.6 (17.8–25.6)	4.5 (3.7–5.5)

Sensitivity: *n* = number with GCT ≥cut-off; *N* = number with GDM. Specificity: *n* = number with GCT <cut-off; *N* = number without GDM. LR+: positive likelihood ratio; LR−: negative likelihood ratio. Conversion factor for SI units for glucose in mmol/L: × 0.05551.

(7.2 mmol/L), and applying lower thresholds to the GCT would increase sensitivity rates to ≥77% but would lead to low specificity rates varying from 64.2 to 56.0% for a GCT threshold of 125 mg/dL (6.9 mmol/L) and 120 mg/dL (6.7 mmol/L), respectively (Table 1). For a GCT threshold of 130 mg/dL (7.2 mmol/L), the positive posttest probability was 26.4%, the negative posttest probability was 5.5%, and 65.1% of all OGTTs could be avoided compared with a universal one-step screening strategy with the 75-g OGTT (Table 1).

The BEDIP-N study is, to our knowledge, the first study that has prospectively evaluated the sensitivity and specificity of the GCT in a universal two-step screening strategy for GDM using the 2013 WHO criteria. The GCT has been used in combination with the 100-g OGTT or the 75-g OGTT with various diagnostic criteria such as the Carpenter and Coustan criteria, the National Diabetes Data Group criteria, the 1999 WHO criteria, or the Canadian Diabetes Association criteria and has shown variable sensitivity rates between 70 and 88% and specificity rates between 69 and 89% when using a GCT threshold of 140 mg/dL (7.8 mmol/L) and sensitivity rates between 88 and 99% and specificity rates between 66 and 77% when using a GCT threshold of 130 mg/dL (7.2 mmol/L) (5). However, many studies had a high or unclear bias because the result of the screening test was used to determine whether further testing was needed for GDM and not all patients received a confirmatory OGTT if the GCT was below a certain threshold (5). Our study avoided these limitations as both health care providers and participants were blinded for the GCT, thus avoiding any bias in screening.

In conclusion, we show now that the GCT has a moderate diagnostic accuracy in a universal two-step screening strategy for GDM using the 2013 WHO criteria. A GCT threshold of 140 mg/dL (7.8 mmol/L) had only a sensitivity of 59.6% and can therefore not be recommended in a two-step approach for GDM using the 2013 WHO criteria. To achieve sensitivity rates ≥70%, the threshold of the GCT would need to be reduced to at least 130 mg/dL (7.2 mmol/L).

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