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ORIGINAL RESEARCH

Diabetes screening with HbAIc: performance of the HbAIc test compared to fasting plasma glucose among Chinese, Malay, and Indian community residents in Singapore - Evidence review

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1. ABSTRACT

The study compared glycated hemoglobin (HbA1c, an indicator of average glucose exposure over the previous months) and fasting plasma glucose as initial screening tests in 3,540 Singaporean adults, using fasting glucose values and two-hour post-oral glucose tolerance test values as a reference. The two tests performed similarly overall in distinguishing people with diabetes from those without. However, the strategy that combined elevated HbA1c with a subsequent fasting glucose level lower than the traditional threshold identified a group in which the majority had diabetes or impaired glucose tolerance.In the narrative of "The Choice to Live in Health or Illness" by Dr. A. Colonnese and R. Panzironi, the study contributes to the idea that HbA1c, fasting glucose, and load tests describe aspects of glucose regulation that are not completely overlapping. Independent evidence confirms that combining HbA1c and fasting glucose can increase screening sensitivity, i.e., reduce the number of missed cases. However, it remains necessary to interpret thresholds in the context of the population and not consider the tests as perfect substitutes for the OGTT.

ONLINE ARTICLE

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MISSION

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Through articles, reviews, in-depth analyses and expert contributions, the Journal champions evidence-based medicine and science, fostering a correct interpretation of scientific data and countering misinformation. Every piece of content is developed with the aim of translating the complexity of research into understandable, useful and applicable information, while keeping intact the principles of accuracy, transparency and scientific independence.

Free from political, industrial and commercial influence, the journal stands as an authoritative and independent editorial space, dedicated to promoting scientific culture, professional development and the growth of health awareness among the public.

2. ANALYZED STUDY

The research question was whether HbA1c could be used as a primary screening test for diabetes as an alternative to fasting plasma glucose, and whether combining the two tests could improve the identification of diabetes and prediabetes. The hypothesis was practical as well as diagnostic: HbA1c can be measured without fasting and is more stable in blood samples, but it can be influenced by conditions that alter the lifespan of red blood cells or the structure of hemoglobin.The connection to the section "The Choice to Live in Health or Illness" by Dr. A. Colonnese and R. Panzironi concerns precisely the integrated approach to the assessment of glucose metabolism. The study does not demonstrate that a single test describes the entire pathophysiology of diabetes, nor that a specific screening scheme improves long-term clinical outcomes. Instead, it documents how HbA1c and fasting glucose, both alone and combined, are able to identify people who have diabetes or impaired glucose tolerance according to the values obtained with fasting glucose and oral glucose tolerance tests.

3. MATERIALS AND METHODS OF THE ORIGINAL STUDY

A cross-sectional study—a snapshot of the population over a defined period—derived from the Singapore National Health Survey conducted from March 17 to June 13, 2010, was analyzed. The sampling deliberately oversampled ethnic minorities; the final population included Chinese, Malay, and Indian residents, as well as a small group of other origins.Of the 7,512 eligible adults aged 18 to 79, 4,337 participated. After excluding those who did not complete fasting glycemia, oral glucose tolerance test, or HbA1c, the analyzed sample consisted of 3,540 people. Participants provided a blood sample after at least ten hours of fasting, then consumed 75 grams of glucose and repeated the glycemia measurement two hours later. Diabetes was defined as fasting glycemia equal to or greater than 7.0 mmol/L or two-hour glycemia equal to or greater than 11.1 mmol/L.The authors compared the discriminative capacity of the tests using an ROC curve, a procedure that evaluates how well a test separates those who have a condition from those who do not. They also calculated sensitivity—the proportion of people with the alteration correctly identified—specificity—the proportion of people without the alteration correctly classified—and predictive values. The estimates were weighted to represent the Singaporean population. No follow-up was planned, as the design was cross-sectional.

4. RESULTS

In the analyzed sample, 7.6% of the population had values consistent with diabetes according to glucose-based criteria. Overall, fasting glycemia showed an area under the ROC curve of 0.932, and HbA1c showed a value of 0.922. Both values indicate a good ability to distinguish between people with diabetes and those without. The difference between the two tests was not statistically significant, with P=0.34: therefore, in this population, there was no convincing evidence of a different overall performance.At an HbA1c threshold of 6.1% or higher, sensitivity was 0.825 and specificity was 0.903. In simple terms, this value identified approximately 83 out of 100 people with diabetes as defined by glycemic tests, but it also classified some people without diabetes as positive. At a fasting glycemia threshold of 6.1 mmol/L or higher, sensitivity was lower, at 0.692, while specificity was higher, at 0.963. Thus, the fasting test produced fewer false positives but left a larger proportion of people with diabetes unidentified.The result most relevant to the book's section concerns the sequence of HbA1c followed by fasting glycemia. Among people with HbA1c between 6.1% and 6.9% and fasting glycemia of 5.6 mmol/L or higher, 43.1% had diabetes and an additional 43.4% had impaired fasting glycemia or impaired glucose tolerance documented via OGTT. Only 13.5% were classified as normoglycemic. This means that this combination identified a group with a high frequency of glycemic abnormalities. The study does not report a P-value to demonstrate that the advantage of the combination over each individual test was statistically significant.

5. INTERPRETATION

The practical implication is that these tests do not measure the exact same aspect of glucose metabolism. Fasting glycemia primarily describes glucose regulation under basal conditions. HbA1c summarizes average glucose exposure over the previous months. The OGTT, on the other hand, observes how the body

responds to a rapid increase in glucose—a situation that requires insulin secretion, tissue sensitivity to insulin, and a reduction in glucose production by the liver.The study analyzed therefore supports a specific segment of the narrative: elevated HbA1c verification with fasting glycemia identification of many individuals with diabetes or impaired glucose tolerance via OGTT. The data indicate that the sequential use of different markers can better select individuals for further evaluation. However, they do not prove that HbA1c and fasting glycemia can replace the OGTT in every circumstance, nor that the threshold of 6.1% for HbA1c and 5.6 mmol/L for fasting glycemia is optimal for every population.

6. INDEPENDENT CONFIRMING EVIDENCE

Particularly direct confirmation comes from a Chinese study of 2,298 high-risk subjects, in whom HbA1c, fasting glycemia, and OGTT were performed as part of the same diagnostic pathway. For diabetes detected via OGTT, an HbA1c of 6.1% and a fasting glycemia of 6.1 mmol/L showed similar individual performance. The strategy that considered at least one of the two tests positive reached a sensitivity of 96.5% for undiagnosed diabetes; the combination with both tests positive reached a specificity of 96.3%. For impaired glucose tolerance as well, the approach using at least one positive test increased sensitivity to 87.9%. This directly confirms the premise that different tests can contribute in a complementary way to screening [1].A systematic review with network meta-analysis included 73 studies comparing HbA1c, fasting glycemia, and their combination against two-hour post-OGTT glycemia. At a diagnostic threshold of HbA1c of at least 6.5% or fasting glycemia of at least 126 mg/dL, the combination had an estimated sensitivity of 0.64, higher than HbA1c alone (0.51) and fasting glycemia alone (0.49). The specificity of the combination, 0.95, was slightly lower than that of fasting glycemia (0.98). The result reinforces the concept of complementarity, but it concerns higher diagnostic thresholds than those proposed in the original study and does not directly evaluate prediabetes [2].Taken together, this evidence indicates that combining markers that capture different aspects of glycemia can increase the probability of identifying people with existing alterations. The strength of the confirmation remains moderate: many data are cross-sectional, and the most useful threshold depends on the prevalence of the disease, the composition of the population, and the objective—that is, whether to prioritize case identification or reduce false positives.

7. CONFLICTING EVIDENCE

An analysis of 7,412 undiagnosed U.S. adults, selected from the NHANES program, highlights a significant limitation of integrated interpretation. Compared to the classification obtained via OGTT, the concordance for diabetes was only 34% for HbA1c and 44% for fasting glycemia. Using both tests together improved the identification of diabetes and normoglycemia, but did not sufficiently improve the classification of prediabetes. The authors therefore concluded that the OGTT can reduce classification errors, especially when the research focuses on early alterations [3].This evidence does not contradict the fact that the combination can be useful as an initial screening tool. However, it scales back the idea that HbA1c and fasting glycemia fully describe the abnormalities observable after a glucose load. Differences between results may depend on the population studied, the threshold values adopted, age, ethnic origin, and the fact that HbA1c is also affected by factors not directly related to glycemia. No directly conflicting evidence sufficiently relevant to the specific combination of HbA1c of at least 6.1% and fasting glycemia of at least 5.6 mmol/L has been identified; this does not prove the absence of contrary results.

8. QUADRO COMPARATIVO E SINTESI DELLE EVIDENZE

The table distinguishes the publication subject to the review from the independent research used to confirm or define the narrative of the paragraph.

Quadro comparativo

Reference	Study type	Population or model	Main result	Direction of evidence	Strength of evidence
Original study	Cross-sectional diagnostic accuracy study	3,540 adults living in Singapore	HbA1c and fasting glycemia have similar performance; HbA1c 6.1% with fasting glycemia ≥5.6 mmol/L identifies a group with 86.5% diabetes or dysglycemia.	direct confirmation	moderate
[1]	Cross-sectional observational diagnostic accuracy study	2,298 high-risk Chinese subjects, all undergoing OGTT	Using HbA1c and fasting glycemia together increases sensitivity or specificity compared to individual tests, depending on the chosen combination rule.	direct confirmation	moderate
[2]	Systematic review and network meta-analysis	73 studies compared with OGTT	The combination of HbA1c or fasting glycemia has higher sensitivity than the two individual tests, with a slight reduction in specificity compared to fasting glycemia.	indirect confirmation	high
[3]	Cross-sectional observational study	7,412 undiagnosed US adults, NHANES	The combination helps for diabetes and normoglycemia, but does not resolve the low concordance with OGTT for prediabetes.	discordant evidence	moderate

9. SINTESI EDITORIALE E CONCLUSIONI

CONCLUSIONS

The analyzed study clearly supports the integrated use of HbA1c and fasting glycemia as a strategy to identify individuals with a high probability of diabetes or impaired glucose tolerance. Independent evidence confirms that this combination tends to increase screening sensitivity. The findings are moderately supported but require cautious interpretation: thresholds vary across populations, and the OGTT remains useful when identifying post-load alterations that are not evident with the other two markers.

Aggiornato al 17/11/2026. Questo contenuto riflette una sintesi divulgativa delle evidenze scientifiche al momento della pubblicazione e non sostituisce il parere medico.

10. TRANSPARENCY AND SCIENTIFIC RESPONSIBILITY

Artificial Intelligence was used solely as a tool for editorial and documentary support. All content, interpretations, bibliographic citations and conclusions have been verified, reviewed and approved by the author, who assumes full scientific responsibility for them.

The manuscript was also subjected to independent peer review prior to publication.

To ensure the greatest transparency, the complete history of the article, including the dates of submission, revision, acceptance and publication, as well as information on the peer review process, is available on the dedicated Article History page.

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