Diagnostic Testing for Diabetes Using HbA$_{1c}$ in the Abu Dhabi Population

Weqaya: the Abu Dhabi Cardiovascular Screening Program

COTHER HAJAT, MBBS, MPH, PhD, MRCP, MFPH
OLIVER HARRISON, MA, MBBS
ZAID AL SIKSEK, BSC, MHCA

OBJECTIVE—The validity of HbA$_{1c}$ as a population diagnostic tool was tested against oral glucose tolerance testing in Abu Dhabi nationals.

RESEARCH DESIGN AND METHODS—The screening tool of HbA$_{1c}$ and random glucose was validated against the “gold standard” oral glucose tolerance test according to World Health Organization criteria.

RESULTS—The HbA$_{1c}$ threshold of 6.4% provided the optimum balance between sensitivity (72.0%) and specificity (84.3%) with positive and negative predictive values of 47.9 and 93.7% and area under the receiver operating characteristics curve of 0.78. This threshold compares with a threshold of 6.5% recommended by the International Scientific Committee and American Diabetes Association and of 6.3% in a recent study in China.

CONCLUSIONS—This study successfully validates the feasibility and threshold of HbA$_{1c}$ for diagnosis of diabetes at the population level in a Middle-Eastern population. This result is a major step in the fight to tackle the increasing burden of diabetes in the United Arab Emirates.

The United Arab Emirates (UAE) has been reported as having the second highest world prevalence of diabetes by the World Health Organization (2005) (1) and the International Diabetes Federation (2). The Weqaya program screened >92% of the UAE national population for cardiovascular disease risk factors including diabetes (3). The International Expert Committee on Diabetes (4) and the American Diabetes Association (5) recommended that an HbA$_{1c}$ threshold of 6.5% should be diagnostic of diabetes. This article seeks to determine the utility of HbA$_{1c}$ as a population-level diagnostic tool.

RESEARCH DESIGN AND METHODS—The Weqaya screening program commenced in April 2008 for UAE nationals (aged ≥18 years) residing in Abu Dhabi linked to the provision of free comprehensive health insurance (Thiqa) and the comprehensive health insurance (Thiqa) and the health authority, Abu Dhabi, United Arab Emirates.

From the 1Department of Public Health and Research, Health Authority, Abu Dhabi, United Arab Emirates; and the 2Health Authority, Abu Dhabi, United Arab Emirates.

Corresponding author: Cother Hajat, chajat@haad.ae.

Received 26 February 2011 and accepted 19 August 2011.

DOI: 10.2337/dc11-0284

© 2011 by the American Diabetes Association. Readers may use this article as long as the work is properly cited, the use is educational and not for profit, and the work is not altered. See http://creativecommons.org/licenses/by-nc-nd/3.0/ for details.

Diabetes Care Publish Ahead of Print, published online September 16, 2011
with diabetes being correctly diagnosed and 16% being incorrectly diagnosed. A comparison of the study cohort with the full Weqaya cohort found higher mean age in this study at 42 years compared with 35 years (P < 0.001). Nondiabetic patients in this cohort had higher mean age, BMI, waist circumference, SBP, DBP, and LDL than nondiabetic patients from the Weqaya cohort. For diabetic patients, mean age and SBP were lower in this cohort than in diabetic patients in the Weqaya cohort.

CONCLUSIONS—This is one of the first studies to demonstrate the utility of HbA1c for diagnosing diabetes and has shown that 6.4% is an optimum HbA1c threshold for the Abu Dhabi national population.

Use of HbA1c as a diagnostic tool

Studies repeatedly demonstrate that within populations, over one-third of all patients with diabetes remain undiagnosed, with resulting complications due to late diagnosis (9). The availability of a single nonfasting blood test could facilitate successful population-level screening programs. The Weqaya study demonstrated this.

HbA1c is an independent predictor of cardiovascular events in patients with diabetes and nondiabetic subjects (10), which makes HbA1c data from screening programs a valuable resource for public health planning.

Comparison with other studies

In this study, an HbA1c threshold of 6.4% yielded the highest AUC (0.78). A recent study in China comparing HbA1c screening with OGTT demonstrated sensitivity, specificity, and AUC of 63%, 96%, and 0.86, respectively (11). Sensitivities and specificities reported using fasting plasma glucose as the reference in the Chinese study were 56 and 97% for their optimum HbA1c threshold of 6.4% (11) and in National Health and Nutrition Examination Survey data were 59 and 97% for their optimum HbA1c threshold of 5.8% (12).

The higher sensitivity and lower specificity in the Weqaya study may be due to population factors affecting glycation of hemoglobin, such as hemoglobinopathies and other abnormal hemoglobin types, anemia (13), vitamins C and E, iron deficiency, and some medication use (14). Different ethnic groups have also been shown to have HbA1c levels up to 0.4–0.7% higher than Caucasian populations despite similar glucose levels (15).

Choice of HbA1c threshold

The choice of HbA1c threshold for clinical practice will depend on whether the tool is being used for screening or diagnosis. Screening tests usually warrant the choice of high sensitivity over specificity. Because HbA1c has now been recommended for use as a diagnostic test, specificity is increasingly important, and the threshold of 6.4% in this study provides a high specificity without too much compromise of sensitivity.

Strength and limitations

This study is the first in a Middle Eastern population to screen at population level using HbA1c and has been shown to be representative (3); however, some differences were shown in nondiabetic subjects between this study sample and the overall Weqaya population.

Summary

HbA1c has been validated as a suitable test for the definitive diagnosis of diabetes in the Weqaya population screening program in a high-risk Middle-Eastern population. This is a major step in the fight to tackle the increasing burden of diabetes in the UAE.

References

1. WHO Statistical Information System (WHOSIS) data [Internet], XXX. Available from http://apps.who.int/whosis/data. Accessed XX XXXXX XXXX.