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Using Glycosylated Hemoglobin to Define the Metabolic Syndrome in United States Adults

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OBJECTIVE — To compare the use of GHB and fasting plasma glucose (FPG) to define the metabolic syndrome (MetS).

RESEARCH DESIGN AND METHODS — Data from the U.S. National Health and Nutrition Examination Survey 1999–2006 were used. MetS was defined using the consensus criteria in 2009. Raised blood glucose was defined as either FPG ≥100 mg/dl (5.6 mmol/l) or GHB ≥5.7%.

RESULTS — In 2003–2006, there was 91.3% agreement between GHB and FPG when either was used to define MetS. The agreement was good irrespective of age, sex, race/ethnicity, BMI, and diabetes status (≥87.4%). Similar results were found in 1999–2002. Among subjects without diabetes, only the use of GHB alone, but not FPG, resulted in significant association with cardiovascular diseases (odds ratio 1.45, P = 0.005).

CONCLUSIONS — Using GHB instead of FPG to define MetS is feasible. It also identifies individuals with increased cardiovascular risk.

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compared with the use of FPG alone, with 74.9% agreement between these two definitions. The use of GHb alone also resulted in a lower prevalence of MetS compared with the use of FPG alone (Table 1). The use of both GHb and FPG resulted in an insignificant increase in the prevalence compared with the use of FPG alone (41.1 vs. 38.8%, \( P = 0.200 \)). There was 91.3% agreement between the use of GHb alone and the use of FPG alone. The agreement was good irrespective of age, sex, race/ethnicity, and BMI. The same trends were found in NHANES 1999–2002 or when the NCEP definition was used (see supplementary Tables A1 and A2, available in an online appendix at http://care.diabetesjournals.org/cgi/content/full/dc09-0190/DC1).

Because there is controversy whether the diagnosis of MetS conveys additional meaning in subjects with diabetes who should already be aggressively treated due to high cardiovascular risk, a subgroup without diabetes (non-DM) was also examined. Similar to the overall cohort, in the non-DM group, the use of GHb alone resulted in lower prevalence of MetS compared with FPG alone, with 90.6% agreement (Table 1). Importantly, in this non-DM subgroup, only the use of GHb alone, but not FPG, resulted in significant association with cardiovascular diseases (odds ratio 1.43, \( P = 0.005 \)) when the consensus criteria in 2009 was used to define MetS (supplementary Table A3).

**CONCLUSIONS** — The controversy regarding the definition of MetS has been addressed recently in a joint scientific statement (4). GHb reflects the average blood glucose level over several months, and its measurement does not require a fasting blood sample. In this study, we demonstrated that there was good agreement between GHb and FPG in identifying individuals with MetS, despite only a moderate agreement (\(~75\%\)) between GHb and FPG in defining raised blood glucose. The components of MetS are inter-correlated; therefore, a certain degree of inaccuracy or fluctuation in one component is tolerated and does not result in misclassification. The agreement between GHb and FPG in the definition of MetS is good in different subgroups. We can therefore confidently conclude that using GHb instead of FPG to define MetS is feasible. This is true at least for Americans, based on the most up-to-date data on a nationally representative sample of Americans, and was confirmed using historical...
data. It remains to be seen if our conclusions are also applicable to Asians, among whom the prevalence of raised blood glucose is likely to be different.

The current cut point of GHb identifies a slightly smaller group of people as having MetS. However, it also identifies subjects at high risk for cardiovascular diseases, even in those without diabetes, when the consensus criteria in 2009 are used to define MetS. Whether GHb results in better risk stratification needs to be investigated in large prospective studies.

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K.L.O. researched data, contributed to discussion, and wrote the manuscript. A.W.K.T. and K.S.L.L. contributed to discussion and reviewed/edited the manuscript. S.S.C. and P.C.S. contributed to discussion. B.M.Y.C. contributed to discussion, wrote the manuscript, and reviewed/edited the manuscript.

References