Comparison of Waist-to-height Ratio, Hypertriglyceridemic Waist Phenotype, Triglycerides to HDL-C Ratio and Fasting Plasma Glucose With the Matsuda Index for the Prediction of Insulin Resistance/hyperinsulinemia

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Abstract

Background

Current screening algorithms for type 2 diabetes (T2D) rely on fasting plasma glucose (FPG) and/or HbA1c. This fails to identify a sizeable subgroup of individuals in early stages of metabolic derangement who are at high risk for developing diabetes or cardiovascular disease. The Matsuda index, a combination of parameters derived from a fasting and postprandial insulin assay, is an early biomarker for metabolic dysfunction (i.e. insulin resistance/compensatory hyperinsulinemia). We compared four widely available anthropometric and biochemical markers indicative of this condition (waist-to-height ratio (WHtR), hypertriglyceridemic waist phenotype (HTW), triglycerides to HDL-C ratio (TG/HDL-C) and FPG) to the Matsuda index.

Methods

This cross-sectional analysis included 2231 individuals with normal fasting glucose (NFG, n=1333), impaired fasting glucose (IFG, n = 599) and T2D (n=299) from an outpatient diabetes clinic in Germany and thus extended a prior analysis from our group done on the first two subgroups. We analyzed correlations of the Matsuda index with WHtR, HTW, TG/HDL-C and FPG and their predictive accuracies by correlation and logistic regression analyses and receiver operating characteristics.

Results

In the entire group and in NFG, IFG and T2D, the best associations were observed between the Matsuda index and the WHtR (r=-0,458), followed by HTW phenotype (r=-0,438). As for prediction accuracy, WHtR was superior to HTW, TG/HDL-C and FPG in the entire group (area under the curve 0,801) and NFG, IFG and T2D. A multivariable risk score for the prediction of insulin resistance was tested and demonstrated an area under the ROC curve of 0.765 for WHtR and its interaction with sex as predictor controlled by age and sex. The predictive power increased to 0.845 when FPG and TG/HDL-C were included.

Conclusions

Using as a comparator the Matsuda index, WHtR, compared to HTW, TG/HDL-C and FPG, showed the best predictive value for detecting metabolic dysregulation. We conclude that WHtR, a widely available anthropometric index, could refine phenotypic screening for insulin resistance/hyperinsulinemia. This may ameliorate early identification of individuals who are candidates for appropriate therapeutic interventions aimed at addressing the twin epidemic of metabolic and cardiovascular disease in settings where more extended testing such as insulin assays are not feasible.

Full Text

This preprint is available for download as a PDF.

Figures

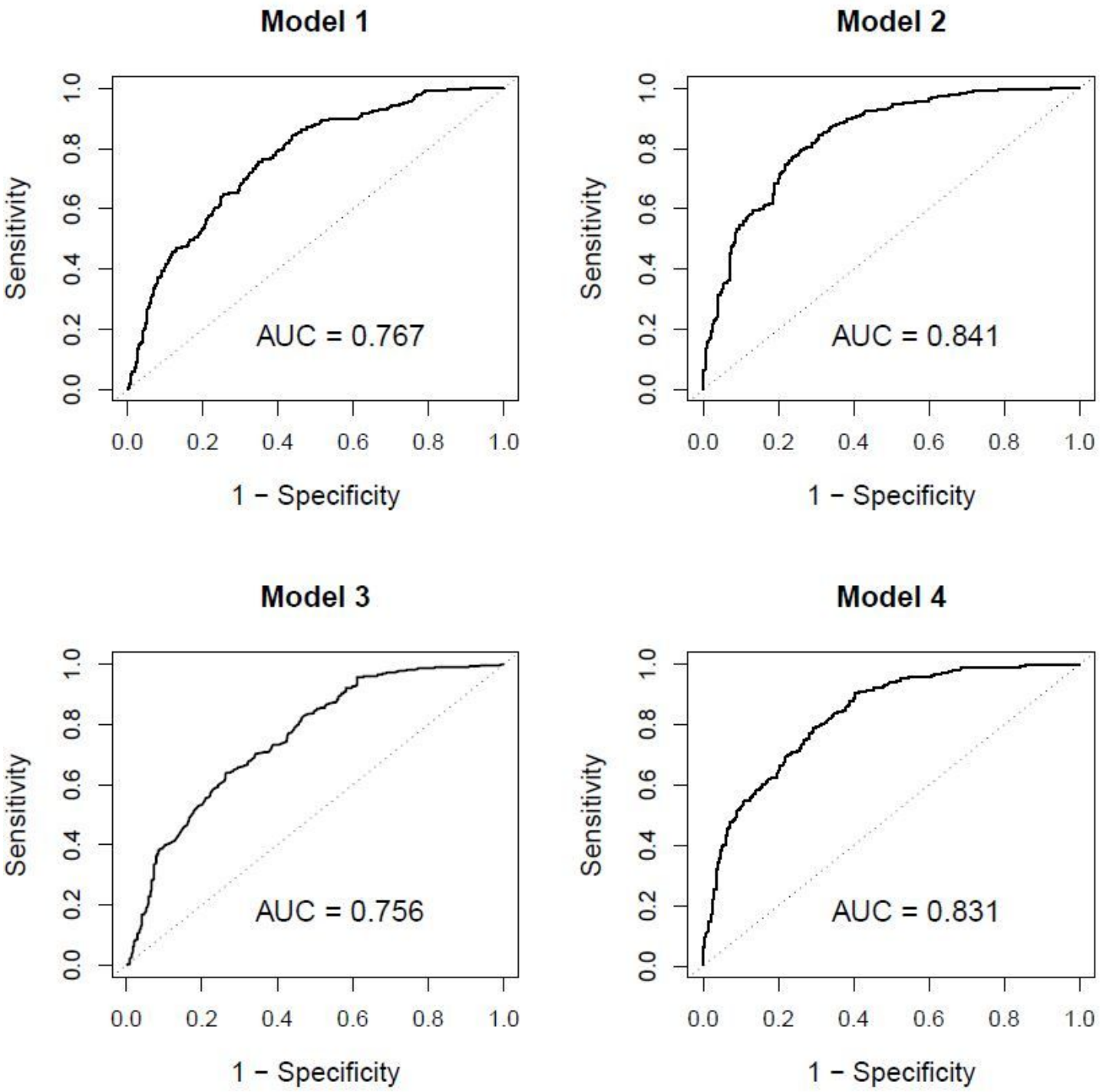

Figure 1

ROC curves for models 1 to 4 from the validation sample. Plots of the respective sensitivity against the false positive rate (1 minus specificity). The area under the curve (AUC) of an ideal binary classifier is 1, the AUC of a test without discriminatory power is 0.5.

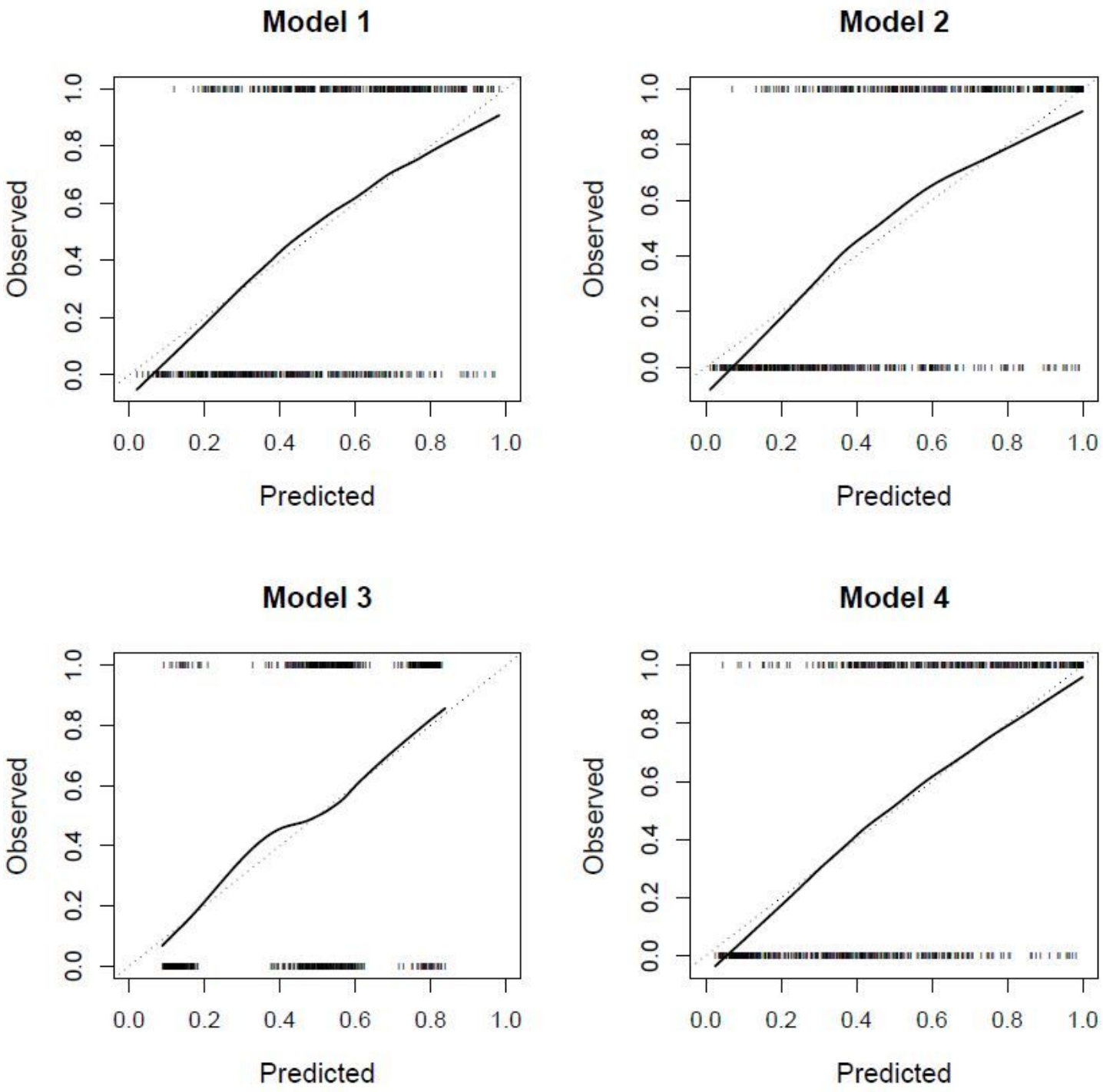

Figure 2

Calibration curves for models 1 to 4 from the validation sample. Plots of observed frequencies of insulin resistance (1 or 0) against predicted probabilities from the respective models. The ideal calibration curve is the bisector of the coordinate system (dashed line).