Prevalence of Abnormal Glucose Tolerance and Their Risk Factors in Urban and Rural Malaysia

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OBJECTIVE—To determine the prevalence of prediabetes and diabetes among rural and urban Malaysians.

RESEARCH DESIGN AND METHODS—This cross-sectional survey was conducted among 3,879 Malaysian adults (1,335 men and 2,544 women). All subjects underwent the 75-g oral glucose tolerance test (OGTT).

RESULTS—The overall prevalence of prediabetes was 22.1% (30.2% in men and 69.8% in women). Isolated impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) were found in 3.4 and 16.1% of the study population, respectively, whereas 2.6% of the subjects had both IFG and IGT. Based on an OGTT, the prevalence of newly diagnosed type 2 diabetes was 12.6% (31.0% in men and 69.0% in women). The prediabetic subjects also had an increased prevalence of cardiovascular disease risk factors.

CONCLUSIONS—The large proportion of undiagnosed cases of prediabetes and diabetes reflects the lack of public awareness of the disease.

The prevalence of type 2 diabetes has increased globally over the past two decades. In Malaysia, the National Health and Morbidity Survey 2006 (unpublished data) recorded a diabetes prevalence of 14.9% among adults aged >30 years. This is an astounding increase from a similar survey conducted in 1996. Despite this rising prevalence and increasing awareness, diabetes is often left undetected (1). Early recognition and prevention is therefore important because diabetes is associated with unhealthy contemporary lifestyle (2). Impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) identify individuals at increased risk for developing diabetes and cardiovascular disease (CVD) (3,4). Because of increased awareness, IGT is being diagnosed and reported more frequently, resulting in the higher prevalence of IGT compared with a few decades ago. Using the 75-g oral glucose tolerance test (OGTT) would identify those individuals with IGT and diabetes based on 2-h postprandial blood glucose values. The aim of this study was therefore to determine the prevalence of prediabetes and diabetes using a 75-g OGTT in both rural and urban areas in Malaysia and to identify the metabolic abnormalities and risk factors associated with these conditions.

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Abnormal glucose tolerance and risk factors

Table 1—Demographic characteristics and biochemical parameters of the prediabetic and diabetic subjects

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Isolated IFG</th>
<th>Isolated IGT</th>
<th>IFG/IGT</th>
<th>New diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>n (%)</td>
<td>131 (3.4)</td>
<td>625 (16.1)</td>
<td>102 (2.6)</td>
<td>487 (12.6)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>50.4 ± 13.4</td>
<td>49.75 ± 13.98</td>
<td>50.44 ± 11.48</td>
<td>52.70 ± 12.78*</td>
</tr>
<tr>
<td>Sex (%)</td>
<td>Male 66 (50.4)</td>
<td>164 (26.2)</td>
<td>29 (28.4)</td>
<td>151 (31.0)</td>
</tr>
<tr>
<td></td>
<td>Female 65 (49.6)</td>
<td>461 (73.8)</td>
<td>73 (71.6)</td>
<td>336 (69.0)</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>Male 90.92 ± 10.47</td>
<td>90.98 ± 12.30</td>
<td>92.32 ± 10.11</td>
<td>93.47 ± 12.86</td>
</tr>
<tr>
<td></td>
<td>Female 85.04 ± 11.88</td>
<td>85.88 ± 12.76*</td>
<td>90.73 ± 12.99*</td>
<td>90.00 ± 12.41*</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>26.31 ± 5.40</td>
<td>26.84 ± 5.42*</td>
<td>28.32 ± 6.74*</td>
<td>28.02 ± 6.62*</td>
</tr>
<tr>
<td>Systolic blood pressure (mmHg)</td>
<td>137.24 ± 22.43</td>
<td>134.62 ± 23.60</td>
<td>140.98 ± 23.46</td>
<td>140.54 ± 23.43*</td>
</tr>
<tr>
<td>Diastolic blood pressure (mmHg)</td>
<td>79.79 ± 12.30</td>
<td>80.63 ± 11.32</td>
<td>82.02 ± 11.15</td>
<td>83.45 ± 12.35*</td>
</tr>
<tr>
<td>Fasting plasma glucose (mmol/L)</td>
<td>6.41 ± 0.24</td>
<td>5.04 ± 0.70*†</td>
<td>6.43 ± 0.24</td>
<td>8.22 ± 3.26*</td>
</tr>
<tr>
<td>2-HPP (mmol/L)</td>
<td>6.31 ± 1.05</td>
<td>8.97 ± 0.86*</td>
<td>9.09 ± 0.83†</td>
<td>13.87 ± 5.49*</td>
</tr>
<tr>
<td>A1C (%)</td>
<td>5.48 ± 0.01</td>
<td>5.45 ± 0.49†</td>
<td>5.57 ± 0.41</td>
<td>6.72 ± 1.95*</td>
</tr>
<tr>
<td>Total cholesterol (mmol/L)</td>
<td>6.15 ± 1.30</td>
<td>5.82 ± 1.26*</td>
<td>6.04 ± 1.22</td>
<td>6.19 ± 1.33*</td>
</tr>
<tr>
<td>HDL (mmol/L)</td>
<td>1.36 ± 0.32</td>
<td>1.38 ± 0.39</td>
<td>1.33 ± 0.37</td>
<td>1.34 ± 0.37</td>
</tr>
<tr>
<td>LDL (mmol/L)</td>
<td>3.76 ± 1.04</td>
<td>3.70 ± 1.14</td>
<td>3.75 ± 1.02</td>
<td>3.86 ± 1.22*</td>
</tr>
<tr>
<td>Triglycerides (mmol/L)</td>
<td>± 1.18</td>
<td>1.60 ± 1.04</td>
<td>1.60 ± 1.01</td>
<td>2.01 ± 1.52*</td>
</tr>
<tr>
<td>Uric acid (mmol/L)</td>
<td>380.20 ± 124.55</td>
<td>325.27 ± 101.46†</td>
<td>349.83 ± 86.51</td>
<td>334.21 ± 97.66</td>
</tr>
</tbody>
</table>

Data are means ± SD or n (%). *P < 0.05 between IFG and IFG/IGT. †P < 0.05 between IGT and IFG/IGT. ‡P < 0.05 between IFG and IFG/IGT.

82.4% had BMI ≥23 kg/m², and 10.8% were current smokers. Using multiple logistic regression analysis, prediabetes was found to be associated with a history of smoking, age, and the low-income group.

The prevalence of newly diagnosed type 2 diabetes was 12.6% (31.0% in men and 69.0% in women) and increased with age from 3.8% among adults aged <30 years to 11.6% among adults aged 40–49 years and was still higher (16.5%) in the older age-group (≥60 years). Without relying on the OGTT, we would have missed ~5% of type 2 diabetes cases.

CONCLUSIONS—Glucose intolerance in this study is defined according to the World Health Organization diagnostic criteria (5). The prevalence of prediabetes in our study is comparable to other similar studies (6,7), and the percentage rose to 24.4% in those aged ≥60 years. Interestingly, the prevalence of IFG was lower than IGT in studied populations. Similarly, IGT was found to be more prevalent compared with IFG in Mauritius (8), in the U.S. (9), and in Pima Indians (10).

In our study, ~16.1% of adults had isolated IGT, a condition that increases the risk for diabetes and other cardiovascular risk factors (11). In fact, many subjects with IGT will develop CVD before progressing to diabetes, as shown in one Japanese study (12). Changes in lifestyle and dietary habits in our population, in both rural and in urban areas, have resulted in the increased prevalence of risk factors for CVD, such as obesity, hypertension, and diabetes. Our prediabetic subjects had a high risk for CVD. This is not to be unexpected because prediabetes is a prelude to type 2 diabetes and is also associated with various comorbidities, which has been termed metabolic syndrome.

The prevalence of newly diagnosed type 2 diabetes in our study was 12.6% and is increasing with age. This high prevalence of undiagnosed diabetes, together with its earlier age of onset (<30 years), poses a serious public health problem, especially if there is no serious concerted effort taken to improve it. By performing the OGTT, we were able to diagnose more subjects with type 2 diabetes because it captured both fasting and elevated 2-h plasma glucose levels.

In summary, the high prevalence of glucose intolerance among adults aged >18 years has raised public health concerns. Because individuals with prediabetes usually have no apparent clinical symptoms, great efforts may be needed to identify them early and to intervene against the root causes of insulin resistance, such as overweight, physical inactivity, and unhealthy diet in pediatric primary care and through public health services.

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No potential conflicts of interest relevant to this article were reported.

N.M. wrote the manuscript and researched data. N.A.K. reviewed and edited the manuscript and researched data A.A.I., A.S.K., and I.S.I. researched data. K.I.M. and K.A.K. researched data and contributed to discussion. N.A.Y., O.A., and S.H.M.I. researched data. W.M.W.B. and W.N.w.m. researched data and contributed to discussion.

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