Prevalence of Diabetes Mellitus and Impaired Fasting Glucose in the Adult Population of Iran: The National Survey of Risk Factors for Non-Communicable Diseases of Iran

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Running title: Diabetes in Iran

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Abstract

Despite concerns of a diabetes epidemic in the Middle East, internationally published data on national estimates of prevalent type 2 diabetes in Iran do not exist. In this article we document a dramatically high prevalence of diabetes in Iran based on the results of the first Survey of Risk Factors of Non-Communicable Diseases (SURFNCND) of Iran, 2005. In this national cross-sectional survey recruiting 70,981 Iranian citizens aged 25 to 64 years, we found that 7.7% of adults aged 25-64, or 2 million adults, have diabetes, among whom half are undiagnosed. An additional 16.8%, or 4.4 million, of Iranian adults have impaired fasting glucose. This high prevalence of diabetes in working aged adults is an ominous sign for this developing nation. As the relatively young Iranian population ages in the future, and urbanization continues or accelerates, the prevalence of diabetes will likely escalate.
Introduction:
The Middle East is expected to bear one of world’s greatest increases in the absolute burden of diabetes in the coming decades. Most of this increase is anticipated to affect the economically productive 45 to 64 year old age segment, in contrast with most developed countries, where the increase in diabetic patients will occur in those ≥65 years old [1]. Although national estimates of the diabetes burden in Iran do not exist, the most recent study reported a high prevalence of diabetes in the highly urbanized population of Tehran, Iran’s capital city [2]. Here we report the diabetes-related results of the national Survey of Risk Factors of Non-Communicable Diseases (SURFNCID) of Iran. As a population-based sample of over 89,000 Iranians, this study provides an opportunity to estimate the national prevalence and burden of IFG and diabetes. As such, it provides a valuable baseline for public health planning.

Research Design and Methods:
The first Iran SURFNCID, a nationally representative cross-sectional health survey, was conducted in January and February, 2005 using guidelines of the stepwise approach to noncommunicable disease risk factor surveillance of WHO [3,4]. In brief, a multistage probability cluster sampling scheme was used to randomly sample 89400 adults aged 15 to 64 from the urban and rural noninstitutionalized population of all 28 provinces of Iran.

Participants were interviewed and examined to determine demographic characteristics and medical conditions, including a history of diabetes. Participants who reported a history of physician or health care professional -diagnosed diabetes are classified to have known diabetes (KDM). Subsequently, all participants aged 25-64 years (70,981 individuals) were asked to attend a health facility or laboratory for collection of blood samples following a 12-hour fast. The departments of laboratory and medical diagnosis of each corresponding medical university in provinces selected the laboratories based on standard instructions. The laboratories measured FPG with coefficients of variation less than 3%. Out of all 89440 respondents, 18459 individuals were under 25 years and of the remaining 70,981 individuals 53,508(75.4%) participated in the biochemical examination. Blood specimens were collected and handled under standard conditions. After excluding 406 (0.7%) subjects who did not fast and another 871 (1.6%) with invalid blood samples, FPG was measured in 52,231 individuals. In those without KDM, FPG ≥ 126 mg/dl were regarded as newly diagnosed diabetes mellitus (NDM). Those without KDM having FPG levels ≥ 100 mg/dl (5.6 mmol/l) but <126 mg/dl (7.0 mmol/l) were designated as having impaired fasting glucose (IFG) [5].

Data were analyzed considering the cluster and design effects using STATA version 8.0. To extrapolate the results to the Iranian adult population, data were weighted directly to Iran population aged 25 and <65 years, estimated from the 1996 national census, to match the age (10-year strata), sex, and area of residence (rural/urban).

Results:
Total prevalence of diabetes was 7.7% (95% confidence interval [CI]: 7.5-7.9%), equivalent to 2.0 million cases when extrapolated to the Iran population aged 25-64 years (Table). Prevalence of diabetes was about a third higher in urban areas (8.6%) than in rural areas (5.7%). About a half of these cases (1.0 million) were previously undiagnosed. Moreover, 16.8% (CI: 16.4-17.2%), comprising 4.4 million people, had IFG. The peak prevalence was observed among persons aged 55-64 (16.8%), whereas
the greatest total numbers (0.6 million) of diabetic persons was among the 45-54 years age group.

Age-specific prevalence of diabetes was 3.0%, 5.8%, 10.8%, and 14.0% in men and 3.0%, 7.0%, 14.0%, and 19.4% in women aged 25-34, 35-44, 45-54, and 55-64, respectively. This age-related increase in diabetes prevalence was significantly greater among women than men (p<0.003 for sex-age interaction). Age-specific prevalence of IFG was 13.4%, 17.3%, 19.9%, and 21.9% in men and 10.1%, 16.4%, 21.8%, and 26.0% in women aged 25-34, 35-44, 45-54, and 55-64, respectively; the interaction of sex and age on prevalent IFG was significant (P <0.0001).

Conclusions:
In this first nationally representative report of the burden of diabetes in Iran, we found a high prevalence of diabetes and IFG (8% and 17% respectively), and a large proportion (50%) of undiagnosed diabetes. These estimates would be even greater if an oral glucose tolerance test were used in addition to fasting glucose. An additional concern highlighted by our study is the large burden of diabetes among the middle-aged population. Given the increasing life expectancy of Iranians, this observation suggests that the total number of persons with diabetes is likely to be a particular challenge to the Iranian health care system in coming decades.
Diabetes in Iran

References:
Table 1. Estimates of prevalence and burden of newly diagnosed and known diabetes and IFG in the Iranian 25- to 64-year-old population

<table>
<thead>
<tr>
<th>Impaired Fasting Glucose&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Known DM</th>
<th>New DM&lt;sup&gt;a&lt;/sup&gt;</th>
<th>New and Known DM&lt;sup&gt;e&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Burden Prevalence (% (CL))</strong></td>
<td>Burden Prevalence (% (CL))</td>
<td>Burden Prevalence (% (CL))</td>
<td>Burden Prevalence (% (CL))</td>
</tr>
<tr>
<td><strong>Age</strong>&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-34</td>
<td>1,217,452</td>
<td>11.9 (11.2-12.5)</td>
<td>102,657</td>
</tr>
<tr>
<td>35-44</td>
<td>1,336,701</td>
<td>17.3 (16.6-18.1)</td>
<td>248,560</td>
</tr>
<tr>
<td>45-54</td>
<td>1,070,898</td>
<td>21.4 (20.6-22.2)</td>
<td>368,966</td>
</tr>
<tr>
<td>55-64</td>
<td>791,266</td>
<td>24.3 (23.4-25.1)</td>
<td>329,850</td>
</tr>
<tr>
<td><strong>Sex</strong>&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>2,321,870</td>
<td>17.4 (16.8-17.9)</td>
<td>428,275</td>
</tr>
<tr>
<td>Women</td>
<td>2,094,447</td>
<td>16.3 (15.8-16.8)</td>
<td>621,759</td>
</tr>
<tr>
<td><strong>Residential area</strong>&lt;sup&gt;d&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Rural</td>
<td>1,143,041</td>
<td>14.6 (14.0-15.1)</td>
<td>217,785</td>
</tr>
<tr>
<td>Urban</td>
<td>3,273,276</td>
<td>17.8 (17.3-18.3)</td>
<td>832,249</td>
</tr>
<tr>
<td><strong>Total national estimation</strong>&lt;sup&gt;e&lt;/sup&gt;</td>
<td>4,416,317</td>
<td>16.8 (16.4-17.2)</td>
<td>1,050,033</td>
</tr>
</tbody>
</table>

DM, diabetes mellitus; CL, 95% confidence limits
<sup>a</sup> Based on participants’ laboratory results
<sup>b</sup> Standardized for sex and residential area
<sup>c</sup> Standardized for age and residential area
<sup>d</sup> Adjusted for age and sex
<sup>e</sup> Weighted and standardized for age, sex, and residential area on the basis of 2004 Iran population