The prevalence of metabolic syndrome according to the Iranian Committee of Obesity and ATP III criteria in Babol, North of Iran.

Abstract

Background: Metabolic syndrome (MS) is highly significant due to its association to type 2 diabetes and cardiovascular diseases. The purpose of this study was to compare the prevalence of MS according to the report of the Iranian National Committee of Obesity criteria (INCO) versus Adult Treatment Panel III (ATPIII) in Babol, North of Iran.

Methods: Data obtained based on criteria ATP III from the Babol Lipid and Glucose Study (from July 2004 to September 2005) and were compared with the new INCO criteria 2010. The data were collected and analyzed.

Results: In total, 933 adult males and females were evaluated. According to ATP III criteria, the overall prevalence of metabolic syndrome was 23.7% (95% confidence interval: 21%-26.4%); 28.4% and 9.4% were females and males, respectively; however, the prevalence was 20.5% (95% confidence interval:17.9%−23.1%) according to the INCO criteria, 22.5% and 15.7% were females and males, respectively.

Conclusion: The new INCO criteria for the metabolic syndrome proclaimed by the Iranian Committee of Obesity estimated a lower prevalence of syndrome in comparison with ATP III criteria in Babol.

Keywords: Prevalence, Metabolic syndrome, Obesity, Diabetes, Cardiovascular diseases, Babol, ATP III criteria.
Recently, the Iranian National Committee of Obesity (INCO) has announced the new diagnostic criteria in summer 2010 for metabolic syndrome in Iran, and the waist circumference was the only difference with ATPIII criteria (4, 16, 19) (table 1). The new definition requires a new assessment on the prevalence of metabolic syndrome and mortality rate as well as the associated disorders. The research questions are as follows: How much is the prevalence of metabolic syndrome in Babol, North of Iran, based on the new criteria of INCO? How much agreement is there between the new INCO and previous ATPII criteria in the population? Babol Lipid and Glucose Study was conducted in 2004-2005 by the authors; in this regard, we aimed to 1- determine the prevalence of metabolic syndrome in Babol, North of Iran, based on new criteria of the INCO. 2- compare the metabolic syndrome prevalence according to ATP III and INCO criteria and 3- determine the level of agreement between the two criteria.

Table 1. INCO criteria for the diagnosis of metabolic syndrome in Iranian adult population

<table>
<thead>
<tr>
<th>Cut-off points</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>95 cm (men and women)</td>
<td>Elevated waist circumference</td>
</tr>
<tr>
<td>150 mg/dl (1.7 mmol/l)</td>
<td>Elevated triglycerides or drug treatment for elevated triglycerides</td>
</tr>
<tr>
<td>40 mg/dl (1.0 mmol/l) in males</td>
<td>Reduced HDL-C</td>
</tr>
<tr>
<td>50 mg/dl (1.3 mmol/l) in females</td>
<td>or drug treatment for reduced the HDL-C</td>
</tr>
<tr>
<td>Systolic 130 mmHg And/or diastolic 85 mmHg</td>
<td>Elevated blood pressure or antihypertensive drug treatment in patients with a history of hypertension</td>
</tr>
<tr>
<td>100 mg/dl</td>
<td>Elevated fasting glucose or drug treatment for elevated levels</td>
</tr>
</tbody>
</table>

Methods

The study population and procedures: Babol Lipid and Glucose Study started in July 2004 in Ali Ebne Moussa Reza Health Center and ended in September 2005. The research invitation form was distributed to all the city health centers by Healthcare Department of Babol, so that all the volunteers could refer to the location of the study implementation. All the adults over 20 years of age who voluntarily referred to the health center were enrolled. With regard to the age group of over 20 years and the prevalence of dyslipidemia p=0.25 and considering the household size, 3.75, the number of samples was determined to be 930.

The data collection: Four experienced obstetric experts trained for research implementation were responsible for filling out the questionnaires and performing the physical examinations. The experts explained the completion mode of the questionnaire, and that it would be completed by the experts themselves in case of the participants’ illiteracy. The attached questionnaire consisted of demographic information, medical history, personal habits, chest pain, and gynecological questions. Physical examination included blood pressure measurement in addition to anthropometric, height, weight, waist, hip and wrists circumference measurements. Blood pressure was twice measured at an interval of 30 minutes from the subjects’ right arm in a sitting position by an experienced obstetrics expert using a standard mercury barometer with a cuff, the size of which was varied depending on the subjects’ arm circumference. Both measurements were average and considered as the subjects’ final blood pressure. After the completion of questionnaires and physical examination, the patients referred to the laboratory for biochemical tests (glucose, cholesterol, triglycerides, HDL, LDL) in fasting state and 2 hours after 75 g oral glucose intake. Following blood sampling and centrifugation, the serum samples were kept in Eppendorf microtubes in the freeze at -20°C. The samples were taken every week to the Biochemistry Laboratory of Babol University of Medical Sciences and all the tests were performed using the reference methods.

Criteria of metabolic syndrome: According to the Iranian National Committee of Obesity, having at least three criteria will qualify a person for metabolic syndrome (table 1). Based on ATPIII criteria (4, 16), a person is diagnosed with metabolic syndrome if three or more of the following criteria are present:

1. Central obesity, waist circumference (WC) ≥102 and 88 cm in men and women, respectively.
2. Hypertriglyceridemia [triglycerides (TG) ≥150 mg/dL].
3. Decreased HDL (less than 40 and 50 mg/dL in males and females, respectively).
females, respectively). 4. high blood pressure, systolic or
diastolic pressure $\geq 130/85$ mmHg. 5. fasting plasma glucose
(FPG) $\geq 100$ mg/dL. (table 1).

Statistical analysis: The results were compared based on
frequency, percentage, 95% confidence intervals showed in
the prevalence of various disorders using t-test. P-value
$<0.05$ was considered as statistically significant level.

Results

From the total number of 933 participants, 191 (20.5%)
were males, 711 (76.2%) were females, and 31 (3.3%)  cases
were recorded with unknown gender (table 2). Accord ing to
the criteria published by the Iranian National Comm ittee of
Obesity (INCO) in 2011, the prevalence of metabolic
syndrome had been 191 (20.5%), with 95 confidence i nterval
(17.9%-23.1%) Whilst the frequency had been 221 (23.7%),
with 95 confidence interval (21%-26.4%). According to the
old criteria (ATP III), between which the level of agreement
had been K=0.832±0.022 (tables 3, 4). Regarding the  INCO
criteria, 160 (22.5%) women and 30 (15.7%) men had been
observed with metabolic syndrome among the study
population, which was significantly higher in females
(22.5%) than males (15.7%) ($p<0.05$). According to the old
criteria (ATP III), 202 (28.4%) women and 18 (9.4%)  men
had metabolic syndrome ($p=0.045$). The prevalence of
metabolic syndrome was 29.9% (63 cases) in the population
over 50 years of age, and 9.1% (6 cases) in the population
under 30 years of age ($p= 0.001$).

Based on the INCO criteria, TG $\geq 150$ was the most
common metabolic syndrome-associated abnormality with
46.6% prevalence in males and 53% in females (table 3).
According to the INCO criteria, 18.9% of the study subjects
did not have any of the criteria for the metabolic syndrome,
and 32.7%, 28%, 15.8% and 4.7% had respectively one, two,
three and more than three criteria; whereas, based on ATP III
criteria, 15.2% of participants showed no criteria, and
32.4%, 28.7%, 18% and 5.7% were respectively observed
with one, two, three and more than three criteria.

Based on the body mass index (BMI), the study subjects
were divided into two groups; one with BMI<30 and the
other with BMI$\geq 30$; in the comparison between the subjects
with and those without metabolic syndrome according to the
INCO criteria, it has been revealed that those with metabolic
syndrome had higher BMI compared to the others; so 60% of
patients with metabolic syndrome were observed with
BMI$\geq 30$ and 40% with BMI<30, while in the healthy group,
63.5% and 36.5% of subjects were found with BMI<30 and
BMI$\geq 30$, respectively ($p=0.000$).

Table 2. Prevalence of metabolic syndrome criteria in Babol Population

<table>
<thead>
<tr>
<th>Age</th>
<th>No</th>
<th>Abdominal Obesity No (%)</th>
<th>Triglyceride $\geq 150$ mg/dl No (%)</th>
<th>HDL- C* No (%)</th>
<th>Hypertension $\geq 130/85$ mmHg No (%)</th>
<th>Fasting Blood Sugar $\geq 100$ mg/dl No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-29</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>1 (33.3)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>30-39</td>
<td>50</td>
<td>16 (32)</td>
<td>7 (14)</td>
<td>20 (40)</td>
<td>2 (4)</td>
<td>8 (16)</td>
</tr>
<tr>
<td>40-49</td>
<td>49</td>
<td>23 (46.9)</td>
<td>11 (22.4)</td>
<td>24 (49)</td>
<td>2 (4.1)</td>
<td>5 (10.2)</td>
</tr>
<tr>
<td>50-59</td>
<td>42</td>
<td>22 (52.4)</td>
<td>7 (16.7)</td>
<td>22 (52.4)</td>
<td>3 (7.1)</td>
<td>7 (16.7)</td>
</tr>
<tr>
<td>$\geq 60$</td>
<td>37</td>
<td>18 (48.6)</td>
<td>9 (24.3)</td>
<td>19 (51.4)</td>
<td>-</td>
<td>15 (40.5)</td>
</tr>
</tbody>
</table>

| Women |    |                          |                                     |               |                                      |                                        |
| 20-29 | 63 | 12 (19)                  | 22 (34.9)                           | 22 (34.9)     | 16 (25.4)                            | 5 (7.9)                                 |
| 30-39 | 273 | 106 (38.8)              | 173 (63.9)                          | 135 (49.5)    | 70 (25.6)                            | 23 (8.4)                               |
| 40-49 | 213 | 103 (48.4)              | 158 (74.2)                          | 125 (58.8)    | 47 (22.1)                            | 34 (16)                                |
| 50-59 | 100 | 53 (53)                 | 71 (71)                             | 63 (63)       | 25 (25)                              | 23 (23)                                |
| $\geq 60$ | 29 | 17 (58.6)                | 22 (75.9)                           | 18 (62.1)     | 7 (24.1)                             | 11 (37.9)                              |

* Men < 40 and women <50 mg/dl.
A. Waist circumference based on INCO criteria: men and women $\geq 95$cm
B. Waist circumference based on ATP III criteria: men $\geq 102$ cm, women $\geq 88$cm
The prevalence of metabolic syndrome in Babol, North of Iran

Table 3. Comparison of the cardiovascular risk factor in metabolic syndrome and normal groups based on Iranian National Obesity Committee (INCO) criteria

<table>
<thead>
<tr>
<th>Variables</th>
<th>Normal Mean±SD</th>
<th>Men Metabolic syndrome Mean±SD</th>
<th>p value</th>
<th>Normal Mean±SD</th>
<th>Women Metabolic syndrome Mean±SD</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI* (kg/m²)</td>
<td>28.3±14.9</td>
<td>28.7±3.3</td>
<td>0.874</td>
<td>29.4±5.5</td>
<td>31.7±5.1</td>
<td>0.0001</td>
</tr>
<tr>
<td>WC** (cm)</td>
<td>90.2±12.5</td>
<td>100.3±5.3</td>
<td>0.0001</td>
<td>91.4±11.7</td>
<td>101.4±10.1</td>
<td>0.0001</td>
</tr>
<tr>
<td>FPG* (mg/dl)</td>
<td>89.7±30.5</td>
<td>100±18.8</td>
<td>0.062</td>
<td>87.3±35.4</td>
<td>119.1±50.9</td>
<td>0.0001</td>
</tr>
<tr>
<td>Systolic BP**</td>
<td>113.7±11.01</td>
<td>127.2±16.9</td>
<td>0.001</td>
<td>110±11.6</td>
<td>120.07±15.3</td>
<td>0.0001</td>
</tr>
<tr>
<td>Diastolic BP**</td>
<td>73.2±9.4</td>
<td>84.2±10.5</td>
<td>0.0001</td>
<td>70.25±11</td>
<td>75.1±13.4</td>
<td>0.0001</td>
</tr>
<tr>
<td>LDL (mg/dl)</td>
<td>120.6±67.8</td>
<td>140.4±87.06</td>
<td>0.191</td>
<td>115.1±66.6</td>
<td>121.3±73.02</td>
<td>0.411</td>
</tr>
<tr>
<td>Cholesterol (mg/dl)</td>
<td>215.8±90.5</td>
<td>257.9±109.81</td>
<td>0.028</td>
<td>203.4±78.47</td>
<td>221.3±91.1</td>
<td>0.027</td>
</tr>
<tr>
<td>HDL (mg/dl)</td>
<td>64.3±28.5</td>
<td>64.1±34.4</td>
<td>0.971</td>
<td>62.2±21.08</td>
<td>54.7±25.9</td>
<td>0.002</td>
</tr>
<tr>
<td>Triglyceride (mg/dl)</td>
<td>182.5±137.3</td>
<td>286.3±176.48</td>
<td>0.0001</td>
<td>175.9±131.2</td>
<td>279.3±167.9</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

* Body Mass Index  **Waist circumference  *Fasting Plasma Glucose  **Blood Pressure (mmHg)

Table 4. Comparison of the cardiovascular risk factor in metabolic syndrome and normal groups based on previous criteria (ATP III)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Normal Mean±SD</th>
<th>Men Metabolic syndrome Mean±SD</th>
<th>p value</th>
<th>Normal Mean±SD</th>
<th>Women Metabolic syndrome Mean±SD</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI* (kg/m²)</td>
<td>28.2±14.2</td>
<td>29.7±3.6</td>
<td>0.0001</td>
<td>29.5±5.7</td>
<td>31.16±4.9</td>
<td>0.653</td>
</tr>
<tr>
<td>WC** (cm)</td>
<td>90.7±12.2</td>
<td>102.1±6.1</td>
<td>0.0001</td>
<td>91.49±12.27</td>
<td>99.27±10</td>
<td>0.0001</td>
</tr>
<tr>
<td>FPG* (mg)</td>
<td>89.6±29.7</td>
<td>102.4±20.07</td>
<td>0.0001</td>
<td>84.8±30.04</td>
<td>118.11±54.05</td>
<td>0.078</td>
</tr>
<tr>
<td>Systolic BP**</td>
<td>114.5±11.7</td>
<td>127.5±17.7</td>
<td>0.0001</td>
<td>110.5±11.44</td>
<td>118.5±15.2</td>
<td>0.011</td>
</tr>
<tr>
<td>Diastolic BP**</td>
<td>73.6±9.6</td>
<td>86.8±9.4</td>
<td>0.001</td>
<td>70.1±10.9</td>
<td>74.39±13.3</td>
<td>0.0001</td>
</tr>
<tr>
<td>LDL (mg/dl)</td>
<td>126.1±73.4</td>
<td>107.5±54</td>
<td>0.966</td>
<td>116.7±68.16</td>
<td>117.07±69.16</td>
<td>0.316</td>
</tr>
<tr>
<td>Cholesterol (mg/dl)</td>
<td>222.7±95.2</td>
<td>228.2±98.2</td>
<td>0.070</td>
<td>203.8±80.1</td>
<td>216.83±85.7</td>
<td>0.819</td>
</tr>
<tr>
<td>HDL (mg/dl)</td>
<td>63.9±28.1</td>
<td>67.9±39.7</td>
<td>0.0001</td>
<td>63.07±20.54</td>
<td>54.7±25.5</td>
<td>0.586</td>
</tr>
<tr>
<td>Triglyceride (mg/dl)</td>
<td>190.2±137.4</td>
<td>291.3±213.5</td>
<td>0.0001</td>
<td>167.88±129.2</td>
<td>275.2±159.6</td>
<td>0.006</td>
</tr>
</tbody>
</table>

* Body Mass Index  **Waist circumference  *Fasting Plasma Glucose  **Blood Pressure (mmHg)

According to the INCO criteria, the cholesterol level was ≥ 200 in 51.9% and cholesterol <199.5 mg/dl in 48.1% of the study subjects with metabolic syndrome, also, cholesterol ≥200 in 47.8% and cholesterol <199.5 mg/dl in 52.2% of healthy participants.

In spite of the difference between the results obtained, it was not statistically significant (p=0.324). Based on ATP III criteria, cholesterol ≥ 200 was reported in 49.4% of participants with metabolic syndrome and 48.5% of the healthy subjects, between which the difference was not statistically significant (p=0.875). Moreover, LDL≥130 mg/dl was observed in 36% of patients with metabolic syndrome and 26% of healthy individuals (p=0.107), but according to ATP III criteria, LDL level was ≥130 mg/dl in 31% of patients with metabolic syndrome and 30.4% of healthy subjects (p=0.923).
Discussion

In the present study, the prevalence of metabolic syndrome has been 20.5% in adults over 20 years of age based on the criteria reported by the Iranian National Committee of Obesity which has been reduced compared to the previous criteria (ATP III) with 23.7% prevalence. For the explanation of this finding, it can be stated that since 711 of the study participants were females and 191 were males and the common waist circumference cut-off point was ≥95cm, according to the INCO criteria, the reduction in the prevalence seems to be rational compared to the ATP III criteria which was ≥88cm for women and ≥102 for men.

The prevalence of metabolic syndrome has been slightly lower in the present research compared to the previous studies in Iran, reporting 32.7%, 29.9% and 30.1% (13, 20). The existing discrepancies may be owing to the variations in syndrome definition; for instance, other studies reported 3-3.5% prevalence of metabolic syndrome in Italy, while all the five criteria have been considered essential for the diagnosis of the syndrome (21).

Although genetic factors play an important role in the development of metabolic syndrome, higher prevalence of the syndrome goes back to people's lifestyle in our country as they are turning to fatty and fast foods besides inactivity. An increasing trend was observed along with increasing age in both genders which was statistically significant and in accordance with previous investigations (13, 22). With respect to the study conducted, the syndrome prevalence was higher in females than males (22.5% vs. 15.7%), which is not in consistence with other studies, reporting the same prevalence in either genders or slightly more in men but in consistence with other investigations in Iran (20-21, 23).

In line with Fakhrzadeh et al. (20) and Sarrafzadegan et al. (24) studies, high triglyceride was the most common metabolic dysfunction in the present study, probably due to wrong nutritional habits and lack of physical activity; however, low HDL-C was the most frequent abnormality in another study in Iran, which is not contradictory to the present research owing to the relationship between HDL-C and TG, as low HDL-C is brought about by high TG levels (13, 25). Similar to the previous surveys, the prevalence of metabolic syndrome has been significantly associated to increased BMI, and those with metabolic syndrome have had higher BMI (≥30); therefore, helping the obese and overweight individuals to achieve a desirable weight seems to be crucial (20, 26-28).

A healthy lifestyle along with a balanced diet, more consumption of fruits and vegetables, enough physical activities, regular aerobic exercises, keeping fit, and losing the extra weight are the best strategies for the prevention of obesity and metabolic syndrome (27). Although the frequency of cholesterol ≥200 and LDL ≥130 was higher in patients with metabolic syndrome than healthy subjects, the difference was not statistically significant.

According to the study of Sharifi et al. in Zanjan, Iran BMI ≥30, cholesterol ≥200 and LDL ≥130 were higher in those with metabolic syndrome than the normal individuals (25). The prevalence of cardiovascular risk factors (inappropriate waist circumference, TG ≥130, low HDL-C and high blood pressure) was remarkably higher in subjects with metabolic syndrome than those without it, however, the condition was reversed for HDL-C, of course, considering the fact that most of these factors have the same criteria involved in metabolic syndrome, the findings were somehow predictable and in agreement with those obtained by Fakhrzadeh et al. and Anand et al. (20, 29).

In the present study, the number of men was lower than the women and it could be a limitation of the study, but for the comparison of metabolic syndrome prevalence based on the new and old criteria, the population was quite the same. The lower prevalence of metabolic syndrome based on INCO criteria compared with the prevalence of previous ATP III criteria in Babol was due to the difference in waist circumference cut off point between these criteria. However, this difference was not significant.

In summary, the new INCO criteria for the metabolic syndrome, proclaimed by the Iranian Committee of Obesity estimated a lower prevalence of syndrome in comparison with ATP III criteria in Babol. The prevalence of metabolic syndrome was high. Appropriate screening, preventive and therapeutic programs should be considered and implemented in Babol, North of Iran.

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Conflict of interest: There was no conflict of interest.
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