Original Article

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

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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.

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Metabolic syndrome (MS), also known as syndrome X, includes hypertension, glucose intolerance, high triglycerides and low High density lipoprotein (HDL), and is considered as a risk factor for cardiovascular diseases. Not only is the metabolic syndrome a risk factor for cardiovascular diseases and diabetes mellitus, but also increases the risk of other disorders such as polycystic ovary syndrome, fatty liver, cholesterol gallstones, asthma, sleep disorders and some malignancies (1-4).

Studies showed that oxidative stress has important role in pathogenesis of metabolic syndrome and many other diseases (1, 2, 5-12). The prevalence of metabolic syndrome in Iran is one of the highest worldwide. The overall prevalence of metabolic syndrome in Iranian adult population has been reported to be 34.7 to 41.6% according to the different criteria with regard to age (13, 14). Various definitions have been proposed for metabolic syndrome. The first definition was presented by the World Health Organization in 1998 (15). In 2001, the National Cholesterol Education Program (NCEP)-ATPIII (Adult Treatment Panel) proposed a definition which was revised in 2004 with a reduction in fasting serum glucose to 100 mg/dL (4, 16).

The other definitions were then suggested by the Endocrine Society of America and the International Diabetes Federation (17, 18). In most of the definitions, the ideal cut-off points have been mentioned for five criteria including the waist circumference, blood pressure, plasma glucose, triglycerides and HDL, and the waist circumference is the distinctive aspect between all the definitions presented.

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 ATP III 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**

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

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 88cm 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). 4. high blood pressure, systolic or diastolic pressure ≥130/85 mmHg. 5. fasting plasma glucose (FPG) ≥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). According to the criteria published by the Iranian National Committee of Obesity (INCO) in 2011, the prevalence of metabolic syndrome had been 191 (20.5%), with 95 confidence interval (17.9%-23.1%) Whilst the frequency had been 221 (23.7%), with 95 confidence interval (21%-26.4%). According to the old criteria (ATPIII), 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 ≥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≥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≥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≥30, respectively (p=0.000).

Table 2. Prevalence of metabolic syndrome criteria in Babol Population

Age	No	Abdominal Obesity No (%)		Triglyceride ≥150 mg/ dl No (%)	HDL- C* No (%)	Hypertension ≥130/85 mm Hg No (%)	Fasting Blood Sugar ≥100 mg/dl No (%)
		A	B				
Men							
20-29	3	-	-	-	1 (33.3)	-	-
30-39	50	16 (32)	7 (14)	20 (40)	2 (4)	8 (16)	14 (28)
40-49	49	23 (46.9)	11 (22.4)	24 (49)	2 (4.1)	5 (10.2)	14 (28.6)
50-59	42	22 (52.4)	7 (16.7)	22 (52.4)	3 (7.1)	7 (16.7)	9 (21.4)
≥ 60	37	18 (48.6)	9 (24.3)	19 (51.4)	-	15 (40.5)	8 (21.6)
Women							
20-29	63	12 (19)	22 (34.9)	22 (34.9)	16 (25.4)	5 (7.9)	6 (9.5)
30-39	273	106 (38.8)	173 (63.9)	135 (49.5)	70 (25.6)	23 (8.4)	64 (23.4)
40-49	213	103 (48.4)	158 (74.2)	125 (58.8)	47 (22.1)	34 (16)	60 (28.2)
50-59	100	53 (53)	71 (71)	63 (63)	25 (25)	23 (23)	26 (26)
≥ 60	29	17 (58.6)	22 (75.9)	18 (62.1)	7 (24.1)	11 (37.9)	13 (44.8)

* Men < 40 and women <50 mg/dl.

A. Waist circumference based on INCO criteria: men and women ≥ 95cm

B. Waist circumference based on ATP III criteria: men ≥102 cm, women ≥88cm

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

Variables	Men			Women		
	Normal Mean±SD	Metabolic syndrome Mean±SD	p value	Normal Mean±SD	Metabolic syndrome Mean±SD	p value
BMI* (kg/m^2)	28.3±14.9	28.7±3.3	0.874	29.4±5.5	31.7±5.1	0.0001
WC** (cm)	90.2±12.5	100.3±5.3	0.0001	91.4±11.7	101.4±10.1	0.0001
FPG❖ (mg/dl)	89.7±30.5	100±18.8	0.062	87.3±35.4	119.1±50.9	0.0001
Systolic BP❖❖	113.7±11.01	127.2±16.9	0.001	110±11.6	120.07±15.3	0.0001
Diastolic BP❖❖	73.2±9.4	84.2±10.5	0.0001	70.25±11	75.1±13.4	0.0001
LDL (mg/dl)	120.6±67.8	140.4±87.06	0.191	115.1±66.6	121.3±73.02	0.411
Cholesterol (mg/dl)	215.8±90.5	257.9±109.81	0.028	203.4±78.47	221.3±91.1	0.027
HDL (mg/dl)	64.3±28.5	64.1±34.4	0.971	62.2±21.08	54.7±25.9	0.002
Triglyceride (mg/dl)	182.5±137.3	286.3±176.48	0.0001	175.9±131.2	279.3±167.9	0.0001

* 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)

Variables	Men			Women		
	Normal Mean±SD	Metabolic syndrome Mean±SD	p value	Normal Mean±SD	Metabolic syndrome Mean±SD	p value
BMI* (kg/m^2)	28.2±14.2	29.7±3.6	0.0001	29.5±5.7	31.16±4.9	0.653
WC** (cm)	90.7±12.2	102.11±6.1	0.0001	91.49±12.27	99.27±10	0.0001
FPG❖ (mg)	89.6±29.7	102.4±20.07	0.0001	84.8±30.04	118.11±54.05	0.078
Systolic BP❖❖	114.5±11.7	127.5±17.7	0.0001	110.5±11.44	118.5±15.2	0.011
Diastolic BP❖❖	73.6±9.6	86.8±9.4	0.0001	70.1±10.9	74.39±13.3	0.0001
LDL (mg/dl)	126.1±73.4	107.5±54	0.966	116.7±68.16	117.07±69.16	0.316
Cholesterol (mg/dl)	222.7±95.2	228.2±98.2	0.070	203.8±80.1	216.83±85.7	0.819
HDL (mg/dl)	63.9±28.1	67.9±39.7	0.0001	63.07±20.54	54.7±25.5	0.586
Triglyceride (mg/dl)	190.2±137.4	291.3±213.5	0.0001	167.88±129.2	275.2±159.6	0.006

* 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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