DOI: 10.21276/sjams.2016.4.9.47

Scholars Journal of Applied Medical Sciences (SJAMS) **ISSN 2320-6691 (Online)**
Sch. J. App. Med. Sci., 2016; 4(9D):3402-3407 **ISSN 2347-954X (Print)**

(An International Publisher for Academic and Scientific Resources)
www.saspublisher.com

Original Research Article

Prevalence of metabolic syndrome according to different criteria in adults

Armaghan Moravej Aleali[1] , Hajieh Shahbazian[1] ,Leila Yazdanpanah[1] , Seyed Mahmoud Latifi[1], Sara Bahrainian[2]

[1]Health Research Institute, Diabetes Research Center, Ahvaz Jundishapur University of Medical Sciences. Ahvaz, Iran

[2]Department of Pharmaceutics, School of Pharmacy, Tehran University of Medical Sciences. Tehran, Iran

***Corresponding author**
Armaghan Moravej Aleali
Email: armaghanaleali@yahoo.com

Abstract: Metabolic syndrome is a collection of abdominal obesity, hypertension, glucose intolerance and lipid abnormalities (elevated triglycerides, elevated LDL, and decrease the amount of HDL). The aim of this study is to investigate the prevalence of metabolic syndrome in people of Ahvaz according to IDF, ATPIII, Harmonized I and Harmonized II. A cross-sectional study with random cluster sampling in six health centers in Ahvaz was done. Questionnaire for each person filled up including demographic data and examinations, including blood pressure, weight, height, and waist circumference and waist circumference measurement. Prevalence of metabolic syndrome according to ATPIII, IDF, Harmonized I and Harmonized II criteria evaluated. From all participating 912 person, (434 (2/47%) male and 478 (2/52%) female) were evaluated. Mean age was 42/27± 14years (44/2±14/26 for male and 40/5±13/5 for female). Prevalence of metabolic syndrome was 22/8%, 28/4%, 30/9% and 16/9% according to ATPIII, IDF, Harmonized I and Harmonized II criteria respectively and increased with age in both sexes. IDF and Harmonized I had most kappa coordination (0/94). The results show high prevalence of metabolic syndrome in Ahvaz_without considering the different criteria. IDF criteria has good concordance with HI Criteria.
Keywords: Metabolic syndrome, IDF, ATPIII, Prevalence, adults.

INTRODUCTION

Metabolic syndrome or insulin resistance syndrome or X syndrome means presence of abdominal obesity, high blood pressure, glucose intolerance, and lipid disorders (increased triglycerides, increased HDL, and decreased levels of HDL[1]. It is accompany with cardiovascular complications and development of diabetes [2]. It was first explained as metabolic syndrome by Reaven et al 3]. World Health Organization (WHO) was the first organization to provide a clear definition to metabolic syndrome in 1998[4].In 2001, Adult Treatment Panel (ATPIII) provided another definition for this syndrome [5]. The studies have indicated that a set of factors enhances the risk of development of cardiovascular diseases and diabetes [6]. Prevalence of metabolic syndrome is increasing in the world, which is a big health problem. About one fourth of adult population is afflicted by metabolic syndrome [6-8].

Although there are various methods for diagnosis of metabolic syndrome, the most practical methods of clinical diagnosis is to use ATPIII criteria according to which the patient is afflicted by at least three cardiovascular risk factors simultaneously [9,10]. Based on previous definitions, International Diabetes Federation (IDF) proposed another definition in 2005[5,11]. According to this definition, the main emphasis is on abdominal obesity which is different for different races. Based on this definition, waist size for abdominal obesity is 94≤ cm for men and 80≤ cm for women, which are lower compared to ATPIII definition [12].

Some studies have been carried out on different populations with both definitions to investigate the prevalence of metabolic syndrome. For example, in USA[13], according to IDF definition, the prevalence of metabolic syndrome was 40% in adults. The prevalence in Tehran [14] was 31% and 31.7% based on IDF and ATPIII definition respectively. Moreover, in Semnan[2] the prevalence was 28.5 and 35.8% based on ATPIII and IDF, respectively. There is a continuous attempt to obtain more precise criteria.

Some studies [5,6] proposed new criteria called "harmonized criteria for metabolic syndrome. These criteria are based on a combination of IDF and ATPIII.

Harmonized I (H I) criterion includes ATPIII criteria for the prevalence of metabolic syndrome, but size of abdominal obesity is based on IDF[6,13,15,16].

Harmonized II (H II) criterion includes IDF criteria, but waist circumference is based on ATPIII[6,13,16].

The aim of this study was evaluation of the prevalence of metabolic syndrome among people in Ahvaz based on IDF, ATPIII, H I, and H II criteria and concordance of this criteria.

METHODS

The present descriptive analytical study employed a random cluster sampling with the help of the personnel of 6 health centers in Ahvaz. In each center, 76 families were randomly selected, and after their informed consent was gained, 2 members from each family were invited to participate in the study by the centers' authorities. After they were justified, the questionnaires were completed using their individual data, and afterwards examinations like blood pressure in sitting position, weight, height, stomach circumference, and waist circumference. After a break of 15 minutes, the individual's blood pressure was measured using a standard sphygmomanometer once to determine the maximum amount of winding the device, and once to determine the individuals' blood pressure. The participant placed in sitting position and the cuff was fastened on the right arm at a height equal to the heart. Afterwards, the device was winded up quickly so that its pressure reached about 30 mm Hg above the level of the disappearance of radial pulse. The re-measuring of blood was carried out with a distance of 30 minutes, and the mean amount was considered as the individual's blood pressure. Anthropometric measures were carried out after the participants took off their shoes and wore light clothes. Weight and height were measured based on a standard program. The waist circumference was measured at the level of navel, and that of thigh over the clothes and at the highest diameter. The individuals' blood sample was obtained after 12 hours of fasting. Afterwards, the samples were centrifuged and the serum was preserved in the fridge and sent to the laboratory of diabetes studies center. The blood sugar, triglyceride (TG), cholesterol, and high density lipoprotein (HDL) were measured by Enzyme-Colorimetric method and using Pars Azmoon Kits. The autoanalyzer that was used was Biotechnical Instrument, model BT-3000 made in Germany. The level of LDL was measured based on Friedwald Formula, given the amount of triglyceride being lower than 400 mg/dl.

In order to diagnose metabolic syndrome, presence of at least three out of five following cases was considered (according to ATPIII principle) (based on update 2005) [9, 10].

1. Abdominal obesity (waist circumference of 102≤ cm for men and 88≤ cm for women)
2. TG≥150 mg/dl or consumption of medicine for hypertriglyceridemia
3. HDL≤40 mg/dl for men and ≤50 for women or consumption of medicine to increase HDL
4. High blood pressure: BP≥130.85 Mm Hg or consuming antihypertensive drug
5. History of diabetes or consumption of medicine to reduce blood sugar or fasting blood sugar≥100 mg/dl

IDF[12,13] has considered as series of clinical criteria for metabolic syndrome which are similar to those of ATPIII, with this difference that waist circumference is differently defined for different races.

These criteria are as follows:

Waist circumference of equal or over 94 cm for men and equal or over 80 cm for women. In addition to at least two of the following signs:

1. TG of equal or over 150 mg/dl or its special medicine.
2. HDL cholesterol of below 40 mg/dl for men and below 50 mg/dl for women.
3. Hypertension (diastolic blood pressure of equal or over 85 Mm Hg, systole blood pressure of 130 Mm Hg) or consuming blood pressure drug
4. Fasting sugar of equal or over 100 mg/dl or consuming diabetes drug

H I criteria are the same as ATPIII criterion with this difference that the waist circumference of IDF is used in them [6,13,15,16].

H II criteria are the same IDF criteria; however, the waist circumference of ATPIII is used in them [6,13,16]

The data related to the examinations, the results of blood samples, the amount of daily activities, smoking, history of pregnancy for women, family history of diabetes, blood pressure and obesity, education level, ethnicity, and marital status were included in the questionnaire. Descriptive statistics was employed to provide the tables and diagrams, and chi-square test was run to evaluate the correlations. The significant level was set at 0.05.

RESULTS

In this study, there were 913 individuals of over 20 years, with an average age of 42.2±14 years, 434 men (47.5%) and 479 women (52.5%). The mean

age of men and women was 44.2±14.2 and 40.5±13.4 years, respectively, which proved a significant difference between them.(P=0.0001)

The participants' total characteristics are presented in table 1. In addition to age, there was a significant difference between the men and women in terms of their waist circumference, TG, HDL, and BMI. .(P=0.0001)
However, systolic blood pressure was not significantly different between them. .(P=0.11)

The prevalence of metabolic syndrome was 22.8%, 28.4%, 30.9%, and 16.9% based on ATPIII, IDF, H I, and H II, respectively, which is significantly higher among women than men. .(P<0.0001)(Table 2)

Table 3 presents the prevalence of metabolic syndrome based on age in four different definitions. It shows that metabolic syndrome increases with an increase in age.

Based on different definitions, the prevalence of different components of metabolic syndrome among the patients indicates that TG has the highest prevalence in the three definitions of IDF, ATPIII, and H II and waist circumference has the maximum prevalence in Harm I.(Table4)

Kappa coefficient was employed to check the consistency level among the definitions.

According to IDF definition, 2.5% of the individuals who had metabolic syndrome based on ATPIII were reported to be normal. Kappa coefficient for the concordance of the two variables was reported to be 0.72.(Table 5)

On the other hand, IDF and Harm I had the highest concordance based on Kappa coefficient.(κ=0.94)

Table 1: Demographic information of all participants

Variables	Male	Female	Total	P value
Age	44.2±14.2	40.5±13.4	44.2±14.2	0.0001
Waist	90.8±10.7	85±12.3	90.8±10.7	0.0001
Systolic BP	116.2±20.6	114±21.4	116.2±20.6	0.11
Diastolic BP	72.4±15.2	70.1±15.3	72.4±15.2	0.021
FBS	109.1±46.5	103.4±40.1	109.1±46.5	0.049
TG	177.6±111.6	147.9±106.8	177.6±111.6	0.0001
HDL	53.1±11.2	61.1±12.6	53.1±11.2	0.0001
BMI	26.3±3.9	27.7±5.2	26.3±3.9	0.0001

Table 2: Prevalence of metabolic syndrome according to different criteria

Criteria for M.S	Total (%)	Male (%)	Female (%)	P value
ATPIII	22.8	15.9	29	0.0001
IDF	28.4	23.3	33	0.0001
Harm I	3.9	27	34.4	0.014
Harm II	16.9	8.3	24.6	0.0001

Table 3: Prevalence of metabolic syndrome according to different criteria in age groups

Age groups	No.	ATPIII	OR	IDF	OR	Harm I	OR	Harm II	OR
20-29	203	6.4	1	9.4	1	10.3	1	4.9	1
30-39	198	14.6	2.5	45	2.84	22.7	2.5	12.1	2.6
40-49	227	16.9	5.3	78	5.07	37.4	5.1	21.1	5.17
50-59	176	33.5	7.3	72	6.7	43.2	6.5	25	6.4
60-69	80	42.5	10.8	34	7.15	52.5	9.5	26.3	6.8
≥70	29	41	10.3	11	5.9	44.8	7	24.1	6.1

Table 4: Prevalence of metabolic syndrome component in participants

Criteria	No.	Waist(%)	FBS(%)	HNT(%)	TG(%)	HDL(%)
IDF	259	259(100)	180(69.5)	92(35.5)	202(78)	164(63.3)
ATPIII	208	154(74)	160(76.9	93(44.7)	167(80.3)	141(67.8)
Harm I	282	259(91.8)	201(71.3)	105(37.2)	223(79.1)	180(63.8)
Harm II	154	154(100)	111(72.1)	61(39.6)	116(75.3)	100(64.9)

Table 5: Harmonized of 4 different criteria of metabolic syndrome

Others Criteria	IDF Criteria				
		With syndrome	Without syndrome	κ	P value
ATPIII	With syndrome	185(20.3)	23(2.5)	0.72	0.0001
	Without syndrome	74(8.1)	631(96.1)		
Harm I	With syndrome	259(28.4)	23(2.5)	0.94	0.0001
	Without syndrome	0(0)	631(69.1)		
Harm II	With syndrome	154(16.9)	0(0)	0.67	0.0001
	Without syndrome	105(11.5)	654(71.6)		
	ATPIII Criteria				
Harm I	With syndrome	208(22.8)	74(8.1)	0.795	0.0001
	Without syndrome	0(0)	631(89.5)		
Harm II	With syndrome	154(16.9)	0(0)	0.815	0.0001
	Without syndrome	54(5.9)	705(77.2)		

DISCUSSION

The present study indicated the prevalence rate of metabolic syndrome based on 4 definitions of ATPIII, IDF, HI, and HII and also the consistency among these definitions. Prevalence of metabolic syndrome was 22.8%, 28.4%, 30.9%, and 16.9% based on ATPIII, IDF, H I, and H II, respectively, with the highest definition related to H I and the lowest to H II.

Moreover, the minimum consistency was related to IDF and H II with Kappa coefficient of 0.67, and the maximum was related to IDF and H I with Kappa coefficient of 0.94. Compared to ATPIII and H II, IDF and H I definitions show a higher prevalence of metabolic syndrome. In a study in Semnan[2], the prevalence of metabolic syndrome was 35.8% based on IDF and 28.5% based on ATPIII, which is in agreement with the results of the present study. Moreover, in a study carried out in Zahedan[17], the prevalence reported based on IDF was more than that of APTIII (24% vs. 21%). Moreover, in other studies carried out in Qatar[18], India[19], and Germany[20] (The KORA Survey, 2000), similar studies were reported.

However, in some studies like the study of sugar and lipid in Tehran, the prevalence based on ATPIII was more than that of IDF. Moreover, in a study carried out in Mexico[21] and China[22], the results were in agreement with the study of sugar and lipid in Tehran. In all of these four definitions of metabolic syndrome, prevalence among women is significantly higher than that of men, which is in line with some studies in Iran. This difference can be attributed to the less active life of women and their obesity especially abdominal obesity and also their hormonal issues. In study carried out in the USA and Qatar, prevalence was higher among women than men.

In this study, syndrome prevalence increases with an increase in age, which is in agreement with the results of the studies carried out in Iran and other countries. In a study carried out by Ford, the prevalence of metabolic syndrome among Americans of 60-69 years old with 43.5% was the highest level of prevalence.

In the present study, the commonest risk factor of metabolic syndrome is high TG level based on IDF, ATPIII, and H II definitions, and abdominal obesity has the highest prevalence based on H I definition.

However, in the study of sugar and lipid in Tehran, it was reported that low serum HDL was the commonest risk factor based on IDF and ATPIII definitions. In the study carried out in Semnan, high TG level based on ATPIII definition and abdominal obesity based on IDF definition had the highest prevalence. In a study carried out on Hong Kong Chinese, based on IDF definition, patients had a higher waist circumference than ATPIII definition.

In a study carried out in Hungary, abdominal obesity was reported to be the commonest risk factor for metabolic syndrome based on IDF and ATPIII definitions. The highest concordance was between IDF and H I indices with Kappa coefficient of 0.94. This can be attributed to the fact that these two definitions have the same criteria to diagnose metabolic syndrome. This finding is similar to that of Luxembourg (κ=0.93).

In the study carried out by Azizi, consistency between IDF and APTIII definitions was reported. The concordance between IDF and APTIII definitions was reported to be 0.87 and 0.58 in India and Mexico, respectively.

CONCLUSION

Regardless of different criteria, prevalence of metabolic syndrome in the urban community of Ahvaz is high. Moreover, IDF and H I definitions have a good concordance with one another; therefore, they can be utilized in clinical and diagnosing cases.

Acknowledgement

This paper is issued from research project (Reg. No. D 8701) was registered in Health Research Institute, Diabetes Research Center. Financial support was provided by Vice Chancellor for Research, Ahvaz Jundishapur University of Medical Sciences.

Conflicts of interest

The authors declared no competing interests

Funding/Support

Financial support was provided by Vice Chancellor for Research, Ahvaz Jundishapur University of Medical Sciences (Reg. No:D-8703)

REFERENCES

1. Shahbazian H, Latifi SM, Jalali MT, Shahbazian H Amani R, Nikhoo A, et al. Metabolic syndrome and its correlated factors in an urban population in South West of Iran. Journal of Diabetes and Metabolic Disorders 2013;12:11.
2. Ghorbani R, Abtahi Narini B, Eskandarian R, Rashidi pour A, Khamesh ME, Malek M. Prevalence of metabolic syndrome according to ATPIII and IDF criteria in the Iranian population. Komesh Journal 2012;14(1):65-75.
3. Reaven GM. Role of Insulin resistance in human disease. Diabetes 1988;37:1595-1607.
4. Alberti KG, Zimmet PZ. Definition, diagnosis and classification of diabetes mellitus and its complicatins. Pasrt I: diagnosis and classification of diabetes mellitus provisional report of a WHO consultation. Diabetes Med 1998;15:539-53.
5. Expert panel on detection, evaluation and treatment of high blood cholesterol in adults. Executive summary of the third report of the national cholesterol education program(NECP) expert panel on detection , evaluation and treatment of high blood cholesterol in adults(Adult treatment panel III). JAMA 2001;285:2486-97.
6. Szigethy E, Szeles Gy, Horvath A, Hidvegi T, Jermendy Gy, Paragh GY, et al. Epidemiology of metabolic syndrome in Hungary. Public Health 2012;126:143-149.
7. Grundy SM. Metabolic syndrome pandemic. Arterioscler Z Thromb Vasc Biol 2008;28:629-36.
8. Miccoli R, Bianch C, Odoguardi L, Penno G, Caricato F, Giovannitti MG, et al. Prevalence of the metabolic syndrome among Italian adults according to ATPIII definition. Nutr Metab Cardiovasc Dis 2005;15:250-4.
9. Grundy SM, Cleeman JI, Daniels SR, Donato KA, Eckel RH, Franklin BA, et al. American Heart Association; National Heart, Lung, and Blood institute. Diagnosis and management of the metabolic syndrome: an American Heart Association/National Heart, Lung, and Blood Institute Scientific Statement.Circulation 2005, 112(17):2735–2752.
10. Genuth S, Alberti KG, Bennett P, Buse J, Defronzo R, Kahn R, et al. Follow-up report on the diagnosis of diabetes mellitus. Diabetes Care. 2003;26(11):3160-7.
11. Balkau B, Charles MA. Comment on the provisional report from the WHO consultation. Eropean group for the study of insulin resistance (EGIR). Diabetes Med 1999;16:442-3.
12. Alberti KG, Zimmet P, Shaw J: IDF Epidemiology Task Force Consensus Group. The metabolic syndrome-A new worldwide definition. Lancet 2005;366:1059-62.
13. Ford ES. Prevalence of the metabolic dyndrome defined by international Diabetic Federation among adults in the U.S. Diabetes Care 2005;28:2745-9.
14. Hadaegh F, Zabetian A, Azizi F. Prevalence of metabolic syndrome according to the new definition Of IDF and Consistent with the ATPIII and WHO definition in TLGS(Tehran Lipid and Glucose study). Iranian Journal Of diabetes and Lipid 2007;6(4)375-367.[Persian]
15. Alkerwi A, Donneau AF, Sauvageot N, Liar ML, Scheen A, Albert A, et al. Prevalence of the metabolic syndrome in Luxambourg accoding to the joint interim statement definition estimated from the ORISCAV-LUX study. BMC Public Health 2011;11:4.
16. Alberti KG, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, Donato KA, et al. International diabetes and federation task force on epidemiology and prevention; national hear. Lung, and blood institute; American heart

association; World heart federation; international atherosclerosis society; international association for the study of obesity. Harmonizing the metabolic syndrome; a joint interim statement of the international diabetes federation task force on epidemiology and prevention; National heart, lung and blood institute; American heart association; world heart federation; international atherosclerosis society; and international association for the study of obesity. Circulation 2009;120:1640-5.

17. Kaykhaei MA, Hashemi M, Narouie B, Shikhzadeh A, Jahantigh M, Shirzaei E et al. Prevalence of Metabolic Syndrome in Adult Population from Zahedan, Southeast Iran. Iranian J Publ Health 2012;41(2):70-76.
18. Bener A, Zirie M, Musallam M, Khader YS, Al-Hamaq AQ. Prevalence of metabolic syndrome according to Adult Treatment Panel III and International Diabetes Federation criteria: a population-based study. Metab Syndr Relat Disorder 2009;7(3);221-9.
19. Deepa M, Farooq S, Datta M, Deepa R, Mohan V. Prevalence of metabolic syndrome WHO, ATPIII and IDF definiation in Asian Indians: the Chennai Urban Rural Epidemiology Study(CURES-34), Diabetes Metab Res Rev. 2007;23(2):127-34.
20. Rathmann W, Haastert B, Icks A, Giani G, Holle R, Koenig W et al. Prevalence of the metabolic syndrome in the elderly population according to IDF, WHO and NCEP definition and association with C- reactive protein: the KORA survey 2000. Diabetes Care 2006;29-461.
21. Guerrero-Romero F, rodriuez- Moran M. Concordance between the 2005 International Diabetes Federation definition for diagnosing metabolic sundrome with the national Cholesterol Education program Adult Treatment Panel III and the World Health Organization definition. Diabetes Care, 2005 ;28(10)2588-9.
22. Ko G.T.C, Cockran C.S, Chow C.C, Yeung V.T.F, Chan WB, So WY, Chan NN, Chan JCN. Metabolic syndrome by the international diabetes federation in Hong Kong Chinese. Diabetes Research andClinical Practice, 2003;73:58-64.
23. Sadrbafoghi SM, Salari M, Rafiee M, Namayandeh SM, Abdoli AM, Karimi M, Forouzannia SKH. Prevalence and criteria of metabolic syndrome in an urban population: Yazd Healthy heart project. Tehran University Medical Journal, 2007;64(10):90-96.
24. Alkerwi A, Donneau AF, Sauvageot N, Liar ML, Scheen A, Albert A, Guiilame M. Prevalence of the metabolic syndrome in Luxembour according to the Joint Interim statement definition estimate from the ORISCAV-LUX study. BMC public Health, 2011;11:4.