

Metabolic Syndrome and Insulin Resistance: Global Crisis

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Introduction

Insulin resistance: definition

The term insulin resistance can be defined in many ways. It may be defined as inhibition of insulin's action on glucose transport from the extra cellular space (blood and interstitial fluid) into cells of insulin sensitive target tissues (mainly skeletal muscle and fat)¹. The clinical definition of insulin resistance is the impaired ability of insulin (either endogenous or exogenous) to lower blood glucose and to maintain metabolic homeostasis⁴. In other words, insulin resistance is a pathologic state in which target cells fail to respond to ordinary levels of circulating insulin⁵.

The metabolic syndrome: history

²Reavan connected insulin resistance with many metabolic disorders such as glucose intolerance, dyslipidemia, hyperuricemia and hypertension. upon observing the more than coincidental existence of obesity, diabetes, hypertension, hyperlipidemia and atherosclerotic coronary disease concomitantly in a single patient⁶ Reavan suggested that these are caused by a single metabolic disorder, he suggested that the 'insulin resistance syndrome' (IRS) or 'syndrome X' as a cluster of conditions like obesity (especially central obesity), hyperinsulinemia, reduced high density lipoprotein cholesterol level, hypertension and coronary arterial diseases. Further research established this concept with more evidence^{6,3,7,8}. Later the term 'the metabolic syndrome' (MS) replaced the term IRS.

The metabolic syndrome: definition

Metabolic syndrome can be defined as, 'constellation of metabolic derangement including central obesity, glucose intolerance,

hyperinsulinemia, low HDL-C, high triglycerides and hypertension⁶. In other words it is a, 'syndrome characterized by obesity, glucose intolerance, hypertension and dyslipidemia⁸.

The metabolic syndrome: diagnosis

The diagnostic criteria for metabolic syndrome vary according to different organization. Table 2.1-2.3 shows different criteria used by WHO⁹, NCEP-ATPIII¹⁰ and IDF¹¹

According to WHO criteria⁹ IFG and/or IGT and/or insulin resistance and two or more of the following:

Table 2.1: WHO criteria for diagnosis of MS

WHR > 0.90 (male) > 0.85 (female)	BMI	30 kg/m ² ≥ ²
Triglyceride: ≥ 1.7 mmol/L	HDL-C < 0.9 mmol/L (male)	< 1.0 mmol/L (female)
Blood pressure SBP >= 140,	DBP ≥ 90 (without medicine)	
4 Microalbuminuria		

According to WHO criteria⁹ impaired glucose tolerance or insulin insensitivity is a mandatory finding to establish diagnosis of metabolic syndrome. It also take a BMI and WHR as a measurement to obesity and central obesity, it do not take waist circumference in consideration.

According to NCEP-ATPIII¹⁰, any three of the following:

Table 2.2: NCEP-ATPIII criteria for diagnosis of MS

Abdominal obesity	Waist circumference male	102cm; female	88cm	≥
Hypertriglyceridemia	1.7 mmol/L			
Low HDL-C	< 1.0 mmol/L in men & < 1.16 mmol/L in women			
Hypertension	SBP ≥ 130, DBP ≥ 85 (without medicine)			
High fasting plasma glucose	FPG	≥ 161 mmol/L		

NCEP-ATPIII¹⁰ takes abdominal obesity instead of WHR or BMI as a measure for obesity. It appreciates that it is abdominal obesity which correlates with insulin resistance more.

According to International Diabetes Federation (IDF) criteria¹¹.

Central obesity (waist circumference; male 90 cm; female 80 cm, for South Asians) plus any two of the following factors:

Table 2.3: IDF criteria¹¹ for diagnosis of MS

HDL-C	< 1.03 mmol/L (male) & < 1.29 mmol/L (female)
Triglyceride:	1.7 mmol/L HDL-C < 0.9 mmol/L (male) & < 1.0 mmol/L (female)
Blood pressure	BP \geq 130/85 (without medicine)
FPG	5.6 mmol/L \geq

According to IDF criteria¹¹ central obesity is a mandatory finding to confirm diagnosis of metabolic syndrome.

Of these three criteria only IDF proposes different cutoff point for central obesity (waist circumference) for different ethnic population, which is as follows:

Table 2.4: IDF proposed ethnic-specific values for waist circumference¹¹.

Country/Ethnic group	Waist circumference
Europeans Male	94 cm \geq
Female	80 cm \geq
South Asians Male	90 cm \geq
Female	80 cm \geq
Chinese Male	90 cm \geq
Female	80 cm \geq
Japanese Male	85 cm \geq
Female	90 cm \geq

Ethnic south and central Americans Use South Asian recommendations until more specific data are available

Sub-Saharan Africans Use European recommendations until more specific data are available

Eastern Mediterraneans and Middle East (Arab) populations Use European recommendations until more specific data are available

The prevalence of MS differ from country to country^{12,13}, depending on the lifestyle of the population and on genetic influence.

Metabolic syndrome in America

Data from US national survey suggest that the prevalence of insulin resistance syndrome is 24% among US adults aged more than 20 years¹⁴. Using 2000 census it was estimated that 47 million US residents have the syndrome^{13,15}. Review of two population based study (San Antonio heart study and Framingham offspring study) shows its age sex adjusted prevalence 24% among US whites, 23% among non-Hispanic whites and 31% among Mexican-Americans¹⁶. Rates were highest among

Mexican-American women (33%) and lowest among white women (21%). It was also high among African-Americans¹⁷. It is reported to be high among Hispanic adults¹⁸, and a study on Arab-Americans shows the prevalence of MS among Arab-Americans using NCEP-ATPIII criteria is 23%¹⁹. Data from a Brazilian adolescent sample who were first degree relatives of type 2 diabetic subjects shows an overall prevalence of 6% but it was 26.1% in obese adolescents²⁰.

Metabolic syndrome in Europe

The prevalence in France is 10% in male and 7% in female which is 2.5 times less than that of the US²¹. Data of Finish people shows its prevalence is 17% among male and 8% among female Finish people²². Ozsahin²³ reported prevalence of MS among Turkish adult population as 39.1% in female and 23.7% in male with overall prevalence of 33.4% and higher frequencies in rural people. Data from Belgium shows its overall prevalence is 20% among Belgians²⁴. A study done by Wannmethee²⁵ on a big cohort (n= 2722) of UK old people (age 60 yrs and above) free from CVD showed its prevalence of 27% using NCEP-ATPIII¹⁰ criteria.

Metabolic syndrome in Asia

In India the prevalence of metabolic syndrome is 24.9% (age adjusted)²⁶. A study on Omani people shows age adjusted prevalence of metabolic syndrome is 21%²⁷. Reports from fifth national nutrition survey in Philippines show high prevalence (28%) of MS there²⁸. Tan²⁹ studied prevalence of MS in Singaporean Asian population which includes Chinese, Malay and Indian. They found it more prevalent among Indians (20.4%) then Malay (18.7%) or Chinese (9.4%). Korean national health and nutrition examination survey 1998 shows age-adjusted prevalence of the metabolic syndrome among South Koreans was 14.2% for men and 17.7% for women³⁰. Data from West Bank Palestine shows prevalence of MS 17%³¹. Study among the HongKong Chinese population shows its

prevalence is 16.7%³². Data from a large health check-up population of Taiwan shows prevalence of MS 9.5% (male 10.6% and female 8.1%) in Taiwan³³.

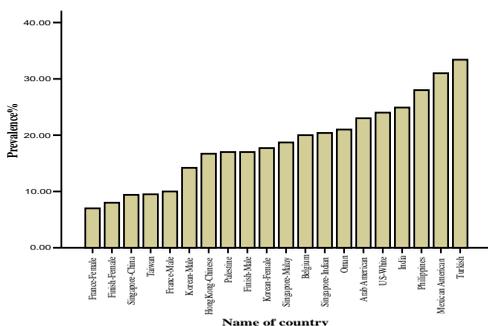


Figure 2.1 The summary of prevalence of metabolic syndrome in different countries

Though still there is not enough data about its prevalence in Malaysia but data on high prevalence of hyperlipidemia (63-76%), obesity (43-52%), hypertension (10-37%), glucose intolerance (DM, IGT, IFG) indicates its high prevalence in Malaysia³⁴.

Conclusion

From our observation we can conclude like Sir George Alberti that 'whichever definition is used and whatever the variation in the numbers due to the different criteria, when looking at prevalence data for the metabolic syndrome in different countries and across various ethnic groups, one fact is clear. Universally, the metabolic syndrome is a huge problem and is one that is growing at an alarming rate'. Global awareness and preparation is needed to combat the future crisis.

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