

Metabolic Obesity in People with Normal Body Weight

Subjects: [Medicine, General & Internal](#)

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The term Metabolic Obesity in People with Normal Body Weight (MONW) is used to describe people who, despite having a healthy body weight - usually defined by the body index (BMI), and more and more often also the percentage of adipose tissue - show metabolic disorders characteristic of obese people.

MONW obesity diagnostic criteria

1. The first records of MONW

Metabolically obese normal weight (MONW) was first described in the 1980s, when Ruderman et al. ^[1] described a case of patients with symptoms indicative of the metabolic syndromes—reduced insulin sensitivity, hypertension, T2DM, and hypertriglyceridemia—despite normal body mass index (BMI). In 1989 Ruderman et al. ^[2] proposed a scoring system that assessed 22 features (Table 1) that were assigned a specific number of points. Obtaining at least 7 points was equivalent to the diagnosis of MONW.

Table 1. A point scale to identify people with MONW ^[2].

Points	Symptoms
1	triglycerides level > 100—150 mg/dL
	blood presure 125—140/85—90 mmHg
	weight gain: > 4 after 18 years for women and 21 years for men
	BMI: 23—25 kg/m ²
	waist: 71.1—76.2 for women and 86.3—91.4 for men
	ethnicity: black women, Japanese-Americans, Latinos, Melanesians, Polynesians, New Zealand Maoris

2	impaired fasting glucose (110—125 mg/dL)
	triglycerides level > 150 mg/dL
	blood pressure > 140/90 mmHg
	essential hypertension (under age 60 years)
	premature coronary heart disease (under age 60 years)
	low birth weight (< 2.5 kg)
	inactivity (< 90 min aerobic exercise/week)
	weight gain: > 8 after 18 years for women and 21 years for men
	BMI: 25—27 kg/m ²
	waist: > 76.2 for women and > 91.4 for men
3	uric acid (> 8 mg/dL)
	ethnicity: Indians, Australian aborigines, Micronesians, Naruans
	gestational diabetes
	triglycerides level > 150 mg/dL and HDL cholesterol < 35 mg/dL
	type 2 diabetes mellitus or impaired glucose tolerance
4	hypertriglyceridemia
	weight gain: > 12 after 18 years for women and 21 years for men
	premature coronary heart disease (under age 60 years)
	ethnicity: some American Indian tribes
5	type 2 diabetes mellitus
	impaired glucose tolerance

polycystic ovaries

This system had its drawbacks, requiring the performance of biochemical tests not routinely performed in healthy people (including uric acid concentration). For this reason, the search for much simpler and more accessible diagnostic criteria was started.

2. A contemporary look at MONW

It is now known that in addition to metabolic disorders people with MONW are characterized by an increased content of adipose tissue—in particular, its visceral deposit ^[3]. The assessment of the fat depot is possible after measuring the body composition. This test allows for precise and accurate measurement of individual body components including muscle mass, lean mass and, most importantly, the percentage of adipose tissue (PBF,% BF), the knowledge of which, together with the BMI value, can be used as a screening tool. Among body compositions methods of body composition analysis, dual-energy X-ray absorptiometry (DXA) is considered the “gold standard”.

Currently, the authors of the MONW diagnostics use the developed indicators:

1. the visceral adiposity index (VAI) - which is based on BMI, WC, triglycerides and HDL cholesterol:

$$\text{Males : VAI} = \left(\frac{WC}{39.68 + (1.88 \times BMI)} \right) \times \left(\frac{TyG}{1.03} \right) \times \left(\frac{1.31}{HDL} \right)$$

$$\text{Females : VAI} = \left(\frac{WC}{36.58 + (1.89 \times BMI)} \right) \times \left(\frac{TyG}{0.81} \right) \times \left(\frac{1.52}{HDL} \right)$$

2. the triglycerides–glucose index (TyG) - which is the product of fasting blood glucose and triglycerides:

$$TyG = \text{natural logarithm} [fasting triglycerides (mg/dL) \times fasting glucose (mg/dL)/2]$$

3. lipid accumulation product (LAP) - which is based on the combination of waist circumference measurements and fasting triglycerides:

$$LAP_{men} = TG (mmol/L) \times (WC (cm) - 65)$$

$$LAP_{women} = TG (mmol/L) \times (WC (cm) - 58)$$

4. the cardiometabolic index (CMI) - which is based on the combination of triglycerides, HDL cholesterol and waist-to-height ratio:

$$CMI = \frac{TG}{HDL_C} \times WHtR$$

5. metabolic syndrome (MetS) criteria according to the criteria of the National Cholesterol Education Program Adult Treatment Panel III (NCEPATP III) or proposed by the International Diabetes Federation (IDF):

Table 2. Diagnostic criteria for the Metabolic Syndrome.

Measure	NCEPATP III [4]	IDF [5]
WC	> 102 cm for men > 88 for women	≥ 94 cm for men ≥ 80 cm for women *
TG	> 1.7 mmol/L	> 1.7 mmol/L or treating hypertriglyceridemia
High-density lipoprotein (HDL) concentration	< 1.3 mmol/L for men < 1.03 mmol/L for women	< 1.0 mmol/L for men < 1.3 mmol/L for women or treating said lipid disorder
BP	> 130/80 mm Hg	≥ 130 mm Hg systolic or ≥ 85 mm Hg diastolic or treatment of previously diagnosed arterial hypertension;
FG	> 6.1 mmol/L	≥ 5.6 mmol/L

or drug treatment of
type 2 diabetes

Legend: WC—waist circumference; TG—concentration of triglycerides; BP—blood pressure; FG—fasting glucose;
* in the European population.

3. Conclusions

MONW is undoubtedly a growing problem that should be the focus of further research. Due to the fact that it is a disease that does not show phenotypic signs, screening tests should be carried out, mainly including body composition analysis among young, theoretically healthy people. This will allow for early detection of MONW and appropriate reactions before the occurrence of undesirable consequences—including atherosclerosis or coronary artery disease.

References

1. Ruderman, N.B.; Schneider, S.H.; Berchtold, P. The “metabolically-obese,” normal-weight individual. *Am. J. Clin. Nutr.* 1981, 34, 1617–1621.
2. Ruderman, N.; Chisholm, D.; Pi-Sunyer, X.; Schneider, S. The metabolically obese, normal-weight individual revisited. *Diabetes* 1998, 47, 699–713.
3. Ding, C.; Chan, Z.; Magkos, F. Lean, but not healthy: The “metabolically obese, normal-weight” phenotype. *Curr. Opin. Clin. Nutr. Metab. Care* 2016, 19, 408–417.
4. Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. *Circulation* 2002, 106, 3143–3421.
5. Alberti, K.G.M.M.; Eckel, R.H.; Grundy, S.M.; Zimmet, P.Z.; Cleeman, J.I.; Donato, K.A.; Fruchart, J.-C.; James, W.P.T.; Loria, C.M.; Smith, S.C. Harmonizing the Metabolic Syndrome. *Circulation* 2009, 120, 1640–1645.

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