

Highlighting the risk of cardiovascular diseases through carbohydrate and lipid metabolism parameters

Carbohydrate and lipid metabolism disorders have a major impact on the development of degenerative diseases such as diabetes mellitus and cardiovascular diseases.

Metabolic disorders can be easily identified by correlating some anthropometric indices (body mass index - BMI, waist circumference) with the laboratory parameters of the carbohydrate metabolism (glycemia, glycated hemoglobin) and lipid metabolism (triglycerides, total cholesterol, HDL-cholesterol, LDL-cholesterol).

Based on these determinations, relevant assessments regarding the severity of the metabolic disorders can be made and the risk for diabetes or vascular disease can be calculated.

3.1. Anthropometric indices

A. Body mass index (BMI)

- It is mostly used for identifying body weight disorders
- It was discovered in 1830 by the Belgian mathematician Adolphe Quetelet
- It is an indicator of the body fat and it is associated with the risk for cardiovascular disease and death
- It is calculated using the ratio between the person's weight and height:

$$\text{BMI} = \text{weight (kg)} / \text{height}^2 (\text{m}^2)$$

Interpretation:

Table 1. BMI Categories

Category	BMI
Underweight	< 18,5
Normal weight	18,5 – 24,9
Overweight	25 - 30
Obese class I (mild obesity)	30,1 – 34,9
Obese class II (moderate obesity)	35 – 40
Obese class III (severe obesity)	> 40

Clinical applications: BMI has been used since 1980 to study obesity and eating disorders (anorexia nervosa and bulimia nervosa).

Limitations:

- overestimates body fat for athletic individuals with high muscle mass;
- underestimates body fat for asthenic individuals, with reduced muscle mass
- in the range 25 - 29.9 kg / m², for overweight individuals, the predictive value for the cardiovascular risk is limited (demonstrated by statistical studies on large population groups of over 400 000 individuals)

B. Waist circumference and the ratio waist circumference / hip circumference

- Are indicators of abdominal obesity
- Excess abdominal (belly) fat is a risk factor for cardiovascular disease and other obesity-related conditions (type 2 diabetes, arterial hypertension, cardiac disorders, stroke, endometrial, breast and colon cancer, sleep apnea, osteoarthritis, liver disease, menstrual disorders)

Interpretation:

- Waist circumference > 94 cm in European men and > 80 cm in European women defines abdominal obesity
- Increased abdominal circumference (> 88 cm for women and > 102 cm for men) is correlated with a high cardiovascular risk.
- The normal value for waist circumference / hip circumference ratio is:
 - < 0,95 for men
 - < 0,8 for women
- Increased ratio over 1.0 in men and over 0.85 in women is correlated with an increased cardiovascular risk

C. BROCA formula and BMR (basal metabolic rate)

a. Broca formula

- It is used for calculating the ideal body weight.
- Calculation:

$$\text{Normal body weight} = \text{height (cm)} - 100$$

Ideal body weight is calculated by subtracting 10% from the normal body weight

Interpretation:

Height = 175 cm

Normal weight = 175 - 100 = 75 kg

Ideal weight = 75 - 10% = 67,5 kg

b. BMR

It is used for calculating the number of kilocalories necessary for 24h

Calculation:

a. For men:

$$\text{BMR (kcal/24h)} = 66,47 + 13,7 \times \text{weight(kg)} + 5 \times \text{height (cm)} - 6,8 \times \text{age (years)}$$

b. For women:

$$\text{BMR (kcal/24h)} = 655,1 + 9,6 \times \text{weight (kg)} + 1,8 \times \text{height (cm)} - 4,7 \times \text{age (years)}$$

3.2. Hyperlipidemia and dyslipidemia

Definition

Hyperlipidemia is a pathological condition characterized by increased triglycerides and/or cholesterol levels

Classification:

1. Hypercholesterolemia (increased serum total cholesterol)
2. Hypertriglyceridemia (increased serum triglycerides)
3. Mixed / combined hyperlipidemia (increased serum total cholesterol + increased serum triglycerides)

Dyslipidemia is a pathological condition accompanied by quantitative and qualitative changes of lipoprotein levels.

For laboratory diagnosis the following analyses are required:

Serum total cholesterol
Serum triglycerides
Lipoproteins analysis

Hyperlipidemia and atherosclerotic risk

Hyperlipidemia is a risk factor for atherosclerotic disease through:

- a. Hypercholesterolemia:
 - the risk for coronary heart disease increases at values above 160 mg/dl;
- b. Increased LDL cholesterol
 - the risk for coronary heart disease increases at values above 150 mg/dl
- c. Decreased HDL cholesterol

- Is a significant and independent predictor of coronary risk especially if it is accompanied by hypertriglyceridemia;
- the atherogenic index (total cholesterol / HDL cholesterol ratio) has a predictive value for cardiovascular risk at values above 5
- LDL cholesterol/HDL cholesterol ratio has a predictive value for cardiovascular risk at values above 3.5 in men and 2.5 in women.