

Inositols, overweight and obesity

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Introduction

As it's well known, severe **overweight** and **obesity** entail a **wide range of health effects**. People affected by this condition face an increased risk of developing various disturbs, including metabolic diseases such as **diabetes**, cardiovascular disease and **hypertension**, but also **respiratory, joint and infertility problems**. In addition, the risks of overweight and obesity for health increases increasing the body mass index.

A healthy lifestyle that targets body weight loss is the first strategy to take to prevent and manage these risks. However, healthy eating and diet often are not enough. In fact, insulin resistance and associated hyperinsulinemia, as we have seen in the section dedicated to PCOS, are also found in the presence of other types of metabolic alterations.

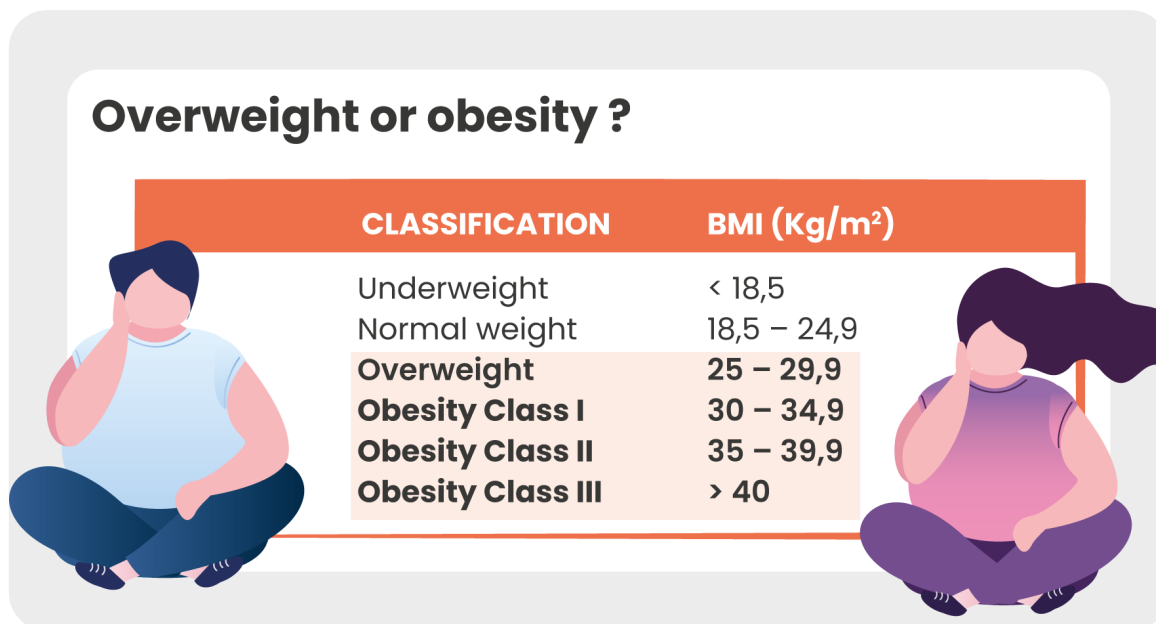
In the obesity, as well as in the overweight, in fact, **the prevalence of insulin resistance increases** exposing the people affected by these conditions to several health risks.

In this chapter, we will see the consequences of excess weight on health **and the help that inositols can offer**, both in terms of prevention and risk management related to obesity or overweight.

Diagnosis: overweight or obesity?

The diagnosis of overweight and obesity is made considering two fundamental parameters:

1. **BMI** or body mass index, relates body weight to height. The BMI result must, however, take into account factors such as age, ethnicity, water retention and musculature.
2. **waist circumference**, which must not exceed 94 cm in the male sex and 80 cm in the female sex [1].



Prevalence: a look at the data

Obesity represents one of the greatest challenges facing modern medicine.

Its prevalence, especially in developed countries, is growing exponentially, enough to induce the World Health Organization to define obesity as the epidemic of the 21st century.

In Italy, there are **25 million** people in excess weight, of which **78% are overweight** and **22% obese**. Compared to the data published in 2001, the latest analysis for 2017 shows that the percentage of men with excessive weight has increased in any age group, while the same trend does not occur in the female sex. In fact, although there is still a general increase in the percentage of overweight and obese women, higher numbers have been recorded, **especially in the age groups between 18 and 24 years of age and over 64 years of age.**

It should be noted that these conditions do not occur homogeneously on the Italian territory. Precisely **the number of Italians who are overweight and obese increases along the boot**, with a higher percentage in the regions of southern Italy than in the northern ones.

Unfortunately, the obesity problem does not only arise during adulthood. In fact, the excess weight is recorded in almost **2 million children**, mainly affecting males between 6 and 10 years of age. **Childhood obesity**, as you can imagine, reflects that one of adults, with an increasing prevalence going down from north to south and with particular attention to Campania region, where the highest percentage of childhood obesity is recorded.

This correlation between obesity in adults and in childhood is not surprising, as **the habit of parents can influence the behavior of children [2]**.



What is the cardiometabolic risk

The accumulation of body fat represents a great health risk, reducing life expectancy. From the 2017 ISTAT data, it emerges that the **prevalence of comorbidities**, i.e. the presence of at least one pathology, such as diabetes, hypertension and heart disease is equal to 24.4% in the general population unlike 46.3% in obese adults. This **“double risk” in the obese population** occurs for all **cardiometabolic diseases [2]**.

87% of the world population suffering from diabetes is overweight or obese.

When we talk about diabetes, we mainly refer to **type 2 diabetes**, that is food depending type diabetes [3]. In fact, there is a **close correlation between the increase in fat and the onset of insulin resistance syndrome**, a typical condition of diabetes. An increase in weight causes a change in the cells that progressively no longer respond to the stimulus of insulin, the hormone responsible for the transport of sugar from the blood to the cells, for the production of energy. In the absence of this transport, the sugar will remain at the blood level, causing **hyperglycaemia**. On the other hand, **the cells of the pancreas will be pushed to produce more insulin** than normal, undergoing progressive deterioration [4].

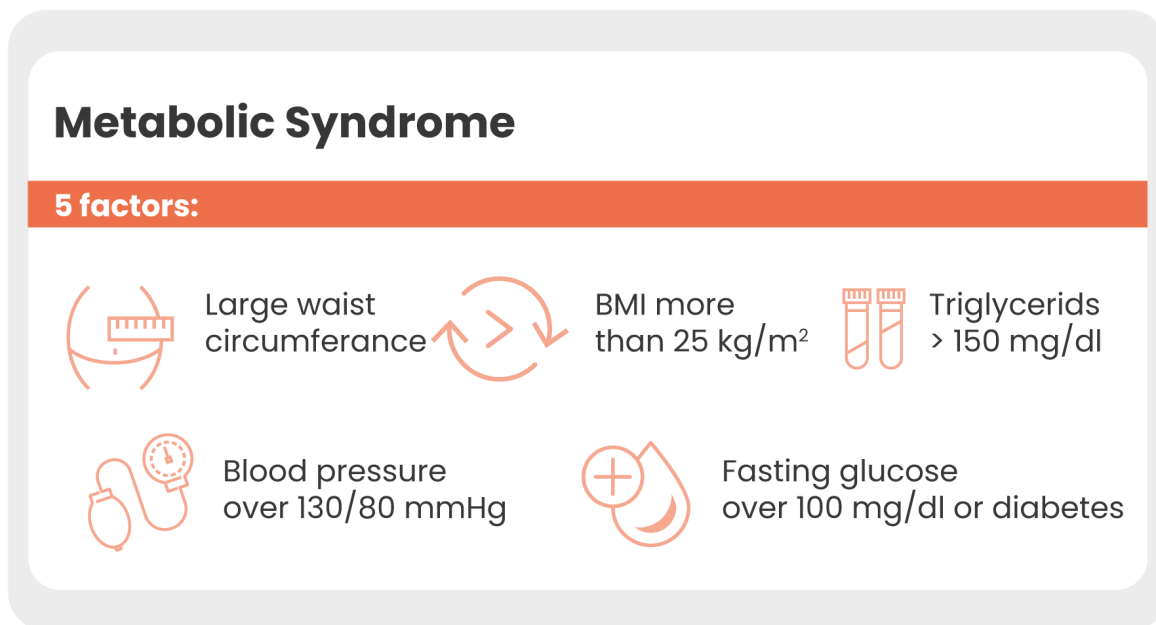


The increase in body weight also represents one of the secondary causes of death, since the frequency of development of important cardiovascular diseases is greater. One of the first signs that are altered by the excess fat is **blood pressure**. This begins to increase, higher than 120/80 mmHg, since on the one hand the heart must necessarily pump harder to reach all the districts, on the other hand because it reduces the pressure control given by the kidneys, which are simultaneously damaged.

In addition, those who are overweight also add to the rise in blood pressure the risk of altered lipid levels. More in detail, an accumulation of triglycerides and LDL cholesterol (bad cholesterol), together with a reduction in good cholesterol, HDL cholesterol, are more registered in overweight and obese subjects than in normal weight. The increase in lipids represents a very important risk factor for cardiovascular diseases, such as stroke, heart attack, cardiac arrest [5].

Before of developing these severe diseases, excess weight can be associated with a syndrome that includes many of the

aforementioned alterations, the metabolic syndrome. It is a set of concomitant factors that endanger cardiovascular health and affects more than 20% of the adult Italian population. **The metabolic syndrome**, in fact, takes into consideration 5 factors: wide waist circumference, BMI greater than 25 Kg / m², triglycerides > 150 mg / dl; blood pressure over 130/80 mmHg, blood sugar over 100 mg / dl or presence of diabetes [6].



Excess weight and fertility: which link?

As already discussed in other sections, **insulin resistance is one of the factors that can lead to high levels of androgens**, frequent in PCOS syndrome, and in general to infertility, reducing the quality of oocytes in women and an imbalance in the levels of testosterone and spermatogenesis in men.

- **Overweight / obesity and fertility in women:**

In women, weight gain does not only cause problems of **fertility**, but also during the entire **gestation period**. Obese women face a double risk of labor induction, quadruple risk of hypertension and gestational diabetes. In addition, preeclampsia and postpartum

hemorrhage are significantly more frequent in obese women than in normal weight women. Greater risks are not only registered for women, but also for infants for whom the need for intensive care increases [7].

- **Overweight / obesity and fertility in men:**

Even for men, excess weight can be an enemy of fertility. The increase in insulin causes a decrease in sex hormone binding proteins. In man this translates into **more free testosterone** which can be transformed into estrogen. Consequently, **overweight and obesity cause a reduction in testosterone levels** and an imbalance between follicle stimulating hormone (FSH), luteinizing hormone (LH) and inhibin B, which regulate the sperm development process [8]. In addition, the increase in fat induces the formation of free radicals and the increase in scrotal temperature, processes that add up to **damage to spermatogenesis** [9].

Not just heart and reproduction

When we talk about the deterioration of the state of health associated with weight gain, we cannot limit ourselves to just the heart and reproductive system.

The conditions of overweight and obesity, in fact, are also related to other equally important pathologies that can worsen the patient's quality of life.

- From a **psychological** point of view, obesity particularly affects mood by **increasing the risk of onset of depression** by 55% [10].
- At the **lung level**, excess fat can affect the ventilation capacity, and it can also **cause important episodes of sleep apnea**, especially in the male sex.
- To all this, **damage to the bone and joint level** can occur, with a clear incidence of osteoarthritis and damage to the joints [11].

- Numerous scientific evidences have shown a higher prevalence of cancer in obese patients. In the latter, **the risk of developing cancer increases**, especially for endometrial, breast and colon ones [12].

Role of inositols in overweight and obesity

Reading all the risks related to weight gain, the importance of acting in a timely manner to limit the damage that could occur emerges. Obviously, resuming a correct diet and exercise is the first steps to get back on the right path, as experts indicate. In these cases, however, you can get allies to associate with which you can discuss with your doctor, including inositols.

- **Myo-inositol**

In addition to being involved in the **signal of sex hormones**, myo-inositol is also the protagonist of insulin. Its role, as the **second messenger of insulin**, is to increase glucose uptake within the cell, making it available for energy production.

Given its task, its presence in certain organs such as, for example, heart and brain is taken for granted. Under conditions of increased blood glucose levels, which are associated with insulin resistance and hyperinsulinemia, the levels of myo-inositol in the body are reduced, thus losing its action [13].

In these particular patients, supplementation with myo-inositol is positive in restoring normal blood sugar and insulin levels. In fact, in postmenopausal women suffering from metabolic syndrome, the supplementation with myo-inositol for six months has allowed a reduction in BMI, waist circumference and also in the HOMA Index.

The latter one is an important parameter for defining the insulin resistance condition. In addition, these women had found benefits on

lipid parameters, such as cholesterol and triglycerides, also recording a drop in blood pressure [14]. The positive effect of myo-inositol continues even for longer periods, proving to be even more effective with therapy prolonged to one year [15].

To learn more read: [**Myo-inositol, what it is and what it is used for**](#)

- **D-chiro-inositol**

Myo-inositol is not the only one in its family that can be useful. **D-chiro-inositol also modulates the insulin signal and plays a fundamental role in the synthesis of glycogen.** In subjects with insulin resistance, the levels of d-chiro-inositol are altered, exactly as for myo-inositol. In fact, experimental studies have shown reduced levels of d-chiro-inositol in the presence of insulin resistance and type 2 diabetes.

As already mentioned, under these conditions in insulin sensitive tissues (such as muscle, liver and fat) the levels of myo-inositol decrease and consequently also decreases the activity of epimerase, an enzyme assigned to the transformation of myo-inositol into d- chiro-inositol [16].

But what if you only administer D-chiro-inositol?

It is the same question that Professor Nestler asked himself in 1999, who evaluated the effects of D-chiro-inositol in PCOS women with BMI higher than 28.

To learn more, read also: [**D-chiro-inositol: what it is, use and benefits**](#)

Among the results of the study, an improvement in cholesterol and waist circumference emerges, but not in BMI. In addition, a reduction was obtained in one of the blood glucose parameters, more precisely in that of the area under the curve, in women who had high initial blood glucose [17].

Myo and D-chiro 40:1 by metabolic profile

The debate over the use of only Myo-inositol, D-chiro-inositol, or both in combination is still ongoing today, although there is new scientific evidence to consider. Obviously there is no univocal answer, but the choice depends on the individual conditions that occur.

However, the combination of MI and DCI 40:1 represented an arrival point in scientific research. In particular, the MI and DCI 40:1 combination was effective in PCOS women with BMI > 25, but not only! In fact, in these women, the metabolic component is particularly relevant and can be compared with other conditions that provide for the onset of insulin resistance.

But what are the effects of MI and DCI 40:1?

- In PCOS women with BMI > 25 the first studies of MI and DCI 40:1 date back to 2012. The first study, in fact, performed by Dr. Nordio compared treatment with myo-inositol only with treatment in combination for a period of six months. The results showed the efficacy of both treatment on the metabolic profile, but with a faster effect in the group treated with MI and DCI 40:1. In fact, in these women, already at three months of therapy, there was a reduction in insulin levels, in the HOMA index and in blood sugar [18]. This was only the first efficacy result, followed by many others published over the following years.
- We must wait until **2016** to have evidence of the effect of the 40:1 **combination on non-PCOS patients**. In detail, in that year the first **supplementation work of MI and DCI 40:1 was published in 20 type 2 diabetic patients**. These patients had already undergone stable hypoglycaemic therapy for three months to which the combination was added. of inositols. After a further three months, these patients saw **improvements in fasting blood glucose, but especially in glycated haemoglobin, an important parameter for the evaluation of drug therapy** [19].

For further information read: **[The true story of Myo and d-chiro-inositol 40:1](#)**

Sources

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Other topics that may interest you

Myo-inositol

D-chiro-inositol

40:1

Alpha-lactalbumin

PCOS

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