

## **CHEMICAL STUDY OF THE MACA (*Lepidium meyenii* Walp)**

Since the first chemical-nutritional analysis carried out in maca it has been considered as a root with a high content of proteins, iron and calcium, inclusive higher than that in other roots and tubers.

The maca is considered an acceptable energetic-plant food due to its content in starch, fructose and glucose. The values in kcal are similar to those in the potato and the cassava. The chemical analysis carried out by the Lima's Institute of Nutrition (2, 3, 4) shows the following results:

### **Major components (%) Vitamins (mg)**

Water	68.70	-carotene	0.07
Proteins	10-18	Thiamin	0.15
Carbohydrates	23.00	Riboflavin	0.31
Fiber	1.90	Ascorbic acid	3.10

### **Minerals (Dry base mg/100 g)**

Fe	16.6
Mn	0.8
Cu	5.9
Zn	3.8
Na	18.7
K	2,050.0
Ca	150.0

Another advantage of the maca is its low level of grease and high level of fiber. The grease is mainly composed by unsaturated fatty acids (linoleic, palmitic and oleic) (4).

The carbohydrates supply most of the maca kilocalories (176-384 kcal), being the main fructose and glucose (5).

The amino acids constitute the base of the proteins and their composition in the maca is important, mainly the high content in essential amino acids.

The high content of iron is an advantage over other plants that do not have it, since it is a highly important mineral for the human metabolism. The presence of zinc is also important because it is considered an excellent antioxidant.

As we already have seen, since the Incas time the maca has been used due to its excellent nutritive power expressed by its elevate content in proteins and carbohydrates of high quality, but this do not would explain the different therapeutic benefits attributed to it. Nowadays, the published studies have reported that the maca possesses a large amount of secondary metabolites (chemical compounds present in the plants without intervening in the metabolism, but fulfilling a defense function within them) to which it would be

possible to attribute these benefits (6).

In 1961, Chacón (7) reported the presence of alkaloids, flavonoids, phenolic compounds, saponins, glycosides, steroids and/or triterpenes in three ecotypes of maca (red, yellow and black). In 1995 Jerí (8, 9) additionally reported the presence of anthocyanins (compounds with a high antioxidant power) in the yellow ecotype. In 1996, a collaborative study between the San Marcos Major National University and the American Institute of Physiotherapy, reported the presence of alkaloids, flavonoids, saponins and glucosinolates in the yellow ecotype as well as in another ecotype of purple color (10). All the secondary metabolites found in the maca have been associated in the literature to different properties, being the more important ones the increase in fertility (steroids), antioxidant activity (anthocyanins, flavonoids, alkaloids, etc.) and stimulant (alkaloids).

The sterol fraction in the maca is composed by sitosterol (45%) and campesterol (27%) (4).

The presence of glucosinolates in the maca was reported for first time in 1980 by Johns (11), who detected benzyl-glucosinolates and para-metoxibenzyl. These, present also in other species of the *Lepidium* genus (12, 13), are important due to their relation with the reproductive hormonal processes.

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