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## Influence of Colour Type on the Concentration of Potential Fertility-Enhancing Secondary Metabolites of the Andean Plant Maca (*Lepidium meyenii* Walp)

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### Abstract

Maca (*Lepidium meyenii*) is an ancient crop which grows best in the central Peruvian and Bolivian Andes between 3,800 and 4,500 m a.s.l. During the last decades, Maca has received and still receives much attention, this in particular because of its potential fertility effects. These effects are reported to vary between Maca colour types. The following secondary metabolites have been discussed to play an important role in the fertility-enhancing effect of Maca in humans and animals: glucosinolates, macaene, macamides, linoleic and linolenic acid, campesterol and  $\beta$ -sitosterol. The present study aimed at comparing the concentrations of the above mentioned compounds in crude and boiled Maca hypocotyls of four different colour types (yellow, red, black and violet). The Maca hypocotyls were collected on eleven farms in the regions of Pasco, Junin and Tarma (Departments of Pasco and Junin, Peru). The plant material collected was dried, milled, boiled and analysed with HPLC for the metabolites listed above. The glucosinolate content varied, ( $p < 0.001$ ) between different colour types. Total glucosinolate contents ( $\mu\text{mol g}^{-1}$  DM) of red (17.9) and violet (17.3) Maca hypocotyls were higher ( $p < 0.05$ ) than that of yellow (13.3) and black (10.8) Maca. Boiling reduced ( $p < 0.001$ ) the contents of the glucosinolates in Maca hypocotyls. The highest linoleic ( $1.34 \text{ mg g}^{-1}$  DM) and linolenic acid contents ( $1.03 \text{ mg g}^{-1}$  DM) were found in red Maca, the highest Macaene ( $1.42 \text{ mg g}^{-1}$  DM) and  $\beta$ -sitosterol ( $0.43 \text{ mg g}^{-1}$  DM) contents in yellow Maca and the highest Macamide 1 (N-benzyl palmitamide) ( $0.60 \text{ mg g}^{-1}$  DM) content in Violet Maca. Black Maca contained the lowest amounts of macaene, linolenic acid and  $\beta$ -sitosterol. Macamide 2 (N-benzyl-5-oxo-6E, 8E-octadecadienamide) and campesterol did not significantly differ among colour types. In most metabolites the farm effect was very distinct, which means that there are factors other than colour type such as duration of fallow, date of plantation, date of harvest and post-harvest treatment, such as drying technique, which might affect the contents of these compounds, thus presumably influencing the effect of Maca on fertility. Since the colour type of the Maca hypocotyls exerted this strong influence metabolite concentration, a different activity in improving human and animal fertility can be expected.

**Keywords:** Colour types, Fertility, Glucosinolates, *Lepidium meyenii*, maca, Secondary compounds