BIOFORTIFICATION OF SWISS CHARD MICRO- AND BABY GREENS WITH SELENIUM AND IODINE

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Introduction

Agrifood systems are currently facing scrutiny due to their capacity to address the challenges posed by population growth, climate change, and depletion of natural resources. The FAO/UN projects that sustainable food production must increase by 70% by the mid-century to meet the demands of a growing global population [1]. Consequently, addressing food insecurity and malnutrition has become a significant focus of the UN's 2030 Agenda for Sustainable Development. One critical aspect of nutrition is the deficiency of essential micronutrients like selenium and iodine (the hidden hunger), which affects billion people worldwide, leading to severe health issues [2]. Climate change can further exacerbate the problem by reducing the levels of these elements in the soils and cultivated foods [3]. Swiss chard (*Beta vulgaris* subsp. *cicla*) is an herbaceous leafy vegetable consumed worldwide and popular for its year-round availability and affordability. It is rich in antioxidants and the leaves and stalks contain high quantities of chlorophyll and betanin pigments, dietary fiber, and other micronutrients such as vitamins A and C and minerals such as calcium, iron, and phosphorus [4].

Objective

This study aims the development of sustainable methods for Swiss chard microgreens and baby leafy greens biofortification with selenium and iodine under controlled vertical farming.

Methodology

Screening of inorganic forms for biofortification

\+ Hoagland's nutrient solution

Conditions:
Photoperiod
Temperature
Humidity
pH

5 selenium/iodine concentrations

Approximately 12 days of germination for microgreens and 30 days for baby greens

Biomass yield
Fresh weight
Morphophysiological parameters
Selenium/iodine concentration (by ICP-MS)
*In vitro a*ntioxidant activity (by QUENCHER)
Photosynthetic pigments (by HPLC-MS)

Bioaccessibility and bioavailability assays

Plant samples selected in the first task will be submitted to *in vitro* simulated gastrointestinal digestion, according to INFOGEST. The bioaccessibility and bioavailability of selenium/iodine will be accessed.

Selenium/iodine(by ICP-MS)
Free and conjugated amino acids (by UPLC-MS)
Phenolic compounds (by HPLC-MS)
Organic acids (by HPLC-PDA)

Plant biofortification and growth optimization

Independent variables: selenium/iodine concentration and blue (447 nm)-red (660 nm) LED light ratio, among others.
Dependent variables: selenium/iodine contents and morphophysiological and chemical parameters.

Study of the biofortified micro- and baby greens

Experimental validation of the optimized conditions to produce biofortified Swiss chard micro- and baby greens.

Nutritional analysis: moisture, fat, proteins, ash, fiber, carbohydrates, energy.

Chemical analysis: minerals, free sugars, organic acids, tocopherols, total folates, phenolic compounds.

Antioxidant activity: thiobarbituric acid reactive substances formation inhibition and oxidative hemolysis inhibition assays. Anti-Inflammatory activity *via* inhibition of nitric oxide production by lipopolysaccharide-stimulated RAW 264.7 cells.

Future perspectives

It is expected to provide sustainable healthy foods and novel production processes to the market with a broad scientific and socio-economic impact that could be exploited by different stakeholders.

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