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Physicochemical and antioxidant characteristics of different sprouts

Características fisicoquímicas y antioxidantes de diferentes germinados

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Abstract

In the germination of seeds an increase in their nutritional value has been observed, such as the increase in protein and micronutrients. It has been found that continuous intake of some types of sprouts helps prevent certain chronic diseases, such as colon cancer, Alzheimer's, among others. The objective is to evaluate the physicochemical and antioxidant characteristics of alfalfa, chia, lentil and broccoli sprouts. For the seed germination process a container was placed with water and covered with a cloth so that a firm surface remained and on this the seeds were placed. The seeds were sprayed with water twice a day until favorable growth was noted. Broccoli sprouts obtained the highest values of DPPH radical inhibition and polyphenol content. The physicochemical and antioxidant characteristics vary according to germination days.

Sprouts, Health, Antioxidants

Resumen

En la germinación de semillas se ha observado un incremento en su valor nutritivo, como el aumento de proteína y micronutrientes. Se ha encontrado que la ingesta continua de algunos tipos de germinados ayuda a prevenir ciertas enfermedades crónicas, como el cáncer de colon, el alzheimer, entre otras. El objetivo es evaluar las características fisicoquímicas y antioxidante de los germinados de alfalfa, chía, lenteja y brócoli. Para el proceso de germinación de semillas se colocó un recipiente con agua y se cubrió con una tela de tal manera que quedara una superficie firme y sobre esta se colocaron las semillas. Las semillas se rociaban con agua dos veces por día hasta notar crecimiento favorable. El germinado de brócoli obtuvo los valores más altos de inhibición al radical DPPH y el contenido de polifenoles. Las características fisicoquímicas y antioxidantes varían de acuerdo a los días germinación.

Germinados, Salud, Antioxidants

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Introduction

The diet consists of a set of practices, customs, ideologies and availability of food for individuals, during any stage of life nutrients will be required to ensure the nutritional needs are met (Bergero, 2017), the nutritional needs of each individual found related to energy expenditure, need for essential nutrients and limited by fat, cholesterol, salt and alcohol (Carcamo Vargas & Mena Bastías, 2006). It is necessary to choose habits of eating food that in addition to meeting these needs provide a sufficient content of antioxidants and fiber that prevent cardiovascular and chronic degenerative diseases, these foods should preferably be of plant origin (WHO / FAO, 2003).

Seed sprouts and legumes are widely used in oriental cuisine in hot dishes and salads. Domestic germination is mainly carried out in underdeveloped countries due to its low cost and benefits such as activation of nutritional factors, increase dietary fiber, B vitamins and promotes greater mineral bioavailability (Valera, Torres, & Cova, 2018). In the germination of cereal or leguminous seeds an increase in their nutritional value has been observed, such as the increase in protein and micronutrients (Barrón-Yáñez et al., 2009). Some authors have compared the nutritional value between sprouts and plants, such is the case of broccoli where their nutrients in sprouts are 10 to 100 times more than adult plants (Hinojosa-Dávalos et al., 2019). In addition, germination can significantly improve the total phenolic content, antioxidant activity, as well as the amount of phenolic acids and flavonoids detected in the outbreaks which are higher in the sprouts than in non-germinated counterparts (Pajak, et al., 2019).

The increase in flavonoids and polyphenols give the plant a greater bioactive effect and are currently considered as desirable compounds in human food for their antioxidant activity and more and more studies suggest that the exogenous consumption of antioxidants from vegetables and fruits helps to prevent degenerative diseases since they exert various physiological effects in humans, such as in the prevention of oxidation due to the damage of low density lipids and lipoproteins (Coronado, et al., 2015; Yodpitak et al., 2019).

It has been found that the continuous intake of some types of sprouts such as sprouted brown rice which helps prevent certain chronic diseases, such as colon cancer, Alzheimer's, due to its higher content of y-aminobutyric acid (Park, 2015; Yodpitak et al., 2019). Therefore, the objective of this work was to evaluate the physicochemical and antioxidant characteristics in different seed sprouts such as lentils, chia, broccoli and alfalfa.

Methodology

Preparation of sprouts

Lentils (Lens culinaris), chia (Salvia hispanica), broccoli (Brassica oleracea var. Italica) and alfalfa (Medicago sativa) seeds were placed to germinate, for which a container with water was placed and covered with cloth in such a way that a firm surface will remain and on this the seeds were placed. The seeds were sprayed with water twice a day until favorable growth was noted.

Preparation of extracts

Once the sprouts had considerable growth, they were cut, weighed and crushed with the help of a mortar and water added to a 1: 3 ratio, with the exception of alfalfa sprouts which was prepared at a 1:10 solution of water, then the extracts were placed in a shaker at 200 rpm for 30 minutes, and then placed in a centrifuge at 3000 rpm for 30 minutes to obtain a less cloudy extract.

Physicochemical Determinations Humidity

Its determination was made using the method indicated by the AOAC.

Ash

Its determination was made using the method indicated by the AOAC.

Reducing and total sugars

Its determination was made using the method indicated by the AOAC.

Acidity

Its determination was made with the AOAC method.

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Antioxidant activity (DPPH radical)

The activity of the extracts was measured according to the methodology described by Brand-Williams et al. (1995) through the inhibition of the stable radical 2,2 diphenyl-1-pricrylhydracil (DPPH •) that has a violet coloration with a maximum absorbance of 515 nm and that once reacts with an antioxidant, it is reduced and its absorption to it disappears. 2.9 ml of a methanolic solution of DPPH • was placed in a quartz cell and reacted with 0.1 ml of the aqueous extract of the sprouts. The mixture was allowed to react and the change in absorbance was monitored on a UV / visible spectrophotometer for a period of half an hour every 5 minutes. This test was performed on each germinated extract in triplicate.

The percentage of DPPH inhibition was calculated using the following equation:

% INH = [(Ac - As) / Ac] x 100

Where:
Ac = DPPH absorbance • before the reaction
As = absorbance of the DPPH mixture • with the sample.

Determination of polyphenols (Folin-ciocalteau)

It was performed according to the Folin-Ciocalteau methodology (Singleton et al., 1999). 1 ml of each sample of triplicate extracts was placed in a test tube, and 5 ml of diluted reagent (1:10) of Folin-Ciocalteau was added, allowed to stand for 7 min and 4 ml of the solution was added of 7.5% sodium carbonate until a homogeneous mixture is achieved. The tubes were covered in order to protect them from light and incubated for 2 hours at room temperature. Absorbance readings were read at 740 nm on a UV / visible spectrophotometer.

Flavonoid Determination

5% Sodium nitrite ($NaNO_2$) was prepared with distilled water, 10% Aluminum Chloride ($AlCl_3$) with distilled water and 1M sodium hydroxide (NaOH). 250 µl of the extracts of the sprouts were used, then 75 µl of 5% NaNO2 was added and allowed to stand for 5 minutes, 150 µl of 10% $AlCl_3$ was added and kept at rest for 6 minutes and finally added 500 µl of 1M NaOH plus 275 µl of distilled water.

The readings were made at 510 nm absorbance on a UV / visible spectrophotometer (Re et al., 1999).

Results

The sprouts of the four different broccoli, chia, alfalfa and lentil seeds grew over a period of 3 to 6 days, with the lentil being the fastest growing.

The physicochemical characteristics of each of the sprouts evaluated in this investigation are reported in Table 1. Of which similar characteristics are observed among them.

Parameters	Alfalfa	Lentil	Chia	Broccoli
pH	6.23	6.6	6.01	6.17
Total solids (° Brix)	4.18	5.22	5.4	5.61
Humidity (%)	9.2	8.5	7.4	7.9
Ashes (%)	4.34	5.71	5.16	5.21

Table 1 Physicochemical characteristics of alfalfa, lentil, chia and broccoli sprouts

Antioxidant activity

Table 2 shows the results of the antioxidant properties for sprouts, with broccoli sprouting which has higher values for the percentage of inhibition (63.49 ± 1.43%) and the total polyphenol content (76.41 ± 5.03 mq GAE / L) comparison to the lentils, chia and alfalfa sprouts, shown in table 2.

Sprouted	Radical Inibition % DPPH	Polyphenols mq GAE / L
Lentil	5.07 ± 0.64	22.17 ±0.11
Chia	47.25 ± 4.8	23.79 ± 0.46
Alfalfa	8.013 ± 0.75	28.73 ± 0.45
Broccoli	63.49 ± 1.43	76.41 ± 5.03

GAE: Gallic acid equivalent

Table 2 Antioxidant properties of alfalfa, lentil, chia and broccoli sprouts

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When germinating, the seeds increase the content of some nutrients with respect to the seeds from which they originate, such as vitamins and assimilable minerals, as well as a considerable increase in enzyme levels.

Conclusions

The physicochemical and antioxidant characteristics of the sprouts evaluated depend on the germination conditions and days.

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