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ANTIOXIDANT CAPACITY OF COOKIES MADE WITH AMARANTH AND BETABEL FLOUR

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Abstract: Antioxidant capacity is the activity of a substance to inhibit oxidative degradation, in such a way that it acts, mainly, thanks to its action to react with free radicals since these are highly reactive molecules that can cause cellular damage and/or various diseases. Therefore, it is called antioxidant, which is commonly ingested through food. In that sense, there are three food sources that have phytochemicals with high antioxidant capacity, these are: beets for their presence of betalains and free phenolic groups; amaranth for its bioactive peptide content; and honey, since it has phenolic compounds and flavonoids. Therefore, the main objective was to evaluate the antioxidant capacity in the preparation of cookies enriched with antioxidants from amaranth, beet, peanut and cactus flour. An experimental/quantitative investigation was carried out, the samples were worked in triplicate and a blank control was also used; Amaranth, beet, peanut and cactus flours were made separately. Subsequently, two formulations of the cookies were made, using different percentages of the flours, and honey was used to sweeten them. The percentage of inhibition of the ABTS radial was determined, resulting in a % inhibition of 75.66% and 68.17% for G7075 and G9055, respectively. Concluding that cookies are a source of antioxidants with high capacity, which probably give them a functional property with benefit to the body.
Keywords: enriched foods, amaranth, antioxidants, beet, antioxidant capacity.

INTRODUCTION

Antioxidant capacity is the activity of a substance to inhibit oxidative degradation, in such a way that an antioxidant acts mainly thanks to its action to react with free radicals and, therefore, is called an antioxidant. However, the ability they have to react with free radicals can benefit pathological conditions associated with the state of "oxidative stress", such as cancer, diabetes, atherosclerosis, neurodegenerative disorders and aging (Cameron and Pauling, 1978 p. 4540).

In this sense, functional foods are those that contain biologically active components that exert basic beneficial and nutritional effects on one or several functions of the body and that translate into an improvement in health or a reduction in the risk of suffering from diseases (Fuentes- Berrio et al, 2015 p. 143-145). Now, it is known that most functional foods have properties such as antioxidants and this characteristic is mainly attributed to their powerful activity as metal chelators and antiradical activity, in addition to providing antimutagenic and anti-inflammatory activity; They may also have the ability to prevent diseases such as: cancer, atherosclerosis, osteoporosis, cardiovascular diseases, neurodegenerative diseases; among others (Rojas-Jiménez et al, 2015 p. 95-98).

For this reason, beets have long been recognized for their antioxidant power, which fluctuates between 8.37% ± 0.29 to 21.83% ± 0.35 AOAC and is not only attributed to the presence of betalains but also to other bioactive compounds such as polyphenols (Hayet Ben Haj Koubaier, 2014 p. 1935; Fuentes-Barría et al, 2018 p. 179).

While amaranth is a pseudocereal, it does not cause celic diseases, since it does not cause allergic reactions in the intestinal mucosa. Some studies using amaranth flour and protein isolates reported the presence of peptides and L-ascorbic acid, beta carotenes, polyphenols, anthocyanins and lutein. Regarding the antioxidant capacity, values of 154 ± 15.7 mg EAG/100 g dry matter (corresponding to 1.54 ± 0.15 mg EAG/g dry matter) are reported in whole seed of A. hypochondriacus, obtained with *aqueous solution*. of 50% methanol (Matías Luis et al, 2018 p 426-431; Narwade and Pinto, 2018 p. 74).

Finally, in the case of honey, various investigations consider that the most important factor that gives the diversity of color and flavor is the presence of bioactive compounds such as phenolics, flavonoids, benzoic acids, cinnamic acids, among others, where Their concentration and antioxidant capacity, which ranges between 357.196.96 mg EAA/100 g and 145.85 ±0.35 µg/kg of honey, depends on the floral sources used to obtain it, as well as seasonal and environmental factors.

Based on the aforementioned, the present work aims to evaluate the antioxidant capacity of sweet cookies made from non-conventional sources.

METHOD AND MATERIALS

METHODOLOGY

An experimental/quantitative investigation was carried out, where the antioxidant capacity was determined through the formulation of a food, the samples were analyzed in triplicate and the average and standard deviation were calculated, in addition to applying an ANOVA, to determine the significant differences.

FLOUR PREPARATION:

Amaranth: It was crushed in a conventional blender for 5 min, once ground it was passed through a sieve (No. 25), then it was refrigerated until use.

Beet: It was cut and processed in an industrial food processor (Rhino ® model PROAL-550), placed in stainless steel trays and placed in a convection oven at 80 °C for 4 hours. Once dry, it was crushed in a blender to obtain the flour, sifted (sieve, No. 25), and subsequently refrigerated until use.

Peanuts: they were cleaned by removing the shell that covers them and were subsequently crushed in a blender to obtain the flour, sieved (sieve, No. 25) and refrigerated until use.

Nopal: cut into 1.5 to 2.0 cm pieces, placed on stainless steel trays and placed in the convection oven at 80 °C for three hours. Once dry, it was ground in a blender to obtain flour, then refrigerated until use.

FORMULATION OF THE SAMPLES (SWEET COOKIES).

To prepare the cookies, it was based on a homemade cookie recipe which was modified to add the raw materials proposed in this research. Subsequently, formulations were made with normal wheat flour and whole wheat flour together with the flours made from amaranth, beet, peanut and cactus, to know what the behavior of the mixture would be with respect to the color, consistency of the dough, smell, flavor and texture. Once the test was carried out with the different flours, it was observed that the dough performed better with whole wheat flour; Therefore, whole wheat flour was used to make the cookies.

The final formulation with wheat flour plus amaranth, beet, peanut and cactus flour gave rise to two cookies enriched with antioxidants, G9055 and G70755. The difference between G9055 and G7075 is that the G9055 cookie has a smaller amount of whole wheat flour (75 g), a greater amount of beet flour (25 g), a smaller amount of honey (55 g) and a greater amount of butter. (90g); There is an increase in the amount of beet flour, since it produced a sweetening flavor, for that same reason the amount of honey was decreased. The G7075 cookie was made with a greater amount of whole wheat flour (85 g), a smaller amount of beet (15 g), a greater amount of honey (75 g) and a smaller amount of butter (70 g); With this we hope that it will be well accepted by the public.

ANTIOXIDANT CAPACITY

77.6 mg of the ABTS reagent were weighed and 20 mL of distilled water was added to obtain a concentration of 7 nm in aqueous solution. Subsequently, 13.2 mg of potassium

persulfate (2.45 mM) was weighed and reacted in an amber flask with the ABTS solution. These solutions were homogenized and covered with aluminum foil. The solution was allowed to incubate for 16 hours at room temperature; Finally, the ABTS solution was diluted in absolute ethanol until obtaining an initial absorbance of 0.7 ± 0.02 at 732 nm (García Giraldo and Reyes Pineda, 2016).

The determination of antioxidant activity was carried out according to the method proposed by Brand-Williams (1997) with slight modifications. Each test was performed 3 times and each sample was performed in triplicate. 5 g of sample were weighed, macerated and volumetric to 25 mL with absolute ethanol. Each sample was placed in a reciprocal shaker for one hour. The supernatant was extracted and placed in a centrifuge at 1,500 rpm for 20 minutes. the supernatant and made up again to 25 mL with ethanol. When the extracts were obtained, their antioxidant capacity was determined, for which 50 µL of the extracts were taken and 1,450 µL of ABTS were added and taken to the spectrophotometer at a wavelength of 732 nm.

RESULTS

FORMULATION OF COOKIES ENRICHED WITH ANTIOXIDANTS

Amaranth was chosen (*Amaranthus* spp.), beet (*Beta vulgaris L.*), peanut (*Arachis hypogaea*), egg, honey, cactus (*Opuntia ficus-indica*) and milk; due to its high content of folic acid, betalain, proline and vitamin $B_{12,}$ which can be useful to generate a food enriched in antioxidants.

First, the cookies were prepared with the homemade recipe, these were formulated with sugar, normal wheat flour, egg, milk, butter and vanilla (white control sample). Subsequently, formulations were made with normal and whole wheat flour together with flours made from amaranth, beet, peanut and cactus, to know what the behavior of the mixture would be with respect to color, consistency of the dough, smell, flavor. and texture. Once the test was carried out with the different flours, it was observed that the dough performed better with whole wheat flour; Therefore, it was used to make the cookies.

The final formulation with wheat flour plus amaranth, beet, peanut and cactus flour gave rise to two cookies enriched with antioxidants, G9055 and G70755. The difference between G9055 and G7075 is that the G9055 cookie has a smaller amount of whole wheat flour and a greater amount of beet flour, a smaller amount of honey and a greater amount of butter; There is an increase in the amount of beet flour, since it produced a sweetening flavor, for that same reason the amount of honey was decreased. The G7075 cookie was made with a greater amount of whole wheat flour, a smaller amount of beet, a greater amount of honey and a smaller amount of butter.

In table 1, it is observed that the two formulas of the cookies enriched with amaranth, beet, peanut and cactus flour, have a high percentage of antioxidant capacity compared to the control white cookie (37.93%), G9055 of 68.17% and G7075 with a value of 75.66%.

Samples	% inhibition	Standard deviation
White	37.93%	0.006
G9055	68.17%	0.01
G7075	75.66%	0.004

Table 1. Results % inhibition by radical ABTS

DISCUSSION

The high antioxidant capacity is due to the fact that the raw materials are known to be antioxidants such as beet, amaranth and honey; In addition, the presence of anthocyanins, coumarins, phenols, flavonoids,

cardiac glycosides, and terpenoids, known for their antioxidant effects, was confirmed (López-Morata et al, 2017); (Usaga et al, 2022); Bautista-Justo et al, 2010; (Herrera, et al, 2012). However, the ability they have to react with free radicals can benefit pathological conditions associated with the state of "oxidative stress", such as cancer, diabetes, atherosclerosis, neurodegenerative disorders and aging (Cameron and Pauling, 1978).

CONCLUSIONS

It is concluded that the results shown represent an important role, not only for the acceptability of the designed foods, but also for the functionality provided by antioxidants (flavonoids, terpenoids, coumarins and phenols), affirming the hypothesis and fulfilling the objective of the study. Cookies enriched with amaranth, beet, peanut and cactus flour demonstrated an increase in caloric intake, fiber and minerals; They also represent a source of antioxidants such as anthocyanins, coumarins, phenols, terpenoids and flavonoids; which could provide a greater nutritional and beneficial contribution to the diet.

With the research carried out, it is considered to continue with studies to evaluate the benefits in *vivo,* and verify that the bioactives fulfill their functions.

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