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A MEAT PRODUCTS ALTERNATIVE: VEGAN CASHEW PARISER – ANTIOXIDANT, NUTRITIONAL AND SENSORY CHARACTERISTICS

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Abstract

Since the beginning of the third millennium, globally, there has been a continuous increase of the flexitarian, vegetarian and vegan diet people number, which has led to a higher market demand for plant-based alternatives to meat products. The work first goal was to obtain a cashew nuts pariser, in two assortments: VCP1 and VCP2, the difference between them being that in VCP2 was added red beet juice as natural coloring. Another aim of this paper was to analyze the two finished products concerning total polyphenol content (TPC), antioxidant activity by Cupric Ion Reducing Antioxidant Capacity (CUPRAC) and by 1,1-diphenyl-2-picrylhydrazyl (DPPH) free radical scavenging activity (RSA), proximate composition, energy value and sensory characteristics (5 points hedonic scale). Because, compared to cashews, red beet juice had a TPC (9.46±0.14 mg gallic acid/g) more than twice as high, a CUPRAC (68.72±0.18 mg Trolox/g) more than 5 times higher, a stronger RSA, the addition of this juice to VCP2 determined a higher TPC and a better antioxidant activity compared to VCP1. Both finished products were well appreciated by tasters for all organoleptic characteristics.

Key words: *antioxidant activity, cashew, polyphenols, red beet, vegan pariser.*

INTRODUCTION

Today, to be a flexitarian (omnivorous diet, but with a very low consumption of meat and animal products), vegetarian (a plant-based diet without meat and meat products, but with dairy, and eggs) or vegan (only plant-based products diet), for many people, it means more than a fad, it practically represents a lifestyle (Raphaely & Marinova, 2014; Bedin et al., 2018; Sijtsema et al., 2021). Those who have given up eating meat and meat products do so for religious or ethical reasons, related to the environment, their own state of health or from desire to lose pounds (Bedin et al., 2018; Mihai et al., 2021; Gonciarov et. al., 2015). Following the increase in the number of people who choose a diet without meat and meat products has led in the last two decades to a growing market demand for plant-based products to replace conventional meat ones (Savu & Petcu, 2002; Petcu, 2013; Joshi & Kumar, 2015; Bakhsh et al., 2021). There are several producers who make such vegan meat analogues using soy, peas, wheat gluten, rice, mushrooms, nuts as raw materials and who want to convince consumers not only through special organoleptic properties, very close to those of conventional meat products, but also through high nutritional quality (Joshi & Kumar, 2015; Joshi et al., 2016).

Cashew nuts are the main product of the cashew tree (*Anacardium occidentale*), belonging to the *Anacardiaceae* family. These nuts, also called "wonder nuts" are a rich source of polyunsaturated fatty acids (especially linoleic acid), protein, carbohydrates, calcium, phosphorus and iron, also having an important content of phenolic compounds and a good antioxidant activity

(Soares et al., 2013; Sajeev & Saroj, 2015). The kernels of cashew nuts can be consumed both raw, fried and salted or as additions to various confectionery, pastry and bakery products. As a result of the rich protein content, cashews and cashew protein isolates have recently started to be used in vegan products to replace cheeses and even in vegan alternatives for meat products (Ogunwolu et al., 2009; Liu et al., 2018; Chen et al., 2020; Lima et al., 2021; Short et al., 2021; Maciel et al., 2022).
Red beet (*Beta vulgaris* L.), belonging to the *Chenopodiaceae* family, is a rich source of fiber, potassium, manganese, carotenoids, B-vitamins (B1, B2, B3, B6, B9 and B12), as well as vitamin C, zinc, copper, iron and inorganic nitrate (Babarykin et al., 2019; Ceclu & Nistor, 2020; Mirmiran et al., 2020). Recently, more and more researchers have focused their attention on the high content of polyphenolic antioxidants (phenolic acids, phenolic acid esters, flavonoids) in beetroot, but also on the high concentration of betalains - natural water-soluble pigments that contain nitrogen, proving to have good antioxidant and free radical scavenging activity as well as anticancer, antimicrobial and antiviral action (Kavalcová et al., 2015; Masih et al., 2019; Šlosár et al., 2020). Beetroot juice can be used as such in the food industry for the coloring of certain preparations, and also, only the betalains can be extracted from it to be used as food dyes (in powder form) (Ben et al., 2014; Masih et al., 2019).
The first goal of this work was to obtain a plant-based pariser made from cashew nuts in two assortments: one without the addition of dye and one using red beet juice as a natural dye. Another aim of the work was to analyze the finished products in terms of total polyphenols content, antioxidant and free radical scavenging activity, proximate composition, energy value, as well as sensory characteristics.

MATERIALS AND METHODS

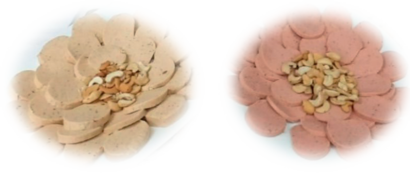
Vegan cashews pariser preparation

Were prepared two types of cashew nuts pariser: VCP1 and VCP2, using raw and auxiliary materials from the Romanian market, according to the recipes presented in Table 1.

Table 1. Recipes for the two cashew pariser preparation

Materials (%) \ Pariser type	VCP1	VCP2
Cashew nuts (raw)	18.60	18.60
Garlic (powder)	1.90	1.90
Lemon juice (fresh)	5.60	5.60
Coconut oil	1.90	1.90
Sweet paprika (powder)	0.90	0.90
Inactive yeast flakes	0.60	0.60
Dehydrated oregano	0.90	0.90
Dehydrated thyme	0.90	0.90
Salt	0.90	0.90
Pepper	0.90	0.90
Water	65.00	59,40
Agar - agar	1.90	1.90
Red beet juice (fresh)	-	5.60

To obtain the two varieties of vegan pariser, the raw cashew nuts were weighed and then hydrated in water for 4 hours. Separately, fresh juice was obtained from the peeled red beet, using a Tefal ZE 585H38 Easy Fruit centrifugal juicer, and the amount required to obtain VCP2 was measured. Then all the other ingredients were weighed and together with the hydrated cashew they were put into a blender (minus the agar-agar and 1/4 of the amount of water) and blended until a fine paste was obtained. The agar-agar gel formed by boiling with water was later added to this paste and the whole mixture was again subjected to the blending operation. The obtained paste was poured into cylindrical shapes previously greased with a little coconut oil, after which the products were cooled for 6 hours at 4°C. After cooling and solidifying the composition, samples were taken from each type of pariser (VCP1 and VCP2), as well as cashew nuts and red beet juice, in order to determine the total polyphenol content, antioxidant and free radical scavenging activity.



VCP1 VCP2

Figure 1. The two types of cashews pariser

Assessment of the total polyphenol content

The evaluation of the total polyphenols content (TPC) in the finished products as well as in cashew nuts and beetroot juice was carried out by the Folin-Ciocâlteu assay, which is based on the reducing properties of polyphenols against hexavalent molybdenum from the poly-phosphomolybdate contained in the Folin-Ciocâlteu reagent (Folin & Ciocâlteu, 1927). The higher TPC in the sample, the more hexavalent molybdenum will be reduced to lower oxidation states (+4, +5) with the formation, in a basic environment, of a more intense blue color (absorption bands at 750 nm) (Huang et al., 2005; Prior et al., 2005). The same working method was used as that presented by Dumbrava et. al., (2020) and the results were expressed in mg gallic acid/g of sample.

Assessment of the antioxidant activity
The antioxidant activity was determined for the same samples as in the case of TPC, using the cupric ion reducing antioxidant capacity method (CUPRAC), this being able to highlight both water-soluble and fat-soluble antioxidants in the analyzed samples. (Apak et al., 2007). The work methodology was identical to that described by Dumbrava et al., (2020) and the results were expressed in mg Trolox/g of sample.

Assessment of the free radical scavenging activity
The free radical scavenging activity (RSA) was determined by the 1,1-diphenyl-2-picrylhydrazyl (DPPH) method (Hue et al., 2020), both for the cashew nuts and for the beetroot juice as well as for the finished products. For this purpose, 2 g of each sample were weighed and subjected to extraction for 2 hours, at 25°C, under continuous stirring, with 20 ml of 70% ethanol. After the extraction was completed, the samples were filtered through a Whatman no. 1 filter. From each filtrate, 1 ml was measured, which was then treated with 2.5 ml of a 0.1 mM solution of DPPH in 70% (v/v) ethanol. The mixture was well homogenized and incubated at room temperature and in the dark for 30 minutes. For each sample thus prepared, the absorbances were read at 517 nm, using 70% ethanol as a reference. A control sample was also prepared using 1 ml of 70% ethanol and 2.5 ml of 0.1 mM DPPH solution. The following relationship was used to calculate the free radical scavenging activity (RSA):

$$\text{RSA (\%)} = \frac{Ac - As}{Ac} \times 100$$

where: Ac is the control sample absorbance,
As - absorbance in the presence of the sample.

Statistical analysis
The determinations of TPC, antioxidant activity and RSA were carried out in triplicate and the results were expressed as a mean values ± standard deviation (SD). For statistical data processing was used Microsoft Excel 2010.

Assessment of the proximate composition and energy value
In order to determine the proximate composition and energy value for the two finished products (VCP1 and VCP2), the USDA Nutritional Data Base was used.

Sensory evaluation
The obtained vegan pariser assortments (VCP1 and VCP2) were organoleptically analyzed by a group of 36 untrained panelists, men and women, aged between 20 and 54 years, using the hedonic scoring scale from 1 to 5, appreciating: section appearance, texture, color, taste and smell. The obtained vegan pariser assortments (PV1 and PV2) were organoleptically analyzed by a group of 36 untrained panelists, men and women, aged between 20 and 54 years, using the hedonic scoring scale from 1 to 5, appreciating -the appearance in the section, the texture, the color, the taste and the smell, the way of working, the level of acceptability and the interpretation of the score ranges being exactly the same as those presented by Dumbrava et al. (2020).

RESULTS AND DISCUSSIONS

Total polyphenols content
For cashew nuts, red beet juice and for finished products total polyphenols content (TPC) determined using the Folin-Ciocâlteu method led to the results shown in Table 2.
The experimental results presented in Table 2 show that the fresh red beet juice had a TPC more than twice as high (9.46±0.14 mg gallic acid/g) as the cashew nuts (4.02±0.09 mg gallic acid/g), this being also reflected in the concentration of these compounds in the vegan

pariser with the addition of red beet juice (VCP2) which had a higher content (3.67±0.07 mg gallic acid/g) than VCP1 (2.76±0.04 mg gallic acid/g).

Table 2. TPC in cashew nuts, red beet juice and finished products

Sample	Total polyphenols (mg gallic acid/g)
Cashews	4.02±0.09
Red beet juice	9.46±0.14
VCP1	2.76±0.04
VCP2	3.67±0.07

Soares et al. (2013) reported for conventional and organic cashew nuts, TPC values of 3.26 mg GAE/g, respectively 3.46 mg GAE/g, these being slightly lower than that found in this work (4.02±0.09 mg gallic acid/g). For beetroot, Ben Haj Koubaier et al. (2014) found total polyphenol content values for a raw beetroot extract of 14 mg gallic acid/g, while Ninfali & Angelino (2013) reported values between 0.720 to 1.276 mg/g.

Antioxidant activity

From the data on the antioxidant activity presented in Table 3 results that the red beet juice had a cupric ion reducing antioxidant capacity more than five times higher (68.72±0.18 mg Trolox/g) than that of cashew nuts (12.64±0.06 mg Trolox/g), which determined that the VCP2 also had an antioxidant activity with over 50% higher (13.48±0.07 mg Trolox/g) than VCP1 (8,96±0.02 mg Trolox/g).

Table 3. Antioxidant activity of cashews, red beet juice and finished products

Sample	Antioxidant activity (mg Trolox/g)
Cashews	12.64±0.06
Red beet juice	68.72±0.18
VCP1	8.96±0.02
VCP2	13.48±0.07

For conventional and organic cashews, Soares et al. (2013) found values of antioxidant activity of 6.77 respectively 7.02 mg Trolox/g, while Slavov et al. (2013) determined an antioxidant activity for red beet juice, through a modified ORAC method, of only 2.38 mg Trolox Equivalents/g.

Free radical scavenging activity

The determinations regarding the free radical scavenging activity (RSA) carried out by the DPPH free radical method, on the ethanolic extracts obtained from cashew nuts, red beet juice and the finished products, presented in Table 4, showed that all extracts had a high RSA. Red beet juice had the highest DPPH radical inhibition percentage value (95.74±0.47%), and of the two finished products, the pariser with the addition of beetroot juice (89.72±0.35%).

Table 4. Free radical scavenging activity (RSA) of cashews, red beet juice and finished products

Sample	RSA (%)
Cashews	89.64±0.32
Red beet juice	95.74±0.47
VCP1	86.47±0.21
VCP2	89.72±0.35

Proximate composition and energy value of finished products

The results obtained by calculation for the proximate composition and energy value of the two types of vegan pariser are presented in Figures 2 and 3.

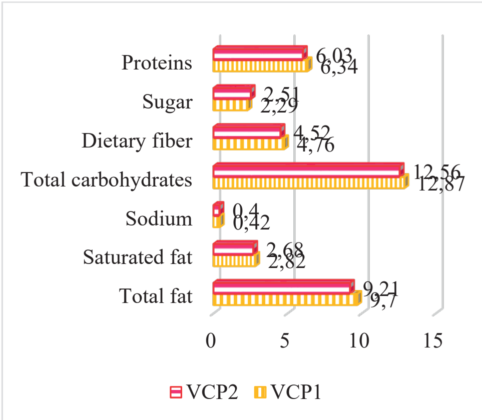


Figure 2. Proximate composition of finished products (g/100 g)

There are no big differences between the two finished products in terms of proximate composition and energy value, the vegan pariser with added beetroot juice (VCP2) being, however, less caloric (142.04 kcal/100 g) than VCP1 (148.14 kcal/100g), VCP2 being slightly lower in fat (9.21 g/100 g total fat of which 2.68 g/100 g saturated fat), total carbohydrates (12.56 g/100 g), dietary fiber (4.52 g/100g), protein (6.03 g/100g), but slightly richer in sugars (2.51 g/100g). Both products had a low sodium content (0.4 g/ 100 g and 0.41 g/100 g respectively) and no cholesterol, unlike the meat-based versions of pariser.

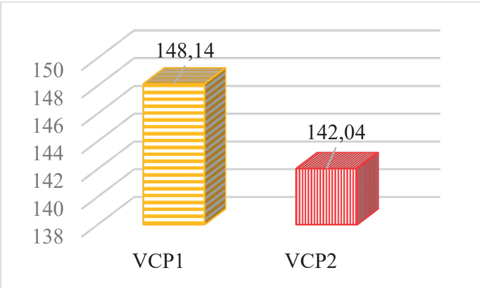


Figure 3. Energy value of finished products (kcal/100 g)

Sensory analysis

The organoleptic properties analysis of the two varieties of vegan pariser VCP1 and VCP2, using the hedonic scoring scale method from 1 to 5, led to the results presented in figure 4.

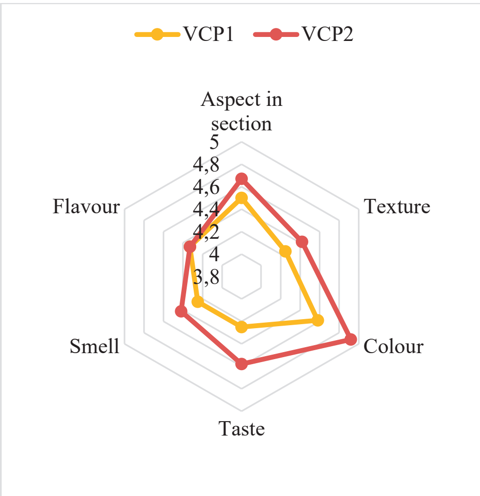


Figure 4. Global values of the sensory evaluation of finished products using a 5-point hedonic scale

Both types of vegan pariser were appreciated with average scores above 4 (good) for all the evaluated sensory characteristics, the highest score (very high level of acceptability) meeting for the appearance in the section (4.50 for VCP1 and 4.67 for VCP2), color (4.58 for VCP1 and 4.92 for VCP2) and taste (4.58 for VCP2). VCP2 scored higher than VCP1 in all sensory characteristics, except for aroma, where both products obtained 4.33 points.

CONCLUSIONS

Meat products, a category of which pariser is a part, are basic foods in the daily diet of many consumers. Since more and more consumers want or are forced, for medical or other reasons, to reduce or even give up the consumption of meat and meat products, there is a growing need on the market for plant-based products that can replace meat and which should be appropriate both nutritionally and organoleptically.

The current work aimed to obtain a plant-based alternative to the meat-based pariser: vegan cashew pariser in two versions: with and without the addition of red beet juice as a natural coloring. The obtaining technology was simple and fast.

The red beet juice, with a content of total polyphenols more than twice as high as cashew nuts, as well as with stronger antioxidant and antiradical activity, had the effect of increasing the values of these characteristics in the pariser assortment in which it was added.

Regarding the proximate composition, both variants of pariser had very close values of the content of proteins, carbohydrates, lipids, sodium. The energy value of the cashew vegan pariser variant with added red beet juice was slightly lower than that of the VCP1 variant. Unlike the varieties of meat pariser, these vegan alternatives are lower in calories, do not contain cholesterol, instead they have dietary fiber.

From organoleptic point of view, both assortments of pariser were well appreciated by the tasters, obtaining scores above 4 for all the analyzed sensory characteristics, the best appreciated being the vegan cashew pariser with red beet juice addition.

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