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RESEARCH ON THE CHEMICAL AND BIOACTIVE EVALUATION OF ORGANIC PUMPKIN PULP (*CUCURBITA MAXIMA*)

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Abstract

A vegetable with a high nutritional value and with a low cost of cultivation makes the pumpkin a coveted candidate as a functional ingredient in obtaining bakery products with a special destination. The aim of the work was to carry out a study on the introduction of pumpkin flesh (Cucurbita maxima), obtained in an ecological system, in the production of gluten-free products intended for people with metabolic or allergic problems. Fresh and baked pumpkin pulp was analyzed from a chemical and biochemical point of view. The demand for vegetable ingredients that add value to a food product has increased a lot recently. Also, the demand for bakery products is increasing, especially for products specific to a certain segment of vulnerable consumers. The obtained results showed that protein content for Cucurbita maxima pumpkin flesh is 23.06% for the fresh version and 15.51% for the baked version; and the fiber content of the analyzed samples is 10.794% for the pumpkin pulp and 7.623% for the baked pumpkin pulp. Regarding total phenolic, values of phenolic compounds found in our research, are 36.03 mg/100g for pumpkin flesh and 40.40mg/100g for pumpkin flesh. A high of value total phenolic compounds will have a major impact on bakery products.

Key words**:** *pumpkin, carotenoids, polyphenolic compounds*

INTRODUCTION

The current conjuncture determines a new approach to the choice of ingredients and the creation of new formulas for food products in the bakery industry. Such as, the accelerated increase in the price of animal ingredients, the new food and environmental policy of the European Union, as well as the emphasis placed on ecological and sustainable products, determine the change in the optics of producers in this field. In order for the processing units to survive, they must find solutions to replace conventional raw materials with other ingredients that are much more accessible, sustainable, sustainable and nutritious. For this reason, the use of vegetables and fruits in the bakery industry becomes a practice that will determine a new breath in the creation of new assortments and the production of products on a large scale for people with various metabolic conditions. Vegetable ingredients are important sources of fibers and valuable nutrients for the human body.

In the last 30 years, many vegetables lost their economic importance. The main causes being the reduction of the lots put into use, but especially the drought and temperature differences that created special problems for the producers. Due to the drought, imports were stimulated, which in turn caused imbalances in the activity of small entrepreneurs.

A culture that was forgotten at the expense of imported products was the pumpkin culture. Pumpkins are the genus *Cucurbita* and the family *Cucurbitaceae*. The pumpkin species available include *C. maxima* (called "bostan" or “winter pumpkin” in Romania), *C. moschata* (called "plăcintar" in Romania) and

C. pepo (called "dovlecel" in Romania). These three species are cultivated worldwide and have high production yields [28]. In the current selection of pumpkins in Romania, only a few crops from the species *Cucurbita maxima* L, *Cucurbita moschata* Duch are included. In 2020, Romania had a production of 21,470 tons/year according to [11].

In this context, the research regarding the reintroduction of this species into culture has a very solid motivation, especially in ecological culture.

Pumpkins are cooked and consumed in many ways, and most parts of the pumpkin are edible, from the fleshy shell to the seeds. Pumpkin flesh is consumed in soups, puree, smoothies and juices, or it is incorporated into various foods, such as gluten-free cakes, candies, breads and pastry products. In the many country, pumpkin is a must have by Halloween or in different dishes, especially in the autumn season. Pumpkin seeds and pumpkin seed oil are also commonly consumed in some countries.

Taking into account the prospects of introduction and expansion in the culture of many cucurbit species, new and much more diversified crops can be obtained considering the adaptability of the species to the environmental conditions and the type of soil specific to the area. Due to its high resistance to diseases and pests, it is a species that can be successfully cultivated in an ecological system.

Since it is not sufficiently exploited, we proposed a more thorough study of the *Cucurbita Maxima* species known as Pumpkin, and its valorization by obtaining different products with high nutritional and economic value. Pumpkin is an edible food which must to be included in daily diet because can give various health and therapeutic benefits in our body. Many research studies have been conducted on the bioactive ingredients of pumpkin peel, flesh, and seeds to provide an overall picture of their health-related impacts, which have demonstrated its anti-inflammatory [25], antibacterial, anticarcinogenic [13], antidiabetic [8], and antihypertensive properties, associated with this climber for diabetes [4, 23].

In food industry, pumpkin has attracted increasing attention in special for its nutritional profile, and due to the fact that it can be included in a wide range of recipes. The most important edible parts of the pumpkin are: *pumpkin seeds* - are rich in fiber, protein, and unsaturated fatty acids, which can all play a supportive role in healthy weight loss, and the edible oil obtained from the pumpkin seed is rich in oleic acid; *pumpkin pulp*: the ripe fruit is sweet and used to make confectionery-pastry-bakery and juice or slightly alcoholic beverages. Pumpkin pulp is used in the food industry for the production of pastries, baked goods, juices, jams, marinades, and baby food.

Pumpkin culture is profitable because it does not require high care expenses and they have a good yield per crop. At maturity, pumpkin are stable for 1–3 months after their harvest, after they become susceptible to microbial spoilage, moisture loss, and color changes after peeling. Thus, to extend the shelf life, pumpkin pulp is subjected to drying and branding techniques to obtain pumpkin flour, extremely versatile flour often used to obtain functional foods. Other preservation methods applied are: freezing, baking, preservation in the form of puree. This also allows pumpkin to be used as an ingredient in manufacturing foods such as bakery-pastry products for quality addition [30], as the rich nutrient content of this vegetable increases the nutritional quality of baked products [17].

Pumpkin inserted in cookies or muffins recipe, have been found to bring good nutritional value and sensory characteristics who make them acceptable and well-appreciated to consumers [31].

Pumpkin is rich in carotenoids, polysaccharides, oils, sterols, para amino benzoic acid and good amount of vitamins and minerals. Pumpkin seeds are of high protein, low in fat content and they are good source of elements like potassium, magnesium, copper, zinc, selenium and molybdenum. The phyto-constituents of pumpkin make it vital in different types of diet. Pumpkin is the best-known sources of

beta carotene. Beta-carotene is a powerful antioxidant that gives orange vegetables and fruits their vibrant color. The body converts any ingested beta carotene into vitamin A. All these benefits made it essential to include in our daily diet. Large size of fruit is a major limitation; to overcome this many processing methods like drying or dehydration are applied to make flour [2].

In this context, the purpose of the paper was to carry out a study on the introduction of pumpkin flesh (*Cucurbita maxima*) in the production of gluten-free products intended for people with metabolic problems or allergies.

MATERIALS AND METHODS

The raw material used was purchased from Bio&Co. The pumpkin was selected based on soundness, cleanliness, no pest damage or mechanical damage.

Fresh and baked pumpkin pulp was analyzed from a chemical and biochemical point of view.

The demand for bakery products is increasing especially for products with specificity for a certain vulnerable consumer segment. To meet the sensory and nutritional expectations of customers, these cookies are developed and standardized.

Plant material and pulp preparation: the pumpkin fruits were washed, halve, peels and seeds was removed. The peeled pumpkin was cut into small cubes and prepared as follows: *pumpkin flesh* it was grated and *pumpkin flesh baked* at 200°C/40 minutes in a convection oven. The samples were evaluated in triplicate for each analysis.

Methods of sample preparation and chemical analyses it was carried out at the laboratories of Research Center for Studies of Food Quality Q-lab, University of Agronomic Sciences and Veterinary Medicine of Bucharest, Romania.

Determination of the dry matter (DM) was achieved by weighing 1 g of the sample, and then dries at 105°C, in an oven until a constant weight. The determination of the dry matter content (DM) was carried out by the gravimetric method, through the removal of water by evaporation and weighing, according to the European Pharmacopoeia, edition 7, the results being expressed in percentages.

Elemental analysis C, H, N and determination of protein content- The analysis of the total N, H, C content was realized on the Dumas method, using the Elemental Analyzer EA 3000. This method involves the total combustion of the sample in atmosphere of oxygen. The gases produced are reduce with the help of copper to H_2O, N_2, CO_2 and SO_2 and quantified using a universal detector. From the ground samples was weighed of 2–3 mg, enter in a tin crucible and subjected to combustion at 950°C. The amount of protein was calculated by multiplying the total nitrogen content by a factor of 6.25.

Determination and quantification of fibers by the Acid detergent fiber (ADF) method according to Van Soest - the samples were dried and ground to pass through a 1mm sieve. Weigh in a crucible 1 g of grinded sample and add 100 ml of acid detergent solution at room temperature and some drops of n-octanol. Heat, then leave to reflux for 60 minutes from the moment the sample reached boiling point. Filter and wash 3 times with boiling water, then twice with cold acetone. Dry 8 hours at 105°C and let cool in a desiccator, and after this is weighing.

A calculation is:

ADF = {[(crucible weight + residue weight) - crucible weight]/ Sample Weight} x 100; [%].

Determination of total polyphenol content (TPC) by Folin-Ciocâlteu method - Depending on the type of sample, 1 g of material is mortared in the presence of quartz sand and 10 ml of 70% methanolic solution in water. The extracted sample is left overnight in the dark at room temperature. The next day, shake for 60 minutes to favor the extraction, centrifuge for 5 minutes at 5,000 rpm and 4°C and transfer the supernatant to another bottle. Over the remaining sediment, add another 10ml of 70% methanolic solution, shake and centrifuge. Repeat procedure. Finally, the 3 supernatants are combined, the final volume of the extract being 30 ml. For the quantitative determination of the total content of

polyphenols, the Folin-Ciocâlteu method following a protocol adapted from [12].

Determination of the content of carotenoid pigments by UV-VIS The carotenoids pigments content was quantified after petroleum ether extraction method. In a mortar with pestle, 1 g of the sample was mortared in the presence of quartz sand, and washed quantitatively several times with petroleum ether.

The ethereal extract was vacuum filtered and transferred quantitatively into a 50 ml volumetric flask. It was dosed spectrophotometrically against a petroleum ether blank at wavelengths 452 and 472 nm, using the Specord 210 Plus UV/VIS spectrophotometer. Results were calculated according to the formulas proposed by [30]. The results obtained and presented are the average of three independent values and are expressed as mean ± standard deviation (SD).

The determination of the antioxidant activity by the DPPH method consists in establishing the antioxidant activity based on the DPPH test, using the stable free radical 2,2-diphenyl-1-picrylhydrazyl (DPPH), according to the method described by [9]. To determine the antioxidant activity, a volume of 200 µl of the extract solution obtained for polyphenols is used, and 2 ml of DPPH solution (0.2 M) in methanol is added. Stir magnetically in the dark for 30 minutes. After incubation, the absorbance is measured at a wavelength of 515 nm.

Statistical analysis of obtained data was performed using Microsoft Excel for standard deviation and represent the average of three replicates with independent sample preparation.

RESULTS AND DISCUSSIONS

Overview

Pumpkin cultivation was carried out in Niculești commune, Ciocănari village, Dâmbovița county within Bio&Co, an ecological vegetable farm, which is a project of *Ateliere Fără Frontiere (Workshops without frontiers)*, a Romanian non-profit association that creates jobs for vulnerable people, in workshops of social and solidarity economy.

To facilitate the access of people from vulnerable backgrounds to the labor market, in order to build their self-confidence, professional and personal independence.

The climate in the area is temperate continental with hot and dry summers and cold winters, dominated by the frequent presence of cold continental air masses from the East, or Arctic from the North and strong winds that blow snow. The multiannual average value of the air temperature is 11°C, a value that is characteristic of the eastern sector of the Romanian Plain. The multiannual average amount of precipitation oscillates around 500 mm. The wind regime is characterized by prevailing air currents from the Northeast and East, currents that can reach 125 km/hour in winter. The land on which the town is located was part of *Codrii Vlăsiei*.

Research data

Pumpkin culture

Pumpkin grows well in most types of soil, whether light, medium or heavy, as long as they are well drained.

Due to the fact that it is an ecological crop, before the establishment of the crop, an agrochemical mapping of the land was carried out.

Mapping was carried out before and after basic fertilization with manure. Before the establishment of the crop on this land there was an alfalfa crop that was incorporated into the soil in the fall with the plowing (Table 1).

The material incorporated as biodegradable fertilizer - Lucerne (*Medicago sativa*) is a perennial plant from the legume family, with leaves composed of three leaflets and blue-violet flowers, cultivated as a forage plant. Research shows that, while following the application of chemical fertilizers with nitrogen, plants can transform only 50% of the administered amount into plant matter, the nitrogen left in the soil after a leguminous crop is fully utilized.

Table 1. Agrochemical characteristics of the land on which the experience was located

Emplacement	pH	Soluble salts, [%]	Content of soluble forms [ppm]			
			$N - NH_4^+$	$N - NO_3^-$	$P - PO_4^{3-}$	K^+
Before fertilization with manure	6.71	0.054	14.25	19.72	11.43	55.00
After fertilization with manure	6.64	0.050	47.50	152.86	28.57	165.00

Source: [27, 35].

It is estimated that after an alfalfa crop, average 280 kg nitrogen/ha. The green leaves of this plant contain eight essential amino acids (which the body is unable to synthesize). *Medicago sativa* distinguished by the high content in enzymes, phytoestrogen, protein, calcium, iron, magnesium, phosphorus, potassium, essential amino acids and vitamins C, B6, D, A, K and E (biologist Frank Bouer) [15].

Alfalfa was present on the plot used in the experiment for 3 years, and then it was incorporated into the plot by plowing after the last mowing. In autumn, 10 t/ha of manure was also administered. The manure was very well decomposed. After applying the manure, a deep plowing of the land was performed. From the data of table 1, it is observed that the soil pH varied between 6.71 before fertilization and decreasing to 6.64 following the application of manure. Nitrogen in the soil, as well as the level of phosphorus and potassium, also increased a lot. The level of nutrients is balanced, the soil being well-supplied for a pumpkin crop, and during the vegetation period, three more facial fertilizations will be applied. In the spring, the land was shredded with the disc harrow and the leveling bar, and the day before sowing, it was once again passed with the combiner to achieve a good compaction of the soil and maintain its moisture to ensure the rapid emergence of the seeds.

The establishment of the culture was done by sowing directly in the field respecting the sowing distances from the experimental scheme.

Sowing was done on April 30, 2021, when the soil temperature reached 9-10°C, it was sown at a depth of 3-4 cm and 3 seeds were placed in each nest. The seeds were purchased in Austria and are certified organic.

Care work carried out in culture

Weed control by mechanical weeding when the plants were small, then hand weeding done very carefully so as not to displace the pumpkin seeds.

After the pumpkin plants grow, they cover the ground very well and smother the weeds themselves. Irrigation was carried out at the nest when the plants were small, then the culture was no longer irrigated.

No disease and pest attacks were reported in the crop considering that this crop was sown for the first time on this land and there are no pumpkin crops in the area.

In ecological crops, monoculture is not recommended because the pumpkin can have diseases such as powdery mildew and downy mildew, and the remains of stems can become a source of infection, causing damage to seedlings and developed plants. Consequently, on the same plot, the pumpkin can be cultivated again only in the third year.

Sources of raw material and preparation

The raw materials used were purchased from Bio&Co. For current use as an ingredient, it was selected only healthy, solid, intact pumpkins without mechanical damage or pests. The pumpkin was washed, halve, peels and seeds was removed. The peeled pumpkin was cut into small cubes and prepared as follows: *pumpkin flesh it was grated* and *pumpkin flesh baked* at 200°C/40 minutes, in a convection oven. The samples were evaluated in triplicate for each analysis.

Evaluation of physical properties

Pumpkin flesh is a good source of dietary fiber, which plays very important role in human health. Because of low energy value dietary fiber obtained from pumpkin pulp is very helpful in lowering blood glucose level [16, 33].

Extracts of pumpkin pulp exhibited antimicrobial and antioxidant potential [6]. Extracts of pumpkin, enriched with

carotenoids can be called as phyto-complex, a good source of bioactive compounds, delays cell proliferation in a human chronic lymphocytic leukemia cell line [22, 5].

Table 2. Proximate composition of fresh pumpkin

Products	**DM %**	**Protein %**	**ADF (Acid Detergent Fiber) %**
C. maxima fresh	5.676 ± 0.055	23.06 ± 0.787	10.794±0.570
C. maxima baked	10.046 ± 0.098	15.51 ± 4.130	7.623±0.219

Values are given as means of three replicates ± SD. Means with different superscript letters within a column are significantly different (P < 0.05). SD = Standard deviation of the mean
Source: Determinations made through the EcoDonela project.

It is known that the chemical composition of the pumpkin can vary greatly depending on the climatic conditions of that year and genetic factors.

After the analysis, it was found that the humidity of the fresh sample is 96.42%, a value that approaches the results obtained in other studies. For example, in other bibliographic sources, the humidity of fresh pumpkin is between 89.50-95.00% [36]. We can say that our sample is in parameters. The humidity of the sample of baked pumpkin is about average 90%, a rather high value, but it is justified by the use of mild heat treatment, so as to protect its bioactive components. We can conclude that the fresh *Cucurbita maxima* pumpkin has a higher humidity, which leads to obtaining soft, fluid doughs, something found in work practice. These problems influence the long-term storage and preservation. *Cucurbita maxima* pumpkin flesh baked at 200°C/40 minutes in the convection oven has a greater stability in the product, but the still high humidity creates the same problems as with the fresh one. Pumpkin flesh baked by *Cucurbita maxima*, has good stability in mixtures and integrates nicely into the finished product. Due to the lower humidity, the doughs are more consistent, aromatic and beautifully colored.

One of the most important chemical content quality indicators is the dry matter content. It ensures the quality and output of the recycled products. Regarding the content of dry matter, the results show (Table 2) that in the case of fresh *Cucurbita* pumpkin flesh, a maximum value of 5.676 % and by baking it increases to approximately 10.046 %. The fruits of great pumpkins accumulate higher amounts of dry matter compared with the amount of the fruits of oil pumpkins. This is due to the relatively high sugar content in the flesh of *Cucurbita maxima* fruits.

Protein is important for tissue repair and cell growth, being involved in building each tissue in human body. They affect transport through the cell membranes of various vitamins and minerals. The protein content for *Cucurbita maxima* pumpkin flesh is 23.06 % for the fresh version and 15.51 % for the baked version.

The fiber content of the analyzed samples is 10.794% for the pumpkin pulp and 7.623% for the baked pumpkin pulp. These values are confirmed by similar studies, respectively values of 6.66% of the dry substance. The reduced values of the fiber content in the case of the cooked pulp is confirmed by the literature reports that mention that blanching reduces the amounts of starch, ash, fiber, phosphorus and iron due to leakage during the blanching process [14, 19, 10]. Presence of dietary fibers in pumpkin pulp, reduce sugar levels increased with increasing substitution of pumpkin flesh or flour in bread.

Determination of biological activity

Bioactive compounds, important for human nutrition, are considered an excellent alternative for disease prevention and treatment. These compounds are beneficial for health, because they strengthen the immune system and prevent the body from getting sick. We can mention the most important bioactive compounds present in pumpkin: polyphenols, carotenoids, vitamins, omega-3 fatty acids, organic acids, nucleosides and nucleotides, and phytosterols have attracted a lot of attention due to their role in preventing several chronic diseases. The scientific world is continuously searching for natural sources

of bioactive compounds, and many have found pumpkin (Cucurbita L. spp.) extremely interesting because it contains large amounts of bioactive compounds [20]. Due to the high content of carotenoid compounds, pumpkin (C. maxima) pulp is a rich source of natural antioxidants, especially β-carotene.

Antioxidants are compounds that can reduce oxidative stress directly, reacting with free radicals, or indirectly, inhibiting the activity or expression of free radicals through intracellular enzymes. There are two types of antioxidants: the body's own antioxidants (glutathione, coenzyme Q, alpha lipoic acid) and the antioxidants taken from the diet (vitamin C, vitamin E, selenium, beta-carotene) which are well represented in colourful fruits and vegetables: beets, carrots, spinach, broccoli, tomatoes, cherries, red grapes, berries. Today, there is a growing interest in plants such as ginseng, turmeric, ginkgo, rosemary, green tea, garlic, ginger, which are rich in antioxidants.

Table 3. Proximate composition of fresh pumpkin

Type of pumpkin flesh	Total polyphenol content (TPC) (mg / 100 g)	Antioxidant activity (mg equiv Trolox/100 g)	Content of carotenoid pigments (mg/100 g)
C. maxima fresh	36.03 ±5.27	1.746 ± 0.225	0.776 ± 0.019
C. maxima baked	40.40 ±4.31	1.751 ± 0.183	2.388 ± 0.120

Values are given as means of three replicates ± SD. Means with different superscript letters within a column are significantly different ($P < 0.05$). SD = Standard deviation of the mean
Source: Determinations made through the EcoDonela project.

Phenolic content they have an important role in the growth and reproduction of plants, and contribute to the color and sensory characteristics of fruit and vegetables [1]. Total phenolic content was determined in fresh pumpkin fruit as well as in pumpkin pulp baked. Following the laboratory determinations, the following values were found phenolic compounds, found in our research, respectively 36.03 mg/100g for pumpkin pulp fresh and 40.40mg/100g for pumpkin pulp baked (Table 3). The concentration of polyphenolic compounds in pumpkin depended on the degree of ripening. The content of polyphenolic compounds in ripe fruit was 33.5 mg/100 g dm, whereas in unripe fruit it was 10.3 mg/100 g dm. This content was similar to the results observed in methanol–aqueous extracts in the C. maxima 'Marina di Chioggia', and 'Jumbo Pink Banana' cultivars [3, 21, 26].

The results obtained were in accordance with the literature data, the amounts are found in intervals between 90 mg GAE/100 g [7] and 24 mg/100 g FW, the lowest value detected by [24]. As it could be expected, in pumpkin products lower but still significant amounts of phenolics were determined and the registered reductions were probably due to the thermal processing.

The determination of the antioxidant activity was carried out with the help of the UV - VIS spectrometer. The fresh pumpkin flesh sample has an antioxidant activity of 1.746 mM Trolox equiv/100g ripe pumpkin flesh has a value of 1.751 mg equiv Trolox/100 g. Content of antioxidants in baked pumpkin is much higher than in fresh pumpkin flesh. These results show that heat treatment does not influence the antioxidant activity of pumpkin pulp [29].

Pumpkin is an excellent source of carotenoids, especially at peel and pulp level. The yellow to orange color of pumpkin peel and flesh is due to present of carotenoids. High carotenoids contents is present in varieties showing more yellow color [34]. Pumpkin pulp pigments are widely used as additives in food products, in medicine and in cosmetics. Pumpkin pigments include carotenoids, lutein and zeaxanthin. The carotenoids are responsible for the characteristic yellow-orange color of pumpkins [34].

The orange color of the skin and flesh of the pumpkin is due to the high content of carotenoids located in the two parts of the fruit [3]. The high content of carotenoids is present in varieties that show a more intense orange color [34]. Pigments (eg carotenoids, lutein and zeaxanthin) from pumpkin pulp are

widely used as additives in food, medicine and cosmetics [34].

In fact, the yellow color of pumpkin at its young stage develops to orange in its ripened stage due to a increase by 11 fold in the carotenoid content of the fruit [18, 32]. Carotenoids are considered major source of vitamin A, important for our human body improving eyesight, immune system, reproductive system, growth and development.

The content of carotenoid pigments determinate by UV-VIS method, at the analysed samples, shows that great pumpkin flesh raw and baked are rich in source of carotenoids. The sample with pumpkin pulp fresh has a total carotene content of 0.776 mg/100 g and in the baked pumpkin pulp it has a value of 2,388 mg/100 g. It was found that the total carotene content in the cooked pumpkin is much higher than in the fresh pumpkin. β-carotene is found in vegetables (carrots, apricots, spinach, potatoes, pumpkin, and pepper), oranges, and yellow fruits. Several studies have revealed the prophylactic potential of carotenoids for cancer, diabetes, inflammatory diseases and cardiovascular diseases.

Studies support the ingestion a large number of vegetables and fruits which has a high carotenoid content, and that has a protective role to the consumption of a type of carotenoid-based product. Thus, the diversification of vegetables and fruits is a prophylactic strategy, more effective, compared to the intake of carotenoids from a single vegetable product.

CONCLUSIONS

In recent years the consumption of fruits and vegetables has increased rapidly due to the awareness of their health benefits for people. These plant ingredients come with phytochemicals, such as carotenoids and phenolics, which are believed to reduce the risk of developing degenerative and chronic diseases. The results of our study indicated that the tested pumpkin pulp, fresh and ripe, is a valuable source of carotenoids and phenolics. In other words, pumpkin is an edible ingredient, ideal for the bakery industry.

Incorporating the pumpkin pulp in gluten-free formula creates the opportunity for innovation and development of novel products. So, the pumpkin pulp, used in raw or cooked form, of this pumpkin variety could be the most suitable to enrich manufactured foods with dietary fiber. The use of *Cucurbita maxima* pumpkin pulp, obtained from local organic farms, has a high nutritional value, and inserted into various bakery formulas, lead to obtaining a food with a functional role in the body, easy processing, appropriate behavior when baking, and products with color identity. In conclusion, pumpkin pulp seems to be a valuable source of active compounds for baked products. In conclusion, pumpkin pulp seems to be a valuable source of active compounds for baked products.

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