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**Evaluation of Bioactive Compounds and Antioxidant Activity
 in a Functional Jam Based on Pumpkin and Ginger**

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Abstract: This paper aims to provide a physicochemical and sensory characterization of an innovative jam product, developed by valorizing pumpkin in combination with functional ingredients such as ginger, lemon, and raisins. The study focused on determining the nutritional profile and antioxidant capacity of the final product, using sugar as a preservative and sweetening agent. The determination of titratable acidity revealed maximum values for the ginger raw material, while the raw pumpkin exhibited lower acidity. The resulting jam was processed to a concentration of 55°Brix. Compositional analysis showed a dry matter content of 54.8% and a moisture content of 43.3%. The analysis of bioactive compounds demonstrated a significant increase in antioxidant concentration in the finished product: the total polyphenol content reached 2.13 ± 0.0015 mg GAE/g, a value superior to the individual raw materials (ginger: 0.77 mg GAE/g; pumpkin: 0.64 mg GAE/g). This synergy was also reflected in the radical scavenging activity (RSA), with the finished product showing a free radical inhibition capacity of $67.98 \pm 0.045\%$, compared to 14.95% for ginger and 5.49% for pumpkin. Sensory evaluation, conducted using the spider diagram method, confirmed the high acceptability of the jam, which achieved superior scores across all analyzed parameters, particularly for consistency (8.4) and taste (8.2). The results highlight the successful combination of a traditional recipe with ingredients such as raisins and ginger, resulting in a balanced product with high commercial potential and outstanding sensory characteristics..

Introduction

In the current context of rising chronic disease incidence, consumer orientation toward functional foods has become a priority. This paper explores the nutritional valorization of pumpkin (*Cucurbita moschata*), an underutilized agricultural crop that is exceptionally rich in essential bioactive compounds.

Pumpkin represents an excellent source of:

- **Carotenoids:** Particularly beta-carotene (a precursor to Vitamin A), which is responsible for ocular protection and antioxidant defense.
- **Essential nutrients:** Vitamins (C, E), minerals (K, Mg, P, Se), and dietary fibers (pectin).

Ingredients for enhanced functionality

To create a product with superior sensory and antioxidant profiles, the jam was enriched with:

- **Ginger (*Zingiber officinale*):** Contributes gingerols and shogaols with antimicrobial, anti-inflammatory, and neuroprotective properties.
- **Lemon:** Provides Vitamin C and citric limonoids, acting as a natural preservative and anti-carcinogenic agent.
- **Raisins:** Supplement the product with natural sugars, potassium (up to 854 mg/100g), and fiber, improving glycemic control.

The primary objective of this research was to evaluate the impact of adding ginger and other auxiliary raw materials on the antioxidant activity and sensory qualities of pumpkin jam. The study aims to demonstrate that transforming pumpkin into a processed product (functional jam) not only preserves its beneficial compounds but also offers a healthy alternative to conventional confectionery products, featuring an improved nutritional profile

Material and method

A jam was made from pumpkin, ginger, raisins, and lemon.

The jam was subjected to physicochemical and sensory analysis:

- Determination of total polyphenol content
- Evaluation of antioxidant activity using the DPPH free radical method
- Determination of moisture content
- Determination of acidity
- Determination of total soluble solids
- Sensory analysis



Results and discussions

Total polyphenol content

Sample	Polifenoli totali (mg GAE/g)
Ginger	0.77 ± 0.0007
Pumpkin	0.64 ± 0.0007
Pumpkin and ginger jam	2.13 ± 0.0015

Radical Scavenging Activity

Sample	RSA(%)
Ginger	14,95 ± 0,25
Pumpkin	5,49 ± 0,36
Pumpkin and ginger jam	67,98 ± 0,045

Moisture / Dry matter: 43,3% / 54,8%

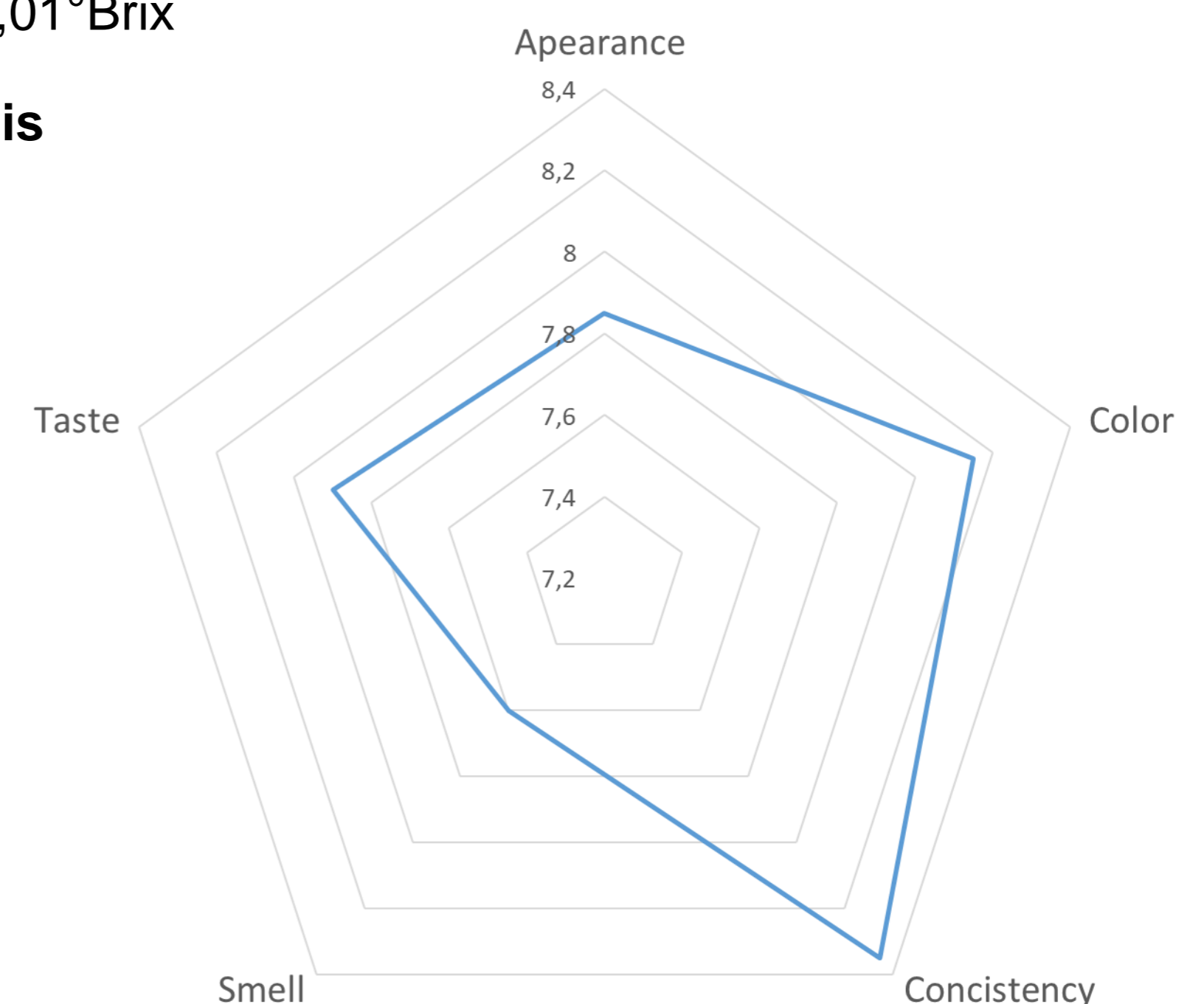
Acidity

- Pumpkin – 0.36 ± 0,04 acidity degree
- Ginger – 0,24 ± 0,01 acidity degree
- Lemon juice – 0.53 ± 0,07 acidity degree
- Raisins – 0.39 ± 0,06 acidity degree
- Jam – 0,46 ± 0,05 acidity degree

Total soluble solids

- Jam – 55 ± 0,01°Brix

Sensory analysis



Conclusions

- Pumpkin is an affordable food source with therapeutic properties, offering numerous nutritional benefits for both healthy individuals and those with various pathologies. In addition to these benefits, pumpkin has proven its utility in weight management, being used in various weight-loss diets. Furthermore, pumpkin is an inexpensive raw material, allowing for the production of jam at low costs.
- The DPPH free radical scavenging activity analysis revealed that the strongest antioxidant activity was observed in the finished product, while the weakest antioxidant activity was found in the raw material.
- Sensory analysis of the pumpkin jam yielded positive results regarding its visual appearance and consistency; however, several suggestions for improvement were noted, such as adding a larger amount of ginger. The presence of ginger, alongside sugar, allows for better preservation of the jam.