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Apricot chutney – a variety of functional sweet-sour sauce

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Abstract

Apricots are fruits with an attractive colour, distinctive flavor, and valuable nutritional qualities. They can be consumed fresh, sun-dried, or as jams, marmalades, syrups, jellies, or spiced sauces. They are an important food source, rich in provitamin A and ascorbic acid, with these nutrients gradually increasing throughout the ripening stages. Additionally, apricots are a natural source of polyphenols, proteins, carbohydrates, minerals, and fibers, contributing to their significant biological properties.

Apricot chutney is an innovative product in the category of sweet-sour-spicy sauces, made from apricots, onions, and natural powdered spices. This study aimed to develop and characterise the chutney from sensory, physicochemical, and nutritional perspectives.

The obtained product has a fine consistency, and a rich aroma, and imparts a unique flavour to the food it accompanies. It is also nutritionally valuable, being rich in polyphenols (78.9±0.42 mg GAE/100g) and exhibiting high antioxidant activity (86.52±0.24 mg Trolox/100g). The energy value of the chutney is 182.65 cal/100g, and it contains no preservatives or synthetic food additives. These results support the recommendation that this product can be confidently consumed.

Key words: apricot chutney, sensory, physicochemical properties

1. Introduction

Current research on the nutritional and health benefits of various fruits and vegetables has made consumers more conscious of their dietary choices, leading them to prioritize foods rich in nutraceutical elements. These foods provide additional support to the body's natural antioxidant systems in combating reactive free radicals produced within biological systems.

In this context, apricot fruits (*Prunus armeniaca*) are highly valued by consumers not only for their particularly pleasant taste but also for their numerous health benefits, which have been extensively documented in various studies.

Apricots are consumed both fresh and in various prepared forms, contributing significant amounts of nutrients, including sugars (over 60%), proteins (8%), fibers, minerals, and vitamins (A, C, E, K, and the B-complex), as well as polyphenols and organic acids such as citric and malic acid [1, 2, 3].

They are recommended for addressing vitamin A deficiency, anemia, physical and mental fatigue, stress, and depression. Apricots also help strengthen immunity, balance pH levels in the stomach, blood, and tissues, and provide a rich source of essential minerals such as calcium, magnesium, and potassium [4, 5, 6]. Furthermore, they contain compounds with potent antioxidant properties, including vitamin C, carotenoids, and polyphenols [7].

The fresh appearance of these fruits is pleasant and attractive, coloured from yellow to orange, with soft, juicy and sweet-sour pulp and subtle, characteristic aroma, all these characteristics being strictly correlated with the varieties, the area of origin, the ripening

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period and the parameters the quality of apricots [8].

Access to fresh apricots is limited to the short period of the year when they ripen. To meet the growing market demand, numerous preservation techniques have been developed, including drying, freezing, packaging in controlled environments, and processing into jams, compotes, juices, sauces, and jellies [8]. While processing - particularly thermal processing - can lead to the loss of some nutrients, including antioxidants that offer significant health benefits, the consumption of such products remains highly beneficial.

Carotenoids present in apricot fruits are well-known for their protective effects against cardiovascular diseases, gastritis, hepatic steatosis, intestinal disorders, cancer, and other chronic illnesses [9, 10]. These compounds are especially abundant in orange-coloured fruits and vegetables [11]. However, carotenoids are chemically sensitive and can easily undergo oxidation under the influence of high temperatures, light, and pH variations, resulting in changes to both the color and nutritional value of processed products [12]. Nevertheless, studies indicate that common culinary processing methods that avoid excessive heat do not significantly degrade the carotenoids present [13].

Apricots are a good source of antioxidants, with studies revealing significant variability among different varieties. Medium- and late-ripening varieties have been found to exhibit better antioxidant capacity and higher total phenolic content compared to early-ripening varieties, with a positive correlation observed between these two characteristics [14, 15]. Moreover, research indicates that the antioxidant capacity of apricots can be influenced by environmental factors, agricultural practices, and genetic variability [16, 17, 18].

The consumption of apricots, along with their commercial and nutritional significance, has gained increasing attention in recent years. As a result, many researchers are focusing on studying various apricot varieties, their health effects, and the impact of processing on their organoleptic and nutritional qualities [2].

This study aimed to develop a new product: a spicy sweet-and-sour sauce, with apricots as the main ingredient, with additions of aromatic spices. The product was characterized from sensory, physicochemical, and nutritional perspectives. Two versions of the sauce were created, differing in their main addition: one included onion, while the other included garlic, with the rest of the spices remaining identical.

From a sensory point of view, the sauce was evaluated for consistency, color, aroma, taste, and aftertaste to assess its acceptability among consumers. The product's polyphenol content and antioxidant capacity were evaluated and compared to those of the raw material, while its nutritional value was also determined.

2. Material and methods

2.1. Obtaining the sauces

Two versions of the sauce were designed, the ingredients used were identical, except the addition of garlic to one of the versions, and the proportional reduction of the amount of onion, for more flavor. The list of ingredients is shown in table 1, and the technological flow diagram of the processes is shown in fig. 1.

Table 1. List of ingredients used

Ingredients	Variant 1	Variant 2
Apricots, kg	3	3
Red onion	200	190
Oil, ml	50	50
Raisins, g	100	100
Brown sugar	400	400
Lemon juice, ml	100	100
Balsamic vinegar, ml	125	125
Chili powder, g	10	10
Cinnamon	10	10
Caraway, g	10	10
Cloves, pieces	10	10
Pepper, g	5	5
Ginger powder, g	10	10
Garlic, g	-	10
Salt, g	20	20

Apricots were washed, pitted and then cut into small pieces. The onion and garlic were peeled and then chopped. Chopped onion was placed in a non-stick pan and lightly sautéed in oil, and then chopped apricots, sugar, balsamic vinegar, raisins and salt were added and cooked over a suitable heat until the sauce thickened and concentrated. Then the rest of the spices were added, and in the second version of the sauce, garlic was also added for extra flavor. The sauce was boiled for another 10 minutes and then it was distributed in jars. For immediate consumption, the sauce can be kept in the refrigerator, and if it is desired to keep it for a longer time, the jars can be

sterilized in the oven.

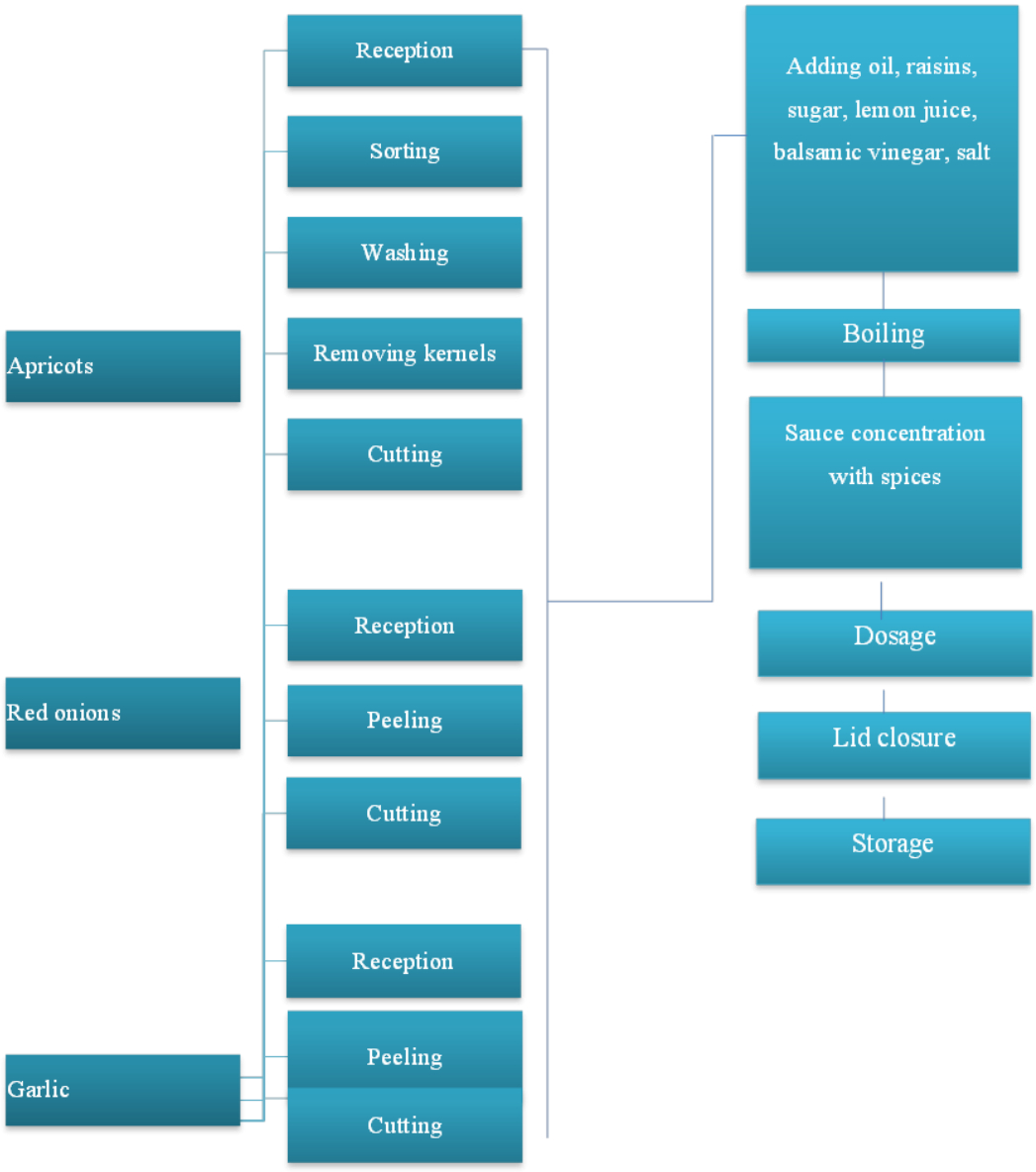

Figure 1. Technological flow diagram for obtaining apricot sauce

2.2. Determination of moisture and dry matter

The total phenolic content (TPC) of the samples was evaluated using the Folin–Ciocalteu method, both for the finished products as well for raw apricots. In this procedure, each ethanolic extract (1 mL) was mixed with Folin–Ciocalteu's reagent and water 1:1:20 (v/v) [19]. The samples were incubated for 8 min. Then, sodium carbonate (10 mL) with a concentration of 7% (w/v) was added. After incubation for 10 minutes, the absorbance at 750 nm was measured. The total phenolic content was calculated against the reference standard calibration curve of gallic acid. The TPC was expressed as mg of gallic acid equivalents (GAE) per 100 g of fresh sample [20, 21, 22, 23].

2.3. Assement of the total polyphenol content

The antioxidant activity was determined for the same samples as in the case of TPC using the cupric ion reducing antioxidant capacity method (CUPRAC), which was able to highlight both water-soluble and fat-soluble antioxidants in the analyzed samples. [23, 24, 25, 26, 27, 28].

2.4. Sensory evaluation

The obtained sauces (V1 and V2) were organoleptically analysed by a group of 20 untrained panellists, aged between 20 and 25 years, based on a sensory sheet, using the hedonic scoring scale from 1 to 5, appreciating: color, texture, taste, smell and after taste. It was followed that the color and consistency be uniform, the taste be pleasant, characteristic of
the raw materials used, and the smell be pleasant, corresponding to the added spices, not allowing foreign tastes and smells (sour, bitter, rancid, repulsive, etc.).

2.5. Assessment of the proximate composition and energy value

In order to determine the proximate composition and energy value of the raw apricots and the finished products, the USDA Nutritional Data Base was used [29, 30].

3. Results and Discussion

The moisture and dry matter values were, for both sauce variants, 41.2%, respectively 58.8% for the dry matter, the sauce being well bound and consistent. The values obtained were not different in the two variants of the sauce, because the difference between the two variants was only the introduction of a small amount of garlic in the case of V2 and the proportional reduction of the amount of onion in this case.

The polyphenol content and antioxidant capacity of apricots and the two variants of sauces, are shown in table 2 and figure 2.

Table 2.Polyphenol content and antioxidant capacity of raw apricots and the two sauce variants

Parameter	Raw apricots	Variant 1	Variant 2
Polyphenol content, mg gallic acid/g	52.35±0.14	78.9±0.42	79±0.12
Antioxidant activity (mg Trolox/g)	148.05 ±0.38	86.52±0.24	86.82±0.14

In the fresh fruits, the polyphenol content was 52.35±0.14 mg gallic acid/g, values that are similar to those found by other authors [14, 22, 31], the values being influenced by the apricot variety and the degree of ripeness [14, 15]

In the case of the obtained sauces, the content of polyphenols was increased in both variants, the differences between the two sauces being insignificant (78.9±0.42, respectively 79±0.12 mg gallic acid/g), increase determined by the addition of ingredients in the recipe, respectively of garlic in the V2 version [32].

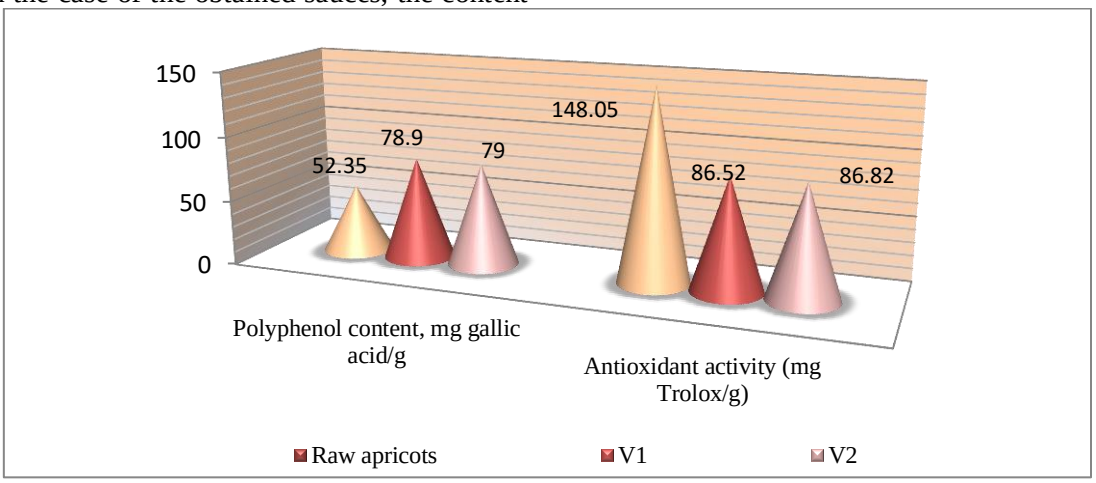

Figure 2. Polyphenol content and antioxidant capacity of raw apricots and the two sauce variants

This can be explained by the findings of Xu et al. (2007) cited by Abd Elnoor in 2019, [8] that the free fraction of phenolic acids increased after heat treatment. Heat treatment has been shown to increase the phenolic content in vegetable products due to food dehydration and the increase of phenolic extraction in products.

Regarding the antioxidant capacity, it was 148.05 ±0.38 mg Trolox/g in the case of fresh fruit and 86.52±0.24, respectively 86.82±0.14 mg Trolox/g in the case of the two types of

sauce, comparable values with those found by Abd-Elnoor, 2019 in the case of apricot jam processing [8].

Decreases in the antioxidant capacity values of apricots processed in the form of jam, up to 40.8%, were also recorded by Rababah et al, which further decreased with the increase in the storage period of the jam. The slightly increased value of the antioxidant capacity in the case of variant V2 can be attributed to the addition of freshly crushed garlic [33, 34].

Regarding the sensory analysis of the apricot sauces, all the characteristics analyzed were well appreciated by the panellists, with averages above 4 (fig. 3).

The taste and smell of the V2 variant were the best scored, with averages of 4.9, probably due to the addition of garlic, but, for the same reason, the aftertaste of this variant was the most derated parameter for this variant (4.1).

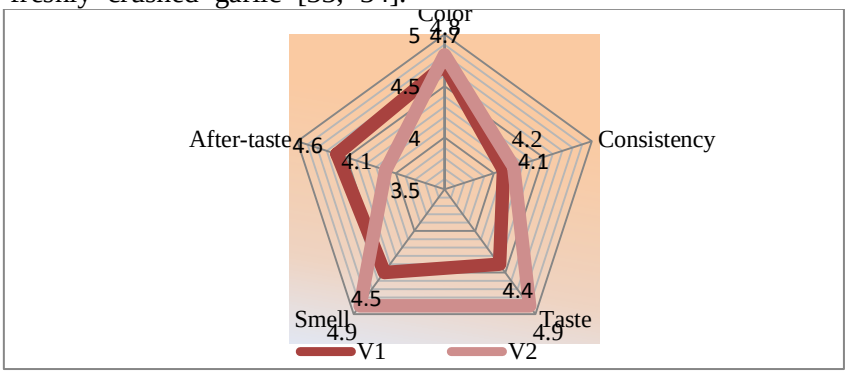

Figure 3. Values of the sensory evaluation of apricot sauces using a 5-point hedonic scale

The vivid color of the sauces was well appreciated in the case of both variants, with averages between 4.7 and 4.8.

The least appreciated characteristic, compared to the other sensory characteristics, was the consistency, which was slightly rougher due to the pieces of fruit and vegetables, which were not blended, but only finely chopped, not velvety and smooth like regular ketchup, with which, however, can be successfully replaced.

The degree of acceptability of these sauces is very good, the average scores obtained falling between 4.48-4.58, they can be consumed alongside meat products, cheeses or even for pizza or pasta.

The results obtained by calculation for the proximate composition and energy value of the two types of apricot sauces, compared to raw fruits are presented in table 3.

Table 3. Proximate composition and energy value of the two types of apricot sauces and raw fruits

Nutrition data for a serving size of 100 g	**Raw apricot**	**V1**	**V2**
Total carbohydrates	11.2	32.035	33.08
Sugar (g)	9.2	29.84	28.95
Dietary fibers (g)	2	2.27	2.27
Proteins (g)	1.4	0.24	0.34
Total fat (g)	0.4	6.5	6.6
Sodium (mg)	1	2.65	2.85
Energy value (cal)	52.35±0.14	78.9±0.42	79.4±0.22

According to the calculations, the nutritional values of the two types of sauce are very close, given the components of the recipe, slight increases can be found in the amount of protein, fat and sodium, for these components the garlic added to the V2 version is richer in these elements and slight decreases in carbohydrates and sugars, where the garlic substituted in the recipe in the case of V2 is poorer than the onion, the rest of the ingredients being the same.

The energy value per one hundred gram portion of the two sauce variants is also close in terms of values (78.9 and 79.4 calories respectively), values which as an absolute value are not very high, recommending the

use of these products to be consumed by any category of age.

4. Conclusion

The results of this study demonstrated, as other researchers did, that apricots are a good source of nutrients and biologically active compounds, such as antioxidants. Human health and nutrition are constantly in the attention of specialists, and natural plant compounds are carefully studied to be able to use them for potentially beneficial effects

As a result, there is an increasing demand for foods that not only fulfil the basic need of nutrition but additionally have disease-preventive and curing roles, the antioxidant properties of apricots can fulfil this role

The present study aimed to develop two varieties of apricot-based sauces that would be well-accepted by consumers while meeting the specified nutritional requirements. The preparation process is simple and can easily be done at home.

For the sauces produced, the polyphenol content was higher in both variants compared to fresh apricots, with only minor differences observed between the two sauces. Although the antioxidant capacity was reduced due to thermal processing, it remained significant enough to recommend the sauces as a valuable source of antioxidants.

Regarding the sensory analysis of the apricot sauces, all the characteristics analyzed were well appreciated by the panellists, with averages above 4, the best being scored the taste and smell of the V2 variant, with an average of 4.9, probably due to the addition of garlic. Regarding the nutritional values of the sauces, they were close in value due to the very similar composition of the recipes. The calculated energy values of the sauces are relatively low, and can be consumed by any age group.

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