DEVELOPMENT AND EVALUATION OF PEAR JAM ENRICHED WITH POPPY SEEDS AS A FUNCTIONAL FOOD PRODUCT

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Abstract

This study aimed to develop an innovative functional food product — pear jam enriched with poppy seeds. Fruit jams are valuable sources of vitamins, minerals, simple sugars, soluble dietary fiber, phytonutrients, phytoestrogens, anti-inflammatory compounds, and antioxidants such as polyphenolic flavonoids, vitamin C, and anthocyanins. These bioactive compounds help neutralize free radicals, protecting the body against cancer, aging, and infections. Poppy seeds complement this profile, offering fats, proteins, manganese, calcium, linoleic acid, and vitamin E.

Two types of jams — plain pear jam and pear jam with poppy seeds — were evaluated through sensory and physicochemical analyses. Sensory results showed that the poppy seed variant excelled in taste, appearance, and consistency, receiving the highest possible score (5.0), while color and aroma scored 4.8 points. Physicochemical analysis assessed sugar content, vitamin C concentration, and refractive index. Pear jam with poppy seeds exhibited higher sugar content (61.2°Brix) and refractive index (1.4501) than plain pear jam. However, vitamin C levels were slightly higher in plain pear jam (64.2 mg/100 g) compared to the enriched version (58.7 mg/100 g).

Introduction

Functional foods – defined as products that provide health benefits beyond basic nutrition – have gained increasing attention in nutrition science due to their potential to prevent disease and promote well-being. These products often leverage naturally occurring bioactive compounds such as dietary fiber, polyphenols, vitamins, and unsaturated fatty acids to deliver added physiological value. Reviews highlight that dietary fiber and antioxidants are key targets in the development of functional formulations, since their synergistic presence can modulate oxidative stress, inflammation, and metabolic health [1,6]. Polyphenols, in particular, are plant secondary metabolites with antioxidant, anti-inflammatory, and anti-carcinogenic properties; their conjugation with dietary fiber further influences bioaccessibility and health impacts, making fruit-based matrices attractive delivery vehicles [3,5,7].

Fruit jams represent a promising carrier for such bioactive compounds, combining palatability, extended shelf life, and concentrated phytochemical content. Processing techniques and ingredient selection can markedly affect retention of phenolics, vitamin C, and overall antioxidant capacity, as shown in studies on polyphenol-enriched jams [2,11]. Moreover, the antioxidant profiles of diverse plant foods have been systematically catalogued, underscoring

the value of selecting fruit sources with high intrinsic capacity to scavenge free radicals for functional formulations [4].
Pears are a rich source of polyphenolic compounds with emerging evidence of significant antioxidant, anti-inflammatory, and other bioactive effects; recent work has explored their polyphenol fraction and potential application in functional food development [12]. Their natural composition (providing soluble fiber, vitamin C, and phenolics) makes pear-based preserves a logical substrate for enhanced nutritional products. Complementing fruit-derived benefits, seed ingredients such as poppy seeds contribute additional functional attributes: they are dense in unsaturated fatty acids (notably linoleic acid), vitamin E, minerals (calcium and manganese), proteins, and other bioactive compounds, and have been recognized for their nutraceutical potential in food applications [8,9,10]. Their inclusion can increase lipid-soluble antioxidant capacity and supply essential fatty acids, while also influencing texture and sensory perception. Despite the individual recognition of pear-derived polyphenols and poppy seeds as health-promoting ingredients, their combined use in a single spreadable fruit product remains underexplored. Fruit jams enriched with complementary functional ingredients have previously shown that formulation changes can improve both nutritional profile and consumer acceptability, but the specific sensory and physicochemical trade-offs when incorporating poppy seeds into pear jam have not been systematically evaluated. This study therefore aimed to develop and characterize a novel functional product – pear jam enriched with poppy seeds – by assessing its sensory attributes alongside key physicochemical parameters (sugar content, refractive index, and vitamin C), thereby determining the extent to which poppy seed addition modifies both perceived quality and bioactive potential.

Experimental

2.1. Materials

Two types of jam were obtained – plain pear jam and pear jam with poppy seeds, following our original recipe. The raw and auxiliary materials needed in the production process were purchased from supermarkets or came from our own production.
The recipe for obtaining the 2 types of jam is presented below.

Raw / auxiliary materials	Plain pear jam	Pear jam with poppy seeds
Pear	500 g	500 g
Poppy seeds	-	15 g
Lemon juice	50 ml	50 ml
Sugar	150 g	150 g

2.2. Methods

The two types of jams were analyzed from a sensory and physicochemical point of view.
The sensory evaluation was carried out with the help of a number of 10 tasters, who filled in the sensory sheets following the organoleptic examination of the prepared products: pear jam with poppy seeds and plain pear jam. The tasters had to evaluate the following attributes of the jams: appearance, color, consistency, taste and smell.
The physicochemical analysis of the jams consisted of: determining the sugar content (using a DR201-95 digital refractometer), determining the vitamin C content (STAS 75588-87) and determining the refractive index (using an Abbe refractometer). The physicochemical analyses were done in triplicate.

Results and discussion

Following the results obtained on the basis of the questionnaires, for the assortment of pear jam with poppy seed, the most appreciated sensory characteristics were the appearance, consistency

and taste, all these characteristics obtaining the maximum score of 5 points. Color and smell achieved an average score of 4.8 points, with a small difference (0.2 points) compared to the other sensory characteristics.

For the plain pear jam assortment, the feature most appreciated by tasters was appearance, with an average score of 4.9 points. It was closely followed by consistency, smell (with an average score of 4.8 points) and color (4.7 points). The taste was the least appreciated, but nevertheless this feature also got a good average score of 4.6 points.

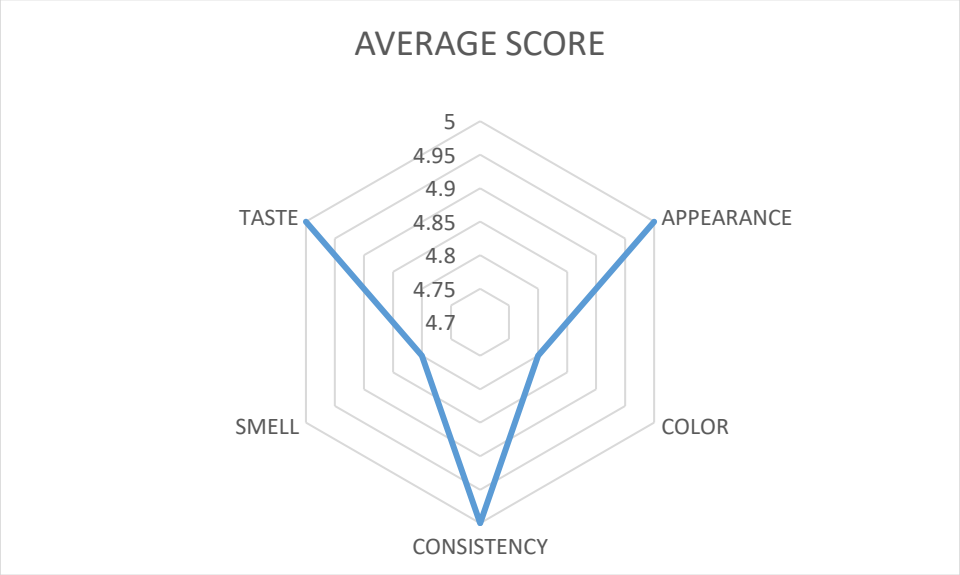

Figure 1. Sensory characterization of pear jam with poppy seeds

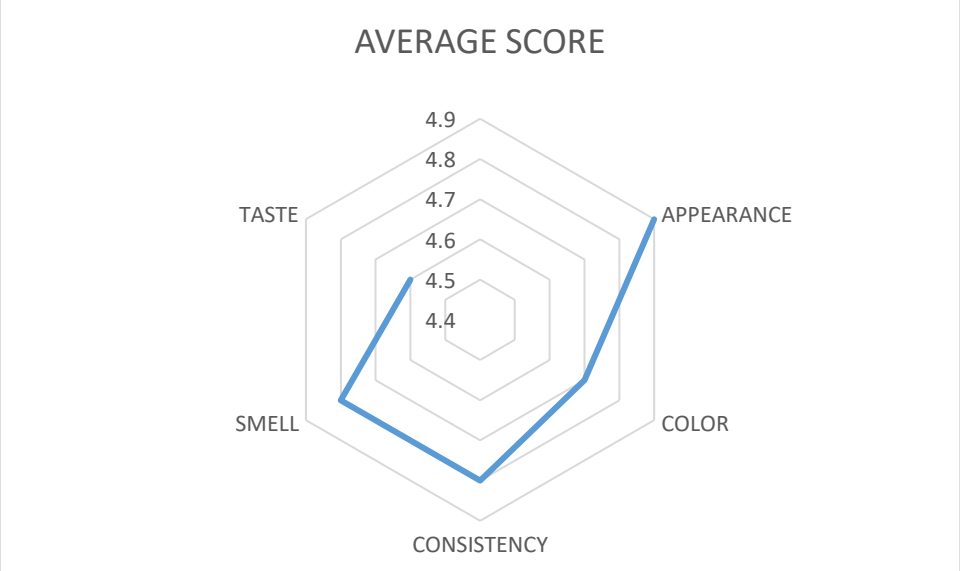

Figure 2. Sensory characterization of plain pear jam

The results of the physicochemical analysis for the 2 varieties of jam are presented in the table below.

Table 1. The results of the physicochemical analyzes for the 2 varieties of jam

Physicochemical analysis	Pear jam with poppy seeds	Plain pear jam
Sugar content (°Brix)	61.2	59.7
Vitamin C (mg / 100 g)	58.7	64.2
Refractive index	1.4501	1.4425

Conclusion

Following the sensory analysis of the studied products, the pear jam with poppy seeds was more appreciated by the tasters, obtaining a total average score of 4.92 points, while the pear jam obtained a total average score of 4.76 points.

The physicochemical analysis of the 2 varieties of jam showed a higher sugar content for the jam sample with poppy seeds (61.2°Brix), compared to 59.7°Brix for the sample without poppy seeds. The difference between the two jam samples is not very large, but can be felt in the taste and consistency. Also, the higher content of soluble solids (sugar + other dissolved substances) can make the product slightly sweeter and with a denser texture and can contribute to a longer shelf life by reducing water activity.

The refractive index increases with the soluble solids content, and the values confirm the difference observed in °Brix. Thus, poppy seed jam, having more dissolved solids, has a higher refractive index, which correlates with a denser texture and possibly a more pronounced gloss.

The vitamin C content is slightly lower in the poppy seed version. Vitamin C is known to be sensitive to heat, oxygen, and processing. Thus, the decrease may be related to additional cooking time or exposure to higher temperatures. The difference between the two types of jam analyzed is modest, so the nutritional impact is not very high. Both variants remain moderate sources of vitamin C.

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