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INFLUENCE OF OLIVE CULTIVAR ON THE SENSORY ACCEPTANCE OF A VEGETABLE PÂTÉ ENRICHED WITH OLIVE POMACE PULP

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ABSTRACT: Brazilian olive oil industry is gradually expanding, generating large volumes of olive pomace (OP) as a byproduct. OP, rich in phenolic compounds and dietary fiber, presents an opportunity for sustainable valorization in food applications. This study investigated the influence of olive cultivar ("Arbequina" and "Koroneiki") on the sensory and physicochemical properties of plant-based pâtés fortified with OP powder (OPP) at 10% and 20%. Sensory analysis was carried out with 102 consumers to evaluate the appearance, color, aroma, taste, and texture. The results from this study showed that pâtés with 10% OPP from "Koroneiki" had the highest acceptance in relation to the appearance/color, linked to a green hue reminiscent of olives. In contrast, pâtés with 20% OPP from "Koroneiki" had lower taste acceptance due to bitterness, astringency, and residual flavors. Further, pâtés with "Arbequina" OP were associated with typical olive aromas and textures but had a slightly sandy consistency. Findings from this study suggests that cultivar selection significantly impacts OP-fortified pâtés' sensory attributes, with potential applications in sustainable plant-based food innovations.

KEYWORDS: Upcycling; Olive pomace; Waste; Sustainable production.

1. INTRODUCTION

The olive oil industry in Brazil is relatively new, but it shows great potential for growth in the coming years (Ambrosini *et al.*, 2022). As the industry grows, large volumes of waste, such as olive pomace (OP), could become an environmental issue. OP is estimated to contain 99% of the phenolic compounds (PC) found in olives (Gómez-Cruz *et al.*, 2024). In Brazil, most mills use a two-phase extraction system, generating about 80% of OP during the oil extraction process. Therefore, innovative solutions to convert OP into valuable products are crucial for supporting the sustainability of the olive oil industry and achieving Sustainable Development Goals like Zero Hunger (SDG 2) and Responsible Consumption and Production (SDG 12).

OP is a paste made from crushed olive pulp and seeds, rich in insoluble dietary fiber and phenolic compounds (Abbattista *et al.*, 2021; Zhao *et al.*, 2023). Its application and direct addition in food has been limited, due to its bitter and spicy flavors, which can affect product acceptance (Difonzo *et al.*, 2021; Cedola *et al.*, 2020).

A growing trend in the market is plant-based foods, which serve as alternatives to meat and dairy products while mimicking their appearance, texture, and flavor. Olive pâtés are particularly popular in Italy. They contain ingredients like peppers, eggplants, onions, zucchinis, olive oils, and garlics (Difonzo *et al.*, 2019; Cosmai *et al.*, 2017a; Cosmai *et al.*, 2017b). Although formulations using OP have not been explored, Cavallo *et al.* (2020) evaluated pâté with table olives enriched with PCs from olive oil extraction residues.

Reusing OP for human nutrition could increase the intake of phenolic compounds, promote health, and add value to the olive oil production chain. However, food products containing relevant levels of PCs (at least 5 mg of hydroxytyrosol and its derivatives) with pleasant sensory characteristics are still limited in research and on the market. Some olive cultivars including “Koroneiki”, are characterized by higher levels of phenolic compounds with strong, bitter, and pungent tastes (Averbuch *et al.*, 2023), while others like “Arbequina”, have a sweeter taste (Borges *et al.*, 2018). These cultivar and maturity differences, which are well-documented for olive oil (Rad *et al.*, 2023), are expected to affect the phenolic content and sensory characteristics of OP, but this has been overlooked (Pierguini *et al.*, 2024). This study aims to investigate the influence of olive cultivar on the sensory of plant-based pâtés fortified with OP.

2. METHODOLOGY

2.1 Obtaining samples and development of the plant-based pâté enriched with OPP

The OP from *Olea europaea* cv. “Arbequina” and “Koroneiki” were collected immediately after oil extraction by the two-phase continuous extraction method, in an extra virgin olive oil industry located in the city of Restinga Seca, RS, Brazil (29° 70′ 79″ S; 53° 50′ 28 ″ W). OP powder (OPP) was obtained by granulometric fractionation of OP using the method described by Speroni *et al.* (2019), except that the process was scaled-up to a 60 kg/h system and 1.2 mm sieve. The ‘OPP was stored at -20 °C for use later. A green banana biomass was obtained, according to the methodology of Riquette *et al*. (2019). The hot green banana biomass was immediately used to prepare the neutral base that was used to formulate the plant-based pâtés enriched with “Arbequina” or “Koroneiki” OPP at 10% or 20% as well as the control pâté that did not contain OPP according to the formulations. All

ingredients were mixed in an industrial blender (model PRD-0447, Metvisa, Santa Catarina, Brazil) and immediately packaged in glass jars.

2.3 Sensory analysis

Two tests were carried out to evaluate the plant-based pâté formulations. The sensory analysis protocol was approved by the Human Research Ethics Committee of the Federal University of Santa Maria (CAAE: 76703023.0.0000.5346). The sensory analysis was conducted with one hundred and two tasters (68 women and 34 men) aged 18-61 years. This analysis took place in individual cabins, under controlled light (fluorescent) and temperature (25 °C). To evaluate the olive pâté, the sample was placed in a plastic cup, coded with three random digits, for the taster to spread the product on a cream cracker biscuit. Samples were presented monadically in complete balanced blocks (Macfie *et al.*, 1989). A sensory acceptance test was performed using a structured hedonic scale of nine points, ranging from "1=disliked very much" to "9=liked very much". The attributes evaluated were appearance, color, aroma, flavor and texture. The Generalized Procrustes Analysis (GPA) was employed to analyze sensory data using XLSTAT software (version 2019.2.2).

3. RESULTS AND DISCUSSION

The acceptance of pâtés containing OPP was evaluated by consumers and shown in Table 1. The best appearance and color acceptance were exhibited by K10% (6.85), followed by K20% (6.25) that had higher scores than the other samples ($p<0.05$). No significant differences were observed in the odor or texture scores among formulations ($p>0.05$), whereas taste scores were similar for formulations except for K20% that had lower taste score than the other formulations ($p<0.05$).

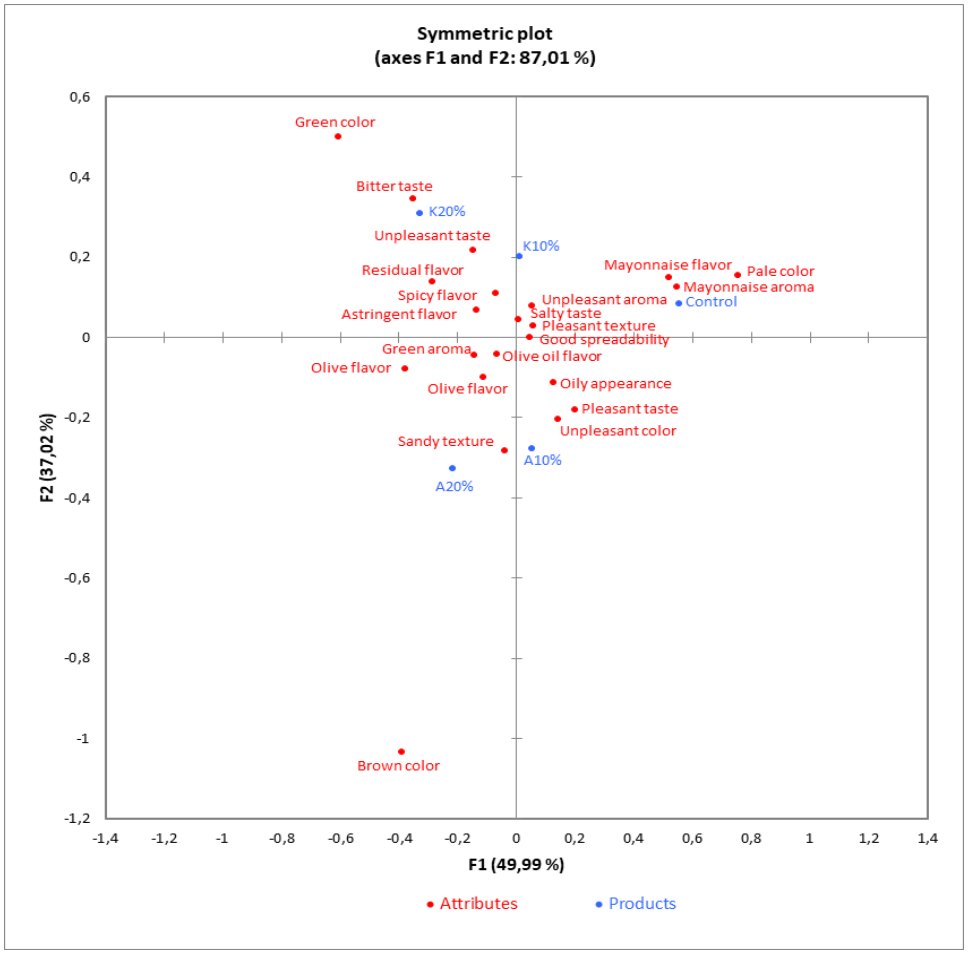
Table 1 – Sensory acceptance of plant-based olive pâtés by consumers.

	Appearance	Color	Odor	Taste	Texture
Control	5.66 bc	5.52 bc	5.35 a	5.68 a	6.71 a
A10%	5.77 bc	5.65 bc	5.59 a	6.04 a	6.61 a
A20%	5.43 c	5.32 c	5.90 a	5.71 a	6.45 a
K10%	6.85 a	6.55 a	5.60 a	5.97 a	7.09 a
K20%	6.25 ab	6.12 ab	5.73 a	4.65 b	6.69 a

Data are means (N=102). T:tasters. F:formulation. Sensory acceptability scale of 9 points, with extremes anchored in the terms "1 extremely disliked" "9 - extremely liked". Lowercase letters indicate significant differences between samples for each attribute.

CATA sensory analysis revealed that pâtés containing OPP cv. "Koroneiki", mainly K20%, were associated with the attributes "green color", resulting from the OPP being obtained mostly from green olives, thus contributing to greater acceptance of the characteristic appearance and color of a pâté with olives. The lowest appearance scores were found for A20% (p<0.05; Table 1), which was associated with the attributes "unpleasant color" and "brown color", as shown in Figure 1.

Figure 1 – Generalized Procrustes Analysis (GPA) for CATA of plant-based pâtés.



Control: pâté without OPP; A10%: pâté with 10% of OPP cv 'Arbequina'; A20%: pâté with 20% of OPP cv 'Arbequina'; K10%: pâté with 10% of OPP cv 'Koroneiki'; K20%: pâté with 20% of OPP cv 'Koroneiki'.

The aroma did not have a significant difference in acceptance between the samples. Control pâté was associated with "mayonnaise aroma", "mayonnaise flavor", and "unpleasant aroma". A10% and A20% were associated with aroma attributes such as "olive aroma" and "green aroma", which characterized the pâté with OPP "Arbequina", reminiscent of preserved olives (Pedan *et al.*, 2019). The taste of the pâtés had similar acceptance for control, A10%, A20% and K10%, but lower scores

for K20% (p<0.05), evaluated by the tasters as "I slightly disliked". This difference corroborates the CATA analysis, which associated K20% sample to an "unpleasant taste", related to attributes such as "bitter taste", "residual flavor", "spicy flavor" and "astringent flavor". Lanza *et al.* (2023), demonstrated that the sensory acceptance of table olive pâtés is influenced by the olive cultivar and related to the sensory attributes of bitterness. No differences in texture scores were observed among the pâtés. However, CATA analysis revealed that A10% and A20% were associated to a "sandy texture". According to Speroni *et al.* (2019), OPP can contain coarse particles of lumps even after particle size fractionation (pits < 1.5 mm), which can be like sand and cause the sensation of an uneven texture of the pâté.

4. CONCLUSION

Pâtés fortified with OPP cv "Arbequina" were associated with attributes characteristic of olive products. However, 10% OPP "Koroneiki" had a better appearance, color and texture compared to the other formulations. Future studies can be carried out to optimize flavor acceptance in this and other products, with blends of cultivars to reduce bitterness of the product.

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