

## NUTRITION AND FOOD SCIENCE

# Production and characterization of green and black olive paste using cream of animal and vegetable origins

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## Abstract

Now-a-days the quest for foods with high flavonoid polyphenols content, lower fat concentration and relative high proportion of monounsaturated or polyunsaturated fatty acids is increasing. Following this tendency green and black olive pastes applying soy cream or cream of animal origin were produced equating a subsequent industrial output, and the rheological, physicochemical and sensory characteristics of were characterized. It was found that the cohesiveness, adhesiveness and hardness of the black olive paste having cream of animal origin showed minimal values. Among samples the moisture varied between 67.15 -72.16% and the inorganic residue of the black olive pastes were also significantly lower from the green olive pastes. Minimum and maximum pH values were measured in green olive paste having soy cream and black paste with cream of animal origin, respectively. The crude fat showed significant differences among the olive pastes, whereas the protein content did not vary significantly. The colour of the black paste with cream of animal origin and soy were slightly orange, whereas the green paste remained green. The sensory analysis of the black olive paste including cream of animal origin showed lower average values for consistency and appearance attributes but the opposite occurred with the salty taste and overall assessment. Concerning to the aroma, the black olive pastes showed the highest values, while the green olive pastes kept similar values. It is concluded that the higher pH of the black olive pastes in conjunction with the water contents limits the shelf life and clearly pointed the need a careful microbial control. Considering that the colour parameters of a food is the first contact point of the consumer, these descriptors in the green olive pastes also seemed to have better acceptance, whereas preferences did not followed healthy options.

*Key words:* Olive, Paste, Soy cream, Sensory analysis, Texture and physicochemical analysis

## Introduction

Currently there is great demand for foods with high flavonoid polyphenols content, lower fat concentration and with a relative high proportion of monounsaturated or polyunsaturated fatty acids. Additionally, the quest for fatty acids with potentially positive effects on human health, such as omega-3 and linoleic acid, is also increasing (Stoll et al., 1999; Roche et al., 2000; Martin, 2008). The main assumption is that a host of beneficial effects prevails to lowering cholesterol (Visioli et al., 1995; Kratz et al., 2002), blood

pressure, and risk of coronary disease (Visioli and Gali, 1998). For instance, Mensink and Katan (1992) reported that unsaturated fatty acids raises the levels of high density lipoproteins in the blood and reduces the level of low density lipoproteins in the blood. In this context, the accumulation of grease inside veins and arteries decreases, limiting the probability of hypertension, heart attack and stroke.

The olive fruit, a small drupe 1–2.5 cm long, thinner-fleshed, produced by the *Olea europaea*, a small evergreen tree (Lidon et al., 2001), has a high content of oil enriched in triacylglycerols and flavonoid polyphenols. These triacylglycerols are mainly composed (Garrett and Grisham, 2010) of a mixture of three fatty acids (oleic, palmitic and linoleic). Oleic acid (C18:1) and linoleic acid (C18:2) are monounsaturated omega-9 and polyunsaturated omega-6 fatty acids, that corresponds to 55-83% and 3.5-21% of the olive oil. Moreover, linolenic acid (C18:3) is a

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polyunsaturated omega-3 fatty acid that makes up to 1.5%, whereas palmitic acid (C16:0) and stearic acid (C18:0) are saturated fatty acids that reaches 7.7-20% and 0.5-5%. The flavenoid polyphenols (about 5 mg in 10 g of olive oil) are mainly composed by hydroxytyrosol and tyrosol, whose antioxidant properties had been recognized. Considering the chemical composition of the olive oil, the olive paste is being recognized not only by its excellent taste and quality, but also by its potential beneficial effects on human health. Yet, the olive paste can include a lot of heterogenic components of animal and of vegetable origins. Green or oxidized olive can also be used in the matrix of the paste. In this context, this work reported the production of olive paste prepared with green or oxidized olives and including cream from animal or vegetable origin, with the perspective of a subsequent industrial development, and aimed to check the related rheological, physicochemical and sensory characteristics. The possible implications on the maintenance of human health are also discussed.

## Materials and Methods

Black and green olive pastes with cream from animal origin were prepared in the laboratory of the Department of Technology and Applied Sciences of the Politechnique Institute of Beja / Portugal, blending until liquefaction pitted black and green olives (100g, Continente, Portugal), pickles (15g, Continente, Portugal, composition: cauliflower, cucumbers, carrots, peppers, onion, chilli, vinegar and salt), ultra-high-processed cream of animal origin (70 mL, animal fat 35%, Continente, Portugal), olive oil (12g, Continente, Portugal) and salt (0.5g). To produce of black olive paste with soy cream 2 g of salt and of soy cream (50g, vegetable fat 17.9%, Provamel, United Kingdom) were used. The green olive paste with soy cream was produced like the black olive paste but without addition of salt

The texture profile analysis was carried out using the texturometer TAHDi (Stable Micro Systems, Godalming, United Kingdom), equipped with a cylindrical aluminum tube with 20.0 mm diameter. The sample of olive paste had a cylindrical shape, the distance travelled by the probe was 20.0 mm, the test speed was 1.5 mm/s and the temperature was 10°C.

The moisture, pH, fat and total nitrogen of samples was determined followed the AOAC method n° 981.12 (AOAC, 1990). The protein values were determined by multiplying the total nitrogen by 6.25.

The colour analysis was carried out using the colorimeter Minolta CR-300 (Minolta, Osaka, Japan) and considered the parameters L\*, a\*, and b\*. The L\* scale ranges from 0 black to 100 white; the a\* scale extends from a negative value (green hue) to a positive value (red hue); and the b\* scale ranges from negative blue to positive yellow.

For sensory analysis hedonic tests were performed to obtain the degree of appreciation by the judging panel of 20 panellists, in test rooms according to NP 4258 (1993). The proof sheet contained a list of sensory descriptors (aroma, salty taste, consistency, appearance and overall assessment). A tasting chart with 9 points was used, being number 1 and 9 indications of highly unpleasant and highly enjoyable, respectively.

Statistical analysis was carried out with STATISTICA 6.0 software Copyright StatSoft, Inc. with comparison of means and standard deviations in the ANOVA and analysis of variance according to the Scheffé test ( $p \leq 0.05$ ).

## Results and Discussion

Texture is an important attribute of food, largely determining its organoleptic quality (Peleg, 1987). This attribute also has a great influence on the processing, storage, maintenance and acceptance by consumers (Aguilera and Stanley, 1999). However, texture integrates a set of mechanical, geometric and surface properties detectable by mechanical, tactile, visual and auditory receptors (Szczeniak, 2002). The mechanical properties are related to the reaction of the food product to a pressure and integrate five primary characteristics: hardness, size, viscosity, elasticity and adhesion. The geometric properties are associated to the size, shape and arrangement of particles in the product. The surface properties are linked to sensations produced in the mouth by water and / or fats (Bourne, 2002). Considering these assumptions, the textural properties that can define consumers preferences were followed, being found that the cohesiveness, which relates the degree of deformation before breaking, of green olive paste with cream of animal origin and black olive paste with soy cream remained with similar values (Table 1). Moreover, the black olive paste having cream of animal origin showed minimal values and significantly different from the highest average values found in green olive paste with soy cream (Table 1). This pattern was reinforced by adhesiveness properties, which relates (deMan, 1999) the attractive forces between surfaces of the food and other material to whom it might contact (namely tongue, teeth and palate). The

adhesiveness of green and black olive pastes with soy cream were similar, but when the cream of animal origin was applied the black olive paste also displayed minimal values and the green olive paste revealed an opposite trend (Table 1). The hardness,

which can be interpreted as a textural characteristic during the first chew, in the black olive paste having cream of animal origin further remained significantly lower relatively to the other samples that did not vary significantly (Table 1).

Table 1. Physical, chemical and texture analysis of black and green olive paste with cream of animal origin or soy. Average values  $\pm$  STD.

	Green olive paste		Black olive paste	
	Soy cream	Cream of animal origin	Soy cream	Cream of animal origin
Hardness (N)	0.64 $\pm$ 0.03 <sup>a</sup>	0.65 $\pm$ 0.01 <sup>a</sup>	0.62 $\pm$ 0.04 <sup>a</sup>	0.39 $\pm$ 0.03 <sup>b</sup>
Adhesiveness (-N.s)	2.45 $\pm$ 0.27 <sup>b</sup>	3.01 $\pm$ 0.18 <sup>a</sup>	2.66 $\pm$ 0.29 <sup>b,c</sup>	1.63 $\pm$ 0.22 <sup>a</sup>
Cohesiveness	1.52 $\pm$ 0.18 <sup>a</sup>	1.37 $\pm$ 0.11 <sup>a,b</sup>	1.36 $\pm$ 0.06 <sup>a,b</sup>	1.27 $\pm$ 0.03 <sup>b</sup>
pH	3.24 $\pm$ 0.14 <sup>d</sup>	3.76 $\pm$ 0.09 <sup>c</sup>	4.63 $\pm$ 0.07 <sup>b</sup>	5.31 $\pm$ 0.06 <sup>a</sup>
Moisture % (m/m)	68.76 $\pm$ 1.29 <sup>b</sup>	67.15 $\pm$ 1.41 <sup>b</sup>	72.36 $\pm$ 1.06 <sup>a</sup>	68.55 $\pm$ 0.45 <sup>b</sup>
Ashes % (m/m)	3.16 $\pm$ 0.009 <sup>a</sup>	3.44 $\pm$ 0.19 <sup>a</sup>	2.53 $\pm$ 0.22 <sup>b</sup>	2.30 $\pm$ 0.25 <sup>b</sup>
Protein % (m/m)	0.88 $\pm$ 0.03 <sup>b</sup>	1.25 $\pm$ 0.05 <sup>a</sup>	0.85 $\pm$ 0.06 <sup>b</sup>	1.18 $\pm$ 0.04 <sup>a</sup>
Crude fat % (m/m)	10.32 $\pm$ 2.97 <sup>c</sup>	16.70 $\pm$ 0.24 <sup>a</sup>	11.12 $\pm$ 0.97 <sup>b,c</sup>	15.72 $\pm$ 1.04 <sup>a,b</sup>
Colour parameters				
a*	-5.51 $\pm$ 0.35 <sup>c</sup>	-5.42 $\pm$ 0.21 <sup>c</sup>	2.47 $\pm$ 0.32 <sup>a</sup>	1.41 $\pm$ 0.23 <sup>b</sup>
b*	25.74 $\pm$ 0.67 <sup>a</sup>	24.51 $\pm$ 0.79 <sup>b</sup>	9.70 $\pm$ 1.26 <sup>d</sup>	12.35 $\pm$ 0.73 <sup>c</sup>
L*	66.75 $\pm$ 0.26 <sup>b</sup>	73.03 $\pm$ 0.63 <sup>a</sup>	42.22 $\pm$ 2.39 <sup>d</sup>	56.23 $\pm$ 1.15 <sup>c</sup>

a,b,c...Means in the same row marked with different letters are significantly different (P < 0.05, n = 3, texture: n = 5, colour: n = 10 Scheffé test).

Water content can help assessing the foods mostly with respect, not only to the texture, but also to the flavour and appearance, to achieve better sensory evaluation (i.e., desirability and acceptability). Following this assumption, the moisture of the black olive paste showed the highest average value, further expressing and defining the mechanical properties of cohesiveness, adhesiveness and hardness (Table 1). Nevertheless, considering that among samples the moisture varied between 67.15 -72.16%, the shelf life of all samples cannot be considered extensive mostly due to microbial load. In this context, the inorganic residue of the black olive pastes was also significantly lower from the green olive pastes (Table 1).

Independently of the shelf life of the pastes, the pH of all samples was also found to be acidic but significantly different (Table 1). Minimum and maximum pH values were measured in green olive paste having soy cream and black paste with cream of animal origin, respectively. Nevertheless, the black olive paste remained above 4.6, whereas the pH of green olive paste was lower in both samples. Accordingly, the black and green pastes can be considered low and high acid foods, respectively. As pH 4.6 is critical to the growing of spores from *Clostridium botulinum*, the black olive paste can be considered a safer food product. Indeed, *Clostridium botulinum* produces an extremely

potent neurotoxin which causes botulism and might kill (Lidon and Silvestre, 2008).

The crude fat showed significant differences among the olive pastes, whereas the protein content varied, not significantly, between 0.82-1.24% (Table 1). The average content of crude fat reached maximum and minimum values in green olive paste with cream of animal origin and soy cream, respectively (Table 1), clearly indicating that the source of the increasing crude fat was not the olive in spite of its maturity. Thus, in spite of the crude fat origin, this food product clearly might amplify the levels of cholesterol or even blood pressure and coronary disease (Visioli et al., 1995; Visioli and Gali, 1998; Kratz et al., 2002).

The colour of the black paste with cream of animal origin and soy were slightly orange, whereas the green paste remained green. In this context, the a\* parameter did not vary significantly between the green pastes (Table 1). Moreover, both types of black pastes were found to be significantly different and also showed a different pattern relatively to the green pastes (Table 1). The b\* parameter all the samples also displayed the yellow colour but the related values were significantly different (Table 1). With regard to the parameter L\*, all samples revealed a high brightness but the values also were significantly different from each other.

The sensory analysis showed (Figure 1) that the consistency and appearance attributes of the black

olive paste including cream of animal origin had a lower average value, whereas the others got similar values. The salty taste showed the highest and lowest average values for black and green olive pastes including cream of animal origin, respectively. This sensory attribute showed middle values with the olive pastes having soy cream. Concerning to the aroma, the black olive pastes showed the highest values, while the green olive pastes kept similar values. The highest values of the overall assessment were sequentially found in the black olive paste including cream of animal origin and soy, while both green olive pastes showed similar average data.

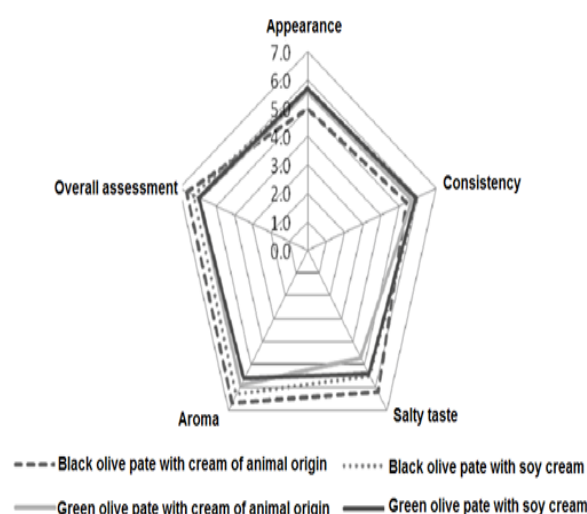


Figure 1. Sensory evaluation through hedonic tests by with 20 panelists. A tasting chart with 9 points was used, being number 1 and 9 indications of highly unpleasant and highly enjoyable, respectively.

## Conclusion

Understanding the relationship between food texture perception and food structure is of increasing importance for companies wishing to produce texturally attractive food products having medical properties. Yet, this study is complicated by the dynamic nature of texture perception and by the presence of large individual differences in oral processes. Thus, a multidisciplinary approach is required, integrating the sensory science and food structure research, i.e., the study of rheologic parameters and microstructure. The stimuli of texture perception are primarily of a mechanical nature. Therefore, to establish a relationship between perceived texture and food characteristics, it is essential to understand the mechanics or the rheology of food deformation. In this context, through the hedonic tests the preference for the

aroma, salty taste and overall assessment of the black olive paste was identified. Additionally, the application of cream of animal origin reinforced this preference. In this framework the host of beneficial effects that might prevail to lowering cholesterol, blood pressure, and risk of coronary disease mediated by the oil composition of the olive fruit is antagonistic to the preference by the addition of cream of animal origin. The higher pH of the black olive pastes in conjunction with the water contents further pointed a limited shelf life and the need a careful microbial control. Considering that the colour of a food is the first contact point of the consumer, the colour parameters of the green olive pastes further seems to be better acceptable.

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