EFFECT OF TIGER NUT (*Cyperus esculentus*) FIBRE ADDITION ON SOBRASADA (SPANISH DRY FERMENTED SAUSAGE) COLOR PROPERTIES AND QUALITY

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Introduction

Fibre is one of the most common functional ingredients in food products and has been used as fat replacer, fat reducing agent during frying, volume enhancer, binder, bulking agent and stabilizer. By-products from tiger nuts (*Cyperus esculentus*) milk production are a suitable fiber source (Sánchez-Zapata et al., 2009). Tiger nut fiber (TNF) can be use as a source of dietary fibre in food processing. These authors studied the chemical, physicochemical and technological properties of TNF. They reported that TNF has a high proportion of total dietary fibre (TDF: 59.71 g/100 g), composed mainly of insoluble dietary fibre (IDF: 99.8%). This content in TDF is higher than that reported for other dietary fibre sources (oat bran, rice bran, peaches, cabbage outer leaves, pears, apples, carrots, jack bean, chia and orange peel) (Sánchez-Zapata et al., 2010).

Sobrasada is a Spanish popular meat product, which is appreciated for its color, aroma and flavor. These characteristics are a result of the manufacturing process and, particularly, the addition of paprika, a spice widely used in the Spanish meat industry (Fernández-López et al., 2007). Sobrasada is a dry-cured sausage traditionally manufactured using lean pork meat and white fat. This product is rich in fat but deficient in complex carbohydrates. Dry-cured meat products for their high fat content are seen as "unhealthy" by consumers who increasingly are aware of the importance of diet on health. The addition of fiber to the meat products opens a new opportunity for the potentially functional food development. The objective of this work was to evaluate the effect of TNF addition (5%) on nutritional, quality and colour properties of sobrasada.

Materials and Methods

Sobrasada elaboration process. Three independent replicates of each batch were prepared at the IPOA Research Group Pilot Plant at the Miguel Hernández University. A traditional formula was used to obtain a "base" batter as follows (percentages of non-meat ingredients are related to 100% meat): 40% lean pork meat, 60% pork fat, 6% (w/w) paprika, 2.3% (w/w) sodium chloride, 0.2% (w/w) white pepper, 0.05% (w/w) oregano, 0.05% (w/w) sodium ascorbate, 0.03% (w/w) sodium nitrite and 0.03% (w/w) potassium nitrite. This mixture was divided into batches with different TNF concentration (0% and 5%). These concentrations were selected previously (TNF was added at concentrations higher than 5% there were technological and sensorial problems that make the product unviable). Finally, the mince was filled into artificial casings made of collagen and all batches were ripened for 35 days at a temperature and relative humidity of 12 ± 2 ºC and 75 ± 5%, respectively.

Proximate analysis of sobrasada. Moisture, ash, protein and fat content were determined by AOAC methods (AOAC, 1995).

Physicochemical analysis of sobrasada. The pH was measured on a suspension resulting from blending a 15 g sample with 150 mL deionized water for 2 min with a pHmeter (Mod. pH/Ion 510, Eutech Instruments Pte Ltd., Singapore). Water activity (aw) was measured at 25 ºC using a Novasina TH- 500 hygrometer (Novasina, Axair Ltd., Pfaeffikon, Switzerland). Colour was evaluated using a spectrophotometer (CM-2600D, Minolta Camera Co., Osaka, Japan) with illuminant D_{65}, 10º observer, Diffuse/O mode, 8 mm aperture of the instrument for illumination and 8 mm for measurement. Colour was described as coordinates: lightness (L*), redness (a*, ±red–green), and yellowness (b*, ±yellow– blue), and the redness index (a*/b*) were calculated. The reflectance spectra at every 10 nm between 400 and 700 nm were also obtained.

Statistical analysis. Analysis of variance (ANOVA) was used to determine significant differences ($p<0.05$) between TNF concentrations. Statistical analyses were carried out using SPSS 16.0 for Windows (SPSS Inc., Chicago, USA).

Results and Discussion

Proximate compositions of sobrasadas are showed in Table 1. The sobrasada control (SC) had a moisture content of 26.34 ± 3.03 (g/100g) and sobrasada with 5% of TNF (STNF) had a value of 28.07 ± 2.52 (g/100g), because TNF was incorporated wet and its WHC retains water. In general, an increase in the percentage of TDF added corresponded to a decrease in moisture content, however in this case TNF addition increased moisture slightly. As expected, a significant decrease in fat content was determined by TNF addition (Table 1), SC had a fat content of 55.35 ± 0.07 (g/100g) and STNF had a value of 51.72 ± 0.03 (g/100g). No significant differences ($p<0.05$) were observed in protein and ash contents of the different samples (Table 1). The addition of 5% TNF significantly increased ($p<0.05$) the TDF in sobrasada, from 2.16 ± 0.01 to 5.74 ± 0.03, obtained a product rich in fibre (Table 1). The physicochemical properties of sobrasada are presents in Table 2. The TNF addition caused a pH decrease (from 4.70 to 4.54) but kept the water activity (0.908) (Table 2). About color properties, the addition of 5% of TNF to sobrasada reduced redness and yellowness; however lightness and redness index had not significant changes ($p>0.05$) (Table 2). TNF had not effects on the shape of sobrasada reflectance spectra (Figure 1).

Conclusion

The addition of 5% TNF decreased fat content in sobrasada and increased the TDF, obtained a product rich in fibre, to getting a healthier product, without significant changes in its physicochemical properties and to maintaining its traditional characteristics.

References

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Table 1. Proximate composition of sobrasadas formulated with different tiger nut fibre levels (**CONTROL:** 0% of tiger nut fiber; **5% TNF:** 5% of tiger nut fiber).

COMPOSITION (%)	CONTROL	5% TNF
Moisture	26.34 ± 3.03	28.07 ± 2.52
Fat	55.35 ± 0.07	51.72 ± 0.03
Protein	17.79 ± 0.18	18.17 ± 1.34
Ash	4.62 ± 0.15	3.68 ± 0.16
Total Dietary Fiber	2.16 ± 0.01	5.74 ± 0.03

Table 2. Physicochemical properties of sobrasadas formulated with different tiger nut fibre levels (**CONTROL:** 0% of tiger nut fiber; **5% TNF:** 5% of tiger nut fiber).

PARAMETER	CONTROL	5% TNF
pH	4.64 ± 0.04	4.54 ± 0.01
Water Activity	0.908 ± 0.007	0.908 ± 0.001
L*	40.03 ± 2.53	40.24 ± 2.44
a*	24.44 ± 1.78	21.75 ± 1,27
b*	25.34 ± 3.80	23.07 ± 2.20
a*/b*	0.96 ± 0.05	0.94 ± 0.06

Figure 1. Reflectance spectra of of sobrasadas formulated with different tiger nut fibre levels (**CONTROL:** 0% of tiger nut fiber; **5% TNF:** 5% of tiger nut fiber).