

EFFECTS OF CITRUS FIBER ON THE SENSORY AND TEXTURAL PROPERTIES OF BEEF BOLOGNA

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Background

At the present time, exists an evident risk of fiber deficit in the human diet as consequence of the way of life changes, food habits, highly processed foods, etc. For these causes it is interesting to increase the consumption of all foods that supply fiber to daily foods intake. Fiber incorporation in frequent consumed foods, for example meat products, could help to overcome the fiber deficit. Further, it is well known that fiber consumption reduces the risk of colon cancer, obesity, cardiovascular diseases and several other disorders and, thus, an increase in the level of dietary fiber, in the daily, diet is strongly recommended.

The great citrus production in Spain has favored the development of a very important industry: citrus juice. This industry produce a great by-product quantity (peel, pulp and seeds), with a high content of fiber, that could be used in the elaboration of high fiber content meat products.

Objectives

The objective of this study was to study the effects of citrus fiber addition on the chemical (moisture, fat, protein, ash and fiber content) sensory and textural (texture profile analysis) properties of beef bologna.

Methods

Five formulations of beef bologna were manufactured by a traditional method with the following formula: 20% beef meat, 20% beef fat, 40% dewlap, a mixture of NaCl (2,5%), ascorbic acid (500mg/kg), NaNO₂ (150mg/kg), potato starch (3%), polyphosphate (300mg/kg) and spices. The only variation in the formula was the percentage of citrus fiber added: 0% (control), 0,5%, 1%, 1,5% y 2%. The preparation and processing of citrus fiber were performed according to developed method of Fernandez-Gines (unpublished data).

Chemical analysis: Moisture content (g water/100 g sample) was determined by drying the samples at 105°C (AOAC 1990). Total fat content (g fat/100 g sample) was extracted by Soxhlet method (AOAC 1990). Protein content (g protein/100 g sample) was determined by Kjeldahl method (AOAC 1990). Ash content (g ash/100 g sample) was determined by incineration in a muffle furnace at 450°C (AOAC 1990). Brute fiber (g brute fiber/100 g sample) was determined by Weende method (AOAC, 1995).

Instrumental measure of texture: texture profile analysis (TPA) was performed with a TA-XT2i Texture Analyzer. Cores of beef bologna (1x1x1cm) were compressed twice to 70% of its height to determine hardness, springiness, cohesiveness, gumminess and chewiness.

Sensory evaluation: Samples of each formulation were evaluated for sensory quality using a non-structured scale in which the panelists evaluate different attributes: appearance, shiny, acidity, fatness, hardness, granularity, chewiness and juiciness. Panelists were members of Department. In each sessions, the panelist was situated in private booth and five samples were analyzed.

Statistical methods: Each parameter was test in triplicate. Results were statistically analyzed by ANOVA test, with one factor (fiber concentration) a five levels (control, 0,5% citrus fiber, 1% citrus fiber, 1,5% citrus fiber and 2% citrus fiber). Orthogonal contrasts were assessed by Tukey's test (Afifi & Azen, 1979) using Statgraphics Plus 2.0 (Statistical, Graphics Corp., Rockville, USA).

Results and discussion

Table 1 presents the mean values for moisture, fat, protein, ash and fiber content. No differences were observed ($P < 0.05$) for moisture and protein. Different observed ($P < 0.05$) in fat values for different percentages of citrus fiber should be attribute to great variability in raw meat material composition and were not due to addition of fiber. The ash content was significantly ($P < 0.05$) lower in control bologna than in the bologna sausages with citrus fiber, the ash values increased with the citrus fiber addition. Significant differences ($P < 0.05$) were found between all the bologna sausages for brute fiber.

The result of sensory evaluation (figure 1) indicate that the fiber addition decreased juiciness and shiny. The juiciness and shiny was significantly ($P < 0.05$) lower in beef bologna with 1,5 y 2% citrus fiber, it could be a consequence of the high holding water capacity of the fiber. The panelist appreciated an increase in the granulosity and acidity ($P < 0.05$) with incorporation of the fiber. The result showed that the sensory properties of bologna sausages with 2% citrus fiber were the worst, due to their granularity and acidity.

The addition of citrus fiber implied a modification of textural parameters (table 2), except for springiness. Significant differences ($P < 0.05$) were found for hardness, cohesiveness, chewiness and gumminess. The values hardness for control bologna was much higher than the same values in the bologna with added fiber. The best results were obtained with bologna containing 0,5% citrus fiber, which gave textural parameters similar to control.

Conclusion

The results of this study indicated at the addition of citrus fiber implied a modification of textural parameters. Hardness, cohesiveness, chewiness and gumminess decreased. These modifications of textural parameters were also appreciated by judges. The sensory analysis results showed that the fiber addition decreased juiciness and shine and increased granulosity and acidity. In general, the addition of fiber was satisfactorily accepted by the panelist.

Pertinent literature

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Table 1.- Mean values for meat composition in bologna sausages

	<i>Control</i>	<i>0.5% citrus fiber</i>	<i>1% citrus fiber</i>	<i>1.5% citrus fiber</i>	<i>2% citrus fiber</i>
% Moisture	59.32a	60.49a	60.99a	62.93a	63.45a
% Fat	23.22ab	22.87a	25.59bc	26.90c	26.95c
% Protein	15.28a	14.69a	15.67a	17.45a	16.02a
% Ash	2.92a	3.07b	3.31c	3.35c	3.43d
% Fiber	0.000a	0.0044b	0.023c	0.204d	0.216e

a-b Values in the same row bearing different letters are significantly different (P< 0.05)

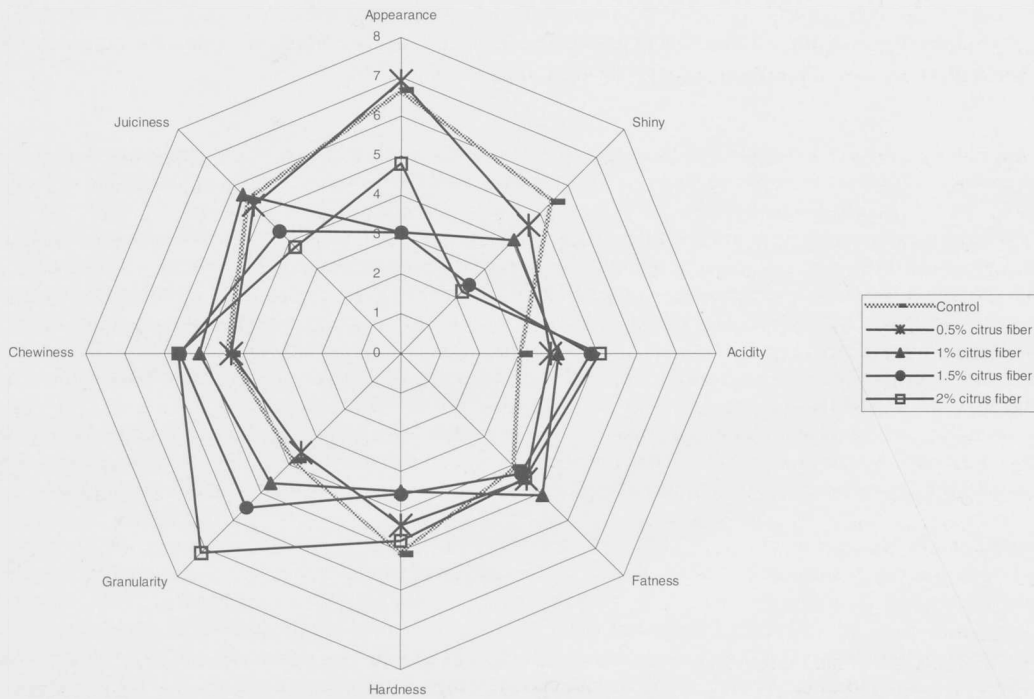


Figure 1.- Sensory evaluation: Results of quantitative descriptive analysis carried out in the control beef bologna and in the beef bologna with different percentages of citrus

Tabla 2.- Mean values for texture measures in bologna sausages: texture profile analysis

	<i>Control</i>	<i>0.5% citrus fiber</i>	<i>1% citrus fiber</i>	<i>1.5% citrus fiber</i>	<i>2% citrus fiber</i>
<i>Hardness (g)</i>	1474.01b	1377.95ab	1271.19a	1263.42a	1319.30ab
<i>Springness (mm)</i>	3.348a	3.358a	3.358a	3.359a	3.361a
<i>Cohesiveness</i>	0.580b	0.559b	0.530a	0.520a	0.565b
<i>Gumminess (g)</i>	844.02bc	892.95c	677.62a	662.32a	740.15ab
<i>Chewiness (g x mm)</i>	2827.09bc	2997.68c	2275.95a	2223.09a	2487.57ab

a-c Values in the same row bearing different letters are significantly different (P< 0.05)