



## Consumer sensory and hedonic perception of sheep meat coppa under blind and informed conditions

Juliana Cunha de Andrade<sup>a,\*</sup>, Elen Silveira Nalério<sup>b</sup>, Citeli Giongo<sup>b</sup>, Marcia Dutra de Barcellos<sup>c</sup>, Gastón Ares<sup>d</sup>, Rosires Deliza<sup>e</sup>

<sup>a</sup> Institute of Chemistry, Federal University of Rio de Janeiro, Avenida Athos da Silveira Ramos, 149 – bloco A, CEP 21.941-909, Cidade Universitária, Rio de Janeiro, RJ, Brazil

<sup>b</sup> Embrapa Pecuária Sul, P.O. Box 242, BR 153 km 633, CEP 96.401-970, Bagé, RS, Brazil

<sup>c</sup> Post-Graduation Programme in Management (UFRGS/PPGA), Federal University of Rio Grande do Sul, Rua Washington Luiz, 855, 3° andar, CEP, 90010-460 Porto Alegre, RS, Brazil

<sup>d</sup> Sensometrics & Consumer Science, Instituto Polo Tecnológico de Pando, Facultad de Química, Universidad de la República, By Pass de Rutas 8 y 101 s/n. Pando, Canelones, Uruguay

<sup>e</sup> Embrapa Agroindústria de Alimentos, Avenida das Américas, 29501, CEP 23.020-470, Rio de Janeiro, RJ, Brazil

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### ABSTRACT

The development of air-dried cured sheep meat products represents an interesting option to add value to the meat of adult animals. In this context, the aim of the present study was to evaluate consumer sensory and hedonic perception of sheep meat coppa, an innovative product. Four sheep meat coppa samples were formulated by varying smoking (smoked vs. non-smoked) and salt content (4.5% vs. 3.4%), and compared with two commercial samples of regular pork meat coppa. Samples were evaluated under blind or informed conditions by 202 consumers, who had to rate their liking and to answer a check-all-that-apply question. Sheep and pork meat coppa samples did not largely differ in their overall liking in both experimental conditions. Smoking and high salt content significantly increased consumers' hedonic perception of sheep meat coppa. The information included in the labels did not modify consumer hedonic perception but influenced their sensory description, particularly for the terms related to the type of meat used in their manufacture. Results indicate positive market opportunities for sheep meat coppa in the Brazilian market.

### 1. Introduction

Sheep meat quality is directly related to its sensory characteristics, such as tenderness, juiciness, taste, and odor (Paulos et al., 2015). The meat from older animals is generally considered a low-value product due to its stronger flavor and higher toughness compared to those of younger animals (Field, Willians, & Miller, 1983). For this reason, consumers tend to show a strong preference for the meat of young animals and, consequently, carcasses from adult or discarded animals are usually not acceptable for direct consumption, which makes their commercialization difficult (Dutra et al., 2013).

In many countries, fresh meat from cull ewes has low value. Nevertheless, several authors have proposed that meat from adult sheep is more suitable to be processed by curing with salts, smoking and drying, or even for the manufacture of fresh sausages after grinding, mixing with salt, spices and other ingredients, and casing (Matos, Menezes, Ramos, Ramos, & Gomide, 2007; Paulos et al., 2015).

Therefore, production of these processed meat products can be a viable strategy to add value to the meat of adult sheep given that such products are usually commercialized at relatively high prices (Sañudo et al., 2016). In this sense, recent studies have demonstrated the feasibility of using sheep meat in the manufacture of processed meat products, such as *Sucuk* (Turkish dry-fermented sausage), cooked ham-type pâté, fresh sausage, *Stelja* sheep ham, and *Cecina* (dry-cured sheep meat) (Dutra et al., 2013; Paulos et al., 2015; Sañudo et al., 2016; Stajić, Perunović, Stanišić, Žujović, & Živković, 2013; Stojković et al., 2015; Yalınkılıç, Kaban, & Kaya, 2012).

The present study focuses on one specific processed meat product, coppa. This product is traditionally manufactured with pork meat (cured neck) and involves two main processes: salting and drying (Toldrá, 2004). Studies investigating the acceptance of sheep coppa have not been found in the literature, therefore representing both a research and market opportunity.

In the Brazilian market, 70% of pork consumption is based on

\* Corresponding author.

E-mail addresses: [jucunhadeandrade@gmail.com](mailto:jucunhadeandrade@gmail.com) (J.C. de Andrade), [rosires.deliza@embrapa.br](mailto:rosires.deliza@embrapa.br) (R. Deliza).

processed products (salami, ham, sausages, mortadella, etc.) rather than on fresh products. In 2016, total *per capita* pork consumption was 14.4 kg/inhabitant, representing 10 kg of processed products. Coppa is considered a niche product, targeted to the high-end market (Guimarães et al., 2017). According to data from Nielsen (2008), cited in Kuo Hue (2011), coppa represented only 0.4% of the total processed pork products evaluated at the time.

Increased concern about the relationship between processed meat products and non-communicable diseases has increased demand for healthful products and has motivated the industry to engage in reformulation strategies (Kraus, 2015; Yang et al., 2015). Some of the most relevant trends regarding product reformulation are salt reduction, replacement of artificial additives by natural alternatives, and the addition of ingredients with potential positive effects on health (Jiang & Xiong, 2016; Perry & Grace, 2015; Strijbos et al., 2016; Valenzuela & Pérez, 2016).

Salt is an essential ingredient in this type of product as it improves texture, decreases water activity for controlling the growth of pathogens microorganism and controls biochemical and enzymatic reactions during maturation, affecting the final flavor (Inguglia, Zhang, Tiwari, Kerry, & Burgess, 2017). Cured air-dried meat products usually contain high salt content: approximately 4.5% or higher (Feiner, 2006). However, high sodium intake has been linked to increased risk of high blood pressure and cardiovascular disease (Aburto et al., 2013). Considering that consumers are not always willing to compromise the taste of products for potential health benefits, it is necessary to study how consumers perceive salt-reduced products in order to develop feasible strategies for salt reduction (Zandstra, Lion, & Newson, 2015).

Smoking is a frequent process in the manufacture of cured air-dried meat products (Toldrá, 2004). It contributes to the flavor, texture and increases the shelf life of the products (Sikorski & Sinkiewicz, 2015). However, smoking has raised concerns about its potential negative effects on health, due to contamination by polycyclic aromatic hydrocarbons, which have carcinogenic, mutagenic and bioaccumulative capacities (Ledesma, Rendueles, & Díaz, 2016).

Market success of sheep meat processed products strongly depends on consumer acceptance. For this reason, a comprehensive understanding of consumer sensory and hedonic perception of products is necessary (Hersleth, Monteleone, Segtnan, & Næs, 2015). In the case of dry-cured ham, taste is a key attribute influencing consumer overall liking (Hersleth, Lengard, Verbeke, Guerrero, & Næs, 2011; Issanchou, 1996; Resano et al., 2011). In addition, color, flavor and adequate saltiness are considered important quality signals by consumers (Hersleth et al., 2011; Morales, Guerrero, Claret, Guàrdia, & Gou, 2008; Resano, Sanjuán, & Albisu, 2007).

Sensory attributes are one of the main characteristics underlying consumers' overall liking of products (Tuorila, 2007). However, consumer perception does not only depend on sensory characteristics (Köster, 2003). Extrinsic attributes, such as package, brand and price play a key role in consumer perception and food choice (Jaeger, 2006). In particular, the information given by the package is an extrinsic factor and a quality cue that influences consumer behavior and could be an opportunity to motivate consumers to purchase a product (Grunert, 2002). However, when communicating food products in the market, it is desirable that consumers perceive consistency between extrinsic product attributes (i.e., information about price, and processing conditions), and intrinsic attributes (i.e., sensory quality during the subsequent eating experience).

The information included in a package can create expectations about the sensory attributes of products or about the level of pleasure generated during consumption (Deliza & MacFie, 1996). After tasting the food, initial expectations of sensory and hedonic characteristics can be confirmed or disconfirmed. Confirmation can lead to high acceptance and repeated consumption and can also confirm the perception of food quality (Deliza, MacFie, & Hedderley, 1999). For this reason, it is important to evaluate consumer perception of products under informed

conditions (Asioli et al., 2017).

The influence of information on consumer perception is particularly relevant in the case of innovative products, as they do not have previous consumption experiences. Their expectations are mainly based on information and experiences with similar products. Hence, of special interest is the understanding of the acceptance of innovative meat processing technologies and products, since they can satisfy modern consumer demands for convenience, health, eating quality and food safety, ultimately adding value to meat products (De Barcellos et al., 2010).

In this context, the objective of the present work was to evaluate consumer sensory and hedonic perception of sheep meat coppa, an innovative dry-cured sheep meat product in the Brazilian market under blind and informed conditions.

## 2. Materials and methods

### 2.1. Manufacture of sheep meat coppa

Sheep meat coppa was produced at laboratory scale using meat cuts from certified Corriedale breed carcasses of approximately 2 years old, raised in grass-fed production system. The meat cuts were randomly taken from a commercial slaughterhouse in a normal day work from chilled carcasses after the neck cut was excised. They were deboned and only muscles from the neck with pH  $\leq$  5.9 and temperature  $<$  6 °C were selected for processing at the Meat Science & Technology Laboratory (Embrapa Pecuária Sul, Brazil). Then, the cuts were vacuum packaged, frozen and stored at  $-20$  °C prior to processing. Coppa was produced using the entire deboned neck muscles seasoned with the following powdered spices: black pepper, garlic, clove and nutmeg (5.65 g/kg, total amount of the spices mixture) and matured in natural casings. The manufacturing process was divided into three steps: salting, equalization of the curing additives rubbed in the surface of the meat cut and drying. For some of the samples, smoking was added. In that case, cold smoking process was conducted in a traditional smoke house with controlled parameters (30–40 °C, RH 75–80%) during 6 h. The drying phase continued in a controlled chamber without smoke (12–15 °C, RH 72–75%) until 30% of weight was lost. The production process lasted for 28 days. For each treatment, seven pieces of coppa (approximately 300 g) were produced. Once drying was completed, the casings were removed and the coppa samples were vacuum packaged and stored under refrigeration until started of the sensory analysis.

Two processing variables were considered in the formulation of the sheep meat coppa samples, smoking and salt, each of which were varied in two levels, as shown in Table 1. The salt content varied in two levels: 4.5% NaCl and 25% salt reduction, 3.4% NaCl. The highest salt content added in the process, corresponded to the sodium content of commercial products available in the Brazilian marketplace.

### 2.2. Consumer study

#### 2.2.1. Participants

A total of 202 middle/high income Brazilians took part in the study. They were recruited at two supermarkets in two Brazilian cities (Rio de Janeiro and Porto Alegre). To be eligible for participation, consumers had to be regular or occasional consumers of cold meat products (at least once a month) and be interested and available to participate in the study. At recruitment stage, no information about the specific aim of the study was provided. The socio-demographic characteristics of the participants are shown in Table 2.

The study was approved by the Ethics Committee of the University Hospital Clementino Fraga Filho at Federal University of Rio de Janeiro, Brazil. Participants completed an informed consent form at the beginning of the study.

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