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# Consumer acceptance and sensory profiling of reengineered kitoza products

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ABSTRACT

Kitoza refers to a traditional way of preparing beef and pork in Madagascar. However, in order to improve some drawbacks previous identified, the product was submitted to a reengineering process. The acceptance and sensory profiling of improved Kitoza products among Portuguese consumers was investigated. A local smoked loin sausage was selected as basis for comparison. Firstly, a Focus Group study was performed to identify sensory descriptors for Kitoza products and explore product perception. Subsequently, a Flash Profile and a consumer sensory acceptance study were conducted. Flash Profile's results showed that beef- and pork-based Kitoza products investigated differed considerably in all sensory dimensions. The Portuguese sausage was characterized as having a more intense and lasting after taste, as well as displaying a higher degree of (meat) doneness. The acceptance study yielded higher overall liking ratings for pork- than for beef-based Kitoza, although the Portuguese sausage remained the most appreciated product.



## 1. Introduction

Kitoza is a traditional product of Madagascar made from lean beef or pork meat. It was consumed for a long time ago by royalty and the wealthy and has been popularized in this country over time. It is nowadays highly appreciated by Malagasy people of different social classes and also by foreigners, being mainly eaten with rice in soups at either breakfast or dinner times.

Kitoza is mainly prepared from meat from the hump of Malagasy zebus or Zebus, although pork meat can be also used. It is locally sold in many different forms: raw in butcheries, cooked in street eateries, dried and smoked in supermarkets.

Kitoza is traditionally prepared by trimming and slicing the meat into approximately 2–4 cm thick and 20–50 cm long strips, which are then uniformly salted. Depending on the preference, spices such as garlic, pepper and ginger may also be added to enhance the taste and tenderize the meat. The strips are then threaded onto a cord and hung over fire (a fireplace or barbecue), in order to smoke for at least 24 h. In butcheries, Kitoza is hung on a cord and then air dried at room temperature.

Meat preservation processes are based on slowing down or inhibiting different microbiological, enzymatic and chemical alteration processes (Sciences et Societé, UNESCO, 1986; Touzi & Merzaia-Blama, 2008). Most meat-based products are obtained through a combination of meat preservation processes such as drying, salting, smoking, frying or fermentation which are inexpensive process and widely used in these countries (Kalilou, 1997; Yacouba, 2010).

Applying meat preservation conditions in these countries is a very difficult task, due to a lack of adequate cold storage infrastructure, and especially, owing to climate and environmental conditions that precipitate the rapid degradation of this product. In Madagascar, due to the highly perishable nature of meat, this type

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of foodstuff is often dried and/or smoked because the preservation process is easy and economically viable.

There are two main advantages related to processing meat through drying:

(1) To reduce the water activity in the processed product, thereby inhibiting the development of microorganisms and the rate of enzymatic reactions;
(2) To reduce the weight and volume of the final product, thus facilitating its preservation during transport and storage (Yacouba, 2010).

Although being widely consumed in several African countries, traditional Kitoza production does not meet EU food safety requirements and cannot be exported to Europe. However, Kitoza has a high organoleptic potential and its production could be improved to meet international standards.

In the framework of an FP7 project – AFTER "African Food Tradition rEvisited by Research", a reengineering process based on the reorganization of traditional one was conducted to develop Kitoza products adapted to the European market with regard to their safety as well as consumer acceptability. To this end, two studies were done. A consumer study was held to investigate acceptance and drivers of preference and choice among Portuguese consumers, in which overall liking, intensity of sensory attributes in relation to participants' ideal level, price and placement were evaluated (Gaze et al., 2015). A complementary study on sensory characterization of the products by means of a sensory descriptive study was performed with experienced panellists using the Flash Profile method (FP). FP is part of the faster and more flexible novel methodologies for sensory characterization that have been developed in the last years, to overcame some of the constraints of time and resources of conventional descriptive analyses (Cruz et al., 2013; Kim, Jombart, Valentin, & Kim, 2013; Valentin, Chollet, Lelièvre, & Abdi, 2012; Varela & Ares, 2012). Not requiring specific training of panellists, FP was suggested by Dairou and Sieffermann (2002), for sensory description of food products according to their most salient sensory attributes. Since then it has been applied to describe many different foods including fruit products and beverages, having been proved to be as satisfactory as conventional profiling in many applications, using either trained or semi-trained panellist or consumer panels (Delarue, 2014; Delarue & Sieffermann, 2004; Moussaoui & Varela, 2010; Valentin et al., 2012; Varela & Ares, 2012). In view of this, the main objective of this study was to investigate the acceptance and sensory profiling of improved Kitoza products among Portuguese consumers.

## 2. Materials and methods

### 2.1. Samples

The Kitoza samples (beef and pork) for sensory and consumer tests were prepared using French meat (due to restrictions to import meat from Madagascar).

These samples were obtained through a reengineering process of the Kitoza products by *Institut technique Agro-Industriel des filières viandes* (ADIV) platform (CE approved) in France under support of traditional knowledge of Madagascar; according to an improved protocol developed in the framework of an international collaborative FP7 project funded by European Union "African Food Tradition rEvisited by Research" (AFTER).

The optimization approach resulted in the final protocol (Fig. 1). At the food processing facilities in CIRAD, Montpellier, France, the meat was cut in strips (2 cm × 30 cm). Then pork meat was seasoned with NaCl (18 g/kg), $NaNO_2$ (0.11 g/kg), $KNO_3$ (0.15 g/kg), garlic (4 g/kg), four spices mix (pepper, cloves, nutmeg, cinnamon,

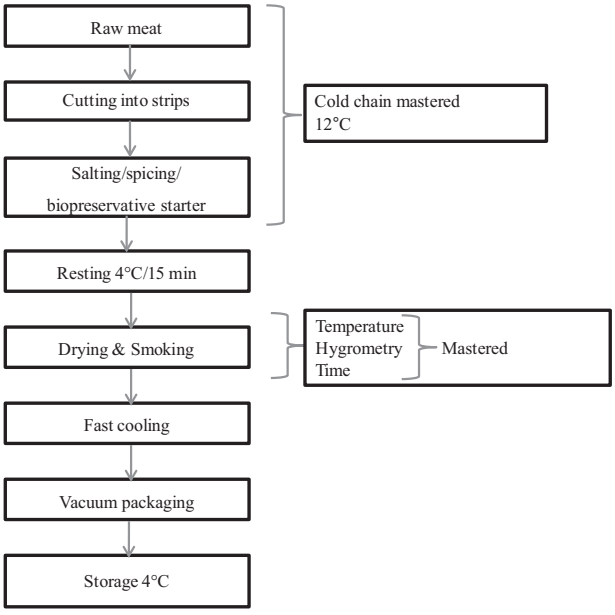


**Fig. 1.** The diagram of reengineered process of Kitoza in Europe.

2 g/kg) and inoculated with the bioprotective cultures (B-LC-77, CHR HANSEN) composed of a mixture of *Pediococcus acidilactici* and *Staphylococcus carnosus*. It is specially developed for application in meat products to secure the formation of curing flavour and stable colour and to inhibit *Listeria monocytogenes*. Our preliminary data showed the interest of the application of these bioprotective cultures on these kinds of products (data not shown). The product was then smoked and dried at 60 °C, 0% of hygrometry during 95 min. Beef meat was seasoned with NaCl (18 g/kg), ginger powder (5 g/kg), sunflower oil (41 g/kg) and inoculated with the bioprotective cultures (B-LC-77). The product was then smoked and dried at 60 °C, 0% of hygrometry during 65 min.

The Kitoza meat samples were vacuum packaged and shipped to Portugal under refrigerated (4 °C) conditions for the Portuguese sensory and consumer's tests. In parallel microbial analyses were carried out.

Since Kitoza is an unknown product for Portuguese consumers, a local smoked loin sausage was selected as basis for comparison. This loin smoked sausage is a commercial product sold by Primor (Portugal). The product is made from pork and is marketed in vacuum packages (350 g) in refrigerated conditions (0 °C–5 °C) and a shelf life of 90 days.

The Kitoza meat samples processed and smoked loin sausage are represented in Fig. 2: (1) Kitoza beef (KB), (2) Kitoza pork (KP) and (3) Traditional Portuguese smoked loin sausage (PS). The three different samples were used for Portuguese sensory and consumer's tests. Samples were served to the panellists at room temperature in the form of thin slices of approximately 0.5–1 cm thickness, without further preparation. Good hygiene practice was followed.

### 2.2. Microbial analyses

Kitoza manufactured samples (beef and pork) were evaluated in terms of food safety and hygiene of the process. Microbiological samples were taken and analysed on selective media according to the Standard methods of microbiological food analysis and the ISO (International Organization for Standardization) Standard (Table 1). The total counts were numerated on Plate Count Agar at 30 °C for 72 h; yeasts and moulds on Yeast Glucose Chloram-