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KHLIAA EZIR, A TRADITIONAL CURED MEAT PRODUCT OF ALGERIA: PREPARATION AND CHARACTERIZATION

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Abstract – *Khliaa Ezir*, is a traditional cooked cured meat product of Algeria prepared using fresh boneless meat. The aim of this study is to describe its typical traditional diagram process and its overall composition and sensory profile. The results showed that *Khliaa Ezir* product presented intermediate moisture content 40.7% (±0.5) with an average pH value of 6.04 (±0.12) in the final product. Fat and protein contents values were 10.8% (±0.32) and 43.75% (±0.53) respectively, while the ash content was around 3.46% (±0.36). The microbiological results showed that the bacterial counts were relatively low, indicating a good hygienic quality. Regarding sensorial characteristics, *Khliaa Ezir* showed high values for global tenderness (5.98 ± 0.12), garlic odour (4.21±0.3) and intensity of flavour (6.14 ±0.22) and low scores for juiciness (2.92±0.45) and acidic flavour 2.99. The hedonic test revealed a high score for overall liking (6.16 ±0.25).

Key Words – Khliaa Ezir; traditional meat product; Algeria; Characterization; Sensory profile.

I. INTRODUCTION

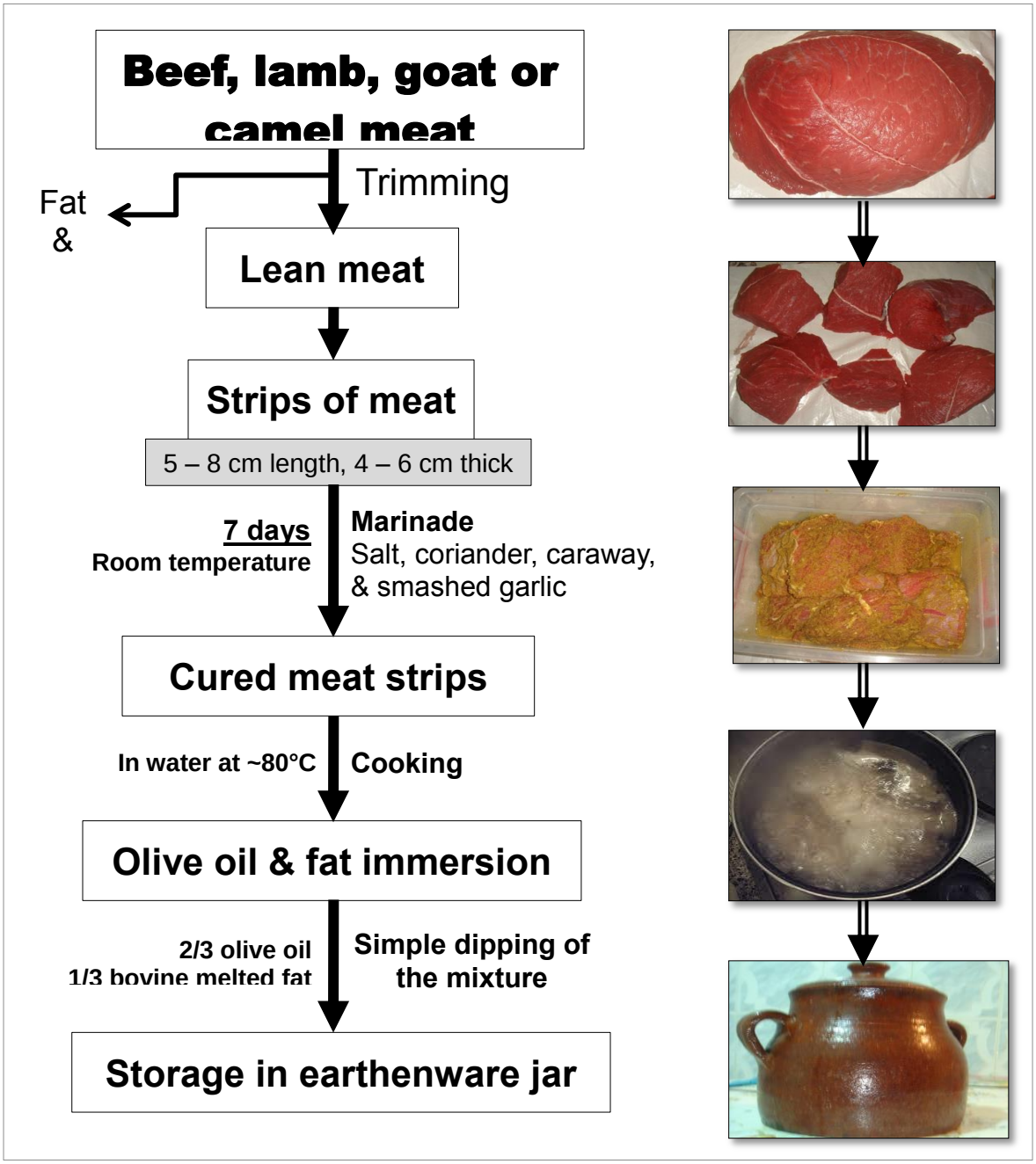
Traditional meat products have always accompanied people living in different areas of the world. They constitute a heritage transferred from generation to another through centuries. These typical products constitute an integral part of the gastronomic culture, tradition and local economy of countries. The cultural diversity of the regions, the different traditional methods of preservation and specific recipes, all contributed to the diversity of the available meat products over the world [1, 2]. Several traditional meat products exist in the Mediterranean countries since highest antiquity [3]. Many of them are prepared only in restricted geographical areas and consumed locally by families in religious feasts. In Algeria, numerous traditional meat products can be found and the most known is *El Gueddid* or *Kaddid*, prepared by salting and sun drying. Among the less known we found *Khliaa Ezir*, *Laknaf* and *Frigat*. *Khliaa Ezir* seems to be the only ripened traditional cured meat produced and consumed in the North East of Algeria [4]. Depending on the livestock facilities in each region, beef, lamb, goat or camel meat can be used for *Khliaa Ezir* preparation. The particularity of its traditional process is the ripening step in earthenware jar (*Ezir*) able to be preserved for more than 1 year. This highly appreciated product, believes now poorly studied and little scientific information is available. For overall characterization of *Khliaa Ezir*, our investigations targeted the North-East of Algeria to surround all the available information in its geographical delimitation. The present paper aims to give a global characterization of the product concerning its preparation diagram, chemical and microbiological composition and sensory profile.

II. MATERIALS AND METHODS

A field survey was conducted in different local households still preparing the product in the North-East of Algeria. *Khliaa Ezir* is made from fresh boneless meat. The beef meat cuts (5 – 8 cm of length, 4 – 6 cm thick) were mixed with salt, caraway, coriander and garlic, and then marinated for 7 days before cooking at 80°C on water. After that, the cooked meat was immersed in a mixture of melted bovine fat and olive oil and preserved in an earthenware jar (Ezir). Three samples of *Semimembranosus* muscle (≥ 2 kg) of beef obtained from a local butcher and aged for approximately 4 days were used to prepare three manufacturing experiments of *Khiaa Ezir* following to the traditional diagram described in Fig. 1. Global composition in triplicate: moisture, proteins (N-total) and ash were determined [5]. Total fat content was determined using the *Soxhlet* method [6]. pH was recorded with a pH meter (Hanna Instruments,) after mixing 1 g of sample in 10 ml of distilled water [7]. For microbiological analyses, aseptically collected samples were used to: (a) total viable count on Plate

Count Agar (PCA); (b) *Enterobacteriaceae* by plating in violet red bile glucose agar at 30°C for 24 h; (c) fecal *Enterococci* on Violet Red Agar (VRBA) at 42°C for 24 h; (d) yeasts and moulds on Malt Extract Agar at 25°C for 48 – 72 h; (e) sulphite reducing *clostridia* on SPS Agar incubated anaerobically at 37°C for 72 h; (f) Lipolytic bacteria were enumerated on Blue Victoria medium at 30°C for 72 h and (g) *Salmonella*.

For sensory evaluation a trained ten-member panel consisting of researchers and PhD students was used to evaluate the three products. *Khliaa Ezir* samples were taken directly from *Ezir*, cut into 3 slices of 3 cm thick, and served to the judges in white plates in a randomized order. A cup containing water (90%) and apple juice (10%) was used to cleanse the palate between tastes [8]. All the sessions were conducted mid-morning. A list of 14 descriptors: global tenderness, juiciness, residue, global flavour, overall liking, salty flavour, fatty, rancid odour, acid flavour, garlic flavour, hot pepper intensity, spices intensity, after-taste intensity and after-taste persistence, with definitions was used by the panel. Each attribute was rated on a 0 (absence of perception) to 10 (very intense perception) unstructured scale [9]. Mean values and standard deviations were calculated from the data obtained from the 3 products using Microsoft Excel Software.



III. RESULTS AND DISCUSSION

The means of the overall physicochemical parameters obtained for the three products of *Khliaa Ezir* are given in Table 1. The pH values are in agreement to those found in similar traditional meat products likely, *Ghorizo of Cebolla* [10], and slightly higher than those observed for the Spanish *Salpicão* [11] and *Turkish Pastirma* [12].

Micro-organisms (log10cfu/g)	Days			
	1	10	30	60
Total aerobie flora	2.69 ± 0.25	2.38 ± 0.5	< 1.00	< 1.00
Total enterobacteria	1.69 ± 0.46	< 1.00	< 1.00	< 1.00
Fecal enterococci	1.30 ± 0.12	< 1.00	< 1.00	< 1.00
Yeast and moulds	Abs	Abs	< 1.00	< 1.00
Sulfite reducing clostridia	Abs	Abs	Abs	Abs
Salmonella	Abs	Abs	Abs	Abs
Lipolytic flora	Abs	Abs	< 1.00	1.84 ± 0.21

The pH obtained in the final product is consistent with pH data on cooked meat [7,10]. According to Durand [13], the pH from 6.0 to 6.2 creates a favourable environment for the subsequent growth of lactic acid bacteria without allowing the growth of pathogenic or proteolytic meat germs. The average values of moisture 40.70 % (± 0.5) are substantially lower than *Salpicão* [11]. It is lower to those found in *Pastirma* and *Ghorizo of Cebolla* which are respectively, 66.64% ± 0.65 and 56.44% ± 2.62 [12, 10]. Throughout the manufacturing process of *Kliaa Ezir*, a water exudation was observed over marinating time.

Figure 1. Flow diagram of traditional *Khliaa Ezir* preparation diagram [4].

Indeed, the cooking of the meat until complete evaporation of water causes a reduction of water content on the final product. The final value of the protein content was around 43.75% (± 0.53), while the final fat content was 10.8% (± 0.32). The ash content reached values of 3.46% (± 0.36). The slightly higher ash content, compared to the raw meat used in the preparation can be resulted from salt and other additives [14].

Table 1. Means and standard deviations (S.D.) of physicochemical parameters of *Khliaa Ezir* (n = 3).

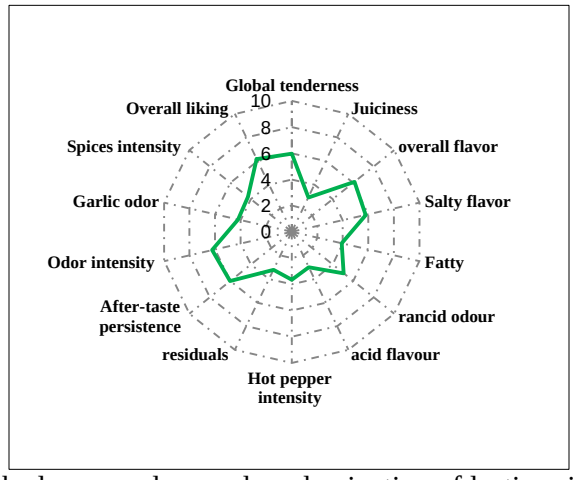
Parameters	Mean	S.D.
pH	6.04	0.12
Moisture (%)	40.70	0.50
Ash (%)	3.46	0.36
Protein (%)	43.75	0.53
Fat (%)	10.80	0.32

The global microbiological results of *Khliaa Ezir* conserved during 60 days of ripening are summarised in Table 2. Mesophilic aerobic counts decreased considerably during ripening. The behaviour of these strains was caused by the anaerobic conditions of the environment inside earthenware jar. This phenomenon is reported by the findings of [15] during the conservation of *Bologna* sausages.

Table 2. Counts and evolution during ripening of micro-organisms concerned with the hygiene of *Khliaa Ezir*.

The *Enterobacteria* population was lower than 2 $\log_{10}$ cfu/g at 1 day of conservation before their disappearance at 60 days of ripening in comparison to their initial population. This can be a consequence of spicing. Spices such as *Carum carvi*, *Allium sativum* and *Coriandrum sativum* were reported to play significant roles in germs growth [16]. Fecal enterococci were eliminated progressively to reach a value of < 1.00 $\log_{10}$ cfu/g. This can be explained by the decrease of pH during ripening period [17].

This observation indicates that *Khliaa Ezir* can contain endogenous lactic acid bacteria which increase throughout the ripening [18]. The number of yeasts and moulds were found to decrease during the conservation period. According to [19], yeasts appeared to be the main causative agent of spoilage. The disappearance of spoilage organisms is favoured



by the low a_w values and predominating of lactic acid bacteria in ripening processes that exerts an

antagonistic action on contaminating flora [20,18]. Finally, sulphite reducing *Clostridia* and *Salmonella* were not detected during the whole ripening process and conservation of *Kliaa Ezir*. This is in agreement with earlier studies in other varieties of traditional cured meat products [20, 11].

Sensory analysis performed on *Khliaa Ezir* at the final step of preparation revealed no significant differences when triangle analysis was (data not shown). The results of the descriptive sensory profile are shown in Fig. 2. Among the 14 descriptors considered only overall liking, evaluated by hedonic test was found to be significantly different ($p < 0.05$) when samples are compared.

However, no significant differences among batches were revealed when analysing any of the specific attributes. Within textural properties (tenderness and juiciness), *Khliaa Ezir* showed high scores for global tenderness 5.98 (±0.12), while juiciness scored low (2.92 ± 0.45). Juiciness is mainly determined by the amount of moisture retained in the product after processing [7]. The decrease in juiciness could be due to water loss throughout processing (marinating and/or cooking). Regarding odour, garlic odour is the dominant spice 4.21 (±0.3). This is in accordance to [21] who confirmed that the spices were the principal driver characteristic among numerous cured meat products. For examples, *Chorizo* is characterized by *pimentón* (Spanish paprika, *Capsicum annum*) and *Salchichón* is distinguished by the presence of black pepper. On the other hand, *Khliaa Ezir* showed high values for intensity of flavour 6.14 (±0.22) and saltiness 5.78 (±0.09), but lower scores for acid flavour 2.99 (±0.75) and fatty 3.9 (± 0.81). In meat products, taste is driven by the presence of low-molecular weight compounds, such as peptides and amines, sodium chloride, inorganic ions, nucleotides, sulphide and nitrogen compounds [21]. However, textural characteristics, which are mostly associated to the proteolysis phenomena and water binding capacity of proteins, influence the chewing of cured meat, assigning, as a consequence, flavour release and development [22]. Thanks to the results obtained from the hedonic test, it seems that the *Khliaa Ezir* was judged very good by all assessors with high scores for overall liking 6.16 (±0.25).

Figure 2. Sensory profile of *Khliaa Ezir*

IV. CONCLUSION

Khliaa Ezir is a very unique, traditional cured meat that is marinated, cooked and ripened in earthenware jar. Regarding the results of the present study, *Khliaa Ezir* is characterized by a considerable bacterial diversity. However, the bacteria interactions that occur during the process are not well understood and must be studied and confirmed with other controlled manufacturing. Also, the textural properties, lipolysis and proteolysis phenomena and formation of volatile compound during the process must be accurately elucidated in further studies.

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