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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 sensory 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 Khliaa 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].
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 Khliaa 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).

<table>
<thead>
<tr>
<th>Micro-organisms (log10cfu/g)</th>
<th>Days</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Total aerobie flora</td>
<td>2.69 ± 0.25</td>
<td>2.38 ± 0.5</td>
<td>&lt; 1.00</td>
</tr>
<tr>
<td>Total enterobacteria</td>
<td>1.69 ± 0.46</td>
<td>&lt; 1.00</td>
<td>&lt; 1.00</td>
</tr>
<tr>
<td>Fecal enterococci</td>
<td>1.30 ± 0.12</td>
<td>&lt; 1.00</td>
<td>&lt; 1.00</td>
</tr>
<tr>
<td>Yeast and moulds</td>
<td>Abs</td>
<td>Abs</td>
<td>&lt; 1.00</td>
</tr>
<tr>
<td>Sulfite reducing clostridia</td>
<td>Abs</td>
<td>Abs</td>
<td>Abs</td>
</tr>
<tr>
<td>Lipolytic flora</td>
<td>Abs</td>
<td>Abs</td>
<td>&lt; 1.00</td>
</tr>
</tbody>
</table>

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 Bolognais sausages. 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 Khliaa Ezir, a water exudation was observed over marinating time.

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

The Enterobacteria population was lower than 2 log10 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 log10 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 aw 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 Khliaa 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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