Fresh Cheese “Peulh Type”: Characterization and Sensory Aspects

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Abstract

The calotropine, a vegetable coagulating enzyme, extracted from Calotropis procera is very used in the preparation of traditional Peulh cheese. In this study, the fresh leaves of this vegetable were used to coagulate raw milk for the production of the fresh cheese Peulh type which was characterized by the physicochemical and sensory aspects. The results showed that this traditional cheese presented a total dry extract of 32.49%, pH 6.28, a lactic acidity of 0.14 p.cent, a protein content of 28.30% and a sweet whey with pH 5.90. The Peulh cheese making yield is 55.45% expressed on dry basis. The sensory aspects showed that it has a firm texture, elastic, not sticky, with a lactic odour and a lactic flavour and has an overall persistence in the mouth of about 15 seconds.

Keywords: Calotropine; Cow milk, Composition, Sensorial profile

Introduction

Several enzymes plant preparations are known for cheesemaking as cardosine from Cynara cardunculus, ficine from Ficus carica, papain from Carica papaya, bromelain from Ananas comus, and the calotropine from Calotropis procera [1-4]. The calotropine, a vegetable coagulating enzyme, is extracted from Calotropis procera of Asclepiadaceae family which is very widespread in the tropical and subtropical areas of Africa (Somalia, Egypt, Libya, the Algerian South, Morocco, Mauritania, Benin, Chad, Niger, Mali, Senegal, Togo) in Asia (India, Pakistan, Afghanistan, Iran, Saudi Arabia), in the center and in the South of America [5]. It is a well-known medicinal plant with leaves, roots and bark being exported as popular medicine to many human and animal diseases [6]. In the folk medicine of Algeria, Calotropis procera is used to treat respiratory diseases rheumatism and asthma [7,8]. Generally, in south African and Asian countries, latex of the plant is used as an antidysenteric, an expectorant, an anti-inflammatory, and also for milk coagulation in cheese making [9,10].

Thus, the calotropine is a protease cysteine coagulant agent [11]. It is very known by its use in the preparation of traditional "Peulh" cheese also called “waragashi” or “wagashi” in most countries of West Africa, mainly in Benin. Calotropis procera is also met in the south of Algeria precisely in Béchar, where our plant study was brought from. This testifies on the Algerian plants biodiversity still ignored as coagulant agent’s sources. Therefore, these milk coagulating agents could contribute to the development of satisfactory quality protein dairy products which would replace proteins meat products relatively expensive. This cheese would have a moderate coast, since its preparation coast would depend mainly of the milk coast.

The work objectives are 1) extraction of the calotropine from the south of Algeria and its use in the fresh “Peulh type” cheese making 2) characterization of the fresh cheese “Peulh type”cheese on the chemical and sensory aspects. We remind that this study has not been approached yet by Algerian authors and we are interested in characterizing the cheese to show closely that it is possible to exploit this plant in Algeria to manufacture the traditional cheese “Peulh” while its origins are derived mainly from Benin.

Materials and Methods

Samples

Five liters of Fresh cow milk samples were purchased on days of experiment into sterilized containers from a private dairy "SAFILAÏT" situated at Ain Smara, of Constantine city and transported immediately to the laboratory under cold storage.

Coagulant enzyme

The plant used is composed of leaves and stems of Calotropis procera proceeded from Béchar southern Algeria city, located 1500 km from Constantine (Figure 1). This plant is forwarded to the laboratory, 72 hours after collection.

Physicochemical composition

Chemical raw milk determinations were performed as described by AFNOR methods [12]: dry extract (NF V 04-207), lactic acidity, (NF V04-207), pH and density. The total proteins were quantified by Lowry’s method [13], against a standard curve.

\[
\text{DO}_{750nm} = f(\text{BSA}); \quad \{Y = 0.022 X; R^2 = 0.9739\}
\]

Typical diagram of « Peulh-type » cheese making

Cheese production was carried out generally, following methods described by O’Connor et al. [14,15]. Five liters of raw cow’s milk were filtered on gauze to eliminate rough fragments and then heated at 60°C for five minutes. Calotropis procera leaves (20 g/liter of milk) were triturated in a milk volume, then filtered trough gauze (Figure 2). The filtrate is added to whole milk (5 L) with increase of the heating temperature at 70°C for 10 minutes where the coagulation occurred and after followed by cooking the curd at 95°C for 4 minutes.
Figure 1: Localisation of the Calotropis procera origin. A- Geographic Algeria cart, B- Caloropis procera plant. Béchar (in red dotted line) is an Algerian Saharian city from where Calotropis procera was brought for study.

Figure 2: Peulh cheese making steps.

Evaluation’s method of cheese depth penetration

The vertical depth penetration of 25 g of cheese presented as a parallelepiped shape (4 cm×2 cm×1.5 cm) measured for 5 seconds by a specific semi-hard cheese plexiglass cone (inclination 30°C, weight 15 g, height 48 mm) using the penetrometer PNR 10, Petrotest, Symeonstr.2a.D-1000, Berlin.

Sensory analysis

Sensory evaluation was carried out to describe with a scoring test, the characteristics of the obtained cheese through tasting and visual observations according to Fallico et al. [17] and Bérodier et al. [18]. A panel of thirty-three persons evaluated cheese texture, odour, aroma, flavour and taste persistence in mouth. 10 g of cheese covered and warmed at room temperature for one hour and then presented to examiners. All sensory characteristics were valued from 1 to 9 points on a point scale.

All analysis were repeated at least 3 times.

Results and Discussion

Milk and fresh Peulh-type cheese composition

The cow’s raw milk used for the cheese making presents the following chemical characteristics cited in Table 1.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.70 ± 0.10</td>
</tr>
<tr>
<td>Lactic acidity (g/L)</td>
<td>1.61 ± 0.13</td>
</tr>
<tr>
<td>Total dry matter (g/100 g)</td>
<td>12.10 ± 0.25</td>
</tr>
<tr>
<td>Proteins (mg/mL)</td>
<td>32.10 ± 0.51</td>
</tr>
<tr>
<td>Density (at 15°C)</td>
<td>1.0273 ± 0.001</td>
</tr>
</tbody>
</table>

Table 1: Cow’s raw milk chemical characteristics.

The physicochemical characteristics of the raw milk used in cheese making are well inserted within the ranges given by different authors as reported by Veisseyre et al. [19-22], where the pH is from 6.6 to 6.8, lactic acid (g L⁻¹), from 1.35 to 1.62, the total solids content from 11.5 to 13% and protein (mg mL⁻¹) from 30 to 35.

According to Dossou et al. [23], raw milks used in the fresh cheese Peulh-type cheese making from three different Benin bovine races (Borgou, Laguinaire and Girolando) presented chemical characteristics as density (g cm⁻³) of 1.03, a water content of 81% to 88%, a pH from 6.5 to 6.6, an acidity (% lactic acid) from 0.17 to 0.25% and proteins (dry basis) from 25.6 to 31.5.

Differences in the cattle breed, the type of diet and probably the climatic factors have created variations between values authors and those obtained. Nevertheless, the fresh milk used in cheese production meets the quality criteria relating to fresh milk, not acid, a dry extract and protein content suitable for obtaining a satisfactory cheese yield.

Fresh cheese Peulh-type chemical analyses have provided the following results presented in Table 2. The results obtained of fresh cheese Peulh-type under experimental, meet the criteria of chemical

Cheese yield expression

To avoid water content errors, the cheese yield was estimated in relation to the dry matter by the use of the following expression as given by Michalski et al. [16]:

\[
\text{Dry yield} = \left( \frac{\text{curd fresh milk quantity} \times \text{total curd dry extract}}{\text{milk quantity} \times \text{total milk dry extract}} \right) \times 100
\]
Table 2: Yield and chemical composition of fresh cheese Peulh-type.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.28 ± 0.02</td>
</tr>
<tr>
<td>Lactic acidity (g p.cent g)</td>
<td>0.14 ± 0.10</td>
</tr>
<tr>
<td>Total dry matter (g/100 g)</td>
<td>32.49 ± 0.16</td>
</tr>
<tr>
<td>Proteins (g/100 g)</td>
<td>28.30 ± 0.09</td>
</tr>
<tr>
<td>Yield</td>
<td></td>
</tr>
<tr>
<td>(g/100 g of fresh matter)</td>
<td>17.69 ± 0.21</td>
</tr>
<tr>
<td>(g/100 g of dry matter)</td>
<td>55.45 ± 0.13</td>
</tr>
</tbody>
</table>

Table 3: Chemical composition of whey fresh cheese Peulh-type.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>5.90 ± 0.02</td>
</tr>
<tr>
<td>Lactic acidity (g/L)</td>
<td>6.80 ± 0.14</td>
</tr>
<tr>
<td>Total dry matter (g/100 g)</td>
<td>6.40 ± 0.14</td>
</tr>
<tr>
<td>Volume (mL)</td>
<td>1727 ± 100</td>
</tr>
</tbody>
</table>

The nutritional importance of cheese arises from its high content of biologically valuable proteins. The protein content of different varieties of cheese varies between 20 and 35%. A 100 g portion of soft cheese will provide 30-40% of the daily protein requirements of an adult. Content (mg/100 g) of fresh cheese contain calcium 90, phosphorus 190, sodium 30, potassium 120 and magnesium 9. As regards the sanitary quality of the fresh cheese Peulh-type, the germs are usually destroyed during cheese cooking at 100°C.

The whey recovered after spontaneous drainage has a pH and a lactic acidity corresponding to a sweet whey where pH ≥ 5.6 and its dry matter consists among other serum proteins (min. 25% on dry basis) as Miller et al. [28] related (Table 3). These proteins can be increased by mechanical pressing which could contribute to the manufacture of some whey cheeses as Ricotta (Italy), Xynomyzithra Kritis (island of Crete, Greece), Manouri (Greece), Brunost, Getost, Mysost (Norway), Ziger (Germany), Karichee (Lebanon), Broccio (Corsica) in order to obtain satisfactory nutritional quality protein whey cheeses.
For taste and odour aspects (Figure 4) the cheese provided dispersion in mouth (5.62 ± 0.18) and a persistence in mouth over than 15 seconds. This aspect is probably due to its texture which is in majority soft and smooth, principal characters of fresh cheese because of its minimum water content over than 60 % [19,26]. Likewise for lactic taste (3.54 ± 0.13) and lactic odour (3.24 ± 0.20), were most important in cheese than herbal odour (2.52 ± 0.08) and herbal taste (2.11 ± 0.11). During cheese making, the heat clotting temperature might relatively masked the herbal leaves odour and taste and might contrary developed lactic taste and lactic odour. However, pungent taste (2.12 ± 0.14) and clotty taste (1.80 ± 0.21) have a low perception intensity.

Conclusion

The traditional technique of peulh cheese making is well known in the West African region, but not in Algeria. The cheese making process that, essentially consists in a coagulation of raw milk by leaf extract of a tropical green plant (Calotropis procera), gives a coagulum and then a fresh cheese after draining. This cheese could consequently improve food quality due to the interest that could present. Thus, its protein ratio, can make an interesting proportion needed for nutritional body human subsistence and its sensory aspects provides to the peulh cheese an appropriate aspect and consequently, an acceptable product. In the other hand, the peulh cheese, if made, in south Algeria could be a solution to save milk produced by farmers and might contribute to their revenue source after rural selling. This first study might contribute to the exploitation of the Calotropis procera plant and therefore valorization of its calotropine enzyme in cheese making, unrecognized and unappreciated in Algeria in spite of the plant abundance in the south of the country.

Authors' Contributions

Dr. Ferial Aziza Benyahia-Krid has provided the research design, participated in the research analysis and has draft and revised the paper.

Dr. Ouarda Aissaoui-Zitoun has participated in the research analysis and in the paper redaction.

Dr. Halima Boughellout has participated in the research analysis and has draft the paper.

Dr. Faiza Adoui has participated in the cheese manufacturing and in research analysis.

Mr. Coco Rogatien Bakou has participated in the cheese manufacturing and in research analysis.

Mr. Denis Wodo has participated in the cheese manufacturing and in research analysis.

Pr. Mohamed Nassereddine Zidoune has provided the research design and revised the paper.

References


