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# CHARACTERIZATION OF THE TRADITIONAL CHEESE ADGHESS PRODUCED FROM COW'S MILK

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## ABSTRACT

In Algeria, milk is traditionally transformed into several forms to allow its preservation, particularly fermented products, among which cheese has been the pride of the culinary tradition for a long time. *Adghess* is a fresh cheese frequently made in the region, especially in rural areas. *Adghess* is a product poorly known outside its original geographical area. The objective of this study was to characterize *Adghess* cheese by determining some of its physicochemical and microbiological characteristics. The characterization was preceded by a survey carried out in Oum El Bouaghi with 50 households in order to determine the production diagram of this cheese. The survey was carried out by means of a questionnaire based on random sampling. Ten samples were collected at the level of five farms located in the region and were analyzed for physicochemical attributes such as pH, total dry extract, total lipids as well as, dornic acidity, and microbial population such as total flora, total and fecal coliforms, *Salmonella*, *Clostridium*, yeast, and molds. The results obtained showed that the cheese samples analyzed were acidic (pH and an acidity of 4.4 and 38.4°D, respectively). For the total dry extract of *Adghess* cheese is 334 g $kg^{-1}$ with a lipid level of 91 g $kg^{-1}$, the recorded ash content was 3.8g/kg, while sodium chloride was 2.4g/kg. The microbiological results showed a high content of the total flora (7.8×108cfu g-1): Total coliforms were noted to be present in all the analyzed samples, with the absence of fecal coliforms. Unlike molds, yeasts marked their presence (4.6×102cfu g-1). The microbiological findings revealed a high level of total flora (7.8108 cfu g-1): total coliforms were found to be present in all of the examined samples, although fecal coliforms were not found. Yeasts (4.6 102 cfu g-1) left a trace of their existence, unlike molds. The absence of all the pathogenic microorganisms sought (*Salmonella*, *Clostidium*, and molds) made the cheese healthier for consumption. Overall, the hygienic quality of the cheese studied was satisfactory. This work constituted the starting point to launch research on this product in order to preserve the know-how on the one hand and achieve the objective of manufacturing it on artisanal, then industrial scales.

**Key words:** Adghess, characterization, traditional, cheese, microbiological, Oum El Bouaghi, preservation, physicochemical, survey

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## INTRODUCTION

Milk and dairy products occupy an important place in the food traditions of many populations around the world. In Africa, traditional dairy products, especially fermented types, have been a proud culinary tradition since antiquity. Many scientific studies show that dairy products traditionally prepared from raw milk have typical flavors and nutritional qualities increasingly sought after by consumers [1, 2]. In addition, these traditional dairy products are of great economic importance. Certain milk processing techniques, due to their complexity and the equipment used, are only possible at the scale of specialized workshops, especially when the volumes of milk to be treated are large [3]. Others, on the other hand, are suitable for artisanal practices such as traditional processing into fermented products, for example*: Lben, Rayeb*, and cheese (*Michouna* and *Bouhazza*) in Algeria [4, 5], *Rob* and *Gariss* (Fermented milk made from camel milk) in Sudan [6].

Africa is a rich continent, not only for its natural fortunes but also for its cultural richness, in particular its cuisine. In Africa, traditional cheese varieties are numerous, yet they are not fully listed and have also been little studied. However, traditional African varieties have not been studied exhaustively. For illustration, a few studies are mentioned.

*Mashanza* is a fresh cheese produced by craftsmen in South Kivu and in other neighboring provinces (North Kivu, Ituri) in the east of the Democratic Republic of the Congo (DRC) [7]. Peuhl waragashi cheese is part of the food culture of the Beninese population. The production of Peulh cheese uses cow's milk, *Calotropis procera*, and the panicle extract of *Sorghum vulgaris* as its main raw materials. When the white cheese is not yet sold, it can be stored in whey, where it retains its humidity [8]. Dried cheese can be kept for 45 days without significant organoleptic change [9]. This Peulh cheese has a pH of 6.4-6.5 and a relatively high fat content between 43.3% and 45.6% [9]. *Jben* is also called *Jibneh Baida* in Egypt. It is prepared from raw cow's or goat's milk or a mixture of the two [10, 11]. *Klila*, a hard variety cheese is made from raw cow's milk by heating the whey of the curd at 50°C to 60°C for 30 minutes without using a starter culture. From a production and sensory attributes perspective (taste, appearance, texture), these are remarkably comparable to Algerian *Jben* and *Klila*. Mish cheese was formerly made in Sudan. It is prepared from rob and fresh cow's milk. The fermentation of the milk is favored by the addition of cumin or garlic. Refining lasts for a month. This cheese is consumed alone or with *Aceda* [6].

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Although Algeria is lagging behind in the dairy industry, some products made from milk or its derivatives have been around for a long time and are traditionally made using ancestral processes. In order to preserve the general heritage and the cultural heritage in particular, it is necessary to prevent the disappearance of many traditional products. In addition, the rural exodus and the profound transformation of the way of life experienced by rural areas stimulate their disappearance. This justifies the launch of an investigation, allowing their census, their identification, and their characterization in order to enhance them and make them a profitable resource, especially in rural areas. These traditional foods have persisted over centuries and have often evolved from a traditional and artisanal level to reach a large scale, like industrial manufacturing. In Algeria, many varieties of cheese prepared according to traditional techniques remain unknown, among which *Adghess* is considered an example. Some kinds of cheese have been identified and even studied, such as *Klila*, *Jben* [13], *Bouhezza* [14, 15], and recently *Michouna* [16]. On the other hand, they remain unknown. *Adghess* is a fresh cheese frequently made in the region, especially in rural areas. This cheese is very popular with the people of the region of Oum El Bouaghi; however, its preparation depends mainly on the availability of the raw material and the livestock of each family. Its production remains less widespread, and its practice does not go beyond the areas of origin. Traditional technology occupies an important place in the artisanal processing of fresh milk. However, traditional Algerian varieties have not been exhaustively studied and are only characterized by traditional production on a family scale. There is limited information available on how to make, consume, and store the cheese. Additionally, data is gathered on its physicochemical and microbiological properties. The food and nutritional characteristics of this product, which follows traditional manufacturing processes, are attracting interest. Virtually no studies have been done on this product. The knowledge of the characteristics as well as the technology for the manufacture of this cheese allows for the preservation of ancestral know-how and contributes to improving the production and the standards of living in rural areas. A scientific and technical contribution could greatly promote the development of this resource. This study serves as the foundation for an approach whose objective is to identify a regionally popular traditional product through its physicochemical and microbiological characterization in order to guarantee the preservation and protection of its unique qualities.

## MATERIALS AND METHODS

### Survey

As a first step, a survey in the region of Oum El Bouaghi was carried out in order to establish the production diagram of *Adghess* cheese. To determine the *Adghess*

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cheese production diagram, a survey was conducted in the Oum El Bouaghi area. In each household, the questions were addressed to the housewife, who is accustomed to routinely preparing milk. For the collection of information relating to the processing of this cheese, the chosen method was a simple survey of a sample of 50 households that prepared and consumed it. Only random sampling ensured the representativeness of the sample. For this method, each individual or household in the population had a known and non-zero probability of belonging to the sample. The survey was carried out by means of a questionnaire. The face-to-face survey remained the surest way to obtain the information sought. All of the data involved in the production process was the subject of the questionnaire. The results were obtained through the use of Epi Info software.

**Sampling**

Ten (10) samples of *Adghess* cheese were collected from farms located in the region of Oum El Bouaghi in order to characterize and study them. The samples taken were prepared by the housewives, who were used to doing it. The collection was carried out in the morning from 10 households (at the level of 5 farms) chosen at random, two samples per family (each farm had one household) (the 10 households chosen for the collection were among the 50 with which the survey was carried out). During the study only, 10 households volunteered to participate in the study and provide *Adghess* cheese. The samples intended for the laboratory were taken in sterile containers, stored and transported in coolers at 6 °C, and kept cold until the analysis. The studied cheese was prepared according to the traditional diagram developed following a survey of families making this cheese. *Adghess* is a traditional fresh cheese; it was made from cow's milk, goat's milk, and sheep's milk, according to the results of the survey.

**Preparation process**

The preparation of *Adghess* (Fig. 1) began with the transformation of raw milk into *Rayeb* (fermented milk) by spontaneous fermentation for 24 to 48 hours at ambient temperature (this temperature differs according to the seasons); the latter was drained before heating to 60°C. Fresh egg yolk and salt were added simultaneously. According to the results of the survey carried out, the quantity of eggs was linked to the volume of cow's milk used: for 3 liters, three fresh egg yolks were used. According to the respondents to the survey, the egg yolk was added in order to improve the texture of the coagulum, which made the cheese firmer. The whole mixture was then drained for 2 to 6 hours. The draining was carried out by sieving using a fabric (cheche or muslin). The obtained fresh *Adghess* cheese (Fig. 2) underwent a molding process, then it was refrigerated. The maximum storage period was 6 days at a temperature between 4°C and 6°C. The traditional diagram

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of *Adghess* cheese-making is illustrated in Figure 1. The maximum storage period, as determined by the survey, was six days.

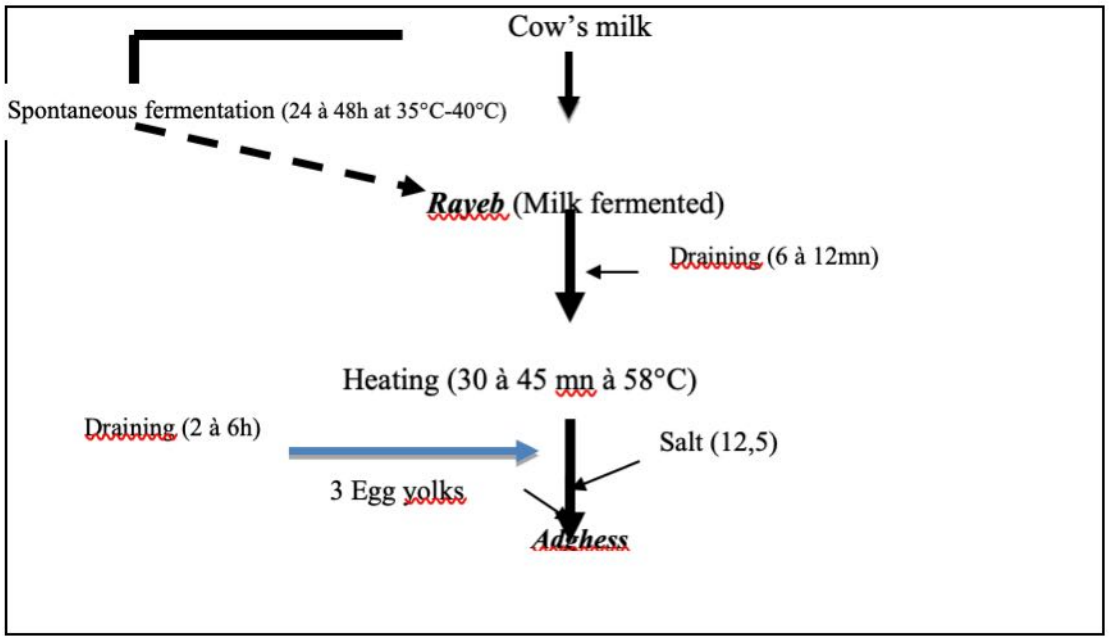


**Figure1: Traditional *Adghess* cheese making diagram (Survey results)**

**Figure 2: *Adghess* cheese**

## Physicochemical analyses

The total dry extract (TDE) was determined according to the standard NF V04-282 (1985), performed in an oven (GALLENKAMP-CE N = ° S094 / 09405, UK) set at 103°C±2°C, and left for 3h until complete evaporation of the water [17]. The fat content was determined according to the acid method –butyrometric- [17]. Three grams of the crushed cheese sample was introduced into the Gerber butyrometer. The fats resistant to the action of sulfuric acid were separated by hot

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centrifugation. The separation was promoted by the addition of iso-amyl alcohol. Less dense fats settled in a translucent and clear layer. The reading was taken directly from the butyrometer. The titratable acidity was determined according to the Association Française de Normalisation (AFNOR) [17], which entails dissolving the lactic acid from a test portion of 10 g of *Adghess* after centrifugation for 10 min at 4000 rpm. The supernatant was made up to 100 ml with distilled water and added two to three drops of phenolphthalein, then titrated with sodium hydroxide solution (0.1 N) until the color changed to pink. The pH was measured using a pH metre (Consort Multi Parameter Analyzer C3030) at 0.01 precision units after dispersing 10 g of the test sample in 50 ml of 'distilled water [17]. Ash incineration was performed at a temperature of 500°C in a muffle furnace (NABERTHEM) of 5g for 3 hours [18]. For sodium chloride, the determination was carried out according to the method of Volhart. The principle consisted of defecation of the sample with zinc hexacyanoferrate, followed by the determination of chlorine in the filtrate by argentimetry in the presence of nitrite [19]. All of these analyses were performed in duplicate.

**Microbiological analyses**

The cheese samples (25 g) were homogenized in a peptone water solution (225 ml) with a blender for 1 min. Decimal dilutions were prepared in sterile conditions. From each dilution, 0.1 ml was plated in media culture [20]. Duplicate bacterial counts by conventional microbiological methods were performed on selected samples after collection from farms. Total aerobic mesophilic bacteria (TAMB) count on PCA incubated at 30°C for two days (48 h)· Total coliforms were sought on BCPL incubated at 37°C for 24 to 48 hours. The search for fecal coliforms focused on the tubes that were used and were thought to be positive. Fecal Streptococci were counted in liquid medium Rothe, incubated at 37°C for 48 h, and confirmed in Litsky medium at 37°C for 24 to 48 h. The pathogenic bacteria in the cheese samples were analyzed for *Salmonella Shigella* (SS) after enrichment in the selenite of natrium, Staphylococci aureus was sought on Baird Parker agars after enrichment in the Giollitti Cantoni for 48 hours at 37°C. Yeasts and molds were enumerated on Oxytetracycline Glucose Agar after incubation at 25°C for 5 days; the enumeration was done separately on yeasts and molds. Sulphite-reducing *Clostridium* was grown on Meat-Liver media, which were incubated at 37°C for 72 h.

After the morphological description counting different genres, the interpretation of the results includes directives of the Algerian official newspaper regarding a fresh cheese, and the number of pathogenic colonies tolerated in a cheese product must be zero.

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## Sensory analysis

The sensory evaluation was carried out based on the scoring test for the description of the samples collected. The characteristics of the cheese were obtained by tasting and visual observations. The progress of the sensory evaluation was carried out according to AFNOR standards [21]. The panel consisted of 15 subjects, nine females and six males, who were chosen because of their availability; they volunteered to participate in these tests as well as their experience in the sensory evaluation of the cheese. The sensory analysis was based on the evaluation according to the following descriptors: texture, odor, consistency, aroma, and flavor. All the characters were rated from 1 to 7. The room had uniform lighting (white light), a neutral color, was odorless, and had a controlled temperature. Ten grams were placed in a dish in the laboratory, warmed at room temperature for one hour, and then presented to examiners. Three samples taken from three different farms were compared mainly for the descriptors: color, odor, taste and texture, using the analysis of variance (ANOVA) test.

## Statistical analysis

The data from the survey were entered and processed by Epi Info version 3 5 4 2013 software to determine the basic statistics. Excel processing was used to establish the means, the standard deviations, and the analysis of variance (ANOVA).

# RESULTS AND DISCUSSION

## Physico-chemical characteristics

The physico-chemical characteristics of traditional *Adghess* samples are shown in Table 1. The average pH value of the samples studied was 4.4. Compared with the value provided by Derouiche [22] for the cow *Michouna* cheese and by Abdelaziz and Ait Kaci [23] (5.4), *Adghess* pH was also lower. In addition, the samples had a pH close to that of *Klila* made from cow's milk (4.31) given by Meribai *et al.* [24] and that brought by Hamama for *Jben* (4.1) [25]. The variability was related to the composition of the raw material, mainly Rayeb, which was the dairy product used to prepare this cheese, and the various stages of manufacture that have undergone fermentation, which induced a decrease in pH by the production of organic acids, mainly lactic acid. It should be noted that the cheese was prepared from fermented milk, which had an acidic pH with an average acidity of *Adghess* 38.4 °D. The low pH of *Rayeb* is linked to the technology of its transformation and is explained by the acidifying activity of lactic acid bacteria. The total Dry Extract

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(TDE) of the samples studied was 334 g $kg^{-1}$ for cow Adghress; these contents were much lower than the value proposed by Derouiche for cow *Michouna* (463g $kg^{1}$) [22]. The TDE results recorded from the samples analyzed were also close to those of *Klila* from cow's milk (329.7g $kg^{-1}$) [25]. This value was lower than that proposed by Mennane *et al*. [12] (456g $kg^{-1}$) for Jben. The TDE of the samples studied was recorded to be higher than those of *Klila* from cow's milk (329.7g $kg^{-1}$). Nevertheless, they were considerably less than *Klila* from goat's milk (367 g/kg), as described by Meribai *et al*. [25]. It should be emphasized that the dry ingredients in *Adghess* also included the eggs that were added during preparation in addition to the raw milk. The amount of dry matter was mainly related to the raw material and the draining time. Therefore, the high fat content of raw milk affected the TDE content of curds, and good draining minimizes loss through the whey. The fat values of cheese were lower than those reported by Derouiche [22] for *Michouna* cow cheese (175g $kg^{-1}$) and those communicated by Berthier (175 g $kg^{-1}$) [26]. The fat content of *Adghess* was also much lower than the minimum value of the interval presented by Kouniba *et al*. [27] for the industrial goat *Jben* (174.7–185.6 g $kg^{-1}$) and that communicated by El Marrakchi and Hamama [28] (183 g $kg^{-1}$). Indeed, the fat content was linked to several factors, namely: the raw material and *Rayeb* used, and the manufacturing conditions (diagram, know-how). Among the factors influencing the composition of milk, food played an important role. In effect, the chemical composition of *Rayeb* varies considerably between different localities, regions, and farms [10].

The ash content found was 3.8 g $kg^{-1}$. This content was much lower than the value reported by Mennane *et al.* [12] (6.2 g $kg^{-1}$), as well as by Derouiche and Medjoudj [5] for *Michouna* cheese (4.91g $kg^{-1}$). The ash content was linked to the levels of minerals in the raw material as well as those provided by the ingredients (egg and salt) added during its preparation and the draining stage.

The average sodium chloride recorded in the analyzed samples was 2.4 g $kg^{-1}$. This average was close to the value found by Derouiche and Madjoudj [5] for *Michouna* cheese. During manufacture, salting was noted to be carried out according to the taste sought from the manufacturer.

**Microbiological characteristics**

The microbiological quality of the *Adghess* cheese studied depended essentially on that of the raw materials used and the ingredients added during its preparation. The main results of the microbiological characterization of *Adghess* cheese are presented in Table 2.

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The microflora of *Adghess* cheese was mainly made up of microorganisms provided by the raw material and the ingredients used. The bacterial load recorded in the cheese studied was relatively high ($7.8 \times 10^8$cfu $g^{-1}$). This number was much higher than the microbial density of *Michouna* cheese ($1.78\ 10^3$cfu $g^{-1}$) noted by Derouiche and Medjoudj [5]. This high rate may be explained by the contamination that may occur during the traditional practice of manufacturing (source of contamination, handler, and utensils). The raw material traditionally treated by farmers, perhaps also the milk put into production, had not undergone cooling after milking, which allowed the proliferation of contamination germs introduced just before milking.

The total coliforms were noted to be present in all the analyzed samples ($1, 51.\ 10^2$ germs/ml), with the absence of fecal coliforms. Compared with the results of Derouiche and Medjoudj [5], *Adghess* cheese had a higher number of total coliforms in comparison to *Michouna* (72.4 germs $ml^{-1}$), while both cheeses were free from fecal coliforms. The presence of total coliforms in all the samples was probably due to contamination during manufacture or during draining, while the absence of fecal coliforms was an indication that fecal contamination had not occurred. Indeed, according to Larpent [30], the presence of coliforms was not necessarily an indication of fecal contamination; they were markers of general hygienic quality.

The tests for *Salmonella*, *S. aureus*, Sulphite-reducing *Clostridium*, *fecal streptococci*, and molds were negative for all the samples; on the other hand, the yeasts were present with a number of $4.6\times10^2$ $cfug^{-1}$. The same results were reported by Derouiche and Medjoudj [5]. The absence of these germs could be explained by good hygienic practice during milking and processing and also by heat treatment applied during the preparation. Indeed, heat treatment at relatively high temperatures was capable of killing them. *Adghess* cheese had a satisfactory microbiological quality, which could reflect the good hygienic behavior of the production, in particular the applied heat treatment.

Indeed, the microbiological quality of cheese depended on that of the starting milk, which depended on the fermented milk to establish the Rayeb. It should be noted that this fermented milk was characterized by its low pH, which made it an unfavorable environment for a significant number of germs. The heat treatment had a positive impact on the microbes, which explained why there were fewer of them in the cheese, given how it was made and how old it was [31].

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The destruction of microorganisms was a function of two parameters: the temperature and the duration of treatment. Indeed, the microflora of *Adghess* cheese was mainly made up of microorganisms provided by the raw materials and all the ingredients used. According to Dortu and Thonar [32], lactic acid bacteria play a very important role in the prevention of pathogenic microorganisms and those responsible for the deterioration of food products through the production of numerous metabolites with antimicrobial properties. Obtaining satisfactory traditional cheese with hygienic quality was linked to several factors, including the quality of the raw milk, the conditions for the preparation of Rayeb, and compliance with rules and hygiene measures for production sites, equipment, and handlers.

**Sensorial Characteristics**

The sensory quality of cheese depended on a number of factors related to both manufacturing technology, chemical and microbiological characteristics of the raw material used.

*Adghess* cheese has been described as yellow paste cheese, with a grainy and sandy texture and an average consistency of 3.66 on a graduated scale of 7. The smell was rather strong, with a very faint animal intensity (1.9 on a scale of 7) and an acidic lactic flavor (3.86 on the same scale). Medium dispersion in the mouth was 10 to 15 seconds, and the medium lactic taste recorded was 4.46.

The persistence was considered typical and rich in aromas. The aromas of *Adghess* depended on those of milk, and mainly on the richness of the precursor substrates of the aromatic components. Regarding the flavor of cheese, it resulted from a balance between many aromatic molecules of lipid, protein or fermentation origin [33]. The aromas, organoleptic properties, and physico-chemical characteristics of cheese depend on those of raw milk which in turn depend on the breed of animals and their type of diet [34].

The sensory quality of cheese depended on a large number of factors, linked both to the manufacturing technology and to the chemical and microbiological characteristics of the raw material used. The latter themselves depend on many upstream factors (of genetic, physiological, dietary origin, *etcetera*) [35]. Analysis of variance (ANOVA) made it possible to study whether the responses of the subjects were consistent and whether the three cheeses were significantly different, and this for each of the criteria separately. The judges had globally convergent opinions for all the descriptors, hence the color ($p>0.05$), the odor ($p>0.05$) and the flavor ($p>0.05$). So the differences were not significant, with the exception of the texture descriptor on which the jury as a whole did not agree on the sandy character of the

cheese paste ($p<0.05$). This difference was probably due to the difference in environmental conditions during production (three farms). Additionally, egg yolks and the type and quality of milk used to make cheese both had a big impact. It was challenging to distinguish between the three cheeses due to the strength and persistence of flavor.

## CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

This is the first preliminary study carried out on *Adghess* cheese, the results of which show that it is an acidic (low pH and high acidity) and fatty product with a relatively high level of lipids compared to other traditional fresh cheeses. Overall, the hygienic quality of this cheese is satisfactory due to the absence of all pathogenic microorganisms. Indeed, the microflora of *Adghess* cheese was mainly made up of microorganisms provided by the raw material and the ingredients used, mainly the eggs. The samples collected present the same characteristics for the descriptors studied, so the differences were not significant, with the exception of the texture.

*Adghess* is traditionally made and is known only in local markets. The identification and study of this cheese allow for the preservation of know-how on the one hand and contribute to the improvement of the economy and life in rural areas on the other. Its industrialization remains an objective to be achieved. This study constitutes a contribution to the identification of traditional cheeses widely consumed but still unknown. Research is, however, necessary to increase knowledge of this product by carrying out more comprehensive analyses. It would be interesting to identify the ecosystem of cheese according to the technological conditions of its manufacture and to ensure the study of the other aspects of this traditional product, essentially affecting aspects in relation to the nutritional quality (vitamins, proteins, minerals). It is also important for other traditional dairy products, which are still invisible. Indeed, identifying and researching other conventional dairy products that are still obscure is also crucial.

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**Table 1: Physico-chemical characteristics of *Adghess* cheese**

| Parameters | Adghess |
|---|---|
| pH | 4.40±0.15 |
| Titratable acidity (°D) | 38.4±0.21 |
| TDE (g $kg^{-1}$) | 334±0.42 |
| Fat (g $kg^{-1}$) | 91± 0.25 |
| Ash (g $kg^{-1}$) | 3.8 ± 0.9 |
| Sodium chloride g / kg | 2.4 ± 0.88 |

TDE : Total Dry Extract

**Table 2: Microbiological characteristics of *Adghess* cheese**

| Microbial flora | Adghess |
|---|---|
| Aerobic germs (cfug$^{-1}$) | $7.8\times10^{8}$ |
| Total coliform (germsg$^{-1}$) | $1.51\times10^{2}$ |
| Fecal coliform (germs g$^{-1}$) | 00 |
| Fecal Streptococci | 00 |
| Yeasts (ufcg$^{-1}$) | 00 |
| Moulds (ufcg$^{-1}$) | 00 |
| Sulphite-reducing clostridia at 46°C (ufcg$^{-1}$) | 00 |
| *Salmonella* (ufcg$^{-1}$) | 00 |
| Staphylococci | 00 |


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## REFERENCES


1. **Chammas GI, Saliba R and C Béal** Characterization of the fermented milk Laban with sensory analysis and instrumental measurements. *J. Food Sci.,* 2006; **71:** 156-162.

2. **Patrignani F, Lanciotti R, Mathara JM, Guerzoni ME and WH Holzapfel** Potential of functional strains, isolated from traditional Maasai milk, as starters for the production of fermented milks. *Int. J. Food Microbiol.,* 2006; **107**: 1-11.

3. **Meyer C** Élevage de la vache laitière en zone tropicale. Edition QUAE; 1999; 314 p.

4. **Derouiche M, Aissaoui Zitoune W, Medjouj H and MN Zidoune** Consumption of milk and dairy products in rural environment, Tebessa, Algeria. Livestock Research for Rural Development, 2016; **28(5).** Retrieved from http://www.lrrd.org/lrrd28/5/meri28089.html *Accessed July 2020.*

5. **Derouiche M and H Medjoudj** Comparative study of the microbial, physicochemical and sensory quality of a traditional cheese *Michouna* produced from cow and goat's milk. In Egor V. Consumption and contamination of dairy products. Nova science publisher, New York, 2020; 1-27.

6. **Abdelghadir W, Nielsen DS, Siddig H and M Jakobsen** A traditional Sudanese fermented camel's milk product, Gariss, as a habitat of *Streptococcus infantarius subsp. Infantarius*. *International Journal of Food Microbiology*, 1998; **127:** 215–219.

7. **Birali M, Sumbu Z and J Walangululu** Contribution à l'étude des procédés de fabrication et des caractéristiques physico-chimiques et sensorielles du fromage *Mashanza* produit au Sud-Kivu. *Journal of Applied Biosciences*, 2019; **144:** 14773-14783.

8. **Dossou J, Hounzangbe-Adote S and H Soule** Production et transformation du lait frais en fromage peulh au Benin. Guide de bonnes pratiques. Version validée lors de l'atelier national du 14 juillet 2006. Université d'Abomey-Calavi Faculté des Sciences Agronomiques, 2006; 33.

9. **Bawath O and AR Amoussou** Etude bilan sur la fromagerie traditionnelle ; Possibilités et limites de la création d'une unité de fabrication artisanale de fromage. Rapport de consultation MDR, Cotonou, 1998; 134.

10. **Benkerroum N and AY Tamime** Technology transfer of some Moroccan traditional dairy products (*Lben*, *Jben* and *Smen*) to small industrial scale. *Food Microbiology*, 2004; **21**: 399-413.

11. **Abdalla OM and AK Abdelrazig** Effect of type of milk on the quality of white soft cheese. U.K. *J. Agric. Sci.,* 1997; **5**:147-157.

12. **Mennane Z, Khedid K, Zinedine A, Lagzouli M, Ouhssine M and M El Yachioui** Microbial Characteristics of *Klila* and *Jben* Traditional Moroccan Cheese from Raw Cow's Milk. *World Journal. Dairy & Food Science*, 2007; **2(1):** 23-27.

13. **Hellal A** Traditional Algerian cheeses. What future? Review *Agroligne*, 2001; **14:** 43-47.

14. **Aissaoui Zitoune O, Benatallah L, Ghennam El-H and MN Zidoune** Manufacture andcharacteristics of the traditional Algerian ripened bouhezza cheese. *Journal of Food Agriculture& Environment*, 2011; **9**: 96-100.

15. **Medjoudj H, Aouar L, Derouiche M, Choiset Y, Haertlé T, Chobert JM, Zidoune M N and AA Hayaloglu** Physicochemical, microbiological characterization and proteolysis of Algerian traditional Bouhezza cheese prepared from goat's raw milk. *Analytical Letters*, 20202019; **53(6):** 905–921.

16. **Derouiche M and MN Zidoune** Characterization of a traditional Michounacheese from the region of Tébessa, Algeria. *Livestock Research for Rural Development*, 2015; **27(11)**. Retrieved from: http://www.lrrd.org/lrrd27/11/meri27229.html *Accessed September 2020.*

17. **AFNOR**. Collection of French standards. Quality control of food products: Milks and dairy products. Physico-chemical analyzes. *Afnor-dgccrf.* (4th edition.). Paris, 1993; 562.

18. **Audigié CI, Figarella J and F Zonszain** Biochemical analysis manipulation. 1st édition, DOIN-Paris, 1984; 274.

19. **FAO**. Manuals of food quality control. Food analysis general techniques, additives, contaminants and food composition N14. *FAO Food nutrition paper.* Rome, 1997; **7**: 230.

20. **Guiraud JP** Food microbiology. DUNOD edition, 136–7. Paris : Tec and Doc Lavoisier, 2003.

21. **AFNOR**. Sensory analysis, collectionofFrenchstandards.1st edition. Paris, 1984; 159 p.

22. **Derouiche M** Milk and dairy products: diversification, frequencies and modes of consumption in the Algerian tradition. Doctoral thesis, Institute of Nutrition, Food and Agri-Food Technologies, Constantine, Algeria, 2017; 189.

23. **Abdelaziz S and F Ait Kaci** Contribution to the physico-chemical and microbiological study of a traditional Algerian cheese made from cow's milk and goat's milk: Jben. Engineering memory in Agronomy, National Agronomic Institute, Algiers, Algeria, 1992; 67.

24. **Meribai A, Jenidi R, Hammouche Y and A Bensoltane** Physico-chemical characterization and microbiological quality of *Klila*: a traditional dry cheese from arid regions of Algeria: Preliminary study. *Journal of New Science*, 2017; **40(4)**: 2169-2174.

25. **Hamama A** Improvements of the manufacture of traditional fermented products in Morocco: case of *Jben* (Moroccan traditional fresh cheese). In Dirar H.A. (éd.): Emerging Technology Series- Food Processing Technologies for Africa, UNIDO, Vienna, 1997; 85-102.

26. **Berthier AM** The composition of goat cheese. Rev. LaitièreFr.1992; 516: 44-45.

27. **Kouniba A, Berrada M and A El Marakchi** Comparative study of the chemical composition of goat's milk of the local Moroccan breed and the alpine breed and evaluation of their cheese suitability. *Journal Med. Vet.* 2007; **158(03)**: 152-160.

28. **El Marrakchi A and A Hamama** Hygienic aspects of fresh goat cheese: Prospects for improving quality. In: Days on « the goat milk industry development prospects in the Mediterranean ». Study FAO Animal Production and Health, Rome, 1995; 131: 24-33.

29. **Mennane M, Lagzouli M, Ouhssine M, Elyachioui E, Berny M, Ennouali M and B Khedik** Physicochemical, microbial and sensory characterization of Morroccan *Klila*. *Middle East Journal of Scientific Research*, 2007; **2(3-4):** 97.

30. **Larpent JP** Les bactéries lactiques. In Microbiologie alimentaire. Fermentation alimentaire, Tome 2. Edit Tec et Doc. Paris, 1996; 3-33.

31. **Ercolini D, Russo F, Ferrocino I and F Villani** Molecular identification of mesophilic and psychrotrophic bacteria from raw cow's milk. *Food Microbiol.* 2009; **26:** 228–231.

32. **Dortu C and P Thonart** The bacteriocins of lactic acid bacteria: Characteristics and interests for the biopreservation of food products. Biotechnol. Agron. Sac. 143-154. Milk. In Vignola CL Milk science and technology. Montreal: International Press, 2009.

33. **Adda J** Flavor formation mechanisms in cheeses, in: XXII Int. Dairy Congress, The Hague, Netherlands, 1986; 169-177.

34. **Poznanski E, Cavazza A, Cappa F and PS Cocconcelli** Alpine environment microbiota influences the bacterial development in traditional raw milk cheese. *Int. J. Food Microbiol*., 2004; **92:** 141–151.

35. **Coulon JB** Factor of production and sensory quality of cheeses. Herbivore Research Unit, Theix INRA, *Production Sanimales,* 2005; **18(1):**49-62.