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Evaluation of the physicochemical quality of raw milk from cattle farms in the region of Djelfa (Algeria)

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Abstract— *Milk is a food of animal origin. In is an important source of nutrients in humans. For this, in order to know the physicochemical quality of raw milk from cows of local and improved breed, a study was carried out on thirty nine samples of raw milk were taken from cattle farms in the region of Djelfa in Algeria.*

The results showed that cow's milk had 3.30 ± 0.54% fat (FT), 8.89 ± 2.05% non-fat dry matter (NFDR), 3.45 ± 0.73% protein (PR), 5.02 ± 1.07% lactose (LC) and a density (DS) of 1.0272 ± 0.0078 with a freezing point (FP) -0.2971 ± 0.0528 ° C and a pH of 6.57 ± 0.24.

The study of the relationship between temperature (TS) and physicochemical indicators has shown the existence of seven weak correlations. Six correlations are negative [pH-TS (r = -0.1258, R^2 = 0.0158); NFDR-TS (r = -0.0551, R^2 = 0.0030); PR-TS (r = -0.0273, R^2 = 0.0007); LC-TS (r = -0.0467, R^2 = 0.0022); DS-TS (r = -0.0323, R^2 = 0.0010); FP-TS (r = -0.0309, R^2 = 0.0010)] and a correlation is positive [FT-TS (r = 0.0279, R^2 = 0.0008)]. In addition, the average temperature is 15.53 ± 5.80 ° C. In parallel, these temperatures in the majority of cases are greatly exceeded the values recommended by Algerian standards (+ 6 ° C). These results reflect risks to the health of consumers. Finally, it will be very useful to carry out a program to improve the food ration on all farms in the country; this will help improve the quality and quantity of raw milk but would also improve Algeria's independence vis-à-vis foreign countries in terms of imports of milk, thereby ultimately providing benefits for all economy of the country.

Keywords— ***Algeria, Cow, physicochemical indicators, temperature, Steppe region.***

I. INTRODUCTION

Milk is the integral product of the total and uninterrupted milking of a healthy, well nourished and underexcited dairy female. It must be collected properly and not contain colostrums [1].

It is an important source of all the basic nutrients required for mammals, including humans. Its physical properties are affected by several factors, including the composition and processing of milk [2].

It is characterized by specific physicochemical parameters which allow its quality to be judged.

Therefore, in the present study we will first determine the physicochemical quality parameters of raw bovine milk produced on farms in the Djelfa region. Then, study the influence of the temperature of the milk in order to know whether or not there is a risk to the health of the consumer. Finally, to propose corrective measures necessary to improve the physicochemical quality along the production chain to avoid accidents caused by collective food poisoning.

II. MATERIAL AND METHODS

2.1. Study area

The present study was carried out in the region of Djelfa which is located in the central part of northern Algeria. It is a crossroads for a significant number of the wilayas.

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It occupies a total area of 32.194,01 km². It is bounded to the south by the wilayas of Ouargla, El Oued and Ghardaïa, to the west by the wilayas of Laghouat and Tiaret, to the east by the wilayas of M'Sila and Biskra and to the north by the wilayas of Médéa and Tissemsilt. The climate of the wilaya of Djelfa is semi-arid to arid with a continental undertone (Figure 1) [3]

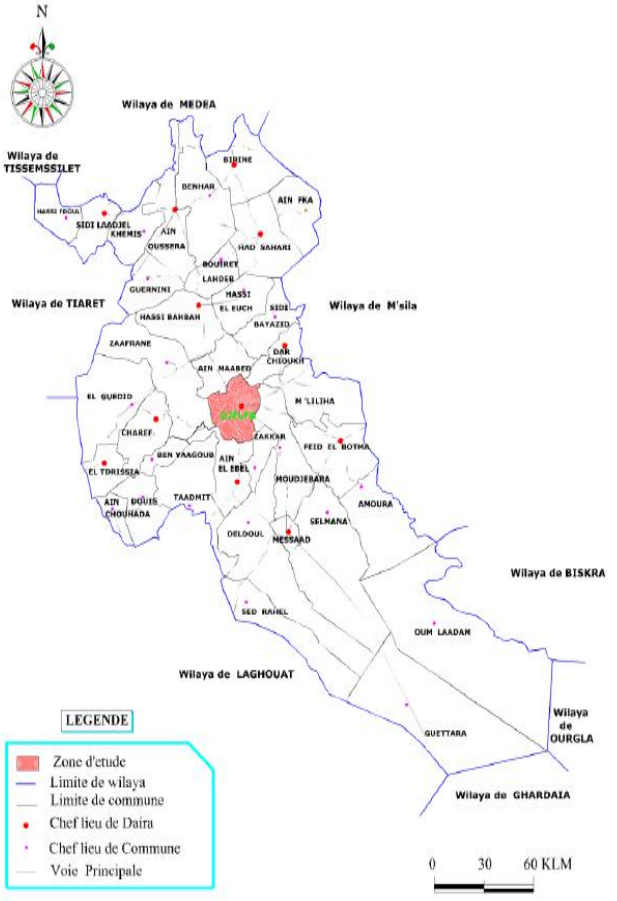

Fig. 1. Administrative situation of the wilaya of Djelfa [4]

2.2. Sample collection

The samples were collected in the Djelfa region. A total of 39 samples of raw udder milk (individual milk) from cows were investigated. The samples were taken in vials clearly identified by meaningful codes to avoid disturbance of the results.

The samples were placed in a cooler under the cold regime and transported to the laboratory of the Faculty of Nature and Life Sciences (Ziane Achour University - Djelfa) where they underwent physicochemical analyzes using specific equipment.

At the same time, the temperature of the milk was recorded during the physicochemical analyzes.

2.3. Physicochemical analysis and study of the influence of the temperature of raw bovine milk

The pH was tested using a HANNA type pH meter.

The research of the physicochemical parameters was carried out by the LactoStar analyzer of the FUNKE GERBER type. These parameters are: fat (MG) (%), non-fat dry matter (MSNG) (%), protein (PR) (%), lactose (LC) (%), density (DS) and freezing point (PC)) (° C).

For the study of the temperature of raw milk on the health of consumers, our results were compared with the criteria required by the interministerial decree N ° 85/1999, relating to the temperatures and the methods of conservation by refrigeration, freezing or deep freezing of foodstuffs, ie a storage temperature of raw milk of + 6 ° C [5].

2.4. Statistical analysis

The physicochemical indicators of raw bovine milk, the average temperature of the milk recorded at the time of physicochemical analysis were used as a source of variation.

Confidence intervals were calculated for each physicochemical parameter.

Correlation coefficients (r) were calculated to estimate the link between the temperatures of the raw milk recorded at the time of the physicochemical analyzes and the physicochemical parameters.

The calculations were made using Microsoft Office Excel® 2007 software.

III. RESULTS AND DISCUSSION

3.1. Results of the physicochemical parameters of raw bovine milk

Overall, the results showed that cow's milk had 3.30 ± 0.54% fat (FT), 8.89 ± 2.05% non-fat dry matter (NFDR), 3.45 ± 0, 73% protein (PR), 5.02 ± 1.07% lactose (LC) and a density (DS) of 1.0272 ± 0.0078 with a freezing point (FP) -0.2971 ± 0.0528 ° C and a pH of 6.57 ± 0.24 (Table 1).

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Table 1. Results of measurements of the physicochemical parameters of raw bovine milk

FT: fat; NFDR: non-fat dry matter; PR: protein; LC: lactose; DS: density; FP: freezing point; pH: potential hydrogen, TS: Temperature; SD: Standard deviation

Physicochemical parameters	Values (Mean ± SD)	Confidence intervals (95%)
FT (%)	3.30 ± 0.54	[-2.31; 8.91]
NFDR (%)	8.89 ± 2.05	[-0.04; 17.82]
PR (%)	3.45 ± 0.73	[-2.28; 9.18]
LC (%)	5.02 ± 1.07	[-1.83; 11.87]
DS	1.0272 ± 0.0078	[6.6276; 6.6324]
FP (°C)	-0.2971 ± 0.0528	[-0.3137; -0.2805]
pH	6.57 ± 0.24	[6.49; 6.65]
TS (°C)	15.53 ± 5.80	[13.71; 17.35]

These results can be explained by several factors, including the diet of dairy cows which are fed with foods that promote the increase in the quality and quantity of milk production.

According to Labioui et al. [6], the variability of pH is linked to climate, lactation stage, food availability, water intake, cow health and milking conditions.

The lipids depend on the breed, the rank of the milking, which influences the fat content. They are classified as the most variable constituents in terms of quality and quantity [7].

The reduction in protein levels in raw milk could be due to the difference in race, the state of udder health and the stage of lactation [8].

Lactose is the main sugar present in milk, the substrate for lactic fermentation for lactic acid bacteria [6].

3.2. Relationship between physicochemical indicators and the temperature of raw bovine milk

The study of the relationship between temperature (TS) and physicochemical indicators has shown the existence of seven weak correlations. Six correlations are negative [pH-TS (r = -0.1258, R^2 = 0.0158); NFDR-TS (r = -0.0551, R^2 = 0.0030); PR-TS (r = -0.0273, R^2 = 0.0007); LC-TS (r = -0.0467, R^2 = 0.0022); DS-TS (r = -0.0323, R^2 = 0.0010); FP-TS (r = -0.0309, R^2 = 0.0010)] and a correlation is positive [FT-TS (r = 0.0279, R^2 = 0.0008)] (Table 2) (Figure 2).

Table 2. Correlation between physicochemical parameters and temperature

pH: potential hydrogen; FT: fat; NFDR: non-fat dry matter; PR: protein; LC: lactose; DS: density; FP: freezing point; TS: temperature; r: Correlation coefficient; R^2: Coefficient of determination

Relationship between parameters	r	R^2
pH-TS	-0.1258	0.0158
NFDR-TS	-0.0551	0.0030
PR-TS	-0.0273	0.0007
LC-TS	-0.0467	0.0022
DS-TS	-0.0323	0.0010
FP-TS	-0.0309	0.0010
FT-TS	0.0279	0.0008

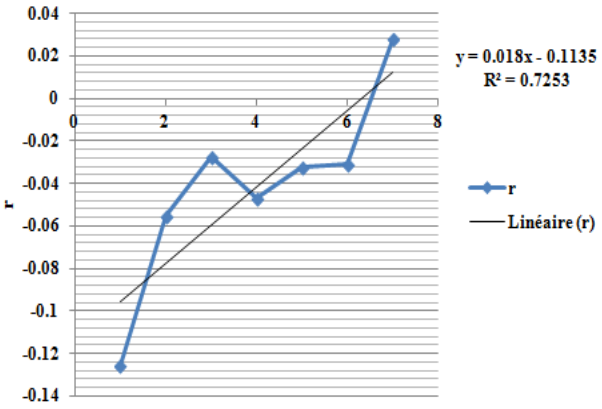

Fig. 2. Distribution of correlation between temperature and physicochemical parameters of raw bovine milk

In addition, the average temperature is 15.53 ± 5.80 ° C. At the same time, these temperatures are in most cases greatly exceeded the values recommended by Algerian standards (+ 6 ° C). These results reflect risks to the health of consumers.

Moreover, in the majority of cases, the temperature exceeds 10 °C. This temperature is considered to be a threshold at which the bacterium *S. aureus* can begin to produce the enterotoxin responsible for the disease [9].

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IV. CONCLUSION

In conclusion, checking the physicochemical quality of raw bovine milk remains an important step, in order to remedy all the defects observed, on the one hand, and on the other hand, to detect wetting of the milk in cases of points of sale. This requires systematic monitoring of raw milk throughout the dairy production chain in order to limit all cases of fraud.

In addition, the results obtained make it possible to discover the existence of high temperatures in raw milk during physicochemical analyzes. This factor is essential in collective food poisoning if the raw milk is consumed without heat treatment.

They have a control and extension program for all stakeholders in the sector in order to improve the quality and quantity of raw bovine milk produced and minimize significant economic losses thereafter.

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