The physicochemical quality of raw milk sold at dairies of Beni Mellal city (Morocco)

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Abstract—In this study, we evaluated the physicochemical criteria reflecting the degree of quality of the raw material that is essential for good human nutrition, raw cow milk sold to consumers in the traditional urban dairies randomly selected in the Beni Mellal city, located in the northern center of the kingdom of Morocco and destined directly for human consumption. For this purpose, 70 samples of raw cow's milk taken from 14 traditional urban dairies, for a period comprised from January to June, were subjected to a physicochemical study covering twelve parameters. The results obtained from physicochemical analyzes of raw milk reflecting stability are generally cited in intervals were often outside and away from national and international standards retained for this nutritional and indispensable material. The levels of fat, protein, lactose, total solids and solids non-fat, plus the degree of the density are sometimes lower indicating that these milks sold in these dairies were often and previously exposed to the phenomenon of fraud and falsification namely wetting and skimming. However, the total absence of the chemical residues of the antibiotics sought in these milks reflects the good hygienic state which reflects the good health status of the dairy cows. Finally, it appears from the findings obtained in this study the importance of adopting of a vigilant and adequate system control addressed by the competent authorities for detect all possible fraudulent and falsified milks and to work in order to organize this random sector in Beni Mellal city to offer a best quality milk for the consumers with high physicochemical and microbiological criteria and which reply to the standards announced by national and international organizations.

Index Terms— Raw cow milk, milk quality, physical and chemical analysis, Beni Mellal city, Morocco.

1 INTRODUCTION

In Morocco, The level of milk consumption and derivatives remains low (38 liters / year) compared to the Maghreb countries; Algeria and Tunisia, where milk consumption reached 95 and 68 liters / year respectively, despite the increase in milk production in recent years (tripling of production between 1969 and 2004). This low consumption is due principally to eating habits where milk is not often used in culinary preparations, and to the weakness of purchasing power. In addition, milk is not accessible to many households, especially in rural areas, aggravating this low milk consumption in Morocco [1]. Despite of drought periods that experienced in Morocco, national milk production more than doubled, reaching 1.2 billion liters in 2000 instead of 581 million liters in 1975 [2], even reached a level of 1.7 billion liters in 2008. On the other hand, Siam et al.[3] announced a figure of 1.57 billion liters in 2008 of which the processed milk represents 1.1 billion liters. The approved industries ensure the processing of these milks and also by a multitude of small traditional traders working in hygiene conditions very criticiquable. Thus, 20-30% of the milk produced is used by the traditional dairies in the preparation of various traditional dairy products, including "Lben" (fermented milk) and "Jben" (fresh cheese) [4]. The latter are the most consumed in Morocco [5].

Milk is known as a matt, slightly viscous white liquid, whose composition and physicochemical characteristics vary considerably according to animal species, and even according to the breeds [6], [7]. The characteristics of milk vary also in function of the period of lactation, milking or breast feeding, and are also tibutaneous to the nature of animal feeding [8], [9]. Schematically, milk is considered such as an emulsion of fat in an aqueous solution, containing many constituents in the dissolved state and in the colloidal form. According to Doyle et al.[10] milk consists of 87% water, 4.8% lactose, 3.7% lipid, 2.6% casein, non-protein nitrogen (urea, creatinine) 0.6% of whey proteins. The mineral salts are: Cations: sodium (58 mg / 100 g), potassium (140 mg / 100 g), calcium (118 mg / 100 g)

and magnesium (12 mg / 100 g). Anions: citrate (176 mg / 100 g), chloride (104 mg / 100 g) and phosphorus (74 mg / 100 g). It should be noted that there are large variations in compositional characteristics between milk from different farms. The state of the animal, heredity, age, state of health, neurovegetative equilibrium, diet, lactation period, quality of the milker, the speed of milking and the conditioning at the time of milking are factors responsible for this large variation observed in the composition of the milks as explained previously by Ercolini et al.[11]. In mammals, milk is essential for the growth of the newborn. Its nutritional interest is indisputable in the growing of young. In adults, it is a source of energy but also protein, minerals and vitamin. In particular, milk proteins are a reference for their essential amino acid content. They are highly recommended for pregnant or nursing women [12]. But, milk is also a food of choice, very favorable to the development of microorganisms, some of which are dangerous from the health point of view according to Guiraud et al.[13].

The objective of this study is to determine the physicochemical characteristics reflecting the stability and nutritional quality of raw cow milk marketed in the traditional urban dairies at the level of the Beni Mellal city.

2 Material and Methods

2.1 Sampling

This work was carried out in the Beni Mellal city (Figure 1), located in the north-central of Morocco. This city has about dozens traditional urban dairies. Each dairy receives about a significant quantity of milk per day from farms around the city or from intermediate vendors. The milk marketed by these dairies is consumed without being subjected to heat treatments, whether in the production of traditional juices (raw milk + fruit juice) as for its use in the preparation of traditional dairy products ("Lben", "Jben" etc ...). The physicochemical quality of the raw milk was monitored monthly from 14 February 2014 to 14 June, i.e. a total of five samplings for each sample at each retail site over this period. Seventy samples (raw milk) were collected in fourteen randomly chosen urban dairies, which are also randomly located in the different large districts of the city. Samples were collected as sold to consumers and transported sterile (sterile bag), and rapidly (not more than one hour between sampling and analysis) in a refrigerated enclosure less than 4 °C in the Biological Engineering Laboratory, Sultan Moulay Slimane University

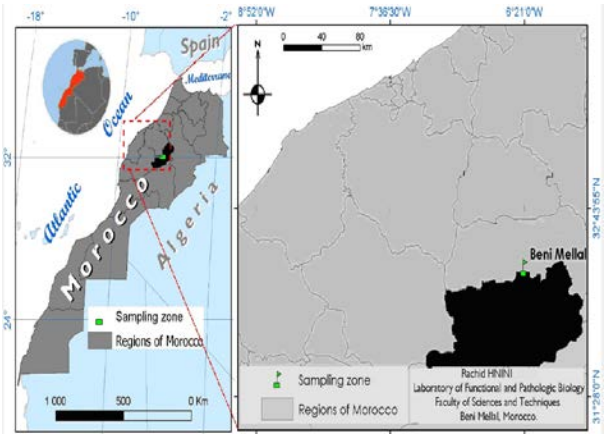

Figure 1: Beni Mellal city localization

2.2 Physicochemical Analysis

In general, after sample collection, the temperature of the milk is directly measured in place with a thermometer. Once raw milk samples arrived at laboratory in an insulated cooler containing ice cubes (thermos-cool boxes (at 4°C)). The pH is immediately measured using an Orion Reseach pH-meter after calibration at pH 7.02 and 4.00 by soaking in a small volume of milk taken from a beaker [14] while titratable acidity is measured by titration with 1 N NaOH in the presence of phenophthalein and acidity of milk was expressed in degrees Doronic (°D) which is equivalent to a grade of 0.1g of lactic acid/L of milk [15]; the milk density is determined using a thermo-lacto- densimeter. It is reduced to 20°C by the following formula: corrected density = read density + 0.2 (milk temperature - 20°C).

When the chemical criteria is considered, the fat content is firstly determined by the acid-butyrometric method of Gerber [16], which consists of an attack of milk with sulphuric acid and separation by centrifugation in the presence of isoamyl alcohol of the released fat [17-18] while the determination of the levels of proteins, fat, total solids, solids-non-fat is carried

out using the milkoscan™ minor apparatus calibrated to official methods to determine the protein level (Kjeldal method), fat content (Gerber method) and total solids (desiccation method). The results are displayed directly on the screen or printed out; the results are expressed g/100g. Finally, the detection of contamination of raw milk by chemical residues of antibiotics was performed using the Delvotest method [19].

3 RESULTS

For assessing quality in dairy industries; several criteria have to be analyzed:

- Physical criteria which are more often associated with milk density, pH, and temperature.

- Chemical criteria more associated with the milk content of nutrients. The content of these substances determines the possible uses of dairy milk and the food value of the derived products. Traditionally, fat and protein contents represent the main constituents [20].

- Hygienic criteria aim to characterize the microbiological aspects by revealing the contamination in microorganisms and the presence of inhibitors of microbial flora (such as antibiotics), which could constitute a health hazard for the consumer.

Characteristics revealing the physicochemical and nutritional quality are fat, protein, lactose, total solids and solids non-fat. On the other hand, the parameters that reflect the stability of raw milk are titratable acidity, ionic acidity (pH), alcohol tests at different concentrations (AT79%, AT76%, AT74%, AT68%) and the temperature, while the parameters which reflect whether the milk was previously exposed to wetting are the density, the freezing point and the brix. The parameter reflecting hygienic state used in this study was to characterize the presence of inhibitors of the microbial flora (such as antibiotics), which could constitute a health hazard to the consumer have been sought.

The findings obtained from physicochemical analyzes of raw milk revealing stability showed that our results are generally cited in intervals often outside and away from national and international standards retained for this nutritional and indispensable material while the rate of fat, protein, lactose and total solids total, fat contents and density are sometimes inferior indicating that these milks sold in these dairies were often and previously exposed to the phenomenon of fraud and falsification namely wetting and creaming. However, the total absence of the chemical residues of the antibiotics sought in these milks reflects the good hygienic state on the one hand as it reflects the good health status of the dairy cows on the other hand. Seventy samples taken at fourteen dairies for five months of follow-up from February to June were analyzed physicochemically every 14th day of each month of follow-up. Thus, the results obtained are given in the following **Tables 1** to **14**.

4 DISCUSSION

The results obtained from the study carried out in fourteen dairy sellers of raw milk in the Beni Mellal city during five months of follow-up showed a degraded quality for all physicochemical parameters reflecting the stability of raw milk, i.e. titratable acidity, ionic acidity (pH), alcohol test and temperature. Whilst, the physicochemical parameters reflecting the nutritional quality of the milk, namely the protein content, total solids, non-fat solids, lactose and fat contents showed a

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variable quality ranging from desirable to non-desirable in function of dairy sellers. The density, freezing point and the brix of the milk were carried out in order to show whether there was the water addition to the milk sold in order to reveal the fraudulent milk.

Temperature plays a key role in the degradation of the quality of raw milk because it promotes the rapid development of the milk microbial flora, thus accelerating its instability; thereafter, the deterioration of its quality. From the results obtained, we note that the temperature of the raw milk taken was between 04 and 10°C. Thus, the storage temperature of less than 4°C of raw milk in these dairies is ideal until it is sold to consumers. This explains why these milks should normally be stable since this temperature does not allow the milk to be transformed into a medium favorable for the development of the bacteria which give the lactic acid, thus enhancing the acidity leading to the destabilization of other essential milk constituents, notably proteins. In front of this normal apparent temperature, we believe that any marked instability could be due to other non-hygienic conditions and not necessarily linked to the temperature of milk preservation in the dairies, however, it not excluded that the development of the microbial microorganisms existing already in the milk as the exact original temperature of the collected raw milk in the farm is not known. Other factors could be suspected as the nature and the conception of the milking tools [21] notably the non-hygienic conditions in which milking takes place [21], [22], [23] and also the type of milking technique put in place [18], [23], [24], [25]. According to legal provisions reporting Order of 13 July 2012 on the conditions for the production and placement in the market of raw milk of bovine animals, small ruminants and domestic solipeds delivered to the final consumer: NOR: AGRG1229148A ELI: http://legifrance.gouv.fr/eli/arrete/2012/7/13/AGRG12291 48A/jo/text, milk requires to be cooled immediately after milking and to be kept at a temperature between 0 ° and + 4 °C, unless the placing on the market takes place within two hours after the end of the milking. Only milk from two successive milking's or milks derived from those milking's carried out over a maximum period of 24 hours can be mixed. In the article N° 7, line 4 of the aforementioned decree, it was recommended "That milk in vending machines must be renewed daily. Unsold milk of the day can only be used for human consumption after having undergone a heat treatment at least equivalent to pasteurization". The maximum milk temperature in the dairy refrigerators is 10 °C. This temperature could be inconvenient for the preservation of the milk until it is delivered to consumers because it allows the development of psychotrophic bacteria. Another problem which could be also detrimental to consumers, notably the sudden rupture of the electric current that can take place, which influences the quality of the milk contained in the refrigerators. This milk could be more acid when sold directly to consumers. The milk storage temperature in Beni Mellal dairies was generally lower than the storage temperature of raw milk sold in the various dairies in the Kenitra city. In this study reported by Hadrya et al.[26], they showed that the storage temperature taken at the time of sampling was 14.1 ± 3.4°C with a minimum of 8.0 °C and a maximum of 19.0 °C. It is also well known that acidity is an indicator of the milk quality at the time of delivery because it makes it possible to determine the quantity of acid produced by bacteria or possible fraud [27]. According to the results obtained in this work, we observed that the found values of the raw milk acidity sold in the dairies were far from the values announced by Hamama et al.[28], which showed that the raw milk acidity is situated normally between 15 and 18 °D for fresh milk (with 1 °D = 0.1g of lactic acid per liter) as they announced also that the wetting of the milk causes a decrease in its acidity to 15°D. Our results for some dairies are also not consistent with the national standard being 18 °D in maximum and 14 to 18 °D for pasteurized milk [16]. According to Guiraud [13], organic nitrogen compounds are essential for the growth of lactic acid bacteria. These latters use proteolytic enzymes that vary greatly from one species to another to obtain organic nitrogen compounds from casein after its decomposition. Many of the farmers and sellers of raw milk are un-

aware that the addition of water and the addition of new milk to the ancient milk stored accelerate the deterioration of its stability. However, any change in acidity could have an impact on the stability of other milk constituents. In dairy technology, changes in acidity during treatments are particularly important because these changes can affect the stability of milk constituents. For example, heating milk causes the loss of carbon dioxide, can also break down lactose into various organic acids, or cause blocking of amino groups in proteins and then increase acidity. Similarly, at high temperatures, tricalcium phosphate can precipitate and cause an increase in acidity triggered by dissociation of phosphate radicals as they have also demonstrated that the development of lactic acid bacteria in milk transforms lactose mainly into lactic acid and they have designated by developed acidity and which leads to the destabilization of the proteins [29].

Concerning the ionic acidity (pH), we have noted the presence of low pH values compared to the most raw milks especially from March to June according to the results obtained. This decrease in pH is indicator of instability of raw milk as it could be due to the exponential increase in temperature which is linked to climate changes often beginning in the March month in the Beni Mellal city. Our results for pH and acidity do not generally agree with those proposed by the French standard for the Dornic acidity of raw milk, indicating a pH between 6.6 and 6.8 for cow's milk [30]. According to Alais [31], the content of casein, mineral salts and ions is dependent on the change in pH and titratable acidity, hygienic milking conditions, total microbial flora and its metabolic activity have also an impact according to El Marnissi et al.[32]. Our results obtained for acidity and pH are in most cases far from those reported by El Marnissi et al.[32] in eight traditional dairies analyzed in Fez city in central Northern of Morocco, between October 2009 and September 2010 (16 D °, 6.6). The alcohol test remains also a very important and complementary parameter of the acidity for the control of the stability of the milk as it gives also an idea on the state of the proteins of the milk. The importance of this test may appear when adding sodium hydroxide to the milk to decrease its high acidity because this test makes it possible to demonstrate the current state in which the proteins are present. In this context, most of the analyzed milks have undergone coagulation because the proteins don't resist to the alcohol action, which reveals the destabilization of the proteins because of their deplorable states as it was revealed by Luquet [29] who reported that the development of lactic acid bacteria in milk transforms lactose mainly in lactic acid and which they have designated by developed acidity and which leads to the destabilization of proteins. The determination of the density and the freezing point as well as the brix of the raw milk was also assessed in order to know if these milks have been previously exposed to the wetting either in the dairies or in the farmers in order to increase the volume of raw milk sold for gain more money. According to Barabosa et al.[33], we can consider raw milks with densities of less than 1.030 as they have been wet given that the wetting of the milk causes a decrease in its density which is normally between 1.030 to 1.035 as we have also shown that the freezing point measurement her was in most cases less than what is previously described (-0.52 to 0.55) by FAO Food and Nutrition [34].

The characteristics revealing the nutritional physico-chemical quality of raw cow milk sold in Beni Mellal dairies during this survey such as contents of fat, protein, lactose, total solids and non-fat solids showed that for the fat, abnormal rates have been found generally. This means that most of these milks have been previously exposed to skimming and wetting either by sellers, intermediaries, breeders and this was more evident in dairies N ° 1, 4, 8, 9, and 11. These dairies have sometimes shown skimmed milks at advanced stages and that have been exposed in parallel at the wetting. In Morocco, it is known that collecting cooperatives, representing the main source of milk supply to milk industries are also concerned by the problem of milk quality delivered by their adherents due principally to cream removing [20].

The rates averages of fat content specified in the literature are 33g/l. These rates may be used in industrial practice when

milk is a mixture of several animals according to the FAO [34]. On the other hand, AFNOR requires that the average fat content must normally be in the range of 28.5 to 32.5g /l [17]. Far from the illegal skimming and wetting operations that can occur in some cases by humans seeking to obtain more money by increasing in the volume of milk by adding water or extracting the layer of floating cream on the surface once the milk has become stable, the milk content of the fat remains sensitive and depends on the other factors other than breeding in agreement with Labioui et al.[14], who argued that climatic conditions, stage of lactation and feeding could have an impact on the variability of fat content. Raw milks exposed to wetting and skimming has also low levels in other essential constituents of raw milk such as lactose content. The results obtained in this work show lower values than those reported by the study of El Marnissi et al.[32], which launched lactose value of 49.0g/l and those reaching 43.51g/l presented by Labioui et al.[14]. According to Michel and Wathiaux [35] lactose remains a main sugar present in milk from which lactic acid bacteria exploit it as a substrate of lactic fermentation, the normal range of lactose for raw milk is 40-50g/l.

The total solids and solids non-fat content remains mainly sensitive to the variation of other major constituents of raw milk. All possible frauds influence the milk physico-chemical composition on the one hand as they lead to the decrease in the nutritional value of the milk on the other hand. According to Mietton et al.[36], the dry matter content of raw cow's milk is in the range of 12.5 and 13% whereas the protein content is in the order from 2.9 to 3.5%. In this context, Simon et al.[20] reported that genetic and environmental factors are among the factors that can significantly influence the physicochemical composition of cow's milk. According to Veisseyre et al.[37] the average of total dry extract is ranged from 125 to 130g/l and the average of defatted dry extract is placed between 90 to 102g/l. In general, 100 grams of raw milk taken from a cow and a woman may contain a quantity of fatty matter of the order of 3.4 g for milk from the cow and 4.4 g for milk from the mother, while the protein level is 3.2g for the cow milk and 1.0g for the mother milk. However, they showed also that the lactose level being 4.7g for the cow raw milk whereas the rate of the minerals met being 0.72g [35].

5 Conclusion

The results obtained in this study were able to demonstrate that the physicochemical quality of the milks sold in the various dairies of the Beni Mellal city in comparison with available national and international standards and to previous studies. In spite of the instability of most of these milks, which often go to inedible milks in view of their increased acidity, nevertheless we have registered that few dairies have milks meeting conventional standards.

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Table 1: Followed-up of physicochemical raw milk parameters of the dairy N° 1.

	FC	PC	TS	SNF	Lac	FP	Bx	AT	Ac	pH	AT 79%	AT 76%	AT 74%	AT 68%	Ds
14/02	2,98	3,14	11,09	8,53	3,91	0,50	09	Negative	21	6,02	Positive	Positive	Positive	Positive	1,0296
14/03	2,81	2,97	11,01	8,68	4,23	0,51	09	Negative	17	6,54	Positive	Positive	Negative	Negative	1,0312
14/04	2,30	2,32	8,71	6,78	3,08	0,45	07	Negative	20	6,19	Positive	Positive	Positive	Positive	1,0270
14/05	2,63	2,76	9,23	8,04	3,56	0,48	08	Negative	20	6,07	Positive	Positive	Positive	Positive	1,0286
14/06	3,44	2,81	12,33	8,40	4,12	0,55	9,5	Negative	19	6,29	Positive	Positive	Positive	Positive	1,0310

FC:fat content (g/100g), PC:protein content (g/100g), TS: total solids (g/100g), SNF:solids non fat (g/100g), Lac: Lactose (g/100g), FP: freezing point, AT: antibiotic test, Ac: acidty, AT: alcohol test, Ds: density.

Table 2: Followed-up of physicochemical raw milk parameters of the dairy N° 2.

	FC	PC	TS	SNF	Lac	FP	Bx	AT	Ac	pH	AT 79%	AT 76%	AT 74%	AT 68%	Ds
14/02	3,81	3,32	12,31	8,92	4,09	0,51	09,5	Negative	15	6,76	Negative	Negative	Negative	Negative	1,0316
14/03	3,88	3,35	12,43	8,96	4,11	0,51	09,5	Negative	20	5,51	Positive	Positive	Positive	Positive	1,0305
14/04	3,01	3,00	10,98	8,53	4,06	0,55	09,5	Negative	20	6,35	Positive	Positive	Positive	Positive	1,0304
14/05	4,8	2,99	10,45	8,37	4,03	0,50	09	Negative	20,5	5,48	Positive	Positive	Positive	Positive	1,0286
14/06	3,33	3,34	11,49	8,68	3,83	0,53	10	Negative	21	5,67	Positive	Positive	Positive	Positive	1,0310

Table 3: Followed-up of physicochemical raw milk parameters of the dairy N° 3.

	FC	PC	TS	SNF	Lac	FP	Bx	AT	Ac	pH	AT 79%	AT 76%	AT 74%	AT 68%	Ds
14/02	3,39	3,10	11,73	8,39	3,82	0,48	09	Negative	20	6,06	Positive	Positive	Positive	Positive	1,0300
14/03	3,89	3,36	12,41	8,93	4,08	0,51	09	Negative	19	5,81	Positive	Positive	Positive	Negative	1,0316
14/04	3,45	3,08	11,45	8,48	3,80	0,49	09	Negative	17	6,59	Positive	Positive	Negative	Negative	1,0320
14/05	2,95	3,12	11,89	8,77	3,69	0,50	09	Negative	18	6,50	Positive	Positive	Negative	Negative	1,0288
14/06	3,67	3,46	11,68	8,45	3,46	0,50	09,5	Negative	18	6,36	Positive	Positive	Negative	Negative	1,0308

Table 4: Followed-up of physicochemical raw milk parameters of the dairy N° 4.

	FC	PC	TS	SNF	Lac	FP	Bx	AT	Ac	pH	AT 79%	AT 76%	AT 74%	AT 68%	Ds
14/02	2,94	2,97	10,65	8,08	3,64	0,45	09	Negative	14	6,75	Negative	Negative	Negative	Negative	1,0280
14/03	2,95	3,06	10,89	8,21	3,67	0,51	09	Negative	18	6,27	Positive	Positive	Negative	Negative	1,0300
14/04	2,77	3,00	10,74	8,55	4,07	0,52	09	Negative	20	6,07	Positive	Positive	Positive	Positive	1,0310
14/05	2,59	2,88	10,65	8,34	3,47	0,48	09	Negative	20	5,92	Positive	Positive	Positive	Positive	1,0298
14/06	3,49	3,37	12,77	8,72	3,82	0,54	8,5	Negative	19	6,03	Positive	Positive	Positive	Positive	1,0310

Table 5: Followed-up of physicochemical raw milk parameters of the dairy N° 5.

	FC	PC	TS	SNF	Lac	FP	Bx	AT	Ac	pH	AT 79%	AT 76%	AT 74%	AT 68%	Ds
14/02	3,37	3,19	11,80	8,88	4,20	0,51	09,5	Negative	15	6,75	Negative	Negative	Negative	Negative	1,0314
14/03	3,10	2,98	11,73	8,34	4,00	0,50	09	Negative	20	6,21	Positive	Positive	Positive	Positive	1,0300
14/04	3,05	2,94	10,31	8,31	3,90	0,53	09	Negative	18	6,27	Positive	Positive	Negative	Negative	1,0300
14/05	3,00	2,10	8,91	7,55	3,17	0,43	06	Negative	20	6,18	Positive	Positive	Negative	Negative	1,0264
14/06	4,00	2,79	11,53	7,90	3,63	0,53	09	Negative	21	5,76	Positive	Positive	Positive	Positive	1,0270

Table 6: Followed-up of physicochemical raw milk parameters of the dairy N° 6.

	FC	PC	TS	SNF	Lac	FP	Bx	AT	Ac	pH	AT 79%	AT 76%	AT 74%	AT 68%	Ds
14/02	4,08	3,59	13,03	9,41	4,29	0,53	10	Negative	20	6,26	Positive	Positive	Positive	Negative	1,0320
14/03	3,13	3,08	11,11	8,38	3,81	0,47	09	Negative	20	6,32	Positive	Positive	Positive	Negative	1,0300
14/04	3,48	2,68	10,77	7,70	3,56	0,49	07	Negative	19	5,52	Positive	Positive	Positive	Positive	1,0250
14/05	2,90	2,97	11,01	8,06	3,86	0,50	09	Negative	20,5	5,37	Positive	Positive	Positive	Positive	1,0294
14/06	3,38	2,79	10,60	7,66	3,41	0,48	08,5	Negative	19	6,70	Positive	Negative	Negative	Negative	1,0280

Table 7: Followed-up of physicochemical raw milk parameters of the dairy N° 7.

	FC	PC	TS	SNF	Lac	FP	Bx	AT	Ac	pH	AT 79%	AT 76%	AT 74%	AT 68%	Ds
14/02	3,62	2,94	11,74	8,52	4,10	0,50	10	Negative	15	6,70	Negative	Negative	Negative	Negative	1,0300
14/03	3,81	3,30	12,27	8,87	4,08	0,51	09	Negative	16	6,68	Negative	Negative	Negative	Negative	1,0300
14/04	3,23	3,00	12,01	8,91	4,03	0,50	09	Negative	18	6,16	Positive	Positive	Positive	Negative	1,0298
14/05	3,05	2,43	8,77	7,91	3,13	0,43	06	Negative	22	4,82	Positive	Positive	Positive	Positive	1,0260
14/06	3,19	2,83	10,95	8,26	3,95	0,54	09,5	Negative	18	6,25	Positive	Positive	Positive	Negative	1,0300

Table 8: Followed-up of physicochemical raw milk parameters of the dairy N° 8.

	FC	PC	TS	SNF	Lac	FP	Bx	AT	Ac	pH	AT 79%	AT 76%	AT 74%	AT 68%	Ds
14/02	4,26	3,42	12,95	9,10	4,17	0,52	10	Negative	20	6,21	Positive	Positive	Positive	Negative	1,0310
14/03	2,34	2,78	9,70	7,71	3,47	0,43	08	Negative	13,5	6,66	Negative	Negative	Negative	Negative	1,0264
14/04	3,03	2,91	10,77	8,26	3,88	0,53	09	Negative	20	6,16	Positive	Positive	Positive	Positive	1,0290
14/05	2,40	2,03	10,15	7,97	3,21	0,49	08	Negative	20	6,08	Positive	Positive	Positive	Positive	1,0282
14/06	2,09	2,85	9,74	8,21	3,90	0,53	09	Negative	20,5	5,83	Positive	Positive	Positive	Positive	1,0310

Table 9: Followed-up of physicochemical raw milk parameters of the dairy N° 9.

	FC	PC	TS	SNF	Lac	FP	Bx	AT	Ac	pH	AT 79%	AT 76%	AT 74%	AT 68%	Ds
14/02	2,06	2,06	10,23	8,69	4,23	0,53	09	Negative		6,60	Positive	Positive	Positive	Positive	1,0330
14/03	2,22	2,70	10,09	8,36	4,21	0,51	09	Negative	20	6,54	Positive	Positive	Positive	Negative	1,0302
14/04	3,33	2,99	11,29	8,49	4,02	0,55	09	Negative	17	5,89	Positive	Positive	Positive	Positive	1,0298
14/05	2,95	2,00	9,43	7,71	3,23	0,35	06	Negative	21	5,72	Positive	Positive	Positive	Positive	1,0258
14/06	3,00	2,54	10,12	7,98	3,35	0,40	08	Negative	21	5,96	Positive	Positive	Positive	Positive	1,0270
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Table 10: Followed-up of physicochemical raw milk parameters of the dairy N° 10.

	FC	PC	TS	SNF	Lac	FP	Bx	AT	Ac	pH	AT 79%	AT 76%	AT 74%	AT 68%	Ds
14/02	3,80	3,04	12,19	8,81	4,29	0,52	09,5	Negative	15	6,71	Negative	Negative	Negative	Negative	1,0310
14/03	4,06	3,09	12,03	8,27	3,71	0,50	09	Negative	19	6,04	Positive	Positive	Positive	Positive	1,0288
14/04	2,88	2,71	10,17	7,75	3,59	0,49	08	Negative	20	5,90	Positive	Positive	Positive	Positive	1,0280
14/05	3,80	3,00	11,98	8,61	3,69	0,50	09	Negative	18	6,23	Positive	Positive	Positive	Negative	1,0288
14/06	3,00	2,72	10,48	7,76	3,77	0,51	09	Negative	18	6,11	Positive	Positive	Positive	Negative	1,0300

Table 11: Followed-up of physicochemical raw milk parameters of the dairy N° 11.

	FC	PC	TS	SNF	Lac	FP	Bx	AT	Ac	pH	AT 79%	AT 76%	AT 74%	AT 68%	Ds
14/02	2,85	2,81	10,53	8,07	3,80	0,47	08	Negative	20	6,07	Positive	Positive	Positive	Positive	1,0280
14/03	4,85	3,06	13,09	8,54	3,98	0,49	09	Negative	16	6,59	Positive	Negative	Negative	Negative	1,0290
14/04	2,30	2,31	8,70	6,75	3,05	0,45	07	Negative	18	6,30	Positive	Positive	Positive	Positive	1,0260
14/05	2,60	2,79	9,45	7, 33	3,19	0,47	08,5	Negative	20	5,99	Positive	Positive	Positive	Positive	1,0296
14/06	5,33	3,07	13,12	8, 07	3,5	0,51	09	Negative	17	6,43	Positive	Positive	Positive	Positive	1,0282

Table 12: Followed-up of physicochemical raw milk parameters of the dairy N° 12.

	FC	PC	TS	SNF	Lac	FP	Bx	AT	Ac	pH	AT 79%	AT 76%	AT 74%	AT 68%	Ds
14/02	3,42	3,05	12,31	9,38	4,45	0,54	10	Negative	20	6,17	Positive	Positive	Positive	Negative	1,0322
14/03	3,71	3,39	11,97	8,62	3,71	0,47	09	Negative	16	6,61	Negative	Negative	Negative		1,0294
14/04	3,24	2,99	11,15	8,45	3,99	0,54	09	Negative	19	6,09	Positive	Positive	Positive	Negative	1,0300
14/05	3,10	3,3	11,09	8,34	4,00	0,51	09	Negative	20	6,01	Positive	Positive	Positive		1,0360
14/06	3,88	2,56	11,31	7,84	3,82	0,52	08,5	Negative	15	6,23	Negative	Negative	Negative	Negative	1,0280
														Positive	
														Negative	

Table 13: Followed-up of physicochemical raw milk parameters of the dairy N° 13.

	FC	PC	TS	SNF	Lac	FP	Bx	AT	Ac	pH	AT 79%	AT 76%	AT 74%	AT 68%	Ds
14/02	3,05	2,72	11,08	8,22	3,25	0,45	09	Negative	14	6,86	Negative	Negative	Negative	Negative	1,0250
14/03	3,27	2,89	11,42	8,73	3,93	0,52	09	Negative	14	6,70	Negative	Negative	Negative	Negative	1,0300
14/04	3,05	2,43	10,65	7,88	3,74	0,43	09	Negative	19	6,21	Positive	Positive	Positive	Positive	1,0260
14/05	2,95	2,68	11,09	8,13	3,17	0,41	08,5	Negative	20	5,78	Positive	Positive	Positive	Positifve	1,0230
14/06	2,84	2,27	8,56	7,34	3,23	0,35	08	Negative	19	6,13	Positive	Negative	Negative	Negative	1,0270

Table 14: Followed-up of physicochemical raw milk parameters of the dairy N° 14.

	FC	PC	TS	SNF	Lac	FP	Bx	AT	Ac	pH	AT 79%	AT 76%	AT 74%	AT 68%	Ds
14/02	4,55	2,62	11,88	7,52	3,45	0,43	08	Negative	12	6,86	Negative	Negative	Negative	Negative	1,0250
14/03	3,41	2,85	11,52	8,53	4,23	0,51	09	Negative	14	6,70	Negative	Negative	Negative	Negative	1,0300
14/04	3,00	2,23	9,65	7,79	3,31	0,45	08	Negative	20	6,01	Positive	Positive	Positive	Positive	1,0260
14/05	2,85	2,08	8,59	7,13	3,02	0,39	06	Negative	20	5,85	Positive	Positive	Positive	Positive	1,0230
14/06	3,00	2,33	9,85	8,02	3,24	0,43	09	Negative	18	6,57	Positive	Negative	Negative	Negative	1,0270