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EVALUATION OF RAW MILK QUALITY GATHERED FROM NORTH EAST AREA OF ROMANIA

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Abstract

This paper presents the data of a study on the commercial quality of fresh cow`s milk gathered from the North East area of Romania. Raw cow milk quality have been surveyed on samples collected from 126650 dairy cows (breeds Friesian, Simmental, Brown and Pinzgau) from 2458 farms from four counties in north eastern region of Romania. The samples were collected in sterilized plastic bottles of 50 ml preserved with bronopol 0.2 %, kept at refrigerating conditions till analysis. Analyses of raw milk included microbiological and physico-chemical parameters like bacterial count, somatic cell count, fat, protein, casein, lactose, urea, dry matter, density and pH. The results of the researches carried out indicated that all the raw milk collected fully complied with the en-force regulations concerning the physico-chemical quality features but for the safety hygienic ones, including the bacterial count (BC) and somatic cells count (SCC) the values found were higher.

Key words*: raw milk, microbiological features, proximate composition, cattle.*

INTRODUCTION

Milk is a natural product with a complex chemical composition (Pereira, 2014; Ivancia et al., 2019), being one of the most complete foods in nutritional terms; being rich in essential nutrients for growth and maintenance of a healthy life (Vilela, 2002; Marcondes et al., 2014).

The importance of adding milk to the human diet is because of its richness in proteins, fats, carbohydrates (lactose), mineral salts, vitamins, which provide immunologic protection and essential nutrients to its consumers (Sordillo et al., 1997; Oliveira et al., 1999; Matte et. al., 2014). The chemical composition is rather complex. Thus it provides an optimal environment for microorganism development (Filimon et al., 2011, Raţu et al., 2018).

Milk chemical composition is influenced by breed, season, physiological condition, animal individuality, lactation stage, feeding, body condition score, sanitary conditions of the mammary gland, interval between lactations, and the moment of milking at which the sample is collected (Miller et al., 1970; Fox and Mcsweeney, 1996; Lane et al., 1997; Bernabucci et al., 2002).

Most of the dry matter in milk is represented by nitrogenous substances, most of them (95%) being proteins and 5% being non-protean nitrogenous compounds (Harding, 1995; Bille et al., 2009).

Milk proteins are ranked as quality proteins (Raţu et al., 2019) with a good biological value and digestibility (97% to 98%) similar to fish meat proteins, rapid absorption and utilization in the body (Schaafsma, 2000).One of the most important proteins is casein (Bos et al., 2000).

It is well known that the fresh raw milk contains bacteria and somatic cells. These are the milk's biological constituents (Schutz et al., 1994). The numbers of these biological constituents varies according to production conditions like the animal's health and hygiene during milking, hygiene of the milking equipment, preserving and transporting the milk and the milk products (Turner et al., 1990; Maciuc et al., 2017). These microorganisms have an important role in the alteration and

contamination of milk (Filimon et al., 2011; Sakar, 2016).

Due to its chemical composition coupled with its high water content, a pH close to neutral, raw milk was recognized as a source of food-borne illness and disease (Sakar, 2016) and epidemiological reports on food-borne outbreaks due to consumption of raw milk infected with potential pathogens have been reported (Oliver et al., 2009).

Temperature control is critical to prevent milk alteration, because of the growth and multiplication of diverse microorganisms resulting in its early deterioration (Lues et al., 2010; Sakar, 2016).

Having in view the new regulations imposed by EU in 2016 (REGULATION (EU) 2016/1012), the current study aimed to present the evolution and the actual stage of raw milk quality from the north east area of Romania.

MATERIALS AND METHODS

The samples were gathered from 126650dairy cattle from 2458 exploitations' from 4 counties situated in the north east region of Romania. Samples were collected in sterilized plastic bottles of 50 ml during the official control of productive performances, which took place at every 28 days, in alternative ways (in first month at morning milking, and in the next month at evening milking). Each sample was previously preserved with bronopol 0.2%, labeled with a unique code and was also mentioned the animals identification number. The samples were kept at refrigerating conditions till the moment in which were delivered to analysis laboratory, and analysed in a maximum of a week from the moment in which the samples were brought to laboratory.

Analyses of milk physico-chemical composition included fat, protein, casein, lactose, urea, dry matter, density and pH were realized in according with AOAC norms (2019) using the Fourier Transformed Infrared technique (FTIR), performed with Lacto Scope (Delta Instruments). Microbiologically speaking, were analysed the following features: bacterial count (BC) using Bactoscope device, and somatic cell count (SCC) performed with Soma Scope device, the obtained results being multiplied by 1000. Before analysis samples were heated into a water bath till a temperature of 38ºC.

The software used for statistical analysis was SPSS. We calculated the average, standard deviation, coefficient of variation.

RESULTS AND DISCUSSIONS

In total a number of 309809 of raw milk samples were analyzed, data from the analysis were summarized in total (Table 1 and 2) and after separated by year and county and by year, county and season(Tables 3-6).

Table 1. Microbiological features of raw milk samples

Specification	Bacterial count (ufc/ml)	Somatic cell count (scc/ml)
$\bar{X}$	182.48	457.19
$s_{\bar{x}}$	387.78	834.03
V (%)	192.29	182.42

*Results have to be multiplied by 1000

Table 2. Proximate composition of raw milk samples

Specification	Fats (%)	Proteins (%)	Lactose (%)	Dry matter (%)	Urea (mg/100 g)	Casein (g/l)	Density (g/l)	pH
$\bar{X}$	3.84	3.366	4.72	12.61	25.337	26.42	1029.52	6.64
$s_{\bar{x}}$	0.78	0.34	0.24	0.68	8.94134	2.93	0.20	0.05
V (%)	20.29	10.29	5.25	5.39	35.28	11.11	0.01	0.85

Regarding the microbiological features of raw milk we can observe that the values for the both indicators exceed the maximum values permitted by national regulatory. We can conclude that producers did not fully respect the good hygiene practices, both during milking, storage or transportation of the raw milk. Analysing the data presented in Table 2, we can observe that the average values for all the determined parameters are similar with the ones mentioned in the specialty literature.

Table 3. Microbiological and proximate composition of raw milk samples in 2017

Specification		Botoşani	Iaşi	Neamţ	Suceava
Bacterial count (ufc/ml)	$\bar{X} \pm s_{\bar{x}}$	192.36±73.25	206.25±64.32	177.41±56.48	185.27±74.34
	V%	165.83	234.58	174.21	165.92
Somatic cell count (scc/ml)	$\bar{X} \pm s_{\bar{x}}$	513.85±890.46	510.01±888.15	400.59±819.94	383.49±710.35
	V%	173.29	174.14	204.68	185.23
Fats (%)	$\bar{X} \pm s_{\bar{x}}$	3.68±0.74	4.10±0.90	3.98±0.71	3.95±0.82
	V%	20.33	21.98	18.00	20.72
Proteins (%)	$\bar{X} \pm s_{\bar{x}}$	3.44±0.36	3.48±0.35	3.45±0.31	3.36±0.40
	V%	10.62	10.05	10.16	12.08
Lactose (%)	$\bar{X} \pm s_{\bar{x}}$	4.75±0.23	4.75±0.22	4.75±0.25	4.63±0.28
	V%	4.90	4.67	5.32	6.00
Dry matter (%)	$\bar{X} \pm s_{\bar{x}}$	12.56±0.12	12.98±0.98	12.91±0.98	12.75±0.81
	V%	1.02	7.61	7.65	6.36
Urea (mg/100 g)	$\bar{X} \pm s_{\bar{x}}$	24.40±7.74	24.41±7.80	19.27±10.95	25.09±7.46
	V%	31.75	31.98	56.85	29.74
Casein (g/l)	$\bar{X} \pm s_{\bar{x}}$	27.20±2.75	27.53±2.73	26.88±2.83	26.25±3.28
	V%	10.13	9.93	10.55	12.51
Density (g/l)	$\bar{X} \pm s_{\bar{x}}$	1029.27±0.20	1029.33±0.87	1029.83±0.87	1029.95±0.88
	V%	0.01	0.08	0.07	0.08
pH	$\bar{X} \pm s_{\bar{x}}$	6.64±0.05	6.64±0.06	6.65±0.10	6.64±0.12
	V%	0.85	1.01	1.60	1.87

Table 4. Microbiological and proximate composition of raw milk samples in 2018

Specification		Botoşani	Iaşi	Neamţ	Suceava
Bacterial count (ufc/ml)	$\bar{X} \pm s_{\bar{x}}$	184.36±73.45	194.45±72.34	172.14±63.13	175.47±74.34
	V%	165.83	134.58	154.41	165.84
Somatic cell count (scc/ml)	$\bar{X} \pm s_{\bar{x}}$	583.16±1004.94	406.15±853.68	475.05±761.63	433.94±819.49
	V%	172.32	210.18	160.34	188.84
Fats (%)	$\bar{X} \pm s_{\bar{x}}$	3.90±0.71	4.24±0.73	3.64±0.71	3.43±0.81
	V%	18.24	17.30	19.70	23.83
Proteins (%)	$\bar{X} \pm s_{\bar{x}}$	3.10±0.32	3.43±0.36	3.48±0.33	3.37±0.37
	V%	10.85	10.67	9.85	11.24
Lactose (%)	$\bar{X} \pm s_{\bar{x}}$	4.73±0.19	4.66±0.22	4.75±0.24	4.64±0.29
	V%	4.17	4.92	5.19	6.32
Dry matter (%)	$\bar{X} \pm s_{\bar{x}}$	12.74±0.97	12.72±0.69	12.35±0.90	12.18±0.89
	V%	7.68	5.49	7.31	7.34
Urea (mg/100 g)	$\bar{X} \pm s_{\bar{x}}$	21.94±9.75	24.55±7.91	29.14±7.87	27.65±6.25
	V%	44.48	32.25	27.00	22.61
Casein (g/l)	$\bar{X} \pm s_{\bar{x}}$	26.54±2.58	26.88±2.90	26.48±2.87	26.43±2.84
	V%	9.74	10.82	10.85	10.74
Density (g/l)	$\bar{X} \pm s_{\bar{x}}$	1029.15±0.89	1029.70±0.76	1029.22±1.06	1029.73±1.03
	V%	0.08	0.07	0.07	0.10
pH	$\bar{X} \pm s_{\bar{x}}$	6.65±0.10	6.68±0.16	6.63±0.13	6.59±0.13
	V%	1.55	2.51	2.08	2.07

From the data presented in Table 3, for year 2017, we observe that the analysed samples had a very good homogeneity regarding the following characters: lactose, dry matter, density and pH (for all the counties). A medium homogeneity was recorded for protein and casein content, also for all the counties. The obtained values were inhomogeneous for the following characteristics: bacterial count, somatic cell count, as well as for fat and urea content. The results obtained from the analysed samples gathered in 2018 show a very good homogeneity for lactose, dry matter, density and pH; a good homogeneity for protein and casein content and an in-homogeneity for bacterial count, somatic cell count, fat and urea content. A possible explanation of those recorded data could be that the small farmers didn't fully respect the welfare conditions for animals. In Tables 5 and 6 are presented, on seasons, data regarding raw milk microbiological and proximate composition gathered, in 2017 and 2018.

Table 5. Variation of microbiological and proximate composition of raw milk samples in 2017 seasons

Specification		Bacterial count (ufc/ml)	Somatic cell count (scc/ml)	Fats (%)	Proteins (%)	Lactose (%)	Dry matter (%)	Urea (mg/100 g)	Casein (g/l)	Density (g/l)	pH
Botosani											
Spring	$\bar{X}$	142.32	562.92	3.83	3.38	4.25	12.32	22.90	25.20	1029.13	6.66
	$s_{\bar{x}}$	140.34	1222.14	0.66	0.30	0.12	0.92	8.88	2.32	0.80	0.08
	V(%)	134.25	161.04	12.35	9.21	3.62	2.34	39.90	9.23	0.02	1.33
Summer	$\bar{X}$	152.32	403.40	3.62	3.25	4.21	12.12	26.66	25.20	1029.14	6.61
	$s_{\bar{x}}$	150.34	723.99	0.66	0.29	0.20	0.92	11.44	2.31	0.96	0.13
	V(%)	189.44	139.45	19.39	9.29	4.45	2.12	42.91	9.00	0.09	2.06
Autumn	$\bar{X}$	131.12	324.99	4.01	3.49	4.69	12.43	21.40	22.43	1029.20	6.66
	$s_{\bar{x}}$	142.44	593.60	0.23	0.31	0.20	0.99	5.21	2.56	0.92	0.10
	V(%)	136.25	129.63	19.32	9.96	4.39	2.66	26.69	9.35	0.08	1.50
Winter	$\bar{X}$	112.12	692.55	3.99	3.43	4.29	12.33	19.12	26.52	1029.11	6.65
	$s_{\bar{x}}$	121.14	1166.39	0.69	0.33	0.19	0.94	9.41	2.55	0.86	0.08
	V(%)	104.52	169.64	12.39	9.26	3.95	2.30	44.00	9.60	0.08	1.31
Iaşi											
Spring	$\bar{X}$	216.27	536.03	4.089	3.41	4.79	12.90	25.33	26.98	1029.37	6.66
	$s_{\bar{x}}$	237.43	888.94	0.90	0.30	0.19	0.97	8.86	2.41	0.87	0.07
	V(%)	206.33	165.83	22.09	9.06	4.01	7.54	35.01	8.94	0.08	1.12
Summer	$\bar{X}$	266.72	487.96	3.87	3.27	4.72	12.64	24.86	26.10	1029.21	6.63
	$s_{\bar{x}}$	273.22	949.42	0.81	0.32	0.20	1.04	7.64	2.59	0.87	0.05
	V(%)	202.23	194.56	20.95	9.87	4.41	8.25	30.73	9.93	0.08	0.81
Autumn	$\bar{X}$	266.27	248.26	4.26	3.59	4.673	13.11	22.66	28.64	1029.24	6.65
	$s_{\bar{x}}$	273.55	464.07	0.86	0.35	0.25	0.91	5.97	2.88	0.82	0.06
	V(%)	226.22	186.93	20.30	9.96	5.37	6.97	26.37	10.06	0.07	0.97
Winter	$\bar{X}$	109.37	728.13	4.12	3.591	4.790	13.039	24.647	28.06	1029.45	6.62
	$s_{\bar{x}}$	337.34	1058.57	0.95	0.32	0.21	0.97	7.82	2.46	0.91	0.06
	V(%)	222.56	145.38	23.13	8.98	4.43	7.48	31.75	8.78	0.08	0.93
Neamţ											
Spring	$\bar{X}$	176.27	325.51	3.82	3.53	4.80	12.67	22.00	25.42	1029.75	6.63
	$s_{\bar{x}}$	187.43	713.01	0.71	0.34	0.22	0.77	10.20	2.95	0.75	0.13
	V(%)	106.33	219.04	18.49	9.72	4.61	6.05	46.35	11.59	0.07	1.95
Summer	$\bar{X}$	266.72	483.84	4.26	3.35	4.66	13.64	27.80	24.51	1030.01	6.67
	$s_{\bar{x}}$	178.11	853.08	0.70	0.33	0.22	0.98	11.06	2.63	0.85	0.13
	V(%)	101.13	176.32	16.40	9.90	4.74	7.22	39.79	10.71	0.08	1.98
Autumn	$\bar{X}$	186.27	375.65	4.07	3.42	4.65	13.11	23.61	27.16	1029.81	6.62
	$s_{\bar{x}}$	278.55	924.27	0.71	0.34	0.25	1.06	10.91	2.91	0.88	0.15
	V(%)	126.21	246.05	17.35	9.79	5.45	8.12	46.21	10.70	0.09	2.31
Winter	$\bar{X}$	79.87	378.64	3.98	3.46	4.76	12.92	19.27	26.89	1029.83	6.65
	$s_{\bar{x}}$	87.84	717.46	0.72	0.35	0.25	0.99	10.96	2.84	0.80	0.11
	V(%)	112.56	189.49	18.00	10.16	5.33	7.66	56.86	10.55	0.08	1.60
Suceava											
Spring	$\bar{X}$	163.76	435.31	3.71	3.22	4.76	12.48	23.68	24.98	1030.04	6.66
	$s_{\bar{x}}$	166.52	811.62	0.81	0.37	0.23	0.87	7.75	3.00	0.89	0.12
	V(%)	181.50	186.45	21.68	11.50	4.83	6.98	32.75	12.01	0.09	1.86
Summer	$\bar{X}$	202.76	428.76	4.16	3.28	4.63	13.00	26.05	25.57	1030.00	6.63
	$s_{\bar{x}}$	116.57	756.29	0.79	0.33	0.30	0.69	6.92	2.57	0.90	0.12
	V(%)	165.99	176.39	18.93	9.94	6.39	5.30	26.56	10.05	0.09	1.74
Autumn	$\bar{X}$	137.76	284.42	4.02	3.62	4.65	12.80	25.36	28.48	1029.79	6.68
	$s_{\bar{x}}$	121.57	535.60	0.81	0.41	0.30	0.77	7.59	3.24	0.83	0.12
	V(%)	136.63	188.31	20.12	11.40	6.50	6.05	29.92	11.38	0.08	1.87
Winter	$\bar{X}$	102.76	260.96	3.94	3.57	4.70	12.73	26.26	27.95	1029.90	6.61
	$s_{\bar{x}}$	161.53	361.38	0.78	0.41	0.28	0.78	7.11	3.23	0.86	0.14
	V(%)	151.63	138.48	19.87	11.47	5.90	6.09	27.08	11.56	0.08	2.18

For raw milk collected in Botoşani County (2017, all seasons) we obtained very homogenous character for lactose and casein content, density and pH. For bacterial count and somatic cell count those characters were inhomogeneous. The rest of the features had a very good or good homogeneity depending on season. For the rest of counties the results show a good to very good homogeneity for all the studied characters with the exception of bacterial and somatic cell count which were inhomogeneous.

Table 6. Variation of microbiological and proximate composition of raw milk samples in 2018 seasons

Specification		Bacterial count (ufc/ml)	Somatic cell count (scc/ml)	Fats (%)	Proteins (%)	Lactose (%)	Dry matter (%)	Urea (mg/100 g)	Casein (g/l)	Density (g/l)	pH
Botosani											
Spring	$\bar{X}$	162.72	761.97	3.83	3.28	4.75	12.56	22.90	25.70	1029.13	6.66
	$s_{\bar{x}}$	140.76	1227.14	0.66	0.30	0.17	0.92	8.88	2.37	0.80	0.08
	V(%)	136.25	161.04	17.35	9.21	3.67	7.34	38.80	9.23	0.07	1.33
Summer	$\bar{X}$	192.72	703.40	3.62	3.25	4.71	12.27	26.66	25.70	1029.14	6.61
	$s_{\bar{x}}$	150.76	973.89	0.66	0.28	0.20	0.87	11.44	2.31	0.96	0.13
	V(%)	136.25	138.45	18.38	8.79	4.45	7.17	42.91	9.00	0.09	2.06
Autumn	$\bar{X}$	131.12	324.89	4.01	3.48	4.69	12.93	21.40	27.43	1029.20	6.66
	$s_{\bar{x}}$	142.64	583.60	0.73	0.31	0.20	0.99	5.71	2.56	0.92	0.10
	V(%)	112.25	179.63	18.32	8.96	4.38	7.66	26.69	9.35	0.08	1.50
Winter	$\bar{X}$	192.12	687.55	3.99	3.43	4.78	12.93	19.123	26.57	1029.11	6.65
	$s_{\bar{x}}$	121.16	1166.38	0.69	0.33	0.18	0.94	8.41	2.55	0.86	0.08
	V(%)	106.52	169.64	17.38	9.76	3.85	7.30	44.00	9.60	0.08	1.31
Iaşi											
Spring	$\bar{X}$	186.27	639.12	4.02	3.40	4.68	12.64	24.13	26.48	1029.83	6.71
	$s_{\bar{x}}$	237.83	1148.65	0.76	0.32	0.24	0.75	7.72	2.58	0.76	0.27
	V(%)	203.33	179.72	18.99	9.47	5.14	5.96	32.01	9.77	0.07	4.10
Summer	$\bar{X}$	253.72	482.81	4.51	3.16	4.63	12.77	30.79	24.81	1029.61	6.64
	$s_{\bar{x}}$	273.22	931.18	0.58	0.34	0.21	0.66	8.47	2.65	0.75	0.09
	V(%)	202.23	192.86	12.96	11.01	4.71	5.17	27.52	10.70	0.07	1.42
Autumn	$\bar{X}$	203.27	230.22	4.40	3.57	4.63	12.78	22.25	28.06	1029.65	6.69
	$s_{\bar{x}}$	273.55	529.71	0.68	0.33	0.20	0.62	6.35	2.60	0.72	0.07
	V(%)	223.22	230.09	15.52	9.25	4.49	4.87	28.55	9.29	0.07	1.11
Winter	$\bar{X}$	109.37	253.29	4.12	3.53	4.71	12.71	22.60	27.69	1029.68	6.65
	$s_{\bar{x}}$	337.38	528.095	0.74	0.34	0.23	0.72	6.54	2.78	0.79	0.09
	V(%)	222.53	208.49	18.17	9.75	5.00	5.70	28.94	10.04	0.07	1.36
Neamț											
Spring	$\bar{X}$	174.27	537.62	3.64	3.42	4.75	12.41	29.40	26.47	1029.25	6.64
	$s_{\bar{x}}$	157.43	795.23	0.72	0.34	0.25	1.01	8.02	3.05	1.08	0.13
	V(%)	104.33	147.92	19.69	9.85	5.33	8.14	27.28	11.52	0.11	2.03
Summer	$\bar{X}$	244.72	322.66	3.64	3.41	4.78	12.36	29.18	26.99	1029.24	6.63
	$s_{\bar{x}}$	175.11	311.47	0.70	0.34	0.23	0.90	7.73	3.16	1.05	0.14
	V(%)	101.13	96.53	19.34	9.91	4.85	7.28	26.51	11.70	0.10	2.07
Autumn	$\bar{X}$	144.27	405.93	3.63	3.42	4.75	12.34	29.03	26.64	1029.22	6.63
	$s_{\bar{x}}$	275.55	567.41	0.73	0.34	0.24	0.91	7.89	2.82	1.07	0.14
	V(%)	124.21	139.78	20.08	9.89	5.07	7.38	27.18	10.58	0.10	2.10
Winter	$\bar{X}$	72.57	724.86	3.66	3.43	4.74	12.38	29.10	25.63	1029.19	6.63
	$s_{\bar{x}}$	57.54	1217.45	0.71	0.33	0.27	0.88	7.84	2.22	1.03	0.14
	V(%)	102.54	167.96	19.43	9.74	5.63	7.14	26.95	8.66	0.10	2.12
Suceava											
Spring	$\bar{X}$	152.46	564.60	3.95	3.16	4.63	12.12	42.40	26.06	1029.99	6.46
	$s_{\bar{x}}$	116.30	844.79	0.97	0.55	0.22	0.66	0.55	4.31	2.02	0.18
	V(%)	131.60	149.63	24.48	17.44	4.81	5.45	1.29	16.55	0.20	2.74
Summer	$\bar{X}$	192.46	361.39	3.54	3.33	4.68	12.21	28.21	25.88	1029.48	6.54
	$s_{\bar{x}}$	116.57	550.84	0.76	0.32	0.26	0.99	6.14	2.51	0.89	0.12
	V(%)	151.67	3035.19	21.47	9.70	5.57	8.08	21.77	9.69	0.09	1.90
Autumn	$\bar{X}$	164.46	660.94	3.29	3.38	4.63	12.04	28.16	26.20	1029.90	6.62
	$s_{\bar{x}}$	116.57	1087.42	0.80	0.36	0.29	0.89	6.13	2.57	1.08	0.15
	V(%)	151.68	164.53	24.26	10.76	6.36	7.40	21.77	9.79	0.11	2.20
Winter	$\bar{X}$	182.46	292.46	3.61	3.41	4.64	12.39	27.08	26.87	1029.62	6.59
	$s_{\bar{x}}$	116.58	555.80	0.82	0.39	0.31	0.90	6.16	3.08	1.03	0.13
	V(%)	151.68	190.04	22.84	11.49	6.62	7.24	22.76	11.47	0.10	2.02

From the data presented in table 6 (for all seasons from year 2018) the same conclusions, as in 2017, could be drawn. The bacterial and somatic cell count were inhomogeneous while the rest of the features (fat, protein, lactose, dry matter, urea, casein content, as well as density and pH) had a good to very good homogeneity depending on season.

CONCLUSIONS

Milk gathered had a poor microbiological quality with values of BC and SCC close to or even above the threshold of actual sanitary regulations. This was due to the fact that producers did not fully respect the hygiene practices, during milking, storage or transportation of the raw milk.

However, all the raw milk collected fully complied with the en-force regulations of the European Union concerning the physico-chemical quality features but for the safety hygienic ones, including the bacterial count (BC) and somatic cells count (SCC) the values found were higher. Cleaning and disinfection of milking equipment is one of the critical control points for determining the hygienic quality of raw milk.

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