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THE QUALITY OF RAW COW'S MILK FOR THE DIRECT CONSUMPTION[1]

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Abstract: It was stated that the investigated milk was characterized with a high level of the total bacteria count ($1,66 – 5,49 \times 10^6$), from which the psychrotrophs constituted $6,21 – 5,49 \times 10^4$. Above 35 – 47% of the milk samples showed an elevated somatic cell level and presence of the pathogens (*Staphylococcus aureus, Streptococcus agalactiae, disagalactiae, uberis*, *Escherichia coli*, *Pseudomonas* sp.). Temperature of the milk was also high (9,5 – 21,2 °C).

Keywords: raw milk quality, milk composition, microbiological quality

Introduction and literature review

After integration of Poland with UE countries the quality of cow's milk still improves. Delivery of milk in extra class to milk plant ranged from 31 to 90 % of total amount of it in dependancy to country region. Milk of the lowest quality is produced in South of Poland (31-45% in extra class) in opposite to the highest quality of it in East and North region (75-90% in extra class). In this number raw milk is offered at town's market places (30-50 % of total production) to direct consumption without pasteurisation. The quality of this kind of milk was subjected to our investigations.

Kamieniecki et al. (2004) described the most important factors affecting the hygienic quality of milk. As factors decreasing somatic cell count they mentioned: outdoor access for cows in the summer season, approximately 12-hour intervals between morning and afternoon milking, pre-milking udder and teat cleaning by wiping, appropriate level of concentrate (4 – 10 kg/day), using of MgO additive in the feeding ratio for cows and avoiding milk from mastitis cows in calf feeding. These authors concluded that the following factors decreased total microorganism count in milk: short-length (<200 cm) cubicles for cows, use of antibiotics at drying-off, practicing for-stripping after udder and teat cleaning, pre-milking udder and teat cleaning by wiping, manual post-milking udder massage, using of the „Duovac" device in milking, and using of vitamin A supplement in cows feeding in the transition period (*Kamieniecki et al.,2004)*.

Skrzypek et al. (2004) showed that foremilking using forestripper was associated with lower somatic cell count and total microorganism count compared to foremilking without a forestripper. Herds in which foremilking was performed before udder and teat cleaning were characterized by heaving higher somatic cell count and lower total microorganism count as compared with herds where both routines were performed in reverse order. The lowest somatic cell count was found in herds where udders and teats were cleaned prior to milking by washing with water containing a desinfectant or wiping with a dry towel. The higher level of somatic cell count was found in herds where wiping with a cotton towel soaked with pure water or teat dipping in soaking foam was practiced.

Sawa (2004) concluded that the following factors were found to have a beneficial effect on the hygienic quality of milk: the free-stall system, milking in milking parlors or pipeline machines, milking machines regulated by pulsation, storing dairy utensils in special rooms, the frequency of dairy utensil preservation according to their servicing instructions as well as cooperation with veterinary surgeons. The lack of pre-milking, not washing and draining of udders before milking and not dipping them after milking as well as problems with cows drying off were the basic factors contributing to an increase in the number of somatic cells in the milk.

Górska and Mróz (2004) showed that only 59% of all cows produced milk which acidity met the standard Polish requirements (6,0-7,5 °SH). During the period of pasture feeding many more cows (over twice the number) produced milk of unnatural acidity than during the period of cowshed feeding. The share of milk characterized with titrametric acidity meeting the standard Polish requirements was evaluated at 43,9% (summer) and 75,4% (winter).

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In oppinion of *Czaplicka (1999)* resistency to mastitis was determined by share of HF genes. The best results were obtained for cows with 50% of HF, but the worst for crossbreeds of 25% or 75% of HF. *Kuczaj (2002)* compared somatic cell level in milk of Black and White as well as Red and White cows. In milk of Red and White cows it was 3-times higher ($10^3 \times 318,5$; $10^3 \times 110,2$ / cm^3) than in milk of Black and White cows.

Czerw et al. (2004) evaluated thypical pathogenes cousing subclinical mastitis. In their opinion in milk of mastitis cows following bacteria were present: coagulase positive staphylococci (*Staph. aureus, Staph. intermedicus*), *Strep. agalactiae, Arcanobacterium*, *E. coli,* coagulase negative staphylococci (*Staph. epidermis)* and *Enterococcus* sp. Number of mastitis caused by these bacteria fluctuated during the whole year, the highest its level was noted during July and November (29 and 39%, respectively). The total bacteria number in milk according to standard Polish requirements should not be higher than $1,0 \times 10^5$ (extra class) or $4,0 \times 10^5$ (I class). Temperature of the delivered milk should be not higher than 8°C (PN-93/A86004).

The aim of the study was to investigate the composition, physicochemical traids and microbiological quality of raw cow's milk for the direct consumption.

Material and methods

The investigations were carried out on the raw cow's milk from market places (15-17 samples per month) during the whole year. The milk was not preserved and cooled and the followind parameters were evaluated:

- sensoric analysis (5-point scale),
- basic composition (dry matter, non fat dry matter, fat, protein and casein, lactose, ash content) using Milkoscan,
- physicochemical traits (density, temperature, titrametric and potential acidity),
- hygienic quality (antibiotics and inhibitory substances presence – Pollutest M, Whiteside test, total cell count - Fossomatic),
- microbiological quality (total bacteria count, psychrotophic bacteria, coliforms, moulds and yeasts counts, pathogenes presence) according to PN-93/A86004.

Results and discussion

Obtained data were presented in tables 1-3. Sensoric quality and basic composition of examined milk was satisfactory. It was shown that values of parameters were higher during the winter period in opposite to summer period. This relation could be explained by differences in milk yield of cows (table 1).

Table 1. Sensoric quality, basic composition and milk density affected by the season of the year

Parameter	Spring (III, IV, V)	Summer (VI, VII, VIII)	Autumn (IX, X, XI)	Winter (XII, I, II)
Sensoric analysis (p.)	4,42 ± 0,36	4,21 ± 0,16	4,38 ± 0,27	4,67 ± 0,57
Dry matter (%)	12,92 ± 1,05	12,60 ± 0,99	12,82 ± 1,14	13,10 ± 0,96
Non fat d.m. (%)	8,70 ± 0,41	8,55 ± 0,52	8,67 ± 0,70	8,79 ± 0,65
Total protein (%)	3,29 ± 0,34	3,20 ± 0,27	3,25 ± 0,19	3,30 ± 0,28
Casein (%)	2,67 ± 0,20	2,62 ± 0,23	2,66 ± 0,24	2,70 ± 0,19
Fat (%)	4,22 ± 0,52	4,05 ± 0,67	4,15 ± 0,58	4,31 ± 0,41
Lactose (%)	4,70 ± 0,21	4,65 ± 0,19	4,69 ±0,15	4,74 ± 0,26
Ash (%)	0,71 ± 0,05	0,70 ± 0,07	0,73 ± 0,08	0,75 ± 0,04
Density (g/cm^3)	1,0290 ±0,0051	1,0285 ±0,0046	1,0286 ±0,0035	1,0292 ± 0,027

Data presented in table 2 revealed that such parameters as temperature and microbiological quality (total bacteria count, psychrotophic bacteria, coliforms, moulds and yeasts counts) and titrametric acidity were unsatisfactory. The worst milk quality was observed during hot months, especially during summer and

autumn period. Offered for direct consumption milk was obtained from mastitis cows. It was shown by Whiteside test results (35,1 – 47,3% of positive reactions in dependence of the season of the year).

Table 2. Selected physicochemical parameters and hygienis quality of the milk affected by the season of the year

Parameter	Spring (III, IV, V)	Summer (VI, VII, VIII)	Autumn (IX, X, XI)	Winter (XII, I, II)
Temperature (°C)	15,4 ± 4,6	21,2± 5,7 A	16,9 ± 6,7	9,5 ± 4,0 A
pH	6,55 ± 0,10	6,50 ± 0,13	6,57 ± 0,14	6,62 ± 0,11
Acidity (°SH)	8,03 ± 1,30	8,42 ± 1,01	8,11 ± 1,24	7,42 ± 0,83
Antybiotics and inhibitory substances (% "+")	2,8	1,1	2,6	3,5
Whiteside test (% "± or +")	41,4	35,1	43,1	47,3
Total microorganism count (cfu/cm^3)	1,86±0,28×10^6 A	5,49±0,84× 10^6 A, B, C	2,19±0,57×10^6 B	1,65±0,32× 10^6 C
Psychritrophic bacteria (cfu/cm^3)	6,52±3,05×10^5	6,21±1,89× 0^5	6,83±3,08×10^5	7,52±3,44×10^5
Coliforms (cfu/cm^3)	5,72±1,83×10^4 A, a	7,54±2,4 ×10^5 A, B	9,63±2,17×10^4 B, C, a	6,36±2,18×10^3 A, C
Yeasts and moulds (cfu/cm^3)	4,27±1,83×10^3 A, D	6,65±3,74×10^5 A, B, C	7,69±5,72×10^4 B, D, E	1,74±0,26×10^3 C, E

A, B, C, D, E – $p \leq 0,01$
a – $p \leq 0,05$

This observation is supported by the results presented in table 3. The somatic cell number ranged from 3,1 × 10^5 to 7,6 × 10^5 in relation to season of the year. The major pathogenes present in milk were: *Staph. aureus, Str. agalactiae, Micrococcus* sp., *Arcanobacterium pyogenes*. The Polish standard requirements regarding the cell count number show no more of it than 4,0 × 10^5 (extra class) or 5,0 × 10^5 (first class) (PN-93/A86004).

Table 3. Pathogenic species number and somatic cell count in milk in different seasons of the year

Parameter	Spring (III, IV, V)	Summer (VI, VII, VIII)	Autumn (IX, X, XI)	Winter (XII, I, II)
Str. aureus	10	8	8	17
Str. intermedicus	6	4	1	5
Str. epidemis	3	1	1	3
E. coli	2	1	1	2
Str. agalactiae	5	7	7	2
Str. uberis	1	3	3	1
Enterococcus spp.	8	9	10	7
Micrococcus ssp.	9	10	11	8
Arcanobacter pyogenes	6	7	8	5
Somatic cell count	6,1×10^5 ± 1,0 ×10^4	3,1×10^5 ± 1,1 ×10^4	6,8× 10^5 ± 1,4 × 10^4	7,6 × 10^5 ± 1,2 × 10^4

Similar data was obtained by *Grega and Sady (1999).* They estimated the total bacteria count in raw cow's milk offered for direct consumption at 5,32 × 10^6, temperature – at about 5,5-17,5°C (winter-summer period). The major pathogenes in milk were *Micrococcus* sp., *Str. faecalis*, *Canidia* sp. and total somatic cell count reached 2,77 ± 0,75 × 10^6.

Conclusions

1. Raw milk offered for direct consumption has poor macrobiological quality and is obtained from mastitis cows.
2. The reason of this fact is unsatisfactory sanitary conditions in cool chain, storagening, transport and distribution of investigated milk.

KVALITET SIROVOG KRAVLJEG MLEKA ZA DIREKTNU KONZUMACIJU

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Rezime

Zabrinutost potrošača o prerađevinama i značaju bio-aktivnih komponenti mleka u Poljskoj je u porastu i utiče na povećanje potražnje za svežim/sirovim kravljim mlekom za neposrednu konzumaciju. Zavisno od regiona 30 do 50% proizvednog mleka se prodaje na gradskim tržnicama.

Cilj istraživanja je bio ispitivanje kvaliteta takvih proizvoda u različitim sezonama/godišnjim dobina tokom godine. Mleko je sakupljano na gradskim tržnicama u Krakovu od indobidualnih proizvođača i podvgnuto: sensornoj oceni, hemijskoj analizi (suva materija, nemasna suva materija, nivo masti, proteina, laktoze, kazeina, minerala, itd.), fizičko-hemijskoj analizi (temperatura, gustina, titrirani aciditet °SH, pH), analizi higijene (prisustvo inhibitora i antibiotika, broj somatskih ćelija), mikrobiološkoj analizi (ukpan broj bakterija, broj psihrotrofnih i kiselih bakterija, broj koliforma, kvasca i plesni, prisustvo patogena). Ispitivano mleko je imalo visok nivo ukupnog broja bakterija ($1,66 – 5,49 \times 10^6$), od kojih psihrotrofne su činile $6,21 – 5,49 \times 10^4$. Navedeni 35 – 47% uzoraka mleka je pokazalo povećan broj somatskih ćelija I prisustvo patogena (*Staphylococcus aureus, Streptococcus agalactiae, disagalactiae, uberis*, *Escherichia coli*, *Pseudomonas* sp.). Temperatura mleka je takođe bila visoka (9,5 – 21,2 °C). Fluktuacije u nivou gore navedenih faktora zavise od sezone u godini. Prema poljskim normama i standardima za sveže mleko za direktnu potrošnju ukupni broj bakterija ne može biti veći od 10×10^5, temperatura – ne viša od 8 °C I odsustvo patogena. Istraživanje je pokazalo da je mleko na ponudi bilo lošeg higijenskog stanja I da je verovatno dobijeno od krava koje imaju mastitis ili nije adekvatno skladišteno u rashladnim prostorijama.

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