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EFFECT OF SUPPLEMENTING DAIRY COWS WITH LIVE YEASTS CELLS AND DRIED BREWER'S YEASTS ON MILK CHEMICAL COMPOSITION, SOMATIC CELL COUNT AND BLOOD BIOCHEMICAL INDICES

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ABSTRACT

The aim of the study was to verify the activity of brewer's yeasts (*Saccharomyces cerevisiae*) given to cows in various forms – live S.c. yeasts cells and dried S.c. yeasts – before calving (21 days) and after calving (80 days) on the chemical composition of milk, somatic cell count in milk, and on some physiological-biochemical parameters of the cows' blood and their health status. The experiment was conducted in a cattle farm at Malerzowice Małe on 75 cows of Polish Holstein-Friesian breed (red and white variety) maintained in the tether system; the cows calved in summer season. The experiment included 2 experimental groups, and the control one, 25 cows in each. All groups of cows were fed with feeding dose balanced according to INRA standards. Dry animals were given complete TMR dose with straw addition, and milking cows – basic dose, partially mixed (PMR), standardized on the yield of 16 kg milk per day. The animals had constant access to water and salt licks. Mean milk yield from the cow on farm was ca. 7000 kg. The cowshed stayed under constant veterinary supervision, it was free from infectious diseases – contagious and invasive ones. The following additives were introduced to the basic doses: brewer's yeasts preparation (Saccharomyces cerevisiae) Leiber BT in amount of 200 g/head/day (gr. I) and an addition of 1 g/head/day of live yeasts (gr. II). Fat content in milk increased significantly in the group of cows receiving dried yeasts addition, and their health status was improved. Also some blood biochemical indices in these cows (protein and globulins level) were higher. An addition of dried yeasts (dead cells) used prepartum caused a significant increase in the level of GGTP, lactic acid, and a significant decrease in urea content compared to the control group. Significant increase in the level of AST, proteins, globulins and glucose and a decrease in urea content was noted at the 80th day of lactation in the group receiving dried yeasts addition. Significant increase in GTP and glucose and significant decrease in the content of lactic acid and cholesterol were noted in a period of 80 days of lactation in cows from group II (live yeasts addition). Other values in cows fed with live cells of Saccharomyces cerevisiae yeasts were like in the control group. Both before and after calving, the level of haptoglobin in cows blood was similar. No symptoms of inflammatory states related to yeasts application were noted.

Key words: lactating cows, brewer yeast, milk components, somatic cells, serum indices, haptoglobin, cows health status.

INTRODUCTION

Analyses of the reasons for somatic cell count (SCC) increase in cow milk was performed at the turn of the 20th century by renown specialists [14, 22]. It was accepted that the principal reason for this phenomenon is inflammatory state of udders (*mastitis*) caused by the main accompanying pathogens and minor environmental ones. From that time, the results of numerous

scientific studies have proved that various factors which are significant in this problem should be taken into consideration.

For example, De Vries et al. [5] emphasized the significance of cows hygiene during dry period, since these factors affect SCC decrease in milk. The influence of cows behavior and hygiene in a cowshed on SCC increase in milk were subjected to examination. A strict study was conducted in a free-stall cowshed, accepting a SCC increase of above 200 thousands/ml as subclinical mastitis. The lairs with sand, access ways to crib and milking machine were cleaned a few times per day and monitored for 4 months. Poor cleaning of access ways, long cows laying resulted in a worse udder hygiene. An increase in milk SCC was noted during the study in 24 cows (34.8%) among 69 heads in the herd. Cleaning of access ways and lairs is of a significance for SCC decrease in milk [5].

Wenz et al. [34] based on an analysis of large population of cows concluded that mastitis cases based on environmental pathogens infections occur 4-5 fold more frequent in dry period than during lactation. This proves that these mastitis related pathogens affect SCC in milk much stronger than it had been supposed previously. Further studies in dairy cows herds concerning the presence of accompanying pathogens demonstrated that there is a strong correlation between SCC in milk and breeding conditions, which presumably reduced an occurrence of mammary gland inflammation state caused by an activity of environmental pathogens [34]. This phenomenon is characteristic for the herds in which mastitis accompanying pathogens stayed under control.

The representatives of science and veterinary services in the USA [34] elaborated statistically the data concerning cattle performance value assessment conducted in 2002 in 80% of dairy cows in 21 states. The farms were divided according to SCC in milk on three groups: <200, 200–400 and >400 thousands/ml. It was noted than in bulk tank milk SCC is significantly affected by the following factors: temperature, total milk yield (> 9000 kg), herd size (> 500 heads), mattresses on the lairs, cows milking using milking machines, calves weaning after 24 hours, pastures using, vaccination against *mastitis*, antibiotics application during dry period, cleaned concrete floor (a positive influence except the temperature).

Dufour et al. [8] analyzed statistically the data selected from 3000 scientific reports examining relationship between milk SCC and other factors affecting this number. The authors concluded that milk SCC is significantly affected by the following factors: teats disinfection after milking, proper course of cows drying, sanitary state of clothes and gloves of the milkman, lairs with sand, addition of selenium and milking sites cleaning.

Bouchard et al. [2] presented the programme of protection against *mastitis* preventing high milk SCC level. One of the postulates was stimulation of cows organism immunity by vaccination and an application of suitable dietary supplements.

Heinrichs et al. [15] discussed an influence of some nutritional components on mastitis occurrence in heifers. Selenium, vitamin E and copper increase phagocytary activity, which decreases the risk of mastitis occurrence. Vitamin A and β-carotenes improve mucosa surface, but the results are not unequivocal, like in the case of zinc addition. Also Machado et al. [20] applying an subcutaneous injection of preparation containing 300 mg Zn, 50 mg Mn, 25 mg Se and 75 mg Cu in the first day of dry period, in the 30th day *ante partum* and 30th day *postpartum* noted SCC decrease and lower number of mastitis cases. Similarly Youssel et al. [36] used the preparation containing vitamin A (200 thousands IU), vitamin E (100 mg), vitamin C (20 mg) and volatile oils to cows in early lactation noted a decrease in milk SCC.

Gotowiecka et al. [13] administered vitamin – enzymatic preparation (Masti Veyxym) to cows with aseptic subclinical mastitis form. A decrease in SCC in milk <400 thousands/ml was noted in 80% of the examined cases in the 2nd week after preparation administration, while in the control group similar decrease was observed only in 22% of the cases.

A veterinary assessment of the reasons of SCC increase in milk is quite divergent. According to Harmon [14] and Malinowski [22], subclinical mastitis caused by infection with environmental pathogens leads to somatic cell count in milk in the range between <300 thousands/ml and >200 thousands/ml. There was a search for a threshold SCC value in milk of cows which are infected and non-infected in dry period between the last and first milking. It is proposed to accept the threshold value of 200 thousands SCC/ml. The pointed threshold in the USA demonstrates a susceptibility of 0.47, and specificity of 0.82 for subclinical mastitis detection [21, 27].

Relationship between milk SCC and animals exposure on high temperature activity was demonstrated. Heat stress affects an increase in milk SCC (by 40 thousands SCC/ml) compared to the cows maintained in thermoregulated environment [9]. An occurrence of mastitis in cows was examined in various climatic zones of India [29]. A significant increase in *Streptococcus spp.* pathogens was observed in summer. A wide study on milk SCC in the USA demonstrated their highest level in the states with moderate temperature [34].

The results from 80 dairy cows farms in Great Britain and mastitis influence on fertility were verified using the statistical model [16]. It was observed that high SCC level in milk decreases fertility indices, SCC higher than 400 thousands/ml elongates an inter-calving interval of 30 days. Subclinical and clinical mastitis reduce well fertility indices in cows.

Desnoyers et al. [4] elaborated meta-analysis from 157 experiments concerning an addition of yeasts cultures in cows feeding. It was noted that this additive causes in cows an increase in: fodder uptake, milk yield, rumen pH, somatic cell count in milk and organic matter digestibility. This increase is more distinct with an increase in complete fodders share in a feeding dose. The authors also suggest that an amount of lactic acid in rumen and blood is subject to a decrease. An addition of live yeasts cells eliminates negative effect of complete fodders increase in cows feeding dose. Yeasts or their products, e.g. MOS – component

of yeasts cell membrane – act as highly active ligands binding gram-negative bacteria, which have type 1 fimbriae for mannose. With an absence of mannanooligosaccharides digestion, mannose-related pathogens are subject to excretion with feces. The American authors claim that MOS may temporarily substitute applied previously preparations of antibiotic character [24].

Other components of brewer's yeasts cell membranes, beta-1,3/1,6-glucan (beta-glucans) causes an immunomodulating effect, especially when added to the feed for poultry and pigs. This activity was also demonstrated in a few experiments in dairy cattle, especially calves and also lambs [23]. There is however lack of strict experiments on dairy cows. The research on an influence of brewer's yeasts on milk SCC are nearly entirely unrecognized.

The aim of this study was to verify an activity of brewer's yeasts addition (*Saccharomyces cerevisiae*) applied to the cows in various form – live cells of *S.c.* yeasts and dried *S.c.* yeasts – before calving (21 days) and postpartum (80 days) on milk chemical composition, somatic cell count in milk and on some physiological-biochemical blood indices and cows health status.

MATERIALS AND METHODS

The experiment was conducted on cattle farm in Malerzowice Małe on 75 cows (in II or III lactation) of Polish Holstein-Friesian breed (red and white variety) maintained in tether system; the cows calved in summer season. The scheme of the experiment included 2 experimental groups and the control one, 25 heads in each. The cows were housed on a chain tether for the whole experimental period. The dairy of the experiment was established in the cowshed for all the cows (3 groups).

All groups of the cows were fed with a feeding dose balanced according to INRA standards. Dry animals were given a complete TMR dose with straw addition, and milking cows – basic dose, partially mixed (PMR), standardized on the yield of 16 kg of milk per day. The animals had a constant access to water and salt licks. Mean milk yield from the cow on the farm was ca. 7000 kg. The cowshed stayed under a constant veterinary care, it was free from infectious diseases – contagious and invasive ones.

The dose for dry cows included: maize silage (whole plants) – 25 kg, wilted grass silage – 15 kg, fresh brewer's grains – 5 kg, feeding straw (mean uptake ca. 2 kg head/day), own complete fodder – 2 kg (maize grains meal – 25%, rapeseed meal – 25%, wheat barn – 25%, barley grain meal – 25%) plus 100 g of B 7-tan mineral-vitamin mixture.

Milking cows of a yield up to 16 kg of milk per day were given 25 kg of maize silage (whole plants), 15 kg of wilted grass silage (Perennial Ryegrass), 5 kg of fresh brewer's grains, 2 kg of feeding straw, 2 kg of own production complete fodder (maize grains meal – 25%, rapeseed meal – 25%, wheat barn – 25%, barley grain meal – 25%), an addition in early lactation period: – 0.5 kg of soybean meal, 1.0 kg of rapeseed meal, 150 g of B 7-tan mineral-vitamin mixture (Therabio Comeron – France).

The following additives were used to the basic doses: an addition of brewer's yeasts preparation (Saccharomyces cerevisiae) Leiber BT in amount of 200 g/head/day (group I) and an addition of 1 g/head/day of live yeasts cultures (group II). Yeasts additions in a suitable ration were carefully mixed with the complete fodder (premix) and given individually, by hand, to the cows from the experimental groups (I and II). The feeding doses with additives were given to dry cows 3 weeks prepartum, i.e. from second half of March to the end of April, and after calving up to 100th day of lactation, i.e. from the 1st decade of April to the 2nd decade of November. Cows from the control group (III) were fed with the basic feeding dose without yeasts addition.

Cows feeding and nutritional value of provided feeding dose and subsequent fodder lots was evaluated one a month. The content of basic nutritional components in fodder samples was estimated using conventional methods in the laboratory of the Department of Animal Nutrition and Feed Management, Wrocław University of Environmental and Life Sciences. Calcium was determined using the method of atomic absorption spectroscopy (ASA), while phosphorus using colorimetric method.

The nutritional value of PMR dose adjusted to daily yield of 16 dcm^3 was as follows: 28.82% DM, 12.0% total protein, 20.1% fiber, 19.7% starch, 6.5% ash, 0.44% Ca and 0.32% P. Energy amount in 1 kg DM was estimated as 0.85 JPM or 1.4 Mcal NEL. Higher milk yield was awarded with an addition of complete fodder (1 kg of fodder per 2 kg of milk) of the following nutritional value (1 kg): 6.53 MJ NEL, 174 g total protein, 2.15 g Ca and 7.06 g P.

The concentration of components in Leiber BT dietary additive (containing 40% of brewer's yeasts) in 1 kg of dry matter was as follows: 25.0% total protein, 3.0 crude fat, 05 crude fiber and 4.0 crude ash; amino acids (in %): lysine 1.8, methionine 0.6, cystine 0.6, tryptophan 1.6, threonine 1.15; mineral components (in mg/100 g): Ca 230.8, P 1038.4, Mg 53.5, Fe 7.95, Mn 0.45, Zn 10.5, Cu 0.9, Na 25.0.

Chemical composition of 1 kg of mineral-vitamin mixture B7-tan (Therabio Comeron, France) was as follows: P 70 g, Ca 210 g, Mg 40 g, NaCI 80 g, Mn 4000 mg, Zn 6000 mg, Cu 800 mg, vit. A 500 thousands IU, vit. D3 80 thousands IU, wit. E 1 thousands IU, vit. B 100 mg, Co 20 mg, J 40 mg, Se 20 mg, + oils lowering protein decomposition in the rumen.

The control of milk performance was conducted once a month (administration control). Routine analysis of milk chemical composition were performed in the Laboratory of Milk Assessment in Opole. The content of basic components was determined in milk samples, including urea content using Combi Foss apparatus (Foss Electric, Denmark). In turn, somatic cell count (SCC) in milk was examined each 2 weeks on Somacount-120 apparatus (Bentley) in the Laboratory of Milk Assessment and Analysis, Wrocław University of Environmental and Life Sciences.

Blood for examinations was collected from 8 cows in a group from jugular vein 2 hours after morning cows feeding. Blood

biochemical indices were examined in serum on Pentra 400 biochemical analyzer (Horiba ABX) in the laboratory of the Department of Environment Hygiene and Animal Welfare, Wrocław University of Environmental and Life Sciences.

Rumen fluid were collected from liquid layer with special tube and bacterial count was determined by using aparaturs for determination bacteria in milk (type Bactocount-70, Bentley).

The numerical data were elaborated using GLM procedure [32], with an application of the least squares method, according to the following model:

$$Y_{ijk} = u + a, + b_j + e_{ijk}$$

where:
u – general mean,
a – subsequent lactation effect (1, 2, 3+further),
b_j – effect of first control milking yield (kg of milk),
e_{ijk} – experimental error.

Significance of the differences between the groups of cows was determined using Scheffe's test [32].

RESULTS AND DISCUSSION

The changes in chemical milk composition during the study are provided in Table 1.

Table 1. Chemical composition of cow milk depending on yeasts kind and month of lactation [%]

Group	Month of lactation	Milk components							
		Dry matter		Fat		Protein		Lactose	
		$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd
Saccharomycescerevisiae – dried brewer's yeasts	1	12.64b	±0.81	4.00b	±0.73	3.11	±0.25	4.85	±0.08
	2	12.52b	±0.78	4.06b	±0.79	2.94	±0.21	4.82	±0.12
	3	13.50a	±1.39	4.82b	±1.18	3.16	±0.40	4.79	±0.11
In total		12.87	±1.09	4.30	±0.98	3.07	±0.33	4.82	±0.11
Brewer's yeasts – live cells	1	12.99	±0.83	4.40	±0.66	3.13	±0.26	4.78	±0.14
	2	12.34	±0.79	3.89	±0.82	2.98	±0.20	4.79	±0.13
	3	12.83	±0.86	4.24	±0.77	3.10	±0.24	4.77	±0.11
In total		12.72	±0.87	4.18	±0.77	3.07	±0.33	4.78	±0.13
Control	1	12.79	±1.00	4.15	±0.94	3.12	±0.37	4.84	±0.10
	2	12.57	±0.99	4.01	±0.98	3.05	±0.22	4.83	±0.09
	3	13.18	±0.82	4.39	±0.66	3.32	±0.35	4.78	±0.15
In total		12.85	±0.96	4.18	±0.87	3.16	±0.30	4.81	±0.12
a,b – values in the columns marked with different letters differ significantly at $p \leq 0.05$									

Except dry matter and fat content in subsequent months, no statistically confirmed differences in the range of milk chemical composition were noted in the milk of cows receiving an addition of dried yeasts (group I). A significant increase in the level of dry matter and fat was obtained in the third month in milk from group I cows.

Schwarz et al. [33] conducted the study on 7 farms of HF breed cows concerning an addition of live cells of*Saccharomyces cerevisiae* during the first 120 days of lactation. No differences in cow milk yield and milk SCC were noted in this study. The reaction of cows given the yeasts before calving on this additive used postpartum was poorer.

The results of previous studies related to an application of brewer's yeasts in dairy cows feeding in a form of preparations containing also other components except live yeasts cells [3] point an increase in fodder uptake, an increase in milk yield during the first 100 days of lactation, an increase in fat content in milk, higher decomposition of organic matter and protein in rumen, higher share of N bacteria in duodenum. The effects were better with higher NDF content in a dose.

Somatic cell count in milk in this study was on a relatively high level (Tab. 2) especially in the group of cows receiving an addition of live yeasts cells and in the control group.

Table 2. Somatic cell count in cow milk depending on applied yeasts kind and month of lactation (summer periods – heat) ($\bar{x}$±SD)

Specification	Month	Group 1					
		Dried yeasts		Live yeasts cells		Control	
		$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd
SCCx1000	1	333.41	±633.00	950.60	±1622.70	732.50	±1006.31
	2	268.01	±386.50	630.05	±836.85	639.42	±1262.09

	3	370.20	±701.20	729.80	±1466.40	518.60	±653.59
	In total	322.52a	±578.32	770.21b	±1338.80	620.19	±994.49
a,b – values in the rows marked with different letters differ significantly at $p \leq 0.05$							

SCC in milk from cows from group I in the first and second month of the study was on a level almost twice lower compared to groups II and III. In the third sample milking, SCC in milk from cows which were given dried yeasts (group I) was nearly twice lower and reached the value of 370 thousands/ml. Analysis of SCC in the whole experimental period ("In total"), confirmed statistical difference between group I and group II. SCC in milk of cows from group I was within the values for extra class milk. Much lower SCC values in the same cowshed were observed in another study (Tab. 3). The reason may be much lower surrounding temperature. According to the theory of Pantoja et al. [27] clinical mastitis form was not observed in this experiment.

Barkema et al. [1] observed based on the research conducted in Holland (300 dairy cows farms) that low milk SCC values were characteristic for cow herds manager by young and educated farmers. Norman et al. [25] demonstrated that mean SCC values in milk of cows in the USA at the end of 1990ties were ca. 300 thousands/ml. They were slightly lower in winter and distinctly higher in summer. Other authors examining an influence of live yeasts cells addition did not note any milk SCC changes in cows [3, 31]. Only the experiment of Dobicki et al. [6] demonstrated that an addition of dried brewer's yeasts significantly reduced SCC in cow milk (Tab. 3). In this study conducted on the same dairy cows population, a high SCC increase was noted during summer heat compared to the examinations in winter – spring period (Tab. 2).

Table 3. SCC in milk and morphology and biochemical blood parameters with various addition of dried brewer's yeasts preparations (examination in winter – summer period) ($\bar{x}$,Sd) [6]

Groups (additive)	SCC x 10^3/ml	Leukocytes (WBC) 10 x 10^6/l	Erythrocytes (RBC) 10 x 10^9/l	Hemoglobin [mmol/l]	(AST) U/l	(ALT) U/l
Saccharomyces cerevisiae – dried brewer's yeasts	129.80 A ±142.38	9.663 A ±2.337	6.844 A ±0.702	5.950 ±0.504	57.625 A ±8.585	23.125 A ±6.854
MOS (Mannan-oligosaccharide)	244.02 B ±219.37	9.400 A ±2.359	5.963 B ±0.814	5.375 ±0.443	49.750 B ±6.692	20.750 Ba ±5.651
Control	216.44 B ±251.05	7.250 B ±1.056	6.138 B ±0.834	5.538 ±0.635	64.625 C ±12.603	22.375 b ±1.996
Reference values [35]		4–12	5–7	5–8.7	58–100	25–74
Explanation: a,b – significance at $p \leq 0.05$; A, B – at $p \leq 0.01$						

The results of the study conducted by Robinson [30], in which an addition of active dried yeasts was used (Diamond) in amount of 57 g/day before and after calving, did not confirm their effect on fodder uptake degree. However, better energy utilization after calving in cows of HF breed (33.11 vs. 31.51 Mcal EN) and better BCS condition index, were noted. Better utilization of dose energy by cows after calving with an addition of live brewer's yeasts cells was demonstrated by other American specialists [3]. Robinson and Garret [31], 23 days prepartum and up to 56th day of lactation given active dried brewer's yeasts in amount of 56 g/head/day. No influence on fodder uptake in prepartum period was observed. After calving in turn, higher fodder uptake, higher milk yield (by ca. 2 kg) and lower body weight loss were obtained, thus better energy utilization (yield at day 56 in the group of primiparous cows 25.4 vs. 27.8 kg/day; multiparous cows 38.6 vs. 40.4 kg/day). No distinct changes in milk chemical composition were observed.

Table 4 presents physiological-biochemical indices determined pre and postpartum in cows from 3 experimental groups (means from 8 samplings in the group).

Table 4. Biochemical blood indices 10 days before calving and 80 days after cows calving

Groups	ALT U/L	AST U/L	GGTP U/L	Lactic acid [mmol/L]	Urea [mmol/L]	Protein [g/L]	Albumins [g/L]	Globulins [g/L]	Glucose [mmol/L]	Cholesterol [mmol/L]	Triglycerides [mmol/L]
10 days prepartum											
I Dried brewer's yeasts	19.8	76.4	34.8	3.35	3.90	84	29	55	2.42	3.18	0.13
II live yeasts cells	19.3	99.7	29.6	2.44	4.94	78	29	48	2.42	2.36	0.10
III Control	20.9	61.6	25.4	2.68	4.49	75	27	47	2.66	3.67	0.20
80 days postpartum											
I Dried brewer's yeasts	25.1	87.2	33.1	1.64	5.10	80	30	50	3.35	5.54	0.14
II live yeasts cells	32.5	86.4	28.3	1.32	5.64	73	33	40	3.27	4.88	0.14
III Control	24.6	62.3	29.0	1.67	6.26	72	31	41	2.96	5.28	0.14

Some changes in morphological and biochemical blood indices in dairy cows given dried brewer's yeasts were noted in previous study [6]. According Drochner [7], determination of white and red blood cells, hemoglobin and cholesterol has a significant meaning in immunological status assessment. The phenomenon of immunomodulation was observed in cows given dried brewer's yeasts. The results of this study (Tab. 4) may be compared the best with other study on dairy cows performed in similar terms [17].

Slightly lowered level of ALT enzyme, and distinctly elevated AST were noted in the cows prepartum, especially with an addition of live yeasts cells. Also the level of GGTP enzyme was clearly higher with dried yeasts addition. Dried yeasts addition caused an incr3ease in the level of total protein and globulins. This additive was also related to a decrease in cholesterol level, visible even more in case of live cells addition. Moreover, an addition of yeasts (in both groups) caused a decrease in triglycerides level compared to the control group.

No significant differences in the level of liver enzymes (ALT and GGTP) were noted in cows 80 days postpartum. The level of lactic acid and cholesterol was lower in group II. Distinctly lower urea level and higher of proteins and globulins were obtained with dried yeasts addition. Also no significant differences were noted in the levels of other examined biochemical indices of blood.

Higher level of AST enzyme – 62 vs. 87 U/L, was observed in cows in 80th day of lactation in both groups with yeasts addition. Urea level increased in all the groups, however it was in the middle of the standards [34]. The level of protein, globulins and glucose was slightly higher with dried yeasts addition. Other examined biochemical indices were similar in the groups and were within standards limits. Similar like in case of the study by Iwańska et al. [17], the level of cholesterol in 70–90 lactation day was distinctly higher. The results concerning cows blood biochemical indices obtained in this study are similar to the results obtained by Lach [18]. Positive effect of brewer's yeasts addition was noted in cows both before calving and 80 days postpartum.

Acute phase proteins index examined at the end of the experiment is presented in Table 5. No statistically significant differences in the content of haptoglobin in cows blood were noted during the whole experimental period, both before and after calving. Emmanuelson et al. [10] noted in beef cattle an increased level of so called acute phase proteins with yeasts cultures addition, which proves some kind of inflammatory state in an organism.

Table 5. Haptoglobin level in cows blood with brewers yeasts addition [g/l]

Specification	Experimental groups		
	I Dried yeasts	II Live yeasts cells	III Without yeasts
7–10 days prepartum	0.00	0.02	0.09
5–6 weeks postpartum	0.00	0.02	0.00
70–90 days postpartum	0.03	0.04	0.19

In American study [24] the cows were given 60 g of yeasts preparation (*Saccharomyces cerevisiae* – dead and live cells) postpartum, separately or with an addition of 28 g of enzymatically hydrolyzed yeasts cell membranes. Hydrolysate contained mannanooligosaccharides and betaglucans. Yeasts cell membrane about 55% beta-1,3 glucans, 10% beta-1,6 glucans and 40% mannoproteins [19]. Except mannans, they contain N-acetylgalactosamine, D-glucosamine, D-galactosamine, D-glucose, D-galactose, which are characterized by low binding potential.

An addition of mentioned above yeasts clearly affected SCC and clinical mastitis. In case of live cells, there were no changes in parameters given above, but hydrolysate addition, i.e. mannanooligosaccharides and betaglucans, significantly decreased SCC and new cases of clinical mastitis, especially after 8 weeks of application. Franklin et al. [12] using MOS in cows prepartum observed an increase in humoral resistance on rotaviruses, and an increase in blood leucocytes number.

An influence of hydrolyzed yeasts application on SCC may be explained by reaction of potential resistance and its activation by cytokines and initiated cascades of metabolic transformations. Beta-glucans act moreover on intestinal endothelium cells and bind some pathogens, e.g. *Staphylococcus spp.* [11].

Relationships between SCC, mastitis and MOS, and beta-glucans were examined by Proudfoot et al. [28]. A decrease in subclinical mastitis (i.e. SCC<200 thousands/ml) and clinical mastitis cases were noted. Mechanism of an activity of brewer's yeasts cells components has not been fully recognized so far. Öztürk et al. [26] did not observe any differences in in vitro examinations concerning an influence of live or autoclaved cells of *Saccharomyces boulardii* yeasts on rumen bacteria metabolism. An increase in bacteria mass resulted according to these authors from digestion of yeasts added by them.

An assessment of yeasts application in cows feeding on their hooves state and health status is presented in Table 6. An addition of dried yeasts and live yeasts cells significantly improved the state of hooves and decreased the number of treated cows.

Table 6. Health status of the experimental cows (n=72)

Specification	Hooves state		Treated cows	
	Before	At the end of experiment	Metabolic diseases	Uterus inflammatory state
I Dried brewer's yeasts	2.96*	3.68*	1	2
II Live yeasts cells	2.91	3.30	1	3
III Control	2.79	2.54	4	8
*point assessment (1 – poor, 5 – very good)				

Additionally, bacteria number (CFU) was verified in liquid rumen content collected using a special probe. The same number was noted in the cows from control group and those receiving dried yeasts addition (CFU 2.2 x 10^8/mL), while in the group with live yeasts addition their number increased of 50% (CFU 3.3 x 10^8/mL) and SD was lower than 20% of means value. These are the values typical for ruminal fluid proving well health status of dairy cows.

SUMMARY

Application of dry yeasts preparation (Leiber BT) had a distinctly positive effect on the chemical composition of milk, cows health status, some biochemical parameters of blood and somatic cell count decrease in milk. Summer heats very clearly increased SCC in cow milk.

Dried yeasts addition used before calving (dead cells) caused a significant increase in the level of GGTP, lactic acid, total protein in cows blood, and a significant decrease in the level of urea compared to the control group.

At 80th day of lactation there were noted a significant increase in the level of AST, proteins, globulins and glucose, and a decrease in urea level in the group with dried yeasts addition, also a significant increase in GTP and glucose level and significant decrease in lactic acid and cholesterol content were observed second group (live yeasts addition).

The level of haptoglobin was similar in cows blood both before and after calving. No symptoms of inflammatory states related to yeasts application were noted.

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Responses to this article, comments are invited and should be submitted within three months of the publication of the article. If accepted for publication, they will be published in the chapter headed 'Discussions' and hyperlinked to the article.
