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EFFECT OF DIFFERENT FAT SUPPLEMENTS USED DURING DRY PERIOD OF COWS ON COLOSTRUM PHYSICO-CHEMICAL PROPERTIES**

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Abstract: The results of certain studies indicate that a relation exists between the quality of colostrum and milk and the correct balancing of energy and protein in the diet for cows in particular during the last three weeks before parturition. The aim of this study was to determine the effect of fat additives offered to cows during the dry period on the composition and physico-chemical properties of colostrum and the pre-colostrum secretion. 24 cows were assigned to one of three groups. Group I – control, received no feed additives; II – received feed supplemented by a mixture of fish and rapeseed oil in a 1:1 ratio, III – received feed supplemented by protected fat (Brgafat). In both cases the addition of fat amounted to 360g, *i.e.* 2% DM. All animals received a PMR concentrate in quantities calculated according to the INRA system. From all the cows samples were taken about 48 hours before parturition of the pre-colostrum secretion and directly after calving of colostrum from the first, complete milking. The samples taken were analysed for basic composition, for the overall number of microorganisms (ONM), somatic cell count (SSC), content of urea, coagulation time after adding rennet, thermostability as well as potential (^{o}SH) and active (pH) acidity. The results of the studies conducted indicate that the composition and physico-chemical properties of colostrum and pre-colostrum is differentiated. Offering protected fat as a feed additive for cows during the last three weeks of the dry period had a significant effect on the share of dry

matter and crude protein in the colostrum produced. The addition of a mixture of fish and rapeseed oil did not have a similar effect.

Key words: cows, feeding, fat additives, colostrum

Introduction and literature review

Numerous studies have shown that the quantity and quality of colostrum produced by cows may change considerably, depending on various genetic and environmental factors: breed, age, nutrition, maintenance system, performance, health condition etc. (*Guliński et al*. 2006, *Tyler et al*. 1999b, *Szulc and Zachwieja* 1998, Vann *et al*. 1995, *Zachwieja* 1991, *Zachwieja* 2004). As result of a decreased supply of immunoglobulins one may observe a decreased level of the calves resistance, increased susceptibility to diseases and increased mortality. (*Besser et al*. 1991, *Lundborg et al*. 2003, *Wittum and Perino* 1995). The results of certain studies indicate that a relation exists between the quality of colostrum and milk and the correct balancing of energy and protein in the diet for cows as well as the share and proportions between mineral elements and vitamins, in particular during the last three weeks before parturition. *Blecha et al*. (1981) demonstrated, that limiting the content of protein in the diet offered to heifers before calving had no significant effect on the content of immunoglobulins in the colostrum. Other authors (*Olson and Bull* 1986, *Preś et al*. 1995) observed only a small effect of the deficiency of protein and energy in the diet for pregnant cows on the content of immunoglobulins in the colostrum whey. However, those cows were observed to produce less colostrum and with a lowered immune value. Similar relations were reported by *Hough et al*. (1988, 1990). The results of the authors' own studies point to a possibility of stimulating the colostrum composition through the use of various feed additives offered to cows during the dry period (*Szulc et al.* 1990a, *Zachwieja et al*. 1997).

The present work aimed at analysing the effect of fat additives offered to cows during the dry period on the composition and physico-chemical properties of colostrum and the pre-colostrum secretion.

Materials and methods

24 Black-and-White cows with a mean yield of 7000 kg were assigned to one of three groups taking into consideration the animal's age, yield during

the previous lactation and share of HF genes, so as to create analogues. Group I – control, received no feed additives; II – received feed supplemented by a mixture of fish and rapeseed oil in a 1:1 ratio, III – received feed supplemented by protected fat (Brgafat). In both cases the addition of fat amounted to 360g, *i.e.* 2% DM. All animals received a PMR concentrate in quantities calculated according to the INRA system. Records were made of the intake of feed dry matter, the condition of the cows (body condition score - BCS) at the start of the experiment and on the day of calving. From all the cows samples were taken about 48 hours before parturition of the pre-colostrum secretion and directly after calving of colostrum from the first, complete milking. The samples taken were analysed for basic composition (dry matter, protein, fat, lactose) using a Milco Scan 133B Foss Electric apparatus, for the overall number of microorganisms (ONM) – Bactocount 70, Bentley, somatic cell count (SSC) – Somacount 150, Bentley, content of urea (Brann Lubbe), coagulation time after adding rennet, thermostability as well as potential (^{o}SH) and active (pH) acidity. The results obtained were subjected to a statistical analysis using a single factor analysis of variance. The significance of differences was determined on the basis of Duncan's test.

Results of investigations and discussion

During three weeks before parturition the intake of feed dry matter by cows from all groups amounted to about 14.9 kg (from 14.83 to 14.96 kg). The cow condition score (CCS) at the start of the experiment ranged from 3.6 in group II and III to 3.8 in the control group. At the moment of calving the BCS value was similar for all groups (3.5). The analysed samples of pre-colostrum secretion, obtained from cows fed fat additives, demonstrated a higher, though not confirmed statistically, content of dry matter and protein, but a lower content of fat and lactose (table 1).

The secretion of cows receiving an addition of protected fat showed the highest content of dry matter and crude protein (21.85 and 16.66%, respectively) which exceeded that observed for the pre-colostrum of control cows by 2.67 and 1.5%, respectively for dry matter and protein. Samples obtained from cows receiving a mixture of oils (group II) showed a significantly ($p \leq 0.05$) lower content of fat. Similar relations were observed for the colostrum samples analysed (table 2). Compared to the control group a statistically significant ($p \leq 0.05$) increase (by over 20%) in the level of dry mater and crude protein was observed in the colostrum of cows receiving

feed supplemented with protected fat (22.71% for group I and 27.42% for group III, for dry matter and 14.10% – I and 18.46% – III for crude protein).

Table 1.Composition of the pre-colostrum secretion of cows depending on the type of fat additives

Item	Group					
	Control		Rapeseed + fish oil		Protected fat	
	$\overline{x}$	sd	$\overline{x}$	sd	$\overline{x}$	sd
Dry matter (%)	19.18	4.54	20.57	3.39	21.85	4.46
Fat (%)	2.47	2.26	1.77	1,27	2.26	2.15
Lactose (%)	1.51	0.71	1.31	0,32	1.15	0.92
Protein (%)	15.16	4.48	16.90	2,82	16.66	3.46
Urea (g/L)	115.0^{ab}	42.9	71.0^{a}	28.3	81.5^{b}	39.2
SCCx1000	3890	3290	991	759	1582	1338
ONMx1000	1060	861	618	393	1010	907

Table 2.Composition of the cows colostrum depending on the type of fat additives offered.

Item	Group					
	Control		Rapeseed + fish oil		Protected fat	
	$\overline{x}$	sd	$\overline{x}$	sd	$\overline{x}$	sd
Dry matter (%)	22.71^{a}	4.68	22.83^{b}	4.29	27.42^{ab}	4.99
Fat (%)	6.26^{b}	3.83	3.03^{ab}	2.70	6.79^{a}	3.64
Lactose (%)	1.75	0.64	1.86	0.55	1.65	0.87
Protein (%)	14.11^{a}	3.89	15.22^{b}	2.44	18.46^{ab}	3.59
Urea (mgx100ml)	200.6	65.8	133.5	38.7	76.0	24.7
SCCx1000	3427^{ab}	2890	593^{b}	365	212^{a}	173
ONMx1000	589^{ab}	371	951^{b}	429	933^{a}	548

A significant decrease in the fat content (over 50%) was observed in the colostrum of cows receiving before parturition feed supplemented with a mixture of fish and rapeseed oil. The level of the remaining components was similar to those recorded in the colostrum of cows from the control group. In the literature available no data was found referring to the composition of the pre-colostrum secretion obtained from cows before parturition. Also, there are no studies analysing the effect of the fat additives used on the composition of colostrum. Studies conducted earlier by the authors indicate that offering cows before calving feeds with an increased content of fat and fat additives does not lead to significant changes in the composition of colostrum, though cows receiving fat additives did show a higher content of whey proteins (*Szulc et al*. 1995). Favourable effects of using fat additives in the feeding of cows during different stages of lactation were observed in relation to the yield of milk and basic milk components, though their per

cent content decreased (*Onetti and Grummer* 2004, *Dihman et al*. 1995, *Secchiari et al*. 2003). *Mondebvu et al*. 2003 observed no effects of the use of fat additives in the feed of cows on milk yield and composition.

It is worth observing that the SSC was significantly lower in the colostrum and pre-colostrum secretion from cows of the experimental groups. Similarly, in those groups a low (compared to the control group) level of urea was observed. However, it is difficult to interpret this phenomenon. The values obtained for the remaining properties of colostrum and the pre-colostrum secretion are similar to those reported in earlier studies (*Zachwieja et al*. 2002a, b, *Zachwieja* 2004, *Zachwieja et al*. 2006). Compared to colostrum, the pre-colostrum secretion was characterised by a lower level of potential acidity (table 3). For group III this difference was confirmed statistically.

Table 3. Physico-chemical properties of the pre-colostrum secretion from cows depending on the type of fat additives offered.

Item	Group					
	Control		Rapeseed + fish oil		Protected fat	
	$\overline{X}$	sd	$\overline{X}$	sd	$\overline{X}$	sd
Acidity, (°SH)	12.60	4.44	12.60	4.45	13.09	2.51
Acidity (pH)	6.49	0.29	6.35	0.16	6.42	0.22
Thermalstability, (ml)	1.70	0.70	2.36^{a}	0.97	1.29^{b}	0.76
Coagulation time (min)	81.2^{a}	32.7	65.7	34.7	57.4^{b}	18.0

The potential acidity of colostrum obtained from cows of group III (receiving protected fat) proved to be significantly higher (table 4) than for the remaining groups, what may be connected with the higher level of crude protein. In colostrum, the higher level of potential acidity was related to lower pH values.

Table 4. Physico-chemical properties of the cows colostrum secretion from cows depending on the type of fat additives offered.

Item	Group					
	Control		Rapeseed + fish oil		Protected fat	
	$\overline{X}$	sd	$\overline{X}$	sd	$\overline{X}$	sd
Acidity, (°SH)	15.78^{b}	2.91	13.71^{a}	2.67	18.07^{ab}	2.51
Acidity (pH)	6.25	0.12	6.20	0.11	6.18	0.05
Thermalstability, (ml)	2.12	0.68	1.62	0.52	1.75	0.79
Coagulation time (min)	68.6	31.8	47.7	26.3	48.4	27.9

a, b- means in rows marked by different letters are significantly differ at $p \leq 0.05$ (in all tables)

Negative relations between the active and potential acidity of colostrum are

indicated also by the results of earlier studies (*Zachwieja* 2004), in which the correlation coefficients between those traits proved to be bellow -0.5 ($p \leq 0.01$). The values obtained for thermal stability of the pre-colostrum and colostrum were low, what confirms the results of other studies indicating that the lowering of colostrum thermostability is related to the high share of whey proteins (*Zachwieja et al*. 2002). Similar relations in the milk of cows were reported by *O'Connell et al*. (2000).

Conclusion

The results of the studies conducted indicate that the composition and physico-chemical properties of colostrum and pre-colostrum is differentiated. Offering protected fat as a feed additive for cows during the last three weeks of the dry period had a significant effect on the share of dry matter and crude protein in the colostrum produced. The addition of a mixture of fish and rapeseed oil did not have a similar effect.

UTICAJ RAZLIČITIH DOPUNA MASTI U PERIODU ZASUŠENJA KRAVA NA FIZIČKO-HEMIJSKE OSOBINE KOLOSTRUMA

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Rezime

Rezultati određenih istraživanja ukazuju na postojanje odnosa između kvaliteta kolostruma i mleka i ispravnog balansiranja energije i proteina u obroku za krave, posebno poslednje tri nedelje pre telenja. Cilj ovog istraživanja je bio određivanje uticaja dodavanja masti u obroke za krave tokom perioda zasušenja na sastav i fizičko-hemijske osobine kolostruma i pre-kolostruma. 24 krave su raspoređene u tri grupe. Grupa I – kontrola, bez aditiva; grupa II – obrok dopunjen smeđom ribljeg i ulja repice u odnosu 1:1; grupa III obrok dopunjen dodavanjem protektirane masti (Brgafat). U oba slučaja dodavanje masti je iznosilo 360g, *i.e*. 2% SM. Sve životinje su dobijala PMR koncentrat u količinama izračunatim prema INRA sistemu. Uzorci pre-kolostruma su uzimani od svih krava 48 sati pre teljenja i

neposredno nakon telenja kolostrum od prve, potpune muže. Analiziran je osnovni sastav, ukupni broj mikroorganizama i (ONM), broj somatskih ćelija (SSC), sadržaj uree, vreme koagulacije nakon dodavanja sirišta, termostabilnost kao i potencijalna (^{o}SH) i aktivna (pH) kiselost. Rezultati analiza ukazuju na razlike u sastavu i fizičko-hemijskim osobinama kolostruma i pre-kolostruma. Davanje protektiranih masti kao aditiva u ishrani krava tokom poslednje tri nedelje pre teljenja je imalo signifikantan uticaj na udeo suve materije i sirovog proteina u kolostrumu. Dodavanje smeše ribljeg i ulja repice nije imalo sličan efekat.

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