Biosynthesis of milk components and vitality of cows with high and low-fat milk

E. Kharitonov

Federal Science Center for Animal Husbandry named after Academy Member L.K. Ernst

Abstract (Click)

When feeding single-type diets to cows, differences in digestion associated with different feed intake rates, masticatory activity and rate of outflow of feed particles from the rumen, and different volumes of absorption of the end products of digestion can be observed. The study of these aspects is important for explaining the differences in the composition of milk of cows with different fat and protein beet and the development of ways to manage the biosynthesis of milk components. The aim of the research was to study the characteristics of nutrition, metabolism and biosynthesis of milk components in highly productive dairy cows with normal and low milk fat levels and the timing of their economic use. The trials were performed on multiparous cows of Holstein breed on the 80 day of lactation on this different milk fat and milk production 39.7±0.75 kg (4.1±0.24% of milk fat in cows with high (n=10) and 2.8±0,13 with low fat content of milk (n=10)). The materials obtained in the experiment was biometrically processed using the ANOVA method. Study the characieristics of fermentation of scar formation substrates and their use in energy metabolism and biosynthesis of the milk components. Found that low fat milk is not associated with a lack of formation of acetate in the rumen (6.1 vs. 6.6 mmol/dl in the contents of the rumen, $p>0.05$) and the change in the hormonal profile, but depends on the reduction of fatty acids synthesis de novo in mammary gland, regulated by conjugated higher fatty acids. The result is a reduction in the need of cows in the exchange energy (reduction of heat transfer by 6.2 MJ), a shorter service period (109.5 vs. 139 days) and the prolongation of their productive use (the number of lactations correlated back with the level of fat in milk ($r=-0.68$, $p<0.05$, $n=1300$).

Material & Methods (Click)

- The studies were carried out on cows of the Holstein breed of 2nd lactation at the end of the first phase (80 day) with milk for the previous lactation of 8-9 thousand kg of milk. Based on the data of the control docks, milk composition, lactation day, fatness, lactation number, two groups of cows (10 heads each) were found in the same feeding group (a group of highly productive cows), but with different fat content of milk according to the results of the last control milking.

References:

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Conclusion

- As a result of the work done to study the functioning of the digestive system, the formation of substrates and their use in energy metabolism and the biosynthesis of milk components in the mammary gland of high-yielding cows of various butterfat milk, at the end of the first lactation phase, it was established that at the level of rumen digestion, the features of fermentation are noted that lead to change in the amount and composition of the absorbing final products of digestion, determining, to a certain extent, the composition of milk.
- It was found that low fat milk is not associated with a lack of formation of acetate in the rumen and a change in the hormonal profile, but depends on the fat-synthesizing function of the breast, which is regulated by conjugated higher fatty acids. The result is a reduction in the need for cows in exchange energy, the likelihood of ketosis and prolongation of their productive use.

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Materials and Methods

- Samples of a rumen liquid obtained after 3 hours after morning feeding with the help esophagus a probe.
- Heat production determined a respiration research (mask method)
- Calculation of the requirements for substrates-precursors of milk components was carried out according to the model (*Kal'nitskii B.D., Kharitonov E.L., 2010)*
- Blood samples were obtained by puncture of the caudal artery and dairy vein.
- Blood also evaluated the hormone level, vitamin supply and test parameters of metabolism.
- The arterio -venous difference (caudal artery -dairy vein) of the concentration of key metabolites in the mammary gland and the efficiency of their absorption were determined. Blood flow through the mammary gland was estimated by calculation in relation to the yield with milk of tyrosine and phenylalanine to their areterio- venous difference (Pacheco-Rios D, 2001). Uptake of substrates mammary gland was determined by multiplying the mean value of the arterio- venous difference by the blood flow.
- The content of lipids and their fatty acid composition, protein, lactose, urea, glucose were determined in milk

Content In the samples of rumen content, the pH, ammonia, and VFA and their composition, the number of bacteria and protozoa, the amylolytic and fibrolytic activity of the microflora) (Kurilov, et.al., 1987).
In the blood plasma, the glucose content was determined with the help of a glucose oxidase method (Vital Diagnostics SPb reagent kit), triacylglycerols by means of enzymatic colorimetric method (the panel of reagents of firm «Soared Diagnostic SPb»), the concentration of NEFA was determined by means of enzymatic colorimetric method (kit «Rendox» UK), β-hydroxybutyrate (a set of reagents from Randox), volatile fatty acids (VFA) (on a gas chromatograph Colour - 800), free amino acids (on amino-acid analyzer AAA-T400, Czech Republic) and urea (a set of reagents" Urea 450 "from the firm" Lahema "). In blood plasma samples, the concentration of insulin was determined by an enzyme immunoassay using commercial kits (DRG, Germany).
The gross energy of the diets and excreta samples was determined using an adiabatic bomb calorimeter (ABK-1, Russia). Analysis of exhaled gases was curried out on a gas analyzer-chromatograph AHT-TI.
Milk composition was determined using a Milk analyzer («Lactostar, GmbH»).
The statistical processing of the data was done in the SPSS for Windows 11.5 computer programme.

Results

Table 1. Daily milk yield and milk composition in cows (M±SE, n=10)

Groups	Milk yield, kg d^{-}	Milk fat, %	Milk protein, %	Lactose, %	Glucose, mM/L
cows with normal milk fat	39,0±1,77	4,1±0,24	3,16±0,05	5,08±0,08	0.24±0.01
cows with low milk fat	40,5±1,25	2,84±0,13*	3,16±0,04	5,13±0,06	0,18±0,02

The cows' diet was represented by silage corn (20 kg), haylage of perennial grasses (8 kg), hay grass (0.5 kg), mixed fodder (16 kg), soybean meal (1 kg), fresh beer pellet (6 kg), molasses (1 kg). Feedstuff consisted of: wheat 20%, barley 33%, oats 5%, maize 13%, sunflower meal 25%, salt1%, minoadditives 1%, premix 1%.

The feeding ration for all groups of cows was the same, consistent with the level of milk production, live weight and day of lactation and was within the limits of the allowed content of individual nutrients.

Results

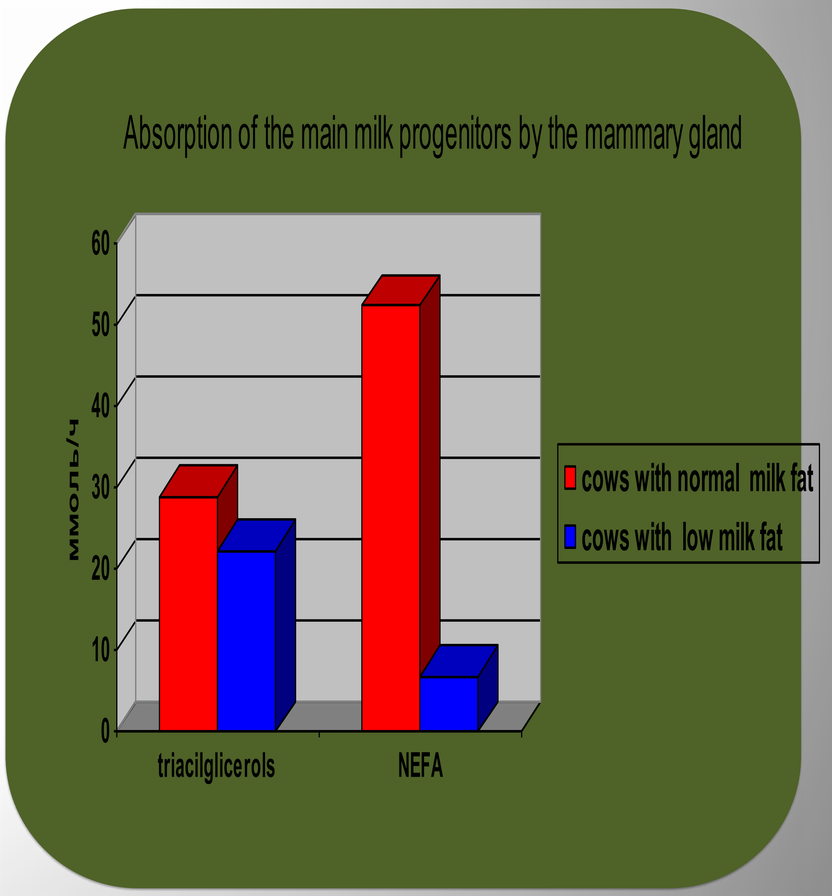
Tabl.2 Characteristics of ruminal fluid of cows (M±SE, n=5)

Item	Groups	
	cows with normal milk fat	cows with low milk fat
pH	6,95±0,209	$6,49±0,207^{0,09}$
NH_3 Mean, mg dl^{-1}	5,53±2,73	4,48±1,63
Total VFA, mM dl^{-1}	9,2±1,37	$10,7±0,76^{0,17}$
Acetate, molar % of VFA	65,6±1,36	$62,2±1,74^{0,10}$
Propionate, molar % of VFA	18,8±0,57	$25,2±1,85^{0,02}$
Butyrate, molar % of VFA	15,5±1,50	$12,4±0,61^{0,04}$
Bacterium 10^6 ml^{-1}	9,2±0,50	9,7±0,34
Protozoa, x 10^5 ml^{-1}	315±35	251±73,7
Amylolytic activity, E dl^{-1}	34,2±3,6	32,2±0,74
Fibrolytic activity,%	12,8±0,67	10,2±0,65

Results

Tabl 3. Consumption of the substratum precursors by the mammary gland for the synthesis of milk components (g / day, % of need)

Groups	substrates - precursors of milk components					
	triacylglycerols + NEFA	% НЭЖК	VFA+ β-hydroxybutyrate	% β-hydroxybutyrate	glucose	mammary plasma flow (L/min)
cows with normal milk fat	990 (109,1%)	36,1	2264,8 (102,2%)	20,9	3155 (113,3%)	11.4±1,33
cows with low milk fat	620,7 (98,2)	7,4	1667 (98,1)	21,0	2962 (112,5)	11,3±0,45



Results

Tabl 4. Efficiency of using OE in cows with different fat content of milk

Item	cows with normal milk fat	cows with low milk fat
Metabolisable energy (ME), MJ	265.1	265.0
Heat production, MJ	108,7	102,5
Heat production, % ME	41,0	38,7
Milk energy, MJ	122,9	106,7
Energy retention, MJ	4,68	30,8

Image