THE YIELD AND CHEMICAL COMPOSITION OF MILK OF COWS FED THE RATION WITH PROTEIN-FIBROUS-EXTRUDERATE

WYDAJNOŚĆ I SKŁAD CHEMICZNY MLEKA KROW ŻYWIONYCH DAWKĄ Z EKSTRUDERATEM BIAŁKOWO-WŁÓKNISTYM

Andrzej TARKOWSKI

Institute of Animal Nutrition, University of Live Sciences in Lublin, Poland, 20-950 Lublin, ul Akademicka 13
Phone number: +48 45 569 15, e-mail tarkowskia@o2.pl

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ABSTRACT

The present research evaluated the effect of protein-fibrous extruderate on yield and chemical composition of milk obtained cows. Protein-fibrous extruderate produced from dry sida (Sida hermaphrodita (L) Rusby) and horse bean meal was compared to a standard concentrate mixture "B" comprising maize silage and meadow hay. Daily yield milk appeared to be comparable between two treatment groups, one fed a protein-fibrous extruderate supplemented diet and other – a standard concentrate. A higher fat and protein content was determined in milk from cows with a dietary protein-fibrous extruderate additive.

Key words: cows, extruderate, milk yield and chemical composition

STRESZCZENIE

Przedmiotem badań była ocean wpływu ekstruderatu białkowo-włóknistego na wydajność i skład chemiczny mleka krów. Ekstruderat białkowo-włóknisty sporządzony z suszu ślazowca pensylwańskiego (Sida hermaphrodita Rusby.) i mączki z bobiku porównywano ze standardową mieszanką treściwą „B" w dawkach pokarmowych krów z udziałem kiszonki z kukurydzy i siana łąkowego. Dzienna wydajność mleka krów była porównywalna w grupach żywionych dawką z udziałem ekstruderatu białkowo-włóknistego i standardowej mieszanki treściwej. Wyższą zawartość tłuszczu oraz białka uzyskano w mleku krów żywionych ekstruderatem białkowo-włóknistym.

Słowa kluczowe: krowy, ekstruderat, wydajność i skład chemiczny mleka.

DETAILED ABSTRACT

Badania przeprowadzono na krowach mlecznych o wydajności rocznej mleka powyżej 4000 kg utrzymywanych w oborze ODR z terenu województwa lubelskiego.

Krowy utrzymywane były w systemie alkierzowym i żywione systemem tradycyjnym. Oceniono porównawczo wpływ ekstruderatu białkowo-włóknistego i standardowej mieszanki treściwej na wydajność i skład chemiczny mleka. Wydajność dzienną mleka przeanalizowano na podstawie wyników kontroli mleczności krów podczas próbnych udojów w okresie 305 dni laktacji. W ocenie statystycznej wyników badań uwzględniono stadia laktacji (> 101, 101-200, 201-305 dni).

W badanych grupach krów stwierdzono porównywalną wydajność mleka w poszczególnych stadiach laktacji. Nie stwierdzono statystycznych różnic pomiędzy średnimi dziennej wydajności mleka. Wydajność mleka w laktacji spadała osiągając jednakże po 200 dniach laktacji wyższą o około 5% wartość w grupie krów żywionych ekstruderatem białkowo-włóknistym. W badaniach własnych stwierdzono, że zawartość tłuszczu i białka w mleku w poszczególnych stadiach laktacji była rosnącą i każdorazowo wyższa w grupie krów żywionych ekstruderatem. Największą zawartość tych składników stwierdzono w mleku krów między 200 a 305 dniem laktacji.

Na podstawie wyników badań stwierdzono, że przy porównywalnej wydajności dziennej mleka krów, zawartość tłuszczu i białka była wyższa o około 7% u krów żywionych ekstruderatem białkowo-włóknistym.

INTRODUCTION

The concept of bovine milk quality includes a number of diverse milk characteristics that are categorized into two major groups, i.e. chemical and microbiological quality. Milk chemical quality determined through animal genetic traits may be seriously impaired due to inappropriate overall management practices or improper nutrition strategy at lactation [8]. Breeders, however, while choosing a cows breed and rearing system recognize milk efficiency (to achieve higher levels of milk production) as a key factor and not composition or nutritive value of milk obtained.

Currently, all the dairy nutritional management strategies implemented have considered lactation periods that are related to cows feed intake capacity and performance. Cows of the highest milk yield need adequate feed rations to satisfy their high nutritional requirements. It is of primary importance in the first lactation stage after calving when cows productivity and nutrient demands rise dramatically while animal capacity for feed intake remains fairly constant.

Increased feed intake at this critical time may be obtained through formulating a diet of appropriate quantitative and qualitative feed composition in ration. The elevated concentrate mixture to forage ration (in favor of the former) in the diet of high producing dairy cows enhances growth of milk yield and milk protein concentration, while decreases a milk fat content [2]. Excessive intake of grain mix ingredient, considered one of the basic constituents of concentrate feeds, tends to develop a number of metabolic disorders, such as among others,

Table 1. Chemical composition of feeds (%)
Skład chemiczny pasz (%)

Feeds Pasze	Nutrients Składniki pokarmowe					
	Dry matter Sucha masa	Crude ash Popiół surowy	Crude protein Białko surowe	Crude fiber Włókno surowe	Crude fat Tłuszcz surowy	N-free extractives Bezaztowe wyciągowe
Maize silage Kiszonka z kukurydzy	28,64	2,02	2,64	8.16	0,98	14.83
Meadow hay Siano łąkowe	81,49	6,89	8,34	30,21	1,70	34,35
Concentrate mixture B Mieszanka treściwa B	89,14	6,89	18,30	10,89	2,00	52,06
Extruderate of sida with horse bean meal Ekstruderat suszu z sidy z bobikiem	86,91	7,78	19,84	21,11	2,11	36,07

lowered cellulolitic activity of ruminal microflora that disrupts the digestibility of forage fibers and whole feed ration [8]. Interaction between components of a protein and fibrous nature in commercial feed concentrate may have a specific effect on a fat and protein content in milk. These contents are taken into account as the data included into the systems that guarantee milk quality at its production process [5].

Protein-fibrous extruderate whose production is based on dry sida and horse bean is an experimental and patented feed of nutritive value that predisposes it to ruminant nutrition [9].

The present research aimed at determination the effect of protein-fibrous extruderate compared to a standard feed concentrate B on cow milk yield and its chemical composition at lactation.

MATERIAL AND METHODS

The investigation was carried out on total of 20 cows , 550-590 kg body weigh and annual milk yield over 4000 kg in the last lactation. The cows in fifth lactation were divided into two groups of 10 each using the analog method. Experimental feeding covered 305 lactation days, when the feed rations of both cows groups comprised forage, as Table 2 shows. As for feed concentrates applied, they included mixture "B" containing ground wheat, 24%. wheat bran, 60%, peanut oilmeal, 4%, grass meal, 4%, urea, 3%, mineral-vitamin supplement, 3% (group 1) and protein-fibrous extruderate containing dry sida and horse bean meal at 50:50% ratio (group 2). Amount of concentrates provided in a cows ration was weighed individually and revised every second week after the control milking (0,5 kg) per 1 kg of milk. Feedstuff samples for chemical analyses were collected and evaluated once a month. Feed chemical composition in fresh matter was established according to standard chemical analysis [1].

Daily milk yield at lactation and its chemical composition was determined every fortnight. A milk fat and protein content was studied by Milkotest and Promilk device.

The research results were evaluated statistically by the analysis of variance using the Statistica 7.1. program.

RESULTS

Silage from maize harvested at wax-ripeness proved to be of very good quality. While, meadow hay obtained from perennial ryegrass of average 8,3% crude protein level and a relatively high crude fiber content was considered to have good quality. Protein-fibrous extruderate from dry sida and horse bean meal was show to contain a higher protein level, especially crude fiber, as compared to concentrate B (Table 1).

Energy value of extruderate appeared to be higher by approximately 10% as against standard concentrate (Table 2).

Average forage intake recorded was fairly equal in both treatment groups, whereas maize silage intake by the cows fed the diet with protein-fibrous extruderate was evidently more equal (Table 3). The cow became accustomed to the extruderate quite promptly and after seven trial days, they were provided with whole rations adjusted to match daily milk production. It is noteworthy, however, that extruderate intake by cows was lower than concentrate "B". It was likely to be caused by twice

Table 2. Nutritive value of feeds
Wartość pokarmowa pasz

Feeds Pasza	Nutritive value Wartość pokarmowa		
	Dry matter Sucha masa g	Net energy Energia netto MJ	Crude protein Białko surowe g
Maize silage Kiszonka z kukurydzy	286	1,75	26
Meadow hay Siano łąkowe	815	2,90	83
Concentrate mixture B Mieszanka treąściwa B	891	4,94	183
Extruderate of sida with horse bean meal Ekstruderat suszu z sidy z bobikiem	869	5,24	198

Table 3. Daily feed intake mean in lactation period of cows (kg)
Średnie pobranie pasz w okresie laktacji krów (kg)

Feeds Pasze	Lactation (days) Laktacja dni)					
	1-100	101-200	201-305	1-100	101-200	201-305
	Group – 1 Grupa -1			Group – 2 Grupa - 2		
Maize silage Kiszonka z kukurydzy	34,1	34,8	35,3	35,4	35,4	35,7
Meadow hay Sianołąkowe	5,1	5,0	4,9	5,1	5,0	5,2
Concentrate mixture B Mieszanka treściwa B	6,3	3,4	-	-	-	-
Extruderate of sida with horse bean meal Ekstruderat suszu z sidy z bobikien	-	-	-	5,4	2,8	-

Table 4. Nutritive value of rations and cover of nutritive requirements
Wartość pokarmowa dawek oraz pokrycie potrzeb pokarmowych

Specifications Wyszczególnienie	Lactation (days) Laktacja (dni)					
	0-100	101-200	201-305	1-100	101-200	2001-305
		Group – 1 Grupa - 1			Group – 2 Grupa -2	
Dry matter, (kg) Sucha masa (kg)	19,5	17,1	14,1	18,9	16,6	14,4
Cover % Pokrycie %	118	111	103	110	100	105
Energy, MJ Energia, MJ	105,5	92,2	75,9	105,0	91,1	77,5
Cover, %	101	107	114	100	103	116
Crude protein, g Białko surowe, g	2462	1941	1324	2413	1890	1360
Cover, % Pokrycie, %	105	106	107	103	103	103

higher fiber content in this feedstuff compared to a standard concentrate and some higher intake of forage, particularly maize silage.

Feed rations formulated for both cow treatment groups have met their nutritional needs with some excess, taking into account the feeding guidelines for cattle and sheep [7].(Table 4).

No statistical differences between the means of daily milk yield at lactation were recorded. Still, in group of cows fed protein-fibrous extruderate supplemented diet, milk yield decline recorded throughout the lactation has turned out to be lowered by approximately 5%.

The treatment group of cows with the diet enriched by protein-fibrous extruderate showed elevated fat and protein contents in milk at each lactation stage. Differences concerning the mean values of these components between the analyzed cow groups were statistically insignificant (Table 5)

DISCUSION

Obtaining high performance of cows in the early and middle lactation stage is related to a feed ration employed, i.e. the proper ration of concentrate feedstuff to forage,

Table 5. Daily yield (kg) and chemical composition of milk (%).
Dzienna wydajność(kg) i skład chemiczny mleka (%)

Lactation (days) Laktacja (dni)	Group – 1 Grupa -1			Group – 2 Grupa -2		
	Milk Mleko	Fat Tłuszcz	Protein Białko	Milk Mleko	Fat Tłuszcz	Protein Białko
0 - 100	22,2	3,67	3,01	21,2	3,82	3,22
101 – 200	16,6	3,54	3,07	15,5	3,65	3,14
201 - 305	8,8	4,04	3,48	9,8	4,04	3,66
Mean Średnia	15,8	3,73	3,18	15,5	3.84	3,34

in favor of the former one. As a consequence, a dietary fiber content approaches a critically low level that affects a milk fat content [8]. Rations used in each nutritional management strategy of high-yielding dairy cows are to be characterized by adequate physical structure termed a fiber content, which in turn is defined as physical efficiency of feedstuff [3.8].

Protein-fibrous extruderate produced from dry sida and horse bean meal constituents an example of a feed of uniform and not too dense structure resembling a honeycomb, of a pleasant flavor and sufficiently high content of protein and crude fiber [10]. The scare research studies investigating the properties of this type of feedstuffs revealed that pelleting or extrusion processing technique may partially protect protein through formation in a final product a sort of starch-protein complex in a cellulose capsule developed from the fibrous material provided [3,4,6]. Implementation of this kinds of protein-fibrous extruderates comprising dry forage and adequate high-protein material may aid in to maintain required protein to fiber proportion in a total feed ration.

Similar daily milk yield values and milk chemical parameters recorded while comparing a standard concentrate feed and extruderate used in cows feed rations indicate potential application of such feedstuffs for ruminant nutrition. Very limited literature concerning formulation and application of this kind of extruderates in cow nutrition management afforded the possibility to present the given above assumption and the conclusions based on the present research findings [2,9].

CONCLUSION

1. Forage intake in group of cows fed protein-fibrous extruderate appeared to be more equal.
2. Daily milk yield of lactating cows was comparable in both treatment groups.
3. A content of milk fat and protein at each lactation stage was higher by 4 -7% in group of cows with protein-fibrous extruderate supplemented diet.
4. Protein-fibrous extruderates comprising dry forage and concentrate materials processed at thermoplastic treatment may constitute a feed complementary to concentrates in ruminant nutrition management.
5. Assurance of the appropriate level of repeatable bovine milk quality imposes the implementation of new typed of cow feedstuffs produced in modern dairy technologies that guarantee food chain safety at their application.

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