UTILIZATION OF PROBIOTICS "STARBIO" IN THE DIETS OF DAIRY COWS: THE EFFECTS ON MILK YIELD AND QUALITY

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ABSTRACT

An experiment has been carried out to investigate the effect of probiotics in the diets of dairy cows on the milk yield and quality. The objectives of the experiment were to improve the efficiency of feed utilization through manipulating the fermentative processes of dietary organic matter in the rumen. Twenty lactating Holstein-Friesian grade cows were used in a completely randomized block design. Four dietary treatments were imposed to the individuals which were consisted of (1) a control diet (18% crude protein), (2) a 16% crude protein ration without probiotics supplement, (3) a 16% crude protein ration with probiotics starbio supplement at 0.5 and (4) a 16% crude protein ration with probiotics starbio supplement at 1.0%. The concentrate ration was fed at a rate of half of the daily milk production plus one kg if the milk production was less than 20 kg/day, and half of the daily milk production plus two kg for cows producing more than 20 kg milk/day. Concentrate was fed at 0600 h and 1500 h. Napier grass was chopped and offered at a rate of 50 kg (fresh)/head/day distributed at 0700 h (25 kg), 1600 h (10 kg) and 2100 h (15 kg). A two-week preliminary period was allowed for the cows to adapt to the dietary treatment before data collection was started. Milk production was recorded and the milk quality was analysed for the specific density, pH, crude protein and fat contents every Wednesdays and Sundays for 8 weeks. Results indicated an increased protein and fat contents of the milk when probiotics was supplemented in the diets, however, there was no positive response of dietary treatments on the milk yield. It was concluded that lowering the dietary protein content until two percentage units would be beneficial as long as probiotics starbio was supplemented in the diets.

Key words: Lactating cows, Probiotics, Milk yield, Quality

INTRODUCTION

High milk producing cows require a better feed availability in terms of quality in a balanced nutrients which should be efficiently metabolizable in the animal tissues (NRC, 1984; Tillman *et al.*, 1984).

The existing locally available feed resources for dairy cows are usually limited by low quality forages and expensive concentrate grain-based diets. Since the digestion of dietary nutrients by ruminants is affected by the activity of ruminal microorganisms, it is of interest that providing the rumen microbial niches with advantageous nutrients and growth inducing substances necessary for optimum microbial growth and its enzymatic activity be carried out.

Standard quality of milk in Indonesia normally requires that the solid content (which includes minerals, sugars, protein, fat and vitamins) range from 13-14%. The solid content of milk, as a matter of fact varies between individuals within a group of dairy cows, especially for the fat content which may range from 3 to 6%, and sometimes more than 6% during the later periods of lactation (Quinn, 1980). Schmidt (1971) indicated that such factors as changes in management practices during lactation, age, colostrum, weight at calving, gestation, dry

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Table 1. Grouping of cows in the experiment

Group	Parity	Lactation Period (Month)
A	III	5
B	II	6
C	II	3
D	II	4
E	I	5

period, climate and the environmental changes affect the milk production and milk composition. Furthermore, it was indicated that decreased milk production could be improved by supplementation of energy.

The use of microbial preparation as dietary supplement has been reported to be advantageous in increasing the animal productive performance. The direct-fed microbials (DFM) which is used to describe probiotics may consist of a single species of microbe, a combination of several species, or even in the form of an enzyme preparation. It has been widely reported that the use of yeast culture, microbial preparation or enzyme in the diet to be an effective means to improve the efficiency of feed utilization (Yoon and Stern, 1995).

The probiotics used in the present experiment (starbio) is a combination of several species of microbes, with carrier substance, which has been indicated to have such characteristics as cellulolytic, proteolytic and amylolytic (Suharto *et al.*, 1994). Previous experiments on the use of probiotics starbio in the diets of broiler (Zainuddin et al., 1994), sheep (Haryanto *et al.*, 1993; 1994; 1996) and beef cattle (Suharto *et al.*, 1994) turned out to be of beneficial. It is expected that supplementation of probiotics starbio in the diets will increase the fermentability of fibrous components by which will increase the energy availability, either for ruminal microbial growth or for the host animal (Haryanto, 1995).

In the present experiment, the probiotics starbio was included in the diets for dairy cows with lowering the dietary protein content in the aim of investigating the response of milk yield and its quality as affected by the probiotic supplementation.

MATERIALS AND METHODS

The experiment was carried out at Balai Pembibitan Ternak dan Hijauan Makanan Ternak (BPT-HMT) Baturraden, Banyumas - Central Java. Twenty lactating Holstein-Friesian grade cows at stages beyond the peak of lactation period were used in the present experiment. The animals were divided into 5 groups based on lactation period, and then put in individual pen as indicated in Table 1.

Four dietary treatments were fed to each group: (1) Ration I (R1) was a concentrate diet normally used in the BPT-HMT (containing 18% crude protein); (2) Ration II (R2) was similar to R1 except that the crude protein content was reduced to 16%; (3) Ration III (R3) was similar to R2 but supplemented with 0.5 % probiotics starbio (as fed); and (4) Ration IV (R4) was similar to R2 but supplemented with 1.0 % probiotics starbio (as fed).

The quantity of concentrate offered was based on the daily milk production, i.e., if the daily milk production was less than 20 kg then the concentrate was offered at a rate of half of the milk production plus one kg per day. For the individuals producing more than 20 kg milk per day, the concentrate was offered at a rate of half of the milk production plus 2 kg per day.

The probiotics starbio was mixed thoroughly in the concentrate. The concentrate was fed at 0600h and 1500h. The formula of experimental ration was shown in Table 2. The forages offered to the animals was chopped Napiergrass (*Pennisetum purpureum*) at a total of 50 kg/head/day with

Table 2. Ration formula used in the present experiment

Ingredients	R1	R2
	%	
Rice bran	20	20
Corn	12	7
Coconut meal	20	18
Wheat Pollard	18	20
Soybean meal	8	5
Kapok seed meal	10	10
Tapioca waste	10	18
Minerals	2	2

the following schedule: 25 kg offered at 0700h; 10 kg offered at 1600h; 15 kg offered as cut forages at 2100h.

A two-week preliminary period was allowed for the cows to adapt to the dietary treatments.

Data of milk production and quality tests for alcohol, specific density, pH, crude protein and fat were carried out every Wednesday and Sunday for 8 weeks. Data were analyzed statistically in a completely randomized block design (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Data of daily milk yield and its quality are summarized in Table 3. The dietary treatments did not significantly affect the milk yield, indicating that reducing the crude protein content of the diet from 18 to 16% (2% unit reductions) resulted in a similar milk production. The non significantly difference in milk yield due to probiotics supplementation in the present experiment was in agreement with those reported by Kamalamma *et al.* (1996). Meanwhile, Dobos *et al.* (1989) and Erasmus *et al.* (1992) reported an increase of milk yield from 0.3 to 3 kg per day. The differences in the productive response to probiotics or yeast culture may be partly due to differences in the type of diet, since there was an interaction between yeast culture and diet as reported by Williams *et al.* (1991). Furthermore, a comparison between the daily milk yield and the 4% FCM showed that a smaller reduction in yield was obtained if 0.5% probiotics starbio was supplemented in the diet. This was due to the fact that the cows fed with probiotic supplemented ration produced a greater milk fat content as compared to the control diet. Table 3summarizes the data of

Table 3. Productive performance of cows as affected by dietary treatments

Parameter	Treatments			
	R1	R2	R3	R4
Milk yield, kg/day	14.3 + 5.1	13.1 + 2.7	13.5 + 2.1	14.2 + 2.7
Specific density	1.0254	1.0249	1.0248	1.0251
pH	6.67 + 0.03	6.69 + 0.01	6.69 + 0.01	6.67 + 0.03
Alcohol test	Negative	Negative	Negative	Negative
Protein, %	$2.52 + 0.07^{ab}$	$2.48 + 0.01^{a}$	$2.57 + 0.06^{bc}$	$2.75 + 0.08^{c}$
Fat, %	$3.5 + 0.3^{a}$	$4.1 + 0.5^{b}$	$4.3 + 0.3^{b}$	$4.2 + 0.2^{b}$

^{a,b} means at similar rows followed by different superscript were different significantly P<.01)

daily milk production and its quality that includes specific density, pH, and alcohol test, in addition to crude protein and fat contents. The 4% fat corrected milk yield were 13.2, 13.4, 14.1 and 14.6 kg/day for R1, R2, R3 and R4, respectively. The milk yield corrected to 4%-fat content as compared to the uncorrected milk yield were relatively higher for those receiving R2, R3 and R4. Lactation period seem to significantly influence the milk yield, indicating that lactation period is indeed a factor determining the milk production (Schmidt, 1971).

The dietary treatments did not significantly affect the specific density of the milk indicating that reduction in crude protein content of the diets provided that probiotics was supplemented either at 0.5% or 1.0% will maintain the milk at a similar quality, with a range of specific density from 1.0248 to 1.0254 which fell slightly below the milk codeaux (1.028).

Milk pH were not influenced by dietary treatments, ranging from 6.6730 ± 0.0310 and 6.6891 ± 0.0129. These pH values were within the range of Indonesian milk codeaux (6.5 - 7.5). Alcohol test for all dietary treatments indicated negative results, suggesting that reduction in crude protein content of the diets and supplementation of probiotics either at 0.5% or 1.0% did not affect the result of alcohol test.

The dietary treatments significantly affected the crude protein content of the milk. Reduction in crude protein content of the diets was followed by a decrease in crude protein content of the milk. Meanwhile, supplementation of probiotics resulted in increased crude protein content of the milk. It is apparent that supplementation of probiotics at 0.5% or 1.0% was better than the control group, even though the dietary protein content was reduced from 18 to 16%. The average of crude protein content of the control group (ration with 18 % crude protein) was 2.5269 ± 0.0696 % as compared to 2.4776 ± 0.1045 % for the group with 16% crude protein ration. Supplementation of probiotics at 0.5% resulted in crude protein content of milk of 2.5686 ± 0.0596 % as compared to 2.7496 ± 0.0761 % when probiotics was supplemented at 1.0%. This indicates that the supplementation of probiotics may also induce the rumen microbial protein synthesis that in turn more protein will reach the post-ruminal tracts, as has been indicated by Wallace (1994). Yoon and Stern (1995) mentioned that supplementation of yeast culture to the diets would induce the microbial enzymic activity and microbial population in the rumen.

Supplementation of probiotics at 0.5 % resulted in 1.65% greater crude protein content of milk as compared to the control group. The corresponding improvement of milk protein value for 1.0% probiotics supplementation was 8.81 %.

The dietary treatments significantly affected the fat content of the milk. Reduction in crude protein content of the diets from 18 to 16% and supplementation of probiotics resulted in greater fat content of milk as compared to the control group. The fat content of the milk ranged from 3.5350 ± 0.2863 % and 4.2881 ± 0.2774 % that is higher than the milk codeaux (2.7 %).

Supplementation of probiotics starbio at 0.5% and 1.0% in the diets resulted in approximately 20% increased milk fat as compared to the control group.

CONCLUSION

Based on the results of the present experiment it was concluded that the use of probiotics as supplement of diets for dairy cows could increase the fat and protein contents of the milk. Probiotics could also improve the efficiency of lower quality feed utilization, suggesting that a beneficial economic impact could be obtained since similar milk production could be gained with a relatively cheaper feed cost.

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REFERENCES

Dobos, R.C., A.J. Dickens and T.J. Norris. 1989. Yea-sacc for dairy cattle in low concentrate input systems. Effect on milk yield and composition in an Australian experiment. Paper no. EC21 *Research and Technical Bulletin*. Alltech, Inc. KY.

Erasmus, L.J., P.M. Botha and A. Kristner. 1992. Effect of yeast culture supplement on production, rumen fermentation and duodenal nitrogen flow in dairy cows. *J. Dairy Sci.*, 75:3056-3065.

Haryanto, B. and I.Inounu. 1993. *Effect of creep feeding on the growth of pre-weaning lambs. Advances in Small Ruminant Research in Indonesia.* Subandriyo and R.M. Gatenby (eds.). SR-CRSP. University of California Davis. California. USA. pp 179-183.

Haryanto, B., K. Diwyanto, Isbandi and Suharto. 1994. Effects of probiotics supplement on the growth and carcass yield of sheep. *Proc. 7th AAAP Animal Science Congress.* Denpasar. Bali. Indonesia.

Haryanto. 1995. Probiotik : *Pemanfaatannya dalam Pakan Ternak.* Balai Penelitian Peternakan Ciawi. Bogor.

Haryanto, B., K. Diwyanto and Suharto. 1996. *Effects of level of dietary fiber on nutrient digestion in sheep fed diets containing probiotics.* Indonesia SR Network Newsletter. Vol. 6(2):4-7.

Kamalamma, U. Krishnamoorthy and P. Krishnappa. 1996. Effect of feeding yeast culture (Yea-sacc1026) on rumen fermentation in vitro and production performance in crossbred dairy cows. *Anim. Feed Sci. Tech.*, 57:247-256.

NRC. 1984. Nutrient requirement of domestic animals. *Nutrient requirement of Beef Cattle.* National Academy of Science. Washington DC.

Quinn, T. 1980. *Dairy Farm Management.* Delmar Publishing. Albany-New York. 12205.

Schmidt, G.H. 1971. *Biology of Lactation.* Cornell University. W.H. Freeman and Company. San Francisco.

Steel, R.G.D. and J.H. Torrie. 1980. *Principles and Procedures of Statistics.* McGraw-Hill Book Co. New York.

Suharto, B. Haryanto, D. Zainuddin dan K. Diwyanto. 1994. *Pemanfaatan Probiotik dalam Pakan untuk Meningkatkan Efisiensi Produksi Ternak.* Fakultas Pertanian Universitas Negeri Sebelas Maret, Surakarta dan Proyek Pengembangan Penelitian Pertanian Nasional. Badan Penelitian dan Pengembangan Pertanian. Bogor.

Tillman, A.D., H. Hartadi, S. Reksohadiprodjo, S. Prawirokusumo dan S. Lebdosoekojo. 1984. *Ilmu Makanan Ternak Dasar.* Gadjah Mada University Press. Fakultas Peternakan Universitas Gadjah Mada. Yogyakarta.

Wallace, R.J. 1994. Ruminal Microbiology, Biotechnology, and Ruminant Nutrition : Progress and Problems. *Journal of Animal Science*, 72:2992-3003.

Yoon, I.K. dan M.D. Stern. 1995. A Review : Influence of Direct-Fed Microbials on Ruminal Microbial Fermentation and Performance of Ruminants. *Asian-Australasian Journal of Anim. Sci.*, 8(6), 1995.

Zainuddin, D., K. Diwyanto dan Suharto. 1993. Utilization of A Probiotic Starbio In Broiler Diet With Different Levels of Crude Protein. *Buletin Peternakan. Bulletin of Animal Science.* Special Edition 1995. Faculty of Animal Husbandry Gadjah Mada University. Yogyakarta.