EFFECT OF DIETARY SUPPLEMENTATION OF MYCOFIX® SECURE ON MILK PRODUCTION AND ITS CONSTITUENTS IN LACTATING CROSSBRED COWS

S.B. PATEL, B.B. PATEL AND J.V. PATEL

Amul Research and Development Association (ARDA)
Amul Dairy, Anand-388001(Gujarat)

Received 15-7-2011 Accepted 15-9-2011

ABSTRACT

A study was conducted to determine the effect of dietary supplementation of sodium bentonite - a mycotoxin binder (Mycofix® secure, Biomin, Singapore) on milk production and milk constituents including somatic cell count and aflatoxin M1 level in lactating crossbred cows. Total ninety cows of three farms were selected and randomly divided into treatment and control group on each farm on the basis of stage of lactation and milk yield. The feeding practices followed, though vary between farms, were common in both the groups. Animals of treatment group received additional sodium bentonite @ 15 g/animal/day for 30 days. There was no significant difference in milk yield, or milk fat, SNF and protein content of milk between two groups on any of the three farms. The somatic cell count (SCC), however, decreased significantly in treatment group on two farms. Among three farms, aflatoxin M1 (AFM1) level also reduced in treatment group on all farms. The result revealed that dietary supplementation of sodium bentonite (Mycofix® secure) was effective in reducing SCC and AFM1 content of milk.

KEYWORDS : Crossbred cows, Mycofix supplement, Milk yield, Somatic cell count, Aflatoxin M1

INTRODUCTION

Mycotoxins are fungal metabolites that can reduce performance and alter metabolism of livestock and poultry (Wannemacher et al., 1991). Mycotoxins can be formed in the field pre harvest and may continue to be formed under suboptimal storage conditions post-harvest. High temperature and moisture content often predispose feedstuffs to fungal growth and mycotoxin formation. Mycotoxins represent wide range of molecules that are harmful to animals and humans. It is generally accepted that the Aspergillus, Fusarium and Penicillium molds are the major producers of mycotoxins detrimental to cattle. The economic losses are due to feed refusal, poor feed conversion, immunosuppressant, interference with reproductive capacities and residues in animal products. When cows consume aflatoxin-contaminated feed from 1 to 3 % of the ingested dose appears in their milk as Aflatoxin M1 (AFM1). AFM1 is the hydroxylated metabolite of Aflatoxin B1. The AFM1contaminated milk is and would be a major concern of the dairy industry. A wide range of physical, chemical and biological methods have been tested as possible procedures for inactivating aflatoxins from the feed. Biological binding agents include hydrated sodium calcium alluminosilicate, bentonite, zeolite, activated carbons, bacteria, and yeast. Mycofix® secure is a mycotoxin binder containing sodium bentonite, manufactured by BIOMIN Singapore Pvt. Ltd. Bentonite supplement is reported to improve milk yield, milk fat/SNF (Rindsig and Schultz, 1970; Slopina et al., 1973; Smith et al., 2007) and reduce SCC and AFM1 of milk (Diatz et al., 2004; Smith et al., 2007). The objective of the present study was, therefore, to know the effect of dietary supplementation of Mycofix® secure on milk production and its constituents including SCC and AFM1 in lactating crossbred cows.

MATERIAL AND METHODS

The present study was conducted on three different commercial dairy farms of Anand District of Gujarat. Total ninety crossbred cows of 2nd and 3rd parity in early, mid and late lactation were selected for this trial. Out of total 90 cows, 22 cows were selected at village Bochasan (Farm A), 36 cows at Sarsa (Farm B) and 32 cows at Ravalapura (Farm C). These animals were randomly and equally divided into two groups on each farm, i.e. T1 (control) and T2 (treatment) group.

The animals of both the groups (T1 and T2) on all three farms were offered with the same amount of concentrate, green and dry roughage. In addition, the animals under T2 group received dietary supplementation of sodium bentonite (Mycofix® secure, BIOMIN Singapore Pvt. Ltd.) @ 15 g/head/day. All the animals were fed the same feed ingredients throughout the period of 30 days trial following one week of adaptation period. The nutrient requirement was calculated on the basis of milk yield and fat content of milk (NRC, 1989). The animals on all the three farms were kept under good hygienic conditions.

The milk yield of all animals was recorded at weekly interval. Milk samples were also collected at weekly interval, for estimation of fat, protein and solid not fat (SNF) by autoanalyzer (Milkospan-605, Foss Electric, Denmark). Estimation of somatic cell count (SCC) in milk was also carried out by autoanalyzer (Fossomatic-5000, Foss Electric, Denmark) and that of AFM1 by IAC-HPLC method. The data collected during the experiment were analyzed using student's 't' test (Snedecor and Cochran, 1994).

RESULTS

The daily milk yield and milk constituents, viz. Fat, SNF and Protein content as well as SCC of the milk of cows of all three farms are presented in Table-1. The differences in the milk yield between the control and treatment groups on all three farms were found to be statistically non-significant. The levels of milk constituents studied also did not vary statistically between groups. The SCC, however, was significantly decreased ($P<0.05$) in T2 group as compared to T1 group on farm A and B. However, this difference was not significant on farm C. The AFM1 level in the milk of farm A was 0.95 ppb in treatment group, which was lower than 1.25 ppb present in the control group. While AFM1 level in T1 and T2 group were 1.22 and 0.11 ppb, respectively, on farm B and 1.02 and 0.34 ppb on farm C (Figure 1), suggesting 3 to 10 time decrease in AFM1 levels in milk following Mycofix® secure supplementation.

Figure 1: Comparison of AFM1 in milk of cows of three farms fed with sodium bentonite

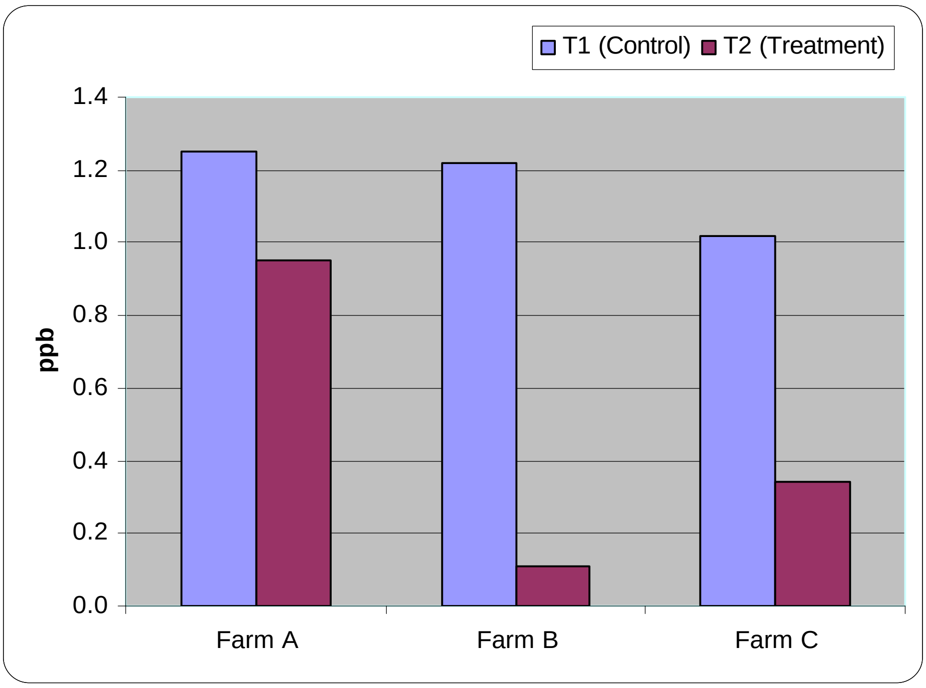

Table 1: Average milk yield and milk composition of cows fed bentonite on different dairy farms

Feeding Period (Week)	Milk Yield (lit/day/animal)		Milk composition						SCC (Cell/ml x1000)	
			Fat%		SNF%		P%			
	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2
Farm A										
0	27.50	23.86	4.50	4.59	8.93	8.88	3.13	3.03	577.36	360.45
I	26.27	23.77	4.38	4.34	8.98	8.89	3.12	3.05	791.09	356.00
II	25.77	24.95	4.45	4.51	9.16	9.07	3.36	3.04	747.64	122.82
III	25.73	23.00	4.30	4.21	9.16	9.10	3.28	3.22	646.73	280.18
IV	25.05	24.09	4.21	4.30	9.09	9.06	3.25	3.15	935.82	238.45
Average	**25.70 ±1.86**	**23.95± 1.93**	**4.34 ±0.15**	**4.32 ±0.10**	**9.10 ±0.07**	**9.03 ±0.8**	**3.25 ±0.08**	**3.12 ±0.09**	**780.32[b] ±270.80**	**249.36[a] ±121.82**
Farm B										
0	9.68	9.44	3.45	3.09	8.68	8.69	3.21	3.28	283.50	294.28
I	9.22	9.46	3.57	3.24	8.55	8.69	3.03	3.15	403.83	266.11
II	8.03	8.28	3.57	3.36	8.56	8.65	3.16	3.24	678.50	505.11
III	7.12	7.68	3.51	3.23	8.68	8.74	3.11	3.17	411.28	489.78
IV	7.41	8.44	3.44	2.89	8.31	8.61	3.16	3.21	630.78	561.78
Average	**7.94 ±1.15**	**8.46 ±1.29**	**3.52 ±0.16**	**3.18 ±0.16**	**8.52 ±0.10**	**8.67 ±0.10**	**3.11 ±0.09**	**3.19 ±0.08**	**481.58[b] ±134.03**	**423.41[a] ±118.43**
Farm C										
0	8.49	7.89	3.74	3.58	8.78	8.78	3.07	3.26	648.24	353.50
I	8.22	7.65	3.56	3.60	8.69	8.85	3.21	3.40	763.19	488.81
II	8.35	7.96	3.41	3.84	8.79	8.90	3.36	3.41	493.06	599.31
III	8.60	7.64	4.00	4.01	8.97	9.03	3.30	3.42	640.00	649.81
IV	8.46	7.69	3.78	3.77	9.10	9.05	3.26	3.35	478.63	383.00
Average	**8.41 ±0.82**	**7.74 ±0.75**	**3.69 ±0.13**	**3.80 ±0.15**	**8.89 ±0.09**	**8.96 ±0.09**	**3.28 ±0.10**	**3.39 ±0.10**	**593.72 ±233.37**	**530.23 ±103.49**

T1 control, T2 sodium bentonite supplement @ 15/d/h.
Means with different superscripts within the row for a parameter differ significantly ($P < 0.05$).

DISCUSSION

Effect on Milk Production and its Constituents

In the present study, no significant difference was found in the milk yield and milk composition of cows of treatment and control groups on any of the farms studied. This observation corroborated with the finding of Hamilton et al. (1988). Ehrlich and Davison (1997) also reported non-significant effect of sodium bentonite supplement on milk yield and its composition. However, contrary to our result, Slonina et al. (1973) reported that bentonite brings about higher fat content in milk of cows, while Rindsig and Schultz (1970) had observed higher SNF % in the sodium bentonite treated group of cows.

Somatic Cell Count (SCC)

Milk production with low SCC is necessary and is a profitable management tool in the dairy farming. In our study, the SCC was significantly decreased in milk of cows on two farms. Contrary to our result, Smith et al. (2007) did not find any effect of glucomannan mycotoxin adsorbent diet on milk SCC. Similarly Applebaum et al. (1982) reported that dietary aflatoxin has no effect on SCC and standard plate counts (SPC) in milk of cows.

Aflatoxin M1 (AFM1)

Aflatoxin B1 carry-over into milk as AFM1 is known to occur quickly, as this metabolite is detected in milk from the first milking after the animal has ingested AFB1-contaminated feed (Diaz et al., 2004; Masoeroa et al., 2007). The results of the present study suggested marked reduction of AFM1 level to the extent of 90.98 % in the milk of cows of T2 group as compared to T1 group. The per cent reduction in AFM1 in milk was 66.66 compared to control on another farm. Diaz et al. (2004) also concluded that supplementation of sodium bentonites in the diet @ 1.2% level has a good potential for reduction in AFM1 level in the milk.

CONCLUSION

The results of the study indicate that Mycofix® secure is effective in reducing SCC and AFM1 content of milk without affecting the other milk constituents, viz. fat, SNF and protein content. However, variation in trend observed may be due to difference in feed ingredients, feeding practices and other managemental factors followed on different farms. To eliminate these factors, level of aflatoxin should be determined for the composite feed on all the farms during different phases of trial period.

ACKNOWLEDGEMENT

The authors wish to acknowledge the Secretary, Amul Research and Development Association, Anand for his cooperation, help and necessary facilities provided to carry out this study. Authors are also thankful to BIOMIN Singapore Pvt. Ltd. for funding the project.

REFERENCES

Applebaum, R.S., Brackett, R.E., Wiseman, D.W. and Marth, E.L. (1982). J. Dairy Sci., **65**: 1503-1508.

Diaz, D.E., Hagler, W.M. Jr., Blackwelder, J.T., Eve, J.A., Hopkins, B.A., Anderson, K.L., Jones, F.T. and Whitlow, L.W. (2004). Mycopathologia, **157**: 233-241.

Ehrlich, W.K. and Davison, T.M. (1997). Australian J. Expl. Agric., **37**: 505-508.

Hamilton, B.A., Carmichael, A.W. and Kempton, T.J. (1988). Australian J. Expl. Agric., **28**: 25-28.

Masoeroa, F., Galloa, A., Moschinia, M., Pivaa, G. and Diaza, D. (2007). Animal, **1**: 1344-1350.

NRC (1989). Nutrient Requirements of Dairy Cattle, 7th ed. National Research Council, National

Academy of Sciences. Washington, DC.

Rindsig, R.B.and Schultz, L.H. (1970). J. Dairy Sci., **53**: 888-892.

Slonina, L., Lehocky J., Sokol J., Rosival I. and Burdova, O. (1973). Veterinárí medicína, **18**: 465-474.

Smith, T.K., Gabriel, D. and Sofya. N. (2007). The effect of feed-borne Fusarium mycotoxins on reproductive efficiency in dairy cows, sows and broiler breeders. Department of Animal and Poultry Science, University of Guelph, Ontario, Canada (Courtesy of Alltech Inc.).

Snedecor, G.W. and Cocharan, W.G. (1994). Statistical Methods 8th edn. Affilliated East-West Press Pvt. Lts., New Delhi, India.

Wannemacher, R.W., Bunner, D.L. and Neufeld, H.A. (1991). Toxicity of trichothecenes and other related mycotoxins in laboratory animals. In: Mycotoxins and Animal Feeds (J.E. Smith and R.S. Henderson, eds). CRC Press, Boca Raton, FL.

❑