Novelty Journals

ISSN 2394-966X

International Journal of Novel Research in Life Sciences
Vol. 3, Issue 4, pp: (18-24), Month: July - August 2016, Available at: www.noveltyjournals.com

Effect of Dietary Supplementation of Saccharomyces Cerevisiae on Milk Composition, Milk Yield and Occurrence of Clinical and Sub-Clinical Mastitis in Lactating Cows

Yin Nyein Aye[1], Hlaing Hlaing Myint[2], Saw Po Po[3], Win Ohnmar Kyaw[4], Ye Htut Aung[5]

[1,2,3,4] Department of Medicine, University of Veterinary Science, Yezin, Nay Pyi Taw, 15013, Myanmar
[5] Pro-rector Office, University of Veterinary Science, Yezin, Nay Pyi Taw, 15013, Myanmar

Abstract: **Sixteen adult cross-bred Holstein Friesian lactating cows, early to mid lactating stage with body condition score 2.5–3.0, were equally divided into two groups: cows from group A were fed only basal diet (n=8) and cows from group B were fed basal diet daily supplemented with live yeast (*S. cerevisiae*) culture providing 50g/head/day (n=8). Before taking the samples, both groups were fed basal diet for 3 weeks as adaptation period. Cows from both groups were fed their experimental diet for 2 weeks as a preliminary period. Milk yield from each cow were daily recorded for 8 weeks. Composition such as milk fat%, protein%, lactose%, density, non-fat solids (NFS), temperature, pH, salts%, freezing point and electrical conductivity (EC) of milk samples from individual cow were examined weekly intervals for 8 weeks by Lactoscan. Milk yield and milk composition between the two groups were compared by *student t* test. Quarter milk samples from each cow were taken for detection of mastitis by California Mastitis Test (CMT) at 3 day intervals for 8 weeks. Quarter based and cow based CMT scores from the two groups were compared by the *Chi square* test. Overall, feeding live *S. cerevisiae* can significantly reduce the incidence of subclinical mastitis in lactating cows. However, feeding live yeast has no significant effect (p>0.05) on milk composition and milk yield.**

Keywords: **Yeast (*Saccharomyces cerevisiae*), Milk Composition, Milk Yield, Clinical and Sub-clinical Mastitis, Dairy Cow, Myanmar.**

I. INTRODUCTION

Mastitis is the most significant disease of dairy herds and a major disease affecting the dairy industry. It can loss the farm economics due to reduction in milk production and treatment costs and affects on public health by drinking unhealthy milk. The severity of mastitis can be classified into clinical and subclinical (Viguier et al., 2009).

In 1990, Williams and Newbold reported that the use of yeast culture to improve livestock productivity, and the underlying mechanisms for such improvement, have attracted increasing attention. Yeast cells are known to be a rich source of vitamins, enzymes and some unidentified cofactors that are helpful in increasing microbial activity in the rumen (Dawson et al., 1990; Williams et al., 1991). Yeast is a naturally rich source of proteins, minerals and B-complex vitamins. Not only does mineral enriched yeast offer a natural form of mineral but also provides other nutrients when consumed (Kreger-van, 1984, 1987).

Van Unden et al. (1958) and Lund (1976) show that feeding of yeast cultures perform active growth promoters in improving animal production and feed efficiency. Living yeasts had been shown to exert more beneficial effect on animal nutrition than dead yeast (Rose, 1987). The general benefits of feeding live yeast culture to animals include increases in milk production, milk fat content, weight gain, feed efficiency, and feed intake, (Phillips and Von Tungeln, 1984). Yeast culture supplementation was shown to increase milk production and milk fat percentage in dairy cows (Willliams et al., 1991; Erasmus et al., 1992; Piva et al., 1993). On the other hand, neither of these parameters was shown to be significantly altered by yeast supplementation (Blauwiekel et al., 1995; Robinson, 1997).

The effect of dietary yeast supplementation on milk yield and milk composition of lactating cow was still controversial. And there was scarcity of literature on dietary yeast on occurrence of clinical and subclinical mastitis. Therefore, the objective of this study was to determine the effect of dietary supplementation of live yeast (*S. cerevisiae*) on the milk yield, chemical composition of milk and occurrence of clinical and subclinical mastitis in lactating cows.

II. METHODOLOGY

Location of the experiment:

This study was assigned in Nan Wai dairy farm, Nay Pyi Taw Region. Analysis of milk composition was conducted at Department of Physiology and Biochemistry, University of Veterinary Science, Yezin, Nay Pyi Taw.

Experimental design:

Sixteen adult cross-bred Holstein Friesian lactating cows, early to mid lactating stage at body condition score 2.5 – 3.0, were equally divided into group A (n=8) and group B (n=8). Eight cows from group A fed with only basal diet (rice straw, concentrate groundnut cake = 5.5 kg/head/day, cotton seed cake = 4.5 kg/head/day) and group B cows fed with basal diet (rice straw, concentrate groundnut cake, cotton seed cake) supplemented with yeast culture providing 50g/head/day daily.

Cows from both groups were given their experimental feedstuffs for 2 weeks as a preliminary period and experimental 8 weeks. Quarter milk samples from each cow and cow based milk samples from individual cow were taken for CMT test at 3 days interval for 8 weeks. CMT scoring system was as followed by Schalm and Noorlander (1957); 0, T, 1, 2, 3.

Eleven parameters of milk from experimental cows were examined with Lactoscan by taking milk samples from individual cow and bulk tank milk samples weekly intervals for 8 weeks. These eleven parameters such as milk fat, protein, lactose, density, NFS, temperature, pH, salts, freezing point and EC were tested with Lactoscan to examine the composition of milk. Milk yield from each cow was daily recorded for 8 weeks.

The milk constituents of milk fat %, protein%, lactose%, density, NFS, temperature, pH, salts, freezing point and EC were compared between 2 groups. Lactoscan data and milk yield data were analyzed by *student t* test. CMT scores between two groups were compared by using *Chi square* test. $P<0.05$ was considered as a level of significant.

III. RESULTS

Comparison of milk composition of cows between group A and group B:

The mean milk fat%, density%, non-fat solids (NFS)%, protein%, temperature, salts%, freezing point and electrical conductivity (EC), lactose%, pH of milk from experimental cows were not significantly different ($p>0.05$) between two groups throughout the experiment.

Comparison of milk yield (kg) of cows between group A and group B:

Although the daily mean milk yield (kg) of cows from two experimental groups were not significantly difference ($p<0.05$), the mean milk yield of cows from group B were significantly higher ($p<0.05$) than that of cows from group B at the last week of experimental period (4^{th} day and 5^{th} day of 8^{th} week).

International Journal of Novel Research in Life Sciences
Vol. 3, Issue 4, pp: (18-24), Month: July - August 2016, Available at: www.noveltyjournals.com

Table 1 Comparison of mean milk yield (kg) of cows between two groups in experimental 8th week

Days	Mean ± SE		Sig. level
	Group A	Group B	
1	5.66 ± 0.43	7.29 ± 0.38	NS
2	5.62 ±0.43	7.36 ± 0.39	NS
3	5.68 ±0.44	7.58 ± 0.40	NS
4	5.58 ± 0.41	7.66 ± 0.41	P<0.05
5	5.60 ± 0.43	7.68 ± 0.40	P<0.05
6	5.74 ± 0.44	7.68 ± 0.40	NS
7	5.84 ± 0.48	7.81 ±0.42	NS

NS = Not significant

P<0.05 = Significant

The mean milk yield of the two groups was analyzed by *student t test*.

Comparison of weekly milk yield (kg) of cows between two groups:

The weekly milk yield of experimental cows from two groups was compared by *student t test*. There was no significant difference in weekly milk yield between group A and group B throughout the experimental period. Weekly milk yield of cows from group B were gradually higher week by week and had tendency to increase in comparison to that of group A.

In within group comparison, no significant difference was observed in weekly milk yield of group A from the week 1 to the week 8. However, weekly milk yield of cows from yeast supplemented group was significantly increased at the 6th, 7th and 8th week of the experiment.

Table 2 Comparison of weekly milk yield (kg) of cows between two groups

Weeks	Mean ± SE		P value
	Group A	Group B	
1	28.54 ± 2.26^{a}	34.19 ± 2.50^{d}	0.31
2	28.78 ± 2.26^{a}	34.74 ± 2.15^{d}	0.25
3	30.03 ± 2.31^{a}	36.74 ± 2.14^{cd}	0.20
4	31.36 ± 2.48^{a}	40.19 ± 2.47^{bcd}	0.13
5	34.88 ± 2.65^{a}	44.10 ± 2.60^{abcd}	0.14
6	37.50 ± 2.78^{a}	47.70 ± 2.67^{abc}	0.12
7	38.90 ± 2.91^{a}	50.37 ± 2.59^{ab}	0.08
8	39.73 ± 3.04^{a}	53.06 ± 2.78^{a}	0.06
Within group Sig. level	0.25	0.001	

P<0.05 = Significant

The weekly milk yield between two groups was analyzed by *student t* test.

The weekly milk yield within group was analyzed by ANOVA.

California mastitis test scores of milk samples based on quarter and cow at the preliminary and experimental periods:

In quarter based comparison, the CMT scores of group B were significantly lower (p<0.05) than that of group A at day 4 and day 7 of the preliminary period. In experimental period, CMT scores of group B were significantly lower (p<0.05) than that of group A in day 7, 10, 13. There were not significantly different (p>0.05) in CMT scores between group A and group B at day 16, 19, 22, 25. However, the CMT scores of group B were significantly lower (p<0.05) than those of group A from day 28 until the end of the experimental period (day 28, 31, 34, 37, 40, 43, 46, 49, 52 and 55).

In cow based comparison, the CMT scores of group B is lower (p<0.05) than those of group A at preliminary day 4, and day 37, 43, 49, 52 and 55 of the experimental period. Except these points, the CMT scores between the two groups were not significantly different (p>0.05) in three day intervals of experimental period.

International Journal of Novel Research in Life Sciences
Vol. 3, Issue 4, pp: (18-24), Month: July - August 2016, Available at: www.noveltyjournals.com

Table 3 Quarter based CMT scores of group A and group B

Day	Group A (out of 32)		Group B (out of 32)		Sig. Level
	Negative	Positive	Negative	Positive	
Preliminary period					
Pre Day 1	16	16	23	9	NS
Pre Day 4	9	23	18	14	P<0.05
Pre Day 7	11	21	24	8	P<0.05
Pre Day 10	15	17	22	10	NS
Pre Day 13	25	7	27	5	NS
Experimental period					
Day 1	15	17	22	10	NS
Day 4	20	12	24	8	NS
Day 7	17	15	27	5	P<0.05
Day 10	14	18	24	8	P<0.05
Day 13	16	16	25	7	P<0.05
Day 16	23	9	22	10	*NS*
Day 19	27	5	28	4	*NS*
Day 22	18	14	25	7	*NS*
Day 25	20	12	26	6	NS
Day 28	18	14	27	5	P<0.05
Day 31	17	15	25	7	P<0.05
Day 34	9	23	22	10	P<0.05
Day 37	8	24	24	8	P<0.05
Day 40	15	17	25	7	P<0.05
Day 43	7	25	24	8	P<0.05
Day 46	11	21	29	3	P<0.05
Day 49	11	21	29	3	P<0.05
Day 52	18	14	31	1	P<0.05
Day 55	15	17	31	1	P<0.05

NS = Not significant

P<0.05 = significant

The CMT score data between the two groups were analyzed by 2×2 contingency test (Chi-square test)

Table 4 Cows based CMT scores of group A and group B

Day	Group A (out of 8)		Group B (out of 8)		Sig. Level
	Negative	Positive	Negative	Positive	
Preliminary period					
Day 1	2	6	4	4	NS
Day 4	-	8	3	5	P<0.05
Day 7	1	7	4	4	NS
Day 10	1	7	4	4	NS
Day 13	4	4	5	3	NS
Experimental period					
Day 1	1	7	4	4	NS
Day 4	3	5	3	5	NS
Day 7	2	6	4	4	NS
Day 10	1	7	2	6	NS
Day 13	2	5	4	4	NS
Day 16	3	5	4	4	NS
Day 19	4	4	6	2	NS

Day 22	2	6	4	4	NS
Day 25	3	5	3	5	NS
Day 28	2	6	4	4	NS
Day 31	2	6	4	4	NS
Day 34	1	7	3	5	NS
Day 37	-	8	4	4	$P<0.05$
Day 40	2	6	4	4	NS
Day 43	-	8	4	4	$P<0.05$
Day 46	4	4	5	3	NS
Day 49	1	7	5	3	$P<0.05$
Day 52	2	6	7	1	$P<0.05$
Day 55	2	6	7	1	$P<0.05$

NS = Not significant

$P<0.05$ = significant

The CMT score data between the two groups were analyzed by 2×2 contingency test (Chi-square test)

IV. DISCUSSION

Dairy cattle in Myanmar are not being used to feeding the probioitcs such as yeast and *Lactobacillus* species. Dairy farmers mostly used to feed the cattle rice straw, grasses, maize stalk and concentrate (groundnut cake, cotton seed cake, etc). And the effect of feeding probiotics on the occurrence of mastitis and milk production of dairy cattle has not been yet established.

All the experimental cows showed no visible udder inflammation, abnormal milk appearance and clinical signs such as fever, loss of appetite and depression throughout the experiment. It indicates that there was no clinical mastitis in all experimental cows during the experimental period. In this study, milk yield was daily recorded and mastitis was determined by CMT as cow-side test in three day intervals. Milk composition changes were examined weekly by Lactoscan.

In the present study, milk composition such as milk fat%, density%, NFS%, protein%, water content%, temperature, salts%, freezing point and EC, lactose%, pH were not significant difference between two groups. This result agrees with the finding of some investigators, Piva et al. (1993), Robinson (1997), Soder and Holden (1999) and Dann et al. (2000), who reported no significant change in milk composition following intake of supplemented yeast culture. However, Alshaikh et al. (2001) described that daily fat, protein, lactose, total solids and solids not fat yields were higher in cows receiving diets supplemented with yeast culture than cows receiving only basal diet. It may possibly due to differences in strains of yeast used in the experiments and also differences in the use of raw materials as basal diet for the experimental cows. In their study, basal diet was Alfalfa hay and the concentrate pellets, which contains corn 60%, barely 4.22%, soya bean meal 22.79%, molasses 8%, protected fat 0.8%, limestone 1.5%, dicalciumphosphate 0.8%, sodium chloride 0.23%, sodium bi-carbonate 1%, vitamin and mineral premix 0.2%, binder 3%. Furthermore, it could be also due to different management practices and variability in provoking environmental conditions associated these trials.

There was no effect of dietary yeast culture on milk fat percentage of lactating cows (Oraskovich and Linn, 1989). However, Wu Zilin (1996) reported that the inclusion of yeast culture in the daily ration of Chinese Holstein dairy cows significantly increased the amount of milk fat production. The present study agrees with Oraskovich and Linn (1989), who reported that there were no changes in milk fat by supplementation of *S. cerevisiae* on the basal diet of cows. Moreover, Oraskovich and Linn (1989) also showed that there was no significant improvement in milk protein percentage by feeding live yeast in dairy cows. But, the significantly increased protein percent was observed when yeast is supplemented in the cow's diets (Fazenda and Soaresm, 1998). The present finding is similar with the finding of Oraskovich and Linn (1989), who reported that there was no significant different effect on protein percentage by adding yeast on the basal diet. These discrepancies may probably due to the differences in strain of the live yeast used and feeding strategies in the different studies.

Although the average daily milk yield tended to be numerically higher in cows fed diet supplemented with yeast culture than that of control cows, no significant different were observed between two groups during the experiment. These results support previous studies by Soder and Holden (1999) and Dann et al. (2000), who were unable to find the supplementary effect of yeast culture on milk yield of dairy cows. However, in some studies, yeast culture supplementation was shown to increase milk production (Willliams et al., 1991; Erasmus et al., 1992; Piva et al., 1993). In addition, there were some improvements in milk production through the use of yeast culture, particularly during the hot months of summer (Fazenda and Soaresm, 1998). These discrepancies could well be associated with differences in breeds, stage of lactation, type of forage given, the source of the yeast culture and feeding strategy in these different studies.

The clinical and subclinical mastitis were detected by CMT test at three day intervals throughout the experiment. The highest CMT scores of 2 were found as sub-clinical mastitis in the cows of both groups in the experimental period. The CMT scores such as Trace, 1 and 2 indicate the existence of subclinical mastitis in both groups in this experiment.

In quarter comparison, the CMT scores of group B were significantly lower ($p<0.05$) than that of group A starting from day 28 to the end of the experimental period. In addition, although only one CMT positive quarter was found in group B, there were 17 CMT positive quarters in group A at the end of experiment. Therefore, the numbers of CMT positive quarters were significantly reduced ($p<0.05$) in the cows of group B in comparison with the cows of group A. In cow based comparison, only one CMT positive cow was found in group B, whereas 6 CMT positive cows were observed in group A at the end of experiment. It indicates that feeding *S. cerevisiae* significantly reduced ($p<0.05$) the incidence of subclinical mastitis. It may possibly due to the beneficial effect of *S. cerevisiae* on cow's immune function and inhibition of pathogen adhesion. Jurgens et al. (1997) and Perez-Sotelo et al. (2005) described that *S. cerevisiae* is a probiotic yeast studied for its beneficial effects on animal growth, host immune function, and inhibition of pathogen adhesion.

The presence of mastitis will depend on environmental (Bruno 2010), region and herd size, season, breed, nutrition and also due to different management systems (O'Rourke 2009). Nutrition can influence the cow's resistance to mastitis. However, nutrition does not influence the expose of teat ends to pathogens. The cows should have adequate energy, minerals and vitamins for optimal milk production. If so, the cows can maintain the udder health and immune status (O'Rourke 2009).

Overall, the present study indicates that feeding live *S. cerevisiae* can significantly reduce the incidence of subclinical mastitis in lactating cows. However, feeding live yeast has no significant effect ($p>0.05$) on milk composition and milk yield.

V. CONCLUSION

From the present study, it is concluded that there was no significant effect of dietary supplementation with live yeast (*S. cerevisiae*) on milk composition in cross-bred Holstein Friesian dairy cows and no significant different effects on milk yield were observed by dietary supplementation of live yeast to lactating cows. However, dietary supplementation of yeast significantly reduced ($p<0.05$) the numbers of quarters and cows based CMT scores of milk.

REFERENCES

[1] Alshaikh MA, Alsiadi MY, Zahran SM, Mogawer HH, and Aalshowime TA, (2001). Effect of feeding yeast culture from different sources on the performance of lactating Holstein cows in Saudi Arabia. *J. Anim. Sci.* 3:352-356.

[2] Blauwiekel R, Loney KA and Riley E (1995). Baker's yeast effluent as a liquid feed for dairy cows and heifers. *J. Dairy Sci*. 78:397-403.

[3] Bruno DR (2010). In: Mastitis, Mammary Gland Immunity, and Nutrition. Mid-South Ruminant Nutrition Conference. Arlington, Texas: 19-26.

[4] Dann HM, Drackley JK, McCoy GC, Hutjens MF, and Garrett JE (2000). Effects of yeast culture (Saccharomyces cerevisiae) on prepartum intake and postpartum intake and milk production of Jersey cows. *J. Dairy Sci*. 83:123-127.

[5] Dawson KA, Newman KA and Boling JA (1990). Effect of microbial supplements containing yeast and lactobacilli on roughage-fed ruminal microbial activities. *J. Anim. Sci.* 68:3392-3398.

[6] Erasmus LJ, Botha PM, and Kistner A (1992). Effect of yeast culture supplement on production, rumen fermentation and duodenal nitrogen flow in dairy cows. *J. Dairy Sci*. 75:3056-3065.

[7] Fazenda N and Soares M (1998). Instituto Superior De Agronomia, Lisboa, Portugal, and Antonio Castanheira, Arrigaga e Cunha Dairy. Use of yeast culture in lactating dairy cows in a commercial dairy in Portugal; International yeast culture dairy research 1998-3.

[8] Jurgens MH, Rikabi RA and Zimmerman DR (1997). The effect of dietary active dry yeast supplement on performance of sows during gestation-lactation and their pigs. *J. Anim. Sci*. 75:593-597.

[9] Kreger-Van Rij NJW (1984). The yeasts a taxonomic study.3rd ed (Ed. Dawson KA (1987). Mode of action of yeast cultures. Yea-Sacc. In the rumen: A natural fermentation modifier. In: Biotechnology in the Feed Industry. (Ed. Lyons. T. P.) Alltech Technical Publications. USA. pp: 113-118.

[10] Kreger-Van Rij NJW (1987). Classification of Yeasts. The Yeasts 2nd ed. (Eds. Rose AH and JS Harrison) 1. 5-61. London. Academic Press. Cited by Dawson KA (1987). Mode of action of yeast cultures. Yea-Sacc. In the rumen: A natural fermentation modifier. In: Biotechnology in the Feed Industry. (Ed. Lyons. T. P.) Alltech Technical Publications. USA. pp: 113-118.

[11] Lund A (1976). Yeast and Molds in the bovine rumen. J Gen. Microbial.81: 453-462. Cited by Wu. J. F. (1987): The microbiologist's function in developing action-specific micro-organisms. In: Biotechnology in the Feed Industry. (Ed. Lyons TP)Alltech Technical Publications. USA. pp: 181-197.

[12] O'Rourke D (2009). Nutrition and udder health in dairy cows: A Review. *J. Irish. Vet.* 64:1-5.

[13] Oraskovich. V. A. and J. G. Linn. 1989. Effect of yeast culture on milk production and composition in four dairy herds. *J. Anim. Sci*.

[14] Perez-Sotelo LS, Talavera-Rojas M, Monroy-Salazar HG, Laguna-Bernabe S and Cuaron-Ibarguengoytia JA (2005). In vitro evaluation of the binding capacity of *Saccharomyces cerevisiae Sc47* to adhere to the wall of *Salmonella spp*. Rev. Latinoam. Microbiol. 47:70-75.

[15] Phillips WA, and VonTungeln DL (1985). The effect of yeast culture on the poststress performance of feeder calves. Nutr. Rep. Int. 32:287.

[16] Piva G, Belladonna S, Fisconi G and Ssicbaldi F (1993). Effect of yeast on dairy cows performance, ruminal fermentation, blood components, and milk manufacturing properties. *J. Dairy Sci*. 76:2717-2722.

[17] Robinson PH (1997). Effect of yeast culture (Saccharomyces cerevisiae) on adaptation of cows to diets post partum. *J. Dairy Sci.* 80:1119-1125.

[18] Rose AH (1987). Yeast culture a micro-organisms for all species: A theoretical look at its mode action. In: Biotechnology in the Feed Industry. (Ed. Lyons, T. P.) Alltech Technical Publications. USA. pp: 113-118.

[19] Schalm WL, DO Noorlander (1957). Experiments and observations leading to development of the California Mastitis Test. *J. Am. Vet. Med. Assoc.* 130: 199-207.

[20] Soder KJ and Holden. 1999. Dry matter intake and milk yield and composition of cows fed yeast prepartum and postpartum. *J. Dairy Sci*. 82:605-610.

[21] Van Uden N, Carmo Sousa, L Do and M Farinham (1958). On the intestinal yeast-flora of horses, sheep, goats and swine. J Gen. Microbiol. 19: 435-455. Cited by Wu JF (1987).The microbiologist's function in developing action-specific micro-organisms. In: Biotechnology in the Feed Industry. (Ed. LyonsTP) 181-197. Alltech Technical Publications. USA.

[22] Viguier C, Arora S, Gikmartin N, Welbeck K and Kennedy RO (2009). Mastitis detection: Current trends and future perspectives. Trends in Biotechnology 27.

[23] Williams PEV and Newbold, 1990. Rumen probiosis: The effect of novel microorganisms on rumen fermentation and ruminal productivity. In: Recent Advances in Animal Nutrition (Ed. W. Haresign and DJA Cole). Butterworths. London, England.

[24] Williams PEV, Tait CAG, Innes GM, and Newbold CJ (1991). Effects of the inclusion of yeast culture (Saccharomyces cerevisiae plus growth medium) in the diet of dairy cows on milk yield and forage degradation and fermentation patterns in the rumen of steers. *J. Anim. Sci*. 69:3016-3026.

[25] Wu Zilin. 1996. Feed Research Institute, Chinese Academy of Agricultural Sciences, Beijing, China. *J. Anim. Sci*.