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Effect of monensin sodium and yeast metabolites supplementation on reproductive performance of lactating Sahiwal cows

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Abstract

The present study was conducted to evaluate the effect of monensin sodium and yeast metabolites supplementation on reproductive performance of lactating Sahiwal cows. Eighteen lactating Sahiwal cows were randomly allocated into three groups comprising six animals each. The control group (T_0) received a basal diet, while treatment groups received either monensin sodium (T_1 ; 1 g/animal/day) or yeast metabolites (T_2 ; 3 g/animal/day) along with the basal diet for 90 days. Reproductive parameters including calving to first postpartum oestrus interval, calving to conception interval and conception rate were recorded and analysed.

The mean calving to first postpartum oestrus interval was 157.20 ± 22.37 , 153.33 ± 18.01 and 120.33 ± 11.91 days in T_0 , T_1 and T_2 groups, respectively. Similarly, the calving to conception interval was 166.00 ± 21.22 , 188.50 ± 6.81 and 123.33 ± 14.76 days in the respective groups. The conception rate was 50.00 ± 21.22 , 66.66 ± 21.08 and 50.00 ± 21.22 per cent in the control, monensin and yeast metabolite-supplemented groups, respectively. Although numerical improvements were observed in reproductive parameters, particularly reduced postpartum oestrus and calving-to-conception intervals in yeast-supplemented cows and higher conception rate in monensin-supplemented cows, the differences among treatments were statistically non-significant ($P > 0.05$).

It may be concluded that supplementation of monensin sodium and yeast metabolites tended to improve reproductive efficiency in lactating Sahiwal cows; however, the effects were not significant under the conditions of the present study.

Keywords: Sahiwal cows, monensin sodium, yeast metabolites, reproductive performance, conception rate, postpartum oestrus

1. Introduction

Feed additives have become an important component of modern ruminant nutrition because of their ability to improve feed utilization, rumen fermentation, animal productivity and overall health status. Among the various nutritional interventions available, ionophores and yeast-based feed additives have received considerable attention owing to their beneficial effects on ruminal metabolism and production efficiency (Duffield *et al.*, 2008; Habeeb, 2017) [8, 11].

Monensin sodium is a polyether ionophore produced by *Streptomyces cinnamonensis* and is widely used in ruminant feeding systems to improve feed efficiency and animal performance (Duffield *et al.*, 2008) [8]. Its primary mode of action involves selective inhibition of gram-positive ruminal bacteria, resulting in increased propionate production and reduced methane and ammonia synthesis in the rumen (Russell and Strobel, 1989) [16]. Increased propionate production improves glucose availability and energy utilization, thereby reducing the negative energy balance commonly observed during early lactation (Duffield *et al.*, 2008) [8]. Consequently, monensin supplementation has been associated with improved feed efficiency, nutrient utilization, milk production and reproductive performance in dairy cattle (Phipps *et al.*, 2000; Ruiz *et al.*, 2001; Duffield *et al.*, 2008) [13, 15, 8].

In recent years, increasing concerns regarding the use of antibiotic feed additives and

consumer demand for residue-free livestock products have stimulated interest in natural alternatives capable of improving animal productivity and health (El-Bordeny *et al.*, 2019) ^[9]. Among these alternatives, yeast cultures and yeast metabolites derived from *Saccharomyces cerevisiae* have emerged as promising feed additives for ruminants (Desnoyers *et al.*, 2009; Habeeb, 2017) ^[6, 11].

Yeast supplementation positively influences rumen microbial ecology by stimulating cellulolytic bacterial growth, scavenging oxygen within the rumen, stabilizing ruminal pH and enhancing fibre digestion (Desnoyers *et al.*, 2009; Habeeb, 2017) ^[6, 11]. Furthermore, yeast products promote microbial protein synthesis and improve nutrient digestibility, resulting in enhanced feed utilization and animal performance (Habeeb, 2017) ^[11]. Several studies have reported improvements in dry matter intake, milk yield, milk composition and feed efficiency following supplementation with yeast culture products in dairy animals (Desnoyers *et al.*, 2009; El-Bordeny *et al.*, 2019) ^[6, 9].

Apart from productive performance, yeast supplementation may also exert beneficial effects on reproductive efficiency. Improved nutrient availability, enhanced metabolic status and better ruminal fermentation are considered important factors contributing to earlier resumption of ovarian activity, shorter service periods and improved fertility in dairy animals (Desnoyers *et al.*, 2009; El-Bordeny *et al.*, 2019; Habeeb, 2017) ^[6, 9, 11]. El-Bordeny *et al.* (2019) ^[9] reported a reduction in the period to first oestrus and service period, along with improved fertility rate, in lactating buffaloes supplemented with yeast-based probiotics.

Although monensin and yeast products differ in their mechanisms of action, both feed additives ultimately improve nutrient utilization and metabolic efficiency. Monensin primarily enhances energetic efficiency through increased ruminal propionate production, whereas yeast metabolites improve fibre degradation, microbial growth and ruminal stability (Duffield *et al.*, 2008; Desnoyers *et al.*, 2009) ^[8, 6]. Consequently, both additives may contribute to improved productive and reproductive performance in dairy cattle.

Sahiwal cattle represent one of the most important indigenous dairy breeds of India because of their adaptability, disease resistance and ability to maintain production under tropical climatic conditions. However, information regarding the influence of monensin sodium and yeast metabolites on reproductive performance of Sahiwal cows remains limited. Therefore, the present study was undertaken to evaluate the effect of dietary supplementation of monensin sodium and yeast metabolites on reproductive parameters, including first postpartum heat period, calving-to-conception interval and conception rate in lactating Sahiwal cows.

Materials and Methods

Experimental Site

The present investigation was conducted at the Bull Mother Experimental Farm (BMEF), College of Veterinary Science and Animal Husbandry, Anjora, Durg, Chhattisgarh, India. The region is located at an altitude of 317 m above mean sea level and experiences a tropical climate characterized by hot summers, moderate winters and seasonal monsoon rainfall.

Experimental Animals and Design

Eighteen lactating purebred Sahiwal cows in early lactation were selected from the institute herd and randomly allocated into three groups (n = 6 per group) based on parity and body weight. Prior to the initiation of the experiment, all animals

were dewormed with fenbendazole (7.5–10 mg/kg body weight).

The experimental groups were as follows

T₀ (Control): Basal diet only

T₁: Basal diet + Monensin sodium (1 g/animal/day)

T₂: Basal diet + Yeast metabolites (3 g/animal/day)

The feeding trial was conducted for a period of 90 days.

Feeding and Management

All experimental animals were maintained under identical housing and management conditions in a conventional double-row barn system with concrete flooring. The animals were fed a basal ration comprising green fodder, dry fodder and concentrate mixture according to the farm feeding schedule. The green fodder consisted mainly of Hybrid Napier, Sudan grass, Berseem and locally available grasses. In addition, animals were allowed grazing for approximately 4 h daily during the morning. Concentrate mixture was offered twice daily during milking. Fresh drinking water was made available ad libitum throughout the experimental period.

Reproductive Parameters

Reproductive performance of experimental cows was assessed using calving to first postpartum oestrus interval, calving to conception interval and conception rate.

Calving to First Postpartum Oestrus Interval

All cows were observed twice daily (morning and evening) for behavioral signs of oestrus following parturition. The interval between calving and the first observed postpartum oestrus was recorded and expressed in days.

Calving to Conception Interval

The interval from calving to successful conception was recorded for each animal using farm reproductive records and expressed in days.

Conception Rate

Conception rate was calculated as the percentage of inseminated cows that conceived during the experimental period according to the following formula:

$$\text{Conception Rate (\%)} = (\text{Number of cows conceived} / \text{Number of cows inseminated}) \times 100$$

Pregnancy status was confirmed through routine pregnancy diagnosis records maintained at the farm.

Statistical Analysis

Data were analysed using SPSS statistical software. Treatment means were compared by one-way analysis of variance (ANOVA) as described by Snedecor and Cochran. Differences were considered statistically significant at $p < 0.05$.

Results

Reproductive Performance

The effect of dietary supplementation of monensin sodium and yeast metabolites on reproductive performance of lactating Sahiwal cows is presented in Table 1. The mean calving to first postpartum oestrus interval was 157.20 ± 22.37 , 153.33 ± 18.01 and 120.33 ± 11.91 days in the control, monensin-supplemented and yeast metabolite-supplemented groups, respectively. Although cows supplemented with yeast

metabolites exhibited a shorter postpartum oestrus interval compared to the control and monensin groups, the differences among treatments were not statistically significant ($P = 0.236$).

Similarly, the mean calving to conception interval was 166.00 ± 21.22 days in the control group, 188.50 ± 6.81 days in the monensin group and 123.33 ± 14.76 days in the yeast metabolite group. Numerically, cows receiving yeast metabolites showed a reduced calving to conception interval compared to the control and monensin-supplemented cows. However, the variation among groups was statistically non-significant ($P = 0.178$).

The conception rate was 50.00 ± 21.22 , 66.66 ± 21.08 and

50.00 ± 21.22 per cent in the control, monensin and yeast metabolite groups, respectively. Although the monensin-supplemented group recorded a higher conception rate than the other groups, no significant treatment effect was observed ($P = 0.739$).

Overall, supplementation of monensin sodium and yeast metabolites did not significantly influence the reproductive parameters studied. Nevertheless, yeast metabolite supplementation tended to improve reproductive efficiency by reducing the calving to first postpartum oestrus interval and calving to conception interval, whereas monensin supplementation showed a numerical improvement in conception rate.

Table 1: Effect of monensin sodium and yeast metabolites supplementation on reproductive performance of lactating Sahiwal cows

Parameters	T ₀	T ₁	T ₂	Significance level
First Post Partum Heat (Days)	157.2 $\pm$ 22.37	153.33 $\pm$ 18.01	120.33 $\pm$ 11.91	NS
Calving to Conception Interval (Days)	166 $\pm$ 21.22	188.50 $\pm$ 6.81	123.33 $\pm$ 14.76	NS
Conception Rate (%)	50	66.66	50	NS

Discussion

Reproductive efficiency is an important determinant of productivity and profitability in dairy cattle, as it directly affects calving interval, lifetime milk yield and overall herd performance. In the present study, supplementation of monensin sodium and yeast metabolites resulted in numerical improvements in reproductive parameters, although the differences among treatment groups were statistically non-significant ($P > 0.05$). The observed numerical improvements may be attributed to enhanced nutrient utilization, improved rumen fermentation and better metabolic status of supplemented animals.

The first postpartum heat period was numerically reduced in cows supplemented with yeast metabolites (120.33 ± 11.91 days) compared to the control (157.20 ± 22.37 days) and monensin-supplemented groups (153.33 ± 18.01 days). Earlier resumption of ovarian activity following calving is generally associated with improved energy balance and nutrient availability during early lactation. Yeast supplementation is known to stimulate rumen microbial activity, improve fiber digestion and enhance volatile fatty acid production, thereby increasing nutrient availability to the host animal. Improved energy status may facilitate earlier recovery of ovarian function and resumption of cyclicity after calving. Similar observations were reported by Desnoyers *et al.* (2009) [6], who concluded that yeast supplementation improved reproductive performance and metabolic efficiency in dairy cows.

The calving-to-conception interval was also numerically lower in the yeast metabolite-supplemented group (123.33 ± 14.76 days) than in the control (166.00 ± 21.22 days) and monensin-supplemented groups (188.50 ± 6.81 days). A shorter calving-to-conception interval reflects improved reproductive efficiency and reduced days open. The beneficial effect of yeast supplementation may be associated with improved ruminal fermentation, enhanced microbial protein synthesis and improved nutrient utilization, which contribute to better reproductive performance. Similar findings have been reported by Habeeb *et al.* (2017) [11], who observed improvements in reproductive traits following supplementation with yeast-based feed additives.

Monensin supplementation did not reduce the postpartum heat period or calving-to-conception interval compared to the control group; however, cows receiving monensin exhibited a numerically higher conception rate (66.66%) than control and

yeast-supplemented cows (50.00%). Monensin is known to alter ruminal fermentation by increasing propionate production and improving feed efficiency. Enhanced propionate production increases glucose availability and improves energy balance, which may positively influence reproductive function and conception success. Similar findings were reported by Duffield *et al.* (2008) [8], who observed improved reproductive performance in monensin-supplemented dairy cows. Phipps *et al.* (2000) [13] and Ruiz *et al.* (2001) [15] also reported beneficial effects of monensin on reproductive efficiency through improvements in metabolic status and energy utilization.

Although conception rate was numerically greater in the monensin-supplemented group, the differences among treatment groups were statistically non-significant ($P > 0.05$). The absence of significant differences in reproductive traits may be attributed to the limited number of experimental animals, individual animal variation and the relatively short duration of supplementation. Similar non-significant effects of dietary additives on reproductive performance have been reported by Dann *et al.* (2000) and Benchaar *et al.* (2008), who observed numerical improvements in reproductive traits without significant treatment effects.

Overall, the findings of the present study indicate that supplementation of yeast metabolites tended to improve reproductive efficiency by reducing the first postpartum heat period and calving-to-conception interval, whereas monensin sodium supplementation showed a tendency to improve conception rate. However, these improvements were not statistically significant under the conditions of the present experiment.

Conclusion

The present study demonstrated that dietary supplementation of monensin sodium and yeast metabolites had no significant effect on reproductive parameters of lactating Sahiwal cows. However, yeast metabolite supplementation numerically reduced the calving to first postpartum oestrus interval and calving to conception interval, indicating a tendency towards improved reproductive efficiency. Monensin sodium supplementation resulted in a numerically higher conception rate compared to the control group. Although the observed improvements were not statistically significant, the findings suggest that both feed additives may positively influence reproductive performance through improved nutrient

utilization and metabolic efficiency. Further studies involving a larger number of animals and a longer experimental period are recommended to validate these effects.

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Conflict of Interest

Not available

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