Effect of dietary supplementation of poly-herbal mixture and butyric acid on milk production, milk quality and somatic cell counts of postpartum Murrah buffaloes

Subhash Chandra*, P.S. Oberoi, M. Bhakat, R.K. Yogi, Archana Yadav, P.K. Singh and Amit Kumar

ICAR-National Dairy Research Institute, Karnal-132 001, India.
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ABSTRACT

This study evaluated the effect of dietary supplementation of poly-herbal mixture and butyric acid on the milk yield, milk quality and somatic cell counts in Murrah buffaloes up to 90 days of lactation. Thirty six Murrah buffaloes were divided into four groups viz.; T1 control (n=9; Body Weight (BW)=666.22±31.30 kg, Most Probable Production Ability (MPPA)=1834 kg, Parity (P)=3.44) without any supplementation, T2 (n=9; BW=661.89±42.13 kg, MPPA=1860 kg, P=3.56) poly-herbal mixture, T3 (n=9; BW=664.22±14.81, MPPA=1907 kg, P=3.33) poly-herbal mixture + butyric acid and T4 (n=9; BW=672.00±17.97, MPPA=1891 kg, P=3.44) butyric acid on the basis of MPPA and P. In T1 group poly-herbal mixture was supplemented for seven days postpartum along with butyric acid for 30 days pre-partum and 30 days post-partum. In T2 group only butyric acid was supplemented for 30 days during pre-partum and 30 days post-partum periods. The results depicted that milk yield (T1-9.91±1.10, T2-9.72±1.18, T3-9.47±1.38 and T4-8.62±0.97 kg/day), fat corrected milk yield (6%) (T1-18.23±2.03, T2-18.45±2.28, T3-17.79±2.59 and T4-15.59±1.77 kg/day) and average total solid (T1-17.34±0.3, T2-17.80±0.40, T3-17.43±0.29 and T4-6.74±0.25) were significantly higher (P<0.05) in supplemented (T2, T3, and T4) groups as compared to control group (T1). No significant change in milk protein, lactose and SNF but the values was on higher side in treatment group. Somatic cell count (SCC) was significantly (P<0.05) lower in poly-herbal mixture and butyric acid supplemented groups as compared to control group. From the present study it was concluded that poly-herbal mixture and butyric acid supplementation during transition period has beneficial effect in improving milk production and udder health.

Key words: Butyrate, Milk quality, Murrah buffaloes, Poly-herbal mixture.

INTRODUCTION

India possesses 108.7 million (Livestock census, 2012) buffalo population which contributes 51% of the milk production to the national milk pool (Basic animal husbandry and fisheries statistics , 2014). Among the buffalo breeds, Murrah is the pride of India and famous as black gold of India. The breed is widely accepted throughout the globe for its production performance and adaptability. Transition period is crucial phase of the dairy animals, owing to high demand of nutrition, but various factors influence the productive, reproductive performance and economics of dairy production. During transition period, physiological changes and stress related to last trimester fetal growth, parturition and lactation along with dietary change make the animal prone to metabolic and productive disorders. To overcome such problems researchers have tried various feed supplements like sunflower oil (do Prado et al., 2015), poly-herbal galactagogue biscuits (Patel et al., 2013) and Asparagus racemosus (Behera et al., 2013) to improve the productive and reproductive health. Many of these poly-herbal preparations have however not been scientifically evaluated but their traditional use does suggest their safety and efficacy (Singh, 2014). Poly-herbal mixture and butyric acid are believed to assist in the initiation, maintenance or augmentation of milk production and improve udder health (Mullen et al., 2014) as they act as immune-modulators, anti-inflammatory and as source of energy. Therefore, the present study was designed to study the effect of poly-herbal mixture and butyric acid supplementation during transition period has beneficial effect in improving milk production and udder health.

MATERIALS AND METHODS

The present study was conducted on 36 Murrah buffaloes maintained at LRC, ICAR-NDRI, Karnal, having 2-6 parity and age group of 55 to 120 months. The average age at first calving was 42-44 months. Murrah buffaloes, in their last month of pregnancy were divided into 4 groups on the basis of body weight (BW), most probable production ability (MPPA) and parity (P) viz.; T1 control (n=9; BW=666.22±31.30 kg, MPPA=1834 kg, P=3.44) without any supplementation. T2 (n=9; BW=661.89±42.13 kg,
MPPA=1860 kg, P=3.56) poly-herbal mixture, T₂ (n=9; BW=664.22±14.81, MPPA=1907 kg, P=3.33) poly-herbal mixture plus butyric acid and T₃ (n=9, BW=672.00±17.97, MPPA=1891 kg, P=3.44) only butyric acid. In T₃ group, poly-herbal supplementation for seven day post partum, In T₂ group, buffaloes were supplemented poly-herbal supplementation for seven day post partum plus 200 ml butyric acid (99%) supplementation during 30 day pre-partum and 30 day post partum period. The animals of T₃ were given 200 ml butyric acid (99%) supplementation for 30 day during pre-partum and 30 day post-partum period. The poly-herbal mixture was prepared by mixing 25 gns each of following six herbs: i) Foeniculum vulgare (Saunf), ii) Trachyspermumammi (Ajwain), iii) Trigonella foenum-graecum (Methi), iv) Zingiber officinale (Sundh), v) Anethum graveolens (Sowa) and vi) Elettaria cardamomum (Cardamom) along with 25 gram black salt (Kala Namak) was also added to the mixture. 150g of poly-herbal mixture along with 25g black salt was mixed in 1litre water. This mixture was boiled for about 30 minutes till half of water remained. To this, 250 grams of jaggery (gur) was added and heated for another 5-10 minutes. The herbal mixture, thus, prepared was mixed with 1.5 kg of concentrate mixture and fed to the buffaloes of T₁ and T₃ groups after parturition for seven days in the morning hours. The buffaloes were managed as per the standard practices followed in the institutes herd. Buffaloes of the group were offered 10% higher ration than the standard requirements (NRC, 2001). Fresh water was made available to the buffaloes at all the time of the day.

Hand milking was done twice a day at 4.30 AM and 4.30 PM and milk yield of individual buffalo was recorded. To determine the milk composition, 50 ml of milk samples from individual buffaloes were collected at weekly interval in a properly cleaned milk sample bottles. Milk samples were analyzed for milk fat, protein, lactose, SNF and total solids weekly up to 12 weeks and somatic cell count samples were analyzed for milk fat, protein, lactose, SNF and total solids weekly up to 6 weeks. The milk constituents such as fat, protein, lactose and SNF were analyzed by automatic milk analyzer (Meganetco, Bulgarian, and MMB-965-3100). The total solid values of milk sample were estimated by addition of SNF and fat value.

Somatic cell count was done on 7th, 14th, 21st, 28th, 35th, 42nd and 49th day in post partum period. Somatic cell counts of milk samples were measured by two methods firstly by somatic cell counter where 5 ml of Ekoprin reagent (EON Trading) is mixed with 10 ml of fresh milk sample. Ekoprin is a surfactant that dissolves the somatic cells membrane as well as its nucleus envelope and forms a gel, elevating the viscosity of the milk. There is a proportional relation between the viscosity of mixture (milk and Ekoprin) and number of somatic cells of the tested milk. The milk analyzer Ekomilk Scan measures the flowing time of the milk through the sample mixer capillary and determines the number of somatic cells in accordance with this time. In order to cross-check the reading obtained by somatic cell counter, microscopic method was also used Dang et al., (2007). The SCC of each original milk samples was determined in duplicate within 6-h post collection. The milk was heated to 40°C in a water-bath and held for 15 min. at that temperature before being cooled to 20°C with careful stirring. 0.01 ml of milk was spread on a 1 cm (0.5×2 cm) area of a degeresed microscopic slide and dried in a horizontal position. SCC of milk samples were measured microscopically by the method of Martinez et al., (2003). Only those cells which possessed a stained nucleus were counted. The somatic cell count was done under the microscope with a magnification of 40X in 50 fields and average number of cells per field was multiplied by the microscopic factor (0.882). The microscopic factor was determined by using an ocular and stage micrometer. SCC was made by using following formula.

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\text{Somatic cell counts/ml of milk (lakh) = average cells count in one field } \times 0.882.
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The data were subjected to analysis of variance (ANOVA) and comparison between treatment groups was made by Turkey ‘test using SPSS software.

RESULTS AND DISCUSSION

Pre- and post-partum supplementation of butyric acid and post-partum supplementation of poly-herbal mixture had effect on milk production performance and milk quality of Murrah buffaloes. Average daily milk yield per animal per day during 120 day of post-partum period in supplemented groups (T₁, T₂, and T₃) and control group (T₀) were 9.91±1.10, 9.72±1.18, 9.47±1.38 and 8.62±0.97 kg/day, respectively. Milk yield was significantly (P<0.05) higher in T₁ and T₃ supplemented group as compared to control group T₀(Table 1), but no significant difference in milk yield was observed between treatment groups. Overall average daily milk yield (kg/d) was higher in supplemented groups; T₁ by 14.96%, T₂ by 12.76% and T₃ by 9.86% over that of control group. Daily fat corrected milk (6%) in supplemented groups T₁, T₂ and T₃ was 18.23±2.03, 18.45±2.28, 17.79±2.59 respectively higher (P<0.05) as compared to 15.59±1.77 in control group (T₀). FCM was higher in T₁ by 17.23%, T₂ by 17.45% and T₃ by 16.79% over that of the control group.

Higher milk production in poly-herbal and combination of poly-herbal with butyrate supplemented group may be due to galactopoietic activity of some of the herbs like Anethum graveolens (sowa), Foeniculum vulgare (saunf) and Trachyspermumammi (ajwain). It is well know that Anethum Graveolens (sowa) acts as a galacto-gogue (Jana and Shekhawat, 2010), where as Foeniculum vulgare (saunf) plays an important role in promoting milk ejection, stimulating milk flow and increasing milk production (Abascal and Yarnell, 2008) and Trachyspermumammi (Ajwain). (Abascal and Yarnell, 2008) and
(ajwain) acts as galactogogue, hypo-tensive, oxytocic, stimulate milk ducts of mammary gland tissue as well as promote milk ejection (Zuppa et al., 2010; Abascal and Yarnell, 2008; Ghedira et al., 2010). The results are in consonance with the finding of Kholf et al. (2012) who reported that feeding of Zingiber officinalis in goats, significantly (P<0.05) improved milk yield in supplemented groups (18.9%) as compared to control groups. Patel reported the significant increase in milk yield (14.2%) of Surti buffaloes on supplementation of poly-herbal galactogogue preparations. The overall milk fat % in supplemented group (T2, T3 and T4) and control group (T1) were 6.70±0.11, 6.99±0.13, 6.92±0.15 and 6.50±0.14, respectively, which was significantly (P<0.05) higher in supplemented group (T2, T3 and T4) as compared to control group (T1). In other words, milk fat % was higher by 3.07 % in T3, 7.54% in T2 and 6.46% in T1 over that of control group. The increase in milk fat content and yield in T2, T3 and T4 groups in response to increased availability of butyrate are in agreement with earlier studies (Thomas et al., 1984). There was increase in acetate to propionate ratio when butyrate is fed which leads to increase in milk fat content (Sutton, 1984). On the other side, Shah and Mir (2004) reported that feeding of fenugreek seed to dairy cows improved fat content of milk (4.47%) as compared to control (4.01%) group.

Milk protein %, milk lactose % and milk SNF % in supplemented groups (T2, T3 and T4) and control group (T1) were 3.72±0.13, 3.74±0.16, 3.78±0.14 and 3.74±0.13; 4.58±0.15, 4.65±0.15, 4.62±0.14 and 4.53±0.13 and 10.64±0.27, 10.81±0.37, 10.51±0.22 and 10.24±0.19 respectively. There was no significant difference between supplemented and control group. These finding were similar as reported by Mirzaei et al. (2012) in case of cross bred goats supplemented with hreal mixture.

Total solid % in supplemented groups (T2, T3, T4) was 17.34±0.3, 17.80±0.40, 17.43±0.29 respectively and significantly (P<0.05) higher compared to control group (T1) values of 16.74±0.25. Results of SCC indicated that udder health status of animals in supplemented groups were better and significantly (P<0.05) lower as compared to control group (T1). Increase in milk production was probably partially attributed by improvement in udder health. Somatic cell count was observed to reduce by 23.76% in T2, 25.24% in T3 and 16.83% in T4 groups as compared to control. It is also noted that the milk from poly-herbal as well as butyric acid supplemented buffaloes had lesser SCC than reported values in the literature, which could be due to the anti-inflammatory property of both supplements. The improved udder health status in the supplemented group i.e. poly-herbal mixture may be due to synergistic effect of Anethum graveolens (Heamalatha et al., 2011), Foeniculum vulgare (Choi and Hwang, 2004) and anti-inflammatory activity of short chain fatty acid (butyrate) (Verbeke et al., 2010); immune-modulatory, anti-inflammatory and anthithrombosis properties of Trachyspermumammi and Trigonella foenum-graecum (Bonjar, 2004 and Ahmadiani et al., 2001); analgesic and anti-inflammatory properties of Zingiber officinale and Elettaria cardamomum (Sapra et al., 2000 and Jiang, 2006). Butyrate can also regulate neutrophil function and modulate inflammatory cytokine expression, especially in the presence of inflammatory stimuli (Zapolska-Downar and Naruszewicz, 2009). Somatic cell has close relationship with inflammation, udder health and milk quality as well as it reflects the herd health status. Normally during lactation, secretion of somatic cell are common and they eliminate udder infections and tissue damage (Hillerton, 1999).

CONCLUSION

The age old practice of supplementing poly-herbal mixture just after parturition is well known, however novel findings of present study depicting that supplementation of poly-herbal mixture (@425g) as well as poly-herbal mixture and butyric acid (@200ml) in combination may be used safely during transition period to improve milk production and milk quality in Murrah buffaloes.

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CONFLICTS INTEREST

None of the authors have any conflict of interest.

Table 1: Milk Yield, milk composition and milk quality in Murrah buffaloes supplemented with of poly-herbal mixture and butyric Acid.

<table>
<thead>
<tr>
<th>Particular</th>
<th>Control (T1)</th>
<th>Poly-herbal mixture (T2)</th>
<th>Poly-Herbal mixture + Butyric Acid (T3)</th>
<th>Butyric Acid (T4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk yield (kg/d)</td>
<td>8.62±0.97a</td>
<td>9.91±1.10b</td>
<td>9.72±1.18b</td>
<td>9.47±1.38bc</td>
</tr>
<tr>
<td>FCM (6%)</td>
<td>15.59±1.77a</td>
<td>18.23±2.03c</td>
<td>18.45±2.28d</td>
<td>17.79±2.59b</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>6.50±0.14c</td>
<td>6.70±0.11c</td>
<td>6.99±0.13c</td>
<td>6.92±0.15c</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>3.74±0.13</td>
<td>3.72±0.13</td>
<td>3.74±0.16</td>
<td>3.78±0.14</td>
</tr>
<tr>
<td>Lactose (%)</td>
<td>4.53±0.13</td>
<td>4.58±0.15</td>
<td>4.65±0.15</td>
<td>4.62±0.14</td>
</tr>
<tr>
<td>SNF (%)</td>
<td>10.24±0.19</td>
<td>10.64±0.27</td>
<td>10.81±0.37</td>
<td>10.51±0.22</td>
</tr>
<tr>
<td>Total solids (%)</td>
<td>16.74±0.25a</td>
<td>17.34±0.3c</td>
<td>17.80±0.40a</td>
<td>17.43±0.29c</td>
</tr>
<tr>
<td>SCC (105)</td>
<td>2.02±0.16</td>
<td>1.54±0.76</td>
<td>1.51±0.11</td>
<td>1.68±0.10</td>
</tr>
</tbody>
</table>

Means bearing different superscripts in a row significantly (P<0.05)
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