Evaluation of Effect of Peppermint as a New Preventive Method for Milk Fever and Subclinical Hypocalcaemia in Transition Holstein Cows

Mehdi Goodarzi, Mohammad Sadegh Safaee Firouzabadi, Mohammad Mahdi Zarezadeh Mehrizi and Mohsen Jafarian

Department of Large Animal Medicine, Faculty of Veterinary Medicine, Young Researchers Club, Graduated of Veterinary Medicine Faculty, Department of Clinical Pathology, Faculty of Veterinary Medicine, Islamic Azad University, Shahrekord Branch, Shahrekord, Iran

Abstract: Milk fever and subclinical hypocalcaemia are the most important macromineral disorders that affect transition dairy cows. Feeding peppermint to dairy cattle due to physiological or pharmacological functions may affect rumen fermentation and digestibility. Thus, in the present study, peppermint was tested for its effects upon serum calcium and urine pH levels in transition Holstein cows. Twenty dairy cattle (the last 3 weeks prepartum) were divided into 2 groups. Group 1 (control) treated with no peppermint and group 2 (treatment) treated with peppermint. To determine serum calcium and urine pH levels, blood and urine were taken in start of experiment, after 15 days adaptation period with the peppermint being mixed with concentrate and 12 h after calving in second milking. Serum calcium and urine pH levels between control group and treatment group were not significantly different (p>0.05) in start of experiment, but their levels after 15 days adaptation period and 12 h after calving were significant (p<0.05). In treatment group serum calcium and urine pH difference between before treatment and after treatment in three different times were different significantly (p<0.05). According to these results, it can be concluded that peppermint has a great potential as a new preventive method for milk fever and subclinical hypocalcaemia by inducing mild metabolic acidosis or any unknown mechanism.

Keywords: Peppermint, preventive method, subclinical hypocalcaemia, transition dairy cows

INTRODUCTION

Milk fever and subclinical hypocalcaemia are the most important macromineral disorders that affect transition dairy cows. They influence on the transition cow to effect skeletal and smooth muscle contraction and exacerbates the level of immunosuppression experienced by periparturient dairy cattle (Kimura et al., 2006). Normal blood calcium is 8 mg/dL (2.0 mmol/L) in cattle. It has been reported that milk fever cows are up to eight times more likely to develop mastitis in the following lactation, are three times more likely to develop dystocia and two to four times more likely to develop abomasal displacement (Mulligan et al., 2006). On average, 5-10% of dairy cows succumb due to clinical milk fever, suggesting that the incidence rate in individual herds reaches as high as 34% (Houe et al., 2001).

Herbs have been shown to have pharmacodynamical and pharmacokinetical functions. It has been observed that peppermint oil has antifoaming effect on in vitro gastric and intestinal foams (Grigoleit and Grigoleit, 2005a, b). Peppermint has a strong ability to act as a natural manipulator of rumen fermentation (Andoa et al., 2003). In this study we sought to determine if peppermint can alleviate hypocalcaemia and milk fever during the close-up dry period (the last 3 weeks prepartum).

MATERIALS AND METHODS

The research was conducted in summer 2011 at one of commercial dairy cattle farms of Yazd, Iran. In this study 20 Holstein dairy cattle, 4 years old, were tested. Transition dairy cows were defined as those in the last 3 weeks before calving. Their average body weight was 450±25 kg. The cows were divided into 2 groups. Group 1 (control) treated with no peppermint and group 2 (treatment) treated with peppermint.

They were fed with 1 kg of Alfalfa hay, 3 kg of mashed concentrate mix (10% barley groats, 36% canola meal, 21% wheat bran, 30% rice bran, 2/5% vitamin supplements and 0/5% NaCl) and 12 kg of corn silage at 6:30 followed by 2 kg of wheat straw at 19:30. In treatment group, all dry cattle were fed with 400 g of peppermint (sun-dried imported from central areas of...
Iran) daily that was mixed with mashed concentrate. Water provided *ad libitum*.

Macromineral analysis of sodium, potassium, chloride, sulfur and calcium of peppermint were measured using Wet chemistry methods. To calculate Dietary Cation Anion Balance (DCAB) in milli-equivalents per 100 g of ration of dry matter for a peppermint, the following formula was used: \[\left(\frac{\text{percent sodium}}{0.023}\right) + \left(\frac{\text{percent potassium}}{0.039}\right) - \left(\frac{\text{percent chloride}}{0.0355}\right) - \left(\frac{\text{percent sulfur}}{0.016}\right)\] (Moore *et al*., 1997).

Ten mL of blood was taken from jugular vein of each cattle in three different times: in start of experiment (Ca1), after 15 days adaptation period with the peppermint being mixed with concentrate (Ca2), and 12 h after calving (Ca3) in second milking. Serum was separated and the level of calcium was determined spectrophotometrically at 550 nm (Jadhav *et al*., 2010).

The urine pH of all cows determined at three different times similar to blood sampling. Urine pH was measured by digital pH-meter from fresh urine in middle part of urination.

**RESULTS**

Table 1 shows the macromineral analysis for peppermint. For calculation DCAB of peppermint in a feed were used this following:

<table>
<thead>
<tr>
<th>Description</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>1.90</td>
</tr>
<tr>
<td>Potassium</td>
<td>1.60</td>
</tr>
<tr>
<td>Calcium</td>
<td>2.40</td>
</tr>
<tr>
<td>Chloride</td>
<td>3.25</td>
</tr>
<tr>
<td>Sulfur</td>
<td>0.60</td>
</tr>
</tbody>
</table>

\%

**constant milliequivalents:**

- Na 1.90% 0.023 = + 83
- K 1.60% 0.039 = + 41
- S 0.6% 0.016 = − 37/5
- Cl 3.25% 0.0355 = − 91/5

Total cation milliequivalents/100 g = 83 + 41 = +124
Total anion milliequivalents/100 g = 37/5 + 91/5 = −129

Cation-anion difference = 124 − 129 = − 5

Table 2 shows the average of blood calcium levels (mg/dL) in the three different times:

<table>
<thead>
<tr>
<th></th>
<th>Ca1</th>
<th>Ca2</th>
<th>Ca3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>8.81</td>
<td>8.54</td>
<td>7.51</td>
</tr>
<tr>
<td>Treatment</td>
<td>8.94</td>
<td>9.53</td>
<td>8.43</td>
</tr>
</tbody>
</table>

Results are shown as mean±S.D; *: p<0.05

Table 3 shows the average of urine pH levels in the three different times:

<table>
<thead>
<tr>
<th></th>
<th>pH1</th>
<th>pH2</th>
<th>pH3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>6.86</td>
<td>6.89</td>
<td>6.80</td>
</tr>
<tr>
<td>Treatment</td>
<td>6.83</td>
<td>6.04</td>
<td>6.47</td>
</tr>
</tbody>
</table>

Results are shown as mean±S.D; *: p<0.05

significantly different (p>0.05), urine pH levels in treatment group after 15 days adaptation period (pH2) and 12 h after calving (pH3) were significantly lower than in the control group (p<0.05) at similar times. In treatment group the difference between before treatment and after treatment in three different times (pH1, pH2, and pH3) were different significantly (p<0.05). In control group the average of urine pH levels in all of times (pH1, pH2, and pH3) was not different significantly (p>0.05).

**DISCUSSION**

Optimum urine pH for close-up dry cows is about 5.5 to 6.5 (Davidson *et al*., 1995). In this experiment, the average of urine pH levels in peppermint-fed cattle shows peppermint can induce mild metabolic acidosis and normal blood calcium by a negative DCAB or any unknown mechanism. Metabolic acidosis increases tissue response to parathyroid hormone and lead to increase calcium resorption from bone; also parathyroid hormone receptors in bone are less functional at high blood pH (Horst *et al*., 1997).

The most common strategy employed to achieve this negative DCAB is the addition of anionic salts to the diet of pre-calving cattle (Goff, 2004). Anionic salts are expensive, significantly increasing feed costs per day for the close-up group. They are unpalatable and can reduce dry matter intake. Significant reductions in dry matter intake near parturition can predispose animals to metabolic disorders such as milk fever, displaced abomasum and ketosis (Moore *et al*., 1997) but Ando *et al* (2003) reported that ruminal pH was significantly lower in the peppermint-fed steers than in the control steers and Peppermint feeding had no adverse effects upon ruminal fermentation and nutrient digestibility. Also
antispasmodic and antifoaming effects of peppermint oil may play an additional role to induce a good palatability (Grigoleit and Grigoleit, 2005a, b).

Peppermint similar to alfalfa is high in calcium but one of the classical strategies often proposed for milk fever prevention is the restriction of calcium intake pre-calving. This strategy is not a practical alternative for milk fever prevention on farms using grass or grass silage as a large component of the dry-cow diet (Wilson, 2001).

CONCLUSION

Peppermint feeding by inducing mild metabolic acidosis and normal blood calcium can be a new preventive method for milk fever and subclinical hypocalcaemia in transition Holstein cows. This method can be better than other preventive strategies such as addition of anionic salts to the diet and calcium restriction; because of tow-reasons: First, peppermint is cheap, significantly decreasing feed costs per day for the close-up group. Second, it’s no adverse effects upon ruminal fermentation and nutrient digestibility.

ACKNOWLEDGMENT

This study has been supported financially by Islamic Azad University, Shahrekord Branch, Iran.

REFERENCES


