

Early life administration of a *Megasphaera elsdenii* capsule as a tool improves performance and rumen development in dairy-beef calves under subacute ruminal acidosis risk

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Introduction

Ruminal health and solid feed dry matter intake (DMI) is essential for calf growth and development. However, calves can experience decreases in rumen pH leading to subacute ruminal acidosis (SARA), as they transition from liquid to solid diets during weaning. In adult dairy and beef cattle, nutritional interventions with probiotics containing the lactate utilizing bacteria *Megasphaera elsdenii* have been successfully adopted to prevent SARA. Yet, there is limited information on SARA prevention strategies for calves. Thus, the objective of this study was to evaluate the effects of an oral probiotic capsule containing a live culture of *Megasphaera elsdenii* NCIMB 41125 (Lactipro FLX Calf, MS Biotec) on performance and rumen anatomical development of dairy-beef calves under SARA risk.

Materials and methods

Thirty-one dairy-beef crossbred calves (Holstein x Angus; 45.3 ± 7.1 kg; 8.2 ± 2.0 days old) were enrolled in a blinded 76-day randomized trial. Calves were assigned to one of 3 treatments balanced by body weight, age, and passive transfer status: placebo (ME0), single capsule of the probiotic on day 15 (ME15), or probiotic capsule administration on days 15 and 39 (ME15 + 39). Calves were housed individually and had free access to water and calf starter. Calves received 7 L/d of milk replacer (Cows Match Warm Front, Land O Lakes; 150 g/L) split into 2 equal meals until day 41. Starting on day 42, calves received 3.5 L/d of milk replacer divided into 2 meals until they were weaned on day 56. Calves were harvested on day 77. Reticulorumen weight was recorded, and tissue was collected from the ventral sac. Reticulorumen papillae length, width, and surface area were recorded using an image software. The effects of the probiotic capsule were assessed using mixed linear models.

Results

Calves receiving the probiotic had overall greater daily solid feed DMI (ME0 = 1.17 ± 0.13, ME15 = 1.62 ± 0.13, ME15 + 39 = 1.68 ± 0.11 kg/d; $P = 0.01$) and greater average daily gain (ME0 = 0.76 ± 0.08, ME15 = 1.09 ± 0.08, ME15 + 39 = 1.08 ± 0.08 kg/d; $P = 0.01$) compared to control. Furthermore, we observed a treatment by period interaction where calves receiving the probiotic displayed greater solid feed DMI and average daily gain during the weaning ($P = 0.01$) and postweaning ($P = 0.01$) periods. Treatment also affected reticulorumen weight (ME0 = 2.8 ± 0.2, ME15 = 3.6 ± 0.23, ME15 + 39 = 3.0 ± 0.2 kg; $P = 0.01$) papillae length (ME0 = 2.5 ± 0.4, ME15 = 3.6 ± 0.4, ME15+39 = 2.7 ± 0.3 mm; $P = 0.01$), width (ME0 = 1.8 ± 0.1, ME15 = 2.0 ± 0.1, ME15 + 39 = 1.8 ± 0.1mm; $P = 0.04$), and surface area (ME0 = 14.8 ± 1.5, ME15 = 19.3 ± 1.6, ME15 + 39 = 16.1 ± 1.4 mm²; $P = 0.01$).

Significance

Our results showed that providing calves with a *Megasphaera elsdenii* capsule during the preweaning period has the potential to be used as a strategic management tool, especially in preparation for the weaning and postweaning periods. Overall, calves receiving an early-life *Megasphaera elsdenii* capsule had greater performance and reticulorumen development compared to control. Yet, future researchers should investigate how early life *Megasphaera elsdenii* supplementation affects reticulorumen microbiome establishment and dynamics.

