



VOLUME VERSUS CONCENTRATION IN THE LIQUID DIET OF CALVES: IMPLICATIONS OF INCREASED OSMOLALITY FOR INTAKE, BEHAVIOR, AND ANIMAL HEALTH

Joana Palhares Campolina, Saulo Moreira Mendes, Eduardo Moreira Barradas de Souza, Mariana Magalhães Campos, Aline Cristina Sant'Anna, Jaciara Diavão, Abias Santos Silva, Sandra Gesteira Coelho

Feeding programs that increase the solids density of the liquid diet are used to maintain nutrient supply with a reduced liquid volume. However, the literature indicates that increased osmolality may impair gastrointestinal function, delay abomasal emptying, and increase the risk of enteric disorders in calves. The objective of this study was to compare two feeding strategies that provided the same daily amount of total solids at different dilutions, evaluating intake, health, metabolic responses, and behavior. Thirty Holstein calves were randomly assigned to two treatments from 0 to 70 days of age: Control (CON, milk replacer with 12.50% total solids and daily volume of 6 L/day, 450 ± 12 mOsm/kg) and Increased Solids (IDM, milk replacer with 16.67% total solids and daily volume of 4.5 L/day, 629 ± 1 mOsm/kg), maintaining a supply of 750 g/day of solids in both treatments. All experimental procedures were approved by the CEUA/EGL Ethics Committee (protocol 46691412). Intake and fecal scores were monitored daily, as well as days with diarrhea and fever, behavioral indicators were assessed weekly, and ruminal and plasma glucose and insulin parameters were evaluated biweekly. The liquid diet of the IDM treatment showed an approximately 40% increase in osmolality compared with CON. Despite this increase, no adverse effects were observed on starter, water, or nutrient intakes, fecal score, number of days with diarrhea or fever, or glycemic and insulenic responses ($P > 0.005$). Calves in the IDM treatment exhibited a 22.7% reduction in ruminal ammonia nitrogen concentrations compared with CON calves (7.96 vs. 10.30 $\mu\text{mol/L}$; $P = 0.04$), suggesting greater nitrogen utilization efficiency in the ruminal environment. In addition, calves fed the IDM diet spent less time performing non-nutritive oral behaviors, indicating a higher level of satiety. Taken together, these results counter the concern frequently reported that liquid diets with higher osmolality induce gastrointestinal disturbances and impair intake and health. Thus, a moderate increase in milk replacer concentration, resulting in higher liquid diet osmolality, represents a safe feeding management alternative in calf-rearing systems, particularly when higher liquid volumes are impractical.

Keywords: dairy calves, behavior, osmolality, milk replacer.