**Interaction between colostrum and milk replacer supply on growth and gastrointestinal development of dairy surplus calves.**

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***Application:*** Morbidity, mortality, and irresponsible use of antimicrobials are common concerns in the rearing of dairy surplus calves. Consequently, there is a pressing necessity to identify mechanisms to motivate dairy farmers to improve calf care. The findings of this study will contribute to the recognition of developmental and nutritional factors influencing surplus calf well-being. This, in turn, will enable producers to implement effective and practical feeding strategies that prioritize animal welfare, enhance overall health, and promote future profitability.

***Introduction:*** In calves, early postnatal nutrient supply influences growth, future health and performance, and gastrointestinal tract (**GIT**) development (Khan et al., 2007; Ollivett et al., 2012). Colostrum management has been identified to be crucial for calf health and survival. Nevertheless, colostrum has been reported to influence GIT development and digestive and absorptive capacities in neonates (Blättler et al., 2001). However, and to our knowledge, the interaction between colostrum and plane of nutrition and their cumulative effects has not been documented before. Therefore, this study examined the interactions between these two critical early-life interventions and their impact on growth performance and GIT development over time in surplus bull calves as they develop in time.

***Materials and methods:*** One hundred and twenty Holstein-Friesian bull calves (2.16±0.99 d of age; 43.1±3.56 kg BW) were enrolled. At the dairy farm of origin, calves were fed either 2 or 6L of colostrum replacer (**CR**), within 12h after birth, aiming to provide a total of 100 or 300g of IgG, to obtain either failure (**F**) or successful (**S**) transfer of passive immunity, respectively. Upon arrival at the facility, serum IgG levels were measured, therefore; F and S calves were identified accordingly and blocked, and subsequently were randomly assigned to one of two milk replacer (**MR**) feeding schemes: Moderate (**M**; 0.25 Mcal of ME/kg of arrival BW0.75, with 15.0% solids/L of MR) or Low (**L**; 0.135 Mcal of ME/kg of arrival BW0.75, with 12.5% solids/L of MR). In total, there were 4 treatments resulting from the 2×2 factorial design: **FM, FL, SM, SL** (n=30/treatment). Calves were individually housed and received their MR allowance twice daily in teat buckets until d42, and subsequently gradually weaned until d56. Calves had free access to chopped straw and water during the entire study, and a calf pelleted starter was introduced on d22. To evaluate GIT development and composition, 10 calves/treatment were euthanized at 3 different timepoints (21, 42, and 84d of age). Other measurements included BW at arrival and weekly thereafter, and daily intakes were individually recorded. Data was analysed by PROC MIXED in SAS accounting for the fixed effects CR, MR, and time, and their interaction, as well as the random effect of block. Time was entered into the model as a repeated statement and initial BW was used as covariable when appropriate.

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Description automatically generated***Results:*** Initial BW was not different across treatments (Figure 1) while serum IgG was greater in S calves (S=1962.9 *vs*. F=941.0 mg IgG/dL). Throughout the experimental period, BW was significantly influenced by both CR (*P*=0.012) and MR (*P*<0.001) treatments, with a tendency for an interaction between CR, MR, and time (*P*=0.09). The BW at the three distinct slaughter ages was influenced by the allowance of MR (*P*<0.001), wherein calves receiving moderate levels (SM and FM) consistently exhibited higher weights compared to those receiving low allowances, regardless of colostrum treatment (Figure 1). Similarly, increased fresh tissue weights were observed in the duodenum, jejunum, ileum, cecum, and colon of SM and FM calves, with the influence of MR being evident (*P*<0.05) across the three distinct dissection timepoints. By design, calves receiving moderate levels of MR had greater milk intakes (*P*<0.05), while starter intake was influenced by CR (*P*=0.05) and throughout the entire experiment, there was a tendency for an interaction between CR and MR (*P*=0.09).

**Figure 1**. Body weight at three different slaughter timepoints of surplus calves. Calves received one of the four treatments: SM = 300g IgG + moderate milk allowance; FM = 100g IgG + moderate milk allowance; SL = 300g IgG + low milk allowance; FL = 100g IgG + low milk allowance (n =10 calves/treatment/slaughter time point).

***Conclusions:*** No morphological difference were observed from CR supply. However, the provision of MR strongly influenced the development of the GIT. Notably, there was an increase in the tissue weight of the intestine in calves receiving more milk. This augmented weight might imply a potentially larger surface area for nutrient absorption, in line with the greater nutrient supply to these calves. Further study of gut tissue morphology may describe more in depth the value of these interventions on the development of gastrointestinal competence of dairy surplus calves.

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