

Soymilk Replacer versus Whole Milk: Effects on Calf Performance

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Abstract

The demand for milk and its importance in human nutrition limits its availability for neonatal dairy calves, especially in regions where the local breeds of dairy cows have low genetic potential for milk production. Calves are prone to stress during the preweaning period (2-3 months) and therefore need adequate nutritional management (Jenkins, 2021). The early life nutrition of calves has a lasting impact on their productivity and fertility throughout their lifespan (Drackley, 1999; Roy et al., 2016). To enhance the survival and health of young pre-ruminants, alternative sources of milk can be provided (Khan et al., 2012; Dairy Australia, 2020). Soymilk is a plant-based alternative to cow's milk that is made from soybeans (Gadzama et al., 2017). It contains protein, fat, carbohydrates, vitamins and minerals, but it also has some anti-nutritional factors (ANFs) that can interfere with the digestion and absorption of nutrients by calves. However, adequate processing can inactivate ANFs in soymilk making it a promising alternative as a milk replacer (Gernah et al., 2013; Gadzama et al., 2017; Dairy Australia, 2020). This study evaluated the effect of substituting a portion of whole milk with soymilk on the preweaning growth performance of dairy calves. We hypothesized that soymilk could partially replace whole milk without compromising the growth performance of preweaning calves. A total of 16 Holstein x Bunaji calves with an average initial live weight of 34.8 ± 0.7 kg (mean $\pm$ standard deviation) were randomly assigned to one of four dietary treatments: 1) control, without soymilk; 2) low, with 25% DM soymilk; 3) medium, with 50% DM soymilk; 4) high, with 75% DM soymilk in a completely randomized design. Each calf received 2 litres of liquid feed twice daily for 98 days and their body weight, average daily gain, feed intake, feed efficiency, and health status were monitored. To promote rumen development, the animals received a measured amount of concentrate feed. In addition, all calves had *ad libitum* access to Digitaria hay and clean fresh drinking water. All data were analysed in SAS using the General Linear (PROC GLM) procedure with repeated measures that adjusted for fixed and random effects. The results showed that replacing whole milk with 25% DM soymilk improved the feed conversion ratio and calf performance compared to the control group. Calves that received 25 and 50% DM soymilk had significantly ($P < 0.05$) higher total weight gain than the control group. This suggests that soymilk replacer had a positive effect on the growth of the calves up to a certain point. Calves fed 25% DM of soymilk were more efficient with lower total dry matter intake and feed conversion ratio and higher average daily gain compared to the control group. The reason for the peak at 25% DM of soymilk may be related to the optimal balance between the protein and energy content of the diet, as well as the digestibility and palatability of the feed. However, as the proportion of soymilk increased beyond 25% DM, the performance of the calves declined. The calves that received 75% DM of soymilk had the lowest final live weight, total weight gain and average daily gain. This indicates that excessive inclusion of soymilk may have negative effects on the health and nutrition of calves. Therefore, this study indicates that partial replacement of whole milk with up to 25% DM soymilk in calves' diets can improve feed efficiency and growth performance. The findings suggest that soymilk can partially replace whole milk in preweaning calf feeding programs without compromising performance.

Keywords: Milk-replacer, soymilk, preweaning, calf, performance

Table 1: Performance parameters of calves fed soymilk replacer

Parameter	Inclusion levels of soymilk				SEM
	Control (0%)	Low (25%)	Medium (50%)	High (75%)	
Initial live weight, kg	34.50	35.50	34.00	35.25	2.43
Final live weight, kg	100.50 ^{ab}	109.75 ^a	106.00 ^a	93.50 ^b	3.83
Total weight gain, kg	66.00 ^b	74.25 ^a	72.00 ^a	58.25 ^c	2.64
Average daily gain, kg	0.67 ^b	0.76 ^a	0.73 ^{ab}	0.59 ^c	0.03

Dry matter intake, kg/day	4.25 ^a	4.18 ^c	4.22 ^b	4.22 ^b	0.01
Feed conversion ratio kgDMI/kg gain	6.31 ^b	5.52 ^a	5.74 ^{ab}	7.11 ^c	0.29

^{a-c}Means with different superscripts within the same row differed significantly ($P < 0.05$).

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