

# Colostrum replacement with 300 g of IgG does not result in excellent transfer of passive immunity in dairy calves

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## Introduction

New standards for passive immunity in dairy calves from U.S. dairy operations recommend serum IgG concentrations of  $\geq 25$  g/L in at least 40% of the calves. To achieve this serum IgG level from maternal colostrum (MC), a single feeding of 300 g of IgG within 2 h or 400 g in multiple feedings within 24 h is recommended. However, similar recommendations do not exist when colostrum replacers (CR) need to be used. The objective of this study was to determine if feeding dairy calves 300 g of IgG by 2 different colostrum replacement protocols resulted in excellent transfer of passive immunity (serum IgG > 25 g/L).

## Materials and methods

Twenty-seven Holstein dairy calves (male and female) were separated from their dams immediately after birth prior to colostrum ingestion and randomly assigned to 1 of 3 treatment groups. Group CR1 ( $n = 11$ ) was fed 1,412 g of a commercial colostrum replacer powder containing 300 g of IgG divided into 2 equal feedings of 150 g of IgG, each within 2 hours and 4 to 6 hours of life, respectively. Group CR2 ( $n = 7$ ) received a single feeding of 1,412 g of a commercial colostrum replacer powder containing 300 g of IgG within 2 h of life. Group MC ( $n = 9$ ) was the control group and received 4 L of > 22% Brix fresh or frozen maternal colostrum within 2 h of life and another 2 L within 6-12 h of life as per farm protocol. The colostrum replacer product was mixed according to the manufacturer's label. All treatments were fed by a nipple bottle (NB), and if a calf failed to consume the entire dose, an esophageal tube (ET) was used to feed the remainder of the colostrum. Blood samples were collected from all calves at 0 and 48 h of life to determine serum IgG concentrations by radial immunodiffusion. The apparent efficiency of absorption (AEA) of IgG was calculated for groups CR1 and CR2 using the following formula: serum IgG concentration at 48 h of age (g/L)  $\times$  plasma volume (L)  $\div$  total IgG intake (g). Because the data were not normally distributed and could not be adequately transformed, serum IgG concentrations at 48 h were compared statistically using the nonparametric Kruskal-Wallis test. The proportion of calves with either excellent, good, fair or failure of transfer of passive immunity was compared between groups using the Fisher's exact test. A value of  $P < 0.05$  was considered significant.

## Results

None of the calves nursed the entire volume of colostrum treatment from the NB, and ET was used to feed the remaining volumes of CR or MC to all calves in all groups. The mean  $\pm$  SD serum IgG concentrations at 0 h of life were minimal and not significantly different between groups ( $P = 0.36$ ). In contrast, the mean  $\pm$  SD serum IgG concentrations at 48 h of life were significantly ( $P = 0.003$ ) greater in MC calves ( $30.8 \pm 4.3$  g/L) compared with CR1 and CR2 calves ( $15.3 \pm 2.6$  g/L and  $15.6 \pm 2.6$  g/L, respectively). Failure of transfer of passive immunity (FTPI = serum IgG < 10 g/L) was not detected in any calf; however, 10/11 (91%) CR1 calves and 6/7 (85.7%) CR2 calves had fair transfer of passive immunity (serum IgG = 10-17.9 g/L). The majority (88.9%) of calves in the MC group had excellent transfer of passive immunity (serum IgG > 25 g/L). The median AEA for CR1 and CR2 groups (14.3% and 15.1%, respectively) was not significantly different ( $P = 0.25$ ) and were much lower than those reported in previous studies using the same colostrum replacer product in dairy calves.

## Significance

Based on results from this study, complete colostrum replacement with 300 g of IgG within 6 hours of life to dairy calves does not result in excellent transfer of passive immunity (serum IgG > 25 g/L). It is possible that a greater non-IgG solids/IgG ratio in the colostrum replacer negatively affected IgG absorption in CR1 and CR2 groups. The greater mean serum IgG levels and the greater proportion of calves with excellent transfer of passive immunity in the MC group are likely the result of a much greater total IgG mass fed in 6 L of maternal colostrum.

