

Effects of individual colostrum composition on postnatal immune and metabolic adaptation in calves

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The metabolic and health status of the dam has a direct impact on the neonatal calf. Moreover, colostrum intake triggers numerous metabolic and development processes. However, limiting knowledge exists on role of variation in individual colostrum components on metabolic and endocrine adaptation in calves. The objective of this study was to investigate the impact of individual colostrum macronutrients and non-macronutrients on various metabolic and endocrine blood parameters of calves within the initial 24 hours postpartum, with the aim of drawing conclusions regarding the calf's energy metabolism and immunization success. For this purpose, 46 Holstein calves were separated from their dams immediately after parturition to prevent suckling. Each 2 L of individual colostrum (harvest within 4h postpartum) from dams was given to the respective calves at 4h and 12h of age. Prior to feeding, blood samples were taken from the calves at 4h and 12h postpartum. Each individual colostrum was analyzed for macronutrient content (i.e., protein and lactose). Furthermore, concentrations of bioactive compounds immunoglobulin (Ig) G, insulin and adiponectin were analyzed in the respective individual colostrum samples. In blood samples, concentrations of IgG, total protein (TP), glucose and non-esterified fatty acids (NEFA) were analyzed. Statistical analysis was carried out with SAS (V 9.4.). A mixed model with time as fixed effect was used to evaluate changes over time. In addition, Pearson correlation coefficients between colostrum and blood variables were calculated. Significant effects were considered at $P < 0.05$. Over time, we recorded an increase of TP (12h: $P < 0.0001$, 24h: $P < 0.0001$), IgG (12h: $P < 0.0001$, 24h: $P < 0.0001$) and glucose (12h: $P < 0.0001$, 24h: $P < 0.001$) in calves. Conversely, the concentration of NEFA (12h: $P < 0.0001$) declined following the initial colostrum intake, subsequently maintaining this level. Furthermore, there were significant correlations between colostrum protein with the plasma concentration of IgG and TP (TP 12h: $P < 0.01$, $r = 0.45$; IgG 24h: $P < 0.01$, $r = 0.56$; TP 24h: $P < 0.05$, $r = 0.49$), lactose (IgG 12h: $P = 0.08$, $r = -0.26$; TP 12h: $P < 0.01$, $r = -0.45$; IgG 24h: $P = 0.06$, $r = -0.42$; TP 24h: $P = 0.05$, $r = -0.50$), and IgG (IgG 12h: $P = 0.08$, $r = 0.26$; IgG 24h: $P < 0.01$, $r = 0.62$; TP 24h: $P = 0.01$, $r = 0.54$), insulin (IgG 12h: $P < 0.001$, $r = 0.52$; TP 12h: $P < 0.01$, $r = 0.40$; IgG 24h: $P = 0.07$, $r = 0.40$; TP 24h: $P = 0.05$, $r = 0.44$) and adiponectin (IgG 12h: $P = 0.08$, $r = 0.37$; TP 12h: $P = 0.01$, $r = 0.37$). In conclusion, partly close correlations between colostrum components and the metabolic and immunization status of the neonatal calf exist when colostrum from the own dam is fed. The aforementioned correlations further indicate that macronutrients, such as lactose, and bioactive compounds (e.g. insulin and adiponectin), may exert a regulatory effect on IgG uptake, particularly with regard to their influence on gut development and gut closure.

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