TITLE: The effect of the dry period diet and length on colostrum quality and transfer of passive immunity in dairy cattle

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Introduction

Colostrum is the first milk a cow produces after giving birth. Compared to mature milk, colostrum is highly concentrated in antibodies, specifically immunoglobulin G (IgG). The supply of IgG via colostrum ingestion by the calf is crucial for neonatal survival in the first challenging weeks of life. Colostrogenesis initiates 3 to 4 weeks before parturition and ends abruptly after giving birth (Baumrucker & Bruckmaier, 2014). This means that in multiparous cows colostrogenesis takes place in the dry period. IgG transfer from maternal circulation into the mammary gland is a complex process and could be influenced by several factors (Castro et al., 2011). In this study we analyzed the effect of feed intake during the dry period and dry period length on colostrum quality and passive transfer of immunity.

Material and methods

Feed intake during the dry period was measured daily at the ILVO research barn with the Roughage Intake Control system (Insentec RIC) from March 2016 until November 2018. Dry period consisted of a far-off and a close-up period, the latter being initiated 2 weeks before expected calving date. The far-off dry ration was a corn silage based ration (64% of DM content) mixed with straw (29% of DM content). The close-up ration contains corn silage (34% of DM content), grass silage (26% of DM content) and byproducts (28% of DM content). Both rations are supplemented with minerals. Nutritional value of the two diets is represented in Table 1.

Table 1. Diet composition per kg dry matter (DM) during the far-off and close-up period.

Ration	*Crude protein (g/Kg DM)*	*Crude fiber (g/Kg DM)*	*Starch (g/Kg DM)*	*VEM (1/Kg DM)*	*DVE (g/Kg DM)*	*OEB*
Far-off	83.25	237.94	221.57	801.47	49.37	-208.59
Close-up	144.25	181.35	181.57	1010.45	86.39	129.53

First colostrum was harvested from 77 multiparous Holstein-Friesian cows within 1 hour after parturition and quality was measured with the brix refractometer (see Table 2). Brix percentages were transformed to IgG concentration (g/L) with the formula: IgG (g/L)= -7.876+2.938*% Brix (Bartier, 2013). Calves received 6 liter of colostrum within 24 hours after birth (3 feedings of 2L within 2, 6 and 24h after birth, respectively). First milked colostrum was administered in the 2 first feedings, second or third milked colostrum was used for the third colostrum feeding. At the age of three days blood samples were taken from 18 calves and serum IgG was measured using electrophoresis. Statistical analysis was performed in R (version 3.5.1). Factors associated with colostrum quality (in Brix percentage) and transfer of passive immunity were determined using a linear regression model.

Table 2. Mean colostrum quality in function of the cow's parity

Parity	*Number of cows*	*Mean colostrum quality (g/L)*
1	24	56,3193
2	34	55,8786
3	13	63,63492
4	6	74,8287
Total	**77**	**-**

Results

Dry period length (mean ± SD) averaged 55.86 ± 21.91 days, with a range of 25 to 152 days. The average daily total DM intake in the dry period (mean ± SD) was 13.42 ± 1.75 kg, with a range of 8.40 to 17.18 kg. Colostral IgG concentration (mean ± SD) averaged 22.59 ± 3.72 % Brix, with a range of 14.6 to 33.7 % Brix, corresponding to an average (mean ± SD) IgG concentration 58.49 ± 3.05 g/L, with a range of 35.02 to 91.13 g/L. Serum IgG levels of the calves (mean ± SD) averaged 16.56 ± 5.54 g IgG/L, with a range of 7.3 to 29.8 g IgG/L. Colostrum quality was positively influenced by parity and dry period length and negatively influenced by daily dry matter intake (kg/day) and crude protein (CP) intake (g/day)(Table 3). Although dry period length had no significant effect on colostrum quality it tended to have a significant negative effect on serum IgG concentration in calves. The latter results are based upon a small subset of samples. Further research will be done to verify and explain these findings.

Table 3. Factors that affect colostrum quality and passive transfer of immunity with corresponding P values.

	Colostrum quality (Brix)	*Serum IgG concentration (g/L)*
Dry Period length	0.3017	0.0505
Parity	0.0002*	0.1558
DM intake	0.0143*	0.2213
CP intake	0.0130*	0.5862

*P-value < 0.05

Conclusion

These results confirmed the fact that the higher the parity the better the colostrum quality. Surprisingly, colostrum quality seemed to be negatively influenced by the DM and CP intake during the dry period. Further research is needed to elucidate the effect of DM intake and CP intake in the dry period on colostrum quality and transfer of passive immunity. In this study all cows received the same diet. In an ongoing experiment, the effect of the dietary protein concentration is investigated by feeding diets differing in protein concentration.

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