Undernutrition alters metabolic responses to acute inflammation in early lactation cows

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after calving as well as on persistency. Mucus score and DA had a negative impact on milk yield immediately after calving. Consistent with Wood's estimates, Wilmink's estimates indicated that multiparous cows have higher milk production and lower persistency than primiparous cows. Number of mastitis cases and DA were associated with lower overall milk production and higher persistency. Beta hydroxybutyrate was associated with a higher level of milk yield and lower persistency. The ratio of sire to residual variance estimates from Wood's and Wilmink's functions were consistent and approximately 0.4. Wood's model offered a better fit for the lactation curves considered. Our findings demonstrate the need to incorporate disease indicators on the assessment of the genetic component influencing the trajectory of the lactation curve. These findings contribute to a long-term multistate project database (USDA-NIFA-AFRI-003542) for direct measures of fertility.

Key Words: lactation curves, metritis, nonlinear mixed models

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0140 Genetic and environmental components of disease traits in dairy cattle.

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Diseases in U.S. Holstein are responsible for losses of approximately $ 1 billion annually in dairy production due to reduced milk production and increased costs. The objective was to assess the impact of environmental factors and magnitude of genetic parameters on the incidence of diseases in dairy cows early (<10 d) and late (35 to 60 d) postpartum. Binary and multinomial disease records on approximately 6000 Holstein cows from farms in Texas, Minnesota, California, and Florida were evaluated using mixed effects logistic and Poisson models. Early postpartum binary diseases included: dystocia, retained placenta, subclinical ketosis (blood β-hydroxybutyrate BHBA > 1), and metritis. Late postpartum binary diseases included: displacement of abomasum, mastitis, respiratory problems, and clinical endometritis. Mucus score at 7 d, number of mastitis cases up to 60 d, and lameness at 35 d (five levels) were analyzed assuming a Poisson model. Fixed effects in all models included: lactation number (3 levels), season (summer and winter), U.S. region, and farm. Other fixed effects evaluated depending on the disease included: twins, body condition score, BHBA level, calf gender, stillbirth, first test-day milk production record, and other diseases. The cow's sire was included as a random effect in the models. Overall lactation, region, and season had a significant effect on the incidence of all diseases, except for lactation on respiratory problems, and season on mastitis and displacement of abomasum. First lactation cows exhibited the highest incidence of dystocia, metritis, and clinical endometritis and lowest incidence of mastitis, retained placenta, lameness, and displacement of abomasum. Clinical endometritis, metritis, lameness, and respiratory problems were lower in summer than winter. Dystocia, retained placenta, and subclinical ketosis were positively and significantly associated with clinical endometritis and metritis. Subclinical ketosis and dystocia were positively and significantly associated with displacement of abomasum. Mastitis was negatively and significantly associated with milk yield at first test-day. Heritability estimates for the diseases ranged from 0.06 (retained placenta) to 0.4 (respiratory problems). The differences in genetic parameter estimates among alternative disease descriptors offer insights into effective approaches to lower the incidence of disease through genetic selection. These findings contribute to a long-term multistate project database (USDA-NIFA-AFRI-003542) for direct measures of fertility.

Key Words: metritis, postpartum, production

0141 Undernutrition alters metabolic responses to acute inflammation in early lactation cows.

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The objective was to test effects of nutrient restriction on responses to an intramammary lipopolysaccharide (LPS) challenge in early lactation cows. Multiparous Holstein cows were either allowed ad libitum intake of a lactation diet throughout the study (CON, n = 9, 7.1 MJ/kg DM NE_L, 17.4% CP), or the ration was diluted with barley straw (48% DM) for 4 d (RES, n = 8, 5.2 MJ/kg DM NE_L, 12.2% CP) starting at 24 ± 3 d in milk. After 72 h, one healthy rear mammary quarter was infused with 50 µg of LPS (*E. coli* 0111:B4). Blood samples were collected at –1.5, –0.5, 1, 2, 4, 6, and 10 h relative to LPS. Data were analyzed using SAS mixed models. Intake, milk, and protein yields and NE_L balance did not differ before diet change (21.8, 39.0, 1.15 kg/d, and –5.6 MJ/d, respectively, on d –1), but were significantly affected in RES (9.8, 28.3, 0.79 kg/d and –74 MJ/d, respectively, on d 3 of restriction and before LPS), as were plasma indicators (Table 1). Insulin response (area under the curve, AUC) to LPS was lower

Table 0141.

Table 1. Plasma insulin and metabolite concentration at 72 h of dietary treatments and response to LPS challenge. $P < 0.01$ for all variables.

	Treatments	
	CON	RES
Insulin (μIU/mL)		
72 h	17	11
AUC_{10h} [1]	174	42
NEFA (μM)		
72 h	370	1672
AUC_{10h}	-1,957	-9,047
BHBA (mM)		
72 h	0.69	2.98
AUC_{10h}	3.68	-6.05
Glucose (mg/dL)		
72 h	69	50
AUC_{10h}	-17	64

[1] Incremental area under the curve during 10 h post-LPS, concentration units per 10 h.

in RES compared with CON, but it was greater for NEFA, BHBA, and glucose. The NEFA nadir post LPS was 599 and 101 μM at 4 h for RES and CON ($P \leq 0.001$), respectively, and it preceded insulin change in RES. The BHBA decrease in RES was consistent with NEFA response to LPS, but BHBA increased from a low baseline in CON (treatment × time interactions, $P \leq 0.05$). The negative glucose AUC in CON could be related to the insulin increase post LPS. Rectal temperature increase did not differ between treatments (+2.1 ± 0.15°C at 6 h). Nutrient restriction altered peripheral metabolic responses to an intramammary LPS challenge.

Key Words: inflammation, undernutrition, dairy cow

0142 Potential modulation of the toxic effects of *Escherichia coli* in bovine endometrium by lactic acid bacteria. S. Genís[*1], A. Sánchez-Chardi[2], A. Bach[3,4], and A. Arís[1]. [1]*Department of Ruminant Production, IRTA, Caldes de Montbui, Spain,* [2]*Servei de Microscopia, UAB, Cerdanyola del Valles, Spain,* [3]*ICREA, Barcelona, Spain,* [4]*IRTA, Caldes de Montbui, Spain.*

The ultrastructural assessment of toxic effects using field emission scanning electron microscopy (FESEM) and transmission electron microscopy (TEM) can provide important information to elucidate the mechanisms of infection and to develop preventive strategies. The aim of this study was to evaluate the effects of a lactic acid bacteria (LAB) combination, based on *L. rhamnosus* MOI 25, *P. acidilactici* MOI 25, and *L. reuteri* MOI 2, at preventing *Escherichia coli* infection and maintaining bovine endometrial tissue health. Triplicate samples of epithelial cell cultures were studied in a 2 × 2 factorial design in the presence or absence of an *E. coli* infection and with or without LAB. Samples were mounted in FESEM stubs and observed without coating in a Zeiss Merlin microscope. A qualitative assessment of general structure of the epithelium (size and shape of cells, ultrastructure, and amounts of ultrastructure of microvilli), presence of *E. coli* and LAB in cell surface, cell debris, presence of mucus in the cell surface, mitochondrial damage, and cell death was performed by the analysis of 10 random selected areas for each treatment. For TEM, contrasted ultrathin sections were observed in a Jeol 1400 operating at 80kV. A semiquantitative approach was performed by the analysis of 10 random selected sections in three areas for each treatment and data were analyzed using a Fisher exact test. *Escherichia coli* alone or with LAB appeared in low numbers in epithelial cells surface and in no case formed biofilms or interactions between each other. *Escherichia coli* abundance was lower ($P < 0.05$) in samples treated with LAB than in those infected with *E. coli* alone. Healthy epithelium was observed in cells treated with LAB (epithelial cells with normal size and shape and normal aspect of microvilli), whereas in cultures infected with *E. coli*, abundant areas with cell debris and bacilli in epithelial cell surface were observed. The incidence of necrosis (as assessed by TEM) in *E. coli* samples tended ($P = 0.07$) to be greater than in noninfected cultures. Control or LAB preincubated cells showed less mitochondrial damage ($P = 0.01$) than nontreated cells, a parameter strongly related to cell death. Overall, LAB appear to offer protection against *E. coli*, by mechanism different than the formation of biofilms, and thus, LAB combinations could be used as a preventive strategy for metritis.

Key Words: endometrium, FESEM, TEM