Table 1 (Abstr. 2313).

	Treatment[1]						
	CTL	PA	HT	CS	SO	SEM	*P*-value
Milk yield, kg/d	42.1^{b}	44.1^{ab}	44.0^{ab}	44.2^{ab}	45.4^{a}	1.3	<0.01
ECM, kg/d	42.9^{b}	46.3^{a}	45.5^{ab}	44.3^{ab}	43.1^{b}	1.5	0.01
Fat, %	4.08^{ab}	4.31^{a}	4.22^{ab}	4.01^{b}	3.58^{c}	0.16	<0.01
Fat, kg/d	1.70^{bc}	1.89^{a}	1.84^{ab}	1.76^{abc}	1.61^{c}	0.08	<0.01
True protein, %	3.32^{a}	3.33^{a}	3.27^{ab}	3.19^{b}	3.19^{b}	0.08	<0.01
True protein, kg/d	1.39	1.46	1.43	1.41	1.44	0.05	0.16
MUN, mg/dL	13.1^{ab}	13.6^{a}	12.5^{ab}	11.9^{b}	9.7^{c}	0.6	<0.01
$D_{4,3}$, μm	4.04^{xy}	4.12^{x}	4.07^{xy}	4.05^{xy}	3.79^{y}	0.11	0.09
Casein micelle size, nm	161	166	161	163	163	4	0.48
Lipolysis, mEq/100g fat	0.48	0.63	0.48	0.62	0.50	0.08	0.23

[1]Means within a row with different superscripts differ at $P \leq 0.05$ (a,b,c) or $0.05 < P \leq 0.10$ (x,y).

Pasture averaged 17.5% CP and 53% NDF, and pTMR 9.7% CP and 15% NDF. The experiment lasted 12 wk with 2 wk for a covariate period followed by 3 sampling periods during wk 4, 7, and 10. Individual herbage intake was estimated using Cr_2O_3 and in vitro DM digestibility of feeds. Fecal grab samples were taken 8 times over 5 d in each sampling period. Data were analyzed using the MIXED procedure of SAS with repeated measures over time. Herbage intake was lower (7.52 vs. 6.92 kg/d; $P < 0.01$) in LIN compared with CTRL, and pTMR intake tended to increase with feeding LIN (14.9 vs. 14.5 kg/d; $P = 0.07$). However, total intake of DM, OM, CP, and NDF was not affected by treatments. Similarly, milk yield (mean = 27 kg/d), concentrations and yields of milk fat and milk protein were not changed when cows received CTRL or LIN. In contrast, MUN concentration was lower ($P < 0.001$) in LIN (8.38 mg/dL) than CTRL (11.0 mg/dL). Treatments had no effect on the apparent total-tract digestibilities of DM (mean = 61%), OM (mean = 63%), CP (mean = 56%), and NDF (mean = 53%). Furthermore, no treatment effects were observed for BW change and BCS. In summary, LinPRO-R fed at 6% of diet DM did not affect milk yield and nutrient digestibility in grazing dairy cows.

Key Words: digestibility, flaxseed, grazing.

2313 Effects of dietary lipid supplements on milk production and raw quality in dairy cows. M. Landry*[1,2], F. Huot[1,2], Y. Lebeuf[1,2], J. Chamberland[1,2], G. Brisson[1,2], D. E. Santschi[3], É. Paquet[1], D. E. Rico[4], P. Y. Chouinard[1,2], and R. Gervais[1,2], [1]*Université Laval, Québec, Canada,* [2]*Centre de recherche en sciences et technologie du lait STELA, Québec, Canada,* [3]*Lactanet, Québec, Canada,* [4]*Centre de recherche en sciences animales de Deschambault, Québec, Canada.*

This study was conducted to evaluate the effects of 4 lipid supplements on milk production and technological properties. Ten multiparous Holstein cows (64 ± 21 DIM) were used in a replicated 5 × 5 Latin square design and fed a basal TMR without supplementation (CTL) or with 2% (DM basis) fatty acids (FA) provided as soybean oil (SO), calcium salts of palm FA (CS), hydrogenated tallow FA (HT) or palmitic acid-enriched supplement (PA). Periods lasted 21 d, with the last 5 d used for milk sampling and production measurements. Data were analyzed using the MIXED procedure of SAS, with cow as random effect. Intake of DM was similar between treatments (29.5 ± 0.6 kg/d; $P = 0.14$). Milk yield was increased with SO compared with CTL, whereas CS and PA tended to increase milk yield compared with CTL (Table 1). Milk fat content was decreased with SO compared with any other treatment and increased with PA compared with CS. Milk true protein content was greater for PA and CTL compared with CS or SO, but true protein yield was not affected. Energy-corrected milk (ECM) and fat yield were increased by PA compared with CTL or SO. Milk urea nitrogen (MUN) was lower with SO compared with any other treatment and was also lower for CS compared with PA. Fat globule diameter ($D_{4,3}$) tended to be greater for PA than SO. Casein micelle size and milk lipolysis (increase in milk free FA content after 24 h of storage at 4°C) was not affected by treatment. Overall, HT had limited impact on milk composition, while CS and SO decreased milk protein content and PA increased ECM compared with the CTL diet.

Key Words: dairy cow, lipid supplement, raw milk quality

2314 Hepatic metabolome of grazing dairy cows with or without environmental control during lactation. G. Cañibe*[1], M. García-Roche[1], A. Jasinsky[2], A. Casal[2], and M. Carriquiry[1], [1]*Departamento de Producción Animal y Pasturas, Facultad de Agronomía, Universidad de la República, Montevideo, Uruguay,* [2]*Departamento de Producción Animal y Pasturas, Facultad de Agronomía, Estación Dr. Mario A.Cassinoni, Universidad de la República, Paysandú, Uruguay.*

Twenty spring-calved multiparous Holstein cows (588 ± 26 kg body weight, 2.8 ± 0.1 body condition score) were used in a randomized block design. Cows grazed a mixed pasture (one session from 17:00 to 5:00 h, 35 kg of dry matter (DM)/d of herbage allowance), and were supplemented with a total mixed ration (9.5 kg DM/d, 30:70 forage:concentrate) in a compost barn (with fan and soakers; CB-GRZ; n = 10) or in an open pen (OP-GRZ; n = 10). The aim of this work was to characterize differentially enriched hepatic metabolic pathways, by means of metabolomic analysis, in mid-lactation cows exposed to different environmental conditions during summer. Milk production and composition, BW, and BCS were recorded and liver biopsies were collected at 135 ± 11 d in milk. Four days before biopsy collection the temperature humidity index (THI) ranged from 58 to 73 and was at least 9 h per day ≥70. The metabolome was analyzed using a targeted metabolomic approach through a gas chromatography/time-of-flight mass spectrometry method and results analyzed with, an orthogonal partial least squares discriminant analysis, the variable importance to projection (VIP) score was calculated, and metabolites with VIP score >1 were selected to perform a set enrichment analysis (MSEA) using Metaboanalyst 5.0. Volcano plots were used to determine differentially abundant metabolites among treatments. Energy corrected milk (ECM), BW and BCS were analyzed using a model which included treatment as a fixed effect. ECM yield (31.9 vs. 30.64 ± 1.1 kg/d for CB-GRZ vs. OP-GRZ), BW and BCS (665 vs. 669 ± 36 kg, 2.8 vs. 2.8 ± 0.1 body condition score, $P > 0.05$) did not differ between treatments. MSEA showed an enrichment of the gluconeogenic pathway (FDR <0.05). Phosphoenolpyruvate tended to be more abundant ($P = 0.06$) while, 3-phosphoglycerate, and glucose were more abundant ($P < 0.05$) for OP-GRZ than CB-GRZ cows (FC > 1.4). Despite similar ECM yield BW and BCS, our results showed an enrichment of the gluconeogenic pathway during mid lactation in summer, especially for cows exposed to environmental conditions during supplementation.

Key Words: liver, metabolites, gluconeogenesis

2315 Impact of heat stress and dietary lipids on plasma oxylipids in dairy cows. G. C. Aguiar[1,2], A. Ruiz-Gonzalez[2], R. Almeida[1], J. Gandy[3], A. Contreras[3], and D. E. Rico*[4], [1]*Universidad Federal do Parana, Curitiba, Parana, Brazil,* [2]*Université Laval, Quebec City, Quebec, Canada,* [3]*Michigan State University, East Lansing, MI,* [4]*CRSAD, Deschambault, Quebec, Canada.*

Heat stress can trigger inflammatory responses in dairy cows, which in turn may be modulated by unique oxylipids synthesized from dietary lipid substrates. Our objective was to evaluate the effects of heat stress and dietary lipid type on plasma lipoxygenase- (LOX), cyclooxygenase- (COX), and Cytochrome P450-derived oxylipid concentrations. Twelve lactating Holstein cows (38.5 ± 9.8 kg milk/d; 85 ± 33 DIM) were randomized into treatment in a replicated incomplete Latin square design with two 10-d periods. Treatments were: 1) Heat stress + fish oil (HS/n3; 8.3% EPA, 19% DHA; Max THI = 84), 2): Heat stress + corn oil (HS/n6; 55% linoleic acid;) and 3): Thermoneutral pair feeding + corn oil (TN/n6; Max THI = 64). Oils were abomasally-infused daily in 2 boluses (160 g/d). Blood samples were collected 4 h after abomasal infusion on d 0, 5, and 10 for lipid analysis by LC-MS/MS. Data were analyzed in a mixed model with repeated measures including cow and period as random effects, and treatment, time, and their interactions as fixed effects. Relative to HS/n6, HS/n3 resulted in reduced rectal temperatures and respiratory rates ($P < 0.05$), while increasing plasma concentrations of EPA, DHA and cytochrome P450-derived DiHDPA and EpDPE (>3-fold; $P < 0.05$). Relative to HS/n3, both HS/n6 and TN/n6 exhibited increased LOX-derived oxylipids such as 9-HODE, 9-oxo-ODE, 13-HODE (>30%; $P < 0.05$), whereas 15-HETE concentrations were reduced (−37%; $P < 0.05$). There was no effect of treatment on plasma isoprostanes or COX-derived lipids ($P > 0.30$). Partial alleviation of hyperthermia by fish oil was associated with changes in plasma oxylipid profiles in dairy cows under heat stress.

Key Words: fish oil, omega-3, lipidomics