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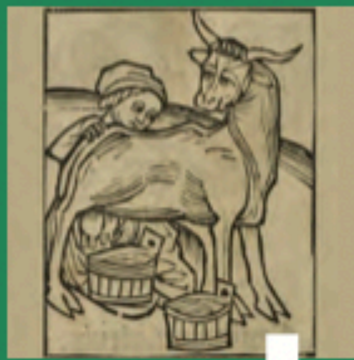

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While creatinine and AC 4:0 were increased ($P < 0.001$) on day 14, taurine was decreased ($P < 0.01$) on day 14 only in the HS cows, compared with day 0 (Figure 1). Additionally, other 7 compounds had a raw $P < 0.05$ for the interaction effect. Among these, alanine was increased ($P < 0.01$) on day 14 in both groups as it was greater ($P = 0.03$) for HS than TN cows, while citrulline was increased ($P = 0.03$) on day 14 only in the HS cows (Figure 1). Carnitine (AC 0:0) was greater ($P = 0.03$) for HS than TN cows only on day 14. Similarly, TG 55:9 concentrations were increased ($P = 0.05$) on day 14 in the HS cows but no significant difference was found in the TN cows when comparing day 0 and day 14. Finally, phosphatidylcholine (PC) 31:2 was greater ($P = 0.02$) for TN than HS cows only on day 14, while PC 37:2 decreased ($P = 0.02$) on day 14 only in the HS cows (Figure 1).
The minor changes observed in the plasma compared to milk in association with HS indicate that the mammary gland is more sensitive to HS than the overall metabolic response reflected by plasma. Increased milk creatinine concomitant with unchanged plasma creatinine (suggesting no dehydration effect) could indicate enhanced nutrient uptake by the mammary gland during enhanced muscle protein catabolism (Fan et al., 2019; Koch et al., 2016). Alanine, which is a product of AA transamination in muscle during AA catabolism and works as a shuttle between muscle and liver, was greater in the milk for HS than TN cows on day 14, possibly indicating enhanced use of AA instead of lipids for energy production (Koch et al., 2016). Our results indicated that HS comprised not only enhanced muscle catabolism but also taurine depletion possibly due to its use by the immune system when dealing with oxidative stress (Bai et al., 2021).

Conclusion and Implications
Our results suggested enhanced muscle catabolism reflected by increased milk creatinine, alanine and citrulline, and lower taurine. Additionally, the milk rather than plasma metabolome appeared to be sensible to HS being a fact to consider in future HS studies sampling design.

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O161 Hepatic energy metabolism of dairy cows in grazing systems with or without environmental control during lactation

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Keywords: Mitochondria; Metabolism; Liver

Introduction
The onset of lactation triggers a set of coordinated metabolic adaptations which enable the animal to face metabolic stress and maintain energy and nutrient homeostasis largely coordinated by the liver. In addition, heat stress impacts on dairy cow metabolism, health and affects feed intake and therefore milk production (Drackley, 1999). Therefore, the objective of this study was to assess the effect of two intensive grazing productive systems with two levels of environmental control on hepatic metabolism during lactation.

Material and Methods
Twenty spring-calved multiparous Holstein cows (588 ± 26 kg body weight, 2.8 ± 0.1 body condition score) were assigned to a randomized block design and assigned to two treatments: grazing (mixed pastures, forage allowance of 35 kg of dry matter (DM)/day, n = 10) supplemented with total mixed ration (TMR, 9.5 kg DM/day, 30:70 forage:concentrate ratio, n = 10) in a compost barn (with fan and soakers; CB-GRZ) or grazing supplemented with TMR in an open pen (OP-GRZ). Liver biopsies were collected and cryopreserved at 35 ± 5, 135 ± 11 and 185 ± 11 days in milk (DIM). Hepatic mitochondrial function was assessed measuring oxygen consumption rates sustained by complex-II (succinate) substrates. Liver composition (free glucose, glycogen, and triglycerides concentrations) was assessed spectrophotometrically using commercial kits. Average body temperature was measured using surface sensors (Thermochron, Maxim Integrated) during summer (between 132 and 218 ± 11 DIM). Data was analyzed with a mixed model using repeated measures, and included DIM, treatment, and their interaction as fixed effects.

Results and Discussion
Energy corrected milk peaked during early lactation and decreased towards 135 and 185 DIM for both groups (33, 31 and 25 ± 0.8 kg/day, $P < 0.001$), while it was neither affected by treatment nor its interaction with DIM. Average body temperature during summer was greater for OP-GRZ than for CB-GRZ cows (37.03 vs. 37.62 ± 0.04°C, $P < 0.05$). Free glucose decreased at 185 DIM, while glycogen concentrations tended to be greatest at 35 DIM and lowest at 135 DIM, being intermediate at 185 DIM. The higher concentrations of free glucose in early lactation are probably related to increased gluconeogenesis to sustain increased milk production (Greenfield et al., 2000). Indeed, free glucose in the liver correlated positively ($P < 0.05$) with lactose yield ($r = 0.4$). The free glucose to glycogen ratio showed that gluconeogenesis was prioritized over glycogen glycogen synthesis when milk peaked, at 35 and 135 DIM. Although no differences were found in liver

Table 1
Energy reserves and mitochondrial function in liver biopsies of dairy cows in grazing systems with or without environmental control during lactation

	Treatments (Treat)	DIM			SEM	*P*-value		
		35	135	185		DIM	Treat	DIM x Treat
Free glucose (mmol of glycosyl units.g wet weight^{-1})	CB-GRZ	0.041	0.035	0.018	0.004	0.01	0.89	0.58
	OP-GRZ	0.035	0.036	0.024				
Glycogen (% m/m)	CB-GRZ	2.73	2.38	2.55	0.27	0.08	0.21	0.39
	OP-GRZ	3.71	2.32	3.04				
Triglycerides (% m/m)	CB-GRZ	2.45	3.25	2.33	0.39	0.11	0.55	0.96
	OP-GRZ	2.55	3.60	2.58				
Free glucose to glycogen ratio	CB-GRZ	0.31	0.26	0.13	0.05	0.04	0.76	0.79
	OP-GRZ	0.20	0.30	0.20				
Triglyceride to glycogen ratio	CB-GRZ	0.92	1.61	1.09	0.11	0.001	0.41	0.39
	OP-GRZ	0.66	1.81	0.88				
Coupling efficiency	CB-GRZ	0.45	0.73	0.75	0.07	0.002	0.42	0.48
	OP-GRZ	0.59	0.84	0.68				
Leak control rate	CB-GRZ	0.54	0.26	0.24	0.06	0.003	0.28	0.82
	OP-GRZ	0.39	0.15	0.20				

CB-GRZ: compost barn; OP-GRZ: open pen.

triglyceride, the ratio between triglycerides and glycogen peaked at 135 DIM and decreased thereafter at 185 DIM ($P < 0.05$) suggesting a differential use of these two body reserves during lactation.
Mitochondrial respiration measurements indicated coupling efficiency, determined as the proportion of respiration destined to ATP synthesis, was lower during early lactation ($P < 0.01$); while proton leak was maximum at 35 DIM ($P < 0.01$), corresponding with the higher energy demands during early lactation. In addition, mitochondrial leak may be positively regulated by reactive oxygen species formation (Brookes, 2005) (see Table 1).

Conclusion and Implications

Results showed differential use of different hepatic reserves during lactation, since free glucose and glucose to glycogen ratio profiles ($r = 0.5$; $P < 0.01$) across lactation were similar and there is a depletion of glycogen reserves at 135 DIM, glycogen lysis may have been a relevant mechanism in order to maintain glucose homeostasis. The increase in energy demands in early lactation was associated to reduced coupling efficiency and increased proton leak of mitochondrial complex-II, denoting the challenge of adapting to the high energy demands of early lactation. However, although mean body temperature was affected by environmental control, we did not observe any differences on evaluated parameters between CB-GRZ and OP-GRZ.

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O162 Feeding high indigestible protein and housing under low sanitary conditions increases post-weaning diarrhoea and reduces nitrogen retention in weaned piglets

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Keywords: Piglets; Protein fermentation; Sanitary conditions; Post-weaning diarrhoea; Nitrogen metabolism

Introduction

Protein fermentation has been associated with post-weaning diarrhoea (PWD). Although feeding a high-protein diet reduces faecal consistency (Pieper et al., 2012), it does not always result in PWD (Htoo et al., 2007). Differences in environmental conditions might underlie these contradictory results. In addition, housing pigs under low sanitary conditions negatively affects energy and N metabolism (van der Meer et al., 2020), and protein fermentation might exacerbate this. Therefore, we studied the effects of protein fermentation and sanitary conditions on PWD and energy and nitrogen metabolism in piglets.