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.

Material and Methods

Female weaned piglets (n = 160, 29 ± 0.3 days, 9.1 ± 0.1kg) were fed a high (HiP) or low indigestible protein diet (LiP) and were housed under low (LSC) or high sanitary conditions (HSC) for 14 days. Piglets were housed in 4 climate-controlled respiration chambers, with 2 pens per chamber containing 4 piglets per pen, divided over 5 batches. For HSC, pens were disinfected before each batch and a strict hygiene protocol was adhered to. For LSC, there was no hygiene protocol and pooled faeces from commercial pig farms were spread twice a week in the pens. Diets included TiO_2. The HiP diet (207 g/kg crude protein) included sunflower seed meal and the LiP diet (191 g/kg crude protein) included casein as main protein source. Digestible crude protein (165 g/kg) and non-starch polysaccharide level (216 g/kg) were equal between diets. Piglets were fed ad-libitum the first 3 days followed by paired-feeding from day 4 onwards. Rectal temperature was measured daily. Rectal faeces were collected daily and scored on consistency ranging from 1 (liquid faeces) to 5 (hard faeces). From day 9 to 14, a complete energy and nitrogen balance was performed using half of the piglets. Feed intake and quantitative faeces plus urine excretion were recorded. Exchange of O_2, CO_2 and CH_4 was recorded every 12 min to calculate heat production. Effects of diet, sanitary conditions (SC), their interaction, batch, and batch-interactions were evaluated using the MIXED (continuous variables) or GLIMMIX procedure (Poisson distribution; faecal scores) of SAS.

Results and Discussion

Feeding HiP ($P < 0.001$) decreased faecal consistency from day 5-14 and LSC ($P < 0.001$) decreased it from day 4-6 and 12-13, but diet and SC did not interact (dietxSC, $P = 0.35$). Rectal temperature in week 2 tended to be higher for piglets housed under LSC ($P = 0.071$). This is in line with previous studies using this model to induce low-grade immune system stimulation, where LSC increased serum haptoglobin concentrations (van der Meer et al., 2020).

As anticipated, the apparent total tract digestibility (ATTD) of nitrogen was reduced by HiP (68.7 ± 1.5 vs. 78.5 ± 0.7%; $P < 0.001$) and by LSC (70.9 ± 2.1 vs. 76.3 ± 1.4%; $P = 0.034$), and the effect of LSC was largest when feeding the HiP diet (interaction $P = 0.028$). The ATTD of energy was reduced by LSC (66.2 ± 1.2 vs. 71.3 ± 1.5%; $P < 0.001$). Energy ATTD was higher when feeding the HiP diet (72.4 ± 1.2 vs. 65.1 ± 0.9%; $P < 0.001$), despite the lower nitrogen ATTD, likely because of a greater fibre fermentability when feeding HiP.

Energy retention averaged 296 ± 38 kJ/kg metabolic BW ($kg^{0.60}$) per day and was not affected by diet ($P = 0.95$) and SC ($P = 0.67$). Energy retention efficiency as percentage of gross energy and digestible energy intake was also not affected by diet or SC ($P > 0.05$ for all). Nitrogen retention was reduced by feeding HiP (1.59 ± 0.14 vs. 1.66 ± 0.14 g N/ $kg^{0.60}$ per day; $P = 0.034$) and by housing under LSC (1.46 ± 0.12 vs. 1.78 ± 0.10 g N/ $kg^{0.60}$ per day; $P = 0.005$), but there was no interaction ($P = 0.34$). Nitrogen retention efficiency as a percentage of ingested nitrogen was reduced by both HiP (53.7 ± 3.3 vs. 67.3 ± 2.4%; $P = 0.005$) and LSC (54.3 ± 3.9 vs. 66.7 ± 1.8%; $P = 0.002$), but nitrogen retention efficiency as a percentage of digested nitrogen was only reduced by LSC (76.3 ± 4.3 vs. 87.4 ± 1.5%; $P = 0.034$).

Conclusion and Implications

Protein fermentation increased PWD, irrespective of SC. Both protein fermentation and LSC reduced nitrogen retention and nitrogen efficiency. This was mainly caused by losses at the digestive level when feeding a diet inducing protein fermentation, but by losses at both digestive and post-absorptive level when housing piglets under LSC.

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O163 Effect of short-term events on the activity of gestating sows and their nutritional requirements

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Introduction

Various events, like a heatwave or a feeder dysfunction, can induce behavioural and physiological adaptations in gestating sows. Most often, these adaptations require energy and may deteriorate production performance (litter development and growth, sow body condition) if this extra energy is not provided. Previous studies mainly explored the effects of lasting events, while in practice most of the time these