Camel milk exhibits insulinogenic properties in pigs fed a high fat diet

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Camel milk (CM) contains insulin like peptides and is high in vitamin C, vitamin E, glutathione and other antioxidants (Izadi et al., 2019). While the mode of action is unknown, CM has demonstrated insulinogenic properties. Diabetic rats fed CM had no change in body weight (BW) or basal plasma glucose concentrations, while in response to a glucose challenge showed significant fasting hypoglycemia compared to control (Korish et al., 2020). While Hamad (2011) showed that CM supplementation reduced basal glucose concentrations (more so than cow or buffalo milk) in diabetic rats. Using the pig as a monogastric model, this pilot experiment aimed to examine the effects of CM consumption on metabolic responses to an *in vitro* glucose tolerance test (IVGTT).

20 female large White x landrace pigs (mean 33.6kg BW starting weight) were housed in individual pens and randomly allocated to one of 4 treatments (n=5): control (Con); high fat (HF), or CM (the HF diet plus 500ml CM/ day) of raw CM (RCM) or pasteurized CM (PCM). Pigs were fed *ad libitum* twice daily for a period of 6wks with water available *ad libitum*. Pelleted diets were formulated to meet or exceed nutrient requirements for growth, while the HF diet contained approx. 16% fat. After 6wks of feeding, pigs were fitted with an ear vein cannula and the following day an IVGTT conducted (0.3 g/kg BW glucose). Isolated plasma was analysed for glucose, insulin and fatty acid (NEFA) concentrations via commercial kits. Data was assessed for area under the curve (AUC) using a linear trapezoidal summation, and clearance rate (CR) calculated as the slope of the change. Statistical analyses were performed using GenStat software 18th ed. using the restricted maximum likelihood (REML) model. As no significant difference was noted between RCM and PCM treatments, responses were combined and are presented as CM.

Prior to the IVGTT there was no variation in basal glucose, insulin or fatty acids due to diet. Pigs fed CM tended to have a reduced peak insulin (P=0.058) and an increased glucose nadir (P=0.009) in response to glucose infusion (Table 1). Pigs fed CM tended to have the lowest insulin $AUC_{0\text{-}20}$ (P=0.064).

Table 1. Plasma glucose, insulin and fatty acids parameters derived from intravenous glucose tolerance tests (IVGTT) including basal, peak, nadir and recovery concentrations measured in growing female pigs fed either a control (n=5), high fat (n=5) or camel milk (combination of raw and pasteurized, n=10) diet. AUC = area under the curve; CR = clearance rate.

		Control	High Fat	Camel Milk	SED	P-Value
Baseline (mM)	Glucose	5.0	5.5	5.8	0.60	0.280
	Insulin	4.9	3.1	3.5	1.20	0.219
	NEFA	0.65	0.72	0.66	0.137	0.833
Peak (mM)	Glucose	14.7	17.7	16.6	2.58	0.462
	Insulin	57.9	44.6	33.4	12.04	0.058
	NEFA	1.32	1.39	1.13	0.174	0.178
Nadir (mM)	Glucose	3.0	4.2	4.7	0.61	0.009
	Insulin	1.7	1.2	2.5	1.14	0.388
	NEFA	0.18	0.26	0.24	0.052	0.234
AUC 0-20 (mM.min)	Glucose	84	90	104	31.7	0.686
	Insulin	676	474	373	151.8	0.064
	NEFA	-3.3	-2.6	-1.4	2.82	0.675
CR 2-30 (%/min)	Glucose	3.9	3.2	3.7	0.69	0.607
	Insulin	7.3	7.1	6.7	1.81	0.909
	NEFA	3.8	3.3	2.5	1.86	0.652

Our preliminary results tend to support the hypothesis that feeding CM can have insulinogenic actions in pigs. The reduced peak insulin response to the IVGTT without a concurrent increase in glucose peak suggests that CM is enhancing insulin sensitivity. Further studies are required to further elucidate the responses to CM consumption in pigs.

References

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