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Effects of insulin and fetal bovine serum on lipoprotein lipase and glucose and acetate utilizations by cultured bovine adipose tissue explants

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A system of culture of bovine adipose tissue (AT) explants was used to study the regulation of bovine lipoprotein lipase (LPL). The *in vitro* utilization of 2 energy and lipogenic substrates (glucose, acetate) was determined. The effect of insulin (2 mUI/ml) and/or fetal bovine serum (FBS, 10%), which stimulated LPL activity in monogastric AT, were studied. Nine dry non-pregnant Holstein cows were maintained for 10 d on a restricted diet (25% of energy maintenance requirement, EMR) then overfed (222% of EMR) for 3–5 weeks before slaughter, in order to increase lipid deposition and lipogenic activities. Samples of perirenal AT were collected, finely cut in 10–15 mg pieces, and cultured in sterile conditions for 24 or 48 h. The LPL activity was measured after a detergent (deoxycholate–nonidet P_{40}) extraction procedure.

The glucose utilization was significantly increased by insulin addition, with or without FBS (table I). It was also enhanced by the addition of FBS alone showing close additive effects of insulin and FBS. The acetate utilization was significantly increased by insulin addition, without additional effect of FBS. The LPL activity declined after 24 or 48 h of culture. It was significantly increased by insulin, but only in the absence of FBS, which completely abolished the insulin effect (significant negative interaction). The FBS alone had no effect on LPL activity. These data validate the use of bovine AT explants as a model for metabolic studies, and confirm the direct anabolic effect of insulin on ruminant AT.

Table I. Effects of insulin (2 mUI/ml) and fetal bovine serum (FBS, 10%) on glucose and acetate utilization and lipoprotein lipase (LPL) activity of cultured bovine adipose tissue (AT) explants.

	Control	*Insulin*	*FBS*	*Insulin + FBS*	*Effects (P <)*		
					I	*FBS*	*I x FBS*[a]
Day 1[b]							
Glucose [c]	12.1	22.8	16.1	28.2	0.001	0.001	0.57
Acetate [c]	35.8	60.6	49.2	59.9	0.001	0.19	0.15
LPL[d]	48.1	59.2	49.5	47.4	0.11	0.07	0.02
Day 2[b]							
Glucose[c]	17.3	25.5	20.2	31.0	0.001	0.03	0.44
Acetate[c]	30.9	59.0	38.8	52.8	0.001	0.87	0.20
LPL[d]	35.1	47.3	31.9	33.0	0.01	0.001	0.02

[a] I x FBS = insulin x FBS interaction; [b] glucose and acetate utilizations between 0 and 24 h (day 1) or 24 and 48 h (day 2), LPL activities after 24 (day 1) or 48 (day 2) h of culture; [c] µmol/g AT per 24 h; [d] % of initial activities (133 ± 31 nmol fatty acids/min per g AT, at day 0).