Influence of feed withdrawal on plasma leptin concentrations in lambs of different carcass composition N4.8

E. von Borell[1], H. Sauerwein[2] and M. Altmann[1]

[1]Institute of Animal Breeding and Husbandry with Veterinary Clinic, Martin-Luther-University, Halle, Germany

[2] Institute of Physiology, Biochemistry and Animal Hygiene, Bonn University, Bonn, Germany

Introduction

- **Feed deprivation decreases plasma leptin concentrations according to the amount of body fat reserves.**

- **A greater response was observed in lean than in fat humans and rats. However, the few results from ruminants are contradictious.**

Plasma leptin as an accurate indicator for carcass composition and useful for selection?

A previous study indicated that the precision for the prediction of carcass fat in lambs by plasma leptin is comparable with the ultrasound measurement of fat thickness (Altmann et al., in prep.):

		independent variables:			
		leptin		ultrasound fat thickness	
	n	R^2	RMSE	R^2	RMSE
Lambs of 35 kg live weight	27	0.26	2.44	0.09	2.70
Lambs of 45 kg live weight	29	0.23	3.39	0.31	3.20
Total	**56**	**0.34**	**3.03**	**0.34**	**3.03**

However, the correlations between carcass composition and leptin measured in feed deprivated lambs tended to decline with increasing length of fasting:

	length of feed withdrawal		
	9 h	19 h	43 h
n	9	62	15
visceral fat	-0.11	0.52	0.25
subcutaneous fat	0.85	0.49	-0.28
intermuscular fat	0.57	0.50	-0.28
lean	-0.71	-0.58	0.16

Hypothesis: stronger relationship between leptin and carcass compostion in ad libitum fed than in fasted lambs?

Objective

- **The objective of this study was to determine the influence of feed deprivation on**

  - **plasma leptin concentrations in growing lambs with different body fat and on**

  - **the relationship between leptin and fatness.**

Material and Methods

Animals

- 30 male lambs, group-housed on deep litter
- ad libitum access to concentrates (10.2 MJ NE/kg) and hay during growth
- feed withdrawal for 24 hours at 40 kg live weight
- slaughtering after feed deprivation
- dissection into:
  - visceral fat (perirenal, pelvic, and omental fat)
  - intermuscular fat
  - subcutaneous fat
  - lean
  - bones

Blood sampling and hormone assays

- immediately before and after feed withdrawal
- collection of five blood samples from each lamb between 9.00 h and 11.00 h in intervals of 30 min
- samples were pooled in aliquots after centrifugation and stored at -20°C
- leptin assay: specific enzyme immunoassay (Sauerwein et al. 2004),
  intra-assay coefficient of variation: 6.3 %
  inter-assay coefficient of variation: 13.9 %
- insulin assay: commercial IRMA kit (Cat. No. KIP1251, BioSource Europe S.A., Nivelles, Belgium, contributed by IBL Hamburg No. 13 021)
  intra- assay coefficient of variation: 4.5 %
  inter-assay coefficient of variation: 12.2 %

Statistical analysis

- ANOVA and Duncan's multiple comparison post hoc test ($P < 0.05$) for leptin concentrations in lambs with low, medium and high fat content
- Pearson correlations for the relationships between carcass composition and leptin concentrations

Carcass composition of lambs with low, medium and high total fat content

		Total fat content					
		low (n=11)		medium (n=9)		high (n=10)	
		Mean	S.E.M.	Mean	S.E.M.	Mean	S.E.M.
Age at slaughter	days	100	7.0	97	5.7	94	2.7
Daily gain	g/day	363	20.9	369	15.8	387	11.8
Carcass weight	kg	18.4^{a}	0.4	18.6^{ab}	0.3	19.7^{a}	0.4
Visceral fat	g	782^{a}	51.4	894^{a}	52.0	1062^{b}	34.3
Carcass side:							
Subcutaneous fat	g	330^{a}	18.6	403^{b}	25.3	560^{c}	16.3
Intermuscular fat	g	709^{a}	23.4	850^{b}	27.6	1100^{c}	31.3
Lean	g	6095	133.7	5955	107.0	6000	166.9

Means with different letters within a row are different ($P < 0.05$)

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Leptin concentrations (ng/ml) of lambs with low, medium and high total fat contant

	Total fat content					
	low		medium		high	
Leptin	Mean	S.E.M.	Mean	S.E.M.	Mean	S.E.M.
Before fasting	4.72[a]	0.2	5.28[ab]	0.5	5.93[b]	0.4
After fasting	3.36[b]	0.2	3.61[b]	0.3	3.43[b]	0.3
Difference	-1.36[a]	0.2	-1.68[a]	0.2	-2.50[b]	0.3

Means with different letters within a row are different ($P < 0.05$)

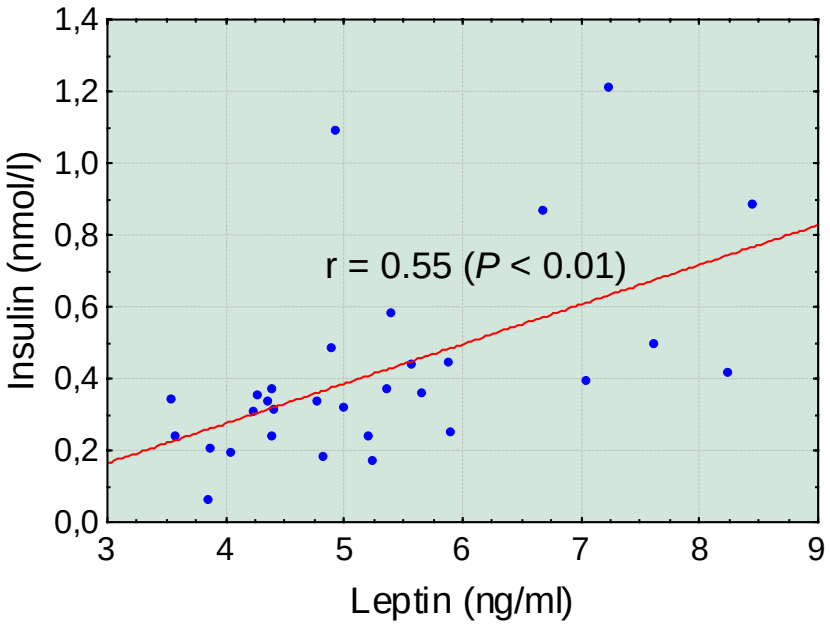
Insulin concentrations (nmol/l) of lambs with low, medium and high total fat contant

	Total fat content					
	low		medium		high	
Insulin	Mean	S.E.M.	Mean	S.E.M.	Mean	S.E.M.
Before fasting	0.30	0.04	0.46	0.10	0.51	0.10
After fasting	0.06	0.01	0.08	0.01	0.08	0.02
Difference	-0.24	0.04	-0.37	0.10	-0.43	0.10

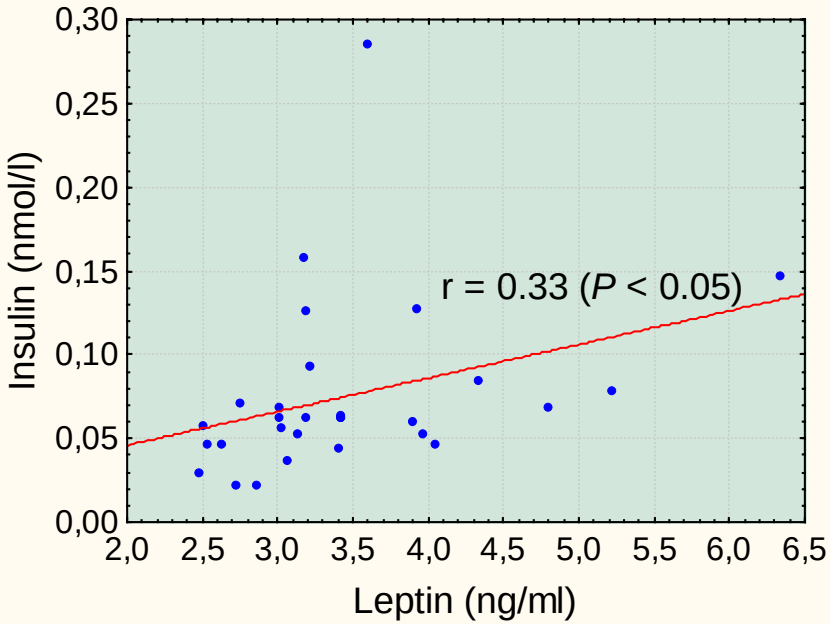
Mean differences within a row were not significant

Correlations between leptin and insulin

before fasting



after fasting



Correlations between leptin concentrations and tissue masses

Leptin	Visceral fat	Inter-muscular fat	Subcu-taneous fat	Total fat	Lean
Before fasting	0.58***	0.36*	0.45*	0.49**	-0.23
After fasting	0.33	0.09	0.20	0.20	0.03
Difference	0.57***	0.47**	0.51**	0.56***	0.03

* $P < 0.05$

** $P < 0.01$

*** $P < 0.001$

Correlations between insulin concentrations and tissue masses

Insulin	Visceral fat	Inter-muscular fat	Subcu-taneous fat	Total fat	Lean
Before fasting	0.19	0.26	0.36*	0.30	0.15
After fasting	0.22	0.15	0.24	0.21	0.10
Difference	0.17	0.26	0.36*	0.30	0.15

* $P < 0.05$

Conclusions

- **Plasma leptin concentrations as well as their correlations to the fat tissues are reduced by feed deprivation.**
- **Response of leptin to feed withdrawal is greater in fat than in lean lambs.**
- **In tendency similar changes were observed for insulin.**
- **Leptin concentrations in fasting lambs reflect more the actual metabolic situation rather than the extent of body fat reserves.**
- **Utilization of leptin concentrations as an indicator for carcass composition can not be recommended in lambs after short term feed withdrawal.**