mRNA expression of genes related to lipogenesis and lipolysis in adipose tissue and plasma leptin in dairy cows during the dry period and in early lactation

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Background

§Adipose tissue provides the energy that allows most tissues to overcome the negative energy balance occurring during early lactation. The increase in plasma NEFA concentration in response to a negative energy balance, is the result of the orientation of adipose tissue towards the state of catabolism.

§The free fatty acids that are released into the circulation may play part in reducing peripheral tissue insulin sensitivity.

§Reduced insulin sensitivity in peripheral tissue could potentially change the relative rates of lipolysis and lipogenesis.

Goal

§To investigate changes in plasma leptin concentration parallel to changes of lipogenic-and lipolytic related genes in subcutaneous adipose tissue of dairy cows from prepartum to early lactation:

- Leptin
- AdipoR1 and AdipoR2 (adiponectin receptor 1 and 2)
- HSL (hormone-sensitive lipase)
- PLIN (perilipin)
- LPL (lipoprotein lipase)
- ACSL1 (acyl-CoA synthase long-chain family member 1)
- ACC (acetyl-CoA carboxlase)
- FASN (fatty acid synthase)
- GPD2 (glycerol-3-phosphate dehydrogenase 2)

Materials and Methods

§ 27 dairy cows

§ Blood samples: every two weeks

§ Subcutaneous adipose tissue biopsies:
wk 8 a.p. (-8 wk), on day 1 (+1 d), wk 5 p.p. (+5 wk)

§ RNA extraction with RNeasy Lipid Tissue Mini kit (QIAGEN, Maryland 20874, USA)

§ Quantitative RT-PCR: Rotor-Gene™ 6000 (Corbett Research, Sydney, Australia)

§ Normalization of the expression of the Leptin, AdipoR1, 2, HSL, PLIN, LPL,ACSL1, ACC, FASN, GPD2 : GAPDH

§ Data analysis:

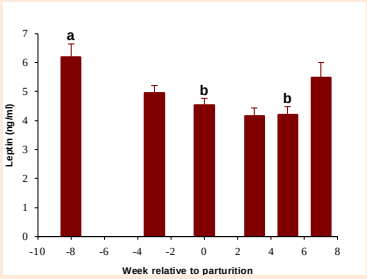
- Data are presented as means ± standard error
- MIXED procedure (SAS) with time point as fixed effect and cow as repeated subject.

Results

Table 1. Mean ± SEM of mRNA abundance (log_2) of leptin, adiponectin receptors, and lipogenic-and lipolytic related genes in the adipose tissue before and after parturition in dairy cows.

Adipose gene	Time relative to parturition[1]			*P*-value
	-8 wk	+1 d	+5 wk	
Leptin	13.67 ± 0.51	14.24 ± 0.39	13.06 ± 0.47	0.13
AR1	15.22 ± 0.24	15.31 ± 0.11	15.40 ± 0.09	0.70
AR2	18.30 ± 0.35	18.23 ± 0.25	17.75 ± 0.20	0.22
GPR109A	15.45 ± 0.30	15.79 ± 0.22	15.67 ± 0.18	0.57
PPARγ	17.93 ± 0.35	18.30 ± 0.20	18.25 ± 0.17	0.44
LPL	20.97 ± 0.36	20.96 ± 0.21	20.49 ± 0.23	0.35
HSL	18.56 ± 0.35	18.83 ± 0.27	18.66 ± 0.22	0.75
PLIN	19.59 ± 0.36	19.79 ± 0.26	19.85 ± 0.21	0.77
ACC	9.94 ± 0.51[a]	8.19 ± 0.38[b]	9.17 ± 0.37[ab]	0.02
FASN	19.09 ± 0.54[a]	15.69 ± 0.41[b]	17.58 ± 0.36[c]	< 0.001
ACSL1	18.18 ± 0.39	18.07 ± 0.25	17.88 ± 0.23	0.77
GPD2	11.64 ± 0.23	11.84 ± 0.14	12.10 ± 0.15	0.17

[1] mRNA abundance was calculated relative to the expression of the GAPDH gene as reference gene, Means within a row with different superscripts (a, b) differ ($P < 0.05$).



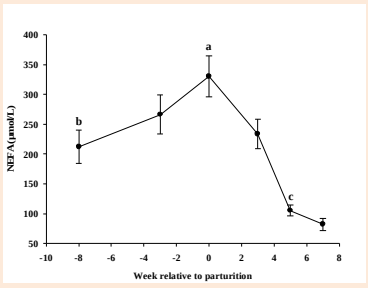


Fig. 1 Patterns of plasma leptin and NEFA concentrations.

Conclusions

üReduced plasma concentrations of leptin during p.p. compared with a.p. would be in favor of increasing metabolic efficiency and energy conservation, for mammary function and reconstitution of body reserves.

üLower mRNA abundance of ACC and FASN on d 1 p.p. compared with other biopsy time-points may imply an attenuation of fatty acid synthesis in subcutaneous adipose tissue shortly after parturition.

üUnchanged gene expression of most selected factors over time may be ascribed, in part, to biopsies in advanced early lactation, as well as to a lower rate of lipolysis, which reflected by the modest plasma concentration of NEFA.