Negative energy balance during the transition period stimulates milk yield of sows

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Background:

- No. of Liveborn piglets has increased in DK: 10.8 ->14.1 (1992-2009)
- Preweaning mortality has increased (from 11% to 14%)
- Increasing litter size reduces birth weight (Foxcroft, 2009)
- Insufficient energy supply for piglets is a major death cause
- High intake of colostrum and milk is crucial to ensure survival and growth of piglets
- No focus on transition period or colostrum yield

Background (continued):

- During transition, sows are typically shifted from a gestation diet (rich in fiber) to a transition diet (rich in fat, low in fiber) one week before parturition
- This dietary shift affects the absorbed nutrients, absorption site and the route of absorption (+ diurnal uptake of energy)

  SCFA (fiber fermentation, hindgut, portal vein)

  MCFA (some dietary oils, small intestine, portal vein)

  LCFA (some dietary oils, small intestine, lymph)
- MCFA and LCFA are used preferentially for different purposes
- Specific fatty acids are bioactive in tissues (Jump, 2002)

The physiology and nutrient priority changes…

	Transition		Lactation	
	Late Gestation	Farrowing	Early Lactation	Peak Lactation
Duration	1 week	1 day	1½ week	2½ week
Fetal growth	yes			
Udder growth	yes	yes	yes	
Colostrum	synt	secr		
Milk comp.		changes	changes	constant
Milk prod.		onset	increase	constant
Maternal E-bal	-		-	--
Maternal fat-bal	+		-	--

In spite of these changes, sows are typically fed the same diet during transition and throughout lactation

Aim:

- The aim is to improve performance of lactating sows and suckling piglets

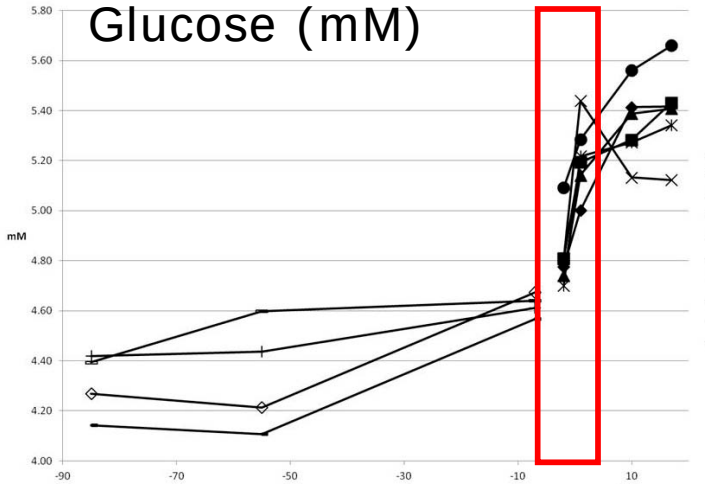
- Hypothesis:

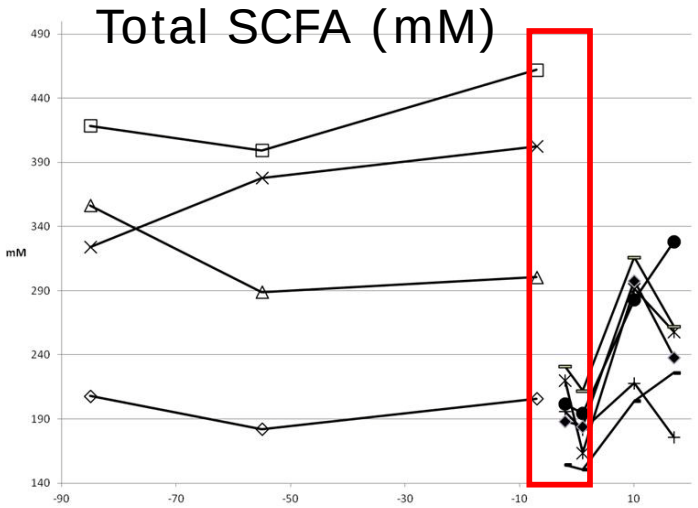
The shift in nutrient supply in the transition period affects blood metabolites and in turn performance of sows and piglets in the following lactation

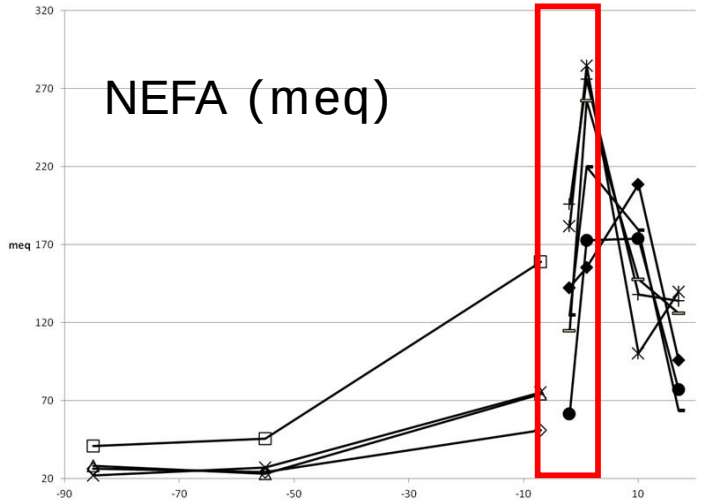
Experimental design

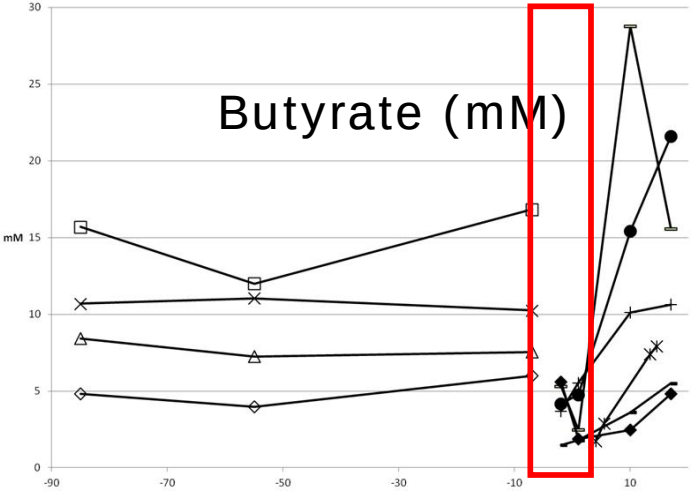
- 48 sows of 2nd parity were fed contrasting levels of dietary fibers until d108 of gestation (17, 32, 35 and 40% fiber)
- During transition and lactation, sows were fed one of six transition diets with contrasting levels of dietary fat (3-8% added fat with different MCFA/LCFA proportions)
- Blood samples were collected at d30, 60, 108 and 112 of gestation and at day 1, 10, 17 and 28 of lactation. Backfat was measured by ultrasound d108 of gestation.
- Piglet LW gain was recorded as indicators of yield of colostrum (0-24h) and milk yield in early lactation (d7-10) and at peak lactation (d17-28)
- Factors during transition with effects on yield of colostrum and milk yield in early and at peak lactation were studied

Changes in metabolite profiles around parturition









Correlations between dietary intake and performance of sows

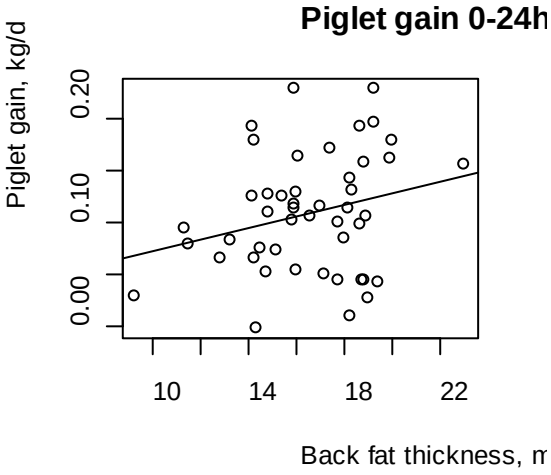
	Colo-strum	Early lactation	Peak lactation
	Gain 0-24h	Gain d7-10	Gain d17-28
Daily intake of energy from			
Starch d108-112, g/d	NS	NS	NS
Starch d113-115, g/d	NS	NS	NS
Starch d1, g/d	NS	NS	NS
MCFA d108-112, MJ/d	NS	NS	NS
MCFA d113-115, MJ/d	NS	NS	0.33*
MCFA d1, MJ/d	NS	NS	0.28†
LCFA d108-112, MJ/d	NS	NS	-0.29*
LCFA d113-115, MJ/d	NS	NS	NS
LCFA d1, MJ/d	NS	NS	NS
Daily intake of			
DF d108-112, g/d	NS	NS	NS
DF d113-115, g/d	NS	NS	NS
DF d1, g/d	NS	NS	NS
ME d108-112, MJ/d	NS	NS	-0.28*
ME d113-115, MJ/d	NS	NS	NS
ME d1, MJ/d	NS	NS	NS

Correlations between plasma metabolites and performance of sows

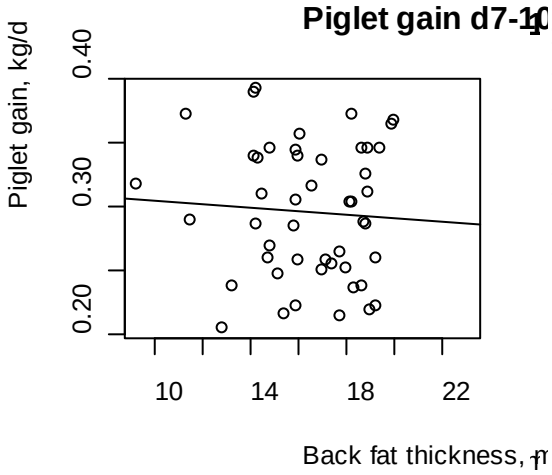
	Colo-strum	Early lactation	Peak lactation
	Gain 0-24h	Gain d7-10	Gain d17-28
Plasma concentrations			
Glucose d108	NS	NS	NS
Glucose d112	NS	-0.25 †	NS
Glucose d1	NS	NS	NS
Lactate d108	NS	-0.29*	NS
Lactate d112	NS	NS	NS
Lactate d1	NS	NS	NS
NEFA d108	NS	NS	NS
NEFA d112	NS	NS	NS
NEFA d1	NS	NS	NS
Acetate d108	NS	NS	NS
Acetate d112	NS	NS	NS
Acetate d1	0.29 †	NS	NS
Propionate d108	NS	NS	NS
Propionate d112	NS	NS	NS
Propionate d1	0.35*	NS	NS
Butyrate d108	NS	NS	NS
Butyrate d112	0.35 *	NS	NS
Butyrate d1	0.27 †	NS	NS
MCFA d1	0.37*	NS	NS
LCFA d1	NS	NS	NS

Correlation between backfat thickness at d108 of gestation and performance of sows

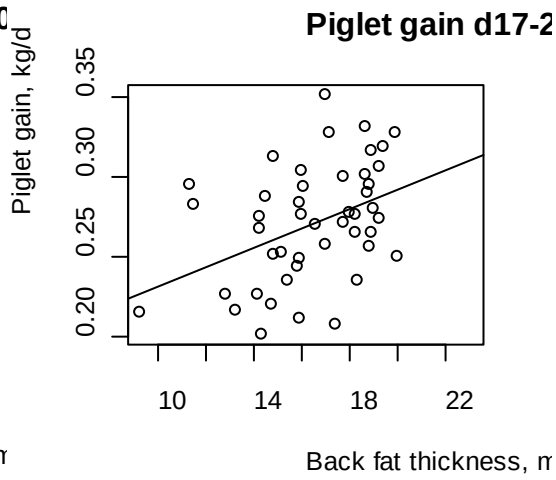
Colostrum
(P = 0.08)



Early lactation
(P = 0.07)

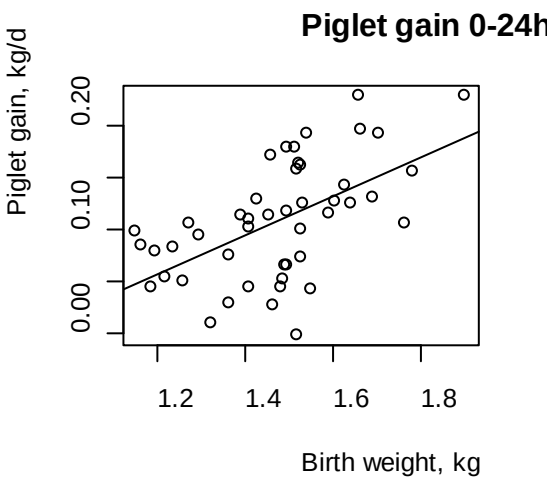


Peak lactation
(P < 0.01)

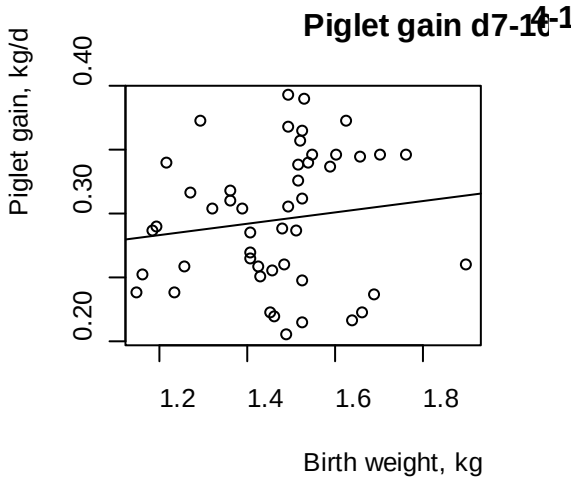


Correlation between mean piglet birth weight and performance of sows

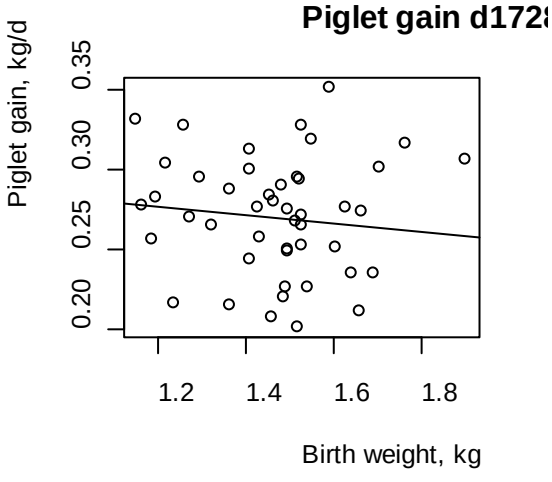
Colostrum
(P < 0.001)



Early lactation
NS

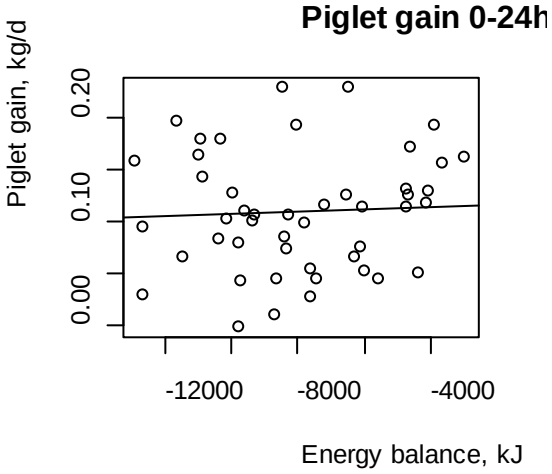


Peak lactation
NS

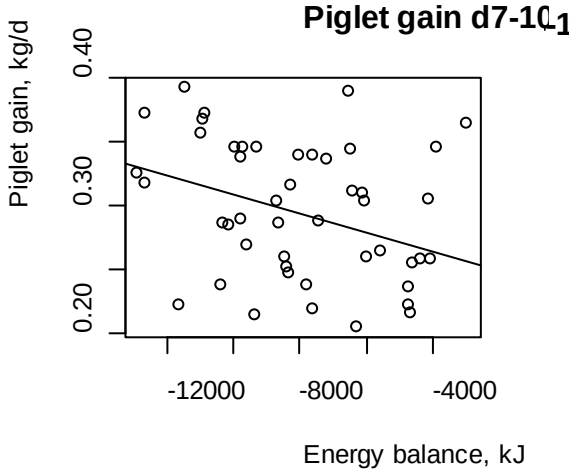


Correlation between energy balance of sows on d113-115 of gestation and performance of sows

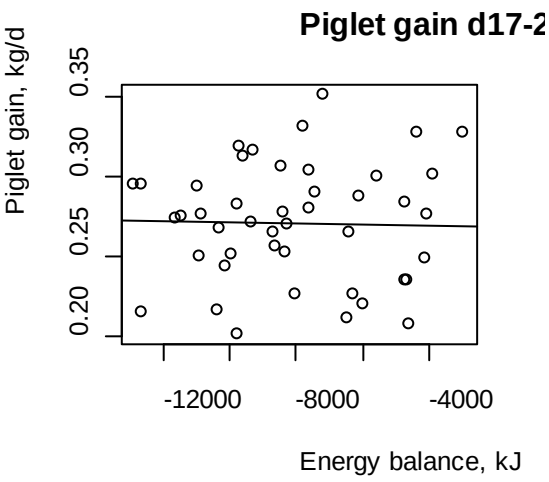
Colostrum
NS



Early lactation
(P < 0.05)



Peak lactation
NS



Conclusions

- Transition period is important for yield of colostrum, and milk yield in early lactation and at peak lactation
- Yield of colostrum, milk in early lactation and at peak lactation are regulated differently:

  Colostrum: High plasma SCFA and MCFA, High Backfat (10-20 mm BF), high piglet birth weight (1.1–1.9 kg)

  Yield in early lactation: Low plasma glucose and lactate, low EB (-12 to -4 MJ ME) and low backfat (10-20 mm BF)

  Yield at peak lactation: High intake of MCFA energy, low intake of LCFA energy, low intake of ME, high backfat d108 (10 to 20 mm BF)

Conclusions – continued

Focus on the transition period is important to ensure survival and improve growth of piglets

Poster: # 28 (session 1)

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