Importance of sow colostrum in relation to piglet survival

Hélène Quesnel
INRA
Saint-Gilles, France




DIET
AGRICULTURE
ENVIRONMENT

INRA

Piglet mortality in herds

✓ **Selection for prolificacy has increased piglet mortality before weaning**

➔ ***1 out of 7 piglets dies before weaning***

✓ **Two thirds of mortality before weaning occur during the first 3 days after birth**

✓ **Early death is mainly due to a low consumption of colostrum**

Even when the cause of the death is crushing (weak or starved piglets)

Edwards, 2002; Le Dividich et al., 2005

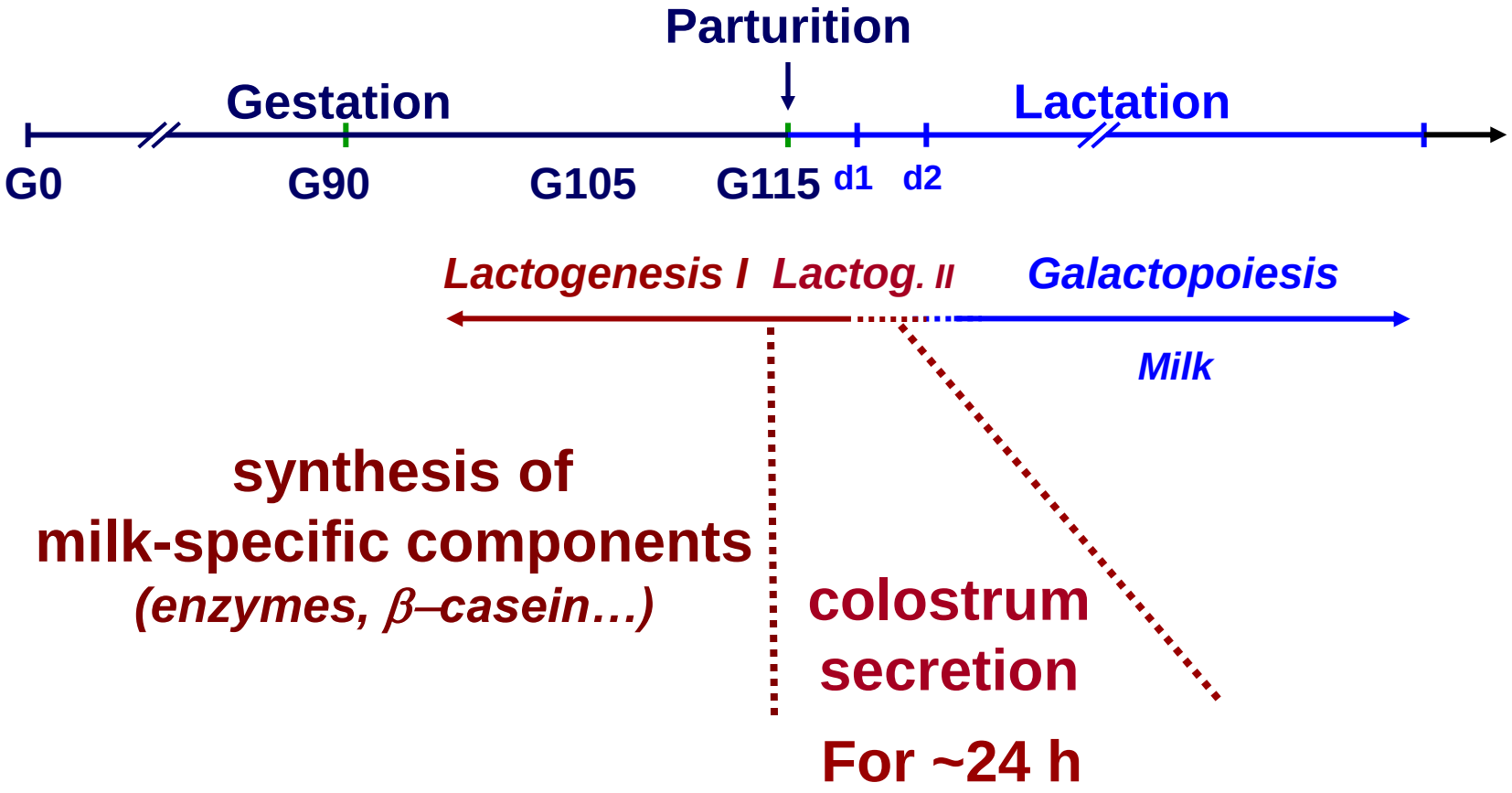
Sow colostrum and piglet survival

Roles of colostrum in relation to characteristics of newborn piglets

Relations between colostrum intake and piglet performance

Colostrum production by the sow

Colostrum:
the first secretion of the mammary gland, rich in immunoglobulins (IgG)



Characteristics of newborn piglets

Exposed in a cold environment at birth

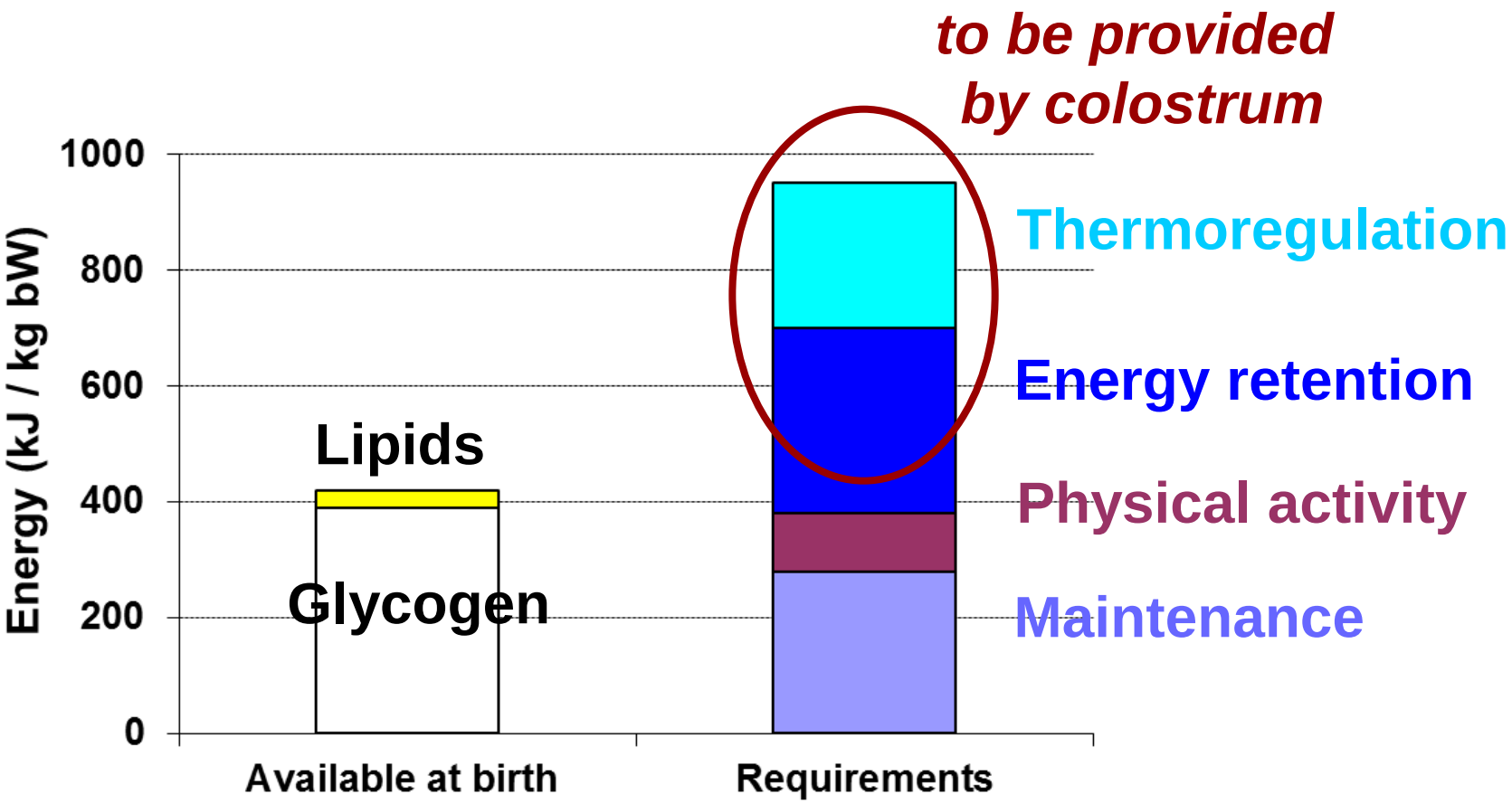
thermal neutrality: 32-34°C

ambient temperature: 10°C less

- ✓ **Low energy stores**
  - **No brown adipose tissue**
  - **Low fat content**

aggravated by selection for reduced carcass fatness (Canario et al., 2007)

Energy stores and requirements for the first 24 h after birth



Le Dividich et al., 2005

Characteristics of newborn piglets

✓ **No immunity**

(no transfer of Ig through the placenta)

➔ ***The piglet is dependent on the sow for immune protection***

Rooke and Bland, 2005

✓ **Immature gastrointestinal tract**

➔ ***Colostrum provides growth factors (IGF-I, insulin, EGF, TGFβ) for the development and maturation of the gastrointestinal tract***

Xu et al., 2002

Roles of colostrum

- ✓ **Nutritional: energy, immediately available**
- ✓ **Immunological: passive immune protection**
- ✓ **Physiological: milk-borne growth factors**

Sow colostrum and piglet survival

Roles of colostrum in relation to characteristics of newborn piglets

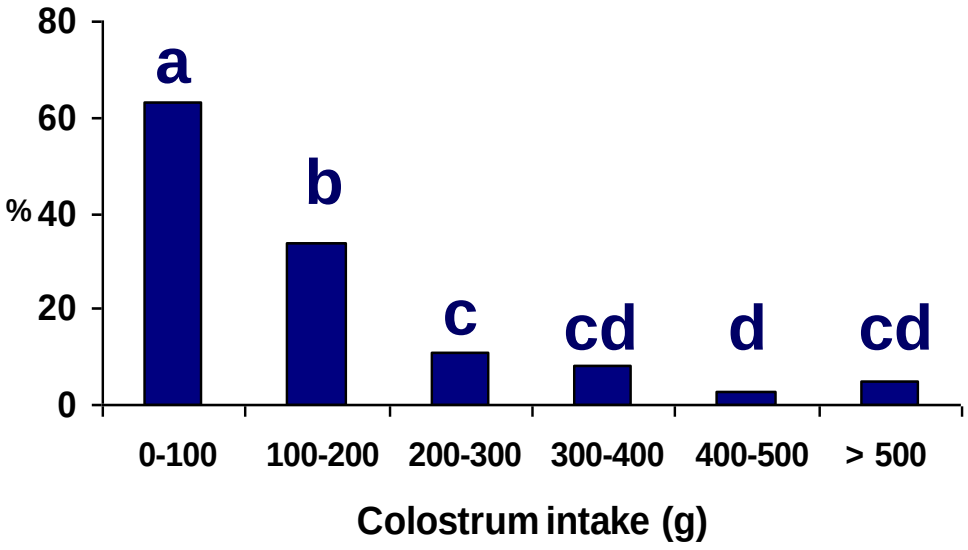
Relations between colostrum intake and piglet performance

Colostrum production by the sow

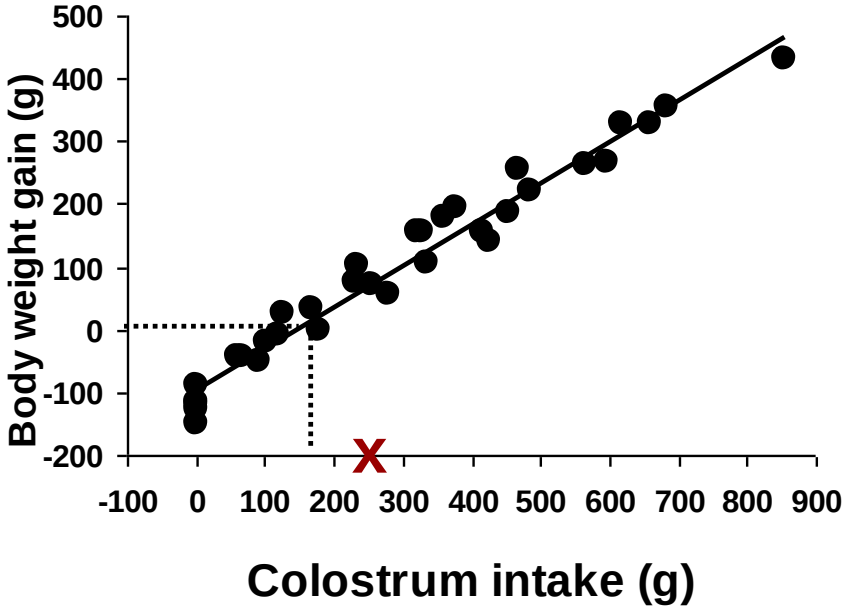
Colostrum intake and piglet performance

Colostrum intake estimated between birth and 24 h, based on piglet weight gains

Mortality rate until weaning

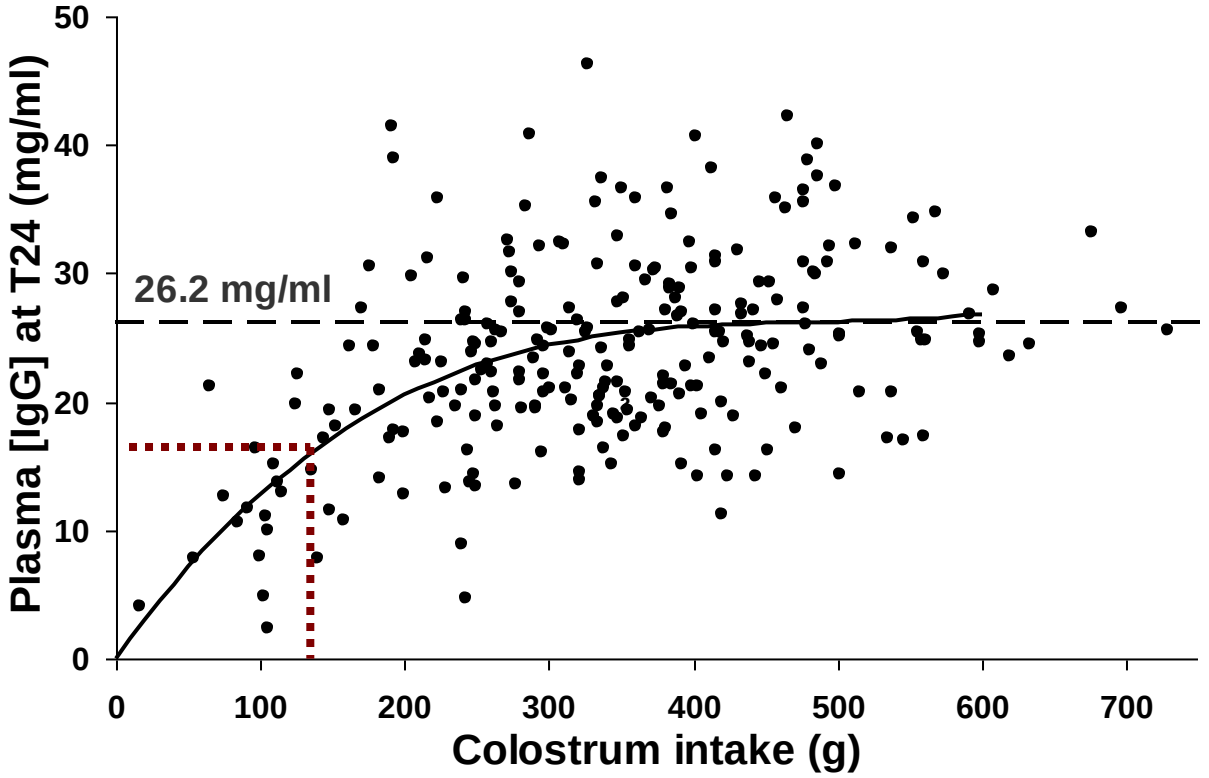


BW gain for 24 h



Devillers, 2004

Colostrum intake and piglet performance



Devillers, 2004

What is a satisfactory systemic immunity??

15-17 mg IgG/ml of plasma?

Coalson and Lecce, 1973

Colostrum intake and piglet performance

Positive correlation between piglet plasma [IgG] at 2 and 28 days of age

➔***The higher passive immunity is soon after birth, the higher immunity is at weaning.***

Rooke et al., 2003; Devillers et al., 2011

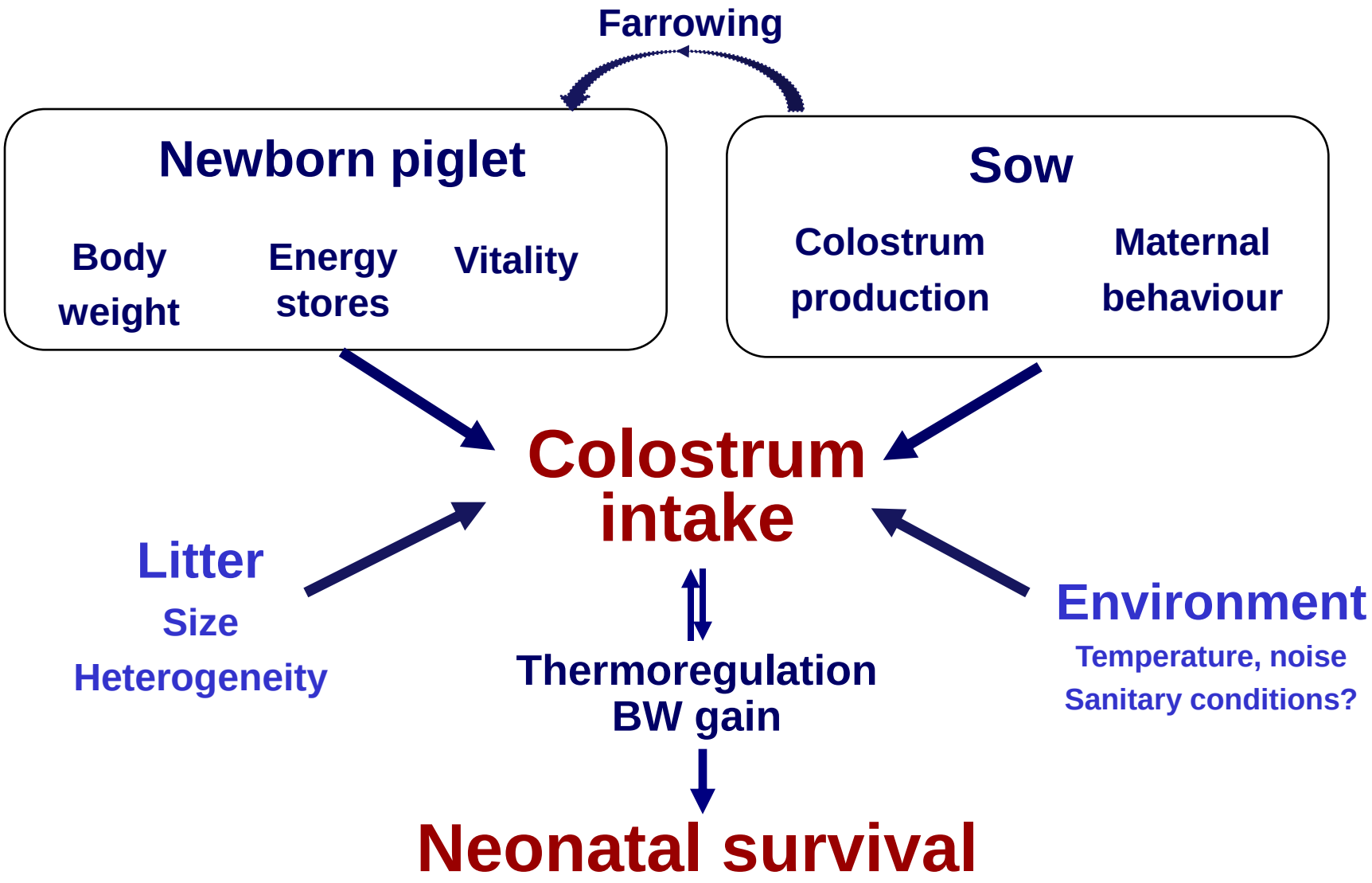
Colostrum intake and piglet performance

➔**Energy is essential for early post-natal survival**
➔**Passive immunity is important for later resistance to disease challenge**

Le Dividich et al., 2005

➔ ***Increasing colostrum intake by individual piglets is essential for reducing neonatal mortality.***

Colostrum intake by individual piglets



Ways to increase colostrum intake

Increasing piglet's ability to suckle

by ↗ maturity at term and inherent vitality of piglets at birth

Maternal nutrition: promising results

Reducing within-litter variation in birth weight

Genetics (like in rabbits)?

Maternal nutrition?

(cf Anne Wientjes, session 23 EAAP 2012)

Increasing colostrum production by the sow

Colostrum yield highly variable: 1-6 kg

Factors of variation?

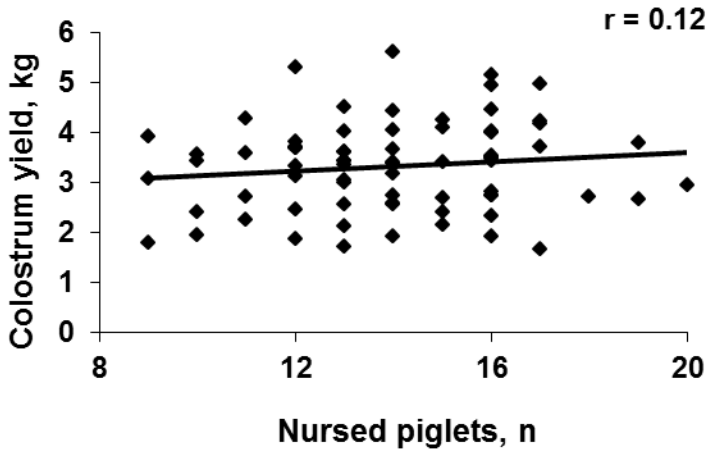
Sow colostrum and piglet survival

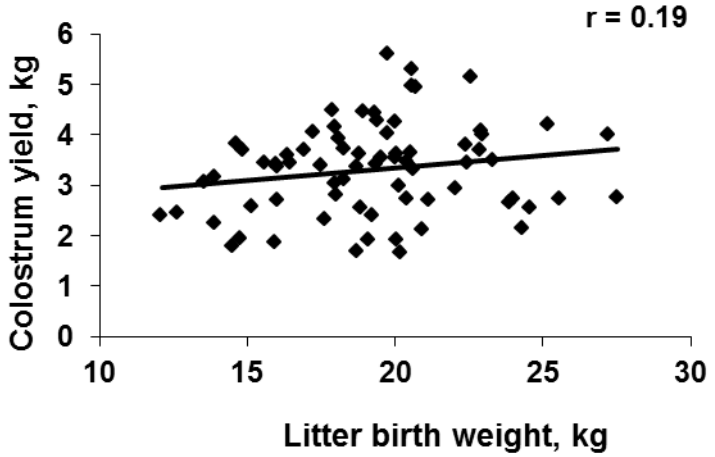
Roles of colostrum in relation to characteristics of newborn piglets

Relations between colostrum intake and piglet performance

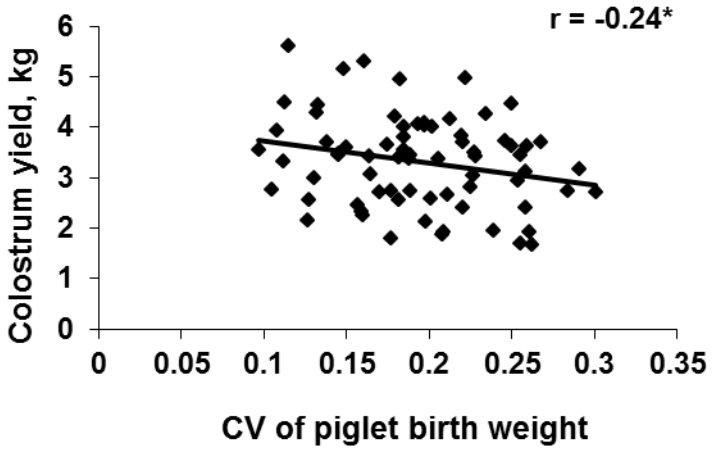
Colostrum production by the sow

Colostrum production: factors of variation





n = 72

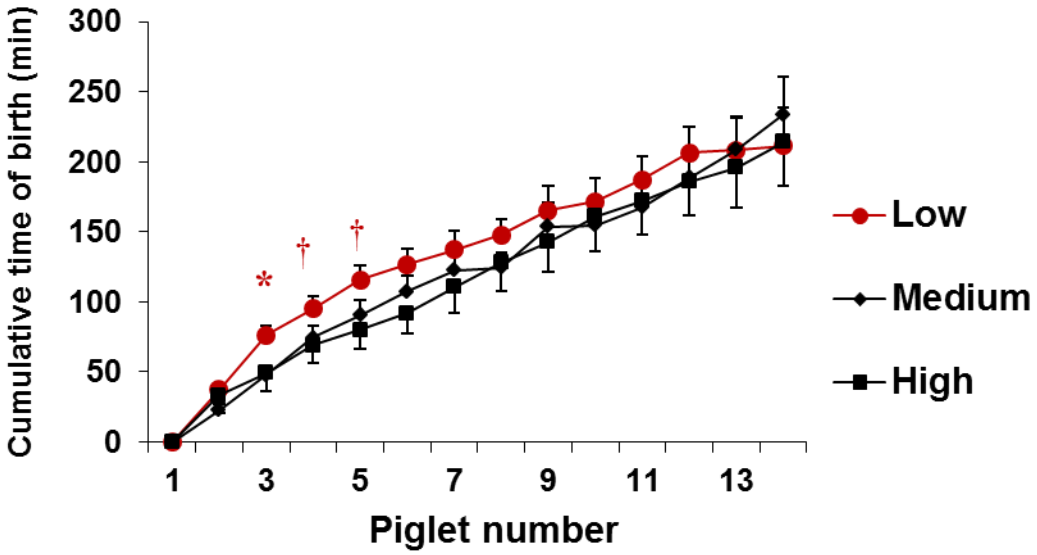


Devillers et al., 2007; Quesnel, 2011

Colostrum production: factors of variation

Level of colostrum yield	Low	Medium	High	*P*
n	26	29	17	
Colostrum yield, kg	2.4	3.5	4.5	
Born alive	14.4	13.7	15.1	NS
Stillborn	1.8[a]	0.9[b]	0.9[b]	*

Kinetics of birth of the piglets



Impact on vitality?
Hormonal background?

Quesnel, 2011

Lactogenesis: 3 major events

1. Synthetic activity of the mammary epithelial cells

mRNA, enzymes, caseins ↗ ***caseins, lactose ↗↗***

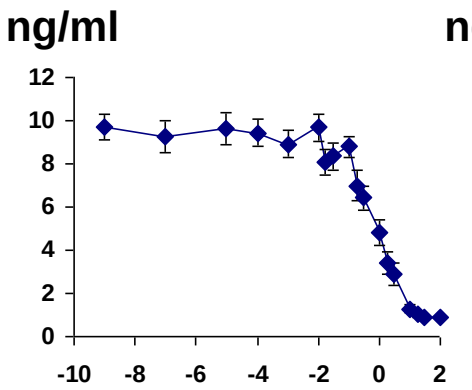
2. Change in the morphogy of the mammary epithelium

3. IgG transfer via a specific receptor (FcRn)

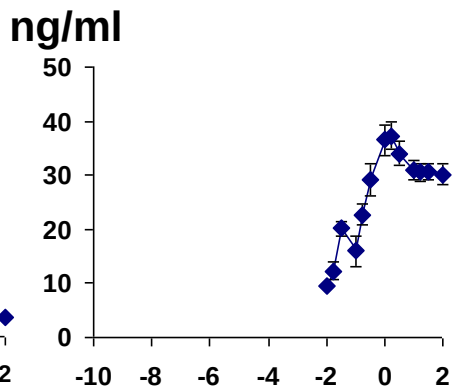
Lactogenesis: 3 major events

regulated by hormones involved in the process of parturition and prolactin

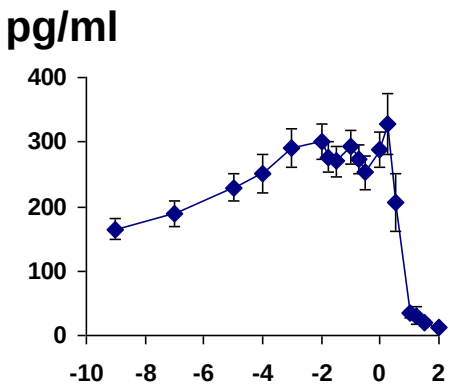
Progesterone



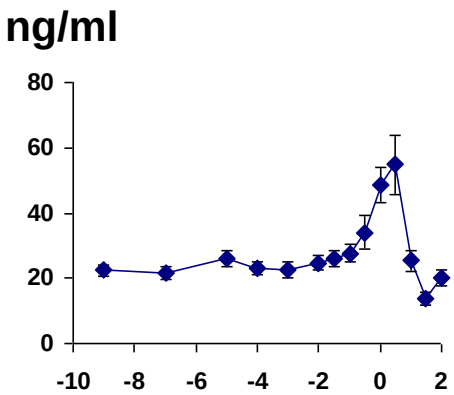
Prolactin



Oestradiol-17β



Cortisol

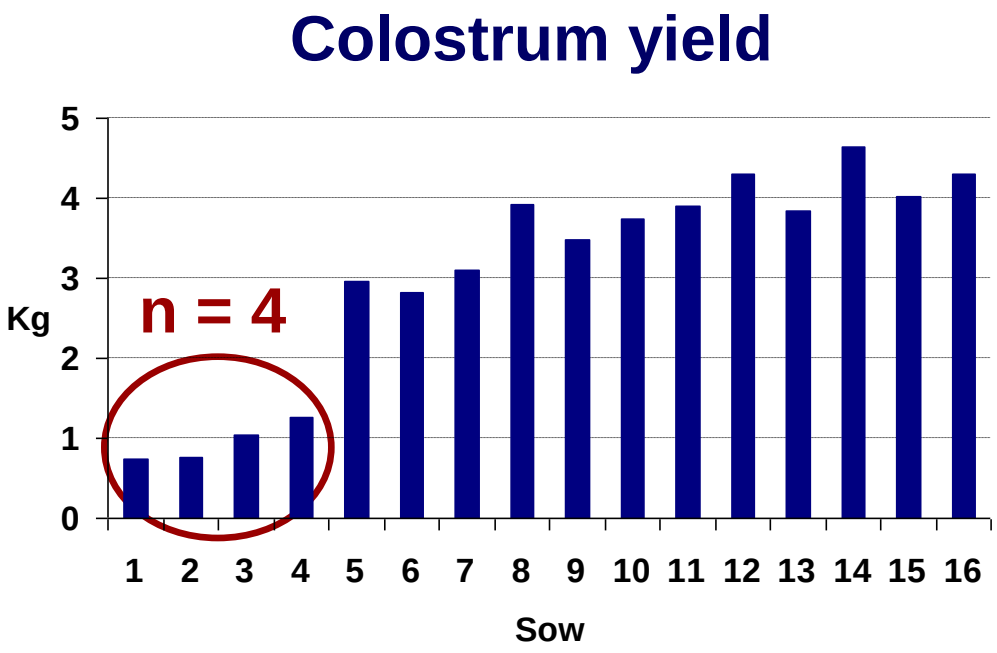


Days related to farrowing

Necessary for the initiation of lactation

Barrington et al., 2001; Farmer et al., 2006

Colostrum production: endocrine regulation



Sows with a low yield:

*** less lactose in colostrum**
*** less tight epithelium**

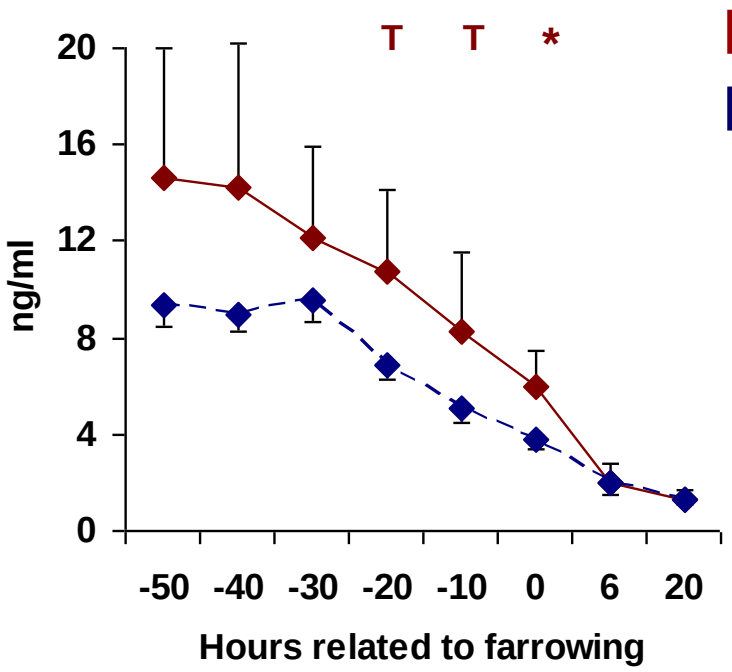
compared to sows with a medium to high yield of colostrum

➔ **Impaired lactogenesis (~1 kg)**

Foisnet et al., 2010

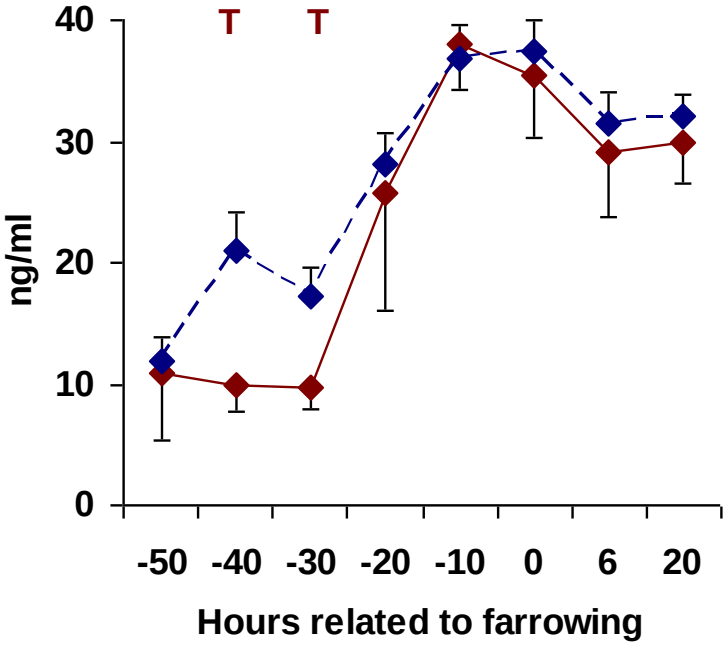
Endocrine control of lactogenesis

Progesterone



Low
High

Prolactin



➔ **Delay in tight junction closure?**

➔ **Lower lactose synthesis?**

➔ ***Impaired lactogenesis could be due to a delay in hormonal changes before farrowing.***

Foisnet et al., 2010

Endocrine control of lactogenesis

Role of IGF-I?

Positive correlation between [IGF-I] before parturition and colostrum yield (r = 0.64, *P* = 0.03)

Foisnet et al., 2010

IGF-I

- ✓ **mitogenic hormone (+ cell turnover)**
- ✓ **anabolic hormone (+ nutrient uptake by MEC)**

Lee et al., 1993; Farmer et al., 2008

Conclusions and Perspectives

Increasing colostrum intake by piglets is important:

to reduce neonatal mortality

to improve the immune protection of piglets *(important in the context of reducing the use of antibiotics)*

Increasing colostrum production by sows

Further knowledge needed on the impact of:

✓endocrine and metabolic background during the peripartum period

✓mammary gland development during pregnancy

✓maternal behaviour.

Thank you for your attention

DIET
AGRICULTURE
ENVIRONMENT