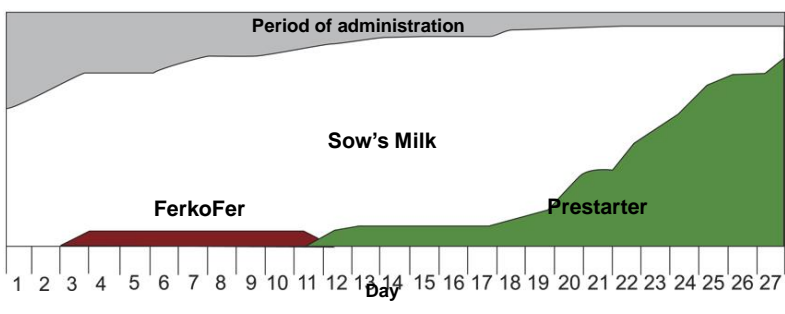




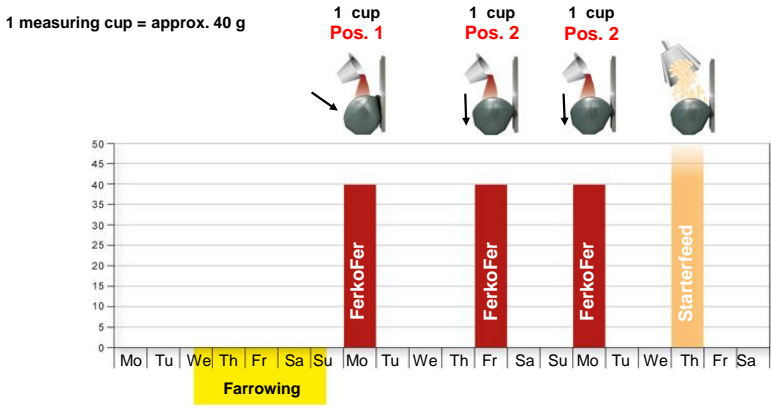
Administration of FerkoFer



FerkoFer is given 3 times during the period from 2-4 days after farrowing until the piglets are 8-12 days old. Each time, 1 measuring cup (approx. 40 g) is given per litter of 12 piglets. Thus, after the 3 administrations, each piglet in the litter has received approx. 10 g of FerkoFer. In this way, it is achieved that iron is available to the piglet throughout period.



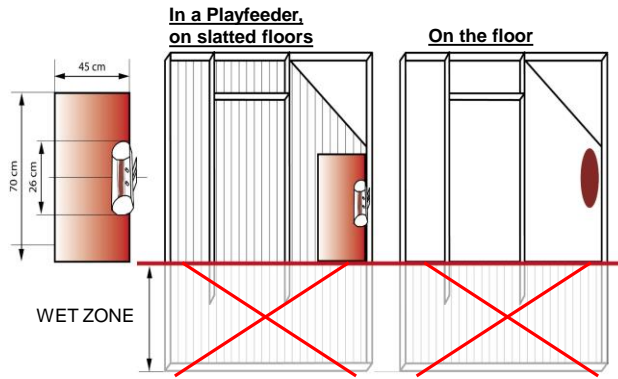
Application in practice



Farrowings usually take place at the end of the week. Monday after the farrowing, the administration of FerkoFer begins. It continues as shown in the illustration. A total of 10 g of FerkoFer is administered per piglet, equivalent to 120 g per litter (12 piglets).



Distribution of FerkoFer



FerkoFer is distributed in a clean dry place on the floor, between the sow and the resting place of the piglets, but out of reach of the sow and not too close to the slats.



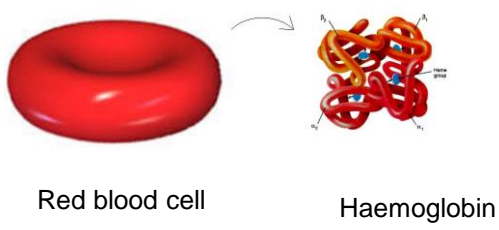
The theoretical requirement

The total iron requirement (“consumption”) of the piglet during the 3 first weeks after birth is app. 230 mg.

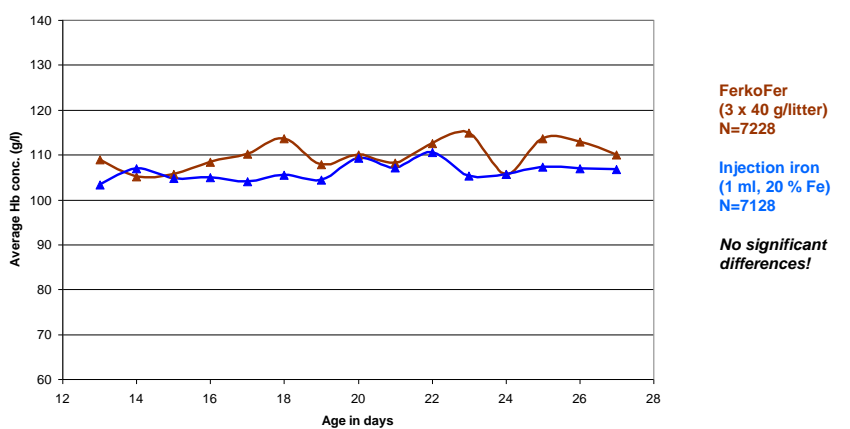
Total iron requirement	app. 230 mg
Iron reserve at birth	app. 50 mg
<u>Supply from the sow’s milk</u>	<u>app. 25 mg</u>
Required iron supplement	app. 155 mg



Measurement of haemoglobin



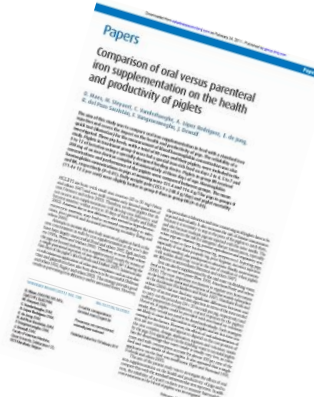
The hemoglobin concentration in 13-27 days old piglets, which have been given oral iron powder from Biofiber-Damino (brown curve) or injection iron (blue curve). Both curves are based on measurements of more than 7000 piglets.





Trial in Belgium 2010

		FerkoFer	Injection	p
Day 3	Hb.konc, (g/l) (n=249)	75,9	78,1	0,25
Day 25	Hb.konc, (n=240)	109,6	101,1	0,00*
	Time spent/litter (sec.)	27,3	56,9	<0,01*
	Mortality day 3-25, (%)	11,4	12,2	0,78
	Daily weight gain (g/day)	253,9	248,8	0,17

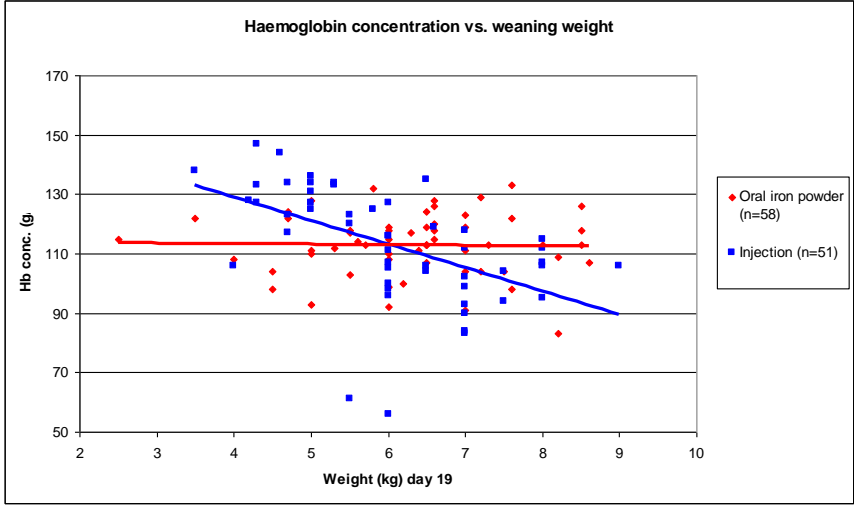


D. Maes, M. Steyaert, C. Vanderhaeghe, A. López Rodríguez, E. de Jong, R. del Pozo Sacristán, F. Vangroenweghe, J. Dewulf. *Comparison of oral versus parenteral iron supplementation on the health and productivity of piglets. Veterinary Record* (2011)168(7): 188.

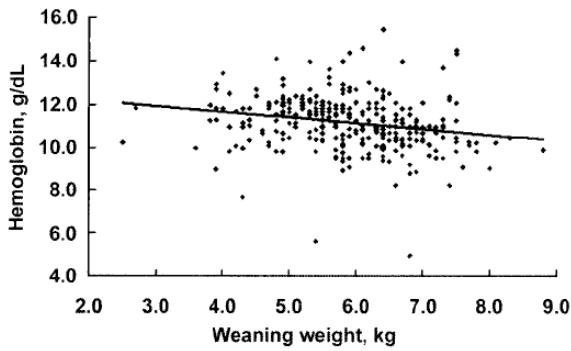


Another french trial...

	FerkoFer (n=58)	Injection (n=51)
Haemoglobin, (g/l), day 19	112,9	113,0
Daily w. gain, day 1-19 (g)	241	221



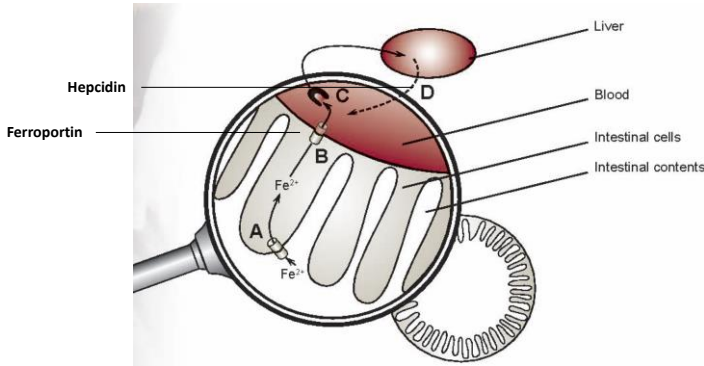
Hb vs. weight in an American trial (injection)



Jolliff JS, Mahan DC. Effect of injected and dietary iron in young piglets on blood hematology and postnatal pig growth performance. J. Anim. Sci. 2011. 89:4068-4080.



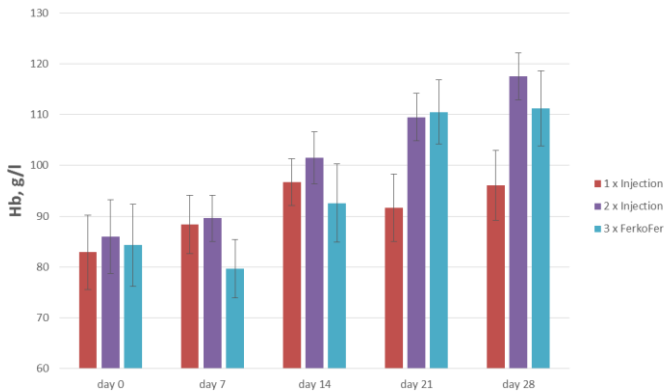
Hepcidin: Key regulator of iron absorption in the gut



The liver excretes hepcidin (D) when body iron levels are sufficient. Ferroportin (B) – the iron transporter in the intestinal cell – is inhibited by hepcidin.



FerkoFer compared to 1x and 2x injection



A German study on different iron supplementation methods (n=64-69 in each group). 1x inj. significant lower on day 21 and 28.
 Ripke S. (2015) Einsatz zur Kontrolle der Eisenmangelanämie beim Saugferkel. Tierärztlichen Fakultät der Ludwig-Maximilians-Universität München.



Reference ranges

The MERCK VETERINARY MANUAL
 TABLE 6. Hematologic Reference Ranges

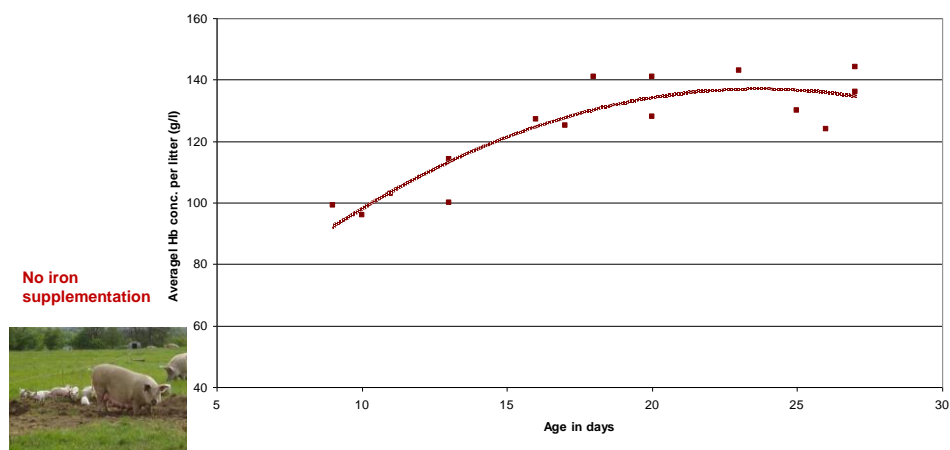
	Conventional (USA) Units	11 Dogs	Dog	Cat	Cow	Horse	Pig	Sheep	Goat	Rabbit	Llama	Yucatanian Pure-Bred Pig	Ostrich									
PCV (hematocrit)	%	> 10-2	37-55 (25-34)*	30-45 (24-34)*	24-46	32-64*	26-43 (26-35)*	27-45	22-38	33-50	29-39	37-51	32									
Hemoglobin (Hgb)	g/dL	> 10 g/L	12-18	8-15	8-15	10-18	9-15	9-15	8-12	10-17	13-18	11-15	12									
Red blood cells	$\times 10^6/\mu\text{L}$	> 1012	5.5-8.5	5-10	5-10	6-12	5-7	5-15	5-10	10-17	11-10	6-8	1.7									
Reticulocytes	%		0-1.5	0-1	0	0	0-12	0														
Mean corpuscular volume	fL		46-77	39-55	48-60	34-50	52-62															
Mean corpuscular Hgb	pg		19.5-24.5	13-17	11-17	13-19	17-24	15-20	15-20	17-24	13-22	14-18	16									
Mean corpuscular Hgb concentration	g/dL	> 10 g/L	32-36	30-36	30-36	31-37	29-34	31-34	30-36	29-37	28-33	33										
Platelets	$\times 10^5/\mu\text{L}$	$\times 1011/L$	2-9	3-7	1-8	1-6	2-5	2.5-7.5	3-6	2.5-6.5												
White blood cells	$\times 10^9/L$	$\times 10^9/L$	6-17	5.5-19.5	4-12	6-12	11-22	4-12	4-13	5-12.5	7.5-21.5	19-38	5.5									
Neutrophils (segmented)	%	$\times 10^3/\mu\text{L}$	60-70	3-11.4	35-75	15-45	0.6-4	30-75	3-6	20-70	2-15	10-50	30-48	20-75	1-9.4	60-74	18-63	3.3-24	63*	3.4		
Neutrophils (band)	%	$\times 10^3/\mu\text{L}$	0-3	0-0.3	0-3	0-0.3	0-2	0-0.12	0-1	0-0.1	0-4	0-0.8	0	rare	0-1	0-0.35	0-1	0-0.4				
Lymphocytes	%	$\times 10^3/\mu\text{L}$	12-30	1-4.8	20-55	1.5-7	45-75	25-60	35-75	40-75	2-9	50-70	2-9	30-85	13-35	24-70	4.5-17	34	188			
Monocytes	%	$\times 10^3/\mu\text{L}$	0-3	0-1	0-0.85	2-7	0-0.25	0-0.85	1-8	0-0.6	0-10	0-1	0-6	0-0.75	0-4	0-0.55	1-4	0.05-0.5	1.4	3-13	0.6-5.0	2.9
Eosinophils	%	$\times 10^3/\mu\text{L}$	0.3-0.75	0-1	0-0.75	2-20	0-2.4	1-10	0-0.8	0-15	0-1.5	0-10	0-1	1-8	1-4	0.05-0.5	0.15-0.3	1-12	0.2-4.6	0.3	0.02	
Basophils	%	$\times 10^3/\mu\text{L}$	rare	rare	rare	0-2	0-0.2	0-3	0-0.3	0-3	0-0.5	0-3	0-0.3	0-1	0-0.12	1-7	0.05-0.9	0.2	0-0.4	0-0.4	0.2	
Myeloid/erythroid ratio			0.75-2.4:1	0.6-3.9:1	0.3-1.8:1	0.9-3.8:1	1.2-2.2:1	0.8-1.7:1	0.7-1.0:1													
Plasma protein	g/dL	> 10 g/L	6-7.5	6-7.5	6-8	6-8.5	6-9	6-7.5	6-7.5	5.4-8.3												
Plasma fibrinogen	g/dL	> 10 g/L	0.15-0.3	0.15-0.3	0.1-0.6	0.1-0.4	0.2-0.4	0.1-0.5	0.1-0.4	0.2-0.4	0.1-0.4	0.1-0.4										

* Adapted, with permission, in part from Duncan J.R. and Prasse K.W., Veterinary Laboratory Medicine, 2nd ed., Iowa State University Press, 1996. 15- to 6-wk-old pigs; kittens 3- to 45-day-old pigs; *Lower in foals and solid-blooded horses (heterophil slaver in young animals)

**Hemoglobin:
90-130 g/l in adult pigs**

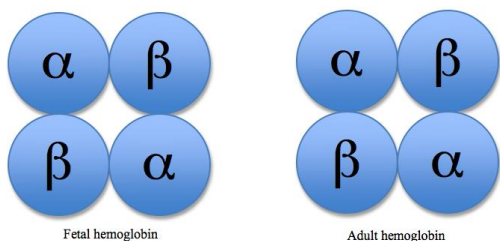


Hb concentration in free range piglets





Haemoglobin in pigs



+ 2,3-Bisphosphoglycerate (DPG)



Changes in haematology

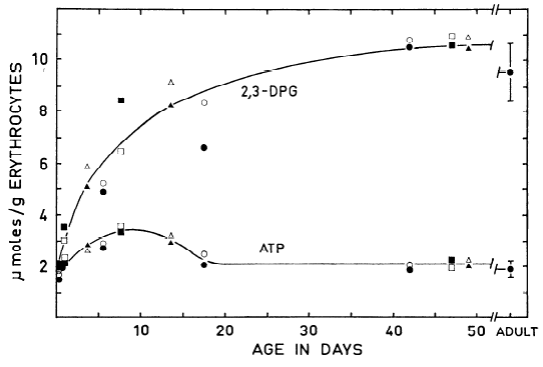


FIG. 2. Postnatal changes of pig red cell DPG and ATP concentrations. Symbols as in Fig. 1. Adult values (±1 SD) are mean values from 8 determinations.



Oxygen affinity piglet blood

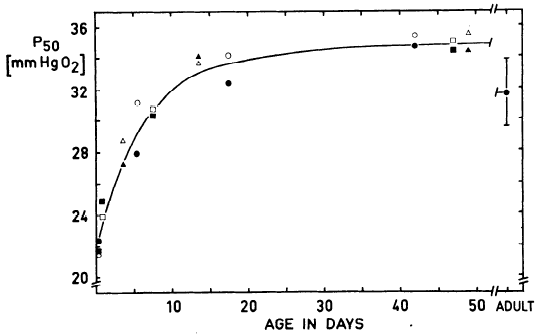
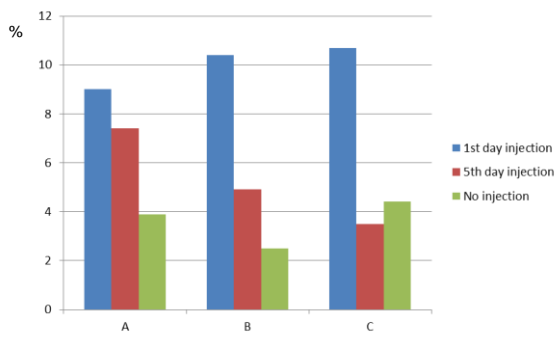


FIG. 3. Postnatal changes of P₅₀ (37°C, 40 mmHg CO₂, plasma pH 7.4) of pig blood. Symbols as in Fig. 1.



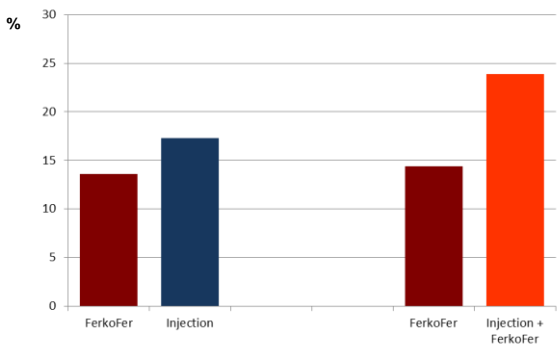
Iron overload - polyarthritis in piglets



Swedish trial (Holmgren, 1996). The trial was carried out in 3 herds, where it was examined how many piglets were affected by polyarthritis, after they had received an iron injection (iron dextran) on the 1st or the 5th day of life, respectively, or no iron injection. (n=1737)



Polyarthritits in piglets

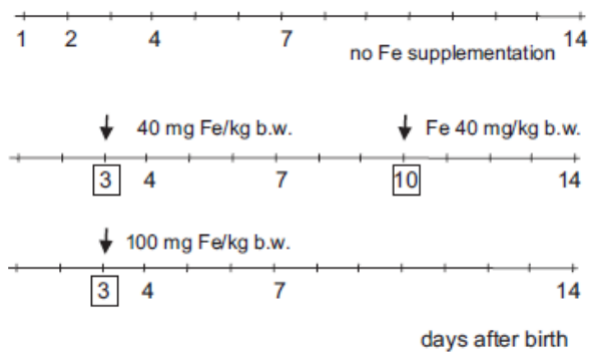


Trials from Schweden on piglet iron and polyarthritits. More piglets suffered from polyarthritits when iron dextran was injected compared to voluntary oral iron.

Iron injection in piglets and its effect on infections: *PorcoFer till smågrisar i stället för järminjektion* (2009) LTJ-Faculty datasheet 12, 2009. Results are confirming **Holmgren**, 1996.



Iron toxicity in the liver

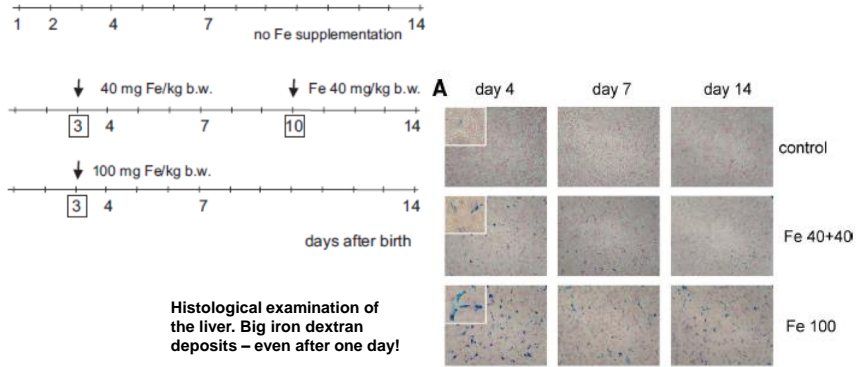


Two different dosage regimen of injected iron (+ 1 control) was tested in piglets

Lipinski et al. (2010), Benefits and Risks of Iron Supplementation in Anemic Neonatal Pigs *The American Journal of Pathology*, Vol. 177, No. 3.



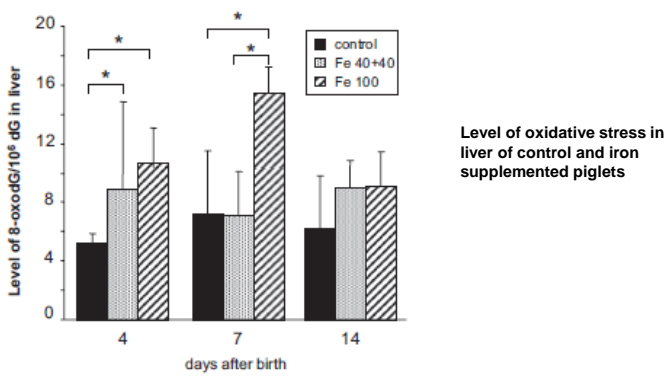
Iron toxicity in the liver



Lipinski et al. (2010) Benefits and Risks of Iron Supplementation in Anemic Neonatal Pigs The American Journal of Pathology, Vol. 177, No. 3.



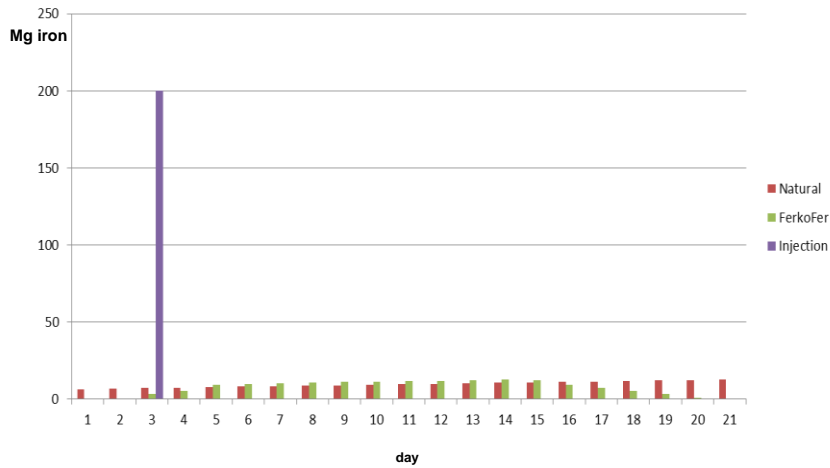
Iron toxicity in the liver



Lipinski et al. (2010) Benefits and Risks of Iron Supplementation in Anemic Neonatal Pigs The American Journal of Pathology, Vol. 177, No. 3.



The Best Iron Administration ?



Conclusions

- Absorption of FerkoFer (dietary iron) is regulated in the gut
- Injected iron cannot be regulated



Conclusions

What is an appropriate amount of iron and haemoglobin varies individually – it depends on:

- Health status
- Size
- Age



Bovine colostrum for gut protection



Tim Hesselballe Hansen, R&D, Biofiber-Damino A/S



Colostrum collection and production

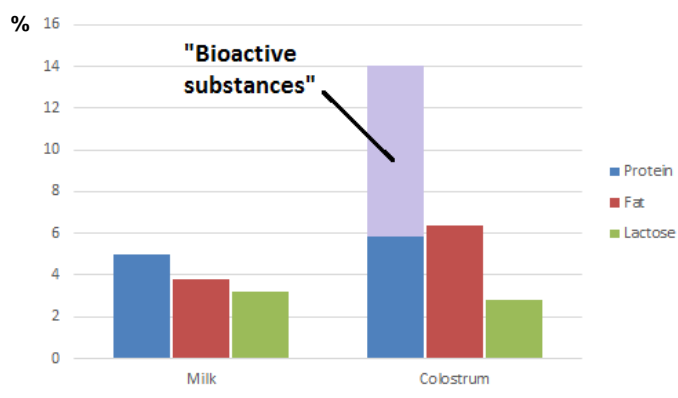


Colostrum production - basic principles:

- Big batches – homogeneity
- Only 1st and 2nd milking
- Handle with care – low temperatures
- WHOLE colostrum – only water is removed



Composition of bovine colostrum?



Composition of bovine colostrum?

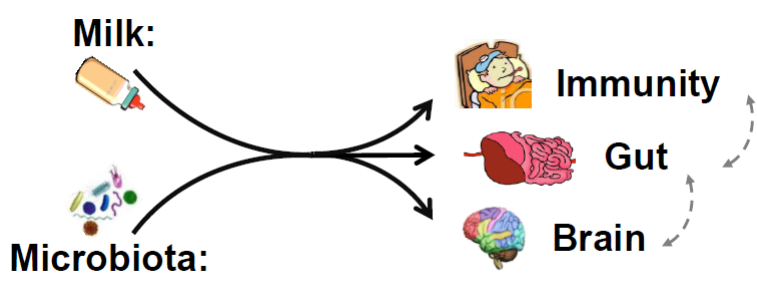
Bioactivity in colostrum:

Antimicrobial	Immune development	Anti-inflammatory	Tolerance/priming
Immunoglobulins: sIgA, SIgG, SIgM	Macrophages	Cytokines: IL-10, TGF-β	Cytokines: IL-10 ; TGF-β
Lactoferrin, lactoferricin B and H	Neutrophils	IL-1 receptor antagonist	Anti-idiotypic antibodies
Lysozyme	Lymphocytes	TNF-α and IL-8 receptors	
Lactoperoxidase	Cytokines	sCD14	
Nucleotide-hydrolyzing antibodies	Growth factors	Adhesion molecules	
κ-Casein and α-lactalbumin	Hormones	Long-chain PUFA	
Haptocorrin	Milk peptides	Osteoprotegerin	
Mucins	Long-chain PUFA	Lactoferrin	
Lactadherin	Nucleotides	Hormones and growth factors	
Free secretatory component	Adhesion molecules	cortisol, estrogen, progesterone, thyroid hormones, erythropoietin, gonadotropin, insulin, leptin, prolactin, procalcitonin	
Oligosaccharides and prebiotics			
Fatty acids			
Maternal leukocytes and cytokines			
sCD14			
Complement and complement receptors			
β-Defensin-1			
Toll-like receptors			
Bifidus factor			

Not species specific!



Research projects:
FØSU 2008-2013, NEOMUNE 2013-2018



How to feed a (weak) newborn

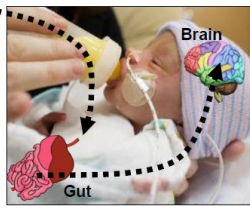
Piglet/mice studies:
University of Copenhagen



Infant studies:
Copenhagen/Odense Hospitals
10 infant hospitals in China
Amsterdam hospitals
.....
.....

- A: Feeding interventions:**
- When to start oral feeding?
 - How much to feed & how?
 - Which milk diet to feed?
 - Nutrient composition?
 - Bioactive nutrients?

- B: Gut-related endpoints:**
- Structure, digestion, absorption
 - Neurons, motility, gut peptides
 - Pathology, diarrhea, intolerance



- D: Brain-related endpoints:**
- Growth, structure, neurotrophic
 - Signaling, receptors, inflamm.
 - Memory, learning, psychomotor

- C: Immune-related endpoints:**
- Infections, sepsis, vaccination
 - Tissue inflammatory mediators
 - Gut microbiota colonization,



Biofiber-Damino's role in Neomune

Bovine colostrum for:

Piglet model studies at universities (China, Denmark, Belgium etc.)

Clinical trials, Intensive care units and children's hospitals (Denmark, Netherlands, China, Australia)



Biofiber-Damino's role in Neomune

NEC – Necrotizing enterocolitis. Fast progression from non-specific signs to extensive inflamm. and necrosis in GIT

ALL – Acute Lymphoblastic Leukemia. GIT toxicity during chemotherapy.



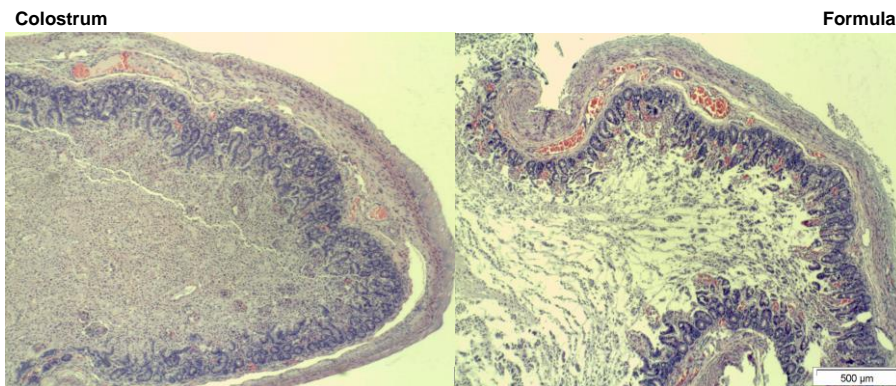


ALL – Acute lymphoblastic leukemia

- Most common form of childhood cancer
- Aggressive treatment - chemotherapy
- GIT toxicity in 40-100 % of patients
- Piglet studies



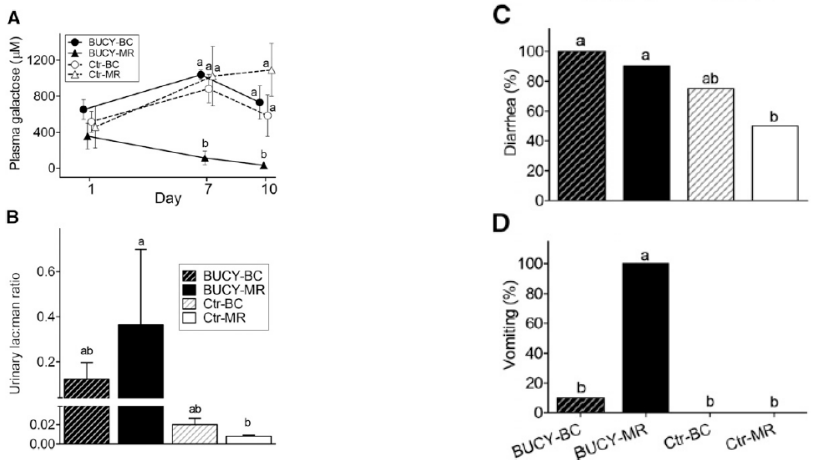
Effect of bovine colostrum on inflammation during chemotherapy – *intestinal mucositis*



Peter Erik Lotko Pontoppidan, Institut for Human Ernæring, University of Copenhagen



Effect of BC on piglets during chemotherapy



Fed 165ml/kg/d, d0-11, BUCY d1-6, n=37, Pontoppidan et al., 2015



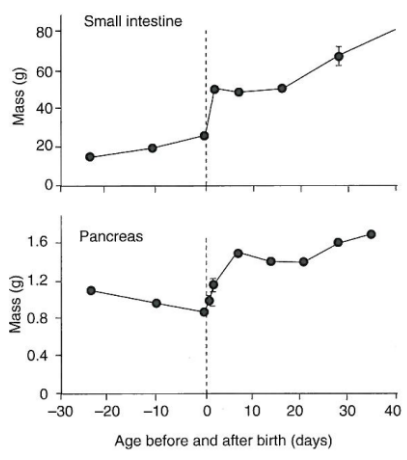
Colostrum and preterm piglets

- Piglets (92-95 % gestational age) as a model for premature babies
- Immature gut
- Feed intolerance
- High risk of NEC
- Long term effects





Colostrum and preterm piglets



Birth – the biggest transition!



Colostrum and preterm piglets

Experimental design

Day 1	Day 3	Day 4-5
	Colostrum Formula	
Cesarean -> TPN ->	2x formula + colostrum 2x formula + colostrum powder 2x formula + past. colostrum powder	sacrificed

N=45, 105-107 days of gestation. Støy et al. 2012.





Colostrum and preterm piglets

	NEC incidens (%)	mean NEC score
Formula (n = 14)	71 ^b	2,8 ^a
2Fcolostrum (n = 13)	69	2,3 ^a
Colostrum (n = 7)	50	1,6 ^b
2F + pulver colostrum (n =8)	38	1,6 ^b
2F + past. pulver colostrum (n = 9)	33 ^a	1,5 ^b

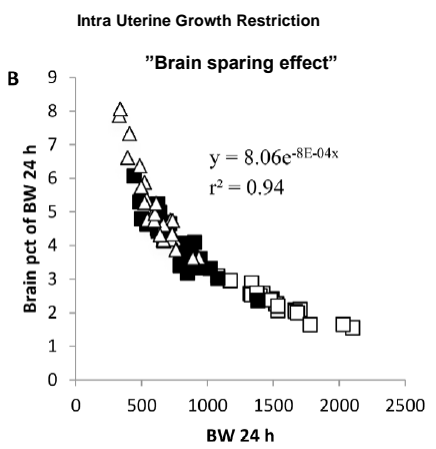
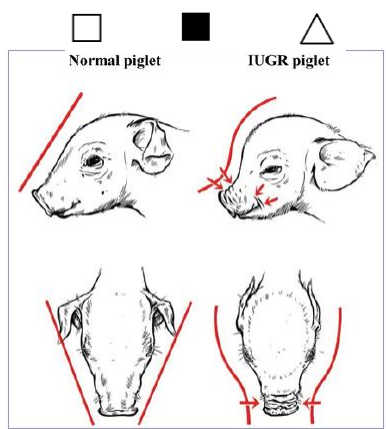


How can research in bovine colostrum be used in pig production?

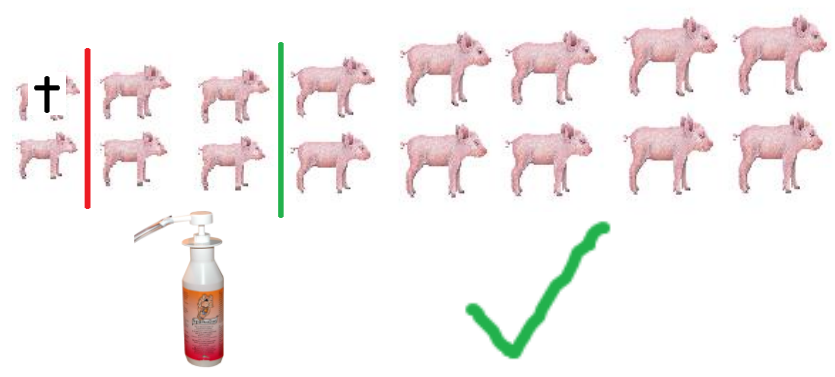




IUGR-piglets are very common



A litter of 16 piglets

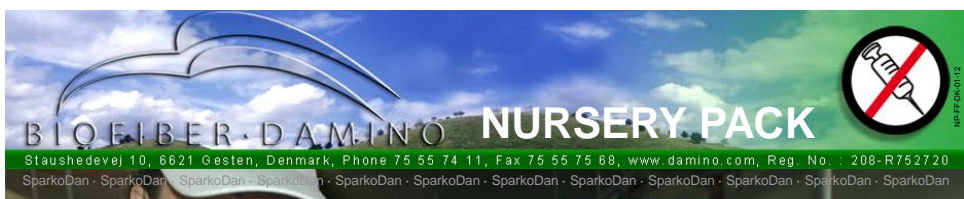




SparkoDan



- Bovine colostrum
- Bioactivity
- Water based
- Colostrum supplement, not substitute!
- Gut protection



SparkoDan®

Dosering af SparkoDan:
2 pumpeslag = ca. 4 ml
pr. gris pr. dosering