

Pigs' favourite rapeseed cake

Chief Scientist Hanne Maribo
hma@lf.dk

Videncenter for
Svineproduktion



Rapeseed for pigs

- **Outline**

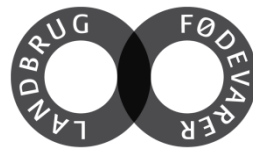
- Rapeseed project!
- Effect in the pig
- Rapeseed cake for weaners
- Trials with rats
- Rapeseed cake for finishers
- Fermented rapeseed for weaners
- Conclusion

Outcome of project involving:

DJF (AA), Scanola, Den Lokale Andel,
SCIENCE (KU) and VSP (L&F)

Financially supported by the Innovation Act, DFFE

Pig Research
Centre



The end of the rapeseed project is in sight.....

- The aim was to study the entire chain from variety through process - effect on rats and pigs
- We now know:
 - **Weaners** tolerate rapeseed better than **finishers**
 - Large variations in **nutrient content** in products available in DK
 - Glucosinolate content still high in Danish rapeseed, but...
 - Perhaps gentle processing will improve quality

Outcome of a project involving:

DJF (AA), Scanola, Den Lokale Andel,
SCIENCE (KU) and VSP (L&F)

Financially supported by the Innovation Act, DFFE

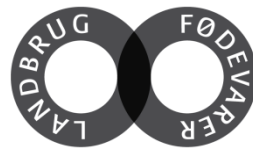


Rapeseed in pig feed!

- **Give it to the cows!**
 - They cannot eat it all
- **Why, then, should Danes use it for pig feed?**
- **It is (usually) cheap**
- **It is grown in Denmark**
- **Good amino acid profile**
- **Negative effects:**
 - Indigestible husk
 - Varying quality: varieties/heat-treatment
 - Risk of reduced quality of fat (finishers)
 - Has a bad reputation



Pig Research
Centre



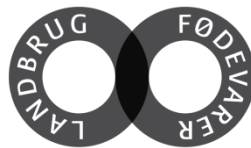
Inclusion in feed

- Today, economically relevant (regular, current diet):
 - 5-8 % in feed for weaners (cake)
 - 5 % in feed for finishers (meal)
- **Replaces soybean meal and wheat**



VSP max.
recommendation:
Weaners: 5-15 %
Finishers: 20-40 %

Pig Research
Centre



Rapeseed - pitfalls!

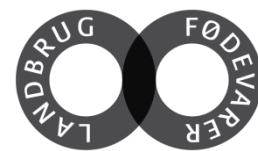
- **Varieties, glucosinolate content**
 - New EU rules 2013: below 18 $\mu\text{mol/g}$ seed
 - In rapeseed cake 40% oil out = 30 $\mu\text{mol/g}$ - *theory*
 - *But we need to go further down!*
- **Heat-treatment during extraction of oil**
 - Improves utilization of oil
 - Deactivates myrosinase
 - Breaks down glucosinolates – to antinutritional factors
 - Availability of lysine



Degree of heat-treatment, limit:

4-hydroxyglucobrassicin min. 2 $\mu\text{mol/g}$

Pig Research
Centre

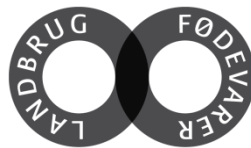


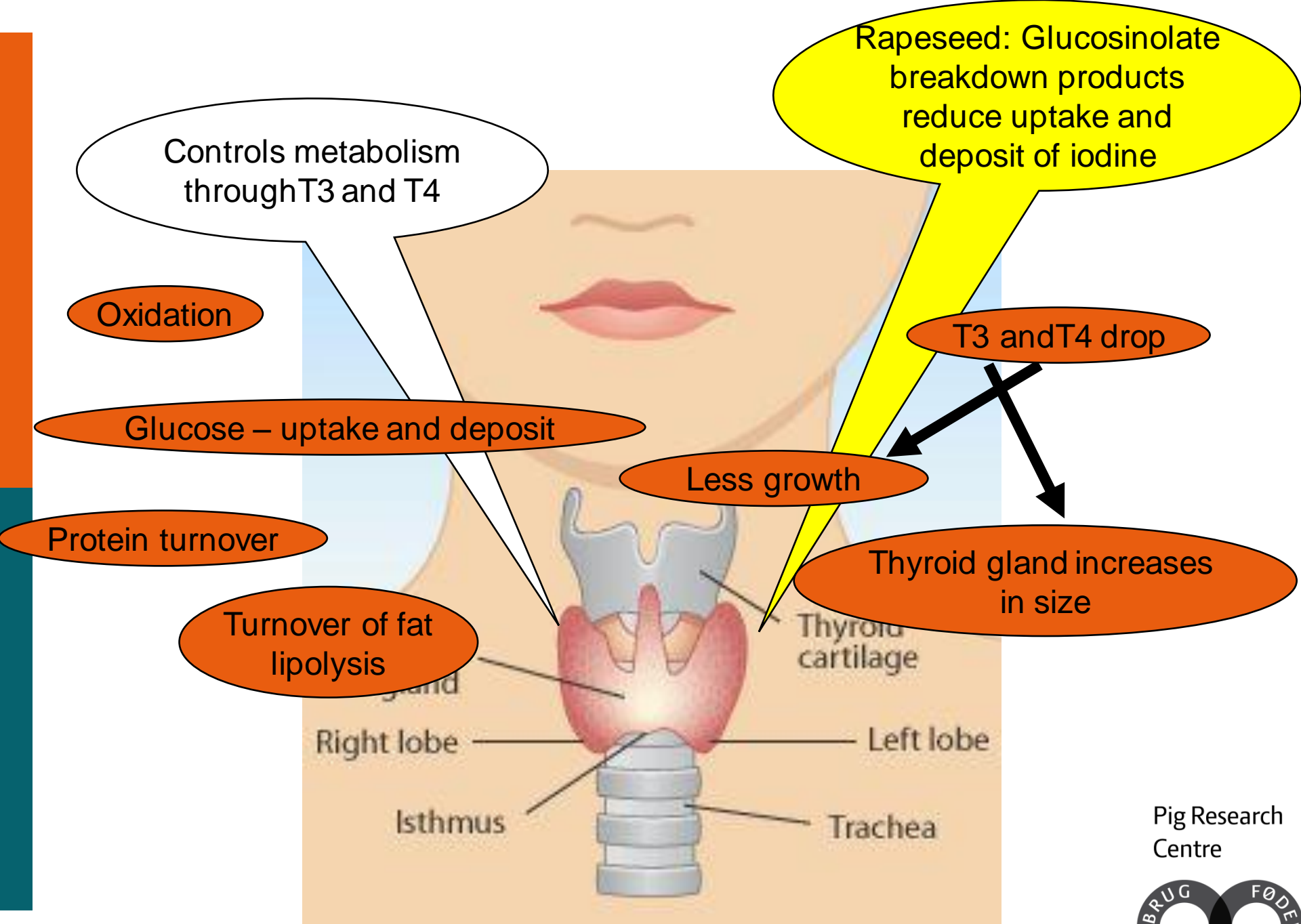
Breakdown of glucosinolates

**Antinutritional factors produced
from glucosinolates due to**

- 1. Myrosinase-breakdown**
- 2. Too much heat**

Pig Research
Centre





Rapeseed cake for weaners (7-30 kg)

- **Concerns**

- Appetite drops
- They die
- Increases diarrhoea
- Impossible immediately after weaning

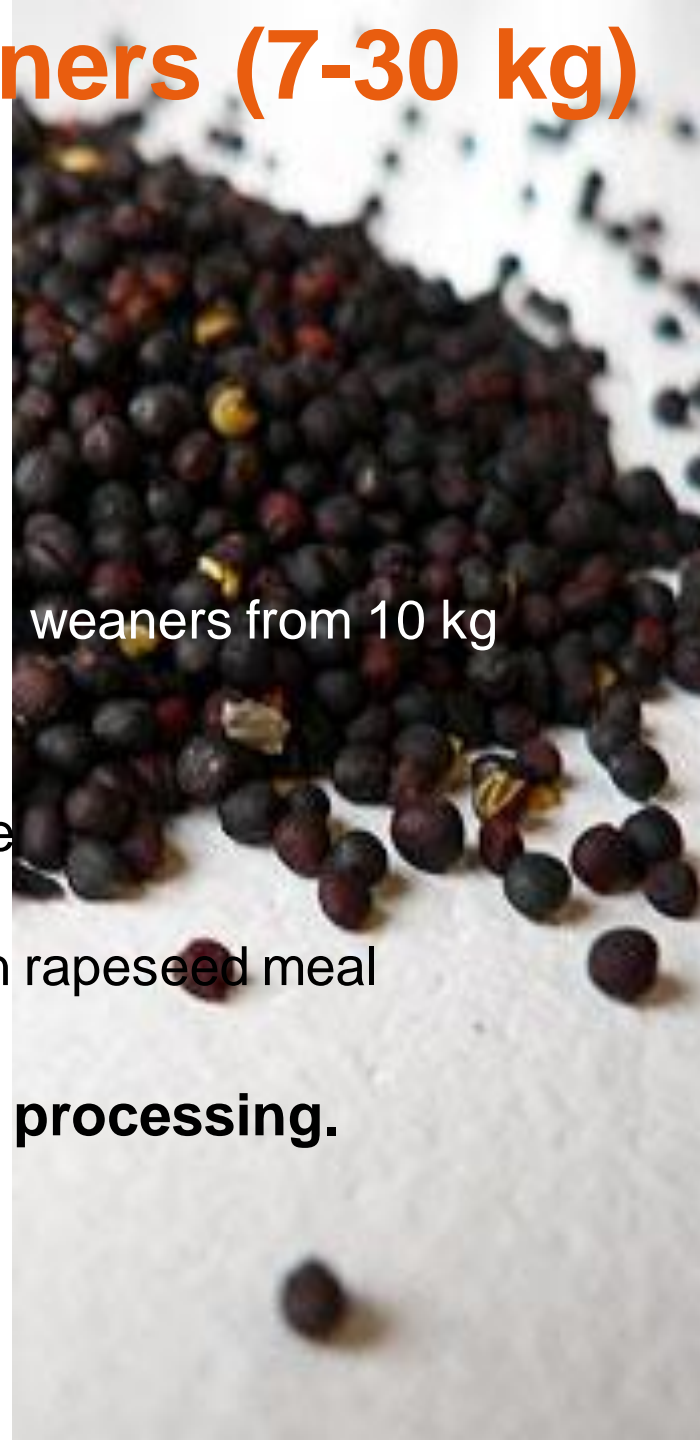
- **We investigated that!**

- Rapeseed cake products (2009) 15 % for weaners from 10 kg

- **Results:**

- Positive results with Danish rapeseed cake
- Nutrient content being analysed!
- Lower productivity with Polish and German rapeseed meal
- No influence on health

- **We continued investigating variety and processing.**



Next trial: rapeseed for weaners (7-30 kg)

Weaners, 580 pigs/treatment

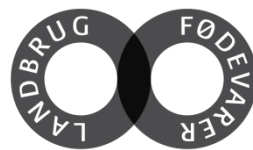
- ♦ 6.7-10.1 kg piglet diet 8-9 % rapeseed cake
- ♦ 10-30 kg weaner diet 15 % rapeseed cake

Protein	Control	Rapeseed cake				
Heat	-	Gentle	High	High	Cold	Cold/ dehulled
Glucosinolates	-	Low 13	Low 10	High 23	Low 12	Low 12
4-hydroxy.	-	3.8	1.4	0.7	4.0	3.1

Gentle: 109 for 12 minutes

High: 115 for 12 minutes + 105°C for 20 minutes

Pig Research
Centre



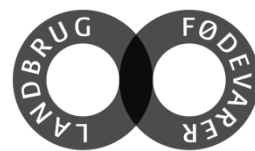
Effect on physiology – rats

Glucosinolate/ process temp.	Thyroid gland mg/100 g rat	Liver g/100 g rat
Control, pea protein	8.4 ^c	4.6 ^c
Low/Gentle	17.9 ^{ab}	5.3 ^{ab}
Low/Hard	15.1 ^b	5.0 ^b
High/Hard	22.8 ^a	5.7 ^a
Low/Cold pressed	16.6 ^{ab}	5.0 ^b
P-value	<0.001	0.003

Fact box

Low = Lioness
10 µmol/g
High= Excalibur
23 µmol/g

Pig Research
Centre



Weight of organs, pigs, mg/kg pig

Glucosinolate/ process temp.	Thyroid gland mg/kg	Liver g/kg
Control, soybean meal	116	25.9a
Low/Gentle	163	29.7b
Low/Hard	159	32.1b
High/Hard	140	30.7b
Low/Cold pressed	158	29.9b
P-value	0.08	0.01

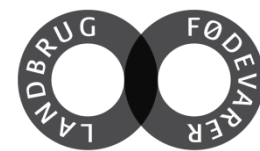
Fact box 1

Low = Lioness
10 $\mu\text{mol/g}$
High = Excalibur
23 $\mu\text{mol/g}$

Fact box 2

7-9 kg = 8% rapeseed cake
9-30 kg = 15% rapeseed cake

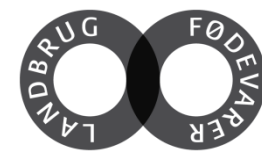
Pig Research
Centre



Productivity results, (Maribo 2012,report 949)

Glucosinolate/ process temp.	Daily gain, g/kg	FCR FUgp/kg	Production value
Control	510	1.75 ^a	100 ^{ab}
Low/Gentle	495	1.80 ^b	94 ^a
Low/Hard	496	1.72 ^{ab}	99 ^{ab}
High/Hard	508	1.73 ^{ab}	101 ^b
Low/Cold pressed	488	1.71 ^{ab}	97 ^{ab}

Pig Research
Centre



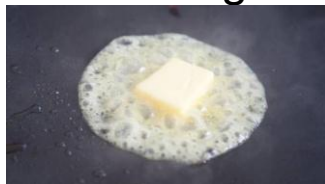
Rapeseed cake for finishers (30-110 kg)

From Scanola – new gentle processing

Rapeseed cake, %	0	10	20
Index, identical feed prices	100	91 ^{tend}	83*

- Conclusion**

- 10 % rapeseed cake in feed - € 0,7 per 100 kg feed
- 20 % rapeseed cake no good – quality of fat!



- Glucosinolates likely to be the problem on productivity

Physiological effects of glucosinolates

- **Rats**
 - Effect on weight of liver and thyroid gland
- **Weaners**
 - Effect on weight of liver, tendency to effect on thyroid gland
 - No effect on productivity?
- **Finishers**
 - Negative effect on productivity
- **Summing up?**
 - Short-term effect of glucosinolates on organs
 - Not enough time to affect productivity in weaners
 - But probably explains long-term effect seen in finishers
- **Currently being investigated**
 - Same inclusion of rapeseed cake for the entire growth period
 - Effect with high and low glucosinolate content for 9-100kg pigs

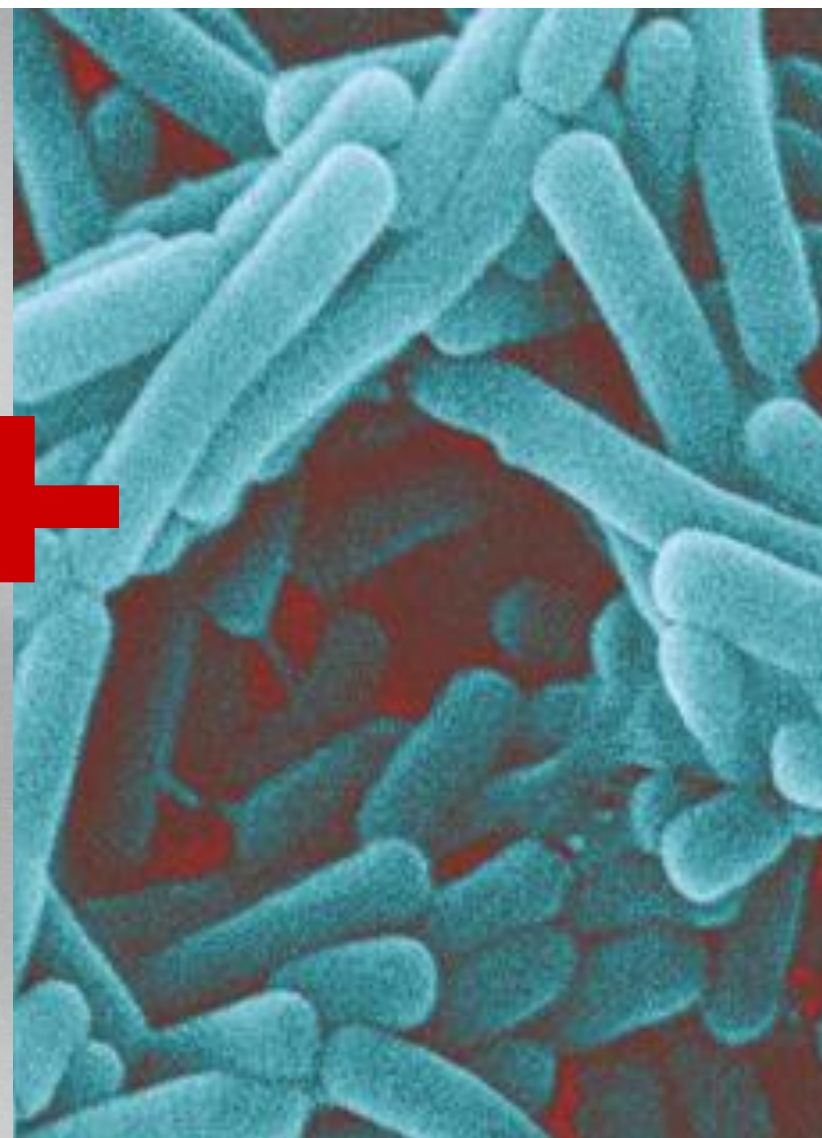
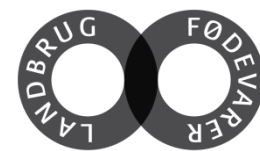
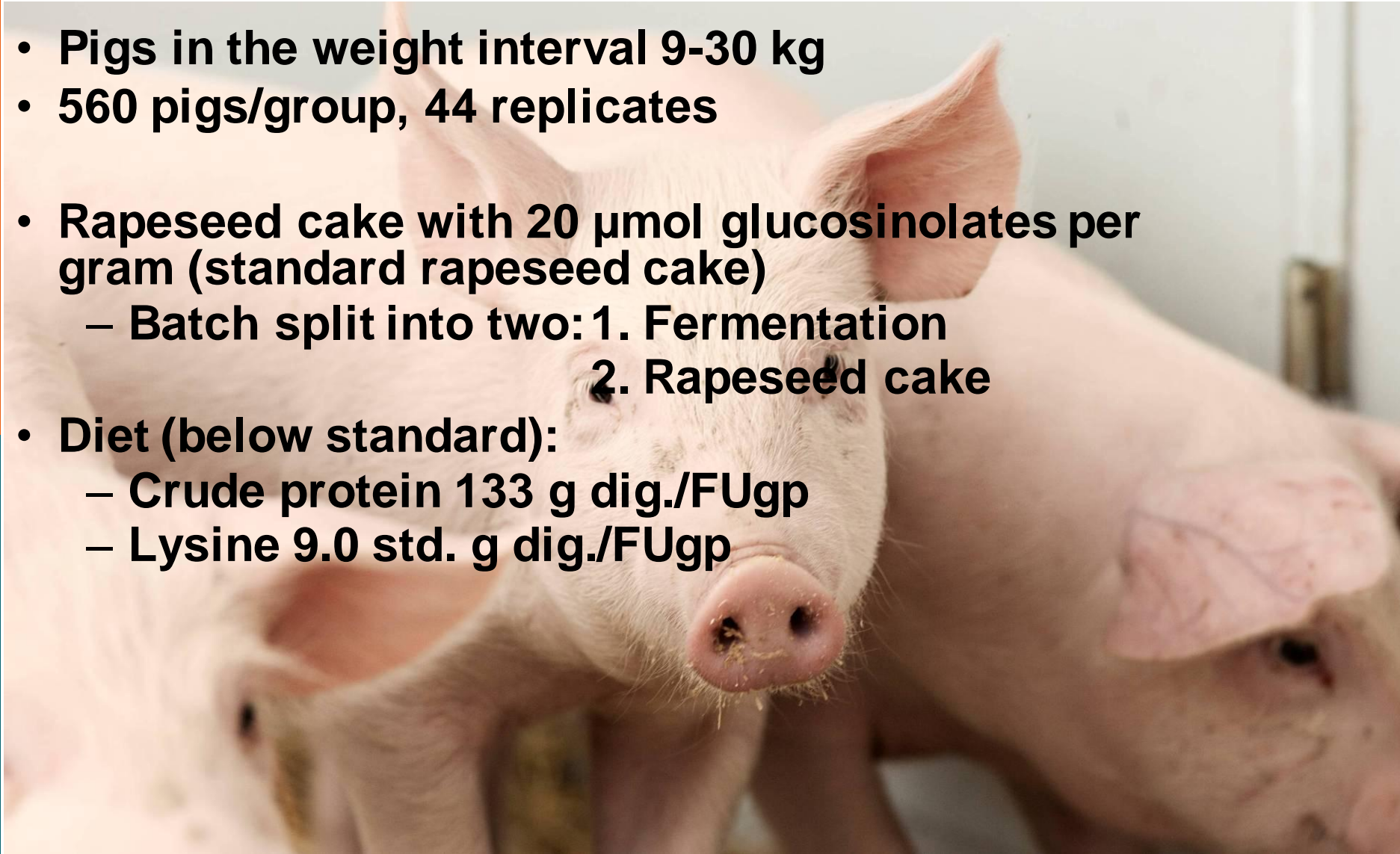


Fig Research
Centre



Fermented rapeseed cake for weaners

- Pigs in the weight interval 9-30 kg
- 560 pigs/group, 44 replicates
- Rapeseed cake with 20 μmol glucosinolates per gram (standard rapeseed cake)
 - Batch split into two: 1. Fermentation
2. Rapeseed cake
- Diet (below standard):
 - Crude protein 133 g dig./FUgp
 - Lysine 9.0 std. g dig./FUgp



Fermented rapeseed cake from "European Protein"

- **Content:**

- 50% rapeseed cake (batch, 5 tons)
- 10% wheat bran
- 40% inoculation material: potato peel, molasses, lactic acid bacteria and water

- **Process:**

- Mixing cart for cattle feed
- Rammed with wheel loader
- Covered with plastic
- Stored for 7 days
- Drying (Spin Flash)

Prerequisites - feed

DIETS %	"Fermented " diet	Rapeseed cake
Rapeseed product	15	11
Protein dig.	85	76

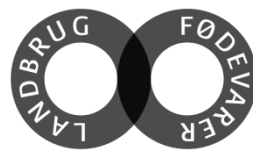


Results: protein quality rats

Søren Krogh Jensen (2013)

	Fermented Rapeseed cake	Rapeseed cake
Digestibility %	79,0a	81,5b
Biological value %	52,2	62,4
Netto utilisation	41,2a	50,9b

Pig Research
Centre



Results 9-30 kg pigs (Maribo 2012, report 942)

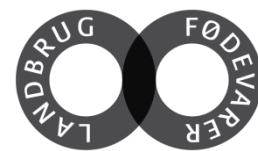
Diets	Control soya	Fermented Rapeseed cake	Rapeseed cake
g/day	531 ^a	509 ^b	533 ^a
FUgp/day	1,04	1,02	1.03
FUgp/kg	1,96 ^a	2,00 ^b	1.94 ^a
Index identical prices	100 ^a	93 ^b	102 ^a

Minimum difference for significance = 5 index points

No effect on health:

- Treatments for diarrhoea (1.0 day/pig)
- Dead 0.3 % and 3.6 % moved to hospital pen

Pig Research
Centre



Fermented rapeseed cake – conclusion

- Production value 7 % lower compared with control
- Production value 9 % lower compared with 11 % rapeseed cake
- Diet with fermented rapeseed cake must be **€ 1,5 cheaper than control per 100 kg**
- Lactic acid in fermented rapeseed cake = 5.6 % i.e. 0.6 % in feed
- Fermentation and/or heat-treatment reduce content of glucosinolates and 4-hydroxy-glucobrassicin
- Fermented rapeseedcake yields **lower** production value
 - Protein digestibility of 85 is too high?
 - Protein quality not good?
 - Production of antinutritional factors?
- We continue investigating fermented rapeseed cake

Messages ...

- **Low-quality rapeseed cake negatively affects physiology**
 - The content of glucosinolates must be lowered to 10-12 $\mu\text{mol/g}$
 - The process must deactivate myrosinase and....
 - Prevent breakdown of glucosinolates
 - Ensure that protein is not destroyed
- **Fermented rapeseed cake is not the solution**
 - Protein digestibility too high
 - Antinutritional factors from fermentation and heat-treatment

1 mm



Pig Research Centre still recommends...

- Up to 8 % rapeseed cake for weaned pigs
- Up to 15 % rapeseed cake for weaners 9-30 kg
- Diet with fermented rapeseed cake must be € 1,5 cheaper per 100 kg
- Max. 10 % rapeseed cake for finishers 30-100 kg, provided feed is € 0,7 cheaper per 100 kg
-and we will continue investigating rapeseed cake for pigs

