

Monitoring PRRS using laboratory data

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THE FACULTY OF HEALTH AND MEDICAL SCIENCES
UNIVERSITY OF COPENHAGEN

CENTER FOR RESEARCH IN PIG PRODUCTION
AND HEALTH



Book of presentations of the 3rd CPH Pig seminar
February 3, 2016

Up to Date with Pig Research



www.cphpig.ku.dk

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Preface

The Center for research in pig production and health – CPH Pig – enhances, consolidates and raises the profile of pig production research. The importance of research and innovation for the Danish pork industry remains crucial. The Danish pig producers face tight financial pressures and many factors contribute to the volatility surrounding the pork industry. The production of finishers in Denmark is declining as producers export a significant and increasing number of weaners to be finished elsewhere in Europe. A goal of CPH Pig is, in collaboration with its many partners, to support the Danish pig industry with R&D that is essential in addressing drivers of a profitable and sustainable pork production in a global market.

The 2016 seminar presents the recent developments across a diverse range of disciplines impacting on pig production particularly on increased productivity, survival among piglets, MRSA, reduction in antibiotic usage and objective measurements of animal welfare. With this in mind, the research presentations of the CPH Pig seminar will cover four main themes: “Growing pigs”, “Sows and Piglets”, “Welfare” and “MRSA”. It is our hope that this third CPH Pig seminar will provide an excellent forum to present new findings, foster in-depth discussions, and hopefully provide solutions to some of the industry’s challenges.

The University of Copenhagen and CPH Pig are integral in the training of undergraduate and postgraduate students and generating junior scientists who are essential to the future of the industry. CPH Pig outwardly promotes the involvement of students and early-career scientists at the meeting. The seminar again has a considerable number of young scientists attending and presenting their work and for many it will be their first opportunity to interact with key industry figures and organisations.

It is a pleasure to direct the CPH Pig seminar and contribute to facilitating the networking of those involved in pig research and pork production. This seminar is possible because a dedicated group of individuals coordinated and arranged all aspects of the event. We wish to thank everyone for their contribution and dedication. However, most importantly, thank you for participating and making the seminar a great success. Thank you for your support and we hope you will continue to be part of the future achievements of the center.

Hans Henrik Dietz
Chairman

Christian Fink Hansen
Center Director

Programme

CPH Pig Seminar February 3, 2016 Up to Date with Pig Research



Time	Presenters	Title
9:00-9:10	Hans Henrik Dietz Head of Department, Department of Large Animal Sciences, University of Copenhagen	Welcome
9:10-9:30	Jens Ulrich Nielsen Director, Innovation, SEGES Pig Research Centre	Key Lecture: Benefits of linking universities and the Danish pig industry – from the industry's point of view
<i>Session 1: Growing pigs</i>		<i>Chair: Jens Peter Nielsen</i>
9:30-9:45	Gitte Blach Nielsen, Industrial PhD student, Department of Large Animal Sciences, University of Copenhagen & MSD Animal Health	PCV2 infection dynamics: Diagnostics, between-batch consistency and correlation to productivity parameters
9:45-10:00	Dan Børge Jensen, PhD student, Department of Large Animal Sciences, University of Copenhagen	A multivariate dynamic linear model for early warnings of diarrhea and pen fouling in slaughter pigs
10:00-10:15	Louise Kruse Jensen Assistant Professor, Department of Veterinary Disease Biology, University of Copenhagen	Osteomyelitis in Danish slaughter pigs
10:15-10:30	Anna Helena Stygar, Post doc., Department of Large Animal Sciences, University of Copenhagen	Monitoring growth in finishers by weighing selected groups of pigs
10:30-11:00 MORNING TEA/COFFEE		
<i>Session 2: Sows and Piglets</i>		<i>Chair: Anne-Helene Tauson</i>
11:00-11:15	Ana Carolina Lopes Antunes PhD Student, DTU National Veterinary Institute	Monitoring PRRS using laboratory data
11:15-11:30	Sophie Van Vliet PhD student, Aarhus University	Impact of feeding regime on growth in prepubertal gilts
11:30-11:45	Thomas Sønderby Bruun, Senior Specialist, SEGES Pig Research Centre	Increasing the dietary level of protein for lactating sows affects litter gain and sow weight loss
11:45-12:00	Charlotte Amdi Williams, Post doc., Department of Large Animal Sciences, University of Copenhagen	Gastric emptying rate and blood values in newborn intra-uterine growth restricted piglets
12:00-13:00 LUNCH		

Session 3: Welfare**Chair: Björn Forkman**

13:00-13:15	Karl Johan Møller Klit PhD student, Department of Large Animal Sciences, University of Copenhagen	The use of virtual herds in veterinary and agricultural education
13:15-13:30	Marlene Kirchner Assistant Professor, Department of Large Animal Sciences, University of Copenhagen	Assessing farms with the Danish animal welfare index
13:30-13:45	Helle Pelant Lahrmann Industrial PhD student, Department of Large Animal Sciences, University of Copenhagen & SEGES Pig Research Centre	Tail biting: prevalence among docked and undocked pigs from weaning to slaughter
13:45-14:00	Janni Hales Pedersen Post doc., Department of Large Animal Sciences, University of Copenhagen	Loose housed sows with low piglet mortality
14:00-14:30	AFTERNOON TEA/COFFEE	

Session 4: MRSA**Chair: Anders Miki Boyesen**

14:30-14:45	Julie Elvekjær Hansen PhD student, DTU National Veterinary Institute	Levels of MRSA on pigs and environmental samples
14:45-15:00	Carmen Espinosa-Gongora Post doc., Department of Veterinary Disease Biology, University of Copenhagen	Can we reduce MRSA ST398 in positive farms by eliminating a few pig carriers?
15:00-15:15	Anna Camilla Birkegård PhD student, DTU National Veterinary Institute	How to pool fecal samples in a cross-sectional study of antimicrobial resistance genes in Danish pig herds
15:15-15:30	Nicolai Weber, PhD student, Department of Large Animal Sciences, University of Copenhagen	Can pooled faecal samples be used for resistance profiling? -Resistance in <i>E. coli</i> isolates from diarrhoeic nursery pigs?
15:30-15:35	Christian Fink Hansen Professor, Department of Large Animal Sciences, University of Copenhagen	Concluding remarks



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List of participants

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Key Lecture: Benefits of linking universities and the Danish pig industry –
from the industry's point of view

By Jens Ulrich Nielsen, Director, Innovation, SEGES Pig Research Centre

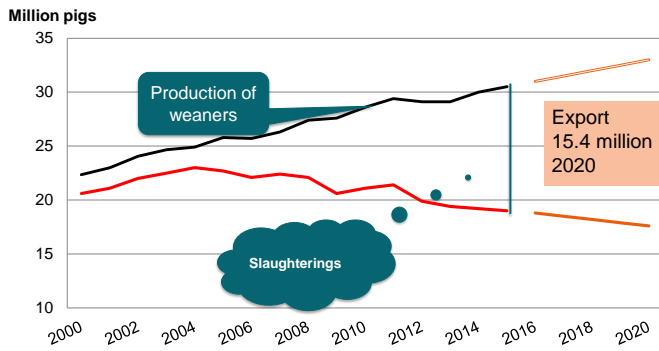


BENEFITS OF LINKING UNIVERSITIES AND THE DANISH PIG INDUSTRY – FROM THE INDUSTRY'S POINT OF VIEW

SEGES Pig Research Centre
 Jens Ulrich Nielsen, Director, Innovation

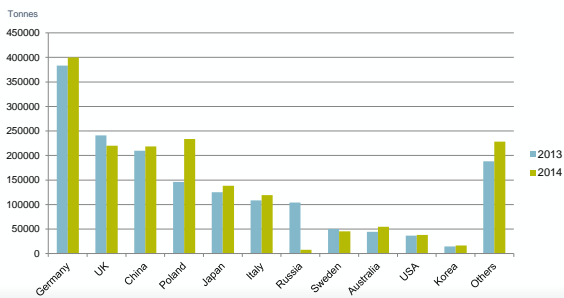


PRODUCTION OF PIGS IN DENMARK



Danish pork exports

THE DANISH STANDARD



DANISH PIG RESEARCH CENTRE

- Financed by Danish pig farmers
- 160 employees
- Responsible for research and development programmes and knowledge transfer to the Danish pig industry
- Support the development of a responsible and economically sustainable pig industry with the highest possible level of welfare and a minimum impact on the environment
- Trials for 15 million Euro annually
- Operate on 200 commercial farms



STRONGHOLDS IN COOPERATION WITH THE UNIVERSITIES

- Ensure that the industry benefits from research
- More relevant pig research
- Involvement of central qualifications
- Improve credibility and validation of SEGES PRC's work
- Access to more funds
- Knowledge transfer to the industry
- Supplementary training of employees
- Recruitment of new employees
- Mutual utility assurance
- Most recent knowledge included in education

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MANY CHALLENGES - LOTS OF RESEARCH

WE ARE LOOKING FOR ANSWERS AND SOLUTIONS, NOT COSTS

sows with gastric ulcers

Routine tail docking

Environmental impact

Castration

MRSA

High sow mortality rates

Antibiotic use

Thank you




Session 1: Growing Pigs

PCV2 infection dynamics:
Diagnostics, between-batch consistency and correlation to productivity
parameters

By Gitte Blach Nielsen, Industrial PhD student, Department of Large
Animal Sciences, University of Copenhagen & MSD Animal Health

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Faculty of Health and Medical Sciences



PCV2 infection dynamics: Diagnostics, between-batch consistency and correlation to productivity parameters

Preliminary results

CPH Pig February 3rd 2016

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Background

Porcine circovirus, type 2 (PCV2) known worldwide as a cause of reduced productivity in growing pigs

'Not killing pigs for diagnosis' – blood samples 'golden standard'

Impact of infection: Level of viremia in serum by PCR-analysis

Oral fluid sampling – quick, more animals, welfare


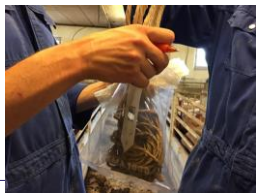

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Research questions

Does level of PCV2:

- Correlate between serum and oral fluid ?
- Vary between batches in the same herd ?
- Correlate to productivity parameters and antibiotic usage ?

Sub-dataset from vaccination field trial
Only non-vaccinated pigs included – vaccination influences PCV2 level

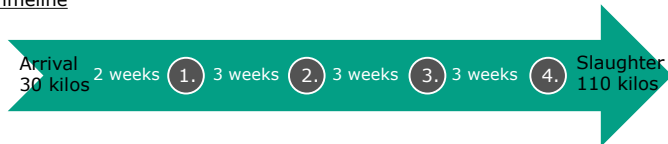
Study design

1 finishing herd 'Blue SPF' – highest health status

14 batches included (arriving 2 weeks apart), 2-5 pens sampled in each:
4 blood samples per pen -> 1 pool for PCV2-PCR-analysis
2 cotton ropes for oral fluid collection per pen -> 1 pool for PCV2-PCR-analyse

PCV2-PCR at DTU-Vet. -> 'viral copies per ml sample' on a log(10)-scale

Timeline



The same 4 pigs bled at consecutive sampling time points
– unless removal due to death or disease had occurred



Results

Totally, 65 pens sampled 4 times = 260 serum/oral fluid pairs

Results are not published yet and therefore omitted



Diagnostics

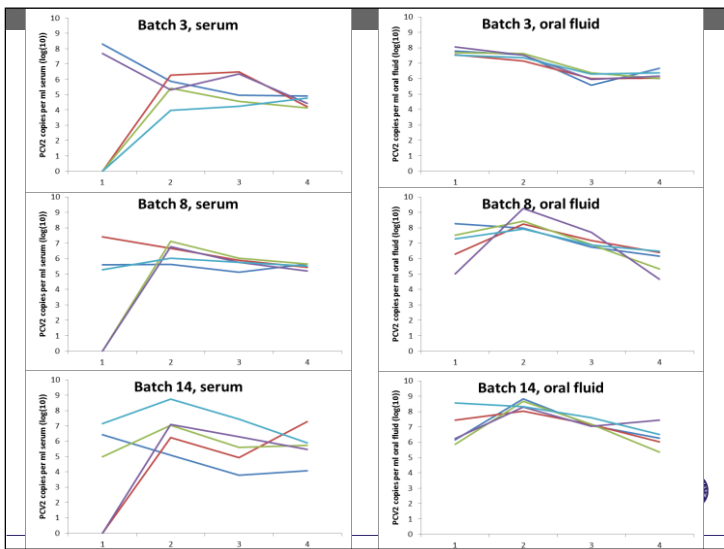
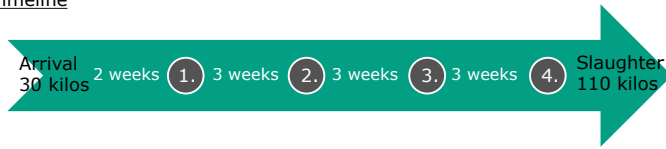
– serum and oral fluid correlations

Results are not published yet and therefore omitted



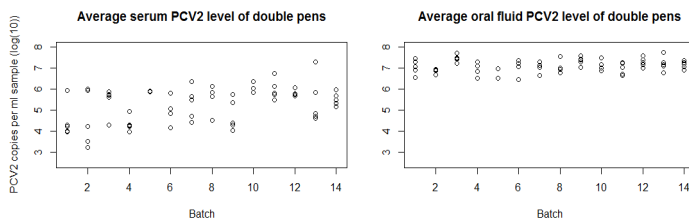
PCV2 infection dynamics within batch

Timeline



Between-batch consistency

Viremia over time ~ average of the 4 time points



Correlations – PCV2 level and other parameters

Results are not published yet and therefore omitted



Key points for the pig industry



Based on the results from this study:

Oral fluid sampling seems to be a relevant alternative to blood sampling

- The prevalence of positives was higher
- The level was higher

Serum level differed between batches (sections) within a herd,
oral fluid level did not

PCV2 level was positively correlated to mortality and antibiotic usage



A multivariate dynamic linear model for early warnings of diarrhea and pen
fouling in slaughter pigs

By Dan B. Jensen, PhD student, Department of Large Animal Sciences,
University of Copenhagen

UNIVERSITY OF COPENHAGEN

Department of Large Animal Sciences

I ♥ CPH Pig


A multivariate dynamic linear model for early warnings of diarrhea and pen fouling in slaughter pigs

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Department of Large Animal Sciences, University of Copenhagen

HERD CPH PIG 2016

PigIT



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Department of Large Animal Sciences

(Early) warnings – what’s the point?

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- 1. So many pigs, so little time!**
 - A modern farm typically contains **thousands of pigs**
 - Health is assessed by farm staff walking through the herd
 - Problems are **easy to miss**
- 2. Sensors: always vigilant!**
 - 24/7 sensor monitoring combined with detection algorithms
 - Identification of high risk pens:
 - focused attention**
 - Proactive response**
- 3. We need to know what to look for!**
 - Some data are more valuable than others

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In Conclusion

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Take Home Messages

- Automatic detection** and early warnings can help the farmers **focus their attention** on high risk pens
- Drinking behavior** and **Temperature** hold the most useful information for predicting diarrhea and pen fouling
- Different data** types might be best exploited in **different ways** (e.g. summaries vs. modeling)

Acknowledgements:
Council for Strategic Research
Pig Research Center (VSP)
The technical staff at Aarhus University

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Materials and methods:
Multivariate Dynamic Linear Model

- a Quick Introduction

1. Features:

- Dynamic, *i.e.* Adaptive
- Provides one-step-ahead forecasts
- Multivariate: co-variances are considered!


2. Usefulness:

- Monitoring of (production) systems over time

3. Multiple variables → multiple forecast errors:

- Forecast error unification (Cholesky decomposition/transformation)
 - I call it the **DLM/Cholesky method**

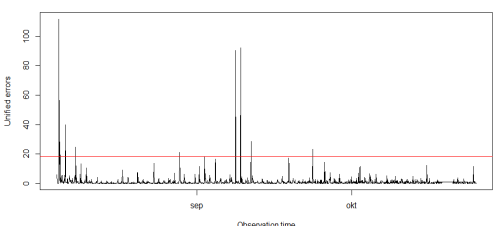
HERD CPH PIG 2015 Dias 4



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Results:
Unified forecast errors

Healthy batch
 Unified forecast errors



Adjusting SE and SP:
 How many consecutive alarms for one full alarm?

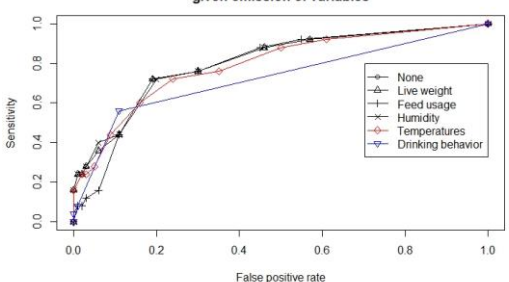
HERD CPH PIG 2015 Dias 5



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Results:
Performance evaluation

ROC given omission of variables



Prediction window:
 -3/+1 days

HERD CPH PIG 2015 Dias 6



Osteomyelitis in Danish slaughter pigs

By Louise Kruse Jensen, Assistant Professor, Department of Veterinary
Disease Biology, University of Copenhagen

Osteomyelitis in Danish slaughter pigs

Louise Kruse Jensen, DVM, PhD
Assistant professor in Veterinary Pathology
Louise-k@sund.ku.dk

Osteomyelitis is a common finding in Danish slaughter pigs.

- Welfare problem for the individual pig.
- Economic problem



Inflammation of the bone and bone marrow = osteomyelitis

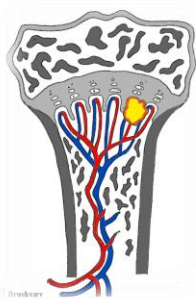
Pathogenesis

- **Systemic haematogenous**
 - Metaphysis – long bones
 - Vertebrae
 - Ribs
- **Local lymphatic/haematogenous**
 - Vertebrae, caudally from *os sacrum*
 - Tail biting
- **Traumatic**
 - Shoulder ulcerations

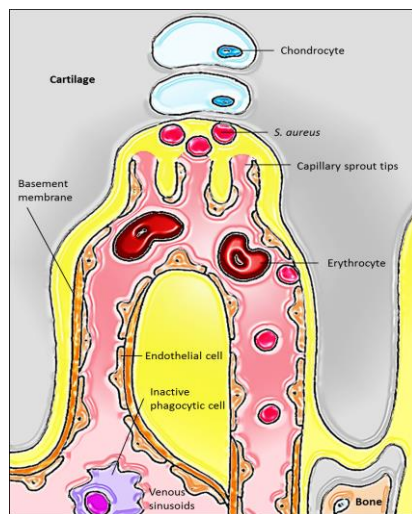


Concomitant tail biting and vertebral osteomyelitis in and caudally from *os sacrum* = local rejection of the pelvic bloc





Department of Veterinary Clinical Pathology

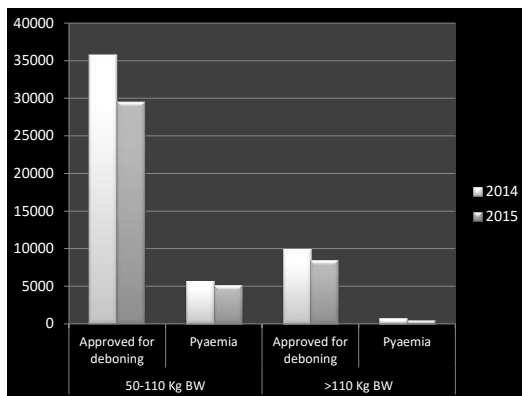


Sequelae of osteomyelitis

- Pathological fracture
- Arthritis
- Soft tissue/muscular abscess
- Sequestra formation
- Retained grow
- Malformations of the bone

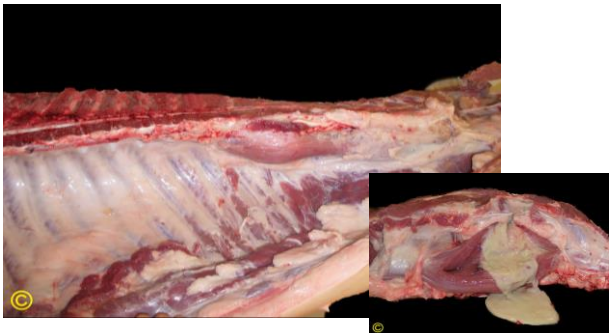


Incidence of osteomyelitis



Why is these data a problem?

- Economic

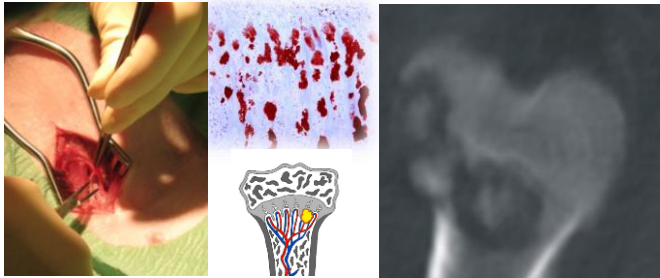


Animal welfare



My research

PhD title: "Development, characterization and application of a porcine model for haematogenous osteomyelitis in children"



The fingerprint of osteomyelitis

"A model is a lie that helps you see the truth"



Analysis of bone tissue and blood samples for specific biomarkers of osteomyelitis (Immunohistochemistry, microRNA, mRNA)



Benefit of my research
for the Danish pig industry

**Finding of biomarkers for
osteomyelitis can result in a futher
diagnostic tool**

Increased focus on individual welfare

Monitoring growth in finishers by weighing selected groups of pigs

By Anna Helena Stygar, Post doc., Department of Large Animal Sciences,
University of Copenhagen

UNIVERSITY OF COPENHAGEN Department of Large Animal Sciences

Faculty of Health and Medical Sciences

Monitoring growth in finishers
by weighing selected groups of pigs

Anna Helena Stygar
Department of Large Animal Sciences
University of Copenhagen
as@sund.ku.dk


PigIT

CPH Pig 03-02-2016

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Data on body weight

- Knowledge about the herd (previous growth records)
- Insertion body weight (at batch, pen and animal level)
- Monitoring selected group of pigs (at pen and animal level)



CPH Pig 03-02-2016
Slide 2


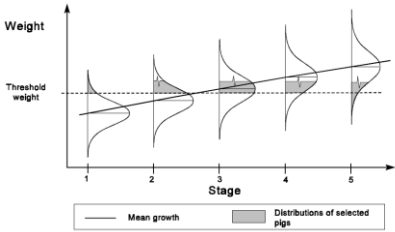
PigIT

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Why to monitor body weight?

Production control

Delivery strategy


From Kure, 1997

CPH Pig 03-02-2016
Slide 3

PigIT


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Objectives of this study




- Develop a monitoring and decision support tool
 - Production control
 - Marketing decisions (forecasting number of pigs above a body weight threshold)
- Quantify the value of information in finishers (including or excluding the information on body weight)

CPH Pig 03-02-2016 Slide 4




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Material and methods – data from the herd



- Batches: **9**
- Data collected between: **2012-2015**
- BW observations at insertion and first delivery (all pigs)
- BW observations of selected group (every week of 2 double pens)
- Total number of observations: **9,800**
- Number of observations used for setting model parameters: **7,918**
- Number of observations used for testing: **1,882**
- Number of observed pens in a batch: **14**
- Number of pigs inserted: **~480**




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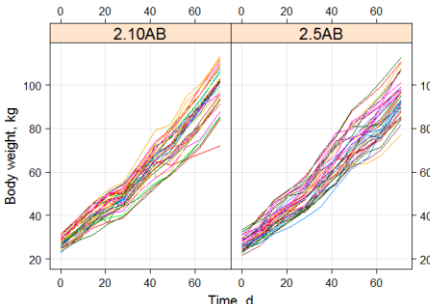
UNIVERSITY OF COPENHAGEN Department of Large Animal Sciences

Material and methods – data from the herd

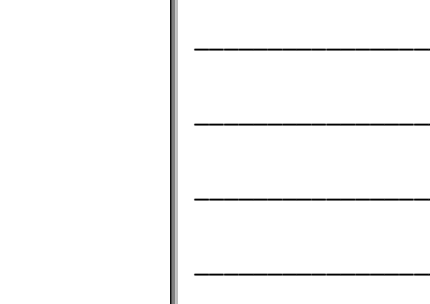


Insertion date: 2013-08-14


2.10AB



2.5AB



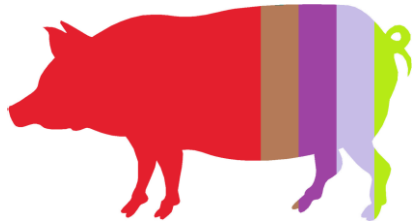
CPH Pig 03-02-2016 Slide 6



Material and methods – parameter estimation



$$y_{i,j,k,t} = \beta_0 + B_{0,k} + b_{0,j,k} + (\beta_1 + B_{1,k} + b_{1,j,k})t + (\beta_2 + B_{2,k} + b_{2,j,k})t^2 + A_{i,j,k,t} + \varepsilon_{i,j,k,t}$$



CPH Pig 03-02-2016
Slide 7



Material and methods –Multivariate Dynamic Linear model and Kalman filter



Observation equation: $Y_t = F_t' \theta_t + v_t, \quad v_t \sim N(0, I\tau^2)$

System equation: $\theta_t = G_t \theta_{t-1} + W_t, \quad W_t \sim N(0, W_t)$

$$Y_7 = (30, 32, 29, 31)'$$

$$\theta_t = (\beta_t, B_t, b_t, A_t)$$


$$v_t = \begin{pmatrix} \sigma_t^2 & 0 & 0 & 0 \\ 0 & \sigma_t^2 & 0 & 0 \\ 0 & 0 & \sigma_t^2 & 0 \\ 0 & 0 & 0 & \sigma_t^2 \end{pmatrix}$$

CPH Pig 03-02-2016
Slide 8



Material and methods –Multivariate Dynamic Linear model and Kalman filter



Prior: $\theta_t | D_{t-1}$

One step forecast: $Y_t | D_{t-1}$

Posterior: $\theta_t | D_t$

Sequential forecast for k steps ahead for $j=1, \dots, k$: $\theta_{t+j} | D_{t-1}$

Forecast distribution: $Y_{t+j} | D_t$



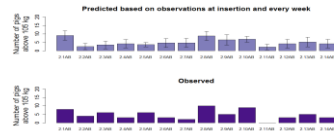
CPH Pig 03-02-2016
Slide 9





Conclusions – practical application

- Model can be used for production control.
- Model can be used to inform a farmer about the starting week of the delivery as well as number of pigs ready to market from a given pen.
- Further economic evaluation is necessary !!



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Slide 22





PigIT - Improving welfare and productivity in growing pigs using advanced ICT methods **PigIT**

Acknowledgments:



This research was supported by the Danish Council for Strategic Research (The PigIT project, Grant number 11-116191)

Project manager: Professor Anders Ringgaard Kristensen

CPH Pig 03-02-2016
Slide 23



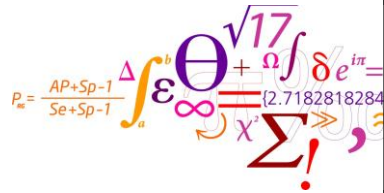
Session 2: Sows and Piglets

Monitoring PRRS using laboratory data

By Ana Carolina Antunes, PhD student, DTU National Veterinary Institute

Monitoring PRRS using laboratory data

Ana Carolina Antunes*, Fernanda Dorea, Dan Jensen, Tariq Halasa and Nils Toft



*email: aclan@vet.dtu.dk

DTU Vet
National Veterinary Institute

What is Porcine Reproductive and Respiratory Syndrome (PRRS)?

Some general information...

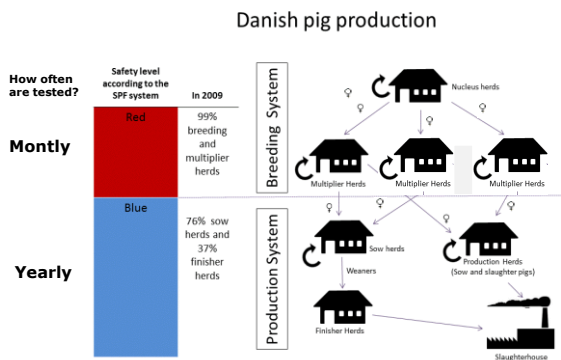
- Caused by a virus
- Clinical symptoms: it varies a lot!
- Endemic in Denmark
- Serology tests performed on regular basis (SPF system)



2 DTU Vet, Technical University of Denmark

03/02/2016

Just a quick overview of the data



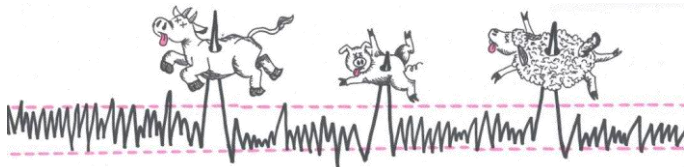
3 DTU Vet, Technical University of Denmark

03/02/2016

What are the objective?

Monitor PRRSV in Danish swine herds

- PRRS seroprevalence
- Univariate process control algorithms
- Dynamic generalized linear models



Arinna Cosmin

How can this be used?

- Set up a monitoring system
- Disease outbreaks detection
- Evaluate control and eradication programs
- Extended to other diseases and animals species
- Extended to other databases
- Combined with coordinates (spatiotemporal analysis)

Thank you for your attention



Impact of feeding regime on growth in prepubertal gilts
By Sophie Van Vliet, PhD student, Aarhus University

IMPACT OF FEEDING REGIME ON GROWTH IN PREPUBERTAL GILTS

Sophie van Vliet¹, Thomas S. Bruun², Janni Hales Pedersen³, Christian Fink Hansen³, Peter K. Theil¹

¹ Aarhus University
² SEGES Pig Research Centre
³ University of Copenhagen

Sophie.vanvliet@au.dk

A U AARHUS UNIVERSITY

BACKGROUND

Currently most gilts are not fed according to their requirements

Overall aim:

Reduce feed consumption in gilts/sows without negatively affecting production and longevity, by increasing body fat retention and reducing body protein retention in growing gilts prior to mating

Objectives:

- Manipulate growth and body composition in gilts
- (Long term consequences of altered body composition - colostrum and milk yield)

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EXPERIMENT

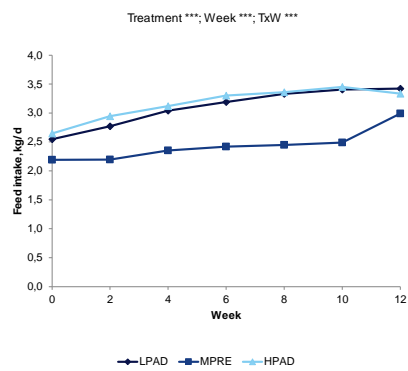
- 3 treatments
- 48 gilts
 - 3 littermates from 16 litters
 - 60 kg LW (~15 weeks old)
- Fed according to bodyweight
- Measurements
 - Weight and backfat every second week
 - Blood samples in week 0, 4, 8 and 12
 - D₂O enrichment in week 0 (n=9) and at first heat after 25 weeks of age (all)

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TREATMENTS

- LPAD – low protein ad libitum (4.1/ 3.3 g SID Lys/ FU – diet for pregnant sows)
 - High fat deposition – intermediate protein deposition
- MPRE – moderate protein restricted (5.0/ 4.1 g SID Lys/ FU)
 - Low fat deposition – low protein deposition
- HPAD – high protein ad libitum (6.6/ 5.0 g SID Lys/ FU – diet for slaughter pigs)
 - Intermediate fat deposition – high protein deposition

FEED INTAKE

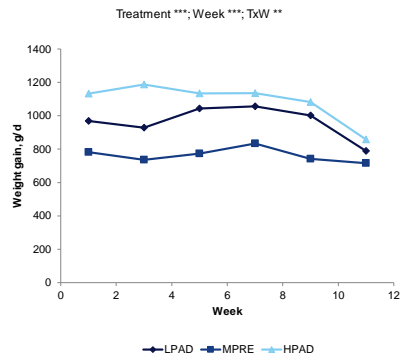


THREE LITTERMATES

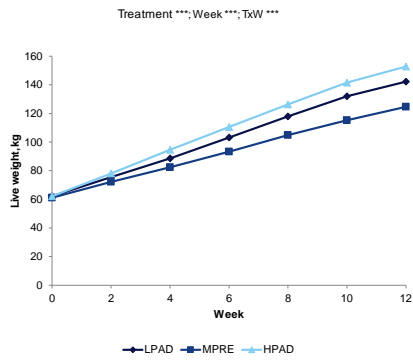
Week 12



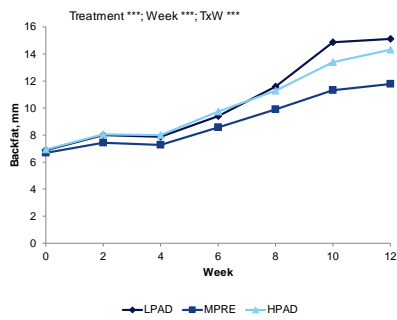
WEIGHT GAIN



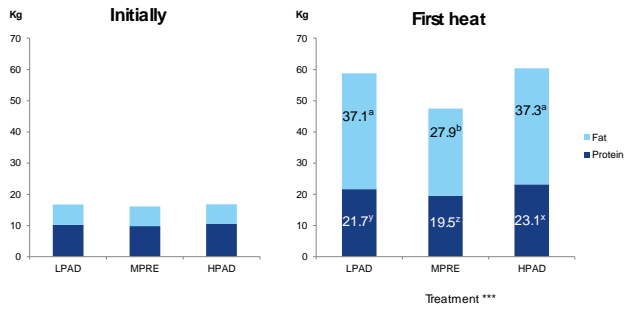
LIVEWEIGHT



BACKFAT



BODY FAT AND PROTEIN POOLS



PLASMA METABOLITES

	Treatment			P-value
	LPAD	MPRE	HPAD	
Glucose, mM	5.57	5.46	5.57	0.30
Lactate, mM	3.01 ^a	3.02 ^a	2.34 ^b	0.03
Urea, mM	3.91 ^a	3.40 ^b	3.50 ^b	<.001
NEFA, μ M	27.7 ^b	28.0 ^b	34.1 ^a	0.004
Triglycerides, mM	0.31 ^b	0.33 ^b	0.37 ^a	<.001
Insulin, pM	26.0 ^a	17.8 ^b	31.2 ^a	<.001
IGF-1, ng/mL	147 ^b	144 ^b	168 ^a	0.002

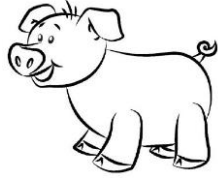
CONCLUSION

Body fat and protein retention can be altered by feeding regime

- LPAD—high fat retention and intermediate protein retention
- MPRE—low fat and protein retention
- HPAD—high protein retention and intermediate fat retention

Follow up study -> the effects of altered body composition on colostrum and milk yield

THANK YOU FOR YOUR ATTENTION



Increasing the dietary level of protein for lactating sows affects litter gain
and sow weight loss


By Thomas Sønderby Bruun, Senior Specialist, SEGES Pig Research
Centre

UNIVERSITY OF COPENHAGEN

Materials and methods – 540 sow study


Placement

- Sow body weight
- Sow backfat




Day 2

- Litter equalisation
14 piglets/sow
- Litter weight
- Sow body weight
- Sow backfat

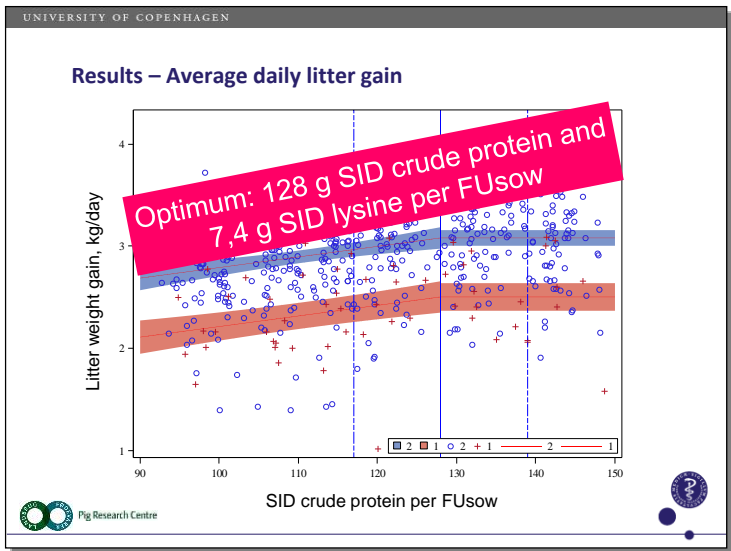


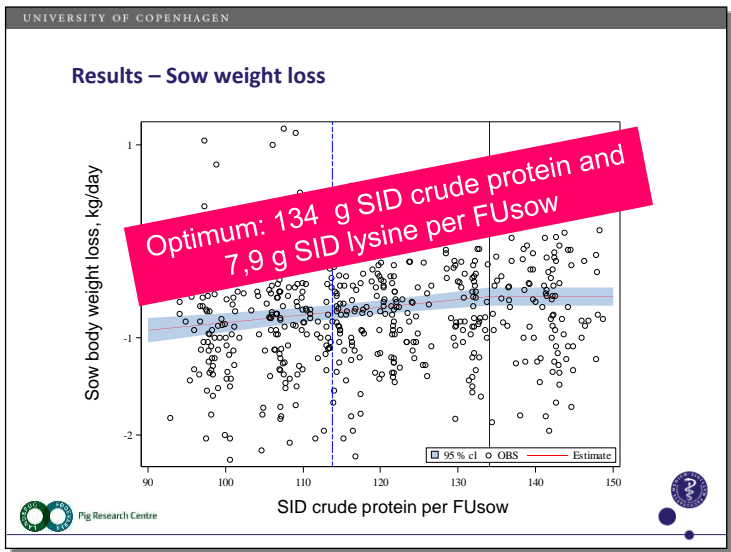
Weaning

- Litter weight
- Sow body weight
- Sow backfat



Pig Research Centre





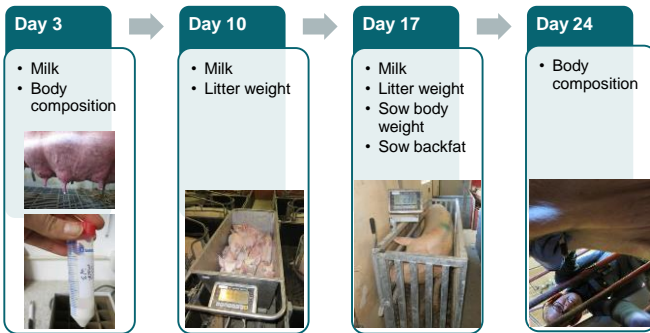
Results

Subsequent reproduction

- No effect on the number of days to first mating
- No effect on farrowing rate
- Marginal effect on litter size

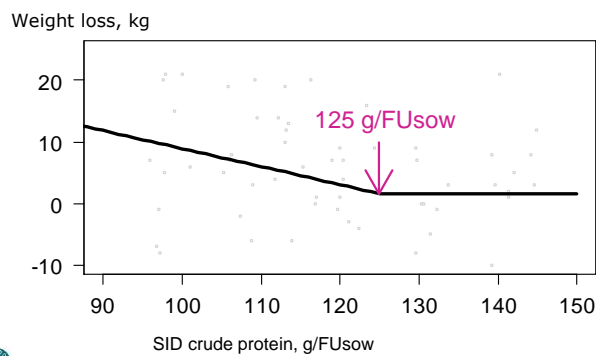


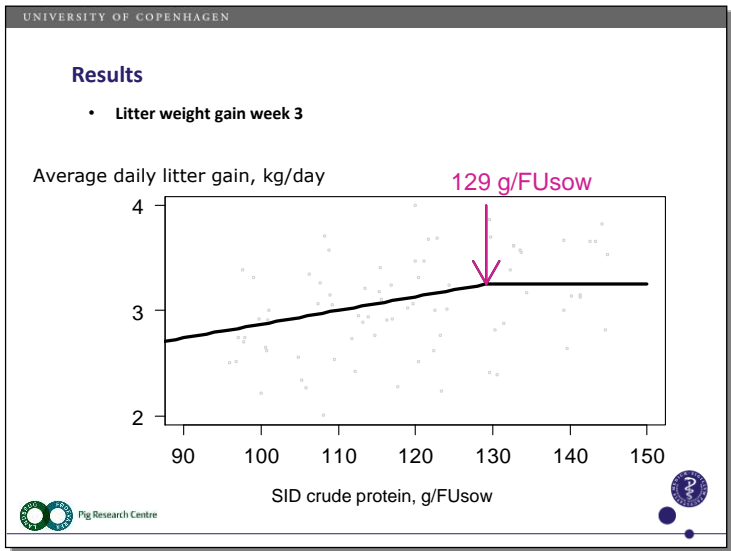
Materials and methods – 72 sow study

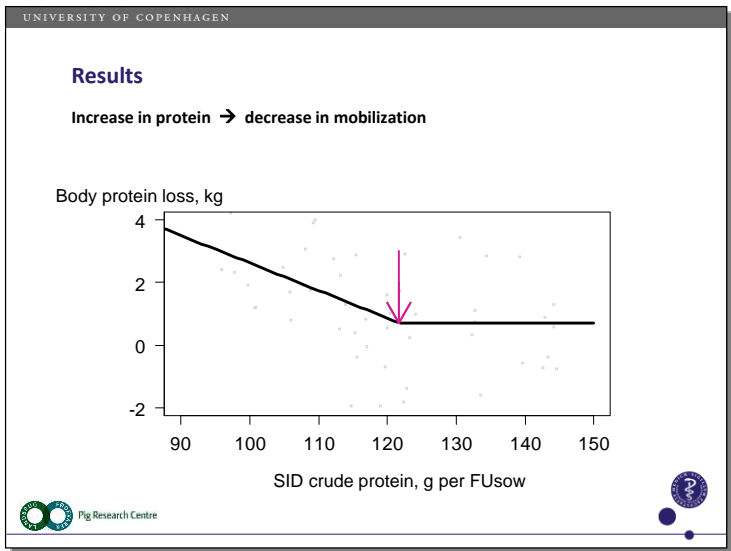


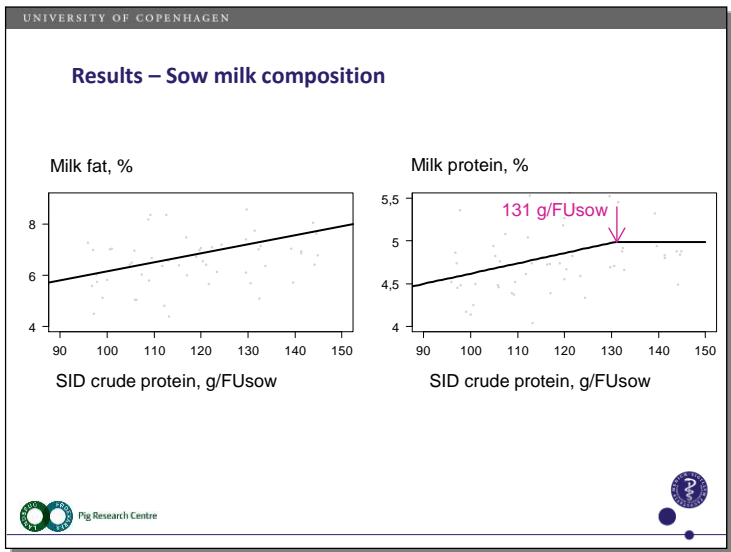
Results

- Less weight loss in last week of lactation









Conclusion

Increase protein during lactation

- Increased litter weight gain
- Reduced sow body weight loss
 - Limited mobilization of muscle protein
 - Increased mobilization of fat
- Increased nutritional content in milk
- (No influence on prevalence of piglet diarrhea)

Subsequent reproduction was not affected

- Minor positive effects of increased protein on subsequent litter size



Thank you for your attention!



Gastric emptying rate and blood values in newborn intra-uterine growth
restricted piglets

By Charlotte Amdi Williams, Post doc., Department of Large Animal
Sciences, University of Copenhagen

KOBENHAVNS UNIVERSITET Department of Large Animal Sciences

Det Sundhedsvidenskabelige Fakultet

Gastric emptying rate and blood values in newborn intra-uterine growth restricted piglets

Charlotte Amdi Williams Ph.d., Post doc, ca@sund.ku.dk
University of Copenhagen, Department of Large Animal Sciences

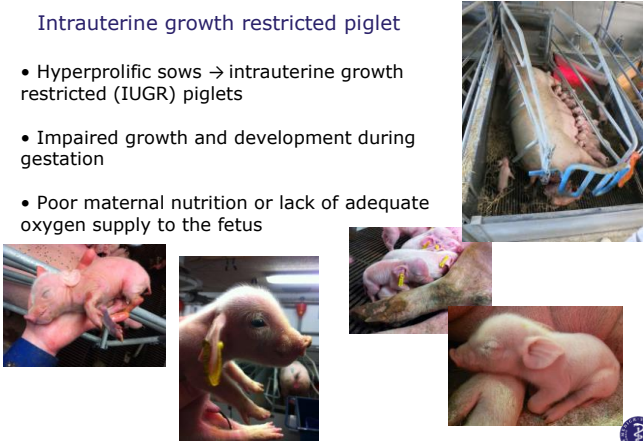



CPH Pig 03/02/16
Dias 1

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Intrauterine growth restricted piglet

- Hyperprolific sows → intrauterine growth restricted (IUGR) piglets
- Impaired growth and development during gestation
- Poor maternal nutrition or lack of adequate oxygen supply to the fetus




CPH Pig 03/02/16
Dias 2

KOBENHAVNS UNIVERSITET Department of Large Animal Sciences

Intrauterine growth restricted piglet

- More nutrients are redirected to brain and heart → fetal adaptive reaction (Roza *et al.*, 2008)
- 25 % to 30 % of newborn piglets in DK suffer from IUGR when defined on their headshape (Hales *et al.*, 2013, Amdi *et al.*, 2013)
- Higher mortality rate in IUGR piglets (Hales *et al.*, 2013)



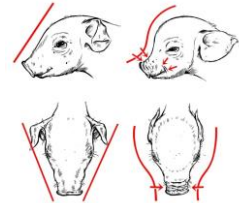
CPH Pig 03/02/16
Dias 3

KØBENHAVNS UNIVERSITET Department of Large Animal Sciences

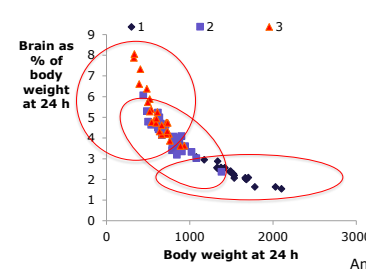
Intrauterine growth restricted piglet

Characteristics:

- Steep dolphin-like forehead
- Bulging eyes
- Hair with no direction of growth



Hales et al., (2013), JAS



Brain as % of body weight at 24 h

Body weight at 24 h

Amdi et al., (2013), JAS

CPH Pig 03/02/16
Dias 4

KØBENHAVNS UNIVERSITET Department of Large Animal Sciences


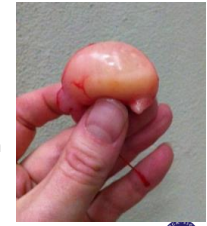
The IUGR piglet's problem?

- They can not digest the amount of recommended colostrum (Amdi et al., 2013)
- Up to 50 % of piglets that die within the first few days have empty stomachs (Hales et al., 2013)

Therefore we investigated:

How quickly do the stomachs empty?

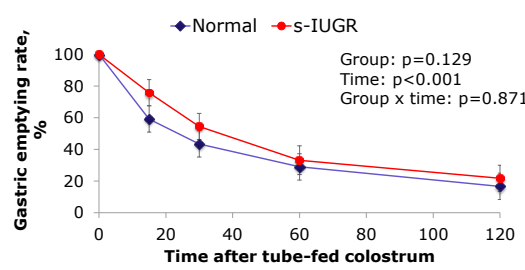
- 48 piglets – 24 IUGR, 24 Normal
- Tube-fed 12 mL/kg porcine colostrum at birth
- Euthanised after 15, 30, 60 and 120 min

CPH Pig 03/02/16
Dias 5

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Gastric emptying rate



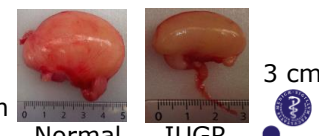
Group: $p=0.129$
Time: $p<0.001$
Group x time: $p=0.871$

Gastric emptying rate, %

Time after tube-fed colostrum

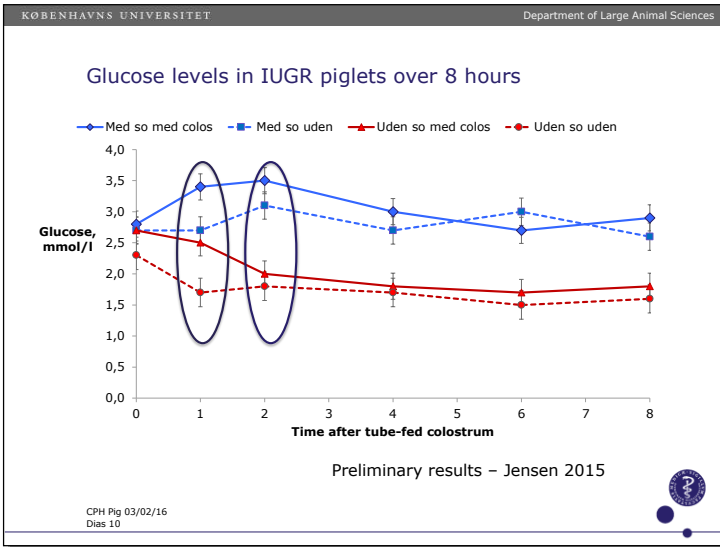
Normal s-IUGR

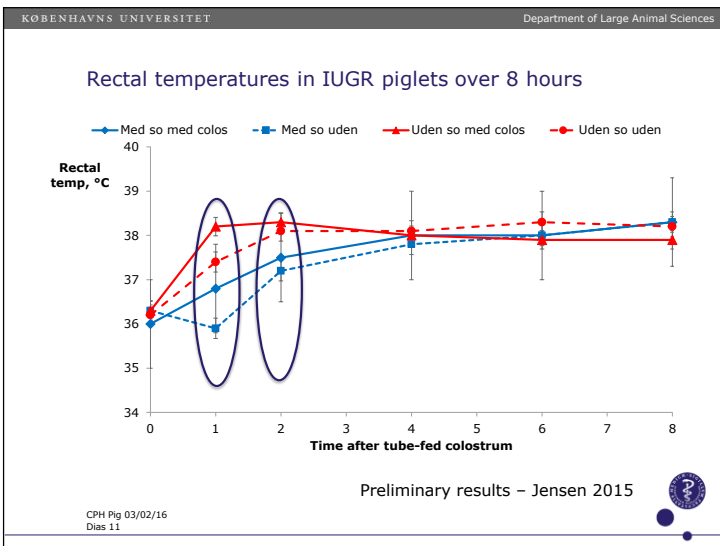
Preliminary results: Amdi, Klarlund et al., in manuscript preparation



5 cm Normal IUGR 3 cm

CPH Pig 03/02/16
Dias 6





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Take home message

- Gastric emptying rate is similar
- Stomachs are small and empty fast
- IUGR piglets might be more challenged in blood glucose
- Colostrum increases rectal temperatures with one degree
- However colostrum has to be given every hour...
- The sow has an effect

IUGR piglets after 2 weeks

CPH Pig 03/02/16
Dias 12

Thank you:



Pig Levy Fund (Svineavgiftsfonden) for support and funding

The group at KU: Prof Christian Fink Hansen, Post doc Janni Hales, Phd stud Anja Strathe, speciale stud Mette Versner Klarlund, Laura Lundgaard Jensen and Camilla Højgaard



Thank you to Askelygaard for their IUGR piglets and help ☺

And a thank you to Julie Lynegaard and Maiken Engelsmann for letting us use some of their pictures ☺



Session 3: Welfare

The use of virtual herds in veterinary and agricultural education
By Karl Johan Møller Klit, PhD student, Department of Large Animal
Sciences, University of Copenhagen



The use of virtual herds in veterinary and agricultural education

Karl Johan Møller Klit DVM, PhD-Student, Camilla Kirketerp Nielsen DVM, PhD-Student
karl.johan.klit@sund.ku.dk, cape@sund.ku.dk
Department of Large Animal Sciences



Why virtual herd?

- Teaching environment



VISITORS
PLEASE RESPECT
FARM BIOSECURITY
Please contact the manager before entering.

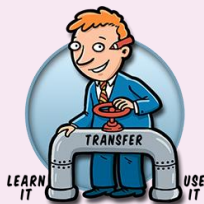
Do not enter property without prior approval.
Keep to roadways and laneways.

ADU Health farmbiosecurity Plant Health



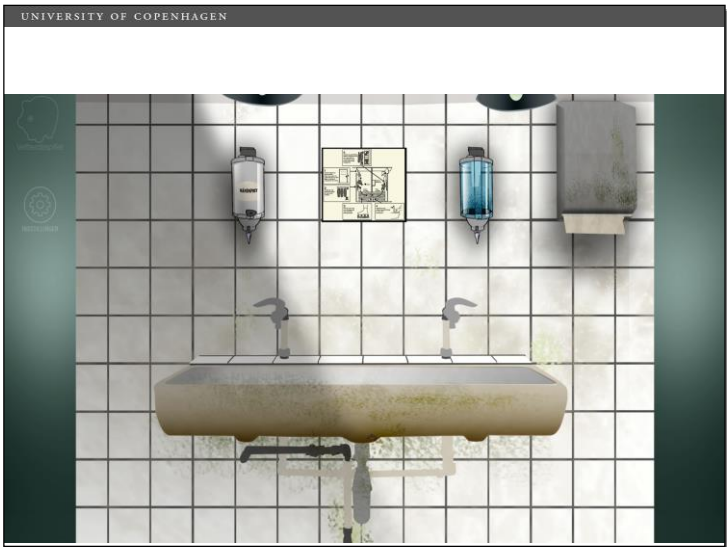
Transfer

- The ability to use a skill beyond the present context
- To be value – any skill must be transferable to real life



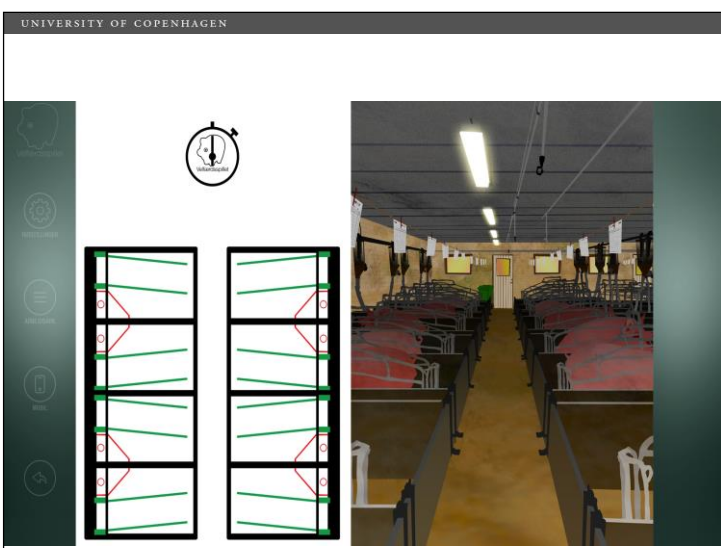


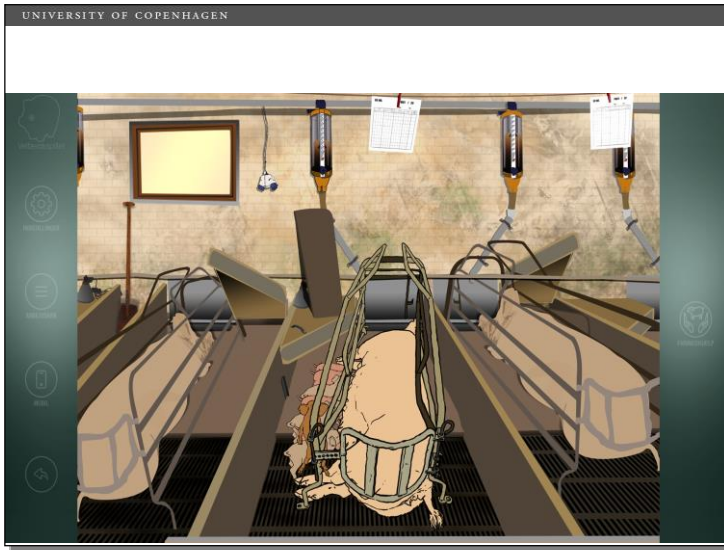


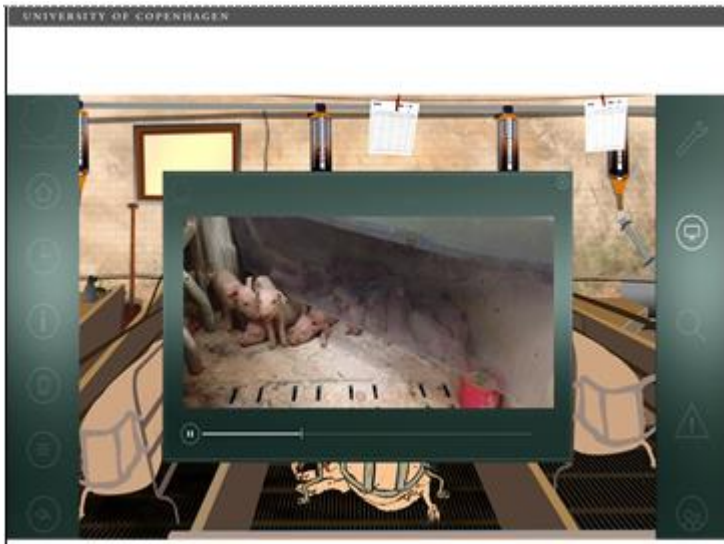


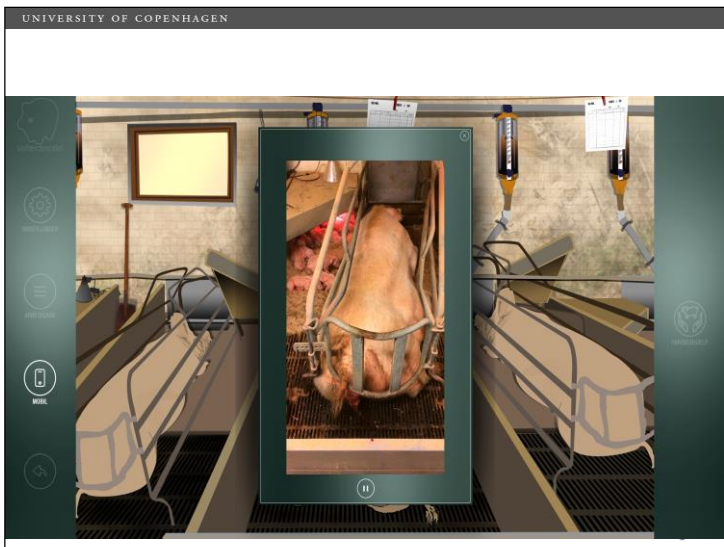












Thank you

Svineafgiftsfonden



Assessing farms with the Danish animal welfare index

By Marlene Kirchner, Assistant professor, Department of Large Animal Sciences, University of Copenhagen

KØBENHAVNS UNIVERSITET Institut For Produktionsdyr og Heste - Dyrevelfærd og Sygdomsbekæmpelse

Det Sundhedsvidenskabelige Fakultet

Assessing farms with the Danish animal welfare index

Marlene Kirchner
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Copenhagen Pig 2016 Marlene K. Kirchner Section for Animal Welfare and Disease Control
Dias 1

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What is an animal welfare index?

An animal welfare assessment evaluates the welfare state of the animals at that specific point in time, representative for a period

The DAW- Index makes it possible to study the development of animal welfare over time, eg. several years.

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Dias 2

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The project

Project runs 2013-2016

- Farrowing sows & piglets, gilts and gestating sows, fattening pigs
- Index 1.
 - Based on existing registrations (meat control, use of antibiotics)
- Index 2.
 - Based on farm visits, preferred animal based measures
- Index 3.
 - Best combination of 1 & 2

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Dias 3

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The 'survival factors' for included indicators

- Hedonistic definition of animal welfare
- Validity – reliability – feasibility
- Experts round
- On-farm visits [90 Pig herds]
- Welfare Quality comparison
- Recording time max. 1hour

DUNCAN, 1996; KNIERIM & WINCKLER, 2009; WHAY ET AL., 2004; WELFARE QUALITY, 2009

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Dias 4




KØBENHAVNS UNIVERSITET

Which aspects of Animal Welfare are covered by DAWIN?

4 Principles of Animal Welfare	Indicators
Good Feeding	Behavioural
Good Housing	Clinical
Good Health	Resources
Appropriate Behaviour	Records

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Dias 5




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The 'surviving' indicators included in DAWIN

27 for farrowing sows
22 for weaner and fattener
21 for piglets
28 gestating sows and gilts

Can change until the final version!

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Dias 6



Tail biting: prevalence among docked and undocked pigs from weaning to slaughter

By Helle Pelant Lahrmann, Industrial PhD student, Department of Large Animal Sciences, University of Copenhagen & SEGES Pig Research Centre



TAIL BITING: PREVALENCE AMONG DOCKED AND UNDOCKED PIGS FROM WEANING TO SLAUGHTER

Helle Pelant Lahrmann, Industrial Ph.D. Student



February 3th 2016



INTRODUCTION

- EU directive bans routine tail docking
- More than 95% of European pigs are tail docked (EFSA 2007)
- Estimated 3.1% of Danish pigs tail bitten despite the tail docking procedure (D'Earth et al., 2014)
- The consequences of a cessation of tail docking in conventional Danish piggeries are not known

Study aim

Determine consequences of tail docking cessation on tail biting in a well-managed Danish conventional herd.



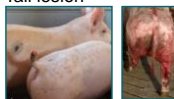
DEFINITION TAIL BITING & TAIL LESION

- Tail biting is a behaviour – damaging or non-damaging
- Definition damaging tail biting
 - Pig's chew on a pen mates tail resulting in a bloody wound on the tail (Munsterhjelm et al. 2013)
- Damaging tail biting
 - is painful to the pig
 - can develop to such an extent that the pig loses the majority of the tail
 - increases the risk of infections
 - increases the need for antibiotic treatments
 - may cause death or euthanasia (Kritas & Morrison 2004 & 2007)
- Tail lesion is a condition

Tail biting



Tail lesion



MATERIAL & METHODS

- Two groups
 - +/- tail docking
- Housing
 - Same pen from weaning to slaughter (stable group)
 - Docked and undocked pigs in different pens
 - 20-22 pigs per pen, mixed gender
 - Daily provision of ~230 g straw on the floor until 70 kg + two vertical wooden sticks per pen
 - If tail biting occurred a Bite Rite was added and the amount of straw was doubled
- Animals
 - LYD – pigs, castrated males, individually earmarked



Bite Rite



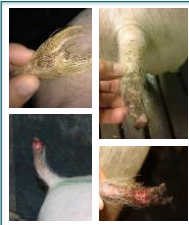
PEN DESIGN



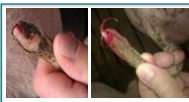
RECORDINGS

- Every second week all tails were inspected by a trained technician
- Recordings by stockperson
 - Date tail biting outbreak
 - Antibiotic treatments
 - Dead/euthanized pigs
 - Pigs removed from pen and cause
- Abattoir
 - Tail lesion comments/condemned

Part missing



Full length



THANK YOU FOR YOUR ATTENTION!!!



Challenging task!...



Finishers with intact curly tails



Loose housed sows with low piglet mortality

By Janni Hales Pedersen, Post doc., Department of Large Animal Sciences, University of Copenhagen

UNIVERSITY OF COPENHAGEN

Faculty of Health and Medical Sciences

Loose housed sows with low piglet mortality

Janni Hales Pedersen
Post Doc
Department of Large Animal Sciences
hales@sund.ku.dk

February 2016

Pig Research Centre This project was founded by the Danish Centre for Animal Welfare

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Background

Danish industry

- 10 % loose housed lactating sows

Loose housed sows is a challenge

- Higher piglet mortality
- Temporary confinement for 4 days reduces mortality
- Not all sows have high mortality

Identify good sows

- Do they have a better farrowing process?
- Are they more active?
- Do they perform more pre-lying behaviour?

Pig Research Centre

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Experiment

Video recordings of 40 sows

- Parity 1 and 2
- Observation from end of farrowing to litter equalization

Registrations

- Farrowing duration
- Postural changes
- Pre-lying behaviour
- Piglet behaviour

Good sows	Bad sows
0-1 dead piglet before equalization	2+ dead piglets before equalization

Loose Confined

Pig Research Centre

Thank you for your attention!!!



Session 4: MRSA

Levels of MRSA on pigs and environmental samples

By Julie Elvekjær Hansen, PhD student, DTU National Veterinary Institute


DTU

Levels of MRSA on pigs and environmental samples

Julie Elvekjær Hansen
 MSc. in Biology-Biotechnology, PhD student

*Technical University of Denmark, National Veterinary Institute,
 Frederiksberg, Denmark*

juhan@vet.dtu.dk



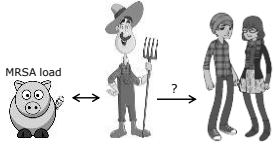
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DTU

Introduction > Aim > Method > Method verification > Results > Concluding remark

LA-MRSA is a public health concern

- Denmark: overall MRSA level is low
- Ambition of maintaining low levels of MRSA
- Increasing prevalence in livestock, especially in pig production – LA-MRSA load not known
- LA-MRSA reservoir – possibility of spread into the general population
- Control and prevention of increasing MRSA level in community
- Assessment of intervention strategies



2

DTU

Introduction > Aim > Method > Method verification > Results > Concluding remark

Aims of the study

- To assess the possibilities of quantification of the animal MRSA load by nasal and skin swab samples
- To test two different active air samplers for quantification of airborne MRSA as a measure of environmental MRSA load

3

Introduction > Aim > **Method** > Method verification > Results > Concluding remark DTU

Quantification of animal load and air load

- Colony counts and determination of colony forming units →

$$\text{CFU/ml}(\text{swab}) = \frac{\text{count} \times \text{dilution factor}}{0.1\text{ml}}$$

Samp'l air: 250l on blood, Duplicates of 250l on MRSA 2
 Sartorius (MD8): 250l on blood, Duplicates of 250l on MRSA 2

Samp'l air: different volumes directly onto Brilliance™ MRSA 2
 Sartorius: different volumes onto gelatine filter and incubated on Brilliance™ MRSA 2

- Determination of CFU/m³

4

Introduction > Aim > Method > **Method verification** > Results > Concluding remark DTU

Animal load - Biological and technical replicates

- Sampling : 3 pigs
- 4x3 swabs were obtained as: 3 nasal swabs + 3 skin swabs from each side of the pig
- Each of biological replicates were divided and analysed as three technical replicates in the lab, leading to 36 samples from each pig in total

Source	Nasal swabs		Skin swabs	
	Variance	%	Variance	%
Bio. replicate	0.37	24	0.08	31
Pig	1.11	72	0.13	53
Residual	0.06	4	0.04	15
Total	1.54	100	0.25	100

CFU based on counts from 10⁻², where the 10⁻¹ counts were zero

Nasal swabs seems to cause greater variation in the results than use of skin swabs. For nasal swabs a larger proportion of the variance can be explained by the difference between pigs.

5

Introduction > Aim > Method > **Method verification** > Results > Concluding remark DTU

Animal load - Biological and technical replicates


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6

Introduction > Aim > Method > Method verification > Results > **Concluding remark** 

Concluding remarks

- Quantification of animal LA-MRSA load is possible by direct plating
- Measurements of airborne LA-MRSA load are more stable from Sartorius MD8 air sampler than Sampl'air
- Limitations
 - Contaminant growth can interfere
 - Difficult to standardize
 - Air level as a time point measurement
- Benefits
 - Societal knowledge and demystification of "swine-MRSA"
 - We hope to be able to reduce or hinder the amount of LA-MRSA that escapes the farm
 - Provide knowledge for the authorities to base their decision-making on

10




Acknowledgement


Main supervisor
Karl Pedersen (DTU Vet)

Co-supervisors
Anders Rhod Larsen (SSI)
Ulrike Lyhs (DTU Vet)


<p><u>DTU Vet</u> Anna Irene Vedel Sørensen Nils Toft Margrethe Carlsen Kári Karbech Mouritsen</p>	<p><u>SSI</u> Robert Leo Skov Jesper Larsen Øystein Angen</p>	<p><u>University of Copenhagen</u> Carmen Espinosa-Gongora</p>
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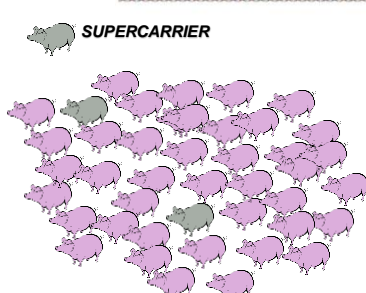
11

Can we reduce MRSA ST398 in positive farms by eliminating a few pig carriers?

By Carmen Espinosa Gongora, Post doc., Department of Veterinary Disease Biology, University of Copenhagen

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SUPERCARRIERS **PIG STAPH**




SUPERCARRIER

A minority of the pigs (4-11%) are "SUPERCARRIERS" characterized by a high amounts and stable carriage of *S. aureus* in the nose

Espinosa-Gongora et al. 2015 *Appl. Env. Microbiol.*

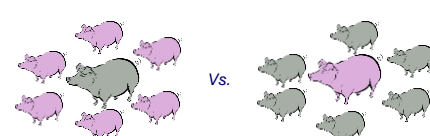
ARE HOST GENETICS INVOLVED AS A CARRIAGE FACTOR?




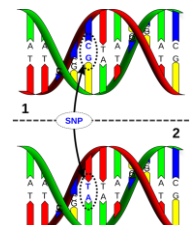

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SUPERCARRIERS **PIG STAPH**

ARE HOST GENETICS INVOLVED AS A CARRIAGE FACTOR?



Whole genome sequencing of the pigs

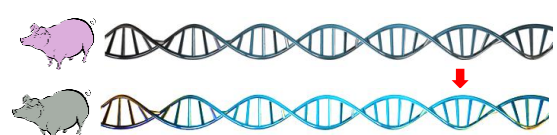




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GENOME-WIDE ASSOCIATION STUDY (GWAS)

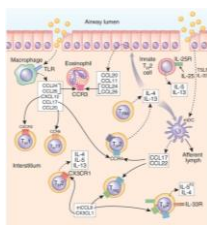

GWAS study using Illumina Porcine SNP60 beadchip (Ramos et al. PLoS one 2009)

➤ Skallerup et al., Genome-wide association study reveals a locus for nasal carriage of *Staphylococcus aureus* in Danish crossbred pigs. *BMC Veterinary Research*



Chemokines
CCL1
CCL2
CCL8
CCL11

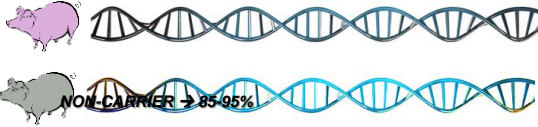
IMMUNE MEDIATORS

GENOME-WIDE ASSOCIATION STUDY (GWAS)

GWAS study using Illumina Porcine SNP60 beadchip (Ramos et al. PLoS one 2009)

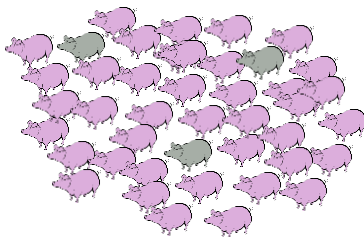
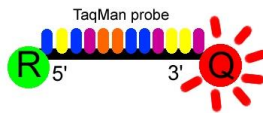
- Skallerup et al., Genome-wide association study reveals a locus for nasal carriage of *Staphylococcus aureus* in Danish crossbred pigs. *BMC Veterinary Research*



SUPERCARRIER → 5-15%



RAPID DIAGNOSTIC BY PCR PIG STAPH



CONCLUSIONS & FUTURE WORK

PIG STAPH

- Reducing MRSA levels in pig farms requires **MULTIPLE** measures
- **FARM TRIAL** to test the efficacy of eliminating the *supercarriers*
- **In combination** with more strategies (antimicrobial use? zinc? hygiene? probiotics? disinfection methods? etc...)
- Investigate **functional differences** in the immune response → possible new strategies





DANISH COUNCIL FOR
INDEPENDENT RESEARCH |
FTP



CARMEN ESPINOSA-GONGORA

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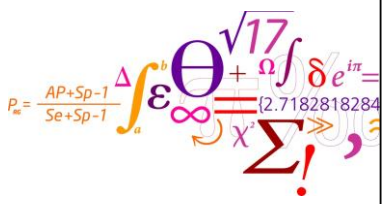
How to pool fecal samples in a cross-sectional study of antimicrobial
resistance genes in Danish pig herds

By Anna Camilla Birkegård, PhD student, DTU National Veterinary
Institute

DTU

How to pool fecal samples in a cross-sectional study of antimicrobial resistance genes in Danish pig herds

Julie Clasen, Anders Møllerup, John Elmerdahl Olsen, Øystein Angen, Anders Folkesson, Tariq Halasa, Nils Toft, **Anna Camilla Birkegård**




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Why?

- Level of zoonotic antimicrobial resistance genes in Danish pig herds
- Cross-sectional study
 - 500-800 herds
 - Spatial randomness
 - Short sample period

Technical University of Denmark - Vet



Where?

DTU

Technical University of Denmark Vet

DTU
CPH
Pig

How many?

- Minimal number of samples
- Herd level of antimicrobial resistance

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DTU
CPH
Pig

Farm

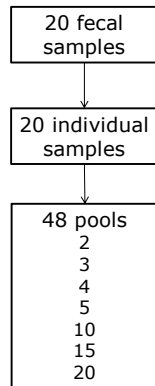
15		10
5		2
18		3
3		1
10		3
5		1
11		3
2		1

DTU

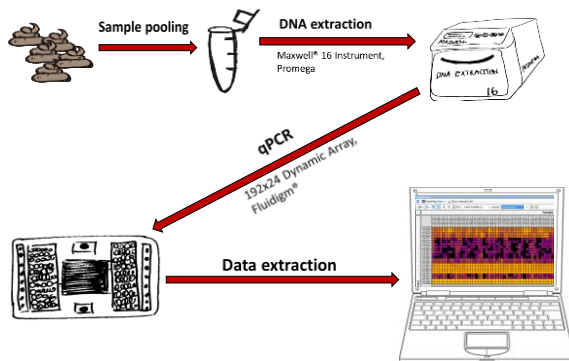
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Creating the pools



Analyzing the samples

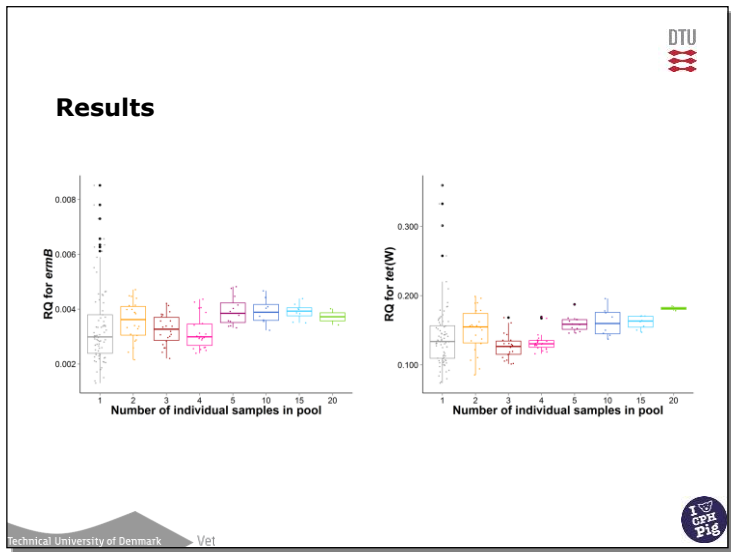


Level of antimicrobial resistance

$$RQ_{\text{primer set}} = 2^{-\Delta C_q}$$

$$\Delta C_{q, \text{primer set}} = C_{q, \text{GOI}} - C_{q, \text{reference gene}}$$





DTU

Optimizing the pooling method

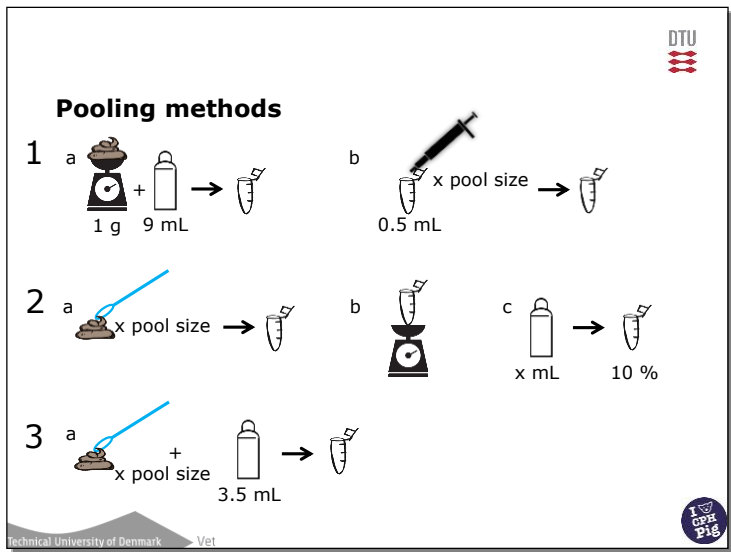
- 5 herds
- 5 samples per herd

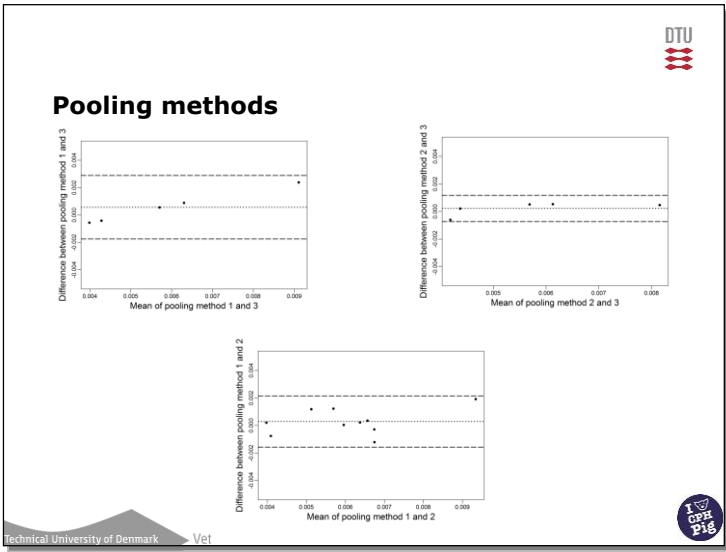
- 3 pooling methods

- 10 pools for method 1 and 2
- 5 pools for method 3

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DTU
CPH Pig





Conclusion

- Five samples per herd
- Pooling method 3

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I ❤️ CPH Pig

Can pooled faecal samples be used for resistance profiling? -Resistance in
E. coli isolates from diarrhoeic nursery pigs

By Nicolai Weber, PhD student, Department of Large Animal Sciences,
University of Copenhagen

UNIVERSITY OF COPENHAGEN Department of Large Animal Sciences

Faculty of Health and Medical Sciences

HERD Can pooled faecal samples be used for resistance profiling?

-Resistance in *E. coli* isolates from diarrhoeic nursery pigs

I CPH Pig

Nicolai Weber
PH.D STUDENT,
Department of Large Animal Sciences,
University of Copenhagen

UNIVERSITY OF COPENHAGEN Department of Large Animal Sciences

I CPH Pig

Dias 2

UNIVERSITY OF COPENHAGEN Department of Large Animal Sciences

I CPH Pig

Hypothesis:
"Virulent E.coli isolates from the pen floor has same resistance profile as virulent E.coli isolates from diarrheic nursery pigs contained in the pen"

Dias 3



Motivation

Development of diagnostic decision tool for selection of antibiotic classes for treatment of *E.coli* diarrhoea



Supervisors:

Jens Peter Nielsen (Professor, DVM, PhD, Dipl. ECPHM)
 Christian Fink Hansen (Associated Professor, MSc Animal Science, PhD)
 Ken Steen Pedersen (CEO OE-Vet A/S, DVM, PhD, Dipl. ECPHM)



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Dias 4

Study design

Pig samples



- 3 nursery facilities
- In pens with >25 % diarrhoea
- 3 diarrheic pigs per pen

Pen samples

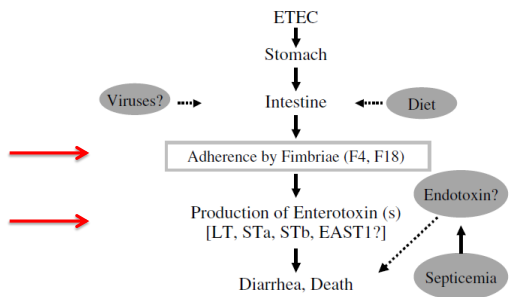


- 1 pen floor sample

Dias 5



Pathogenesis



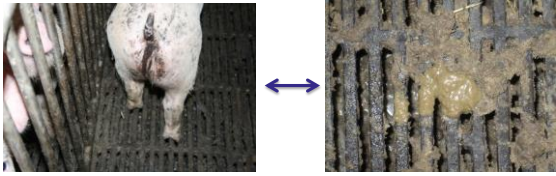
Definition: Virulent *E.coli* = fimbriae positive and toxin positive

Dias 6



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Study design



Comparison of resistance status at pen level

Hypotheses: Res.Pen = Res.pig


Dias 7



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Results

89 virulent isolates analysed – all F18 positive
87/89 hemolytic activity



22/86 sampled pigs 13/31 sampled pens

Dias 8




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Results

Antimicrobial class	Overall resistance		
	% resistant	DTU-VET 06-08*	Clinical breakpoint (µg/ml)
# Isolates	89	55	
Tetracycline	47.2	69.1	16
Ampicillin	60.7	34.5	32
Sulphamethoxazole	69.7	70.9	512
Trimethoprim	69.7	36.4	16
Streptomycin	34.8	83.6	32
Spectinomycin	18.0	56.4	128

Resistance profiles analysed by Sensititre system
* From the national guidelines of antibiotic use

Dias 9



Results

% Resistant by Herd

	Herd 1	Herd 2	Herd 3
Isolates analysed	42	25	22
Tetracycline	100	0	0
Ampicillin	33.3	84	86.4
Sulphamethoxazole	97.6	84	0
Trimethoprim	97.6	84	0
Streptomycin	43	52	0
Spectinomycin	38.1	0	0

Dias 10



Results

Agreement study:

Definitions:

Res.pig = 1 or more virulent E.coli isolates from 1 or more pigs for the pen

Res.pen = 1 or more virulent E.coli isolates from 1 pooled pen floor sample

Dias 11



Results

		Pig level		Total
		+ Virulent	- Virulent	
Pen level	+ Virulent	10	3	13
	- Virulent	2	16	18
Total		12	19	31

Sensitivity = 83.3 %; Specificity = 84.2 %
 PPV = 76.9 %; NPV = 88.9 %

Dias 12



CPH Pig is financially supported by the Pig Levy
Fund (Svineafgiftsfonden)



www.svineafgiftsfonden.dk

Thank you for participating
– see you next year!





www.cphpig.ku.dk