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Description of immune and inflammatory biomarkers modulated by seaweed intake in sows

SEAMARK DELIVERABLE 4.6

Aarhus University



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SEAMARK DELIVERABLE 4.6:

DESCRIPTION OF IMMUNE AND INFLAMMATORY BIOMARKERS MODULATED BY SEAWEED INTAKE IN SOWS

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Abstract

Fermentationexperts A/S (FEXP) has developed a fermented supplementary pig feed (EP119) containing *Ascophyllum nodosum* (*A. nodosum*) and *Saccharina latissima* (*S. latissima*). EP119 is expected to work through an antimicrobial property that downregulates pathogenic bacteria in the pig gut with a derived improvement of the systemic health. This project aimed to analyse the impact of EP119 on sow immunity and inflammatory status. The sows' immunity was evaluated clinically and biochemically by, for example, analysing inflammation markers in serum, but indirect measures of sow health such as piglet growth were also included.

The project consisted of three studies (Focal-I study, the Multiparity study and Focal-II study) in which all sows were randomly allocated to either a control group (CON) fed a standard diet, or an experimental group (EXP) fed standard diet supplemented with EP119. The Focal-I study followed 39 sows for a longer period (approx. 19 months) with a focus on sow's individual health. The multiparity study examined key production data for 398 sows as well as individual feed consumption and backfat depth over a period of approx. 7 months. The Focal-II study consisted of a subgroup of 141 sows from the multiparity study (followed synchronous) which were subjected to the same individual health assessment as for Focal-I sows.

There were only minor differences between EXP and CON sows. In the Focal-I study, significantly less colostrum uric acid (UA) was found from EXP sows compared to CON sows ($p = 0.045$). UA has antioxidative properties and has previously been found in lower concentrations in colostrum from sick sows compared to colostrum from healthy sows. In the Focal-II study, a significantly lower average litter weight (total litter weight at weaning including dead piglets) was found in EXP litters ($p = 0.016$), corresponding to a 4.3 kg higher litter weight from CON sows compared to EXP sows. Furthermore, the piglets average daily gain (ADG) was significantly higher in CON litters compared to litters from EXP sows ($p = 0.020$). On average, the ADG was 1.07 times higher in the CON group. The results presented were thus in the opposite direction of the hypothesis, expecting EXP sows to have the best colostrum quality and the highest piglet growth. It can therefore be concluded that EP119 does not improve the sow's performance.

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LIST OF ABBREVIATIONS

Abbreviation	Description
AB	Antibiotic
ADG	Average daily gain
<i>A. nodosum</i>	<i>Ascophyllum nodosum</i>
AU	Aarhus University
CI	Confidence intervals
Cloudfarms	A cloud-based software solution for managing and analysing production data for pork producers, including pig management, boar and semen management, and sow management
CON	Control group: Sows fed with a standard diet
CRP	C-reactive protein. An acute-phase protein that increases in inflammatory conditions
DanBred	Danish sow breed
Day ÷ X	First observation day of gilts in the Focal-I study
Day ÷ Y	Approx. 14 days before the pregnant gilts in Focal-I study were moved from the pregnancy barn to the farrowing section for the first time
Day ÷ Z	The day after the gilts in the Focal-I studied farrowed for the first time (hereafter gilts are often called parity 1 sows)
Day P	Day Pregnancy. Last pregnancy before the end of the study
Day F	Day Farrowing. The day when the barn staff for the first time noticed that a given sow had finished farrowing
Day W	Day Weaning. Observations made every Wednesday 3 weeks after farrowing
DF	Degrees of freedom
<i>E. coli</i>	<i>Escherichia coli</i>
EM-means	Estimated marginal means
EP119	Product in trial. Fermented supplementary feed for pigs containing rapeseed, <i>Ascophyllum nodosum</i> and <i>Saccharina latissima</i>
EXP	Experimental group: Sows fed the standard diet added EP119

FEXP	Fermentation experts A/S
Gilt	Mature female pig that has never had piglets or is pregnant for the first time
GLM	Generalized linear models
IgA	Immunoglobulin A. A type of antibody that protects piglets against infections
IgG	Immunoglobulin G. A type of antibody that protects piglets against infections
LM	Linear models
LME	Linear mixed effects models
ParCent	Mean-centered parity
Parity	The number of times a sow has farrowed
<i>P. calcareum</i>	<i>Phymatolithon calcareum</i> (red algae)
REML	Restricted maximum likelihood estimation
<i>S. latissima</i>	<i>Saccharina latissima</i>
SE	Standard errors
TN70	Topigs Norsvin TN70. A Dutch Norwegian sow breed line
TNF- α	Tumor necrosis factor- α . A cytokine that increases in inflammatory conditions
UA	Uric acid. UA possesses antioxidative properties
UCPH	University of Copenhagen

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1. INTRODUCTION

Numerous examples of the immunomodulatory effects of brown macroalgae are found in the literature. *In vitro* studies are the most frequent. For example, the study of Mildenerberger et al. (2024) could demonstrate immunomodulatory properties of *Saccharina latissima* (*S. latissima*). Among *in vivo* studies, Bonde et al. (2023) were able to modulate the transcriptional response to a helminth infection in the jejunum of weaned pigs after adding 8% fermented *S. latissima* to the feed. Also in weaned pigs, higher serum antioxidant barrier has been observed after feeding a supplement containing 1.5% *Ascophyllum nodosum* (*A. nodosum*) and 0.5% of the red algae *Phymatolithon calcareum* (*P. calcareum*) (Frazzini et al., 2024). In dogs and cats, *A. nodosum* has shown to prevent dental deposit accumulation (Gawor and Jank, 2023). However, knowledge of macroalgae's effect on the immune system is still lacking. This is particularly the case for *in vivo* studies in pigs.

Due to many beneficial properties, fermentation has been used for countless food and feed products for centuries. Optimal fermentations increase the shelf life of foods (e.g., (Radhakrishna et al., 2023)) and improve the nutritional value of plant-based foods by breaking down anti-nutritional factors (Garrido-Galand et al., 2021). Fermented foods can enhance the diversity of the gut microbiome which seems to contribute to several health-promoting effects (Leeuwendaal et al., 2022) and protects against invasion of inflammatory microorganisms (Downs et al., 2022). As recently reviewed by Alfaia et al. (2024), diverse gut microbiomes contain beneficial microorganisms contributing to a well-functioning metabolism and antioxidant capacity. Some fermentations also contribute with improved flavour (Radhakrishna et al., 2023) a property which is attractive to pig farmers who aim for palatable feed to motivate sows to eat large amounts of feed after farrowing. This can prevent severe weight loss during lactation that is often seen among well-functioning and high-yielding sows increasing the risk of developing shoulder ulcers and oestrus delay. However, high feed consumption is not desirable from an environmental and economic perspective. Therefore, the aim is to achieve a low feed intake without compromising the health of the animals.

EP119 is a commercially available supplementary feed for pigs, developed by Fermentationexperts A/S (FEXP). The production takes place over several weeks of anaerobic processing where the individual components of rapeseed and a smaller proportion of seaweed (*A. nodosum* and *S. latissima*) undergo a two-stage homofermentative solid-state co-fermentation. The fermentation uses inoculants and three different strains of lactobacilli to ensure synergistic fermentation and a uniform product. After fermentation, the products are dried down to a coarse meal (see Appendix 1). After an initial feeding period, EP119 is expected to inhibit microbial pathogens in the pig gut, a potential which was recently described *in vivo* for other EP products (Beck et al., 2024). Fewer microbial gut pathogens are expected to positively influence pig health with the potential to

increase the sow productivity. This includes, for example, improved colostrum quality and increased sow milk production that will provide the farmer with an increased piglet weaning weight. Moreover, anti-inflammatory compounds found within EP119 are expected to positively influence immune function and systemic inflammation. Finally, the fermentative properties of EP119 are expected to contribute to lower sow feed consumption that goes hand in hand with a higher piglet weaning weight and less weight loss among the sows measured by backfat thickness.

In general, feed consumption and nitrogen emissions can be reduced when pigs are good at utilizing the feed protein. Good protein utilization can be achieved by choosing a raw protein material with high digestibility, such as soy meal, which is widely used in pig production worldwide. To achieve more sustainable pig production, there has been a search for alternatives to soy meal, which is primarily produced in North and South America and must be transported over large distances. One of these alternative protein sources is rapeseed meal (Lestingi, 2024). EP119 uses rapeseed as a protein source, which contributes to the product's green profile. However, rapeseed is not the usual protein source for either sows or other pigs.

The present project aimed to study the effect of EP119 on sow's health, immunity and productivity. We hypothesized that the sow's gut microorganisms could take advantage of EP119, making it possible to shift the sow gut microbiome in favour of more beneficial microorganisms over time (SeaMark Deliverable 4.4 and 4.5). Such a change, coupled with the inherent immunomodulatory properties of fermented seaweed, was expected to promote the sows' immune response, which would be detectable when they were challenged by a stressful farrowing. EP119 fed sows (EXP sows) were therefore assumed to show fewer clinical signs, to have less need for antibiotic (AB) treatment and a lower immune response after farrowing compared to sows fed only a standard diet (CON sows). Finally, it was our expectation that EP119 can reduce sows feed consumption, improve sow farm production figures and increase piglet growth.

1.1. Specific hypotheses

To accommodate outsiders with no knowledge of pig production, we have listed a more detailed description of the specific hypotheses below.

- EXP sows are expected to have more live-born piglets, more total born piglets and to wean more piglets than CON sows.
- EXP sows are expected to have fewer stillborn piglets and a lower piglet mortality rate from day of farrowing (Day F) to the day of weaning (Day W) than CON sows.
- Since FEXP has practical experience in observing more piglet diarrhoea in litters from EXP sows, simultaneously with the occurrence of high piglet growth, we expected more diarrhoea treatment (litter

level) among piglets from EXP sows than from CON sows. Among farmers, this type of diarrhoea is often called "welfare diarrhoea" since the diarrhoea is presumed to be caused by overeating due to high sow milk production. "Welfare diarrhoea" is thus not a clinical diagnosis.

- The average piglets weight gain from EXP sows was expected to be higher at weaning (Day W) than for CON piglets.
- Colostrum quality from EXP sows was expected to be higher, measured by high concentrations of uric acid (UA), Immunoglobulin A (IgA) and Immunoglobulin G (IgG), compared to colostrum from CON sows.
- It was hypothesized that EXP sows would have fewer clinical signs at farrowing (Day F) than CON sows, measured by lower rectal temperature, less incidence of udder oedema and a higher faecal score (more soft faeces) on Day F.
- EXP sows were expected to have higher backfat thickness on Day W, a smaller inflammatory response and a lower AB consumption compared to CON sows.
- Since sows that become ill after farrowing often need birth assistance, we expected less birth intervention among EXP sows compared to CON sows.
- EXP sows were expected to have a lower feed consumption from Day F to Day W than CON sows.

2. METHODOLOGY

2.1. Ethics Statement

The experimental protocol was evaluated and approved by the Danish Animal Experiments Inspectorate, The Danish Veterinary and Food Administration (DVFA) under the permit number 2023-15-0201-01427.

2.2. Animals and feed

The present project was conducted on a Danish sow farm with approximately 2000 sows. In total, 437 sows were available for the research study with an almost 50/50 split regarding the main factor of interest, namely whether the sow had been exposed to the feed additive EP119 (EXP) or not (CON); $n = 207$ (47%) and 230 (53%), respectively. Since the experimental farm had changed genetics from originally using DanBred sows (DanBred P/S, Vejle, Denmark) to purchasing Topigs Norsvin TN70 (TN70; Topigs Norsvin, Herning, Denmark) shortly before the study started, the dataset consists of 76 DanBred and 361 TN70 sows. The distribution of the sows is further described below.

The sows were fed purchased dry feed by use of an electronic sow feeding system (Bopil, Sønderborg, Denmark) in the gestation barn and a SpotMix feed plant (Bopil, Sønderborg, Denmark) in the farrowing unit. SpotMix allows individual monitoring of the sows' feed consumption. The feed plant was initially checked for unwanted microorganisms and negative results were found. The farm's feed curves followed instructions from Topigs Norsvin with individual adjustments

in the farrowing unit, taking the sows' appetite into account. The adjustments were based on the staff's assessments of the sows' appetite which is a normal farm procedure. Until farrowing, sows were fed three daily feedings. From the day of farrowing, sows were fed restrictively with three feedings per day which were stepped up to four times feeding per day approx. one week after farrowing.

This report (D4.6) focuses only on the sow's clinical condition, immunity and production parameters, of which the latter variables are considered indirect measures of animal health. Results relating to the sow's gut microbiome are reported in other SeaMark deliverables (D4.4 and D4.5).

2.3. Study design

The project was divided into three longitudinal case-cohort study designs. In all three study designs, sows were divided into the following two groups:

1. **Control group (CON):** Sows fed a standard diet with unfermented rapeseed as the protein source.
2. **Experimental group (EXP):** Sows fed control feed supplemented with 6% EP119 in the gestation feed and 9% EP119 in the lactation feed.

The three studies are referred to as follows:

1. **Focal-I study:** Examine individual health and production data of 39 focal sows monitored intensively from gilts to 3rd parity.
2. **The multiparity study:** Examine central production data of 398 multiparity sows recorded by the farmer in the farm's efficiency control system (Cloudfarms AS, Bratislava, Slovakia) according to the normal procedure at the farm. In addition, the sows' feed consumption and backfat depth were also recorded.
3. **Focal-II study:** Examine individual health data from a subset ($n = 141$) of the multiparity sows.

All three studies began with a longer feeding period without intervention from the project, which allowed transformation of the gut microbiome for EXP sows. Continuous observations were made over time, but the primary observation period was immediately after the latest observed farrowing, since sow's immune system is particularly challenged due to giving birth. The feeding regimens are described for each of the three study designs further below.

2.4. Conditions and exclusion criteria

Sows were excluded if they were to be sampled in a medical withholding period.

First-parity sows were excluded from the Multiparity study, and the Focal-II study because the feeding plant in the gilt barn did not allow the animals to be divided into EXP and CON at the given time.

Year	2023			2024					
Feeding periods	Apr26 – Dec31			Jan1 - Feb5	Feb5 – Mar8	Mar8 – Jul6	Jul6 – Jul17	Jul17 – Nov27	
Feed	CON EXP			CON ^{+B} EXP ^{+B}	CON EXP ^{+B}	CON EXP	CON EXP ^{+EP}	CON EXP	
Observation days for each batch (Barn unit)	Day + X (Quarantine)	Day + Y (Pregnancy)	Day + Z (Farrowing)			Day P (Pregnancy)		Day F (Farrowing)	Day W
Total observation periods for 6 batches	Apr26	Oct23 - Dec10	Nov10 - Dec31			Apr4 – Apr9		Sep23 - Nov5	Oct16 - Nov27
Description	First observation day. All gilts were randomly distributed into either CON or EXP	Approx. 14 days before the 1st parity sows/gilts were moved to the farrowing section	The day after the parity 1 sows/gilts farrowed for the first time			Sampling (3 rd parity)		The day where the barn staff for first time noticed that a sow had finished farrowing (could be the day of farrowing itself or the day after)	Wednesday 3 weeks after farrowing
Samples and observations (n = 39 sows)	Faeces*	Faeces*	Faeces* Faeces from piglets*			Faeces*		Clinical, Body condition, Faeces*, Blood, Colostrum, Piglets	Production data, Body condition, Piglets, AB use, Feed consumption

Table 1: Timeline for observation days of 39 Focal-I sows fed either standard feed (CON n = 23) or standard diet added EP119 (EXP n = 16) during 1st - 3rd parity in 2023 and 2024. The sows were distributed across 6 batches. The blue line highlights six sow observation days where Day ÷X is upon arrival and housing in the quarantine barn and before feeding EP119. Day ÷Y was approx. 14 days before the first farrowing. Day ÷Z was the day after the first farrowing. Day P (Pregnant) was at the end of the third pregnancy. Day F (Farrowing) was immediately after the farm staff declared that a given sow had completed farrowing. Day W (Weaning) was Wednesday three weeks after farrowing. +B indicates addition of Benzoic acid. +EP indicates feeding both groups of sows control diet only due to lack of EP119. *Sampled separately for D4.4 and D4.5.

In autumn 2024, sows in batch 4 and 5 were ill due to a breakout with *Actinobacillus pleuropneumoniae* and subsequent AB treatment. Therefore, the data collection was totally cancelled for Batch 4 (week 43, 2024) but not Batch 5 as these sows were well when they reached farrowing (21 and 22 October 2024) and because the AB withholding period (5 days) was passed at that time (Both batches of sows were treated 10/10/2024).

2.5. Focal-I study

The Focal-I study ran from April 26, 2023, to November 27, 2024. During this period, 39 focal sows (EXP n = 16 (41%); CON n = 23 (59%)) were monitored individually from gilts to 3rd parity. The timeline of the study is described in Table 1. Upon arrival at the farm on April 26, 2023 (referred to as Day ÷ X), a faecal sample was taken from each gilt to determine a pre-composition of the faeces for D4.4 and D4.5. Thereafter, the gilts were randomly divided into EXP or CON and fed for a longer period (approx. 19 months) allowing EP119 to modulate the gut microbiota. Up until November 27, 2024, data and samples were collected on five more occasions: Approx. 14 days before the gilts/1st parity sows were moved to the farrowing section (Day ÷ Y), the day after the sows had their first litter (Day ÷ Z), during 3rd pregnancy (Day P; sampled between April 4 and 9, 2024), immediately after farrowing of the 3rd litter (Day F) and close to weaning (Day W) which were the Wednesday three weeks after farrowing (min. 21 to max. 24 days). On Day F, the litters were equalized according to the farm's normal procedure. At this procedure, the barn staff decided the litter size (number of piglets per litter) after a professional assessment of how many piglets each sow could take care for. The staff were prohibited from treating AB or

Non-Steroidal Anti-Inflammatory Drugs (NSAID) before sampling. As the gilts gradually reach sexual maturity, they were distributed over 6 batches of weekly farrowing groups.

From January 1 to March 8, 2024, the feed was mistakenly added with Benzoic Acids (initially in both groups' feed and later in only the EXP-feed; see Table 1). Benzoic Acids have a significant effect on gut microbiomes. For this reason and several practical reasons, the project was extended with the Multiparity Study and the Focal-II study. This change allowed EP119 to influence the microbiome of Focal-I sows once again and enabled studying new sows with a clear and consistent feeding history. At the same time, and due to the already occurring changes in the study design, the farmer was allowed to make a minor and similar change in the mineral composition of the feed mixture in both feed compositions (EXP and CON) (see Appendix 2 for the feed recipe used in 2024 and Appendix 3 for the recipe used in 2025). Unfortunately, a less serious feeding error also occurred from July 6 to July 17, 2024 (11 days) where no EP119 were added the EXP feed. Both EXP and CON sows were fed control feed during the 11 days (Table 1).

Table 1 also describes the types of samples and observations made at the six sampling points. Except faecal samplings, all data based on samples and observations from either Day F or Day W of the last observed farrowing period (3rd parity). The definition of the clinical variables is described in Appendix 4.

Some examples of tests and procedures performed during data collection is displayed in Fig. 1-3, which show blood samples, piglets being weighed and measuring of backfat thickness.

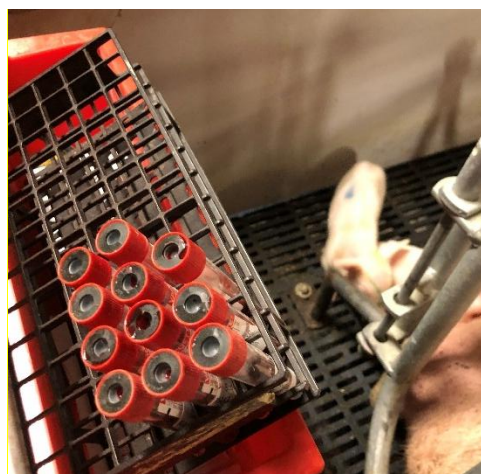


Figure 1: Blood samples from sows.



Figure 2: Weighing piglets.



Figure 3: Measuring backfat thickness on a sow.

2.6. Biochemical analyses

Blood samples were collected from the jugular vein (*v. jugularis*) in 9 ml vacuette serum tubes with no additive for preparation of serum (VWR International, Pennsylvania, US). All blood samples were kept at room temperature for a maximum of 30 min before storage on ice and transported to the laboratory at Aarhus University, Dept. of Animal and Veterinary Sciences, Tjele, Denmark after which they were refrigerated between 2 and 5 °C until the next day for further processing. The additive-free tubes were centrifuged for 10 min at 1000 × g (4 °C) and the serum were separated and initially stored at -18 °C for a maximum of 10 days. Afterwards the samples were stored at -80 °C until analysis, which was performed within 8 months from first sampling date. Colostrum samples were obtained into 50 mL sterile Greiner centrifuge tubes (Greiner Bio-One, Kremsmünster, Austria) from each sow after administration of 2 mL oxytocin (10 IU/mL) per sow (Oxytocin "Intervet" Vet., MSD Animal Health, Copenhagen V, Denmark). The samples (approx. 6 mL; unfiltered) was immediately storage on ice and pipetted into 4.0 mL sterile cryotubes (In Vitro A/S, Fredensborg, Denmark) in the laboratory the day after. Like the blood samples, the colostrum samples were stored at -80 °C until analysis within 8 months from the first sampling date.

C-reactive protein (CRP) and Tumor Necrosis Factor- α (TNF- α) were analysed in serum to describe the inflammatory status of the sows. The analysis was performed at the University of Copenhagen, Department of Veterinary and Animal Sciences, Frederiksberg, Denmark. Concentrations of CRP were measured by ELISA using commercially available paired anti-swine capture and detection antibodies (R&D Systems, Abingdon, UK). Absorbance was read at 450 nm on a Multiskan Plate Reader (Thermo Fisher, Waltham, MN, USA). TNF- α concentrations in serum were measured by ELISA using commercially available paired anti-swine capture and detection antibodies (R&D Systems, Abingdon, UK). Absorbance was measured as above. Concentrations of TNF- α below the detection limit of the assay were assigned an arbitrary value of half the lowest value of the standard curve (15.6 pg/mL for TNF- α).

For evaluation of colostrum quality, it was chosen to analyse for UA, IgA and IgG which was performed at Aarhus University (Dept. of Animal and Veterinary Sciences, Tjele, Denmark). Colostrum UA was measured by enzymatic-fluorometric

assays and analysed using flow injection analyses according to the manufacturer's instructions (Foss Tecator AB, Höganäs, Sweden) and as previously described by (Larsen and Moyes, 2010) and for sows by (Kaiser et al., 2019). For IgA analysis of colostrum, concentrations were determined by a commercially available porcine IgA ELISA kit (No. EKX-FQ2LF9-96; Nordic Biosites, Täby, Sweden). The absorbance was read at 450 nm using a UV/Vis microplate spectrophotometer (Multiscan Sky ThermoScientific, Thermo Fisher Scientific Oy, Vantaa, Finland). Concentrations below the detection limit were set at the detection limit for the assay in question in the calculations (IgA = 1.563 g/L). Colostrum IgG was analysis by a commercial porcine IgG ELISA kit (No. EKX-SVP55G-96; Nordic Biosites, Täby, Sweden). The absorbance was read at 450 nm by using a UV/Vis microplate spectrophotometer (Multiscan Sky ThermoScientific, Thermo Fisher Scientific Oy, Vantaa, Finland). Determination of concentration below the detection limit (IgG = 1.563 g/L) followed the same method as described for IgA.

2.7. The multiparity study

Synchronous with the Focal-I study's last data collection period and from the same 6 batches of sows, 398 multiparity sows (EXP n = 191 (48%); CON n = 207 (52%)) were monitored from May 6 to November 27, 2024 (Table 2). As for the Focal-I sows, the EXP sows in the multiparity study were only fed control feed for 11 days from July 6 to July 17. No samples and clinical observations were made from May 6 to September 23, 2024 (140 days per batch of sows) allowing EP119 to modulate the gut microbiome. After this initial feeding period, data were collected on sow's Day F and Day W (min. 17 to max. 29 days) from Sep 23 – Nov 27, 2024. Data were downloaded from the farm's production data management program Cloudfarms. Cloudfarms data are based on the farm's own records,

including AB treatment, according to normal procedures and standards. The sows' feed consumption from they were housed in the farrowing section and until Day W was downloaded from the SpotMix software (SpotMix; Bopil, Sønderborg, Denmark). To calculate the fat loss during lactation, sows backfat thickness was measured by the scientific staff on both farm visits (Day F and Day W). For this purpose, a Duo-Scanner (DSG+) IMV Technologies (L'aigle, Basse-Normandie, France) was used (Fig. 3).

2.8. Focal-II study

From the multiparity study, a subset of sows (n = 141 (EXP n = 67 (48%); CON n = 74 (52%)) were monitored individually from May 6 to November 27, 2024. These are referred to as the Focal-II sows. In addition to the data which were already collected in the multiparity study (backfat thickness, production data, AB treatment and feed consumption), the Focal-II sows were subjected to a clinical examination, sampling (feces, blood and milk) and litter weighing similar to what was performed for Focal-I sows. The interval between Day F and Day W was min. 22 to max. 23 days for Focal-II sows.

2.9. General considerations for statistical analyses

2.9.1. Primary explanatory variable

As the main factor of interest was the dichotomous case-control status, i.e. whether the sow had been exposed to the feed additive EP119 or not, case-control was chosen as the main explanatory variable.

2.9.2. Secondary explanatory variables

Breed and parity were included as secondary explanatory variables. These were, however, not varying for Focal-I sows

Year	2024		
Total feeding period	May6 – Jul6	Jul6 – Jul17 ^{÷EP}	Jul17 – Nov27
Feed	CON EXP	CON EXP ^{÷EP}	CON EXP
Barn unit	Pregnancy		Farrowing
Observation days for each batch			Day F Day W
Observation period for 6 batches			Sep23 - Nov5 Oct16 - Nov27
Observations (n = 398 sows)			Body condition Feces* Clinical, Blood, Colostrum, Piglets** Production data, Body condition, AB use, Feed consumption, Piglets

Table 2: Timeline for observation days of 398 multiparty sows fed either standard feed (CON n = 207) or standard diet added EP119 (EXP n = 191) from May to November 2024. The sows were distributed across 6 batches. The blue line highlights two observation points where Day F (Farrowing) was immediately after the farm staff declared that a given sow had completed farrowing, and Day W (Weaning) was Wednesday three weeks after farrowing. ^{÷EP} indicates feeding both groups of sows control diet only due to lack of EP119. *Sampled separately for D4.4. and D4.5. **Observed and sampled separately for Focal-II sows (n = 141; EXP n = 67 and CON n = 74), which were a subgroup of the multiparity sows.

since all of the Focal-I sows were TN70 of 3rd parity and thus only included when analysing data from the Multiparity and Focal-II studies. For those studies, breed and parity are partly confounded as all DanBred sows were of parity 5 or older, while the TN70 sows included were of parity 2 to 6. Therefore, to include effect of parity in addition to breed, parity was mean centered within breed (by subtraction of the average parity within breed), hereafter referred to as ParCent.

Except from one section that contained data from four week batches, each week batch was mostly distributed in different sections in the barn, using two sections per batch with a few exceptions. It was therefore decided to include weekly batches as either a random or fixed effect, and disregard barn section.

Due to the lower sample size for Focal-I sows, week groups had here to be combined to avoid spending too many degrees of freedom if included as fixed effect. This was done by combining week groups 22, 23 and 24 as group 1, and week groups 26, 27 and 28 as group 2; referred to as WeekGrp2 in results. This grouping induced equal number of cases ($n = 8$) in both week groups and almost equally many controls ($n = 12$ and $n = 11$ in group 1 and 2, respectively).

2.9.3. Responses as explanatory variables

Variables examined as response of the exposure will not be examined as explanatory variables though some correlation might be expected. Nevertheless, some adjustment was reasonable, e.g., to adjust feed intake for the litter size at weaning and to adjust (by use of an offset) number of liveborn and stillborn by the total number of piglets that was born.

2.9.4. Statistical analyses

Statistical analyses were carried out using the software R v. 4.3.0 (R Core Team, 2023) at a significance level of 0.05. Details can be found in Appendix 5.

3. RESULTS

3.1. Focal-I study

3.1.1. Clinic and body condition

The rectal temperature of the sows after farrowing did not differ significantly between CON and EXP ($p = 0.086$). On average, the temperature was estimated to be 38.7 °C in CON sows (SE = 0.11; 95% CI: 38.5-38.9) and 39.0 °C in EXP sows (SE = 0.14; 95% CI: 38.7-39.3).

The difference in the incidence of udder edema was non-significant ($p = 0.68$) and there was no difference in fecal score from sows on Day F ($p = 0.31$ by nominal logistic regression).

The average loss of backfat thickness per day from Day F to Day W was not significantly different between EXP and CON ($p = 0.50$). The difference was estimated to be 0.18 mm/day in CON sows (SE = 0.015; 95% CI: 0.15-0.21) and 0.16 mm/day in EXP sows (SE = 0.018; 95% CI: 0.13-0.20).

3.1.2. Interventions

There was no significant difference between the groups for birth intervention ($p = 0.29$) and number of sow AB treatments during the lactation period ($p = 0.30$).

3.1.3. Biochemical analyses

Serum

Comparing mean values of the inflammation markers in CON and EXP sows, no significant difference was found for neither CRP ($p = 0.27$) nor TNF- α ($p = 0.11$); here analysing only TNF- α values above the level of detection.

Colostrum

For UA in colostrum, a significant difference in mean concentration was found between CON and EXP ($p = 0.045$).

The mean concentration was estimated to be 212 μ M in colostrum from CON sows (SE = 15.5; 95% CI: 178-247) and 154 μ M in colostrum from EXP sows (SE = 22.1; 95% CI: 103-206). This corresponds to a 58 μ M higher mean concentration of UA in CON compared to EXP (SE = 26.5; CI: 2-114).

The difference in mean colostrum IgG was not significant ($p = 0.13$) between CON and EXP. However, a nominal difference between the groups was estimated, showing 22.0 g/L in colostrum from CON sows (SE = 3.58; 95% CI: 14.6 – 29.4) and 12.4 g/L from EXP sows (SE = 5.06; 95% CI: 1.9 – 22.8). This corresponded to a 9.7 g/L higher mean concentration of IgG in colostrum from CON sows compared to EXP sows (SE = 6.18; CI: -3.1 to 22.4). This trend was thus in the opposite direction of the hypothesis, which expected the highest colostrum IgG from EP119-fed sows.

A similar result was found for colostrum IgA, where the mean colostrum IgA was 4.2 g/L from CON sows (SE = 0.65; 95% CI: 2.9-5.6) and 2.6 g/L from EXP sows (SE = 0.92; 95% CI: 0.7-4.5), corresponding to a 1.7 g/L higher mean concentration of IgA in colostrum from CON sows compared to EXP sows (SE = 1.13; CI: -0.7 to 4.0). The trend was in the opposite direction to the hypothesis, but still non-significant ($p = 0.16$).

3.1.4. Piglets

Total litter weight at weaning, including dead piglets, did not differ significantly between the CON and EXP group ($p = 0.60$). The differences were estimated to be 94.8 kg in CON group (SE = 2.87; 95% CI: 88.2-101) and 92.6 kg in EXP group (SE = 3.63; 95% CI: 84.9-100).

The piglets' average daily gain (ADG) was subsequently estimated to be 258 g/day in CON group (SE = 9.6; 95% CI: 239-278) and 234 g/day in EXP group (SE = 12.7; 95% CI: 208-260), corresponding to a 24 g/day higher ADG in CON compared to EXP (SE = 16.0; CI: -9 to 57). However, the difference was not significant ($p = 0.14$).

The odds ratio of having a smaller litter size at weaning was 2.6 (SE = 2.30; 95% CI: 0.46 – 14.7) for EXP sows versus CON sows,

which was contrary to the hypothesis that EXP sows would be able to wean the most piglets. However, the difference was not statistically significant ($p = 0.27$).

Treatments for piglet diarrhea (litter level) was not significantly different between groups ($p = 0.68$).

3.1.5. Production figures

There was no significant difference between CON and EXP sows for the number of live-born piglets ($p = 0.90$), total piglets born ($p = 0.58$), stillborn ($p = 0.38$) and number of piglets that died during the lactation period ($p = 0.65$).

Feed consumption

The difference in feed consumption was not significant between the two groups ($p = 0.61$).

3.2. The multiparity study

3.2.1. Body condition

The mean backfat loss was 0.12 mm/day in CON sows (SE = 0.008; 95% CI: 0.10 – 0.14) and 0.10 mm/day in EXP sows (SE = 0.008; 95% CI: 0.08 – 0.12), which corresponds to a 0.02 mm/day (SE = 0.010; 95% CI: 0.00 – 0.04) greater loss for CON sows. The difference was on the edge of being significantly different between the groups ($p = 0.053$).

3.2.2. Interventions

A trend towards higher odds of birth intervention was found in EXP sows compared to CON sows, which was contrary to our hypothesis that EP119 fed sows would receive the least birth intervention. However, the difference was not statistically significant ($p = 0.071$). The odds ratio was 1.7 (SE = 0.53; 95% CI: 0.95 – 3.1).

There was no difference in AB treatments between the two groups of sows ($p = 0.28$).

3.2.3. Production figures

There was no effect of case-control status for live-born piglets ($p = 0.98$), total born piglets ($p = 0.52$), stillborn ($p = 0.94$) or for piglets that died during the lactation period ($p = 0.28$).

Feed consumption

The feed usage did not differ between CON and EXP ($p = 0.41$).

3.3. Focal-II study

3.3.1. Clinic

The rectal temperature did not differ between CON and EXP ($p = 0.65$) and was estimated to be 38.8 °C in CON (SE = 0.08; 95% CI: 38.6 – 39.0) and 38.8 °C in EXP (SE = 0.08; 95% CI: 38.6 – 38.9).

Comparing udder oedema score 2 or 3 against score 0 or 1, no difference between EXP and CON-sows was found ($p = 0.81$).

After pooling of soft faeces types (score 3 and 4) and the three lowest scores (0, 1 and 2) indicating absence or dry faeces the two groups were compared. No significant difference between groups were found ($p = 0.33$).

3.3.2. Biochemical analyses

Serum

There was no significant difference between CON and EXP sows for the mean values of CRP ($p = 0.97$) and TNF- α ($p = 0.93$).

Colostrum

The difference in mean UA concentration between CON and EXP sows was not significant ($p = 0.39$). The mean was estimated to be 191 μ M (SE = 15.6; 95% CI: 159-229) for CON and 204 μ M (SE = 16.7; 95% CI: 170-245) for EXP.

The difference in mean colostrum IgG between CON sows and EXP sows was not significant ($p = 0.074$) but tended to be higher in CON sows. Mean colostrum IgG was estimated to be 14.4 g/L in CON sows (SE = 3.33; 95% CI: 8.4-24.5) and 9.2 g/L in EXP sows (SE = 2.45; 95% CI: 5.2-16.4). This corresponds to a mean 1.6-fold higher in CON compared to EXP (SE = 0.38; 95% CI: 0.96-2.5), which is contrary to the expectation that EXP sows would have the highest concentration of IgG in colostrum.

Like the above result, no significant ($p = 0.10$) difference in mean IgA colostrum could be detected between the CON and EXP groups. The mean concentration for CON sows were 3.0 g/L (SE = 0.59; 95% CI: 1.9-4.6). For EXP sows, the mean concentration was 2.1 g/L (SE = 0.42; 95% CI: 1.4-3.3). This corresponds to the mean being 1.4 times higher in CON compared to EXP (SE = 0.28; 95% CI: 0.93-2.1).

3.3.3. Piglets

The average litter weight (total litter weight at weaning, including dead piglets) was significantly higher for CON litters than EXP litters ($p = 0.016$), which was in the opposite direction of the hypothesis expecting piglets at EXP sow to grow the most. The mean litter weight was estimated to be 91.1 kg (SE = 1.84; 95% CI: 87.0 – 95.2) in CON and 86.8 kg (SE = 1.90; 95% CI: 82.6 – 90.9) in EXP corresponding to a 4.3 kg higher litter weight in CON compared to EXP (SE = 4.28; CI: 0.8 to 7.7).

The piglet ADG differed significantly between CON and EXP ($p = 0.020$) and was estimated to be 270 g/day in CON litters (SE = 6.9; 95% CI: 256 – 284) and 251 g/day in EXP litters (SE = 6.3; 95% CI: 239 – 264). This corresponded to a ratio between the means of 1.07 for CON compared to EXP (SE = 0.033; CI: 1.01 to 1.14). **The negative effect of EP119 on ADG was contrary to the hypothesis and our expectations that litters from EXP sows would grow the most.**

There was no difference ($p = 0.97$) between the two groups for litter size at weaning.

The odds ratio for litters receiving diarrhoea treatments more often compared to less often was 1.9 (95% CI: 0.86 – 4.1) for

EXP versus CON litter. The difference was non-significant ($p = 0.11$).

3.4. Supplementary clinical observations - All sows

Abscess was not observed on any sows, ulcer was seen in 3 sows, valvular trauma in 2 sows and the lameness score was 0 for 6 sows, score 2 for 2 sows, and score 1 for the rest of the sows. For lameness, score 1 ("The sow gets up easily without any signs of pain") was observed for 429 sows out of 437. These figures do not give rise to statistical calculations.

4. DISCUSSION

4.1. Seaweed as feed additive for sows

Since EP119 is a fermented mixed product consisting of rapeseed, *A. nodosum* and *S. latissima*, the present study does not provide answers to the effect of the specific seaweed species on sow health and performance. However, literature provides insights into a better understanding of the impact of the different components on organisms, including pigs.

4.1.1. *Ascophyllum nodosum*

Biochemical effects of *A. nodosum* has previously been studied. *In vitro*, Dierick et al. (2009) were able to demonstrate an inhibitory effect on bacterial growth and a suppressive effect on lactate and volatile fatty acids. In the study, the antibacterial effect was particularly pronounced for *E. coli*. Despite the fact that Dierick et al. (2009) was able to demonstrate a significant reduction of *E. coli* in the small intestine of weaned pigs fed a low seaweed dose, there was no evidence of increased body weight gain or effect on the occurrence of streptococci, lactobacilli and the total number of anaerobic bacteria in the pig's intestine (Dierick et al., 2009). Nor was there any difference in villus and crypt height or intraepithelial lymphocytes in the proximal small intestine (Dierick et al., 2009). Similarly, in a 28-day study which aimed to determine the growth performance and immune function in weaned piglets challenged by *Salmonella typhimurium*, no significant effects of *A. nodosum* extract were observed (Turner et al., 2002). *In vitro*, an interesting antimicrobial and antioxidant synergistic effect of *A. nodosum* and *Schizochytrium* spp. were however found by Dell'Anno et al. (2020). In this case the antimicrobial effect of *A. nodosum* required high concentrations of 0.12% and the effect ceased already after 5 and 6 hours. Similar results were found by Gardiner et al. (2008) who demonstrated 100-fold lower coliform counts in the ileum contents (but not in caecum, colon and rectal contents) of finishers fed supplements containing either 6 or 9 g *A. nodosum* extract per kg compared to pigs that received only 3 g extract per kg. Despite the clear effect on coliform bacteria, the study found significantly lower daily gain, slaughter weight and 'kill-out' performance (the carcass weight divided by the live weight), in finishers fed *A. nodosum* extract leading to the conclusion that *A. nodosum* extract has limited commercial value. It should also be noted that the cecal content of bifidobacterium decreased linearly with increasing

concentrations of *A. nodosum* extract, and no effect on the finishers feed intake, feed conversion ratio as well as other slaughter characteristics were found (Gardiner et al., 2008). Bošnjaković et al. (2024) investigated several inflammatory markers in cows but found no differences between controls and cows receiving *A. nodosum*. However, seaweed-fed cows had significantly lower enteric methane emissions compared to cows not receiving *A. nodosum* (Bošnjaković et al., 2024).

The pre-processing methods seem to have an impact on *A. nodosum* properties. Depending on the extraction methods, Venardou et al. (2021) were able to demonstrate (*in vitro*) antibacterial as well as prebiotic properties of *A. nodosum* taken from the faeces of weaned pigs. However, in an *in vivo* follow-up study, it was not possible to demonstrate any effect on *Salmonella* counts after the feed was added *A. nodosum* extract (Venardou et al., 2022). Using an *in vitro* pig digestibility model, Ford et al. (2020) found significantly better effect on digestibility using *A. nodosum* phenolic extracts compared to unprocessed *A. nodosum*, which only showed significant effect after addition of more than 5% *A. nodosum*.

4.1.2. *Saccharina latissima*

Studies investigating the immunostimulant properties and health promoting effect of *S. latissima* in pigs appears more rarely. Yet, Bonde et al. (2023) were able to modulate the gut microbiota after feeding 8% fermented *S. latissima* to pigs co-infected with helminths. The effect was limited for selected systemic immune parameters, and the study did not provide evidence of reducing parasite burdens. Hence, the authors suggested the effects of fermented *S. latissima* localized to intestinal tissue only (Bonde et al., 2023). Using porcine retinal pigment epithelium, Dörschmann et al. (2023) concluded that fucoidans from *S. latissima* were promising agents against age-related retinal damage (macular degeneration), as two of these seaweed species were able to reduce angiogenic cytokines and exhibit anti-inflammatory responses. Recently, Mildemberger et al. (2024) demonstrated (*in vitro*) how extracts of *S. latissima* had immunomodulatory effects and were able to show the expression of cytokines, including TNF- α . In rabbits, improved intestinal mucosal morphology were found after administration of dehydrated *S. latissima* (Al-Soufi et al., 2024). However, the same study did not show any effect on the growth of rabbits for either dehydrated *S. latissima* or *Ulva Lactuca* (dehydrated or extract) (Al-Soufi et al., 2024). In calves daily fed cow's milk supplemented with *S. latissima* (50 g/8 L), there was also no effect on body growth (Samarasinghe et al., 2021). The study results found that calves fed *S. latissima* showed no signs of organ changes or differences in the populations of lactobacilli, Enterobacteriaceae and *E. coli* from the colon and the histomorphology of the small intestine compared to an unexposed control group. Similar results were found for *A. nodosum*, which was also tested (Samarasinghe et al., 2021).

4.1.3. Other seaweed species

Leonard et al. (2011) investigated the effect of *Laminaria* spp. on sows' offspring but found no effect on the number of live-born piglets, litter weight, average birth weight and weaning weight if sows were fed *Laminaria* spp. extract. However, a higher average daily feed intake was observed in the piglets' weaning period. The used extract was associated with a lower prevalence of *E. coli* in cecum, as previously stated for *A. nodosum*, and higher ileal expression of TNF- α (Leonard et al., 2011). Satessa et al. (2020a) investigated unspecified species of brown, green and red macroalgae but found no production beneficial effect on weaned pigs. However, the seaweed combination lowered the weights of hindgut tissue and contents, which the authors explained by antimicrobial activity of seaweed (Satessa et al., 2020a).

4.2. Rapeseed

Since EP119 is a mixed product using rapeseed as a protein source, we found it necessary to use rapeseed in the control feed to minimize the difference between EXP and CON sows. The sow feed could only be delivered as non-fermented rapeseed, and as mentioned in the introduction, rapeseed is not the usual protein source for pigs. The latter is due to a high fiber content and because rapeseed contains several antinutritional factors (e.g., glucosinolates) previously shown to reduce sows' feed intake and cause fewer weaned piglets (Schöne et al., 2001). The selected control feed for the present study was therefore not a classic diet for sows, which possesses a risk that the CON sows would perform below the normal standard of the farm. The concern was magnified by the results of Satessa et al. (2020) who found a beneficial effect of fermented rapeseed meal on the gut microbiota and growth of pigs compared to non-fermented rapeseed. Conversely, a meta-analysis showed that a diet with up to 30% rapeseed meal did not affect the growth performance of pigs, after which the authors concluded that rapeseed could be used as a protein source in balanced diet for finishers (Hansen et al., 2020).

4.3. Fermentation

A previous study comparing fermented rapeseed meal with fermented rapeseed meal supplemented with *A. nodosum* or both *A. nodosum* and *S. latissima* provided an interesting indication of the importance of fermentation (Satessa et al., 2020). This study showed that weaned pigs fed fermented rapeseed had significantly better average daily gain than pigs fed a non-fermented control feed. But quite thoughtful in the same study, fermented rapeseed additives supplemented with *A. nodosum* and *S. latissima* were not able to improve average daily gain and body weight in pigs. In fact, the pigs exposed to seaweed had a worse performance compared to pigs fed only fermented rapeseed (Satessa et al., 2020b). It should also be mentioned that Satessa et al. (2020b) were able to demonstrate an immunostimulant effect of the feed additives containing seaweed but left no detailed explanation for these results.

Compared to unfermented controls, Beck et al. (2024) were able to demonstrate a significantly increased antimicrobial effect of fermented rapeseed without and with seaweed (the latter used as pig feed supplements). Furthermore, the study demonstrated a greater antimicrobial effect of the fermented products against gram-positive bacteria than against gram-negative bacteria but found no improvement in pig feed supplements added *A. nodosum* and *S. latissima*. The latter result raises the question of whether the fermentation process is more important than the raw materials themselves (Beck et al., 2024). Czech et al. (2021) investigated fermented rapeseed and soy and mixtures thereof without added seaweed and found a significant positive effect on weaners. Pigs receiving fermented rapeseed or combinations of fermented rapeseed and soy had the highest feed conversion ratio compared to a non-fermented standard diet with soy meal. Moreover, a significantly lower mortality and diarrhea incidence were observed in pigs given fermented soy or combinations of fermented soy and rapeseed compared to the control group fed non-fermented soy (Czech et al., 2021).

4.4. Piglet growth

In the Focal-II study we found significantly higher litter weight and ADG in piglets from CON sows compared to EXP sows. These results are in line with Gardiner et al., 2008, which as previously mentioned showed lower growth in finishing pigs after the addition of *A. Nodosum*. Also, Michiels et al. (2012) found no improvement in daily weight gain or changes in feed conversion of weaned pigs after 28 days of dietary supplementation with intact dried *A. nodosum* at different concentrations (2.5, 5.0 and 10.0 g/kg, respectively). Moreover, the study by Michiels et al. (2012) was unable to demonstrate any effect on selected gut health parameters (bacterial counts, DNA isolation for pathogen detection, intestinal villus length and crypt depth, intestinal absorption and barrier function) and for four markers of oxidative stress (Michiels et al. 2012). As already mentioned in the introduction, Frazzini et al. (2024) showed significantly higher antioxidant barrier in serum from pigs fed seaweed but with no effect on the weight and average daily gain of the pigs. In this study experimental piglets were fed a dietary supplement containing 1.5% *A. nodosum* and 0.5% *P. calcareum* without being able to show a difference between the groups for total countable bacteria, lactic acid bacteria, and coliform bacteria in feces (Frazzini et al., 2024). Venardou et al. (2022) were able to show inhibitory effects of *A. nodosum* extract on *Salmonella Typhimurium* (*In vitro*). The *in vitro* study by Venardou et al. (2022) was followed by two *in vivo* studies where the first study with newly weaned pigs was able to demonstrate an improved feed conversion ratios (often referred to as F:G or 'feed-to-gain') after weaning and a reduced number of *Salmonella* in feces. After infection with *S. Typhimurium* (challenge trial; no. 2) there was, however, no effect of *A. nodosum* extract on the number of *Salmonella*, but a reduction in the occurrence of Enterobacteriaceae (Venardou et al., 2022).

4.5. Colostrum

To our knowledge, the impact of feed additives containing *A. nodosum* or *S. latissima* on sow colostrum have not previously been studied. In high-yielding dairy cows, however, there have been tentative indications of improved milk composition after supplemental feeding with *A. nodosum* (Bošnjaković et al. 2024).

Also, research into UA concentration in sow colostrum is still in its infancy. In the study by (Kaiser et al., 2019), significantly lower UA concentrations were observed in colostrum from sows suffering from Postpartum Dysgalactiae Syndrome compared to healthy sows. The reason for lower UA concentration in colostrum from sick sows is still unknown. However, as reviewed by Tas and Susenbeth (2007), high UA concentrations in cows were associated with significant production of microbial protein in the rumen, indicating that lower colostrum UA may be a result of reduced energy and microbial metabolism in the animal. It should also be mentioned that UA possesses antioxidant capacity (Duplancic et al., 2011) and is considered a potent antioxidant in bovine milk (Østdal et al., 2000). Therefore, colostrum having low AU concentration must be considered as being of lower quality. Due to the limited knowledge on the subject, it is however difficult to draw decisive conclusions, but since an overall trend towards fewer colostrum immunoglobulins from EXP sows was also found, the EP119 additive does not seem commendable in its current form.

5. CONCLUSION

As our study showed reduced growth among piglets and deterioration in colostrum quality from sows fed with the supplemental feed EP119, the use of the product for feeding should be reconsidered. Future studies should focus on the potential harmful effects of the present product and other potential reasons for our result. Despite the literature providing several examples of antimicrobial properties of *A. nodosum* and *S. latissima*, there are few convincing examples of a systemic health-promoting effect of these seaweed species in the literature. However, since literature often points to a clear local antimicrobial effect of seaweed, including *A. nodosum* and *S. latissima*, it is conceivable that these products are still suitable for short-term treatments of pig diseases such as weaning diarrhea or for external use for wound treatment, for example. Optionally in high doses. For future research it is recommended to focus on the separate seaweed species alone and study whether specific fermentation processes of these can add positive outcomes to pigs. This allows the systemic impact of *A. nodosum* and *S. latissima* to be fully understood, which seems to be required.

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7. DATA SETS

The health effect of fermented seaweed, which is uploaded to Zenodo.

8. APPENDIX

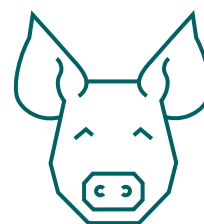
- Appendix 1 EP119 Datasheet
- Appendix 2 Feed recipe 2023
- Appendix 3 Feed recipe 2024
- Appendix 4 Clinical variables
- Appendix 5 Results from SeaMark WP4

DATASHEET

Version: 29.09.2022

EP 119 is a complementary feed produced from rapeseed meal and seaweed fermented with lactic acid bacteria. EP119 contains fermentation metabolites including lactic acid, and contains gut flora stabilizing lactic acid bacteria. The fermentation process ensures a high digestibility of the product and makes the product very suitable for maintaining a healthy gut.

EP119 can be used for up to four weeks as a dietary feed to stabilise digestive disturbances in case of risk of, during periods of, or recovery from digestive disturbance*. EP119 should not exceed inclusion beyond 20% of the complete feed.



PIGS



POULTRY

NUTRIENTS

Dry Matter	890 g/kg
Crude Protein	340 g/kg
Crude Fat	39 g/kg
Crude Fibre	119 g/kg
Crude Ash	73 g/kg
Sugars	29 g/kg

ENERGY

ME Pigs	9.9 MJ/kg
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LACTIC ACID AND BACTERIA

Lactic acid	55 g/kg
Lactic acid bacteria**	>10 ⁶ cfu/g

* It is recommended that advice from a veterinarian be sought before use and before extending the period of use.

** Enterococcus faecium (NCIMB 10415)

AMINO ACIDS	GROSS	SID PIGS	SID POULTRY	
Lys	18.0	14.4	15.2	g/kg
Met	6.4	5.5	6.0	g/kg
M+C	14.4	11.7	12.7	g/kg
Thre	14.5	11.5	11.8	g/kg
Tryp	4.4	3.5	3.9	g/kg
Ile	12.4	10.2	10.7	g/kg
Arg	18.9	16.6	16.8	g/kg
His	8.9	7.6	7.8	g/kg
Leu	19.9	19.1	19.8	g/kg
Val	16.5	13.1	14.0	g/kg
Phen	13.3	11.1	11.5	g/kg
Tyr	10.0	8.2	8.6	g/kg

MINERALS

Calcium	7.7 g/kg
Phosphorus	10.9 g/kg
Dig. Phosphorus	7.1 g/kg
Sodium	1.3 g/kg
Potassium	13.8 g/kg
Chloride	0.6 g/kg

EP119 is a fermented complementary feed composed out of natural Non-GMO raw materials. The figures are based on analyses representing an average. Some variance in chemical composition may occur.

**PHYSICAL CHARACTERISTIC
APPEARANCE:**

EP119 is a dark brown meal product with a pleasant flavor of seaweed and fermentation.

PACKAGE SIZE:

Bulk or big bags.

**STORAGE & SHELF LIFE OF
NUTRIENTS:**

12 months from production date when stored at 20°C or below. Shelf life will be shorter if stored at a higher temperature.

INSTRUCTIONS FOR USE:

PERIOD		EP119 IN % OF COMPLETE FEED
PIGS		
Sows	Gestation	6%
	Lactation	9%
RUMINANTS		
Lactating cows		200 g/day
Dry cows		150 g/day

The product contains 5% lactic acid. Remember to optimise and reduce added acidifiers.

Recipe 2: 119405-B VA Die 122307 DT Forsøg 9 %

Name	Klaus Noe	Tlf. / mobil	97891215 / 61366959
Adresse	Remmerstrandvej 9, Nr. Nisum, 7620 Lemvig	Email	klausnoe@dlgmail.dk

Code	Name	Pct	Mængde
37091-1	Leci E Basis V.fedt 9) M	3,221	64,415
10002-1	Byg Mølle B	10,000	200,000
100014-1	Byg Knust R+B	20,000	400,000
110013-1	Hvede Knust R+B	20,000	400,000
11001-1	Hvede	18,609	372,174
37160-1	Hvedeklid Blandet	2,500	50,000
39100-1	Roesnitter, tørrede, optionelle	2,500	50,000
37144-1	Sojaskrå afskal.	10,173	203,465
119415-1	EP 119 - FORSØG -	9,000	180,000
37105-1	Calciumcarbonat-kalk grov	1,243	24,864
37139-1	Monocalciumfosfat 22,7 M	0,404	8,090
37116-1	Fodersalt MBR	0,476	9,513
104687-1	Magnesiumoxid 37112 25 kg RB	0,087	1,735
41205-1	L-lysin sulfat 70 55% 800 kg M+B +R+C	0,492	9,843
41208-1	DL-Methionin 25 kg BC	0,052	1,030
105051-1	Threonin 41209 600 kg MBHRC	0,105	2,090
106356-1	VA Vit So Fyt Anti 500351 1000 kg RB	0,205	4,091
106621-1	Solvita E 50 500510 1000 kg VBRH	0,274	5,483
41216-1	Cholinchlorid 70 % 12931 25 kg M	0,031	0,614
41374-1	Beta-key Orffa 25 kg Betain	0,030	0,593
41294-1	Mycofix Plus BBSH - 5E - 25 kg MBHR	0,100	2,000
41270-1	AmmoMin 25 kg	0,500	10,000
		100,000	2.000,000

Nutrient		Pr. kg	Pr. energi	Nutrient		Pr. kg	Pr. energi
Tørstof	%	86,77	86,77	St. Ford. Valin	g	5,84	5,44
EFOS-værdi ukorr. Svin %	%	87,07	87,07	St. ileal ford. Arginin	g	6,01	5,59
EFOSi (Enz.f.org. stof v/Ileum	%	79,0	79,0	Calcium	g	7,84	7,30
I-faktor	%	90,8	90,8	Fosfor	g	5,3	4,9
FE so ny	FEso	1,07	1,00	Ford. fosfor, 200 % fytase	g	3,46	3,23
FEsvin ny	FEsv	1,08	1,00	Ford. fosfor, 300 % fytase	g	3,54	3,29
Råprotein	%	15,16	14,12	Ford. fosfor, 400 % fytase	g	3,57	3,32
Råfedt	%	5,14	4,79	Magnesium	g	1,79	1,67
Fedtsyre	g	45	42	Natrium	g	1,99	1,85
Råaske	%	5,49	5,11	Kalium	g	6,72	6,25
Træstof	%	4,15	3,86	Klorid	g	3,65	3,40
Opl. fibre	g	39,01	36,32	Svovl	g	2,05	1,91
Uopl. fibre	g	113,67	105,84	A-vitamin, tilsat	1000 i.e	8,59	8,00
Stivelse	g	394,62	367,43	D3- vitamin, tilsat	1000 i.e	0,86	0,80
Sukker	g	30,18	28,10	E-vitamin/dl-alfa-tokoferol, tils	mg	214,80	200,00
Lysin	g	9,70	9,03	B1-vitamin/ Thiamin, tilsat	mg	2,1	2,0
Methionin	g	2,9	2,7	B2-vitamin/Riboflavin, tilsat	mg	5,37	5,00
Cystin	g	3,1	2,8	B6-vitamin/ Pyridoxin, tilsat	mg	3,22	3,00
Treonin	g	6,5	6,0	B12-vitamin, tilsat	mg	0,02	0,02
Tryptofan	g	1,97	1,83	K3-vitamin, tilsat	mg	2,15	2,00
Valin	g	7,09	6,60	D-pantotensyre, tilsat	mg	16,11	15,00
Isoleucin	g	5,6	5,3	Niacin, tilsat	mg	21,48	20,00
Leucin	g	10,2	9,5	Biotin vitamin H, tilsat	mg	0,43	0,40



Recipe 2: 119405-B VA Die 122307 DT Forsøg 9 %

Name	Klaus Noe	Tlf. / mobil	97891215 / 61366959
Adresse	Remmerstrandvej 9, Nr. Nisum, 7620 Lemvig	Email	klausnoe@dlgmail.dk

Nutrient		Pr. kg	Pr. energi	Nutrient		Pr. kg	Pr. energi
Histidin	g	3,7	3,5	Folinsyre, tilsat	mg	1,61	1,50
Arginin	g	7,1	6,7	Cholinchlorid, tilsat	mg	214,80	200,00
St. F. Råprotein	g	126,73	118,00	Betainhydrochlorid, tilsat	mg	214,80	200,00
St. Ford. lysin	g	8,48	7,90	Fe, jern-II-sulfat	mg	85,92	80,00
St. Ford. methionin	g	2,63	2,45	I, calciumjodat	mg	2,05	1,90
St. Ford. cystin	g	2,55	2,38	Cu, kobber-II-sulfat	mg	15,34	14,29
St. Ford. methionin+cystin	g	5,18	4,83	Mn, manganoxid	mg	42,96	40,00
St. Ford. treonin	g	5,42	5,05	Zn, zinkoxid	mg	102,29	95,24
St. Ford. tryptofan	g	1,65	1,53	Se, natriumselenit	mg	0,31	0,29
St. Ford. Leucin	g	8,73	8,13	Ronozyne HIPhos GT 4000	FYT	1.534	1.429
St. Ford. Isoleucin	g	4,73	4,41	Endox/Bianox	mg	102,29	95,24
St. Ford. Histidin	g	3,09	2,88	Mycifix Plus	mg	1.000,00	931,10
St. Ford. Fenylanin	g	5,82	5,42	Ammomin	mg	5.000	4.655
St. Ford. Tyrosin	g	3,98	3,70				



Recipe 2: 119406-B VA Die 122307 DT Kontrol 9 %

Name	Klaus Noe	Tlf. / mobil	97891215 / 61366959
Adresse	Remmerstrandvej 9, Nr. Nisum, 7620 Lemvig	Email	klausnoe@dlgmail.dk

Code	Name	Pct	Mængde
37091-1	Leci E Basis V.fedt 9) M	3,374	67,486
10002-1	Byg Mølle B	10,000	200,000
100014-1	Byg Knust R+B	20,000	400,000
110013-1	Hvede Knust R+B	20,000	400,000
11001-1	Hvede	17,984	359,673
37160-1	Hvedeklid Blandet	2,500	50,000
39100-1	Roesnitter, tørrede, optionelle	2,500	50,000
37144-1	Sojaskrå afskal.	10,692	213,831
37145-1	Rapsskrå	9,000	180,000
37105-1	Calciumcarbonat-kalk grov	1,226	24,519
37139-1	Monocalciumfosfat 22,7 M	0,453	9,057
37116-1	Fodersalt MBR	0,495	9,899
104687-1	Magnesiumoxid 37112 25 kg RB	0,035	0,697
41205-1	L-lysin sulfat 70 55% 800 kg M+B +R+C	0,460	9,196
41208-1	DL-Methionin 25 kg BC	0,046	0,930
105051-1	Threonin 41209 600 kg MBHRC	0,097	1,931
106356-1	VA Vit So Fyt Anti 500351 1000 kg RB	0,205	4,091
106621-1	Solvita E 50 500510 1000 kg VBRH	0,274	5,483
41374-1	Beta-key Orffa 25 kg Betain	0,030	0,593
41216-1	Cholinchlorid 70 % 12931 25 kg M	0,031	0,614
41294-1	Mycofix Plus BBSH - 5E - 25 kg MBHR	0,100	2,000
41270-1	AmmoMin 25 kg	0,500	10,000
		100,000	2.000,000

Nutrient		Pr. kg	Pr. energi	Nutrient		Pr. kg	Pr. energi
Tørstof	%	86,80	86,80	St. Ford. Valin	g	6,02	5,60
EFOS-værdi ukorr. Svin %	%	87,07	87,07	St. ileal ford. Arginin	g	7,55	7,03
EFOSi (Enz.f.org. stof v/Ileum	%	78,7	78,7	Calcium	g	7,84	7,30
I-faktor	%	90,4	90,4	Fosfor	g	5,4	5,0
FE so ny	FEso	1,07	1,00	Ford. fosfor, 200 % fytase	g	3,43	3,19
FEsvin ny	FEsv	1,08	1,00	Ford. fosfor, 300 % fytase	g	3,54	3,29
Råprotein	%	15,26	14,21	Ford. fosfor, 400 % fytase	g	3,59	3,34
Råfedt	%	5,29	4,93	Magnesium	g	1,79	1,67
Fedtsyre	g	46	43	Natrium	g	1,99	1,85
Råaske	%	5,57	5,19	Kalium	g	6,81	6,34
Træstof	%	4,08	3,80	Klorid	g	3,76	3,51
Opl. fibre	g	43,27	40,29	Svovl	g	2,04	1,90
Uopl. fibre	g	136,80	127,37	A-vitamin, tilsat	1000 i.e	8,59	8,00
Stivelse	g	385,96	359,36	D3- vitamin, tilsat	1000 i.e	0,86	0,80
Sukker	g	35,76	33,29	E-vitamin/dl-alfa-tokoferol, tils	mg	214,80	200,00
Lysin	g	9,71	9,04	B1-vitamin/ Thiamin, tilsat	mg	2,1	2,0
Methionin	g	2,9	2,7	B2-vitamin/Riboflavin, tilsat	mg	5,37	5,00
Cystin	g	3,0	2,8	B6-vitamin/ Pyridoxin, tilsat	mg	3,22	3,00
Treonin	g	6,5	6,1	B12-vitamin, tilsat	mg	0,02	0,02
Tryptofan	g	1,99	1,85	K3-vitamin, tilsat	mg	2,15	2,00
Valin	g	7,33	6,83	D-pantotensyre, tilsat	mg	16,11	15,00
Isoleucin	g	5,9	5,5	Niacin, tilsat	mg	21,48	20,00
Leucin	g	10,5	9,8	Biotin vitamin H, tilsat	mg	0,43	0,40



Info

09-10-2023 13:57:08

Udskrevet af TOJ

Recipe 2: 119406-B VA Die 122307 DT Kontrol 9 %

Name	Klaus Noe	Tlf. / mobil	97891215 / 61366959
Adresse	Remmerstrandvej 9, Nr. Nisum, 7620 Lemvig	Email	klausnoe@dlgmail.dk

Nutrient			Pr. kg	Pr. energi	Nutrient			Pr. kg	Pr. energi
Histidin	g	g	3,8	3,5	Folinsyre, tilsat	mg		1,61	1,50
Arginin	g	g	7,3	6,8	Cholinchlorid, tilsat	mg		214,80	200,00
St. F. Råprotein	g		126,73	118,00	Betainhydrochlorid, tilsat	mg		214,80	200,00
St. Ford. lysin	g		8,48	7,90	Fe, jern-II-sulfat	mg		85,92	80,00
St. Ford. methionin	g		2,63	2,45	I, calciumjodat	mg		2,05	1,90
St. Ford. cystin	g		2,50	2,33	Cu, kobber-II-sulfat	mg		15,34	14,29
St. Ford. methionin+cystin	g		5,13	4,78	Mn, manganoxid	mg		42,96	40,00
St. Ford. treonin	g		5,42	5,05	Zn, zinkoxid	mg		102,29	95,24
St. Ford. tryptofan	g		1,64	1,53	Se, natriumselenit	mg		0,31	0,29
St. Ford. Leucin	g		9,00	8,38	Ronozyne HIPhos GT 4000	FYT		1.534	1.429
St. Ford. Isoleucin	g		4,97	4,63	Endox/Bianox	mg		102,29	95,24
St. Ford. Histidin	g		3,13	2,91	Mycifix Plus	mg		1.000,00	931,10
St. Ford. Fenylanin	g		5,90	5,49	Ammomin	mg		5.000	4.655
St. Ford. Tyrosin	g		4,12	3,83					



Recipe 2: 119404-B VA Drægtig Fiber DT 122307 forsøg 6 %

Name	Klaus Noe	Tlf. / mobil	97891215 / 61366959
Adresse	Remmerstrandvej 9, Nr. Nissum, 7620 Lemvig	Email	klausnoe@dlgmail.dk

Code	Name	Pct	Mængde
37091-1	Leci E Basis V.fedt 9) M	1,901	38,020
10002-1	Byg Mølle B	36,353	727,066
100014-1	Byg Knust R+B	20,000	400,000
110013-1	Hvede Knust R+B	20,000	400,000
37160-1	Hvedeklid Blandet	4,000	80,000
39100-1	Roesnitter, tørrede, optionelle	5,000	100,000
37144-1	Sojaskrå afskal.	3,827	76,534
119415-1	EP 119 - FORSØG -	6,000	120,000
37105-1	Calciumcarbonat-kalk grov	1,176	23,510
37139-1	Monocalciumfosfat 22,7 M	0,153	3,059
37116-1	Fodersalt MBR	0,478	9,557
104687-1	Magnesiumoxid 37112 25 kg RB	0,084	1,677
41205-1	L-lysin sulfat 70 55% 800 kg M+B +R+C	0,015	0,302
105051-1	Threonin 41209 600 kg MBHRC	0,004	0,083
106739-1	Tryptofan 40% 41261 25kg B+C	0,006	0,128
41130-1	VJA Breeder 0,25 Premix 25 kg M +B	0,250	5,000
106621-1	Solvita E 50 500510 1000 kg VBRH	0,125	2,498
41374-1	Beta-key Orffa 25 kg Betain	0,028	0,565
41270-1	AmmoMin 25 kg	0,500	10,000
41294-1	Mycofix Plus BBSH - 5E - 25 kg MBHR	0,100	2,000
		100,000	2.000,000

Nutrient		Pr. kg	Pr. energi	Nutrient		Pr. kg	Pr. energi
Tørstof	%	86,27	86,27	Calcium	g	6,65	6,50
EFOS-værdi ukorr. Svin %	%	84,82	84,82	Fosfor	g	4,2	4,1
EFOSi (Enz.f.org. stof v/Ileum %	%	76,3	76,3	Ford. fosfor, 200 % fytase	g	2,57	2,51
I-faktor	%	89,9	89,9	Ford. fosfor, 300 % fytase	g	2,64	2,58
FE so ny	FEso	1,02	1,00	Ford. fosfor, 400 % fytase	g	2,67	2,61
FEsvin ny	FEsv	1,02	0,99	Magnesium	g	1,79	1,75
Råprotein	%	11,80	11,53	Natrium	g	1,99	1,95
Råfedt	%	4,03	3,94	Kalium	g	5,62	5,50
Fedtsyre	g	35	34	Klorid	g	3,74	3,66
Råaske	%	4,79	4,68	Svovl	g	1,65	1,62
Træstof	%	4,78	4,67	A-vitamin, tilsat	1000 i.e	8,00	7,82
Opl. fibre	g	54,13	52,92	D3- vitamin, tilsat	1000 i.e	0,50	0,49
Uopl. fibre	g	137,40	134,31	Hy.D. 25-hydroxycholecalifero	mg	0,02	0,02
Stivelse	g	422,00	412,51	E-vitamin/dl-alfa-tokoferol, tils	mg	153,45	150,00
Sukker	g	27,32	26,71	B1-vitamin/ Thiamin, tilsat	mg	2,0	2,0
Lysin	g	5,24	5,13	B2-vitamin/Riboflavin, tilsat	mg	8,00	7,82
Methionin	g	2,0	2,0	B6-vitamin/ Pyridoxin, tilsat	mg	5,00	4,89
Cystin	g	2,6	2,5	B12-vitamin, tilsat	mg	0,04	0,04
Treonin	g	4,3	4,2	K3-vitamin, tilsat	mg	5,00	4,89
Tryptofan	g	1,59	1,55	D-pantotensyre, tilsat	mg	25,00	24,44
Valin	g	5,81	5,68	Niacin, tilsat	mg	30,00	29,33
Isoleucin	g	4,4	4,3	Biotin vitamin H, tilsat	mg	0,40	0,39
Leucin	g	8,0	7,8	Folinsyre, tilsat	mg	3,00	2,93
Histidin	g	2,9	2,8	Betainhydrochlorid, tilsat	mg	204,60	200,00
Arginin	g	5,4	5,3	Fe, jern-II-sulfat	mg	150,00	146,63



Info

09-10-2023 13:55:08

Udskrevet af TOJ

Recipe 2: 119404-B VA Drægtig Fiber DT 122307 forsøg 6 %

Name	Klaus Noe	Tlf. / mobil	97891215 / 61366959
Adresse	Remmerstrandvej 9, Nr. Nisum, 7620 Lemvig	Email	klausnoe@dlgmail.dk

Nutrient		Pr. kg	Pr. energi	Nutrient		Pr. kg	Pr. energi
St. F. Råprotein	g	92,87	90,78	I, calciumjodat	mg	2,00	1,96
St. Ford. lysin	g	4,09	4,00	Cu, kobber-II-sulfat	mg	7,00	6,84
St. Ford. methionin	g	1,72	1,68	Cu, kobber-(II)-aminosyrechel	mg	8,00	7,82
St. Ford. cystin	g	2,09	2,04	Mn, manganoxid	mg	28,00	27,37
St. Ford. methionin+cystin	g	3,81	3,72	Mn, mangan-(II)-aminosyrech	mg	22,00	21,51
St. Ford. treonin	g	3,27	3,20	Zn, zinksulfat	mg	45,00	43,99
St. Ford. tryptofan	g	1,25	1,22	Zn, zinkaminosyrechelate, hydr	mg	55,00	53,76
St. Ford. Leucin	g	6,52	6,37	Se, natriumselenit	mg	0,25	0,24
St. Ford. Isoleucin	g	3,50	3,42	Se, hydroxylanalog af selenome	mg	0,15	0,15
St. Ford. Histidin	g	2,32	2,27	Ronozyme HIPhos GT 4000	FYT	1.500	1.466
St. Ford. Fenylanin	g	4,41	4,31	Endox/Bianox	mg	31,25	30,55
St. Ford. Tyrosin	g	2,96	2,90	Mycifix Plus	mg	1.000,00	977,52
St. Ford. Valin	g	4,51	4,40	Ammomin	mg	5.000	4.888
St. ileal ford. Arginin	g	4,66	4,55				



Recipe 2: 118892-B VA Drægtig Fiber DT 122307 kontrol 6 %

Name	Klaus Noe	Tlf. / mobil	97891215 / 61366959
Adresse	Remmerstrandvej 9, Nr. Nissum, 7620 Lemvig	Email	klausnoe@dlgmail.dk

Code	Name	Pct	Mængde
37091-1	Leci E Basis V.fedt 9) M	1,898	37,965
10002-1	Byg Mølle B	35,500	710,000
100014-1	Byg Knust R+B	20,000	400,000
110013-1	Hvede Knust R+B	20,888	417,759
37160-1	Hvedeklid Blandet	4,000	80,000
39100-1	Roesnitter, tørrede, optionelle	5,000	100,000
37144-1	Sojaskrå afskal.	3,795	75,894
37145-1	Rapsskrå	6,000	120,000
37105-1	Calciumcarbonat-kalk grov	1,155	23,100
37139-1	Monocalciumfosfat 22,7 M	0,210	4,194
37116-1	Fodersalt MBR	0,490	9,803
104687-1	Magnesiumoxid 37112 25 kg RB	0,044	0,882
41205-1	L-lysin sulfat 70 55% 800 kg M+B +R+C	0,009	0,181
105051-1	Threonin 41209 600 kg MBHRC	0,004	0,073
106739-1	Tryptofan 40% 41261 25kg B+C	0,005	0,103
41130-1	VJA Breeder 0,25 Premix 25 kg M +B	0,250	5,000
106621-1	Solvita E 50 500510 1000 kg VBRH	0,125	2,492
41374-1	Beta-key Orffa 25 kg Betain	0,028	0,552
41270-1	AmmoMin 25 kg	0,500	10,000
41294-1	Mycifix Plus BBSH - 5E - 25 kg MBHR	0,100	2,000
		100,000	2.000,000

Nutrient		Pr. kg	Pr. energi	Nutrient		Pr. kg	Pr. energi
Tørstof	%	86,27	86,27	Calcium	g	6,64	6,50
EFOS-værdi ukorr. Svin %	%	84,83	84,83	Fosfor	g	4,2	4,2
EFOSi (Enz.f.org. stof v/Ileum %	%	76,2	76,2	Ford. fosfor, 200 % fytase	g	2,55	2,50
I-faktor	%	89,8	89,8	Ford. fosfor, 300 % fytase	g	2,65	2,60
FE so ny	FEso	1,02	1,00	Ford. fosfor, 400 % fytase	g	2,70	2,64
FEsvin ny	FEsv	1,01	0,99	Magnesium	g	1,75	1,71
Råprotein	%	11,76	11,50	Natrium	g	1,99	1,95
Råfedt	%	4,04	3,95	Kalium	g	5,62	5,50
Fedtsyre	g	35	34	Klorid	g	3,82	3,73
Råaske	%	4,84	4,73	Svovl	g	1,65	1,61
Træstof	%	4,72	4,61	A-vitamin, tilsat	1000 i.e	8,00	7,83
Opl. fibre	g	56,62	55,40	D3- vitamin, tilsat	1000 i.e	0,50	0,49
Uopl. fibre	g	152,27	149,00	Hy.D. 25-hydroxycholecalifero	mg	0,02	0,02
Stivelse	g	419,14	410,12	E-vitamin/dl-alfa-tokoferol, tils	mg	153,30	150,00
Sukker	g	30,70	30,04	B1-vitamin/ Thiamin, tilsat	mg	2,0	2,0
Lysin	g	5,24	5,13	B2-vitamin/Riboflavin, tilsat	mg	8,00	7,83
Methionin	g	2,0	2,0	B6-vitamin/ Pyridoxin, tilsat	mg	5,00	4,89
Cystin	g	2,6	2,5	B12-vitamin, tilsat	mg	0,04	0,04
Treonin	g	4,3	4,2	K3-vitamin, tilsat	mg	5,00	4,89
Tryptofan	g	1,58	1,54	D-pantotensyre, tilsat	mg	25,00	24,46
Valin	g	5,90	5,78	Niacin, tilsat	mg	30,00	29,35
Isoleucin	g	4,5	4,4	Biotin vitamin H, tilsat	mg	0,40	0,39
Leucin	g	8,1	7,9	Folinsyre, tilsat	mg	3,00	2,94
Histidin	g	2,9	2,9	Betainhydrochlorid, tilsat	mg	200,00	195,69
Arginin	g	5,4	5,3	Fe, jern-II-sulfat	mg	150,00	146,77



Info

09-10-2023 13:56:30

Udskrevet af TOJ

Recipe 2: 118892-B VA Drægtig Fiber DT 122307 kontrol 6 %

Name	Klaus Noe	Tlf. / mobil	97891215 / 61366959
Adresse	Remmerstrandvej 9, Nr. Nisum, 7620 Lemvig	Email	klausnoe@dlgmail.dk

Nutrient		Pr. kg	Pr. energi	Nutrient		Pr. kg	Pr. energi
St. F. Råprotein	g	91,98	90,00	I, calciumjodat	mg	2,00	1,96
St. Ford. lysin	g	4,09	4,00	Cu, kobber-II-sulfat	mg	7,00	6,85
St. Ford. methionin	g	1,73	1,70	Cu, kobber-(II)-aminosyrechel	mg	8,00	7,83
St. Ford. cystin	g	2,05	2,00	Mn, manganoxid	mg	28,00	27,40
St. Ford. methionin+cystin	g	3,78	3,70	Mn, mangan-(II)-aminosyrech	mg	22,00	21,53
St. Ford. treonin	g	3,27	3,20	Zn, zinksulfat	mg	45,00	44,03
St. Ford. tryptofan	g	1,23	1,20	Zn, zinkaminosyrechelate, hydr	mg	55,00	53,82
St. Ford. Leucin	g	6,61	6,47	Se, natriumselenit	mg	0,25	0,24
St. Ford. Isoleucin	g	3,61	3,53	Se, hydroxylanalog af selenome	mg	0,15	0,15
St. Ford. Histidin	g	2,32	2,27	Ronozyme HIPhos GT 4000	FYT	1.500	1.468
St. Ford. Fenylanin	g	4,40	4,31	Endox/Bianox	mg	31,25	30,58
St. Ford. Tyrosin	g	3,02	2,95	Mycifix Plus	mg	1.000,00	978,47
St. Ford. Valin	g	4,57	4,47	Ammomin	mg	5.000	4.892
St. ileal ford. Arginin	g	5,60	5,48				



Recipe 2: 119405-B VA Die 122307 DT Forsøg 9 % XP

Name	Klaus Noe	Tlf. / mobil	97891215 / 61366959
Adresse	Remmerstrandvej 9, Nr. Nissum, 7620 Lemvig	Email	kn@noeagro.dk

Code	Name	Pct	Mængde
37091-1	Leci E Basis V.fedt 9) M	2,850	57,000
10001-1	Byg	20,002	400,041
100014-1	Byg Knust R+B	10,000	200,000
110013-1	Hvede Knust R+B	20,000	400,000
11001-1	Hvede	19,240	384,800
37160-1	Hvedeklid blandet	2,500	50,000
39100-1	Roesnitter, tørrede, optionelle	2,500	50,000
37144-1	Sojaskrå afskal.	9,850	197,000
119415-1	EP 119 - FORSØG -	9,000	180,000
37105-1	Calciumcarbonat-kalk grov	1,260	25,200
37139-1	Monocalciumfosfat 22,7 M	0,435	8,700
37116-1	Fodersalt MBR	0,465	9,300
104687-1	Magnesiumoxid 37112 25 kg RB	0,090	1,800
41205-1	L-lysin sulfat 70 55% 800 kg MBRC	0,493	9,850
105050-1	DL-Methionin 41208 1000 kg HRMC	0,050	1,000
105051-1	Threonin 41209 600 kg MBHRC	0,105	2,100
41130-1	VJA Breeder 0,25 Premix 25 kg MBR	0,270	5,400
106621-1	Solvita E 50 500510 1000 kg VBRH	0,230	4,600
41216-1	Cholinchlorid 70 % 12931 25 kg M	0,030	0,609
41374-1	Beta-key Orffa 25 kg Betain	0,030	0,600
41294-1	Mycofix Plus BBSH - 5E - 25 kg MBHR	0,100	2,000
41270-1	AmmoMin 25 kg	0,500	10,000
		100,000	2.000,000

Nutrient		Pr. kg	Pr. energi	Nutrient		Pr. kg	Pr. energi
Tørstof	%	86,72	86,72	St. ileal ford. Arginin	g	5,89	5,53
EFOS-værdi ukorr. Svin %	%	87,60	87,60	Calcium Total	g	7,78	7,30
EFOSi (Enz.f.org. stof v/Ileum %	%	78,5	78,5	Calcium	g	7,78	7,30
I-faktor	%	89,6	89,6	Fosfor	g	5,3	5,0
I-faktor m/enzymer, svin	%	91,9	91,9	Ford. fosfor, 200 % fytase	g	3,44	3,23
I-faktor m/enzymer, smågrise	%	90,4	90,4	Ford. fosfor, 300 % fytase	g	3,52	3,30
FE so ny	FEso	1,06	1,00	Ford. fosfor, 400 % fytase	g	3,55	3,33
FeSo23	FEso	1,07	1,00	Magnesium	g	1,78	1,67
FEsvin ny	FEsv	1,06	1,00	Natrium	g	1,97	1,85
Råprotein	%	15,11	14,19	Kalium	g	6,67	6,26
Råfedt	%	4,83	4,54	Klorid	g	3,63	3,41
Fedtsyre	g	42	40	Svovl	g	2,16	2,03
Råaske	%	5,47	5,14	A-vitamin, tilsat	1000 i.e	8,64	8,11
Træstof	%	4,15	3,90	D3- vitamin, tilsat	1000 i.e	0,54	0,51
Opl. fibre	g	44,03	41,34	Hy.D. 25-hydroxycholecalifero	mg	0,02	0,02
Uopl. fibre	g	130,12	122,20	E-vitamin/dl-alfa-tokoferol, tils	mg	213,28	200,29
Stivelse	g	398,12	373,87	B1-vitamin/ Thiamin, tilsat	mg	2,2	2,0
Sukker	g	30,36	28,51	B2-vitamin/Riboflavin, tilsat	mg	8,64	8,11
Lysin	g	9,63	9,05	B6-vitamin/ Pyridoxin, tilsat	mg	5,40	5,07
Methionin	g	2,9	2,7	B12-vitamin, tilsat	mg	0,04	0,04
Cystin	g	3,1	2,9	K3-vitamin, tilsat	mg	5,40	5,07
Treonin	g	6,5	6,1	D-pantotensyre, tilsat	mg	27,00	25,36
Tryptofan	g	1,96	1,84	Niacin, tilsat	mg	32,40	30,43



Info

15-04-2024 14:58:58

Udskrevet af TOJ

Recipe 2: 119405-B VA Die 122307 DT Forsøg 9 % XP

Name	Klaus Noe	Tlf. / mobil	97891215 / 61366959
Adresse	Remmerstrandvej 9, Nr. Nisum, 7620 Lemvig	Email	kn@noeagro.dk

Nutrient			Pr. kg	Pr. energi	Nutrient			Pr. kg	Pr. energi
Valin	g	g	7,06	6,63	Biotin vitamin H, tilsat	mg		0,43	0,41
Isoleucin	g	g	5,6	5,3	Folinsyre, tilsat	mg		3,24	3,04
Leucin	g	g	10,2	9,5	Cholinchlorid, tilsat	mg		212,99	200,01
Histidin	g	g	3,7	3,5	Betainhydrochlorid, tilsat	mg		217,20	203,97
Arginin	g	g	7,1	6,7	Fe, jern-II-sulfat	mg		162,00	152,13
St. F. Råprotein	g		125,65	117,99	I, calciumjodat	mg		2,16	2,03
St. Ford. lysin	g		8,41	7,89	Cu, kobber-II-sulfat	mg		7,56	7,10
St. Ford. methionin	g		2,60	2,44	Cu, kobber-(II)-aminosyrechel	mg		8,64	8,11
St. Ford. cystin	g		2,54	2,38	Mn, manganoxid	mg		30,24	28,40
St. Ford. methionin+cystin	g		5,14	4,83	Mn, mangan-(II)-aminosyrech	mg		23,76	22,31
St. Ford. treonin	g		5,38	5,05	Zn, zinksulfat	mg		48,60	45,64
St. Ford. tryptofan	g		1,63	1,53	Zn, zinkaminosyrechelate, hydra	mg		59,40	55,78
St. Ford. Leucin	g		8,65	8,12	Se, natriumselenit	mg		0,27	0,25
St. Ford. Isoleucin	g		4,68	4,40	Se, hydroxylanalog af selenome	mg		0,16	0,15
St. Ford. Histidin	g		3,06	2,87	Ronozyne HIPhos GT 4000	FYT		1.620	1.521
St. Ford. Fenylanin	g		5,77	5,41	Endox/Bianox	mg		33,75	31,69
St. Ford. Tyrosin	g		3,94	3,70	Mycifix Plus	mg		1.000,00	939,09
St. Ford. Valin	g		5,79	5,44	Ammomin	mg		5.000	4.695



Recipe 2: 119406-B VA Die 122307 DT Kontrol 9 % XP

Name	Klaus Noe	Tlf. / mobil	97891215 / 61366959
Adresse	Remmerstrandvej 9, Nr. Nissum, 7620 Lemvig	Email	kn@noeagro.dk

Code	Name	Pct	Mængde
37091-1	Leci E Basis V.fedt 9) M	2,965	59,300
10001-1	Byg	10,000	200,000
100014-1	Byg Knust R+B	20,000	399,992
110013-1	Hvede Knust R+B	20,000	400,000
11001-1	Hvede	18,700	374,000
37160-1	Hvedeklid blandet	2,500	50,000
39100-1	Roesnitter, tørrede, optionelle	2,500	50,000
37144-1	Sojaskrå afskal.	10,325	206,500
37145-1	Rapsskrå	9,000	180,000
37105-1	Calciumcarbonat-kalk grov	1,240	24,800
37139-1	Monocalciumfosfat 22,7 M	0,485	9,700
37116-1	Fodersalt MBR	0,485	9,700
104687-1	Magnesiumoxid 37112 25 kg RB	0,038	0,750
41205-1	L-lysin sulfat 70 55% 800 kg MBRC	0,463	9,250
105050-1	DL-Methionin 41208 1000 kg HRMC	0,045	0,900
105051-1	Threonin 41209 600 kg MBHRC	0,098	1,950
41130-1	VJA Breeder 0,25 Premix 25 kg MBR	0,265	5,300
106621-1	Solvita E 50 500510 1000 kg VBRH	0,233	4,650
41374-1	Beta-key Orffa 25 kg Betain	0,030	0,600
41216-1	Cholinchlorid 70 % 12931 25 kg M	0,030	0,608
41294-1	Mycofix Plus BBSH - 5E - 25 kg MBHR	0,100	2,000
41270-1	AmmoMin 25 kg	0,500	10,000
		100,000	2.000,000

Nutrient		Pr. kg	Pr. energi	Nutrient		Pr. kg	Pr. energi
Tørstof	%	86,74	86,74	St. ileal ford. Arginin	g	7,43	6,98
EFOS-værdi ukorr. Svin %	%	87,59	87,59	Calcium Total	g	7,77	7,30
EFOSi (Enz.f.org. stof v/Ileum %	%	78,2	78,2	Calcium	g	7,77	7,30
I-faktor	%	89,3	89,3	Fosfor	g	5,4	5,1
I-faktor m/enzymer, svin	%	92,0	92,0	Ford. fosfor, 200 % fytase	g	3,40	3,20
I-faktor m/enzymer, smågrise	%	90,5	90,5	Ford. fosfor, 300 % fytase	g	3,51	3,30
FE so ny	FEso	1,06	1,00	Ford. fosfor, 400 % fytase	g	3,57	3,35
FeSo23	FEso	1,07	1,01	Magnesium	g	1,77	1,67
FEsvin ny	FEsv	1,06	1,00	Natrium	g	1,97	1,85
Råprotein	%	15,20	14,28	Kalium	g	6,76	6,35
Råfedt	%	4,95	4,65	Klorid	g	3,75	3,52
Fedtsyre	g	43	41	Svovl	g	2,15	2,02
Råaske	%	5,55	5,22	A-vitamin, tilsat	1000 i.e	8,48	7,97
Træstof	%	4,08	3,84	D3- vitamin, tilsat	1000 i.e	0,53	0,50
Opl. fibre	g	47,51	44,66	Hy.D. 25-hydroxycholecalifero	mg	0,02	0,02
Uopl. fibre	g	150,99	141,91	E-vitamin/dl-alfa-tokoferol, tils	mg	212,71	199,91
Stivelse	g	389,92	366,46	B1-vitamin/ Thiamin, tilsat	mg	2,1	2,0
Sukker	g	35,50	33,37	B2-vitamin/Riboflavin, tilsat	mg	8,48	7,97
Lysin	g	9,65	9,07	B6-vitamin/ Pyridoxin, tilsat	mg	5,30	4,98
Methionin	g	2,9	2,7	B12-vitamin, tilsat	mg	0,04	0,04
Cystin	g	3,0	2,9	K3-vitamin, tilsat	mg	5,30	4,98
Treonin	g	6,5	6,1	D-pantotensyre, tilsat	mg	26,50	24,91
Tryptofan	g	1,98	1,86	Niacin, tilsat	mg	31,80	29,89



Info

15-04-2024 15:00:13

Udskrevet af TOJ

Recipe 2: 119406-B VA Die 122307 DT Kontrol 9 % XP

Name	Klaus Noe	Tlf. / mobil	97891215 / 61366959
Adresse	Remmerstrandvej 9, Nr. Nissum, 7620 Lemvig	Email	kn@noeagro.dk

Nutrient			Pr. kg	Pr. energi	Nutrient			Pr. kg	Pr. energi
Valin	g	g	7,30	6,86	Biotin vitamin H, tilsat	mg		0,42	0,40
Isoleucin	g	g	5,9	5,5	Folinsyre, tilsat	mg		3,18	2,99
Leucin	g	g	10,5	9,8	Cholinchlorid, tilsat	mg		212,81	200,01
Histidin	g	g	3,8	3,5	Betainhydrochlorid, tilsat	mg		217,20	204,13
Arginin	g	g	7,2	6,8	Fe, jern-II-sulfat	mg		159,00	149,43
St. F. Råprotein	g		125,57	118,01	I, calciumjodat	mg		2,12	1,99
St. Ford. lysin	g		8,41	7,90	Cu, kobber-II-sulfat	mg		7,42	6,97
St. Ford. methionin	g		2,60	2,44	Cu, kobber-(II)-aminosyrechel	mg		8,48	7,97
St. Ford. cystin	g		2,49	2,34	Mn, manganoxid	mg		29,68	27,89
St. Ford. methionin+cystin	g		5,09	4,78	Mn, mangan-(II)-aminosyrech	mg		23,32	21,92
St. Ford. treonin	g		5,38	5,06	Zn, zinksulfat	mg		47,70	44,83
St. Ford. tryptofan	g		1,63	1,53	Zn, zinkaminosyrechelate, hydra	mg		58,30	54,79
St. Ford. Leucin	g		8,91	8,37	Se, natriumselenit	mg		0,27	0,25
St. Ford. Isoleucin	g		4,92	4,62	Se, hydroxylanalog af selenome	mg		0,16	0,15
St. Ford. Histidin	g		3,09	2,91	Ronozyne HIPhos GT 4000	FYT		1.590	1.494
St. Ford. Fenylanin	g		5,84	5,49	Endox/Bianox	mg		33,13	31,13
St. Ford. Tyrosin	g		4,07	3,83	Mycifix Plus	mg		1.000,00	939,84
St. Ford. Valin	g		5,96	5,60	Ammomin	mg		5.000	4.699



Recipe 2: 118892-B VA Drægtig Fiber DT 122307 kontrol 6 % XP

Name	Klaus Noe	Tlf. / mobil	97891215 / 61366959
Adresse	Remmerstrandvej 9, Nr. Nissum, 7620 Lemvig	Email	kn@noeagro.dk

Code	Name	Pct	Mængde
37091-1	Leci E Basis V.fedt 9) M	1,195	23,900
10001-1	Byg	36,773	735,450
100014-1	Byg Knust R+B	20,000	400,000
110013-1	Hvede Knust R+B	20,000	400,000
11001-1	Hvede	1,000	20,000
37160-1	Hvedeklid blandet	4,000	80,000
39100-1	Roesnitter, tørrede, optionelle	5,000	100,000
37144-1	Sojaskrå afskal.	3,090	61,800
37145-1	Rapsskrå	6,000	120,000
37105-1	Calciumcarbonat-kalk grov	1,125	22,500
37139-1	Monocalciumfosfat 22,7 M	0,240	4,800
37116-1	Fodersalt MBR	0,480	9,600
104687-1	Magnesiumoxid 37112 25 kg RB	0,063	1,250
41205-1	L-lysin sulfat 70 55% 800 kg MBRC	0,023	0,450
105051-1	Threonin 41209 600 kg MBHRC	0,005	0,100
106739-1	Tryptofan 40% 41261 25kg B+C	0,008	0,150
41130-1	VJA Breeder 0,25 Premix 25 kg MBR	0,250	5,000
106621-1	Solvita E 50 500510 1000 kg VBRH	0,120	2,400
41374-1	Beta-key Orffa 25 kg Betain	0,030	0,600
41270-1	AmmoMin 25 kg	0,500	10,000
41294-1	Mycofix Plus BBSH - 5E - 25 kg MBHR	0,100	2,000

100,000	2.000,000
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Nutrient		Pr. kg	Pr. energi	Nutrient		Pr. kg	Pr. energi
Tørstof	%	86,16	86,16	St. ileal ford. Arginin	g	5,27	5,22
EFOS-værdi ukorr. Svin %	%	85,24	85,24	Calcium Total	g	6,56	6,50
EFOSi (Enz.f.org. stof v/Ileum %	%	75,9	75,9	Calcium	g	6,56	6,50
I-faktor	%	89,1	89,1	Fosfor	g	4,2	4,1
I-faktor m/enzymer, svin	%	92,0	92,0	Ford. fosfor, 200 % fytase	g	2,47	2,45
I-faktor m/enzymer, smågrise	%	90,4	90,4	Ford. fosfor, 300 % fytase	g	2,57	2,55
FE so ny	FEso	1,01	1,00	Ford. fosfor, 400 % fytase	g	2,61	2,59
FeSo23	FEso	1,02	1,01	Magnesium	g	1,74	1,73
FEsvin ny	FEsv	1,00	0,99	Natrium	g	1,96	1,94
Råprotein	%	11,70	11,59	Kalium	g	5,51	5,46
Råfedt	%	3,48	3,45	Klorid	g	3,91	3,87
Fedtsyre	g	30	30	Svovl	g	1,59	1,58
Råaske	%	4,79	4,74	A-vitamin, tilsat	1000 i.e	8,00	7,93
Træstof	%	4,74	4,70	D3- vitamin, tilsat	1000 i.e	0,50	0,50
Opl. fibre	g	61,81	61,25	Hy.D. 25-hydroxycholecalifero	mg	0,02	0,02
Uopl. fibre	g	167,78	166,25	E-vitamin/dl-alfa-tokoferol, tils	mg	151,00	149,63
Stivelse	g	426,08	422,20	B1-vitamin/ Thiamin, tilsat	mg	2,0	2,0
Sukker	g	30,26	29,98	B2-vitamin/Riboflavin, tilsat	mg	8,00	7,93
Lysin	g	5,19	5,15	B6-vitamin/ Pyridoxin, tilsat	mg	5,00	4,95
Methionin	g	2,0	2,0	B12-vitamin, tilsat	mg	0,04	0,04
Cystin	g	2,6	2,6	K3-vitamin, tilsat	mg	5,00	4,95
Treonin	g	4,3	4,2	D-pantotensyre, tilsat	mg	25,00	24,77
Tryptofan	g	1,57	1,56	Niacin, tilsat	mg	30,00	29,73
Valin	g	5,87	5,82	Biotin vitamin H, tilsat	mg	0,40	0,40



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Udskrevet af TOJ

Recipe 2: 118892-B VA Drægtig Fiber DT 122307 kontrol 6 % XP

Name	Klaus Noe	Tlf. / mobil	97891215 / 61366959
Adresse	Remmerstrandvej 9, Nr. Nisum, 7620 Lemvig	Email	kn@noeagro.dk

Nutrient			Pr. kg	Pr. energi	Nutrient			Pr. kg	Pr. energi
Isoleucin	g	g	4,4	4,4	Folinsyre, tilsat	mg		3,00	2,97
Leucin	g	g	8,0	7,9	Betainhydrochlorid, tilsat	mg		217,20	215,22
Histidin	g	g	2,9	2,9	Fe, jern-II-sulfat	mg		150,00	148,63
Arginin	g	g	5,3	5,2	I, calciumjodat	mg		2,00	1,98
St. F. Råprotein	g		91,05	90,22	Cu, kobber-II-sulfat	mg		7,00	6,94
St. Ford. lysin	g		4,03	4,00	Cu, kobber-(II)-aminosyrechel	mg		8,00	7,93
St. Ford. methionin	g		1,73	1,71	Mn, manganoxid	mg		28,00	27,75
St. Ford. cystin	g		2,04	2,03	Mn, mangan-(II)-aminosyrech	mg		22,00	21,80
St. Ford. methionin+cystin	g		3,77	3,74	Zn, zinksulfat	mg		45,00	44,59
St. Ford. treonin	g		3,22	3,19	Zn, zinkaminosyrechelate, hydra	mg		55,00	54,50
St. Ford. tryptofan	g		1,21	1,20	Se, natriumselenit	mg		0,25	0,25
St. Ford. Leucin	g		6,51	6,45	Se, hydroxylanalog af selenome	mg		0,15	0,15
St. Ford. Isoleucin	g		3,55	3,51	Ronozyme HIPhos GT 4000	FYT		1.500	1.486
St. Ford. Histidin	g		2,28	2,26	Endox/Bianox	mg		31,25	30,97
St. Ford. Fenylanin	g		4,36	4,32	Mycifix Plus	mg		1.000,00	990,90
St. Ford. Tyrosin	g		2,97	2,94	Ammomin	mg		5.000	4.954
St. Ford. Valin	g		4,51	4,47					



Recipe 2: 119404-B VA Drægtig Fiber DT 122307 forsøg 6 % XP

Name	Klaus Noe	Tlf. / mobil	97891215 / 61366959
Adresse	Remmerstrandvej 9, Nr. Nissum, 7620 Lemvig	Email	kn@noeagro.dk

Code	Name	Pct	Mængde
37091-1	Leci E Basis V.fedt 9) M	1,175	23,500
10001-1	Byg	37,595	751,900
100014-1	Byg Knust R+B	20,000	400,000
110013-1	Hvede Knust R+B	20,000	400,000
37160-1	Hvedeklid blandet	4,000	80,000
39100-1	Roesnitter, tørrede, optionelle	5,000	100,000
37144-1	Sojaskrå afskal.	3,295	65,900
119415-1	EP 119 - FORSØG -	6,000	120,000
37105-1	Calciumcarbonat-kalk grov	1,135	22,700
37139-1	Monocalciumfosfat 22,7 M	0,205	4,100
37116-1	Fodersalt MBR	0,470	9,400
104687-1	Magnesiumoxid 37112 25 kg RB	0,098	1,950
41205-1	L-lysin sulfat 70 55% 800 kg MBRC	0,020	0,400
105051-1	Threonin 41209 600 kg MBHRC	0,003	0,050
106739-1	Tryptofan 40% 41261 25kg B+C	0,005	0,100
41130-1	VJA Breeder 0,25 Premix 25 kg MBR	0,250	5,000
106621-1	Solvita E 50 500510 1000 kg VBRH	0,120	2,400
41374-1	Beta-key Orffa 25 kg Betain	0,030	0,600
41270-1	AmmoMin 25 kg	0,500	10,000
41294-1	Mycofix Plus BBSH - 5E - 25 kg MBHR	0,100	2,000

100,000	2.000,000
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Nutrient		Pr. kg	Pr. energi	Nutrient		Pr. kg	Pr. energi
Tørstof	%	86,16	86,16	St. ileal ford. Arginin	g	4,36	4,32
EFOS-værdi ukorr. Svin %	%	85,23	85,23	Calcium Total	g	6,56	6,50
EFOSi (Enz.f.org. stof v/Ileum %	%	76,0	76,0	Calcium	g	6,56	6,50
I-faktor	%	89,2	89,2	Fosfor	g	4,1	4,1
I-faktor m/enzymer, svin	%	91,8	91,8	Ford. fosfor, 200 % fytase	g	2,52	2,50
I-faktor m/enzymer, smågrise	%	90,2	90,2	Ford. fosfor, 300 % fytase	g	2,60	2,57
FE so ny	FEso	1,01	1,00	Ford. fosfor, 400 % fytase	g	2,63	2,60
FeSo23	FEso	1,02	1,01	Magnesium	g	1,76	1,74
FEsvin ny	FEsv	1,00	0,99	Natrium	g	1,97	1,95
Råprotein	%	11,80	11,69	Kalium	g	5,54	5,49
Råfedt	%	3,45	3,42	Klorid	g	3,85	3,81
Fedtsyre	g	30	29	Svovl	g	1,59	1,58
Råaske	%	4,76	4,71	A-vitamin, tilsat	1000 i.e	8,00	7,92
Træstof	%	4,81	4,76	D3- vitamin, tilsat	1000 i.e	0,50	0,50
Opl. fibre	g	59,46	58,90	Hy.D. 25-hydroxycholecalifero	mg	0,02	0,02
Uopl. fibre	g	153,18	151,74	E-vitamin/dl-alfa-tokoferol, tils	mg	151,00	149,58
Stivelse	g	428,21	424,19	B1-vitamin/ Thiamin, tilsat	mg	2,0	2,0
Sukker	g	27,04	26,79	B2-vitamin/Riboflavin, tilsat	mg	8,00	7,92
Lysin	g	5,19	5,14	B6-vitamin/ Pyridoxin, tilsat	mg	5,00	4,95
Methionin	g	2,0	2,0	B12-vitamin, tilsat	mg	0,04	0,04
Cystin	g	2,6	2,6	K3-vitamin, tilsat	mg	5,00	4,95
Treonin	g	4,3	4,2	D-pantotensyre, tilsat	mg	25,00	24,77
Tryptofan	g	1,57	1,56	Niacin, tilsat	mg	30,00	29,72
Valin	g	5,81	5,75	Biotin vitamin H, tilsat	mg	0,40	0,40
Isoleucin	g	4,3	4,3	Folinsyre, tilsat	mg	3,00	2,97



Info

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Udskrevet af TOJ

Recipe 2: 119404-B VA Drægtig Fiber DT 122307 forsøg 6 % XP

Name	Klaus Noe	Tlf. / mobil	97891215 / 61366959
Adresse	Remmerstrandvej 9, Nr. Nisum, 7620 Lemvig	Email	kn@noeagro.dk

Nutrient			Pr. kg	Pr. energi	Nutrient			Pr. kg	Pr. energi
Leucin	g	g	8,0	7,9	Betainhydrochlorid, tilsat	mg		217,20	215,16
Histidin	g	g	2,9	2,9	Fe, jern-II-sulfat	mg		150,00	148,59
Arginin	g	g	5,3	5,3	I, calciumjodat	mg		2,00	1,98
St. F. Råprotein	g		92,48	91,61	Cu, kobber-II-sulfat	mg		7,00	6,93
St. Ford. lysin	g		4,03	3,99	Cu, kobber-(II)-aminosyrechel	mg		8,00	7,92
St. Ford. methionin	g		1,72	1,70	Mn, manganoxid	mg		28,00	27,74
St. Ford. cystin	g		2,10	2,08	Mn, mangan-(II)-aminosyrech	mg		22,00	21,79
St. Ford. methionin+cystin	g		3,82	3,78	Zn, zinksulfat	mg		45,00	44,58
St. Ford. treonin	g		3,22	3,19	Zn, zinkaminosyrechelate, hydra	mg		55,00	54,48
St. Ford. tryptofan	g		1,23	1,22	Se, natriumselenit	mg		0,25	0,25
St. Ford. Leucin	g		6,47	6,41	Se, hydroxylanalog af selenome	mg		0,15	0,15
St. Ford. Isoleucin	g		3,47	3,43	Ronozyme HIPhos GT 4000	FYT		1.500	1.486
St. Ford. Histidin	g		2,30	2,28	Endox/Bianox	mg		31,25	30,96
St. Ford. Fenylanin	g		4,40	4,36	Mycifix Plus	mg		1.000,00	990,62
St. Ford. Tyrosin	g		2,94	2,91	Ammomin	mg		5.000	4.953
St. Ford. Valin	g		4,48	4,44					



Appendix 4. Definitions of clinical variables used in the Focal-I and the Focal-II study of D.4.6, SeaMark

Variables	Unit or categorization	Deskription
Clinical		
Rectal temperature	Degrees of Celsius	Measured on Day F (Fever $\geq 39.5^{\circ}$ C) by use of KRUUSE DIGI-TEMP Digital Thermometer (Jørgen Kruuse A/S, Langeskov, Denmark)
Mammary edema	0, 1, 2 or 3	0) There is no change in color from red to white in the skin and no pasty skin that leaves an impression after a finger press; 1) A color change from red to white is seen in the skin after pressing with a finger; 2) A color change from red to white is seen in the skin together with a pasty skin that leaves an impression after a finger is pressed; 3) Pasty skin is seen that leaves an impression after pressing with a finger, but there is no change in the color of the skin.
Feces score*	0, 1, 2, 3, 4 or 5	Assessed on Day F. 0) Absence of feces; 1) Dry and pellet shaped; 2) Between dry and normal; 3) Normal and soft, but solid and well-formed; 4) Between normal and wet, still formed but not solid; 5) Very wet feces, unformed and liquid
Ulcer(s)	Yes/No	One or more ulcers (≥ 5 cm $\varnothing$) including all kinds of non-healed wounds in dermis or cutis on the body
Abscess	Yes/No	One or more abscess (≥ 5 cm $\varnothing$) on the body
Vulva trauma	Yes/No	A trauma including any kind of non-healed wounds in dermis or cutis. (≥ 2 cm $\varnothing$)
Lameness	1, 2, 3, 4 or 5	1) The sow gets up easily without any signs of pain. All four legs support the body; 2) The sow gets up easily when she is fat, but continually takes small restless steps; 3) The sow only uses one leg slightly to support the body weight; 4) The sow does not use one leg to support the body weight; 5) The sow refuses to get up due to pain in the leg(s)

* Slightly simplified from Oliviero et al., 2009. Feeding sows with high fiber diet around farrowing and early lactation: Impact on intestinal activity, energy balance related parameters and litter performance. Research in veterinary science, 86, 314-319.

Appendix 5

Results from SeaMark WP4

Leslie Foldager^{1,2}

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Abbreviations for variables

ADG	Average daily weight gain
Aid	Farrowing aid / farrowing intervention
AntalDayF	Number pigs in the litter after equalisation
AntalDayW	Number of pigs at weaning
AntalDod	Number pigs dying between farrowing and weaning
CRP	C-reactive protein in serum
DayFlyt	Insertion in the farrowing unit
DayW	From insertion in the farrowing unit until 27 days later
DodF	Number of stillborn piglets
Edema	Udder oedema
FecesD1	Faeces score for sows on DayF
FoderFor	Feed usage
HuldScLoss	Average loss of backfat per day from DayF to DayW
HuldSc1	Backfat thickness DayF
HuldSc2	Backfat thickness DayW
IgA	Immunoglobulin A in colostrum
IgG	Immunoglobulin G in colostrum
KgDayF	Total litter weight after equalisation on DayF
KgDod	Total weight of dead piglets in a litter
LevF	Number of liveborn piglets
MedAB	Use of antibiotics in sows
MedDiarr	Number of times litters were treated with AB due to diarrhoea
Temp	Rectal temperature after farrowing
TNF- α	Tumor necrosis factor alpha in serum
TotF	Total number of piglets born
UA	Uric acid in colostrum

Material

Data and exclusions

One **Focal-2** sow noted as LY, was excluded. Two sows (one Focal-2 and one Multiparity (**MultiPar**)) being second parity **DanBred** as all other DanBred sows were of parity 5 or later. After exclusions, 437 sows were available with an almost 50/50 split regarding the main factor of interest, namely whether the sow had been exposed to the feed additive EP119 (**EXP**) or not (**CON**); N = 207 (47%) and 230 (53%), respectively. Regarding breed, there were 76 DanBred and 361 Topigs Norsvin TN70 (**TN70**). There were 39 **Focal-1** sows; 16 (41%) EXP and 23 (59%) CON. There were 141 Focal-2 sows; 67 (48%) EXP and 74 (52%) CON. Focal-2 and MultiPar combined consisted of 398 sows; 191 (48%) EXP and 207 (52%) CON. We will refer to this combined sample as **Focal-2-MP**.

Ulcer was seen in 3 sows: one DanBred CON sow in parity 8, one TN70 CON sow in parity 3, and one TN70 EXP sow in parity 6. Vulvular trauma was observed in 2 sows: one DanBred CON sow in parity 6 and one TN70 EXP sow in parity 3. Abscess was not observed. Ulcer, Vulvular trauma and Abscess were missing for 262 sows. The lameness score was 0 for six sows (1 CON and 5 EXP), 2 for two EXP sows, and 1 for the rest.

Analysis strategy

Focal groups and multiparous sows

Data from Focal-1 (3rd parity TN70 sows) will be analysed separately.

Data from Focal-2 (multiple parities and both TN70 and DanBred sows) will be pooled with MultiPar (multiple parities and both TN70 and DanBred, but only data from Cloudfarms) for analyses when meaningful (= data available from both studies) and otherwise separately (for responses and explanatory variables not available for all sows/litters = only available for Focal-2 sows/litters).

Primary explanatory variable

The main factor of interest was the dichotomous case-control status, i.e. whether the sow had been exposed to the feed additive EP119 (case group referred to as **EXP**) or not (control group, **CON**).

Secondary explanatory variables

Breed ("**Race**": TN70 vs DanBred) and parity ("**Parity**": 2, 3, ..., 9) were included as secondary explanatory variables. These were, however, not varying for Focal-1 sows (all of which were TN70 of 3rd parity) and were partly confounded for Focal-2/MultiPar sows as all DanBred sows were of parity 5 or older, while the TN70 sows were of parity 2, 3, ..., 6. To include effect of parity in addition to breed, parity was therefore mean-centred within breed (by subtraction of the average parity within breed), hereafter referred to as **ParCent**.

Farrowing happened from 21 September to 9 November 2024. Data was split up in six week groups (“**Ugehold**”), denoted 22, 23, 24, 26, 27 and 28 (not week of year!) decided from expected farrowing date but with some overlap between groups regarding actual date of farrowing. There were 77, 72, 75, 80, 69 and 64 sows in these week groups, respectively. In addition to the date aspect (though over a relatively short period), Ugehold was partly confounded with section/barn (“**Stald**”). Most barns/sections were only used for one of the week groups with exception of Stald 1 which were used for four of the groups as this barn was much larger. Each week group was mostly distributed in two sections/barns, and it was therefore decided to include Ugehold as either a random or fixed effect, and disregard Stald.

For the Focal-1 part, week groups had to be combined to avoid spending too many degrees of freedom if included as fixed effect. This was done by combining week groups 22, 23 and 24 as group 1, and week groups 26, 27 and 28 as group 2. This grouping will be referred to as **WeekGrp2** in results. This grouping has the nice, derived effect of getting an equal number of cases (N = 8) in both week groups and almost equally many controls (N = 12 and N = 11 in group 1 and 2, respectively).

The barn/section and pen number within barn/section was known for 75% of the sows but will not be included as each (known) pen was only used once (70%) or twice (30%).

Responses as explanatory variables

Variables examined as response of the exposure will not be examined as explanatory variables though some correlation might be expected. Nevertheless, some adjustment was reasonable, e.g., to adjust feed intake for the litter size at weaning and to adjust (by use of offset) number of liveborn and stillborn by the total number of piglets that was born.

Statistical analyses

Statistical analyses were carried out using the software R v. 4.3.0 (<https://www.R-project.org/>) at a significance level of 0.05.

For continuous response variables, linear mixed effects models (**LME**) were fitted by use of the function *lme* from the R package *nlme* v. 3.1-162. Testing of variance heterogeneity were carried out using *anova* from the R base package *stats* after restricted maximum likelihood estimation (**REML**). The effects of the primary explanatory variable (case-control) were assessed by F-tests using the *joint_tests* function from the *emmeans* package v. 1.8.5, which also include functions used for calculation of estimated marginal means (**EM-means**; aka least squares means), standard errors (**SE**) and post hoc comparisons (differences) with 95% confidence intervals (**CI**); *emmeans* and *pairs*. Degrees of freedom (**df**) for t-tests (post hoc differences) and for the denominator df in F-tests were determined by Satterthwaite approximation.

For dichotomous (0/1) variables, binomial generalized linear mixed effects models (**GLMM**) with logit link (mixed effect logistic regressions) were carried out using *glmer* from the *lme* v. 1.1-33 package. The effects of the case-control variable were assessed by likelihood ratio

tests using the *anova* function from the base *stats* package. Using the same setup, Poisson GLMMs with log link were fitted for count responses, including a log-offset when relevant.

When the random effect of week group could not be included, normal linear models (LM) or generalized linear models (**GLM**) were instead fitted. For LM the denominator df is not determined by the Satterthwaite approximation. Checking for variance heterogeneity in the LM setup were done by generalised least squares (**GLS**) estimation using the *gls* function from *nlme*. When log-transformation was needed to not reject the assumption of normal distribution, estimates were back-transformed, and the mean then have interpretation as a median. The standard errors were backtransformed by the Delta method (implemented in *emmeans*).

Ordinal response (ordered categories with more than 2 levels; e.g., faeces scores) were dichotomized or analysed by either ordinal (proportional odds), partial proportional odds, or nominal (multinomial) logistic regression. Ordinal models with and without random effects were fitted with the *clmm* and *clm* functions, respectively, from the ordinal package v. 2022.11-16. The proportionality assumption was examined in models without random effects by the *nominal_test* function from *ordinal*. Multinomial model without random effects were estimated by use of the *multinom* function (via neural networks) from the *nnet* package v. 7.3-18.

For the inflammatory marker **TNF- α** a quite high number of observations below the detection limit were found and three sets of models were therefore run: 1) mixed effects logistic regression with being below detection limit as positive response (0/1; 0 = above, 1 = below)); 2) mixed effects model on (log-transformed) values above detection limit (i.e., omitting observations below detection limit; and 3) log-Gaussian Tobit regression with left censoring at the detection limit (with a value arbitrarily set to 15.6, which is half of the lowest value of the standard curve) with robust variances computed with groups defined by Ugehold. The Tobit regression was done by use of the *survreg* and *Surv* functions from the *survival* package v. 3.5-5.

For Focal-1, the initial models included case-control status as fixed effect and either week group as random effect or WeekGrp2 as fixed effect.

For Focal-2 alone or in combination with the other multiparity sows (MultiPar), the initial the models included case-control status, breed (categorical), mean-centred parity (ParCent; continuous) and the interaction between breed and ParCent as fixed effects, and week group as random effect or fixed effect. As noted, breed and parity are partly confounded and were not examined as such in these models. To further investigate breed differences, models may later be run within parity groups 5 and 6 (as these were present for both breeds) with parity as a categorical factor and including the two-way interaction between parity and breed. Likewise, to examine effect of parity, models were run on TN70 sows alone.

Results

Number of liveborn piglets (LevF; integer)

Number of liveborn piglets as registered by the farmer (in Cloudfarms). Hypothesis: EXP sows farrow more liveborn piglets than CON sows.

LevF in Focal-1 sows

The counts of liveborn piglets were from 7 to 21 in CON sows and from 14 to 20 in EXP sows. The quartiles were, however, the same in both groups, with 14, 16 and 18 being the lower quartile, median and upper quartile, respectively, both in CON and EXP sows. It was not possible to include week group as random effect, so WeekGrp2 was included as a fixed effect in a Poisson GLM with $\log(\text{TotF})$ as offset, i.e. the natural logarithm of the total number of piglets born by the sow ($\text{TotF} = \text{LevF} + \text{DodF}$). There was no effect of case-control status ($\chi^2_1 = 0.02$, $p = 0.90$) and the rate ratio was 0.99 (SE = 0.081; 95% CI: 0.84 – 1.2) for EXP vs CON.

LevF in Focal-2-MP sows

The counts of liveborn piglets were from 4 to 22 in CON sows and from 6 to 22 in EXP sows. The quartiles were, however, almost the same in both groups, with the lower quartile being 14 and 15 in CON and EXP sows, respectively, whereas the median and upper quartile were the same in both groups: 16 and 18, respectively. It was not possible to include week group as random effect, so it was included as a fixed effect in a Poisson GLM with $\log(\text{TotF})$ as offset. There was no effect of case-control status ($\chi^2_1 < 0.01$, $p = 0.98$) and the rate ratio was 1.0 (SE = 0.025; 95% CI: 0.95 – 1.1) for EXP vs CON.

Number of stillborn piglets (DodF; integer)

Number of stillborn piglets as registered by the farmer (in Cloudfarms). Hypothesis: EXP sows farrow fewer stillborn piglets than CON sows.

DodF in Focal-1 sows

The counts of stillborn piglets were 0, 1 or 2 both in CON and in EXP sows. The number of farrowing with no stillborn piglets (registered) were 18 (78%) and 10 (63%) in CON and EXP sows, respectively. A single stillborn was observed in 4 (17%) and 5 (31%) cases, while two stillborn piglets were seen for 1 farrowing in both groups (4% and 6%). Thus, numerically the observed proportions of stillborn piglets are in the opposite direction of the hypothesis. Fisher's exact test indicate that these differences are not significant ($p = 0.62$).

It was not possible to include week group as random effect, so WeekGrp2 was included as a fixed effect in a Poisson GLM with $\log(\text{TotF})$ as offset. There was no effect of case-control status ($\chi^2_1 = 0.79$, $p = 0.38$) and the rate ratio was 0.61 (SE = 0.340; 95% CI: 0.21 – 1.8) for CON vs EXP.

Considering instead the derived response of any stillborn (0/1), the corresponding odds ratio from the logistic regression was 0.45 (SE = 0.328; 95% CI: 0.11 – 1.9); obviously also with no indication of a difference ($\chi^2_1 = 1.22$, $p = 0.27$).

DodF in Focal-2-MP sows

The counts of stillborn piglets were 0 to 8 in CON and 0 to 7 in EXP sows. The number of farrowing with no stillborn piglets (registered) were 101 (49%) and 91 (48%) in CON and EXP sows, respectively. A single stillborn was observed in 51 (25%) and 54 (28%) cases, two stillborn piglets were seen for 36 (17%) and 27 (14%) cases, while three or more were observed in the remaining 19 cases (9% and 10%).

It was here possible to include week group as random effect in a Poisson GLM with $\log(\text{TotF})$ as offset. There was no effect of case-control status ($\chi^2_1 = 0.01$, $p = 0.94$) and the rate ratio was 1.0 (SE = 0.10; 95% CI: 0.82 – 1.2) for CON vs EXP.

Considering instead the derived response of any stillborn (0/1), the corresponding odds ratio from the mixed effects logistic regression was 0.87 (SE = 0.191; 95% CI: 0.56 – 1.3); obviously also with no indication of a difference ($\chi^2_1 = 0.41$, $p = 0.52$).

Total number of piglets born (TotF; integer)

The total number of piglets born (LevF + DodF) as registered by the farmer (in Cloudfarms). Hypothesis: EXP sows farrow more piglets than CON sows.

TotF in Focal-1 sows

The total counts of piglets born were from 7 to 22 in CON sows and from 14 to 22 in EXP sows. The quartiles were, however, almost the same in both groups, with 14 and 18 being the lower and upper quartiles in both groups while the median was 16 in CON and 16.5 in EXP sows. It was not possible to include week group as random effect, so WeekGrp2 was included as a fixed effect in the Poisson GLM. There was no effect of case-control status ($\chi^2_1 = 0.31$, $p = 0.58$) and the rate ratio was 1.0 (SE = 0.084; 95% CI: 0.89 – 1.2) for EXP vs CON.

TotF in Focal-2-MP sows

The total counts of piglets born were from 4 to 25 in CON sows and from 6 to 24 in EXP sows. The quartiles were the same in both groups, with 15, 17 and 19 being the lower quartile, median and upper quartile in both groups. It was not possible to include week group as random effect, so it was included as a fixed effect in a Poisson GLM. There was no effect of case-control status ($\chi^2_1 = 0.42$, $p = 0.52$) and the rate ratio was 1.0 (SE = 0.025; 95% CI: 0.97 – 1.1) for EXP vs CON.

Feed usage from DayFlyt to DayW (FoderFor; kg)

The feed usage was noted by the farmer/staff on a form from insertion in the farrowing barn (DayFlyt; -2 to 10 days from farrowing) and until 27 days later (DayW), close to weaning.

Hypothesis: EXP sows have a lower feed usage than CON sows. Other hypotheses may also be reasonable, e.g., that the feed usage is the same in both groups, however with EXP losing less body mass as an indication of a better feed conversion ratio. Taste could be another reason for differences in FoderFor.

FoderFor in Focal-1 sows

Here the random effect of week group could be included. The feed usage did not differ between CON and EXP ($F_{1,36.8} = 0.26$, $p = 0.61$) and was estimated to be 160 (SE = 2.5; 95% CI: 155 – 165) kg in CON and 158 (SE = 2.9; 95% CI: 152 – 164) kg in EXP; corresponding to a 2 kg higher average feed usage in CON compared to EXP (SE = 3.5; CI: -5 to 9) kg, i.e., in the other direction than hypothesised.

FoderFor in Focal-2-MP sows

FoderFor was missing for 105 sows, 52 CON (25%) and 53 EXP (28%). Here the random effect of week group could be included. The feed usage did not differ between CON and EXP ($F_{1,284.2} = 0.67$, $p = 0.41$) and was estimated to be 161 (SE = 2.1; 95% CI: 156 – 166) kg in CON and 162 (SE = 2.1; 95% CI: 157 – 167) kg in EXP; corresponding to a 1 kg higher average feed usage in EXP compared to CON (SE = 0.127; CI: -0.16 to 0.36).

Use of antibiotics in sows (MedAB; 0/1)

Data from Cloudfarms (registered by the farmer). Hypothesis: EXP sows are treated less often with antibiotics than CON sows.

MedAB in Focal-1 sows

In total five sows were noted to have used AB, one EXP and four CON; resulting in observed proportions of AB to be 0.0625 in EXP and 0.1739 in CON. Inclusion of week group as random effect was not possible and thus WeekGrp2 was included as a fixed effect in a GLM. Odds ratio of CON vs EXP was 1.5 (SE = 0.42; 95% CI: 0.84 – 2.6) with no significant difference found ($\chi^2_1 = 1.08$, $p = 0.30$).

MedAB in Focal-2 + MultiPar sows

In total 56 sows were noted to have used AB, 33 CON (16%) and 23 EXP (12%). Inclusion of week group as random effect in the mixed effects logistic regression was possible, there was no difference between CON and EXP ($\chi^2_1 = 1.17$, $p = 0.28$), and the odds ratio of CON vs EXP was 1.4 (SE = 0.41, 95% CI: 0.77 – 2.5).

Number pigs dying between farrowing and weaning (AntalDod; integer)

Number pigs dying between farrowing and the (approximate) day of weaning as registered by the farmer/staff. Hypothesis: fewer pigs from EXP sows die until weaning than from CON sows.

AntalDod in Focal-1 litters

The counts of pigs dying were 0, 1, 2 or 3 for CON and 0, 1 or 2 for EXP. This observation was missing for 2 EXP sows. The number of sows where no pigs were (registered) dead were 5 (22%) and 3 (21%) in the CON and EXP groups, respectively. Fisher's exact test indicated that there was no difference in the two by four contingency table ($p = 0.62$), tabulating number of dead (0, 1, 2 or 3) against case-control status.

In the Poisson regressions it seemed reasonable to use the logarithm of the litter size at farrowing after equalisation as offset, given by $\log(\text{AntalDayF})$. AntalDayF was missing for 3 sows (in addition to the 2 also missing AntalDod) and for these we simply used the number of pigs dying (AntalDod) plus the number of pigs at weaning (AntalDayW). The two sows missing AntalDod had to be left out from this analysis, which thus was based on 37 sows: 23 CON and 14 EXP.

It was not possible to include week group as random effect, so WeekGrp2 was included as a fixed effect in a Poisson GLM with $\log(\text{AntalDayF})$ as offset. There was no effect of case-control status ($\chi^2_1 = 0.20$, $p = 0.65$) and the rate ratio was 1.2 (SE = 0.399; 95% CI: 0.60 – 2.3) for CON vs EXP.

AntalDod in Focal-2 litters

The counts of pigs dying were between 0 and 3 for CON and 0 to 4 for EXP litters, and a larger proportion of EXP (32%) than CON litters (19%) had zero pigs dying between farrowing (after equalising), DayF, and weaning, DayW. The corresponding percentages of litters with 1, 2, 3 and 4 dead pigs were 42%, 28%, 11% and 0% for CON, and 35%, 26%, 5% and 2% for EXP. The number of dead pigs were unknown (missing) for 4 litters, two (3%) from each of the case-control groups. Fisher's exact test indicated that there was no significant difference in the two by five contingency table ($p = 0.22$), tabulating number of dead (0, 1, 2, 3 or 4) against case-control status.

In the Poisson regressions it seemed reasonable to use the logarithm of the litter size at farrowing after equalisation as offset, given by $\log(\text{AntalDayF})$. AntalDayF was missing for 12 litters (7 CON and 5 EXP) among those not missing AntalDod, and for 1 CON of these, AntalDayW was also missing. For the remaining 11 missing AntalDayF, we simply used the number of pigs dying (AntalDod) plus the number of pigs at weaning (AntalDayW). Thus, in total 5 litters were left out from this analysis, which thus was based on 137 sows: 71 CON and 65 EXP.

Week group could be included as random effect in the Poisson GLMM with $\log(\text{AntalDayF})$ as offset. There was no effect of case-control status ($\chi^2_1 = 1.18$, $p = 0.28$) and the rate ratio was 1.2 (SE = 0.191; 95% CI: 0.87 – 1.6) for CON vs EXP.

Number pigs at weaning (AntalDayW; integer)

Number pigs that were weaned. Hypothesis: EXP sows will have more pigs at weaning than CON sows.

AntalDayW in Focal-1 litters

AntalDayW was missing for 2 sows, and these had to be left out of the analysis. The counts of pigs being weaned were 12 (only 2), 13 (only 2), 14 or 15 for CON sows and 13 (only 1), 14 or 15 for EXP sows. There were some structural changes over week groups with equalised litter size of 16 with one exception only used in the first 2 week groups, and litter size of 15 with one exception only used in the last 4 week groups. These changes were also evidently seen in the AntalDayW counts. Fisher's exact test of the two by four contingency table did not suggest the distribution on the four observed litter sizes at weaning to differ between CON and EXP ($p = 0.59$).

It seemed sensible to use $\log(\text{AntalDayF})$ as an offset in the Poisson regression, with the 3 missing values filled in as explained in the AntalDod analysis. It was not possible to include week group as random effect, so WeekGrp2 was included as a fixed effect. There was no effect of case-control status ($\chi^2_1 = 0.07$, $p = 0.78$) and the rate ratio was 1.0 (SE = 0.092; 95% CI: 0.86 – 1.2) for EXP vs CON. The distribution was probably on the edge of being Poisson (though a goodness of fit test did not reject this) so changing to logistic regression was also examined by comparing the litter size of 15 at weaning to the three other observed sizes (12, 13 and 14) combined. For the CON group there was an equal proportion of sows with smaller (12, 13 or 14) and larger (15) litter size at weaning; the counts being 12 (52%) and 11 (48%), respectively. For EXP sows there were 9 (64%) and 5 (36%). The difference was not significant ($\chi^2_1 = 1.23$, $p = 0.27$) and the odds ratio of having a smaller litter size at weaning was 2.6 (SE = 2.30; 95% CI: 0.46 – 14.7) for EXP vs CON, i.e. against the hypothesis but not significant.

AntalDayW in Focal-2 litters

AntalDayW was missing for 7 litters (3 CON and 4 EXP) and these were therefore left out of the analysis. The counts of pigs being weaned were between 10 and 16 for CON litters and 11 to 16 for EXP. Fisher's exact test of the two by seven contingency table did not suggest the distribution on the seven observed litter sizes at weaning to differ between CON and EXP ($p = 0.89$).

It seemed sensible to use $\log(\text{AntalDayF})$ as an offset in the Poisson regression, with the 11 missing values filled in as explained in the AntalDod analysis. It was not possible to include week group as random effect, so it was included as a fixed effect. There was no effect of case-control status ($\chi^2_1 < 0.01$, $p = 0.97$) and the rate ratio was 1.0 (SE = 0.048; 95% CI: 0.91 – 1.1) for EXP vs CON.

Total litter weight at weaning (DayW) incl. dead pigs (KgDayW + KgDod; kg)

The litter (total) was weighed (KgDayW) at the (approximate) day of weaning (DayW) and the weight of pigs dying between DayF and DayW (KgDod) was added. Hypothesis: EXP litters have a larger total weight at weaning (incl. weight of pigs dying) than CON litters.

KgDayW + KgDod in Focal-1 litters

The random effect of week group could be included for this analysis. The total weight was missing for three litters (all being from EXP sows). For one of these the KgDayW was not missing but KgDod was, and there were 2 pigs dying between DayF and DayW. The litter weight did not differ between CON and EXP ($F_{1,33.6} = 0.27$, $p = 0.60$) and was estimated to be 94.8 (SE = 2.87; 95% CI: 88.2 – 101) kg in CON and 92.6 (SE = 3.63; 95% CI: 84.9 – 100) kg in EXP; corresponding to a 2.2 kg higher litter weight in CON compared to EXP (SE = 4.25; CI: -6.4 to 10.9). That is, numerically the direction of the difference was opposite to what we hypothesised.

KgDayW + KgDod in Focal-2 litters

The random effect of week group could be included for this analysis. The total weight was missing for six litters (2 CON and 4 EXP). The average litter weight was significantly higher for CON than EXP litters ($F_{1,127.9} = 5.97$, $p = 0.016$), i.e. in the opposite direction than that hypothesised. The mean litter weight was estimated to be 91.1 (SE = 1.84; 95% CI: 87.0 – 95.2) kg in CON and 86.8 (SE = 1.90; 95% CI: 82.6 – 90.9) kg in EXP; corresponding to a 4.3 kg higher litter weight in CON compared to EXP (SE = 4.28; CI: 0.8 to 7.7).

Average daily weight gain (ADG) from DayF to DayW of piglets (calculated; g/day)

ADG was calculated as the difference between (KgDayW + KgDod) / (AntalDayW + AntalDod) and KgDayF/AntalDayF, divided by the number of days between DayF and DayW. Hypothesis: piglets from EXP sows have a larger ADG than those from CON sows.

ADG of piglets in Focal-1 litters

The random effect of week group could not be included and the ADG was missing for six litters (2 CON and 4 EXP); 3 due to missing information on DayF and 3 due to missing information on DayW. One litter with relatively large ADG of 408 g/day made the normal distributional assumption perhaps questionable, but results were almost the same without this observation, and also after log-transformation. With the relatively small sample size in mind, we decided to keep this observation and run the analysis without transformation. The piglet ADG did not differ between CON and EXP ($F_{1,30} = 2.25$, $p = 0.14$) and was estimated to be 258 (SE = 9.6; 95% CI: 239 – 278) g/day in CON and 234 (SE = 12.7; 95% CI: 208 – 260) g/day in EXP; corresponding to a 24 g/day higher ADG in CON compared to EXP (SE = 16.0; CI: -9 to 57).

ADG of piglets in Focal-2 litters

The ADG was very extreme for one of the CON litters, piglets having an average ADG of 508 g/day where other litters were between 167 og 391 g/day. We decided to exclude this from analyses, which still had to be log-transformed to not reject the assumption of normal distribution. The random effect of week group could not be included, and week group was therefore included as a fixed effect. The ADG was missing for 18 litters (9 CON and 9 EXP). The piglet ADG differed between CON and EXP ($F_{1,112} = 5.58$, $p = 0.020$) and was estimated to be 270 (SE = 6.9; 95% CI: 256 – 284) g/day in CON and 251 (SE = 6.3; 95% CI: 239 – 264) g/day in EXP; corresponding to a ratio between the means (back-transformation

of log differences) of 1.07 for CON compared to EXP (SE = 0.033; CI: 1.01 to 1.14). Thus, significantly in the opposite direction of the hypothesis.

Number of times litters were treated with AB due to diarrhoea (MedDiarr; integer)

Data registered by the farmer/staff after instruction by project leader. The number of AB treatments of a litter due to diarrhoea from DayF to DayW was registered. Hypothesis: litters from EXP sows are treated more often with antibiotics due to diarrhoea than litters from CON sows.

MedDiarr in Focal-1 sows

Treatment happened once in 4 litters, in 3 (13% of) CON litters and 1 EXP (7%). Eleven litters were treated twice, 7 CON (30%) and 4 EXP (29%), whereas 22 litters remained untreated; 13 CON (57%) and 9 EXP (64%). The information was missing for 2 litters (both EXP), which were not included for calculation of the percentages above. According to Fisher's exact test, these proportions do not differ significantly between EXP and CON ($p > 0.99$). For three of the week groups (22, 24 and 27), none of the litters were treated. In the last week group all litters were treated once (3 litters) or twice (2 litters). Considering the equivalent proportions in EXP and CON that were treated twice, the response was changed to 0/1, i.e. not treated or treated.

Inclusion of week group as random effect was not reasonable due to the lack of variation within many week groups (i.e. none or all treated) and thus WeekGrp2 was included as fixed effect in the logistic regression. Odds ratio of EXP vs CON was 0.75 (SE = 0.535; 95% CI: 0.18 – 3.0) and the direction was thus opposite that hypothesised but not significantly ($\chi^2_1 = 0.17$, $p = 0.68$).

MedDiarr in Focal-2 sows

Treatment happened once in 9 (13%) of CON and 10 (15%) of EXP litters, while respectively 7 (10%) and 11 (17%) of CON and EXP litters were treated twice. The rest were untreated; 56 CON (78%) and 44 EXP (68%). The information was missing for 4 litters (2 CON and 2 EXP), which were not included for calculation of the percentages above. According to Fisher's exact test, these proportions do not differ significantly between EXP and CON ($p = 0.39$). The proportion of litters being treated at least once varied from 0 to 78% across week groups. To simplify analysis, the response was changed to 0/1, i.e. not treated or treated (once or twice).

Inclusion of week group was not reasonable due to zero or very few cases of treated litters in some weeks. Therefore, WeekGrp2 was included as fixed effect in the logistic regression. Odds ratio of EXP vs CON was 1.9 (SE = 0.75; 95% CI: 0.85 – 4.1) and the direction was thus as hypothesised but not significantly ($\chi^2_1 = 2.45$, $p = 0.12$).

Considering instead an ordinal logistic regression, the proportionality was rejected for WeekGrp2 (and week group) and a partial proportional odds model with WeekGrp2 as nominal, was therefore fitted. From this model an odds ratio of EXP vs CON of 1.9 for being

treated more times with AB due to diarrhoea vs fewer times was found (95% CI: 0.86 – 4.1), i.e. in the hypothesised direction but not significantly ($\chi^2_1 = 2.50$, $p = 0.11$).

Farrowing aid (Aid; 0/1)

Registered by the farmer. Hypothesis: Aid is given to EXP sows less often than to CON sows.

Aid to Focal-1 sows

Aid was given to 15 CON (65%) and 5 EXP (45%) sows and was not noted for five sows. Inclusion of week group as random effect was not possible and thus WeekGrp2 was included as fixed effect in GLM. Odds ratio of CON vs EXP was 2.2 (SE = 1.66; 95% CI: 0.50 – 9.6) but the difference was not significant ($\chi^2_1 = 1.12$, $p = 0.29$).

Aid to Focal-2-MP sows

The information on aid was missing for 184 of the sows, and the analysis was therefore only considering 214 sows; 119 CON and 95 EXP, of which 66 CON (55%) and 61 EXP (64%) were registered to have been given farrowing aid. The missingness was not at random but highly week group dependent with Focal-2 sows mainly missing from week group 24 whereas MultiPar mainly was non-missing in week groups 22, 23, and partly week 24, while completely missing (except from one) in the last three week groups. As evident from the proportions, the trend was towards higher odds of getting aid for EXP than CON sows though not statistically significant ($\chi^2_1 = 3.26$, $p = 0.071$), and the EXP vs CON odds ratio was 1.7 (SE = 0.53; 95% CI: 0.95 – 3.1), i.e. in the other direction than hypothesised.

Average loss of backfat per day from DayF to DayW, HuldScLoss (calculated; mm/day)

HuldScLoss was calculated as HuldSc1 – HuldSc2 divided by the number of days from DayF to DayW, i.e. the average change in backfat per day from farrowing to weaning. Hypothesis: EXP have a lower HuldScLoss than to CON sows from DayF to DayW.

HuldScLoss in Focal-1 sows

The random effect of week group could not be included for this analysis and WeekGrp2 was instead used as a fixed effect. In addition, the analysis was adjusted for the within case-control group centred backfat thickness at DayF. HuldScLoss was not different between EXP and CON ($F_{1,35} = 0.46$, $p = 0.50$) and was estimated to be 0.18 (SE = 0.015; 95% CI: 0.15 – 0.21) mm/day in CON and 0.16 (SE = 0.018; 95% CI: 0.13 – 0.20) mm/day in EXP; corresponding to a 0.02 mm/day less loss in EXP compared to CON sows (SE = 0.024; CI: - 0.03 to 0.06) mm/day.

HuldScLoss in Focal-2-MP sows

As noted above, change in body condition scoring was unavailable for 116 sows. The random effect of week group could not be included for this analysis and was instead used as a fixed effect. In addition, the analysis was adjusted for the within case-control group centred backfat thickness at DayF. The average HuldScLoss was 0.12 in CON sows (SE = 0.008; 95% CI: 0.10 – 0.14) mm/day and 0.10 in EXP sows (SE = 0.008; 95% CI: 0.08 – 0.12) mm/day, corresponding to a 0.02 (SE = 0.010; 95% CI: 0.00 – 0.04) mm/day larger loss for CON sows being on the edge of significance ($F_{1,271} = 3.79$, $p = 0.053$).

Udder oedema on DayF (Edema; score 0, 1, 2 or 3)

Hypothesis: after farrowing (on DayF) Edema score 2 or 3 is less common in EXP sows than in CON sows. On DayF, Edema score is less common in EXP sows than in CON sows.

Edema in Focal-1 sows

Edema score 3 was not used, one EXP sow had score 2, three CON sows (14%) and one EXP sow (8%) had score 0, and the remaining 18 CON sows (86%) and 11 EXP sows (85%) had score 1. The score was missing for 5 sows, two CON and three EXP. Comparing score 2 or 3 against score 0 or 1 could only meaningfully be done by Fisher's exact test, which did not indicate any difference between EXP and CON ($p = 0.38$). Moreover, since score 2 (or 3) was observed only in EXP, though just once, the hypothesis was not supported in the Focal-1 part. Pooling score 1 and 2 (and 3) also indicated a higher proportion of score 1 and 2 in EXP (92%) than in CON (86%) so this part of the hypothesis was also not supported. Fisher's exact test again did not indicate a difference between EXP and CON ($p > 0.99$), and neither did the logistic regression with case-control status and WeekGrp2 as explanatory factors ($\chi^2_1 = 0.17$, $p = 0.68$). Odds ratio of CON vs EXP was 0.45 (SE = 0.560; 95% CI: 0.04 – 5.1).

Edema in Focal-2 sows

Edema score 1 was by far the most common with 58 CON (81%) and 52 EXP sows (78%) given this score. Six CON (8%) and nine EXP (13%) were scored 0, five and three (7% and 4%) got score 2, while 3 (4%) in both groups got a score of 3. The score was missing for 2 CON sows. Week group could not be included as a random effect and were there included as a fixed effect in the logistic regressions. Comparing score 2 or 3 against score 0 or 1 gave no indication of a difference between EXP and CON ($\chi^2_1 = 0.06$, $p = 0.81$) though score 2 and 3 was more frequently used for CON sows (OR = 1.2; 95% CI: 0.34 – 4.0) when comparing CON vs EXP. Pooling score 1, 2 and 3 also indicate a higher proportion of oedema score in CON (92%) than in EXP (87%) but with no significant difference ($\chi^2_1 = 0.75$, $p = 0.39$). Odds ratio of CON vs EXP was 1.6 (SE = 0.95; 95% CI: 0.53 – 5.1).

Faeces score for sows on DayF (FecesD1; score 0, 1, 2, 3, 4 or 5)

Hypothesis: after farrowing (on DayF) the faeces score is higher in EXP sows than in CON sows.

FecesD1 in Focal-1 sows

Faeces score 5 was not used, one CON sow (5%) had score 4, two CON sows (10%) had score 1, and two EXP sows (15%) had score 2, which was seen in 7 CON sows (33%). Four CON sows (19%) and three EXP sows (23%) had score 0, and the remaining 7 CON sows (33%) and 8 EXP sows (62%) had score 3. The score was missing for 5 sows; two CON and three EXP. Fisher's exact test of the five by two contingency table did not indicate a difference between EXP and CON in the distribution of scores ($p = 0.44$). Combining score 3 with score 4 and pooling the three lowest scores (0, 1 and 2) resulted in the clearest separation with 62% CON sows having the lower scores and 62% EXP sows having the higher scores. Nevertheless, running a logistic regression on this response did not indicate a significant difference between EXP and CON either ($\chi^2_1 = 1.94$, $p = 0.16$); perhaps showing the main problem of the Focal-1 part of the study: too small sample at least for categorical responses (including dichotomous). The corresponding odds ratio of EXP vs CON for having higher scores was 2.7 (SE = 2.03; 95% CI: 0.65 – 11.7).

Combining score 0 with score 1, and score 3 with score 4 (to avoid zero cells), the proportions fluctuated a bit, with proportions steadily increasing in CON from the lower score 0+1 (0.29) over 2 (0.33), to the higher score 3+4 (0.38), whereas in EXP there were more 0+1 (0.23) than score 2 (0.15) but also a much higher proportion of score 3+4 (0.62). An ordinal logistic regression (proportional odds model) estimated the odds ratio of higher score vs lower score for EXP vs CON to be 2.1 (95% CI: 0.54 – 8.2) but not significant ($\chi^2_1 = 1.19$, $p = 0.28$). The proportionality assumption was not violated but running instead the nominal logistic regression, there were also no significant differences found between EXP and CON ($\chi^2_1 = 2.32$, $p = 0.31$). Here the odds ratios with score 0+1 as the reference category showed an odds ratio of 0.51 for score 2 (95% CI: 0.06 – 4.3) and an odds ratio of 2.02 for score 3+4 (95% CI: 0.37 – 11.2) when comparing EXP vs CON; indicating the somewhat conflicting distribution of the proportion of the scores.

FecesD1 in Focal-2 sows

Faeces score 5 was not used, two CON sows (3%) had score 4, 11 CON (15%) and 15 EXP sows (22%) had score 2, 8 CON (11%) and 2 EXP sows (3%) had score 1, while 7 and 11 sows had score 0 (10 and 16%) in CON and EXP, respectively. The largest proportions were having a score 3; 44 CON sows (61%) and 39 EXP sows (58%). The score was missing for 2 CON sows. Combining score 3 with score 4 and pooling the three lowest scores (0, 1 and 2) resulted in 64% CON and 58% EXP sows having the higher scores. From a mixed effects logistic regression on this response the odds ratio for CON vs EXP of 1.5 (SE = 0.55; 95% CI: 0.69 – 3.1) did not indicate a significant difference between CON and EXP ($\chi^2_1 = 0.96$, $p = 0.33$) but the direction was towards higher score in CON and thus reverse that hypothesised. A mixed effects ordinal logistic regression (proportional odds model) estimated the odds ratio of higher score vs lower score for CON vs EXP to be 1.6 (95% CI: 0.77 – 3.1) but not significant ($\chi^2_1 = 1.53$, $p = 0.22$).

Rectal temperature after farrowing (Temp; °C)

Hypothesis: EXP sows have a lower rectal temperature after farrowing (DayF) than CON sows.

Temp in Focal-1 sows

The random effect of week group could be included for this analysis. The temperature was missing for five sows (2 CON and 3 EXP). The min – max temperatures were 38.0 – 39.3 °C for CON sows and 38.1 – 40.0 °C in EXP sows, among which two had fever (Temp $\geq$ 39.5 °C). The rectal temperature did not differ significantly between CON and EXP ($F_{1,31} = 3.14$, $p = 0.086$) and was estimated to be 38.7 (SE = 0.11; 95% CI: 38.5 – 38.9) °C in CON and 39.0 (SE = 0.14; 95% CI: 38.7 – 39.3) °C in EXP; corresponding to a 0.3 °C higher average temperature in EXP compared to CON (SE = 0.18; CI: -0.05 to 0.7). That is, numerically the direction of the difference was opposite to what we hypothesised.

Temp in Focal-2 sows

The random effect of week group could be included for this analysis. The temperature was missing for two CON sows. The min – max temperatures were 37.7 – 39.8 °C for CON sows among which 10 (14%) had fever (Temp $\geq$ 39.5 °C), and 37.6 – 39.9 °C in EXP sows among which 7 (10%) had fever. The rectal temperature did not differ between CON and EXP ($F_{1,132.2} = 0.21$, $p = 0.65$) and was estimated to be 38.8 (SE = 0.08; 95% CI: 38.6 – 39.0) °C in CON and 38.8 (SE = 0.08; 95% CI: 38.6 – 38.9) °C in EXP.

Uric acid in colostrum (UA; μ M)

Hypothesis: colostrum from EXP sows have a higher concentration of uric acid (UA) on DayF compared to colostrum from CON sows.

UA in Focal-1 sows

The random effect of week group could be included for this analysis. Uric acid was not measured in 9 of the sows and was missing in another 3, thus only available from 27 sows: 18 CON and 9 EXP. The min – max UA concentrations were 71.1 – 347.6 μ M for CON sows and 63.5 – 230.8 μ M in EXP sows. The difference in mean concentration between CON and EXP was just below the level of significance ($F_{1,16.0} = 4.74$, $p = 0.045$) and was estimated to be 212 (SE = 15.5; 95% CI: 178 – 247) μ M in CON and 154 (SE = 22.1; 95% CI: 103 – 206) μ M in EXP; corresponding to a 58 μ M higher average concentration of UA in colostrum from CON compared to EXP (SE = 26.5; CI: 2 – 114) μ M. That is, rejecting the hypothesised higher concentration in EXP sows.

UA in Focal-2 sows

Uric acid was not measured in 51 of the sows and was missing in another 6, thus only available from 84 sows: 41 CON and 43 EXP. The min – max UA concentrations were 62.7 – 496.2 μ M for CON sows and 62.8 – 431.7 μ M in EXP sows. To not reject the assumption of normal distribution, log-transformation was needed for the linear mixed effects model. The difference in mean concentration between CON and EXP was not significant ($F_{1,78.3} = 0.75$, $p = 0.39$) and the means were estimated to be 191 (SE = 15.6; 95% CI: 159 – 229) μ M in CON and 204 (SE = 16.7; 95% CI: 170 – 245) μ M in EXP; corresponding to the average concentration of UA in colostrum being 1.07 times higher in EXP compared to CON (SE = 0.086; 95% CI: 0.91 – 1.26).

IgG in colostrum (g/L)

Hypothesis: colostrum from EXP sows have a higher concentration of IgG on DayF compared to colostrum from CON sows.

IgG in Focal-1 sows

The random effect of week group could not be included for this analysis. IgG was not measured in 9 of the sows and was missing in another 3, thus only available from 27 sows: 18 CON and 9 EXP. The min – max IgG concentrations were 1.1 – 51.3 g/L for CON sows and 2.7 – 30.7 g/L in EXP sows. The difference in mean concentration between CON and EXP was not significant ($F_{1,24} = 2.45$, $p = 0.13$) and was estimated to be 22.0 (SE = 3.58; 95% CI: 14.6 – 29.4) g/L in CON and 12.4 (SE = 5.06; 95% CI: 1.9 – 22.8) g/L in EXP; corresponding to a 9.7 g/L higher average concentration of IgG in colostrum from CON compared to EXP (SE = 6.18; CI: -3.1 to 22.4) g/L, i.e. in the opposite direction than hypothesised.

IgG in Focal-2 sows

IgG was not measured in 51 of the sows and was missing in another 6, thus only available from 84 sows: 41 CON and 43 EXP. The min – max IgG concentrations were 2.1 – 61.9 g/L for CON sows and 0.5 – 43.1 g/L in EXP sows. To not reject the assumption of normal distribution, log-transformation was needed for the linear mixed effects model and, moreover, variance was allowed to be heterogeneous in case-control status (i.e. different for the CON and EXP groups). The difference in mean concentration between CON and EXP was not significant ($F_{1,75.6} = 3.29$, $p = 0.074$) but tended to be higher in CON sows (against the hypothesis), where the mean was estimated to be 14.4 (SE = 3.33; 95% CI: 8.4 – 24.5) g/L, than in EXP sows, where the mean was 9.2 (SE = 2.45; 95% CI: 5.2 – 16.4) g/L. This corresponds to the average being 1.6 times higher in CON compared to EXP (SE = 0.38; 95% CI: 0.96 – 2.5).

IgA in colostrum (g/L)

Hypothesis: colostrum from EXP sows have a higher concentration of IgA on DayF compared to colostrum from CON sows.

IgA in Focal-1 sows

The random effect of week group could not be included for this analysis. IgA was not measured in 9 of the sows and was missing in another 3, thus only available from 27 sows: 18 CON and 9 EXP. The min – max IgA concentrations were 0.4 – 10.8 for CON sows and 0.7 – 5.6 g/L in EXP sows. The difference in mean concentration between CON and EXP was not significant ($F_{1,24} = 2.15$, $p = 0.16$) and was estimated to be 4.2 (SE = 0.65; 95% CI: 2.9 – 5.6) g/L in CON and 2.6 (SE = 0.92; 95% CI: 0.7 – 4.5) g/L in EXP; corresponding to a 1.7 g/L higher average concentration of IgA in colostrum from CON compared to EXP (SE = 1.13; CI: -0.7 to 4.0) g/L, i.e. in the opposite direction than hypothesised.

IgA in Focal-2 sows

IgA was not measured in 51 of the sows and was missing in another 6, thus only available from 84 sows: 41 CON and 43 EXP. The min – max IgA concentrations were 0.5 – 12.7 g/L for CON sows and 0.2 – 8.3 g/L in EXP sows. To not reject the assumption of normal distribution, log-transformation was needed for the linear mixed effects model. The difference in mean concentration between CON and EXP was not significant ($F_{1,77.7} = 2.75$, $p = 0.10$) but were numerically higher in CON sows (against the hypothesis) with a mean of 3.0 (SE = 0.59; 95% CI: 1.9 – 4.6) g/L, than in EXP sows, where the mean was 2.1 (SE = 0.42; 95% CI: 1.4 – 3.3) g/L. This corresponds to the average being 1.4 times higher in CON compared to EXP (SE = 0.28; 95% CI: 0.93 – 2.1).

CRP in serum (µg/mL)

Hypothesis: serum from EXP sows have a lower concentration of CRP on DayF compared to serum from CON sows.

CRP in Focal-1 sows

CRP was missing for 5 of the sows (2 CON and 3 EXP) and thus available from 34 sows: 21 CON and 13 EXP. The min – max CRP concentrations were 7.1 – 75.0 µg/mL for CON sows and 5.8 – 56.7 µg/mL in EXP sows. The difference in mean concentration between CON and EXP was not significant ($F_{1,32.1} = 1.26$, $p = 0.27$) and was estimated by the mixed effects model to be 42.7 (SE = 3.96; 95% CI: 33.8 – 51.7) µg/mL in CON and 36.1 (SE = 4.87; 95% CI: 25.8 – 46.4) µg/mL in EXP; corresponding to a 6.7 µg/mL higher average concentration of CRP in serum from CON compared to EXP (SE = 5.94; CI: -5.4 to 18.8) µg/mL.

CRP in Focal-2 sows

CRP was missing for 6 CON sows and thus available from 135 sows: 68 CON and 67 EXP. The min – max CRP concentrations were 0.8 – 64.5 µg/mL for CON sows and 1.1 – 83.9 µg/mL in EXP sows. The difference in mean concentration between CON and EXP was not significant ($F_{1,127.9} < 0.01$, $p = 0.97$) and the linear mixed effects model estimated the mean to be 29.0 (SE = 2.80; 95% CI: 22.8 – 35.3) µg/mL in CON and 28.9 (SE = 2.83; 95% CI: 22.7 – 35.2) µg/mL in EXP sows. This corresponds to the average being 0.1 µg/mL higher in CON compared to EXP (SE = 2.62; 95% CI: -5.1 – 5.3).

TNF-α in serum (pg/mL)

Hypothesis: serum from EXP sows have a lower concentration of TNF-α on DayF compared to serum from CON sows.

TNF-α in Focal-1 sows

TNF-α was missing for 5 of the sows (2 CON and 3 EXP) and thus available from 34 sows: 21 CON and 13 EXP. The concentration was below the detection limit for 13 sows: 7 CON (33%) and 6 EXP (46%). Analysing this in a mixed effects logistic regression, the odds ratio

of being below detection was 1.7 (SE = 1.36; 95% CI: 0.34 – 8.2) with the higher odds being for EXP sows but not significantly different from CON sows ($\chi^2_1 = 0.40$, $p = 0.53$).

The min – max TNF- α concentrations for the samples above detection limit were 57.3 – 545 pg/mL for CON sows and 41.6 – 4256 pg/mL in EXP sows. To analyse these values, log-transformation was needed and, moreover, variance was heterogeneous in case-control status (i.e. allowed to differ, on top of the log-transformation, between EXP and CON sows). The difference in mean concentration on the log-scale between CON and EXP for this subsample was not significant ($F_{1,18.7} = 2.76$, $p = 0.11$) and was estimated by the linear mixed effects model to be 118 (SE = 49.8; 95% CI: 32.9 – 425) pg/mL in CON and 269 (SE = 132.4; 95% CI: 80.9 – 893) pg/mL in EXP; corresponding to a 2.3 times higher average concentration of TNF- α in serum from EXP compared to CON (ratio SE = 1.13; CI: 0.81 to 6.4).

Analysing instead by a log-Gaussian Tobit regression with left censoring at the detection limit (arbitrarily set at 15.6, which was half of the lowest value of the standard curve), the means were estimated to be 42.6 (SE = 21.2; 95% CI: 11.4 – 159) pg/mL in CON and 36.1 (SE = 40.8; 95% CI: 3.2 – 412) pg/mL in EXP sows. This corresponds to a 1.2 times higher concentration, overall, in CON sows compared to EXP sows (ratio SE = 1.2; 95% CI: 0.15 – 9.1), which was not significant ($F_{1,17.4} = 0.03$, $p = 0.87$).

TNF- α in Focal-2 sows

TNF- α was missing for 6 CON sows and thus available from 135 sows: 68 CON and 67 EXP. The concentration was below the detection limit for 35 sows: 18 CON (26%) and 17 EXP (25%). Analysing this in a mixed effects logistic regression, the odds ratio of being below detection was 1.3 (SE = 0.58; 95% CI: 0.51 – 3.1) with the higher odds being for EXP sows but not significantly different from CON sows ($\chi^2_1 = 0.24$, $p = 0.62$).

The min – max TNF- α concentrations for the samples above detection limit were 37.3 – 8733 pg/mL for CON sows and 51.4 – 3978 pg/mL in EXP sows. The concentrations were highly right-skewed, and a log-transformation was not enough to normalize the residuals. A simple non-parametric median test on all values (also those below detection limit) indicated, however, no difference between EXP and CON sows ($p = 0.93$). Applying a triple times log-transformation (i.e. $\log(\log(\log(Y | Y > \text{detection limit})))$), normal distribution was not rejected in the linear mixed effects model, which also did not indicate any significant difference between CON and EXP sows ($F_{1,94.3} = 0.60$, $p = 0.44$) with back-transformed means from the log-log-log-scale being 223 (95% CI: 163 – 313) pg/mL in CON and 193 (95% CI: 142 – 271) pg/mL in EXP.

Analysing instead by a log-log-log-Gaussian Tobit regression with left censoring at the detection limit (arbitrarily set at 15.6, which was half of the lowest value of the standard curve), the means were estimated to be 69.2 (95% CI: 26.2 – 337) pg/mL in CON and 67.3 (95% CI: 34.8 – 165) pg/mL in EXP sows. The overall higher concentration in CON sows compared to EXP sows was not significant ($F_{1,126.9} = 0.01$, $p = 0.91$).