Factors influencing faecal myeloperoxidase in piglets from trials without in-feed therapeuticals

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ZnO and inflammation

Prohibiting high zinc oxide: less protection against post-weaning diarrhea

Many ingredients (additives, feedstuffs) found in the market claiming effects on digestive balance and stool consistency

- **How to quantify and reproduce the effects?**

To respect animal welfare, a non invasive biomarker should be a priority

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Effects of Pharmacological Concentrations of Dietary Zinc Oxide on Growth of Post-weaning Pigs: A Meta-analysis

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Abstract Pharmacological dietary zinc (Zn) concentrations of 1,000 to 3,000 mg/kg diet from Zn oxide have been found to increase growth in post-weaning pigs. However, results were inconsistent among studies. A frequentist meta-analysis, in which effects were numerically described with standardized effect sizes (Hedges's g), was conducted in order to identify and quantify the responses in average daily gain (ADG), average daily feed intake (ADFI), and gain to feed ratio (G/F) in post-weaning pigs upon dietary Zn supplementation from Zn oxide. The inability of independent continuous variables to explain significant heterogeneity obtained with fixed effect models necessitated the use of random effects models to calculate summary statistics. Dietary Zn supplementation increased ($P<0.05$) ADG (mean effect size=1.086, 95 % confidence intervals=0.905-1.266, 26 studies, 72 comparisons), ADFI (mean effect size=0.794, 95 % confidence intervals=0.616–0.971, 25 studies
(mean effect size=0.566, 95 % c
0.710, 24 studies, 70 comparisc
feasible alternative to in-feed antib
post-weaning pigs, and its reducti
environmental pollution will have
feed additives and management st
economic losses.

Keywords Daily gain · Feed effi
Meta-analysis · Post-weaning pig

Introduction

The trace element zinc (Zn) is inv
cellular functions in the bod

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transcription, and signal transduction. Furthermore, it is essential in the maintenance of barrier integrity, protection against pathogens, and regulation of immune response. Zinc requirements for post-weaning pigs are stated by the NRC [1] as 100 mg/kg diet during growth from 3- to 10-kg live weight and as 80 mg/kg diet during growth in 10–20-kg live weight.

During the late 1980s, it was discovered that pharmacological concentrations of Zn oxide (ZnO) resulted in reduced diarrhea and increased growth rates in weanling pigs [2]. Zinc toxicity occurred in growing pigs when Zn was supplemented at levels of greater than 2,000 mg/kg diet from Zn carbonate [3] and 1,000 mg/kg diet from Zn lactate [4]. Although Poulson [2] reported that feed intake and growth rate were reduced in post-weaning pigs when 4,000 mg Zn/kg diet was supplemented from ZnO, no

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Heavy metal driven co-selection of antibiotic resistance in soil and water bodies impacted by agriculture and aquaculture

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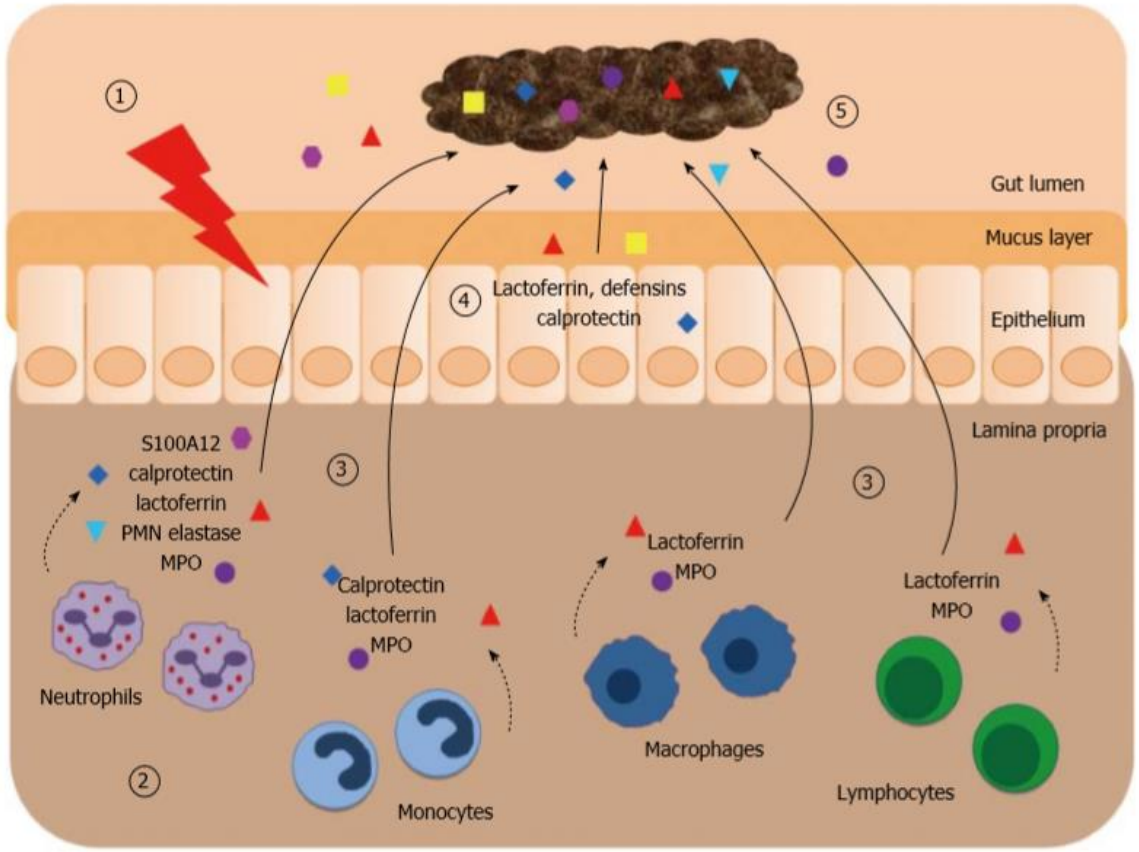
The use of antibiotic agents as growth promoters was banned in animal husbandry to prevent the selection and spread of antibiotic resistance. However, in addition to antibiotic agents, heavy metals used in animal farming and aquaculture might promote the spread of antibiotic resistance via co-selection. To investigate which heavy metals are likely to co-select for antibiotic resistance in soil and water, the available data on heavy metal pollution, heavy metal toxicity, heavy metal tolerance, and co-selection mechanisms was reviewed. Additionally, the risk of metal driven co-selection of antibiotic resistance in the environment was assessed based on heavy metal concentrations that potentially induce this co-selection process. Analyses of the data indicate that agricultural and aquacultural practices represent major sources of soil and water contamination with moderately to highly toxic metals such as mercury (Hg), cadmium (Cd), copper (Cu), and zinc (Zn). If those metals reach the environment and accumulate to critical concentrations they can trigger co-selection of antibiotic resistance. Furthermore, co-selection mechanisms for these heavy metals and clinically as well as veterinary relevant antibiotics have been described. Therefore, studies investigating co-selection in environments impacted by agriculture and aquaculture should focus on Hg, Cd, Cu, and Zn as selecting heavy metals. Nevertheless, the respective environmental background has to be taken into account.

Keywords: co-selection, antibiotic resistance, heavy metal, agriculture, aquaculture, farming

Faecal myeloperoxidase: a biomarker of intestinal inflammation



(Dabritz *et al.*, 2014)

<u>Myeloperoxidase (MPO)</u> :

- Lysozome component
- Biomarker of neutrophil activity
- Function : Oxidation and lysis of pathogens
- Allows early diagnosis and provides help to confirm clinical diagnosis of inflammatory gut disease
- Protein stable to microbial degradation (Silberer *et al.*, 2005)

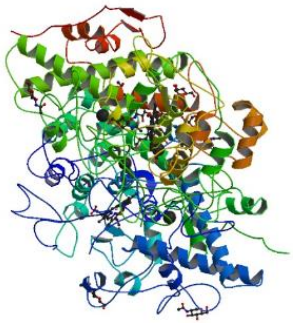
Objective of study

Few available intestinal MPO data from pigs in literature (Pearse *et al.,* 2013, Kansagra *et al.,* 2003, Young *et al.,* 2012)

No faecal MPO data from pigs in the literature but the biomarker utilization is encouraged by Niewold (unpublished data 2015)

1. **Can we enrich the learnings from a performance trial with faecal biomarker ? Especially regarding gut condition?**

2. **Which factors influence faecal MPO values in feeding trials ?**



3D view of MPO

Material and methods

Description of database:

- 8 Trials conducted in 2017 and 2018, about the influence of diet on alternatives to in-feed therapeuticals
- 292 individual samples of piglet faeces

Sample collection:

- Out of rectal ampulla

- Immediately frozen in dry ice container (-78.5°C)

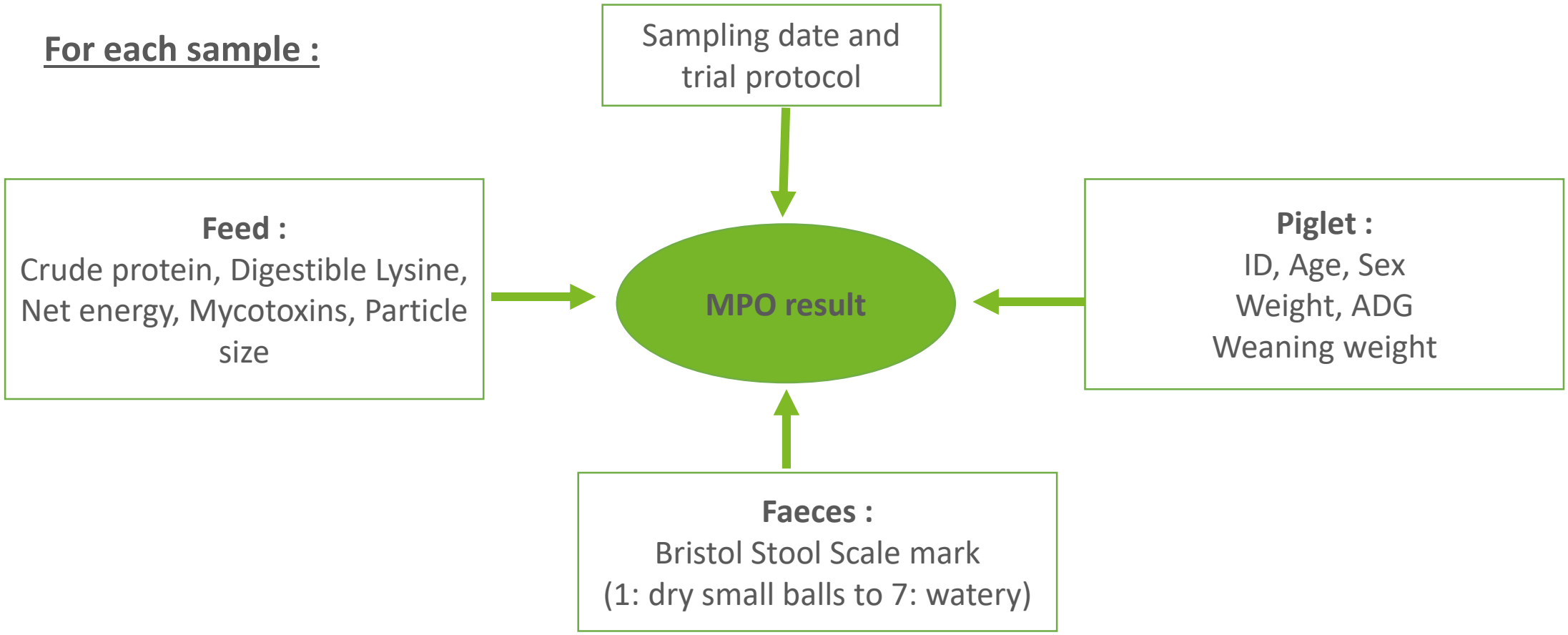
Lab analysis :

- Sample stored in freezer (-20°C)
- Weighed and triturated in buffer solution (HTAB, Sigma)
- Centrifuged after 3 freeze – thaw cycles
- Assay of supernatant in triplicates for MPO activity, based on oxidation of o-dianisidine, with or without addition of faecal extract and plotted *vs.* response to purified enzyme scale from the same plate
- Spectrophotometer microwell-plate reader at 460 nm

(Bradley et al.,1982)

Material and methods

For each sample :



- Analysis with R software, Packages FactoMineR, Tidyverse, Car

Factors influencing faecal MPO:

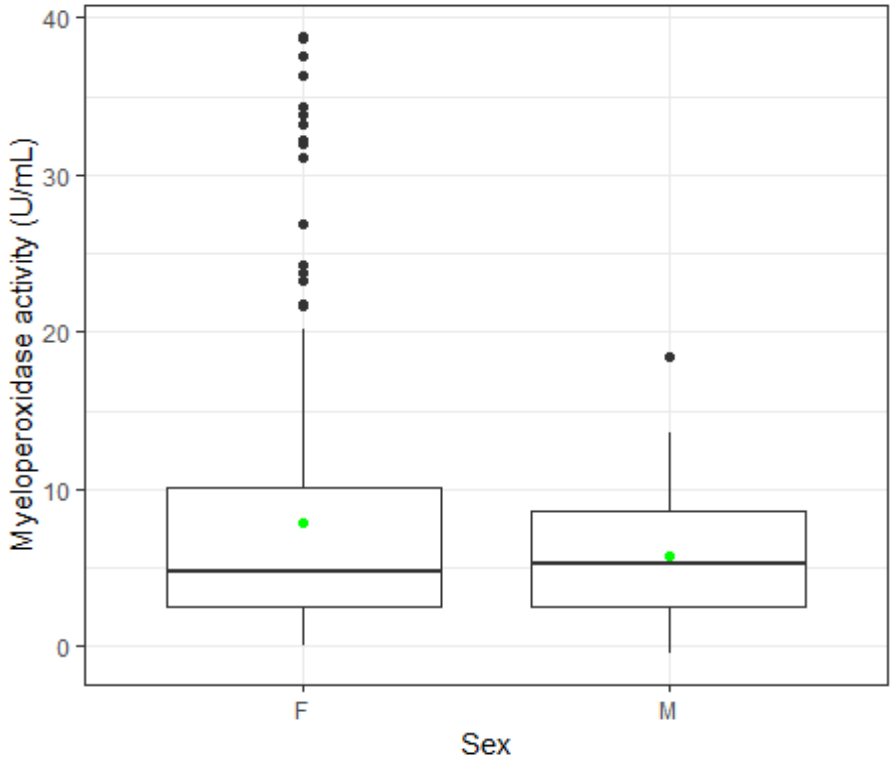
Among all variables studied, only effects of age at sampling and bristol mark reached significance.

No effect of: sex, weaning weight, feed composition or challenge in protocol, was detected.

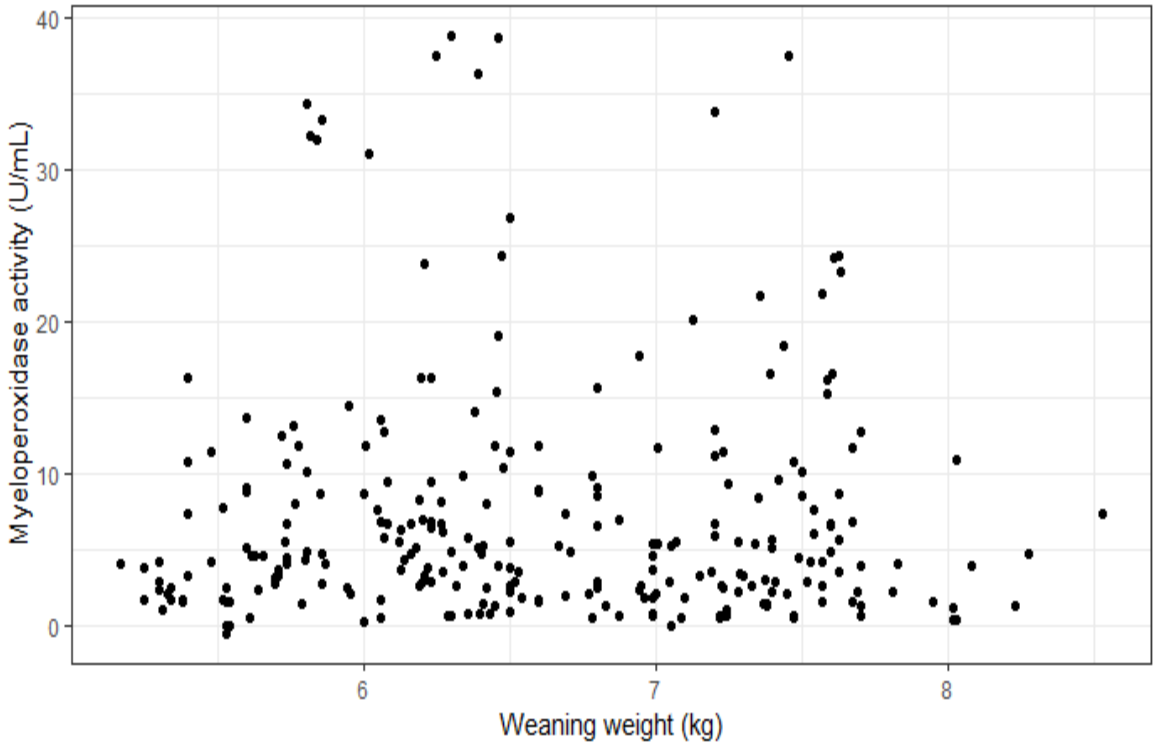
	Sum sq	DF	F.Value	Proba
Intercept	106,0	1	2,1524	0,14365
Phase	2912,4	1	59,1105	**3,73 e^{-13}**
Bristol_mark	600,9	6	2,0326	*0,06206*
Residuals	11923,4	242		

Results

- MPO activity varied between 0 and 38,9 U/mL.

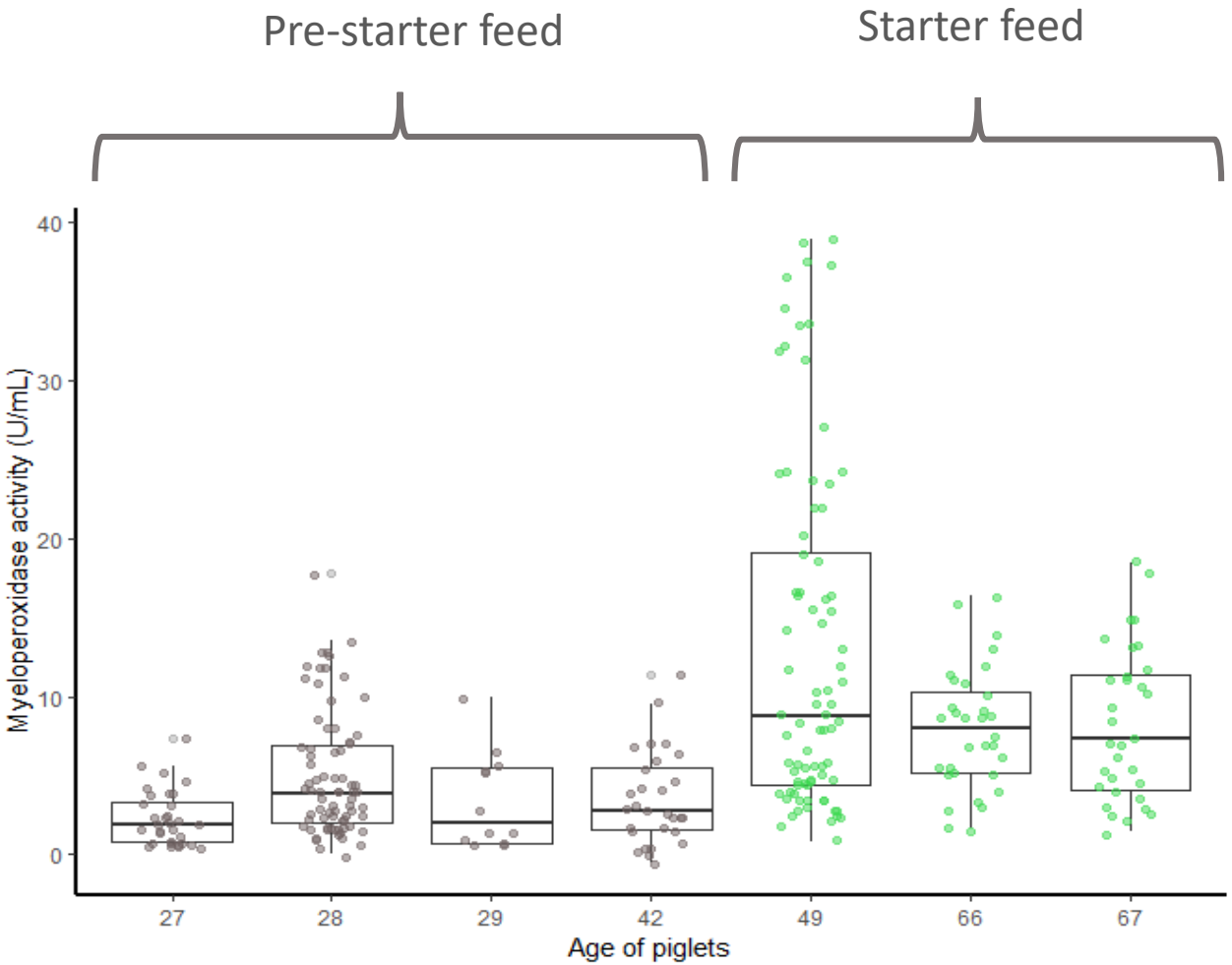


No effect of sex on MPO activity



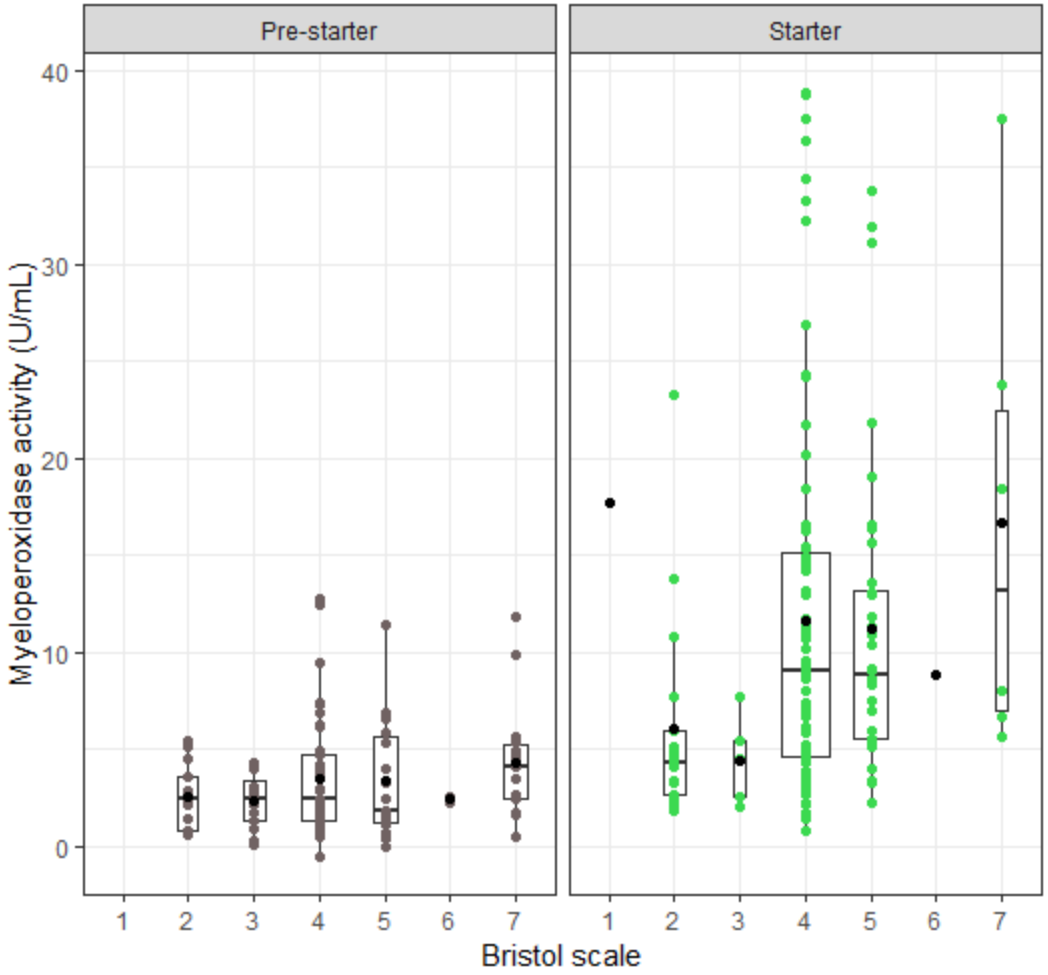
No effect of weaning weight on MPO activity

Results



- MPO activity depended on piglet age at sampling
- MPO activity in piglet faeces was lower in pre-starter *vs.* starter period ($P<0.001$).

Results



- Altogether, no clear relationship between MPO activity and faecal score
- However, frequency of high values of MPO tended to increase with Bristol mark whatever the period considered
- Higher risk of gut inflammation with a less refined diets, especially after feed change.

Discussion and Conclusion

8 independent trials / in 1 research farm

In each trial, faecal MPO activity from a test feed was compared to a control feed

Trial by trial, significant differences have been observed or not between control and experimental diets, allowing a quantitative ranking of alternatives to therapeuticals

➔ See: this summit, abstract P3-12

Another question would be:

Can we use faecal MPO to quantify the inflammatory status on-farm ?

➔ The current dataset does not answer this question.

A new project has started to address this question, in order to further describe the factors of variation and to propose a reference database.

Tak for din opmærksomhed
Thank you for your attention

This work was made possible by other people than authors list ;-)

Thanks to farm and lab's teams