Peer Community In
Animal Science

Varying the hemicellulose content in the diet of lactating sows highlights the importance of early-life interventions for improving health and performance of small piglets during the post-weaning period

Open Access

Published: August 10 2022

Florence Gondret *based on reviews by Hélène Quesnel and Myriam Grundy*

Cite this recommendation as:

Florence Gondret (2022) Varying the hemicellulose content in the diet of lactating sows highlights the importance of early-life interventions for improving health and performance of small piglets during the post-weaning period. Peer Community in Animal Science, 100014. 10.24072/pci.animsci.100014

A recommendation of:

Decreasing the level of hemicelluloses in sow's lactation diet affects the milk composition and post-weaning performance of low birthweight piglets.

Francesco Palumbo, Giuseppe Bee, Paolo Trevisi, Marion Girard
(2022), agriRxiv.2022.00116, ver 4 (R3), peer-reviewed and recommended by Peer Community in Animal Science.
https://doi.org/10.31220/agriRxiv.2022.00116

Submitted: 21 January 2022, Recommended: 08 July 2022

Recommendation

One of the key questions in pig industry nowadays is how health and performance of piglets can be improved by sow nutrition and milk composition. The levels of dietary fibers in sow's gestation diet have positive effects observed on the litters. However, the composition of dietary fibers and the organization of polysaccharides within the cell wall in the different plants determine their physicochemical properties and, thereby, their behaviour in the gut of the sows and the subsequent physiological response of the animals. Hemicelluloses are polysaccharides constituents of the cell walls of plants, which are fermented in the gut to produce volatile fatty acids (VFA). These VFA can serve as energy source for milk synthesis and can thereby influence the development of suckling piglets. Palumbo and colleagues (1) proposed an original experimental design to compare diets with similar fiber contents but different hemicellulose levels, thanks to varying the sources of fibers used in the dietary formulations. Effects were studied on performance and health of lactating sows and their piglets during suckling period and until post-weaning. The dietary treatments had no effect on the total number of piglets weaned and, consequently, on litter weight at weaning. Milk yield was not influenced by the dietary treatments, but milk composition (lactose content, copper and threonine proportions) was affected by the level of hemicellulose in the maternal diets. With a decreasing hemicellulose level in sow diet, milk lactose content linearly decreased, whereas the copper and threonine contents linearly increased. There was no effect on piglet performance during the lactation period. During the second week of post-weaning, a quadratic increase in the incidence of diarrhoea and the number of days with diarrhoea for suckling piglets was observed with decreasing hemicellulose level in diet. Interestingly, the observed effects were partly different for piglets born with a low body weight. Indeed, there was a linear decrease in the incidence of diarrhoea and days with diarrhoea with decreased hemicellulose level in the maternal diet for those piglets, together with increased growth performance from birth to two weeks post-weaning. The authors postulated that the improved growth performance and the lower incidence of diarrhoea observed in small piglets during post-weaning period may be related to the increased abundance of threonine and copper and increased concentration of total VFA in milk of sows fed a diet with reduced hemicellulose levels. This study confirms the importance of early-life interventions to improve the post-weaning development and health of this sub-population of piglets.

Reference

(1) Palumbo F, Bee G, Trevisi P, and Girard M. (2022). Decreasing the level of hemicelluloses in sow's lactation diet affects the milk composition and post-weaning performance of low birthweight piglets. agriRxiv 2022.00116, ver 4 (R3), peer-reviewed and recommended by PCI Animal Science. https://doi.org/10.31220/agriRxiv.2022.00116

Reviews

Evaluation round #2

DOI or URL of the preprint: **https://zenodo.org/record/5909476**

Version of the preprint: R1

Author's Reply, None

Download author's reply **Download tracked changes file**

Decision by Florence Gondret, *24 May 2022*

The authors have adressed many concerns raised by the two reviewers. However, it remains not totally clear why the rationale of the experiment focused on decreasing rather than increasing hemicellulose content at a similar crude fiber content in the diets. One or two sentences to explain expected benefits on the content or activity of beneficial bacteria, either direct or indidirect (through the modulation of other fiber components) should be added at the end of the introduction. According to diets analysis, total DF varied from 203 to 227, so that it remains difficult to know if the objective to compare diets at similar DF content but different HC content was reached. These questions can be easily adressed in a second round of revision.

Evaluation round #1

DOI or URL of the preprint: **https://zenodo.org/record/5909476**

Author's Reply, 17 Jun 2022

Download tracked changes file

Dear Editor,

We would like to thank you and the two reviewers for the constructive feedback. We have adapted the manuscript according to your suggestions and a new

version is available. The comments of the reviewers and the answers we have formulated are also included.

We hope that the revised manuscript meets the requirements for publication in PCI Animal Science

Kind regards,

Marion Girard

Decision by Florence Gondret, *25 Mar 2022*

Dear authors,

The manuscript quoted in reference has now been evaluated by two research scientists who advised that this study touches an interesting subject in today's pig industry.

However, they raised some concerns about the nomenclature of the dietary components (fiber constitutents) and about the rationale of the study (clarification of the hypothesis). They also made a detailed evaluation of the different sections and underlined some points needing clarification or rewording.

Based on these comments, I think that the manuscript is valuable for the scientific community, but can be also improved in its content. Therefore, I invite you yo prepare a revised preprint, before I can write a recommendation.

I thank you for considering PCI Animal Science for the diffusion of your results.

Best regards

Florence Gondret

Reviewed by Hélène Quesnel, *23* Mar *2022*

Download the review

Reviewed by Myriam Grundy, *03* Mar *2022*

This is an interesting study and overall well conducted. However, I have concerns regarding the use of the term hemicellulose in the title and as a main component having an impact on milk composition and post-weaning performance of piglets. It could be misleading as it suggests that the authors used extracted hemicellulose.

Even though the authors measure dietary fibres, they did not measure hemicellulose specifically (which I understand as it is challenging to do). Instead, they measured different classes of dietary fibres based on their solubility in either detergent (neutral or acid, NDF and ADF) or water/ethanol (IDF and SDF). Subtracting NDF by ADF to obtain hemicellulose is often used but unreliable for a lot of ingredients. Indeed, some of the cell wall components (hemicellulose among others) will be lost during NDF measurement; this is particularly true for cereals, such as oat and barley (some of the beta-glucan and arabinoxylan would be extracted then), and legumes (lupin).

Also, the authors varied the amount of different sources of dietary fibres but not hemicellulose per se (not extracted or purified hemicellulose). Indeed, cell walls are complex structures made of a large range of polysaccharides of different nature. Different plants will also have different polysaccharide composition but, more importantly, the organisation of those polysaccharides within the cell wall will be different. Both the composition and the organisation of dietary fibres within the plant tissue will determine their physicochemical properties (for example viscosity, or fermentation as mentioned here) and thereby their behaviour in the gut and the subsequent physiological response of the animal.

It is likely that the dietary fibres from the different sources interacted with each other and the different components of the diets. It would have been interesting to vary only one component of the feed at a time. Therefore, it is not surprising that not clear effect could be seen as so many parameters were changed at once (nature, structure and quantity of dietary fibres). I suggest that the authors change the title and avoid using the term hemicellulose in the manuscript. Eventually, dietary fibres could be mentioned as soluble or insoluble, or they could compared the results based on the different ingredients (sources of dietary fibres).

I could recommend these 2 articles to complement my comments if the authors haven't came across them already:

Scheller, H.V., Ulvskov, P., 2010. Hemicelluloses. Annu Rev Plant Biol 61, 263-289.

Williams, B.A., Mikkelsen, D., Flanagan, B.M., Gidley, M.J., 2019. "Dietary fibre": Moving beyond the "soluble/insoluble" classification for monogastric nutrition, with an emphasis on humans and pigs. J Anim Sci Biotechnol 10.