



Managing More Survivors

Impacts of birthweight and pre-natal growth restriction on piglets

Larger litter size from prolific sows has reduced birth weight of commercial pigs and lead to increased variation of birth weights within a litter. However birth weight alone does not distinguish between small piglets and those that have experienced intra-uterine growth restriction (IUGR).

PROHEALTH work in the UK has been studying IUGR piglets on a JSR Genetics commercial farm to try and understand the impact of these animals and possible strategies to reduce their occurrence in future generations.

A significant benefit to JSR Genetics of participation in the project was the increased level of data recording that was instigated on the farm where the work was carried

out, with records being taken on over 1,500 farrowing and 21,000 piglets which included individual birth weight, head shape and full survival records or cause of death. In addition to the planned findings of the research, these data provided useful information to inform JSR about best practices on this and other farm(s).

The farm contained various farrowing house designs and, during the one year project, implemented different management practices. The data collected at a piglet level, rather than simply at a sow farrowing level, meant optimal farrowing house design could be identified and could better determine the impact, both positive and negative, of a specific management practice. These

data could be analysed to remove any seasonal or genetic effects and be used to further influence future decisions on the farm.

The work highlighted that selecting at sow level against IUGR could be a beneficial tool to improve piglet survival and was much more heritable than selecting on piglet survival alone. Furthermore, discussions internally and with JSR Genetics partners on these findings have encouraged the business to do more to understand IUGR causes. This has included the opportunity to look at spacing between embryo implantation sites within the uterus which may also be influenced by the genetics of the sow.

Therefore, whilst the direct benefits of the project have given opportunities to further develop the selection strategy of sows, it has also created new ideas and areas to explore. The additional benefits from the detailed data made available have been of added value to further improve pig production at JSR Genetics.



Figure 1. Piglets that have experienced intra-uterine growth restriction have characteristic "dolphin" shaped heads as shown here by the piglet on the right in contrast to the conventional piglet (left) (Copyright E. Baxter, SRUC).

PROHEALTH project
www.fp7-prohealth.eu

Key Facts

22 European partners:
 12 industry, 10 academic
 Project duration:
 01/12/2013 – 30/11/2018
 Project coordinator:
 Prof Ilias Kyriazakis,
 Newcastle University, UK



Enriching sow environment and diet during pregnancy influences sow welfare and piglet survival

Conclusions from a PROHEALTH experimental study

Piglet mortality is a major concern for pig producers. On European farms, approximately one piglet out of five or six is born dead or dies after birth. The main cause of still-birth is prolonged farrowing possibly due to stress or fatigue of sows; the main causes for post-natal mortality are hypothermia as a result of hypoxia and(or) starvation, crushing by the sow and infections.

There is some evidence that the environment of the sow during pregnancy can generate maternal stress which could influence piglets before and after birth. Notably, in a previous study of the PROHEALTH project, we observed a positive impact of a friendly housing system on sow welfare and piglet survival (see Newsletter No. 2, November 2015). This friendly “enriched” system in which sows were group-housed on deep straw litter and had 3.5 m² per sow was compared to a system which is a conventional system in many European countries, including France, and in which sows were housed on a slatted floor and had only 2.4 m² per sow.

The difference in piglet survival likely had its origins during gestation since sows from both systems were transferred, a few days before farrowing, to maternity rooms with similar lactation pens and management practices. Based on these results, we hypothesized that enriching the environment and diet of sows housed in the conventional system to mimic straw supply might reduce maternal stress during pregnancy and piglet mortality.

Three experimental systems were thus compared during pregnancy, from the less to the more enriched: the conventional system (C, on a



Figure 2. Sows in the conventional system (left) were compared with sows in the conventional system that was enriched with pieces of oak and straw pellets (right, Picture of straw pellets is “courtesy of www.firstpellets.com”).

slatted floor); the conventional system which was enriched with manipulable material and straw pellets (CE), and the enriched system (E, on deep straw litter and with additional space per sow). In the CE system, pieces of oak attached to a chain were provided to sows to fulfil their need for investigatory behaviour and straw pellets were provided to reduce their frustrated feeding motivation. Straw pellets were provided in the trough after each meal from 3 to 104 days of gestation. Then, all sows (n = 83) were transferred into farrowing pens and housed in identical individual crates on a slatted floor.

Maternal stress was assessed by cortisol concentrations in saliva and by behavioural traits. During late

pregnancy, cortisol concentration of sows was greater in the conventional system (C) than in the enriched system (E) and was intermediate in the conventional enriched system (CE). The enrichment reduced sow stereotypies, which are repetitive movements or postures illustrating frustration ($E < CE < C$) and increased their investigative behaviour exhibited towards manipulable material (oak, straw, pen walls) ($E > CE > C$). Piglet mortality during farrowing and within 12 h of birth was lower in the two enriched systems than in the conventional one. Total mortality (i.e. live-born + stillborn deaths) was lower by 4 percent points in these 2 systems but the difference did not reach the level of significance.

To conclude, when sows were housed in a conventional intensive system during pregnancy, enriching their environment with manipulable material and their diet with straw pellets throughout gestation improved their welfare. These effects were accompanied by a reduction in piglet neonatal mortality. Improving sows' welfare during gestation should therefore be considered to reduce piglet mortality in pig farms.

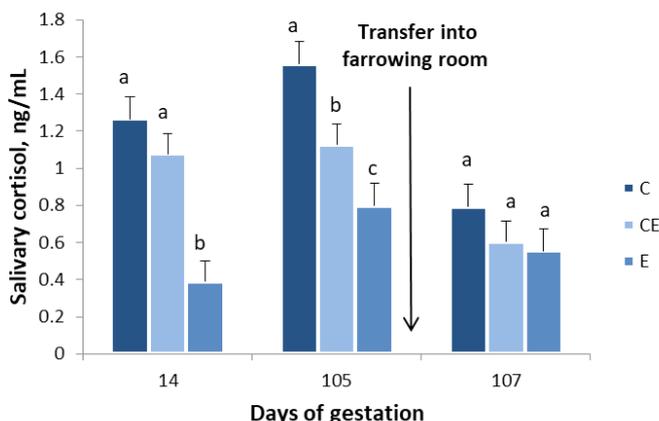


Figure 3. Salivary concentrations of cortisol in the 3 treatments (C: conventional system; CE: C system enriched with manipulable materials and straw pellets; E: system on straw litter and with additional space per sow). a,b,c, within day of gestation, values with different letters differ ($P < 0.05$).

Discover our Online Poultry Journal

Aggregated news and information from the poultry sector

We would like to introduce a new feature that has recently been added to the PROHEALTH website: the Online Poultry Journal which can be found in the PROHEALTH Knowledge Centre.

Conceived and designed by the poultry experts within PROHEALTH, the service strives to deliver a comprehensive but curated selection of news stories from across

the poultry sector. The purpose of the online journal is to reduce the time and effort needed by poultry professionals and enthusiasts to regularly check different sources for updates, providing the users a unique and user-friendly environment for monitoring and searching information coming from different online providers.

The tool is based on news aggregation software that automatically gathers content from a variety of reliable poultry-relevant online channels and contracted primary news providers as well as from crawling selected websites of interest. Aggregated content is processed automatically to the Online Poultry Journal, but it needs to be approved by a human moderator before becoming public.

The users can adjust the displayed news by applying one or more of the different filtering options offered by the tool, e.g. filtering by news source, publishing date or category giving a unique user experience.

The Online Poultry Journal is a formal Deliverable of PROHEALTH and will continue to function until the end of 2020, ie two years after the project is formally concluded.

Have a look and explore the Online Poultry Journal at: www.fp7-prohealth.eu/knowledge-platform/online-poultry-journal



Figure 4. Screenshot of the Online Poultry Journal embedded in the PROHEALTH website.

A strategy for reducing antibiotic use in pig production

How results from PROHEALTH are adding value for a French premix and feed company and its customers

CCPA is a premix and feed company. Our customers are mainly feed manufacturers for poultry, pig and ruminants production, operating in France, across Europe, Asia and Latin America. Innovation and market anticipation are two main pillars of our strategy. We also produce pre-starter feeds for young animals. The main areas of application of the PROHEALTH work for CCPA is relevant for pig production. PROHEALTH innovative results have been shared with our customers during our annual pig and poultry workshops. More than 400 nutritionists have attended these meetings.

«Antibiotic free» strategy for pig production

This strategy responds to a pull from a variety of stakeholders in the food chain, including the consumers. From a nutritionist point of view it leads to new questions about the relationship between nutrition and animal health. Observations conducted during the first phase of the PROHEALTH project have investigated the interaction of genetic selection, health and nutrition especially focusing on piglets at weaning. This work was conducted by INRA in collaboration with CCPA and confirmed the relevance of a specific feed formulation for the piglet, to improve its state of health after weaning (Gilbert et al 2017). On top of the improved piglet health after weaning, we addressed whether this diet would also allow pig producers to stop using antibiotics in the feed, with the aim to reduce global antibiotic usage. We also addressed whether the strategy maintained or perhaps improved the economic output of the farm. Some of these

questions were assessed in another part of PROHEALTH through a retrospective epidemiological study on farmers who changed to antibiotic free diets. The outcomes of the study clearly demonstrate the long term benefit of this strategy. The study focused on risk factors associated with the implementation of antibiotic free diets in pig farms. Proper training of farmers and strict biosecurity showed to be important when using antibiotic free diets. These outcomes allowed CCPA to develop a global strategy for nutritionists and farmers that change to an antibiotics free production, offering a specific feeding program and biosecurity advice. The market implication is high for CCPA because more than 80% of our pre-starter diets are without antibiotics and zinc oxide.

Sows welfare and piglets health

The reduction of neonatal mortality is an important area of work within the PROHEALTH program. In 2004 CCPA developed a diagnostic tool for pig farms with neonatal mortality problems, based on necropsies of a high number of dead piglets. More than 10,000 piglets have been necropsied in our laboratory

and gathered data was analysed in collaboration with Newcastle University. The analysis was associated with a retrospective survey of on farm practices and their relationship with neonatal mortality. This work identified 3 types of farms with different neonatal mortality profiles (Pandolfi et al. 2017). The lowest mortalities were on farms that widely supported both suckling and thermoregulation, tended not to have rules for cross-fostering of bigger piglets and did not cross-foster smaller piglets, or mainly cross-fostered them to multiparous sows. This led to an improvement of the diagnostics performed in our laboratory and of the management advice given to farmers.

Beyond the diagnosis, the work carried out by INRA in an experimental farm made possible to identify the impact of sow stress during gestation on the development of piglets and their viability at birth and in the hours that follow it (Pastorelli et al 2016; Quesnel et al. 2018). Providing toys and substrates to the sows reduced their cortisol level during gestation and improved piglet survival (see the related paper in this newsletter). These suggest that



Figure 5. PROHEALTH's partner CCPA, a French premix and feed company

sow management during gestation could induce stress on sows with detrimental effect on piglets' development and survival. The collaboration with INRA was an opportunity to measure biomarkers to assess pig health and stress. For example, the measure of salivary cortisol proved to be an interesting and non-invasive technique to evaluate sow stress during gestation. This work has been very well received by CCPA customers. To evaluate the field implications of these exciting results, this summer we began a large scale study on 10 commercial pig farms that have different feeding strategies.

The objectives of the large scale study are to:

- Evaluate the possibility of using the salivary cortisol dosage routinely in sow farms.
- Measure the cortisol levels during the gestation of sows in commercial farms and compare them with

observations made in the breeding farm mentioned above.

- Identify nutritional practices and least stressful management of sows.
- Validate the relationship between sow cortisol levels during gestation and the viability of piglets.

This work could lead to new feeding and management strategies of gestating sows that benefit both sow and piglet welfare and thereby positively affect farm productivity.

Overall the association with PROHEALTH has led us to new strategies that could improve the efficiency on pig farms, whilst relying less heavily on antibiotic input.

Literature references

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Sharing the knowledge

Recent peer-reviewed publications from PROHEALTH

As the EU-funded PROHEALTH project is approaching the end of its 5-year duration, the focus has been moved from experimentation and measurements towards analysing, synthesising and concluding. Several recently published papers present PROHEALTH studies and their findings:

- [Sakkas et al. \(2018\)](#) Does selection for growth rate in broilers affect their resistance and tolerance to *Eimeria maxima*?, *Veterinary Parasitology*
- [Pandolfi et al. \(2018\)](#) Connecting Different Data Sources to Assess the Interconnections between Biosecurity, Health, Welfare, and Performance in Commercial Pig Farms in Great Britain, *Frontiers in Veterinary Science*
- [Poulsen et al. \(2017\)](#) *Staphylococcus agnetis*, a potential pathogen in broiler breeders, *Veterinary*

Microbiology

- [Van Limbergen et al. \(2017\)](#) Scoring biosecurity in European conventional broiler production, *Poultry Science*
- [Olsen et al. \(2017\)](#) Impact of egg disinfection of hatching eggs on the eggshell microbiome and bacterial load, *Poultry Science*
- [Chatelet et al. \(2017\)](#) Impact of hygiene of housing conditions on performance and health of two pig genetic lines divergent for residual feed intake, *Animal*
- [Poulsen et al. \(2017\)](#) Longitudinal study of transmission of *Escherichia coli* from broiler breeders to broilers, *Veterinary Microbiology*
- [Giles et al. \(2017\)](#) Molecular approaches to the diagnosis and monitoring of production diseases in pigs, *Research in Veterinary Science*

PROHEALTH is co-organising a session at the **Annual Meeting of the European Federation of Animal Science (EAAP)** on the topic: 'Sustainable control of production diseases in pigs and poultry, with emphasis on early survival' find out more on www.fp7-prohealth.eu/events/eaap-2018

For a full list of all PROHEALTH publications please go to www.fp7-prohealth.eu/knowledge-platform/scientific-publications or read more about PROHEALTH results as part of the **EU's Results Pack on FOOD 2030** www.cordis.europa.eu/result/rcn/229073_en.html

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