



## Editorial: Addressing 21st century challenges in pig production

R.J.E. Hewitt<sup>a,\*</sup>, B. Kemp<sup>b</sup>, S. Millet<sup>c</sup>

<sup>a</sup> SunPork Group, Qld, Australia

<sup>b</sup> Adaptation Physiology Group, Department of Animal Sciences, Wageningen University and Research, Wageningen, the Netherlands

<sup>c</sup> Flanders Research Institute for Agriculture, Fisheries and Food (ILVO), Animal Sciences Unit, Melle, Belgium



The Australasian Pig Science Association (APSA) has provided a forum for scientific discussion related to all aspects of the pig industry since its establishment in 1987. The *Manipulating Pig Production* conference was held for the 18th time in 2021 and focussed on meeting the challenges of producing pork in the 21st century. This conference is viewed globally as an innovative and progressive event. This supplement issue of *Animal* combines review papers, written by invited speakers of the conference, dealing with a diverse range of topics seeking to address contemporary challenges of pig production: from managing the progeny of hyperprolific sows to meeting the expectations of society in addressing animal welfare and sustainability whilst coping with climate change which influences, both directly and indirectly, pork production.

High levels of morbidity and mortality in neonatal pigs are still widespread and have been further exacerbated by the increased use of hyperprolific sows (Baxter and Edwards, 2018). Nutritional and management strategies to improve the performance of neonatal pigs are identified by Farmer and Edwards (2022). They show that nutritional interventions prior to ovulation, such as feeding more energy or fermentable fibres, directly influence oocyte quality and reduce the incidence of piglets experiencing intrauterine growth restriction, whilst feeding specific amino acids during pregnancy enhances the functional quality of the placenta, leading to greater mean piglet birth weights. Nutrition in the transition period, the period just before and after farrowing, is also identified as being critical given the onset of lactogenesis, the potential for foetal hypoxia during the birthing process and the enhancement of colostrum quality and yield. Other management practices in early lactation that have their place in improving the survival and performance of the neonatal pig are also addressed, such as optimising the farrowing environment, the provision of appropriate assistance during and immediately after the farrowing process and alternative rearing practices such as cross-fostering, utilising nurse sows and the provision of artificial milk.

Tail biting continues to be a serious behavioural problem in modern pig production, resulting in reduced animal welfare and health and economic loss to producers (Edwards and Valros, 2021). Tail docking has been the primary practice to reduce this vice and despite it being banned as a routine procedure in the

European Union (EU) since 1994, the absolute majority of pigs are still docked in the EU, and globally. However, the Finnish pig industry has been operating with a total ban on tail docking since 2003 and Finnish producers do not perceive tail biting as a serious issue. In her review, Valros (2022) outlines the typical features of pig farms in Finland that may allow reducing the need for tail docking and the prevalence of tail biting lesions, while discussing risk factors for tail biting. Most Finnish producers have stated they would probably not dock even if it was legal. Despite tail biting still occurring at significant levels, its early detection and the use of intervention 'first-aid kits' have enabled an acceptable and manageable level of tail biting to be reached, with the Finnish producer motivated to rear non-docked pigs, which is possibly one of the most important prerequisites for success.

The projected rise in the global human population and the anticipated increase in demand for meat and animal products whilst reducing the environmental footprint of production present a difficult set of challenges to the livestock sector. Meeting these challenges is likely to require complex decision-making, drawing on evidence from within the whole supply chain and from external sources. A smart agri-system (Collins and Smith, 2022) offers such an integrated multiperspective approach, utilising the cutting edge of precision farming and computer science combined with in-depth insights from data analytics, business, and policy to allow multiobjective decision-making. Collins and Smith (2022) outlines the advantages and challenges of adopting a smart agri-system approach and the relative position the livestock sector sits compared to the adoption of precision agriculture in crop production and outlines how the implementation of such an approach is enhancing the sustainability of a pork production system.

The welfare of farm animals continues to be a primary concern of consumers (Alonso et al., 2020) and robust animal welfare assessment tools are required to identify areas where welfare is compromised or could be enhanced. Kells (2022) highlights the Five Domains framework as a model that has undergone regular updates since its inception in 1994 to keep up with new knowledge and understanding in animal welfare. This paper has a particular focus on Domain 5, the mental or affective state, which draws on the likely consequences of the factors within Domains 1 to 4 – nutrition, physical environment, health, and behavioural interaction – to represent the animal's current welfare state. This approach suggests that the ability to promote positive welfare,

\* Corresponding author.

E-mail address: robert.hewitt@sunporkfarms.com.au (R.J.E. Hewitt).

through the provision of opportunities to express intrinsic behaviours and improved pig-human interactions, is possible within pork production systems.

Pig production faces seasonal fluctuations, which are likely to be exacerbated by climate change, and summer conditions, particularly heat stress, compromise the efficiency of pig production, not only in Australia but around the world. Lower farrowing rates of sows mated in summer, increased carcass fatness of progeny born to those summer mated sows and the slower growth of finisher pigs in summer are examples of seasonal impacts on production efficiency. Liu et al. (2022) reviewed the advances in knowledge that have occurred over the past decade in helping us understand the mechanism underlying these impacts associated with heat stress and provides the reader with potential amelioration strategies. The farrowing rate of sows mated in summer is at least 5–10% lower than the annual average with environmental temperature and daylight length postulated as the cause. The consensus of studies suggests this is mainly due to early pregnancy disruption. Impacts on maternal recognition of pregnancy, embryo survival, the uterine environment and sperm and oocyte quality are discussed. Seasonal patterns of carcass fatness have been reported in Australia, South Korea and Spain and can have major economic impacts within markets that sell products with the rind on. The underlying mechanism of this phenomenon associated with heat stress affecting foetal development and muscle deposition potential, resulting in more low-birth weight (<1.1 kg) pigs, is discussed, along with the direct impacts of heat stress on the growth performance of grower/finisher pigs.

Renaudeau and Dourmad (2022) showed that heat stress is not only an Australian problem. In their review, they investigated the available knowledge of the impact of climate change on EU pig production, with both average temperature and frequency of heat-waves increasing, they identified the main issues that need to be overcome and discussed the modelling approaches undertaken to understand future impact. Heat stress, both acute and chronic, impacts the pig's ability to maintain their relatively constant core body temperature where metabolism is optimal, resulting in loss of performance. However, environmental heat stress is also going to impact the availability and quality of feed resources. On a global scale, climate change will continue to reduce the production of major crops, but these impacts are likely to be geographically specific, with 20% decline in winter wheat predicted for France by the turn of the century, coupled with reductions in cereal grain protein content, and an increase in both internal plant secondary compounds (tannins, phenols and other anti-nutritional factors) and mycotoxin contamination. Accounting for these direct and indirect possible effects adds uncertainty to model projections, and the main issues still to overcome are discussed in this review.

The gastrointestinal tract (GIT) microbiota has received considerable attention due to its essential role in many body processes with work in humans demonstrating links to irritable bowel syndrome, obesity, and asthma, amongst others. However, despite the growing number of publications in this field, it is often difficult to distinguish which research is most relevant for generating solutions applicable for industry. The review of Nowland et al. (2022) focuses on the GIT microbiota of pigs prior to weaning and the ability to influence key pork industry issues and shows that a major determinant of the health and performance of animals is microbial colonisation of the GIT in early life. This early colonisation is influenced by numerous factors including the mother, the pen environment and management practices such as cross-fostering and the use of antibiotics. However, the review also highlights that whilst the immediate impacts of such factors may be understood, the longer-term effects remain unknown and whether interventions in early life can sustain long-term improvements in performance.

In summary, APSA has again developed a scientific programme for its biennial conference, *Manipulating Pig Production* that covered a wide array of topics highly relevant to the challenges of 21st century global pig production. The opportunities to come together in meetings of this nature, and the sharing of these reviews in this journal, continue to encourage the understanding and adoption of new knowledge and technology and continued collaborations into the future.

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Not applicable.

#### Data and model availability statement

Not applicable.

#### Author ORCIDs

**R.J.E. Hewitt:** <https://orcid.org/0000-0002-3353-2754>.

**B. Kemp:** <https://orcid.org/0000-0002-9765-9105>.

**S. Millet:** <https://orcid.org/0000-0003-2311-9381>.

#### Author contributions

**R.J.E. Hewitt, B. Kemp, and S. Millet:** writing, reviewing and editing.

#### Declaration of interest

Robert Hewitt was the President of the 2021 APSA Committee at which these reviews were presented.

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