

BURLEIGH DODDS SERIES IN AGRICULTURAL SCIENCE

Achieving sustainable production of pig meat

Volume 3: Animal health and welfare

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Introduction

Pig meat is the most widely-consumed meat in the world, accounting for 40% of the world's overall meat consumption. The leading producers are China, the EU, USA, Brazil, Russia, Vietnam, Canada, Japan, the Philippines and Mexico. Consumption is growing, both in developed markets such as the United States and particularly in developing countries in Asia. Previous growth in pig production has been driven primarily by developments in breeding and the shift to larger, more intensive systems. These systems face a range of challenges in increasing production sustainably to meet rising demand. Pig production remains vulnerable to zoonotic and other diseases affecting pigs as well as the problem of antibiotic resistance. There is growing pressure to improve feed efficiency in the face of competition for raw materials and rising feed costs. At the same time, there is an increasing focus on reducing the environmental impact of animal production. Finally, consumers are increasingly concerned about animal welfare in intensive systems.

These challenges are addressed by *Achieving sustainable production of pig meat*. The three volumes are:

- Volume 1 Safety, quality and sustainability
- Volume 2 Animal breeding and nutrition
- Volume 3 Animal health and welfare

This volume, Volume 3, reviews the latest research on diseases affecting pigs and their management, as well as providing a comprehensive review of pig welfare across the life-cycle, from gilts and sows to weaned piglets and finishing pigs. The volume also includes generic welfare issues such as the role of pasture-based systems, humane transport, lairage and slaughter techniques.

Part 1 Animal health

The first part of the volume reviews the main diseases affecting pigs as well as ways of managing diseases and boosting pig immune function. Chapter 1 provides an overview of common bacterial, viral, and parasitic pathogens of pigs. Recent events such as the 2009 pandemic influenza outbreak, the continuous spread of African swine fever virus in Eastern Europe, and the recent introduction of several new pathogens into the United States and their spread to Canada, Mexico, Central, and South America have shown the ability of pig diseases to move quickly across borders, and the importance of global cooperation in improve the health and welfare of pigs. The chapter summarizes some of the most common bacteria (both gram-negative and gram-positive), viruses, and parasites found in pig production, and discusses which are particularly important due to their significant effect on production, importance from an international trade perspective, or zoonotic concern.

Continuing the theme of diseases in pigs, Chapter 2 addresses changing patterns of disease affecting pigs, with a particular focus on Porcine Reproductive and Respiratory Syndrome (PRRS) and Porcine Epidemic Diarrhoea (PED). PRRS virus and PED virus are two of the major viruses that affect pigs worldwide. The chapter examines the transmission,

clinical presentation, evolution and spread of these two agents (PRRSv and PEDv), given their importance for pig production worldwide. The chapter discusses in detail the causes, transmission and spread of these two viruses in the pig population both worldwide, and more specifically, the United Kingdom (UK). The chapter provides readers with an overview of the complexity of these two agents and how this influences their clinical presentation and evolution over time and space.

Moving from respiratory systems to the gut, Chapter 3 examines the influence of the gut microbiome on developing immune and metabolic systems in the young pig. The immune and metabolic systems of young piglets develop after birth, and the rate and type of development is strongly associated with the rate and type of colonisation of the intestine with bacteria. The chapter describes the enteric and mucosal immune systems of pigs and presents evidence from experimental studies of the links between the immune system and microbiota. The chapter describes the composition of the microbiome in pigs and highlights its importance in the development of pig immune systems.

The focus of the final chapter in Part 1, Chapter 4, is disease identification and management on the pig farm. After examining the process of disease identification, the chapter provides an overview of disease management and control in pigs. The chapter evaluates both external and internal biosecurity before focusing on the role of vaccination and antimicrobial medication.

Part 2 Welfare issues

Part 2 reviews what we know about pig behaviour and appropriate welfare standards. It also assesses the welfare of different groups of pigs, from gilts and sows to weaned piglets and finishing pigs, as well as transport, lairage and slaughter.

Chapter 5 sets the scene by reviewing current understanding of pig behaviour. The behavioural patterns of domesticated pigs are well conserved from their ancestors. This suggests that the underlying motivational systems are similar to those of wild boar and feral domestic populations. The chapter describes how commercial conditions, whilst providing some welfare benefits, can constrain behavioural expression. The chapter reviews the behavioural ecology of pigs, introduces the concept of behavioural needs and considers the developmental and additive genetic basis behind individual differences in behaviour.

Complementing the previous chapter's focus on pig behaviour, Chapter 6 provides an overview of the challenges of defining and ensuring animal welfare in pig production. Raising pigs for consumption involves exercising control over the quality and duration of their lives, and it is widely accepted that there is a duty to exercise this control humanely. The chapter begins by reviewing conceptual frameworks which can be used to consider and assess animal welfare, and discusses the development of public opinion on the subject. The chapter then discusses common welfare concerns such as confinement, floor space, group size, injuries and surgical husbandry procedures.

Moving on from welfare challenges in pig production Chapter 7 considers pasture systems for pigs. The inclusion of pastures in outdoor pig systems contributes to improving welfare and the sustainability of these farming systems, since it reduces the environmental impact of pig production, as well as reducing nutrient load and soil compaction and thereby improving nutrient distribution. The chapter examines the characteristics and consequences of pasture pig systems (including forage), and provides a detailed case

study of the pasture pig system developed at the Center for Environmental Farming Systems (CEFS), in Goldsboro, North Carolina in the United States.

Chapter 8 considers the welfare of a specific group of pigs, namely gilts/pregnant sows. Mismatches between the evolutionary biology of the sow and current commercial production systems give rise to welfare challenges of stereotyped behaviour development in confined systems and aggression in group housing systems. The chapter describes the welfare issues associated with individual confinement systems and examines the nature and significance of stereotyped behaviour in gestating sows. The chapter addresses the issue of hunger in the pregnant sow, and pressure to adopt group housing systems for pregnant sows. The chapter has a particular focus on the importance of social organisation in sows and looks in detail at the relationship between aggression in stable groups and the method of feed provision available. Finally, the chapter examines sows in extensive systems.

Complementing the previous chapter's focus on pregnant sows, Chapter 9 goes on to examine the welfare of another group of pigs: weaned piglets. Concerns about and demands for improved animal welfare and animal handling systems from authorities, non-government organizations (NGOs), markets, and the public in general are increasing. Among the phases of pork production with opportunities to improve welfare, the weaning period has the greatest opportunity to positively impact most animals. The chapter focuses on current practices that can be detrimental to piglet well-being, alternatives and/or improvements to these, and advances in technology that could improve animal well-being as well as profitability and sustainability.

Continuing the theme of pig welfare at specific life stages of the pig, Chapter 10 examines the welfare of pigs during finishing. Finisher pigs, those of a post-weaning age kept for slaughter, make up the majority of the world pig population of approximately 1 billion animals. The intensive production system for post-weaned pigs is characterised by higher animal density, larger farms, use of concentrated foods and control of the production environment, particularly temperature, humidity and lighting. The chapter explores the relationship between nutrition management and the welfare of finishing pigs and the links between physical and social environment and finisher welfare. The chapter addresses the importance of environmental enrichment and ways to avoid tail biting behaviour. Finally, the chapter describes methods of practical welfare assessment of finisher pigs.

Chapter 11 looks at issues surrounding the transport and lairage of pigs. Defects in meat quality cause huge economic losses for the swine industry each year. Reduction in stress prior to slaughter can help alleviate these costs. The chapter describes the main events that may contribute to pre-slaughter stress and their impacts on animal welfare and pork quality, from on-farm loading facilities and handling to transportation, lairage and handling at the slaughter facility. The chapter evaluates the effects of different pre-slaughter events on animal welfare and pork quality, and describes what producers, truck drivers, and slaughter facilities need to do in order to mitigate these factors.

Concluding the volume, and examining the final stage of pig welfare, Chapter 12 focuses on humane slaughter techniques for pigs. The chapter addresses three stages of the slaughter process, namely movement of pigs, stunning, shackling and sticking. The chapter considers the challenges associated with group-based handling of pigs on the day of slaughter and examines the importance of best practice in surveillance and documentation of animal welfare levels on the day of slaughter. Finally, the chapter shows how improved value of meat products can be achieved by the adoption of the best slaughtering practices.

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