



**THE EFFECTS OF INDIVIDUAL AND
COMBINATIONS OF AIRBORNE
POLLUTANTS ON FEED INTAKE, IMMUNE
FUNCTION AND PHYSIOLOGY OF THE PIG**

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Summary

Poor air quality and surface hygiene are associated with increases in the prevalence and severity of enteric and respiratory diseases, as well as reduced growth rates in pigs. The pollutants which contribute to poor air quality include gases, dust, airborne particles, microorganisms and their toxins. In this study I investigated; 1) the effects of ammonia and alpha haemolytic cocci (AHC) including viridans-group streptococci (VGS) on feed intake, immune function and respiratory tract physiology in pigs, 2) the effects of stocking density on air quality parameters and growth rate in pigs and 3) the effects of shed design and management on air quality parameters. While exposure to AHC appeared to have a greater effect than ammonia on growth rate and feed efficiency, as well as aspects of immune function, the most significant effects were observed in pigs exposed to high levels of ammonia followed by AHC.

There was a strong positive relationship between the stocking density (StD) (m^3 airspace/pig) and the mean growth rate in pigs from 10 to 22 weeks of age, in an all-in/all-out (AIAO) system. There was also a strong negative relationship between stocking density and the number of viable bacteria in the airspace. As the volume (m^3 of airspace)/pig increased, the concentration of bacteria in the airspace decreased and the growth rate of the pigs increased significantly. I hypothesise that airborne bacteria trigger an immunological challenge which redirects metabolic activity that would otherwise contribute to growth and skeletal muscle accretion.

There is evidence that shed design and management can affect air quality and, consequently, growth rate of pigs. The results indicate that improving ventilation through widening ridge vents, leaving floors to dry before restocking pens, increasing pit depth to ≥ 400 mm, and flushing pits with fresh water all have a positive effect on air quality and growth rate. It is clear that facilities need to be managed as an all-in/all-out (AIAO) system as this enables farmers to maximise hygiene by thoroughly cleaning pens between batches, which is likely to improve air quality. Other important management and husbandry factors include adhering to stocking density (m^3 airspace/pig) and stocking rate (pigs/ m^2 floorspace) recommendations, especially in naturally ventilated buildings. The shape and dimensions of the shed, the ventilation and heating system used, and the effluent management system are also important. Maintaining good air quality is essential for pig health, growth, and welfare, as well as those working with pigs.

Statement of originality

This work contains no material which has been accepted for the award of any other degree or diploma in any university of other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

I give consent to this copy of my thesis, when deposited in the University library, being available for loan and photocopying, subject to the provisions of the Copyright Act 1968.

Signed: _____

Timothy Wayne Murphy
December, 2011

Dedication

For my darling wife Lesley

.....Forever

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Abbreviations used in this thesis

Age-segregated rearing	ASR
Allophycocyanin	APC
All-in/all-out	AIAO
Alpha haemolytic cocci	AHC
Average daily gain	ADG
Bacteria	Bac
Batch Farrowing	BF
Beta-glucan	β-1,3-glucan
Bronchial Associated Lymphoid Tissue	BALT
Bronchoalveolar lavage	BAL
Bronchoalveolar lavage fluid	BALF
Cell Mediated Immunity	CMI
Colony forming unit	cfu
Degrees Celsius	°C
Endotoxin Unit	EU
Ethylenediaminetetraacetic acid	EDTA
Feed conversion ratio	FCR
Fluorescein isothiocyanate	FITC
Forced expiratory volume-in-one-second	FEV₁
Forced expiratory flow rate at 25-75% of the FVC	FEF₂₅₋₇₅
Forced vital capacity	FVC
Gram	g
Hour	h
Hygiene air quality	HAQ
Immunoglobulin	Ig
Inspirable particles	TD
Insulin-like growth factor 1	IGF-1
Interleukin-1	IL-1
Intracerebroventricularly	ip
Intraperitoneally	icv
Kilogram	kg

Litre	l
Litre per minute	l/min
Metabolisable energy	ME
Micron	µm
Milligram	mg
Millilitre	ml
Minute	min
Nanogram	ng
Nanomole	nMol
Natural killer	NK
Occupational health and safety	OH&S
Parts per million	ppm
Peridinin Chlorophyll Protein	PerCP
Peripheral blood mononuclear cells	PBMC
Phosphate buffered saline	PBS
Phycoerythrin	PE
Red blood cells	RBC
Relative Humidity	RH
Respirable particles	RP
Revolutions per minute	rpm
Second	sec
Segregated early weaning	SEW
Standard error of the mean	SEM
Standard deviation	SD
Stocking density	StD (m³ airspace/pig)
Stocking rate	pigs/m² floorspace
Streptavidin-Cy-Chrome	CyC
Total dust	TD
Viridans-group streptococci	VGS
Voluntary feed intake	VFI
White blood cell	WBC

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Homer: Wait a minute wait a minute wait a minute. Lisa honey, are you saying you're

never going to eat any animal again? What about bacon?

Lisa: No.

Homer: Ham?

Lisa: No.

Homer: Pork chops?

Lisa: Dad! Those all come from the same animal!

Homer: [*Chuckles*] Yeah, right Lisa. A wonderful, magical animal”

The 7th Season of the Simpson's – Lisa the Vegetarian (3F03)

www.snpp.com/episodes/3F03.html