



# **Antemortem Inspection of Pigs On-Farm: Impact on Food Safety and Animal Welfare**

A thesis  
submitted by

**Jan Jackowiak**

(BSc., BVMS, Murdoch University, Western Australia)

to the  
Faculty of Agriculture and Natural Resource Sciences  
The University of Adelaide

for the degree of  
Master of Agricultural Science

Department of Animal Science  
March 2000

<u>TABLE OF CONTENTS</u>	<u>page</u>
Title Page.....	1
Table of Contents.....	2
List of Tables and Figures.....	6
Acknowledgments.....	7
Declaration.....	8
Abbreviations.....	9
<u>Chapter 1 Introduction</u> .....	<u>10</u>
<u>Chapter 2 Literature Review</u> .....	<u>13</u>
2.1 Introduction.....	14
2.2 Antemortem inspection.....	15
2.2.1 History of antemortem inspection.....	15
2.2.2 Current objectives of antemortem inspection.....	17
2.2.3 Limitations of abattoir antemortem inspection.....	18
2.2.4 Trialing of on-farm antemortem inspection.....	19
2.2.5 Impact of quality assurance on antemortem inspection procedures.....	20
2.3 Outcomes of antemortem inspection.....	21
2.3.1 Conditions commonly detected at antemortem inspection.....	21
2.3.2 Food safety significance of antemortem inspection.....	25
2.3.3 Impact of antemortem inspection on the slaughter process.....	27
2.4 <i>Salmonella</i> – its role in food poisoning.....	28
2.4.1 Importance of <i>Salmonella</i> as a food borne pathogen.....	28
2.4.2 Carcase contamination by <i>Salmonella</i> organisms.....	29
2.4.3 <i>Salmonella</i> in pigs.....	32
2.4.4 Effect of stress on <i>Salmonella</i> levels.....	34
2.5 Summary.....	37

**TABLE OF CONTENTS**

	<b><u>page</u></b>
<b><u>Chapter 3 Methods Development.....</u></b>	<b><u>38</u></b>
3.1 Introduction.....	39
3.2 Classification of grossly detectable abnormalities.....	39
3.3 Standardisation of protocols.....	42
3.4 Postmortem classification of grossly detectable abnormalities.....	45
3.5 Pretesting.....	46
<b><u>Chapter 4 Comparison of On-farm and Abattoir Antemortem Inspection.....</u></b>	<b><u>47</u></b>
4.1 Introduction.....	48
4.2 Methods.....	48
4.2.1 Selection of Herds.....	48
4.2.2 Training.....	49
4.2.3 Inspection on-farm.....	50
4.2.4 Inspection at abattoir.....	50
4.2.5 Analysis of Results.....	51
4.3 Results.....	52
4.3.1 Herd and batch characteristics.....	52
4.3.2 Suspects detected on-farm and at abattoir.....	53
4.3.3 Impact on animal welfare.....	54
4.3.4 Impact on meat rejection and carcass disposition.....	55
4.3.5 PHMS findings in suspect and normal pigs.....	56
4.4 Discussion.....	56
4.4.1 Effectiveness of on-farm antemortem inspection.....	56
4.4.2 Animal welfare benefits of on-farm antemortem inspection.....	57
4.4.3 Potential impact of on-farm antemortem inspection on carcass disposition.....	58

**TABLE OF CONTENTS****page****Chapter 5 Verification of Producer and Abattoir Antemortem Inspection**

	<b><u>Classification of Pigs</u></b> .....	<b><u>60</u></b>
<b>5.1</b>	<b>Introduction</b> .....	<b>61</b>
<b>5.2</b>	<b>Methods</b> .....	<b>61</b>
5.2.1	Selection of herds.....	61
5.2.2	Reference inspector.....	62
5.2.3	On-farm verification protocols.....	62
5.2.4	Abattoir verification protocols.....	62
5.2.5	Statistical analysis.....	63
<b>5.3</b>	<b>Results</b> .....	<b>64</b>
5.3.1	Comparisons between producers and the reference inspector.....	64
5.3.2	Comparisons between an abattoir inspector and the reference inspector.....	66
<b>5.4</b>	<b>Discussion</b> .....	<b>67</b>

**Chapter 6 Salmonella Levels in Suspect Pigs**..... **69**

<b>6.1</b>	<b>Introduction</b> .....	<b>70</b>
<b>6.2</b>	<b>Methods</b> .....	<b>70</b>
6.2.1	Choice of sample type.....	70
6.2.2	Collection of specimens.....	71
6.2.3	Culture of specimens.....	71
6.2.4	Analysis of results.....	72
<b>6.3</b>	<b>Results</b> .....	<b>72</b>
<b>6.4</b>	<b>Discussion</b> .....	<b>74</b>
6.4.1	Culture results.....	74
6.4.2	Effect of time off-feed.....	75
6.4.3	Potential food safety significance.....	75

**TABLE OF CONTENTS**

	<b><u>page</u></b>
<b><u>Chapter 7</u></b> <b><u>Records of Partial/Total Condemnations in Abattoir Data</u></b> .....	<b><u>78</u></b>
7.1 <b>Introduction</b> .....	<b>79</b>
7.2 <b>Methods</b> .....	<b>80</b>
7.2.1    Sources of data.....	80
7.2.2    Selection of abattoirs.....	80
7.2.3    Analysis of data.....	80
7.3 <b>Results</b> .....	<b>81</b>
7.3.1    Abattoir A, C and D.....	81
7.3.2    Abattoir B.....	81
7.3.3    Abattoir E.....	84
7.3.4    Impact of antemortem inspection on food safety.....	85
7.4 <b>Discussion</b> .....	<b>85</b>
7.4.1    Potential impact of on-farm antemortem inspection on food safety.....	85
7.4.2    Comparison of suspect data with condemnation records.....	86
7.4.3    Regulatory issues.....	87
<b><u>Chapter 8</u></b> <b><u>Conclusions</u></b> .....	<b><u>89</u></b>
8.1 <b>Major findings</b> .....	<b>90</b>
8.2 <b>Significance for producers</b> .....	<b>91</b>
8.3 <b>Significance for abattoirs</b> .....	<b>91</b>
8.4 <b>Significance for regulators</b> .....	<b>92</b>
8.5 <b>Significance for consumers</b> .....	<b>93</b>
8.6 <b>Issues raised</b> .....	<b>93</b>
<b><u>Chapter 9</u></b> <b><u>References</u></b> .....	<b><u>94</u></b>
<b><u>Chapter 10</u></b> <b><u>A Producers Guide to On-farm Antemortem Inspection of Pigs</u></b> ....	<b><u>106</u></b>

**LIST OF TABLES AND FIGURES**

		<b><u>page</u></b>
Figure 1	Effect of fasting, transport and lairage on <i>Salmonella</i> levels.....	73
Table 1	Comparison of efficiency of antemortem and postmortem inspection at detecting conditions which normally warrant segregation prior to slaughter...	18
Table 2	Some studies on the prevalence of <i>Salmonella</i> in slaughter pigs.....	30
Table 3	Effect of length of stay in abattoir lairages on prevalence of <i>Salmonella</i> (as % of caeca sampled) in slaughter pigs.....	36
Table 4	Feedback from Australian abattoirs on simplified criteria for classification of grossly detectable abnormalities at abattoir antemortem inspection.....	40
Table 5	Criteria for antemortem inspection of baconers (as amended).....	41
Table 6	Instructions for producers.....	43
Table 7	Standard farm/abattoir reporting sheet.....	44
Table 8	Post-mortem criteria and codes to be used at participating abattoirs.....	45
Table 9	Number of herds, batches and pigs inspected.....	52
Table 10	Distribution of major causes of pigs being classified as suspect by producers on-farm and by antemortem inspectors at the abattoir.....	53
Table 11	Cross-classification of the results of inspection for abnormalities by producers on-farm and by antemortem inspectors at abattoir (n=9,597).....	54
Table 12	Exacerbation of injuries of suspect and normal pigs during transport.....	55
Table 13	Results of antemortem comparisons between producers A, E and D, and the reference inspector.....	64
Table 14	Breakdown of the grossly detectable abnormalities found by producers on the three farms, and statistical comparisons with the reference inspector.....	66
Table 15	Results of antemortem comparisons at one of the project abattoirs between one of the trained antemortem inspectors and the reference inspector .....	66
Table 16	Comparison of prevalences of grossly detectable abnormalities detected in the Netherlands (Harbers et al, 1992a) and Australia (this trial).....	68
Table 17	Incidence of <i>Salmonella</i> isolated from caecal contents of suspect and normal pigs relative to health status and time off-feed prior to slaughter.....	72
Table 18	Incidence of <i>Salmonella</i> isolated from caecal contents of pigs relative to origin and time off-feed prior to slaughter.....	72
Table 19	Prevalence of <i>Salmonella</i> serovars isolated from caecal contents in other studies.....	73
Table 20	Reasons for classifying bacon pigs as suspect at abattoir B.....	82
Table 21	Reasons for postmortem condemnation of suspects at abattoirs B and E....	82
Table 22	Comparison of suspect records with condemnation records.....	83
Table 23	Reasons for postmortem condemnation of normal pigs at abattoir E.....	84

## Acknowledgments

The breadth of this study required the cooperation of a large number of abattoir personnel, pig producers, veterinarians and PHMS inspectors. To these people I offer my sincere thanks.

It is clear that the producers, supported by their veterinarians, have applied themselves in a rigorous and conscientious manner, for which they are warmly thanked. There is much in the data to indicate that their standard of stockmanship ranks highly by international standard.

I am grateful to the participating abattoirs for embracing the project objectives so enthusiastically, for providing a facility for conducting the training sessions and for making their staff available.

I am particularly indebted to the state coordinators who recruited the producers, organised the training sessions and coordinated all the tasks required for each test batch of pigs, and monitored the postmortem findings.

The development of the antemortem and post-mortem criteria was made possible by the responsiveness of the survey respondents. Without their willing expertise the criteria could not have been as realistic and relevant to the field situation.

Jo Slade helped in compiling the training manual and video.

Margaret Cargill taught me the intricacies of scientific writing.

Viv Kolega for the competent microbiology.

Apart from the abovementioned, my personal thanks go especially to the following people:

My supervisors, Dr Phil Hynd (Department of Animal Science, University of Adelaide) and Dr Andrew Pointon (South Australian Research and Development Institute), who both provided constructive criticism of this thesis. Phil Hynd also provided guidance in the extent of the experimental studies and literature review, and ensured I met all my university obligations. Andrew Pointon was the driving force behind the whole project. He set it up largely as part of my employment with the South Australian Research and Development Institute and has mentored me all the way along. I wouldn't have got anywhere without him.

Financial support for the study was generously supplied by the Pig Research and Development Corporation.

**Declaration**

This thesis contains no material previously submitted for the award of any other Degree or Diploma in any other university or institution. To the best of my knowledge, this thesis does not contain any material previously written or published by another person, except where a due reference has been made in the text.

I give consent to this copy of my thesis, when deposited with the University Library, being available for loan and copying.

Date: 10/11/2000

Signature:

Jan Jackowiak



**Abbreviations**

AAPV	Australian Association of Pig Veterinarians
APIQS	Australian Pig Industry Quality Standards
AQIS	Australian Quarantine and Inspection Service
CCP	Critical Control Point
ELISA	Enzyme Linked Immunosorbent Assay
EHEC	Enterohaemorrhagic <i>E. coli</i>
EU	European Union
ECA	Export Control Act
HACCP	Hazard Analysis and Critical Control Point
PHMS	Pig Health Monitoring Scheme
QA	Quality Assurance
TB	Tuberculosis
US or USA	United States of America