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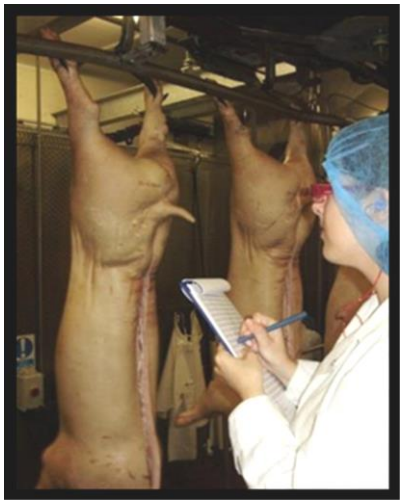
Development of ante and post mortem meat inspection (MI) of pigs as a welfare diagnostic tool (PIGWELFIND)



Key external stakeholders:
All stakeholders in the Irish pig industry including pig farmers/IFA, private pig veterinary practitioners, DAFM, Bord Bia, Meat Industry Ireland/pigmeat processors, Temporary Veterinary Inspectors, pig advisors and academics involved in vet public health (research and teaching).

Practical implications for stakeholders:
Carcass lesions such as skin and tail lesions (TL) observed at meat inspection (MI) provide valuable information on pig performance, health and welfare (HW) on-farm. Links discovered between TL score and lung diseases support the relationship between poor health and poor welfare of pigs on farms and reinforces the argument for inclusion of TL severity scores in the MI process as a HW diagnostic tool. To achieve this implementation of a standardised, computerised recording system at MI for the Irish pig industry is needed. Including carcass lesions and other indicators of pig HW at MI could provide a good monitoring tool allowing pig producers to evaluate their performance over time and against other producers for benchmarking purposes. This information can prove advantageous in developing pig HW management plans and so contribute to the productivity and improved consumer image of the Irish pig industry. Future work should focus on implementation of such a recording system, evaluating the use of the generated data by producers, advisors and vets and its effects on pig productivity, HW, and include cost/benefit analyses of such a system.

Main results:

Carcass lesions such as skin and TL observed at MI are related to and provide valuable information on pig performance, HW on-farm. Links discovered between TL score and lung diseases support the relationship between poor health and poor welfare of pigs on farms and reinforces the argument for inclusion of TL severity scores in the MI process with recorded data to be fed back to pig producers.
Links were also found between several of the carcass lesions measured and indicators of economic performance such as carcass weight. Total carcass and production losses due to carcass condemnations and carcass downgradings =1.7c per kg/deadweight or €1.37 per pig, on average=1.23% (1kg/81.1kg). Estimated annual carcass losses associated with TLs for 10,400 pigs (200 pigs sold p.w.) with TL prevalence (mild to severe) of 72.5% = €14,248.
The core finding of the stakeholder interviews was that any development and utilisation of MI data as a diagnostic tool for pig HW must be supported by the implementation of a communication strategy that will help to build trust and positive relations between all stakeholders in the pig industry. Such a strategy will provide real-time data to support producers to improve pig HW and thereby improve farm profitability. All stakeholders saw the benefit of MI data collection and feedback to pig producers, with certain conditions being of high priority (respiratory lesions).

Opportunity / Benefit:

- Including carcass lesions and possibly other indicators of pig HW at MI could provide a good monitoring tool allowing pig producers to evaluate their performance over time and against other producers for benchmarking purposes.
- This information could prove advantageous in developing pig HW management plans and so contribute to the productivity and improved consumer image of the Irish pig industry.

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- A centralised system to record the findings of MI outcomes could serve as national disease surveillance tool/early warning system and if an all-island approach was taken it could be possible to achieve a "biosecure zone".
- Potential for more targeted prophylaxis and possibly reduced antibiotic use leading to improved HW of the national pig herd as well as a good marketing image.

Collaborating Institutions:

Teagasc project team:
Dr. Laura Boyle (PI)
Dr. Dayanne Lemos Teixeira (RO) (2013-2015)
Ms. Bernadette Doyle (RO) (2015-2016)
Dr. Nienke van Staaveren (Walsh Fellow)

External collaborators
Dr. Niamh O'Connell and Ms. Grace Carroll (QUB)
Mr. Mark Hawe (CAFRE)
Dr. Alison Hanlon and Dr. James Gibbons (UCD)
Ms. Catherine Devitt (External consultant social scientist)

1. Project background:

Pig production in Ireland is caught in a dilemma which is driven by narrow profit margins and the demand for cheap food on one side and regulatory requirements for food safety, animal welfare and environmental protection on the other. High feed prices combined with poor pig prices means that good herd management has never been more important to maximise efficiency and profitability of pig units. Suboptimal housing, management and stockmanship are associated with poor welfare in pigs and are reflected in disease, abnormal behaviour, injury, reduced longevity and productivity. More worryingly they result in an overuse of antibiotics and thereby contribute to the risk of antimicrobial resistance. Although maintaining high standards of animal welfare undoubtedly costs money, there are also financial costs associated with poor pig welfare. Carcass condemnation (CC) at MI (MI) is a major source of financial loss in the pig industry and was one of the main problems which this research hoped to address. It was the finding from earlier related research that abscessation caused by tail biting (a major welfare problem for pigs) is one of the main reasons for CC which led to the strong focus on TLs arising from tail biting in the current project. In a broader context we were aware of the findings of the European Food Safety Authority (EFSA), that MI data are under-utilised in the EU, even as a means of informing herd health programmes. EFSA also advocated the inclusion of indicators specific to pig welfare in the MI process. Hence, it was clear that ante and post mortem MI could be developed as a welfare diagnostic tool and thereby act as an aid to improving pig welfare on farm, reducing carcass losses and ultimately improving profitability of the Irish pig industry. In order to broaden MI to incorporate lesions related to pig welfare it became clear that the association between carcass lesions (especially TLs) and pig welfare on farm had to be validated and that there was a need for a standardized, computerised MI system in Irish slaughterhouses with which to record even routine MI findings. Ultimately though outside the remit of the current project the objective was for improved feedback of MI findings related to pig HW to producers such that they could use such information to inform their herd management plans.

2. Questions addressed by the project:

- Can findings of on-line MI/slaughter checks be used as a pig welfare diagnostic tool?
- What is the relationship between welfare problems detected ante and post mortem and other health issues and carcass condemnations?
- Are carcass lesions altered by processes along the slaughterline?
- Do pre-slaughter handling practices (i.e. mixing) influence the reliability of carcass lesions to reflect pig welfare on farm?
- What are the financial costs to producers of TLs and carcass condemnations?
- Do stakeholders see value in recording and reporting MI findings?

3. The experimental studies:

The research employed a combination of qualitative (social science) and quantitative (epidemiological and controlled) animal/veterinary science based studies. The qualitative work was conducted with stakeholders in the Irish and Northern Irish (NI) pig industry and the controlled animal/carcass based studies were conducted in the research farms at Moorepark (Teagasc) and Hillsborough (AFBI), NI, on commercial Irish pig farms and in slaughterhouses in ROI and NI. Data on TL scores, weights of condemned/trimmed carcass parts, reasons for viscera and carcass condemnation, bursitis and loin bruising collected on 3000 pig carcasses in one factory were compiled and analysed by the research officer hired for the PIGWELFIND

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project. This study yielded two scientific papers which helped to refine the TL scoring protocol which was to be used for most of the later work conducted by the PhD student based at Teagasc Moorepark. The first study involved a controlled comparison of the effects of mixing prior to slaughter on pig behaviour and carcass lesions. This study was conducted on a commercial farm and in the small, local abattoir they supplied. The following two trials were based in larger factories. The first recorded TLs in slaughter pigs in two factories and relationships with PigSys farm performance records were established. This work necessitated close collaboration with the Teagasc Pig Advisory service and utilised their eProfit Monitor. In the second, tail and lung pathologies were scored on the slaughterline in one slaughterplant. This work involved collaboration with pig pathologists in the Central Veterinary Research Laboratories in Backweston and UCD and a private veterinary practitioner with experience in scoring lung pathologies. The fourth study had two components. The first was a comprehensive HW assessment of pigs on 30 commercial farms using a modified version of the Welfare Quality® protocol. This was combined with scoring of TLs of slaughter pigs from the same farms at the different slaughter plants they supplied around the country. Other epidemiological, factory based work conducted by the team at Moorepark involved recording of reasons for detention of pigs ante-mortem and establishing the link between these findings and the outcome of the post mortem MI (on the basis of the acting veterinary inspectors decisions). Three years of data on ante mortem detentions from one Irish slaughterplant were also collected. In the original project plan we proposed to establish the prevalence of external abscesses etc. but it became clear that these occur at too low a prevalence to warrant further investigation. Similarly one of the studies proposed for the PhD student based at QUB could not proceed. The aim was to identify on-farm risk factors for behaviours linked to carcass condemnations and downgradings. However, following in-depth evaluation of the NI database of carcass condemnations (Carcass Information Analysis – CIA) we could not find enough farms with consistent condemnation problems for robust analysis. Instead we investigated the impact of carcass processing procedures on the visibility of carcass welfare lesions. The work was conducted in two abattoirs (Cookstown NI and Dawn ROI) in order to account for potential differences in processing between factories. The major part of the PhD research conducted by the NI team was carried out using the experimental pig herd at the Agri-Food and Biosciences Institute (AFBI) in Hillsborough. In a longitudinal study which followed pigs from birth through to slaughter the degree to which measures taken at slaughter reflect pig lifetime welfare was determined. Blood was also collected from these pigs at slaughter to enable physiological measurements (cortisol and acute phase proteins) to be related to indicators of pig lifetime welfare. Semi-structured stakeholder (veterinary inspectors, private veterinary practitioners, meat inspectors [NI only] and meat plant managers) interviews were conducted to establish perspectives regarding the potential use of ante and post mortem MI as an animal welfare (AW) diagnostic tool in pigs. Specifically a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis was carried out to identify the existing strengths and weaknesses in the industry, opportunities and threats internally and externally. A stakeholder workshop conducted in Nov. 2015 also employed a series of qualitative tools used in social science research.

4. Main results:

- Carcass TL were associated with a higher risk of carcass condemnation (CC) and of trimming. The primary reason for CC is abscessation (ABC) but we could not establish a link between carcass TL scores and the risk of ABC. As the TL score increases the cold carcass weight decreases (significantly in the case of scores ≥2).
- There is a high prevalence of TL and viscera condemnations in Irish pigs. Higher TL scores are associated with a greater risk of lungs being condemned for pathologies. There is significant variation between veterinary inspections in the scoring of viscera pathologies at slaughter.
- Lameness, “downer” and stress were the most common reasons for detaining pigs ante-mortem (AM). Abscess(es) was the primary identified reason for post-mortem (PM) condemnation. There were significant relationships found between reasons for detaining pigs AM and the likelihood of full or partial condemnations.
- Mixing of entire male pigs before transport to slaughter increases the occurrence of aggressive and mounting behaviour. In spite of effects of mixing, transport, slaughter and carcass processing, carcass skin and TL still reflect the presence of these lesions on-farm.
- Variation in TL was observed between farms, especially for moderate lesions. Such lesions are less common on farms which avail of record keeping through an advisory service. Prevalence of TL at MI is associated with farm productivity parameters.
- Indications of high prevalence of respiratory disease in Irish slaughter pigs is a cause for concern. Carcass TLs were associated with severe pleurisy, but not with enzootic pneumonia-like lesions.
- Carcass skin and TL prevalence at MI accurately predicted farms with problems with poor body condition in the 1st weaner stage, bursitis in the 2nd weaner stage and severe TL in the finisher stage.
- Severe skin lesions, TL and loin bruising are more visible on pig carcasses after they have been

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scalded and dehaired, and therefore this is when abattoir-based lesion scoring should take place. The high prevalence of all three lesion types, and the links shown with economically important production parameters, suggests more research into identifying key risk factors is warranted.

- Tail and skin lesions, acquired in both early and later life of the pig, remain visible on the carcass. Low carcass weight was associated with TL reflecting negative impact on growth performance.
- Pigs recorded as having TL during their lifetime had significantly higher hair cortisol levels at slaughter than those with no TL, and pigs recorded as having moderate or severe TL had significantly higher Haptoglobin (Hp) levels than those with no or mild TL. Pigs recorded as being lame during their lifetime also had significantly higher hair cortisol levels than non-lame pigs. As 'good welfare' quantitative behaviour analysis scores decreased, Haptoglobin levels tended to increase and C reactive protein (CRP) levels significantly increased. These findings suggest that Hp, CRP and hair cortisol measured at slaughter could provide insight into the welfare status of pigs during their lifetime.
- The relationship between aggression-related skin lesion scores and other parameters indicative of welfare is not straightforward. Larger pigs may be more inclined to engage in aggression and thus sustain higher levels of skin damage, while also being more susceptible to lameness. However, animals suffering from ill-health appear to avoid aggression and thus sustain fewer injuries. This would suggest that aggression-related skin lesions on the carcass are not a suitable iceberg indicator of welfare status in growing-finishing pigs.
- Producers recognised the benefit of using MI as a tool to improve pig HW. However, some producers were dissatisfied with the current system of MI and were concerned over how MI data will be used if developed further.
- Producers reported positive relationships with their Private Veterinary Practitioner (PVP) but their tolerance of certain animal welfare issues may limit the usefulness of MI data feedback to inform planning for pig HW.
- Communication and relationship difficulties exist between different stakeholders in the pig industry

5. Opportunity/Benefit:

- By developing intervention protocols for the prevention of carcass lesions pig producers can improve pig performance, HW and therefore profitability at farm level. Pigmeat processors could benefit economically from reduced costs of disposal of condemned carcasses and downgraded cuts of meats because of bruising/lesions.
- The project findings raise concerns for the HW of the national pig herd. This finding is of social relevance given the growing concern amongst consumers about the welfare of food producing animals. It also raises concern at a wider level because of the threat of antimicrobial resistance. Nevertheless, the links between the carcass lesions which can be measured at MI and indicators of relevance to pig performance and health on farm revealed offers a promising way of addressing some of these welfare problems.
- The work uncovered dissatisfaction amongst pig producers about current systems of MI and indeed inadequacies/inconsistencies in the way MI is performed. Many of these issues have particular relevance to policy and could be overcome by the implementation of a standardised, computerised system for recording MI (and pig HW measures) combined with some retraining of veterinary inspectors. This is in line with recent recommendations by other stakeholder groups charged with addressing profitability and sustainability issues in the Irish pig industry.

6. Dissemination:

Main scientific publications:

1. Carroll, G.A., Boyle, L.A., Teixeira, D.L., van Staaveren, N., Hanlon, A. and O'Connell, N.E. 2015. Effects of scalding and dehairing of pig carcasses at abattoirs on the visibility of welfare-related lesions. *Animal* 28: 1- 8. doi:10.1017/S1751731115002037
2. Devitt, C., Boyle, L.A., Teixeira, D.L., O'Connell, N.E., Hawe, M., and Hanlon, A. 2016. Stakeholder perspectives on the use of pig MI as a HW diagnostic tool in the Republic of Ireland and Northern Ireland; a SWOT analysis. *Irish Veterinary Journal* 69:17
3. van Staaveren, N., Doyle, B., Manzanilla, E. G., Calderón Díaz, J. A., Hanlon, A., Boyle, L.A. 2017. Validation of tail lesions measured on the carcass as indicators for on-farm HW. *Journal of Animal Science*. 95: 1528-1536

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