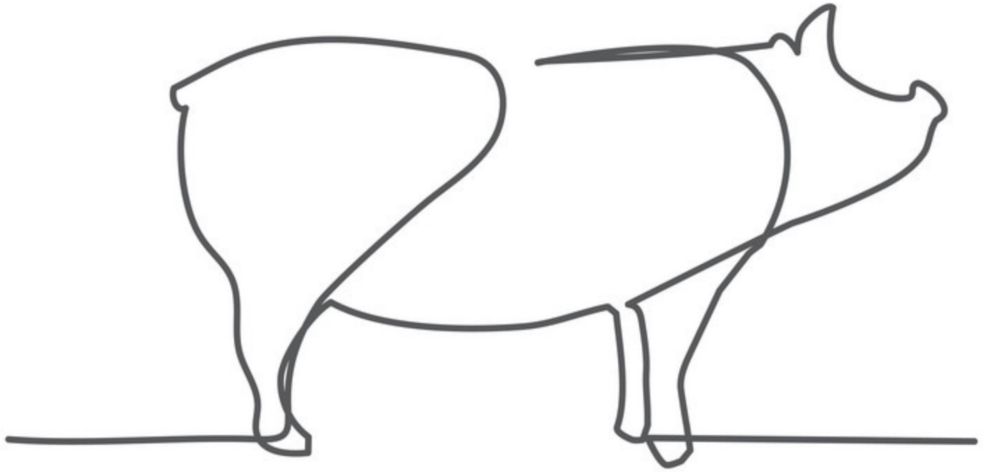
Evaluation of tail biting in pigs at the abattoir



Integrated Master's Dissertation in Veterinary Medicine

Alice Teresa Carneiro Gomes

University of Trás-Os-Montes e Alto Douro

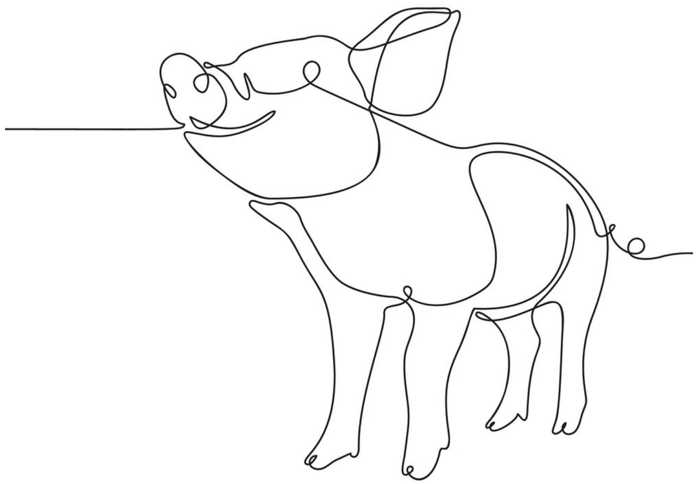
Vila Real, Fevereiro de 2022

The importance of pork

Pork is the most popular meat in terms of per capita consumption worldwide.

In Portugal, it is the second most consumed meat.

In 2020 there was an average per capita consumption of 41kg of meat.



Meat Inspection

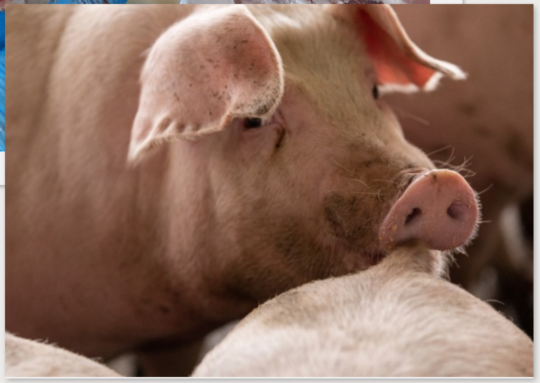
Ensures that the economic operator complies with regulated standards regarding public and animal health and animal welfare

OV

- Documentation
- *Antemortem inspection*
- *Postmortem inspection*
- Animal welfare

Tail biting

- Abnormal behaviour in pigs – can be developed through insufficient stimulation and frustration
- Multifactorial aetiology
- Economic impact from production (farm) to the slaughterhouse
- At the slaughterhouse, these lesions lead to an increase in carcass condemnations
- Monitoring tail biting in slaughterhouses is extremely important
- Welfare "iceberg" indicator



Objective of the study:

- Evaluate the occurrence of tail biting in slaughtered pigs
- To analyse the possible effect of different production systems and tail length on tail damage
- Evaluate the potential effect of tail bites and their severity on total/local condemnations
- To ascertain the importance of adopting a more detailed tail condition scoring system that includes scarred tissue (healed lesions)

Material and methods:

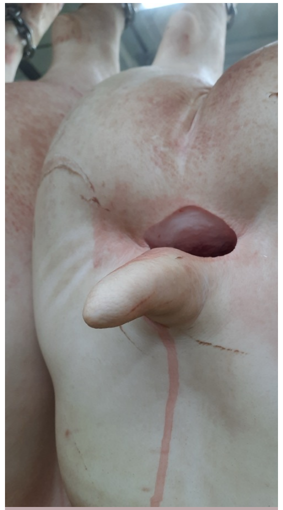
Data collection took place between November 2020 and January 2021, including 9189 pigs from 73 batches

Production systems:

- Conventional
- Convention without AM
- Organic

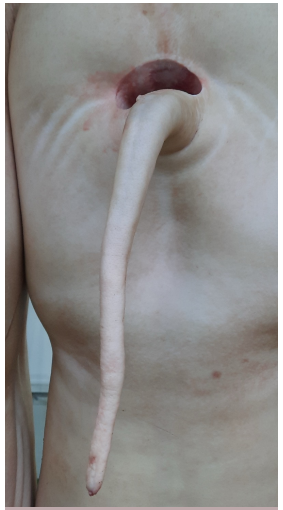
Tail length:

- Fully docked
- Docked mid-length
- Undocked



Fully docked

Docked mid-length



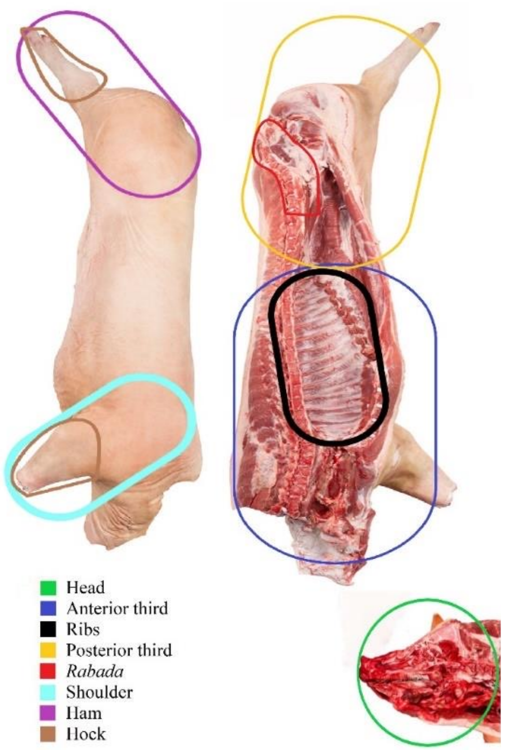
Undocked

By batch, all the animals were identified considering:

- farm of origin
- production system
- tail length
- number of animals per batch
- number and causes of total condemnation (TC)
- number, cause and location of partial carcass condemnation (LC)

In addition, a sample was selected from each batch included in the study, to assess 3636 animals individually. For this sample, in addition to the information collected at batch-level, the following was also recorded:

- Presence of pericarditis
- Presence of pleuritis
- Presence of pneumonia (lung abscesses, purulent pneumonia or presence of all other pneumonias)



Tail damage classification system – Lesion score

Grade 0	No lesion	Score 0
Grade 1	Superficial lesion, no perforation of the tissue or blood	Score 1 Mild lesion
Grade 2	Puncturing wounds associated with biting, with possible presence of blood and inflammation	
Grade 3	Extensive lesion associated with biting, with partial loss of tissue, but no change in tail length	Score 2 Severe lesion
Grade 4	Extensive lesion associated with biting, with partial loss of tissue with loss of tail length	

Tail damage classification system – scarring score

Grade 0	absence of scarring	**Score 0**
Grade 1	scar tissue, but no change in tail length	**Score 1**
Grade 2	scar tissue and loss of tail length	**Score 2**

Results

- The most common production system was conventional and the least common was organic
- In all production systems, the most common tail length was the fully docked
- Despite European legislation prohibiting tail docking as a routine procedure, many pigs in this study were still subjected to docking

	N	Percentage of total (%)
Total number of animals	9189	100
Number of batches	73	100
Number of examined animals at individual-level	3636	39.57
Production system		
Conventional	2596	71.40
Organic	443	12.18
Conventional without antimicrobials	597	16.42
Tail docking		
Fully docked	2849	78.36
• Conventional	2142	
• Organic	356	
• Conventional without antimicrobials	351	
Undocked	429	11.80
• Conventional	194	
• Organic	87	
• Conventional without antimicrobials	148	
Docked at mid-length	358	9.85
• Conventional	260	
• Organic	0	
• Conventional without antimicrobials	98	

Individual analysis - Relationship between scores and respective production systems and tail length

Response variable	Explanatory variable	Statistic	p-value	Odds Ratios		
					Estimate	95%CI
Tail lesion score	Production system	χ^2_2=3.13	0.21			
	Tail length	χ^2_2=18.35	**0.0001**	undocked vs fully docked	**3.11**	**1.83 – 5.30**
				undocked vs docked at mid-length	**2.10**	**1.01 – 4.39**
				docked at mid-length vs fully docked	1.48	0.83 – 2.65
Scarring score	Production system	χ^2_2=5.34	0.069			
	Tail length	χ^2_2=2.04	0.36			

- We were more likely to observe tail lesions in animals with intact tails
- No significant difference was found between the fully docked and the docked at mid-length
- Scarring score was not affected by any of the variables

Individual analysis - Interaction between *postmortem* findings and scores, production system and tail lengths

Response variable	Explanatory variable	Statistic	p-value	Odds Ratios	Estimate	95%CI
Pleurisy	Tail lesion score	χ^2_2=39.68	**<0.0001**	Severe vs no lesions	**2.37**	**1.28 – 4.41**
				Mild vs no lesions	**1.83**	**1.51 – 2.22**
				Severe vs mild lesions	1.30	0.71 - 2.36
	Scarring score	χ^2_2=14.02	**0.0009**	Severe vs no lesions	**1.98**	**1.23 – 3.18**
				Mild vs no lesions	**1.45**	**1.11 – 1.89**
				Severe vs mild lesions	1.36	0.81 – 2.29
	Production system	χ^2_2=3.19	0.20			
	Tail length	χ^2_2=0.45	0.80			
Pneumonia	Tail lesion score	χ^2_2=6.69	**0.035**	Severe vs no lesions	1.36	0.58 – 3.21
				Mild vs no lesions	**1.34**	**1.07 – 1.66**
				Severe vs mild lesions	1.02	0.44 – 2.37
	Scarring score	χ^2_2=2.65	0.27			
	Production system	χ^2_2=2.24	0.33			
	Tail length	χ^2_2=1.21	0.54			
Abscess and purulent pneumonia	Tail lesion score	χ^2_2=14.58	**0.0007**	Severe vs no lesions	**10.68**	**2.97 – 38.5**
				Mild vs no lesions	**2.42**	**1.26 – 4.64**
				Severe vs mild lesions	**4.41**	**1.39– 14.00**
	Scarring score	χ^2_2=23.18	**<0.0001**	Severe vs no lesions	**4.27**	**1.61 – 11.30**
				Mild vs no lesions	**4.22**	**2.20 – 8.07**
				Severe vs mild lesions	1.01	0.35 – 2.91
	Production system	χ^2_2=0.24	0.89			
	Tail length	χ^2_2=5.91	0.055			
Pericarditis	Tail lesion score	χ^2_2=15.64	**0.0004**	Severe vs no lesions	1.07	0.32 – 3.61
				Mild vs no lesions	**1.88**	**1.37 – 2.59**
				Severe vs mild lesions	0.57	0.17 – 1.86
	Scarring score	χ^2_2=10.95	**0.0042**	Severe vs no lesions	0.73	0.28 – 1.86
				Mild vs no lesions	**1.85**	**1.27 – 2.69**
				Severe vs mild lesions	0.40	0.15 – 1.06
	Production system	χ^2_2=1.09	0.58			

	N (%)	Tail lesions 0	Tail lesions Mild (1,2)	Tail lesions Severe (3,4)	Tail scarring C0	Tail scarring C1	Tail scarring C2
Pigs with no findings	451 (12.4)	37.9% (33.4 – 42.4)	61.6% (57.1 – 66.1)	0.4% (0 – 1.1)	91.3% (88.7 – 93.9)	7.3% (4.9 – 9.7)	1.3% (0.3 – 2.4)
Pigs with 1-2 findings	2937 (80.8)	29.2% (27.6 – 30.8)	68.9% (67.2 – 70.6)	1.9% (1.4 – 2.4)	85.7% (84.5 – 87.0)	11.4% (10.2 – 12.6)	2.9% (2.3 – 3.5)
Pigs with >2 findings	248 (6.8)	20.6% (15.5 – 25.6)	77.8% (72.6 – 83.0)	1.6% (0.1 – 3.2)	82.7% (77.9 – 87.4)	13.7% (9.4 – 18.0)	3.6% (1.3 – 6.0)
Type of finding							
Pleurisy	1189 (32.7)	25.4% (22.9 – 27.9)	72.7% (70.2 – 75.3)	1.8% (1.1 – 2.6)	85.1% (83.0 – 87.1)	11.6% (9.8 – 13.4)	3.4% (2.3 – 4.4)
Pneumonia	3092 (85.0)	28.8% (27.2 – 30.4)	69.5% (67.8 – 71.1)	1.7% (1.3 – 2.2)	85.9% (84.7 – 87.1)	11.3% (10.2 – 12.4)	2.8% (2.2 – 3.4)
Abscess pneumonia	53 (1.4)	20.7% (9.5 – 32.0)	71.7% (59.2 – 84.2)	7.5% (0 – 14.9)	71.7% (59.2 – 84.2)	22.6% (11.0 – 34.3)	5.7% (0 – 12.1)
Purulent pneumonia	19 (0.5)	15.8% (0 – 33.8)	84.2% (66.1 – 100)	–	63.1% (39.3 – 87.0)	21.0% (0.9 – 41.2)	15.8% (0 – 33.8)
Pericarditis	275 (7.6)	21.4% (16.6 – 26.3)	77.4% (72.5 – 82.4)	1.1% (0 – 2.3)	83.3% (78.8 – 87.7)	14.9% (10.7 – 19.1)	0.8% (0.2 – 3.4)
Milk spots	193 (5.3)	25.9% (19.7 – 32.1)	73.0% (66.7 – 79.4)	1.0% (0 – 2.5)	87.0% (82.3 – 91.8)	9.8% (5.6 – 14.1)	3.1% (0.6 – 5.6)

- The most frequent lesions were respiratory diseases (pneumonia, followed by pleuritis)
- All the post-mortem findings were associated with tail lesions. Except for one finding, all the others were also associated with the presence of scarred tissue

Batch analysis - Relationship between TC and scores, production systems and tail length

	Batch-level (N=73)	All population (N=9189)	Conventional (N=7201)	Conventional without AM (N=1348)	Organic (N=640)
Total condemnations (TC)	52.1 %, 48 (40.59 – 63.52)	0.8%, 70 (0.6 – 0.9)	0.8%, 58 (0.6 – 1.0)	0.3%, 4 (0.01 – 0.6)	1.3%, 8 (1 – 1.5)
Causes for total condemnation					
Pyemia	38.4%, 28 (27.2 – 49.5)	0.5%, 49 (0.4 – 0.7)	0.6%, 42 (0.4 – 0.8)	0.2%, 3 (0 – 0.5)	0.6%, 4 (0.01 – 1.2)
Peritonitis	13.7%, 10 (5.81 – 21.6)	0.1%, 10 (0.04 – 0.2)	0.1%, 7 (0.03 – 0.2)	0.1%, 1 (0 – 0.2)	0.3%, 2 (0 – 0.7)
Jaundice	2.7%, 2 (0 – 6.5)	0.02%, 2 (0 – 0.05)	0.03%, 2 (0 – 0.07)	0	0
Organoleptic alterations	4.1%, 3 (0 – 8.7)	0.03%, 3 (0 – 0.07)	0.04%, 3 (0 – 0.1)	0	0
Inflammation	4.1%, 3 (0 – 8.7)	0.03%,3 (0 – 0.07)	0.04%, 3 (0 – 0.1)	0	0
Trauma	1.4%, 1 (0 – 4.0)	0.01%, 1 (0 – 0.03)	0.01%, 1 (0 – 0.04)	0	0
Erysipelas	1.4%, 1 (0 – 4.0)	0.02%, 2 (0 – 0.05)	0	0.3%, 2 (0 – 0.7)	0

Response variable	Explanatory variable	Statistic	p-value	Odds Ratios		
					Estimate	95%CI
Total condemnations	Batch tail lesion score	χ^2_1=5.98	**0.0145**		**1.81**	**1.12 – 2.91**
	Batch scarring score	χ^2_1=13.81	**0.0002**		**3.24**	**1.74 – 6.02**
	Production system	χ^2_2=7.27	**0.0263**	Organic vs conventional	**2.27**	**1.07 – 4.81**
				Organic vs conventional without AM	**4.36**	**1.38 – 13.7**
				Conventional without AM vs conventional	0.52	0.19 – 1.40
	Tail length	χ^2_2=0.06	0.97			

- Total condemnations were observed in 0.8% of the carcasses
- Approximately half of the batches recorded at least one TC
- Both the lesion score and the scarring score influenced TC, with scarring playing a more relevant role
- Regarding the production system, the likelihood of observing TC in a batch was higher in organically produced pigs
- The most common cause of rejection was pyaemia

Batch analysis - Relationship between TC per pyaemia and scores, production systems and tail lengths

Response variable	Explanatory variable	Statistic	p-value	Odds Ratios	
				Estimate	95%CI
Total condemnations by pyemia	Batch tail lesion score	χ^2_1=6.22	**0.0126**	**2.06**	**1.16 – 3.63**
	Batch scarring score	χ^2_1=13.79	**0.0002**	**3.86**	**1.89 – 7.88**
	Production system	χ^2_2=2.30	0.32		
	Tail length	χ^2_2=0.45	0.80		

- The likelihood of a pyaemia-related TC was associated with both the lesion score and the scarring score, with the latter again having a more significant role

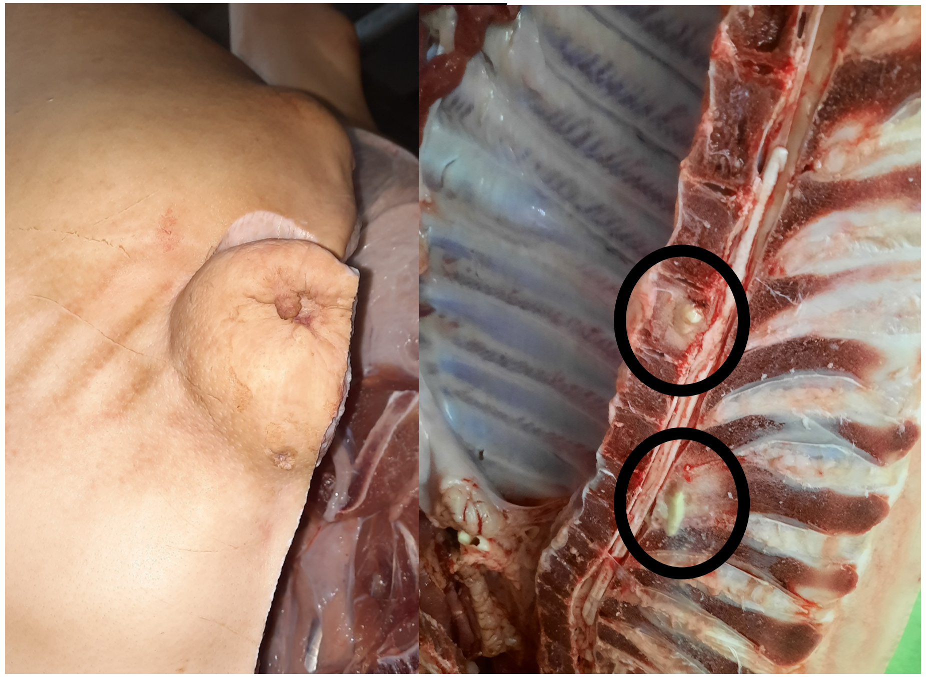
Batch analysis - Relationship between LC and scores, production systems and tail length

	Batch- level (N=73)	All pigs (N=9189)	Conventional (N=7201)	Organic (N=640)	Conventional without AM (N=1348)
Local condemnations (LC) – N, %	69, 94.5% (89.3 – 99.8)	692, 7.5% (7.0 – 8.1)	565, 7.9% (7.2 – 8.5)	48, 7.5% (5.5 – 9.5)	79, 5.9% (4.6 – 7.1)
Parts condemned					
Anterior third	26, 35.6% (24.6 – 46.6)	62, 0.7% (0.5 – 0.8)	56, 0.8% (0.6 – 1.0)	1, 0.2% (0 – 0.5)	5, 0.4% (0.05 – 0.7)
Posterior third	12, 16.4% (7.9 – 24.9)	14, 0.15% (0.1 – 0.2)	13, 0.2% (0.1 – 0.3)	0	1, 0.1% (0 – 0.2)
Head	35, 48% (36.5 – 59.4)	48, 0.5% (0.4 – 0.7)	39, 0.5% (0.4 – 0.7)	3, 0.5% (0 – 1.0)	6, 0.5% (0.1 – 0.8)
Ribs	56, 76.7% (67.0 – 86.4)	450, 4.9% (4.5 – 5.3)	375, 5.2% (4.7 – 5.7)	33, 5.2% (3.4 – 6.9)	42, 3.1% (2.2 – 4.04)
Rabada	23, 31.5% (20.9 – 42.2)	84, 0.9% (0.7 – 1.1)	59, 0.8% (0.6 – 1.0)	11, 1.8% (0.7 – 2.7)	14, 1.04% (0.5 – 1.6)
Hock	17, 23.3% (13.6 – 33)	28, 0.3% (0.2 – 0.4)	21, 0.3% (0.2 – 0.4)	0	7, 0.5% (0.1 – 0.9)
Shoulder	2, 2.7% (0 – 6.5)	2, 0.02% (0 – 0.05)	1, 0.01% (0 – 0.04)	0	1, 0.1% (0 – 0.2)
Ham	1, 1.4% (0 – 4.0)	1, 0.01% (0 – 0.03)	1, 0.01% (0 – 0.04)	0	0

Response variable	Explanatory variable	Statistic	p-value	Odds Ratios	
				Estimate	95%CI
Local condemnations	Batch tail lesion score	χ^2_1=1.33	0.50		
	Batch scarring score	χ^2_1=57.7	**<0.0001**	**6.28**	**3.9 – 10.09**
	Production system	χ^2_2=3.22	0.20		
	Tail length	χ^2_2=4.07	0.13		

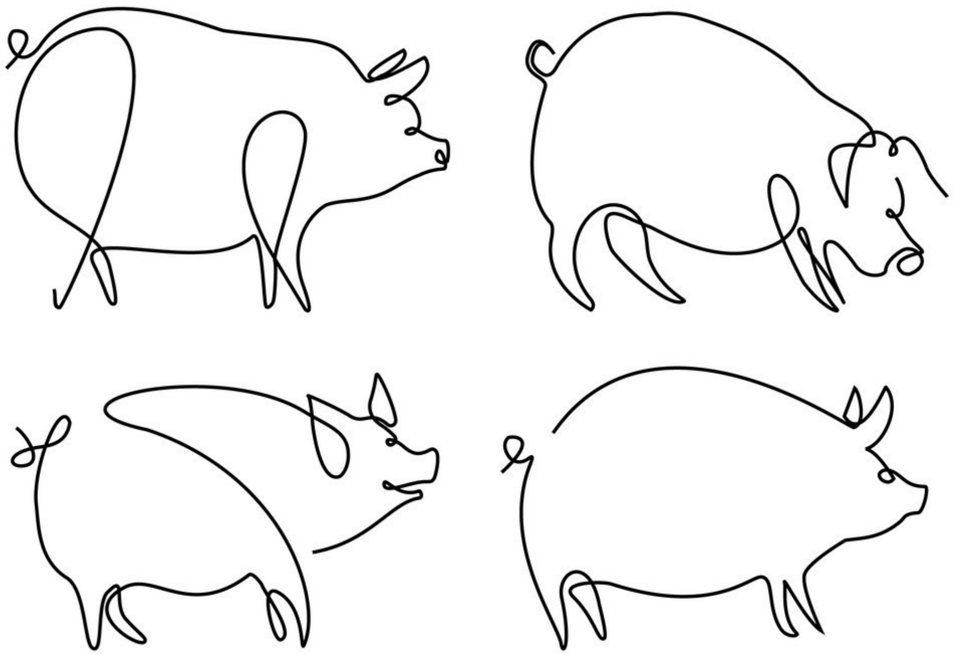
- 7.5% of the pigs underwent a local condemnation (LC)
- 94.5% of the batches had at least one LC
- The area with the highest condemnation rate was the ribs
- LC was only influenced by the scarring score

Batch analysis - Relationship between LC due to abscess and scores, production systems and tail lengths



Response variable	Explanatory variable	Statistic	p-value	Odds Ratios		
					Estimate	95%CI
Local condemnations by abscess	Batch tail lesion score	$\chi^2_1=0.50$	0.48			
	Batch scarring score	$\chi^2_1=44.69$	**<0.0001**		**3.65**	**2.50 – 5.34**
	Production system	$\chi^2_2=2.01$	0.37			
	Tail length	$\chi^2_2=17.24$	**0.0002**	Undocked vs fully docked	**1.70**	**1.13 – 2.57**
				Undocked vs docked at mid-length	0.81	0.49 – 1.33
				Docked at mid-length vs fully docked	**2.10**	**1.43 – 3.10**

- Abscess condemnations were only influenced by scarred tails, with a higher degree of scarring implying a higher condemnation rate
- Animals with undocked and mid-length docked tails had a higher number of LC due to the presence of abscesses



In conclusion

- Animals with undocked tails were highly associated with severe tail lesions and had higher abscess condemnation rates
- Scarring showed a positive relationship with carcass condemnations and *postmortem* findings, and in some cases, was even more relevant than recent tail lesions.
- According to this research, incorporating scarred tissue into the tail monitoring protocol at the slaughterhouse could prove beneficial. These results show the importance of improving the current lesion-scoring method to effectively identify carcasses at risk of condemnation, thus serving as a potential indicator of animal welfare.

Thank you for you attention!

The thesis also resulted in the publication of the following paper:

animals MDPI

Article

The Relationship between Carcass Condemnations and Tail Lesion in Swine Considering Different Production Systems and Tail Lengths

Alice Gomes [1], Claudia Romeo [2,3], Sergio Ghidini [2] and Madalena Vieira-Pinto [4,5,6,*]

1 School of Agrarian and Veterinary Sciences (ECAV), University of Trás-os-Montes and Alto Douro (UTAD), 5001-801 Vila Real, Portugal; atc.gomes123@gmail.com
2 Department of Food and Drug, University of Parma, Via del Taglio 10, 43126 Parma, Italy; claudiarosa.romeo@izsler.it (C.R.); sergio.ghidini@unipr.it (S.G.)
3 Istituto Zooprofilattico Sperimentale Della Lombardia e dell'Emilia Romagna, Via Bianchi 9, 25124 Brescia, Italy
4 Department of Veterinary Sciences, University of Trás-os-Montes and Alto Douro (UTAD), 5001-801 Vila Real, Portugal
5 CECAV—Veterinary and Animal Research Centre, University of Trás-os-Montes and Alto Douro (UTAD), 5001-801 Vila Real, Portugal
6 Associate Laboratory for Animal and Veterinary Sciences (AL4AnimalS), 5001-801 Vila Real, Portugal
* Correspondence: mmvpinto@utad.pt