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Risk-based meat inspection and integrated meat safety assurance

Bacterial dynamics and risk categorisation of two broiler abattoirs in Norway

J Holthe, SJ Hauge, GE Nagel-Alne, O Alvseike

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ANIMALIA
Norwegian Meat and Poultry Research Centre

Sigrun J. Hauge

Gunvor Elise Nagel-Alne

Ole Alvseike

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Why investigate bacterial dynamics and composition along the slaughter line

- Which bacteria survive different processing stages
  - Time/temperature conditions
  - Air speed during chilling
  - Water pressure during washing
  - Other interventions
- Implement effective measures along the slaughter line
- Bacterial communities on chilled carcasses and storage conditions affect shelf life

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Material and methods

Day of sampling	Abattoir	Flock Campylobacter status	Scalding water tank	Before scalding	After plucking	After evisceration	After chilling	Analyses
1A	A	Positive	3	10	10	10	10	TPC[2], E. coli, Enterobacteriaceae
1B	B	Negative	3	10	10	10	10	TPC[2], E. coli, Enterobacteriaceae, 16S rRNA gene seq
2B	B	Positive	3	10	10	10	10	TPC[2], E. coli, Enterobacteriaceae, 16 S rRNA gene seq
Total				30	30	30	30	

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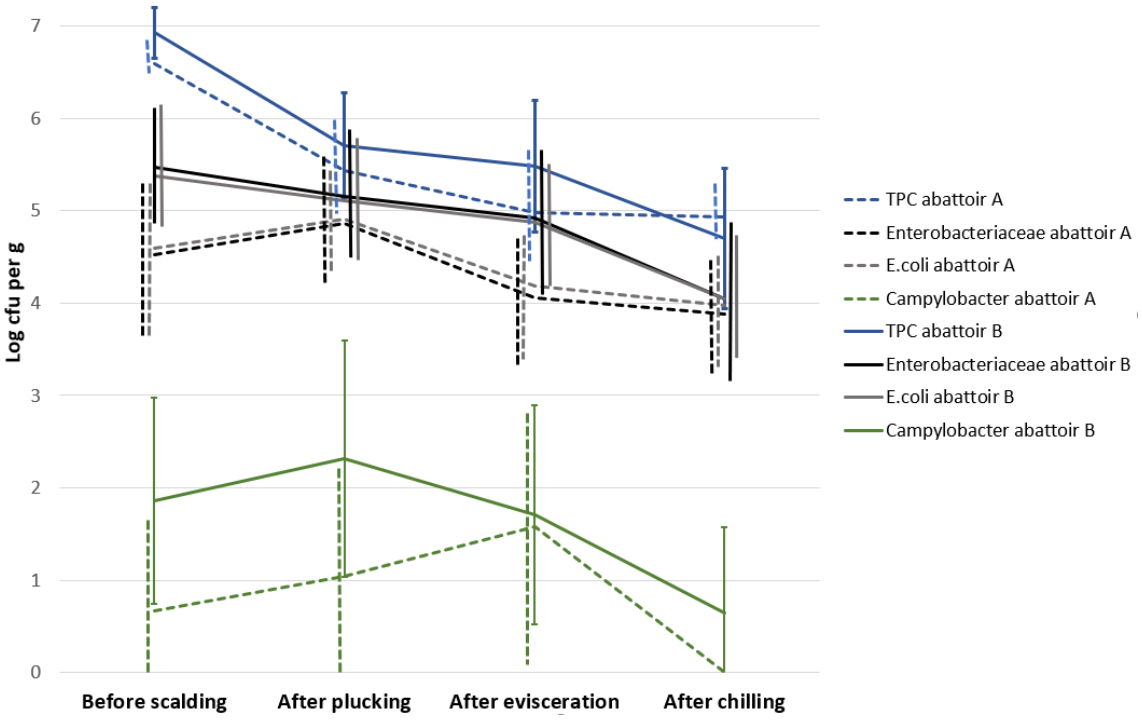
Bacterial loads along the slaughter line



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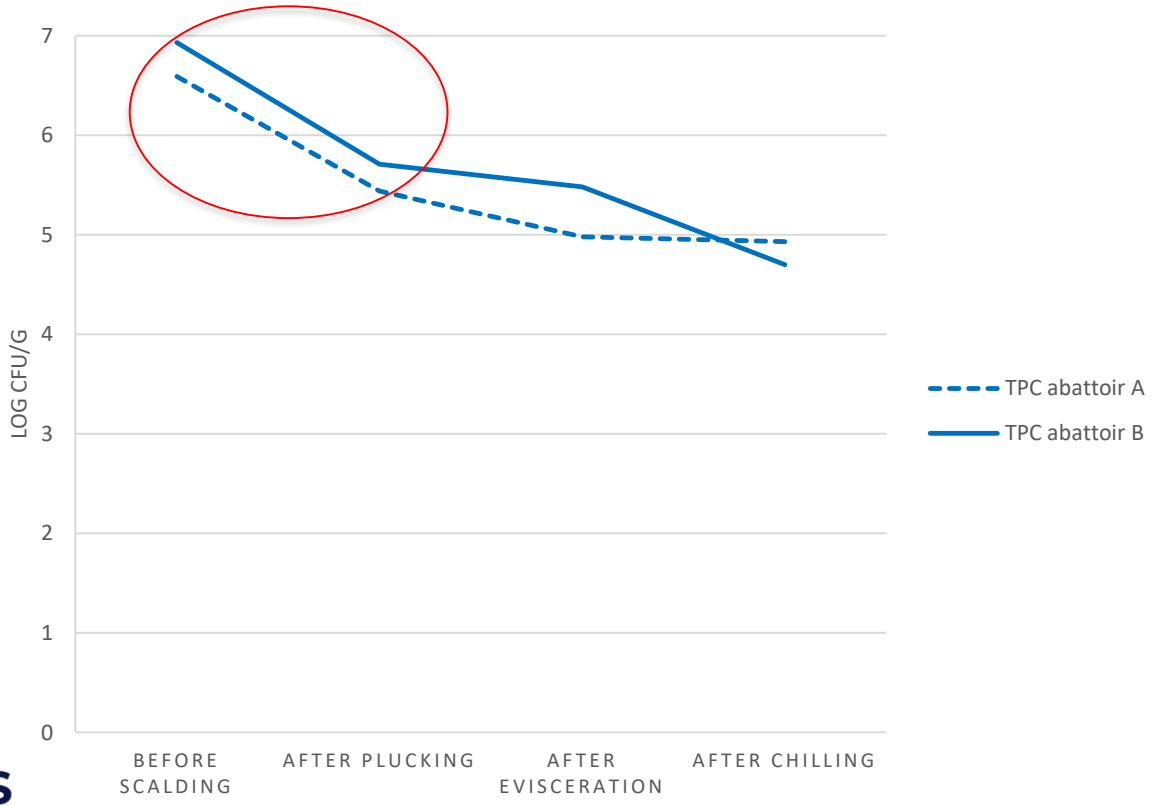
TPC



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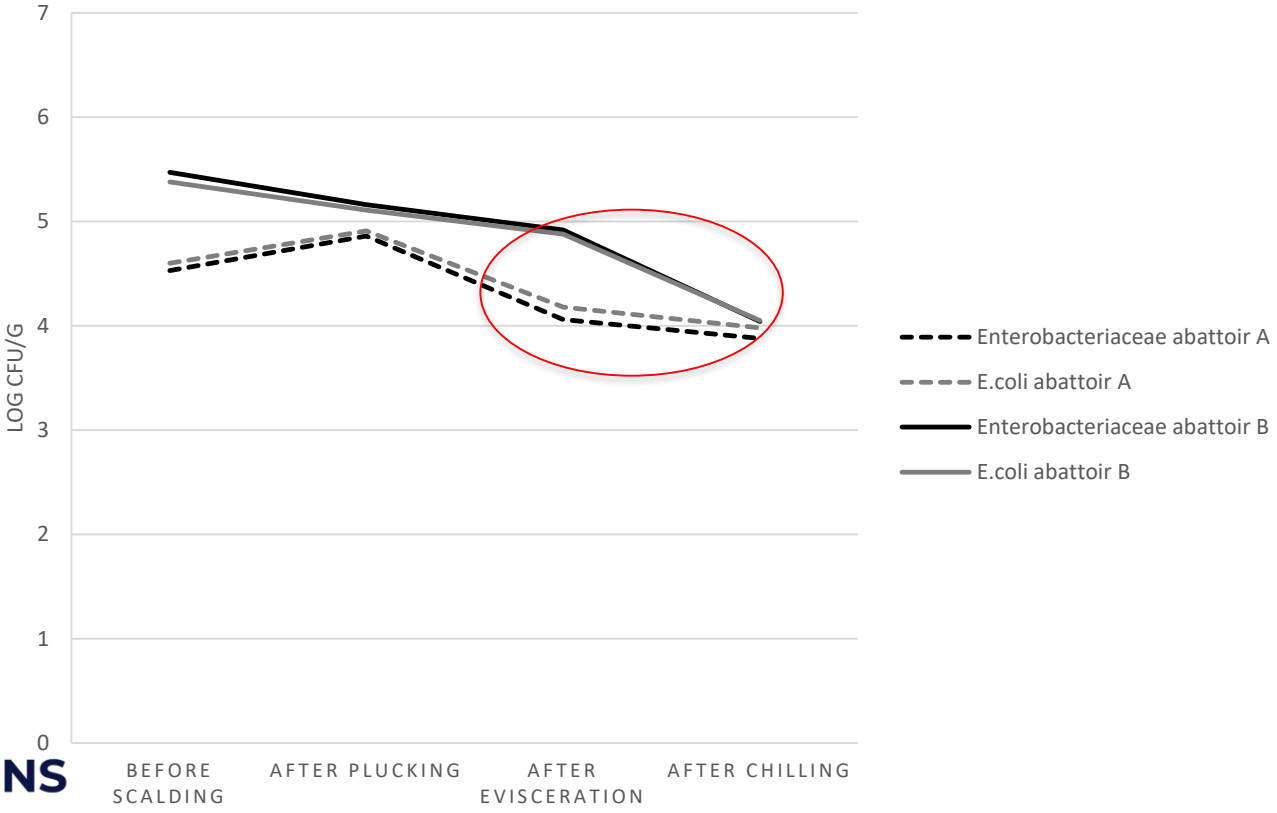
Enterobacteriaceae/E.coli



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Bacterial composition

Genus	Before scalding	After plucking	After evisceration	After chilling
Aeromonas	0.00	0.94	0.57	0.23
Afipia	0.04	0.21	3.52	9.43
Anoxybacillus	0.00	1.39	0.19	0.16
Asinibacterium	0.07	1.39	14.00	26.05
Brochothrix	0.00	0.00	0.00	1.98
Corynebacterium	4.74	0.91	0.27	0.11
DSSD61	0.00	0.06	0.52	0.88
Enhydrobacter	0.00	4.76	1.28	0.05
Enterococcus	0.40	2.41	0.64	0.11
Erysipelatoclostridium	0.76	0.00	0.00	0.00
Escherichia-Shigella	16.11	39.05	25.34	7.22
Faecalibacterium	1.02	0.02	0.00	0.00
Kurthia	0.00	1.71	0.08	0.00
Lactobacillus	2.65	1.28	0.73	0.58
Macrococcus	0.03	3.46	0.62	0.18
Polaromonas	0.01	0.08	1.25	3.76
Pseudomonas	0.15	0.10	0.09	4.89
Psychrobacter	0.04	0.00	0.00	3.68
Rothia	0.15	0.63	0.26	0.06
Staphylococcus	26.22	1.21	0.48	0.11
Streptococcus	8.86	3.18	0.51	0.21
Other genera	22.31	10.44	9.61	10.11

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Risk categorisation

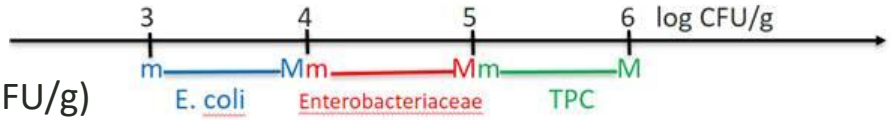
According to Cegar et. al. (2022)

1. Regulatory criteria according to legislation

- *Salmonella* and *Campylobacter*

2. Criteria for three indicator bacteria – after chilling

- TPC (m=5 log cfu/g, M=6 log CFU/g)
- *Enterobacteriaceae* (m=4 log cfu/g, M=5 log CFU/g)
- *E.coli* (m=3 log cfu/g, M=4 log CFU/g)



≤ m = score of 1 (satisfactory), between m and M = score of 2 (acceptable), > M = score of 3 (unacceptable)

Geometric mean of compliance of the scores from 1 and 2 respectively.

Risk category low ≤ 1.5, medium between 1.5 and 2, high risk > 2

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Risk categorisation

Abattoir A

Salmonella: none – Score 1

Campylobacter: 0 log cfu/g – Score 1

TPC: 4.93 log cfu/g – Score 1

Enterobacteriaceae: 3.88 log cfu/g – Score 1

E.coli: 3.98 log cfu/g – Score 2

Geometric mean regulatory pathogens: 1 – low risk

Geometric mean indicators: 1.26 – low risk

Geometric mean in total: 1.15 – **low risk**

Abattoir B

Salmonella: none – Score 1

Campylobacter: 0.64 log cfu/g – Score 1

TPC: 4.70 log cfu/g – Score 1

Enterobacteriaceae: 4.04 log cfu/g – Score 2

E.coli: 4.05 log cfu/g – Score 3

Geometric mean regulatory pathogens: 1 – low risk

Geometric mean indicators: 1.82 – medium risk

Geometric mean in total: 1.43 – **low risk**

Weaknesses:

- Only one or two days per abattoir
- Limits for Enterobacteriaceae and E.coli are 1 log cfu/g different – in poultry, these are often similar