

WG2 Systematic literature review on pre-harvest food safety interventions for broiler

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WG2 Overview



WG2 Background

RIBMINS main goal "MEAT SAFETY"







EFSA Journal 2011;9(10):2351

SCIENTIFIC OPINION

Scientific Opinion on the public health hazards to be covered by inspection of meat (poultry)¹

SCIENTIFIC OPINION

Scientific Opinion on the public health hazards to be covered by inspection of meat (swine)¹



SCIENTIFIC OPINION

Scientific Opinion on the public health hazards to be covered by inspection of meat (bovine animals)¹



European Food Safety Authority

EFSA Journal 2012;10(6):2741



Methods WG2

- Systematic review PRISMA
 - Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement
- Searches were conducted on PubMed® & Web of Science on June 7th 2020
 - Peer-reviewed studies in English
 - Time restrictions: published between 2015 and 2020 (until June 7th)



Effectiveness of pre-harvest meat safety interventions to control foodborne pathogens



Search string structure used for the searches conducted



Eligibility criteria - PICO

PICO	Inclusion Criteria	Exclusion Criteria
	Animal species being evaluated: must include (but not limited to) broilers	Does not include actual or theoretical <pathogen> infection/contamination in broilers</pathogen>
Population	Unit of study [animal, herd, house, barn, farm] and [surfaces, food, water, environment, drinkers, feeder, other animals]	Others
Intervention	Interventions to control/reduce/eradicate <pathogen> in broilers</pathogen>	Studies not mentioning control/reduce/eradicate interventions for < pathogen> in broilers
	Interventions on-farm or during transport (pre- harvest)	Interventions on lairage, at slaughter and post- harvest
	Field/experimental studies	Lab/bench studies
Comparison	Control group present [group subjected to no intervention]	Control group absent
Outcomes	Provides some measure of the efficacy of the intervention	Efficacy of the intervention not measured
Othera	Language: English	Other languages
Uners	Peer-reviews	Grey literature

Thirteen pathogens identified as public health hazards from broilers

Bacillus cereus	Listeria monocytogenes
Campylobacter	MRSA
Clostridium botulinum	Salmonella spp.
Clostridioides difficile	VTEC
Clostridium perfringens	Yersinia enterocolitica
ESBL-Amp C <i>E. coli</i>	Toxoplasma gondii
ESBL-Amp C Salmonella	





Pathogen	Records	Records after	Records retained after	Records retained after
	identified	duplicate removal	abstract screening	full text screening
B. cereus	3	3	0	0
Campylobacter	230	208	34	24
C. botulinum	3	2	0	0
C. difficile	0	0	0	0
C. perfringens	23	22	5	3
ESBL-Amp C <i>E. coli</i>	57	53	6	2
ESBL-Amp C Salmonella	9	9	0	0
Listeria monocytogenes	14	13	0	0
MRSA	17	17	0	0
Salmonella spp.	301	202	33	20
VTEC	201	191	8	1
Y. enterocolitica	6	6	0	0
T. gondii	10	9	0	0

• 51 studies retained:

Campylobacter spp.	24 studies – 71 trials	
Salmonella spp.	20 studies – 62 trials	
VTEC	1 study – 2 trials	
ESBL-AmpC	2 studies – 3 trials	
Clostridium perfringens	3 studies – 27 trials	

• One study was not available



Variable	Category	# trials, n (%)		
		Campylobacter	Salmonella	
On-farm vs during	On-farm	63 (88.7)	52 (83.9)	
transport intervention	Transport coop	8 (11.3)	10 (16.1)	
Study setting	Commercial farm	20 (28.2)	11 (17.7)	
	Commercial plant	5 (7.0)		
	Research lab	46 (64.8)	51 (82.3)	



Variable	Category	# trials, n (%)	
		Campylobacter	Salmonella
Type of intervention	Bacteriophages	1 (1.4)	5 (8.1)
	Biosecurity	7 (9.9)	2 (3.2)
	Cleaning & disinfection	16 (22.5)	17 (27.4)
	Combination of measures	1 (1.4)	6 (9.7)
	Competitive exclusion	-	3 (4.8)
	Feed additives	35 (49.3)	13 (21.0)
	Litter management	1 (1.4)	10 (16.1)
	Oral immunization	4 (5.6)	-
	Vaccination	6 (8.5)	6 (9.7)

Type of intervention	Efficacy of interventions %*		
	Campylobacter	Salmonella	
Bacteriophages	0	80	
Biosecurity	71.4	0	
Cleaning & disinfection	50	76.5	
Combination of measures	0	16.7	
Competitive exclusion	-	100	
Feed additives	31.4	30.8	
Litter management	0	50	
Oral immunization	0	-	
Vaccination	0	16.7	



Results

Clostridium perfringens

- 26 trials investigated the use of different feed additives – 38.5% effective
- 1 trial used a drug-free program + feed additives + improved water quality + good brooding conditions -Ineffective



Results

ESBL - AmpC E. coli

- Feed additives <u>not</u> effective
- Enrofloxacin was effective
- Cessation of ceftiofur and its substitution with lincomycin-spectinomycin effective initially, but led to an increase in antimicrobial non- β -lactam resistance

WG2



Results

VTEC

 Feed supplementation with Agaricus bisporus in 2 different concentrations: no stats, numerical difference found



WG2 Discussion

Most studies, including vaccination studies, were performed under controlled research settings

We need more large-scale randomised, blinded trials conducted with different vaccination strategies on commercial farms.

These would ascertain the efficacy of these interventions under field conditions.



WG2 Discussion

Interventions to control less prominent hazards: less frequent or nonexistent

Public health burden associated with broilers as sources of human infection is still controversial or low \rightarrow ESBL AmpC, VTEC, Y. *enterocolitica*)

Only indoor farms considered in this study (*T. gondii* prevalence is lower)

L. monocytogenes, B. cereus, C. botulinum, C. perfringens, and S. aureus are mainly controlled by post-harvest interventions.



WG2 Conclusions



- Limitations: eligibility criteria might have eliminated effective interventions
- Some pathogens are frequently controlled by post-harvest interventions



WG2 Take home messages

- Focus on two main hazards (Salmonella spp. and Campylobacter spp.), which reflects the high burden of disease.
- Research is **lacking** on the development of **targeted immunisation** strategies for each pathogen.
- Vaccination strategies should always be implemented in combination with other interventions, especially those which are related to best farming practices.
- Interventions such as good cleaning and disinfection and strict biosecurity may be enough to prevent the introduction and/ or control less prevalent pathogens.



WG2 References // outputs

 Pessoa, J.C., Rodrigues da Costa, M., Nesbakken, T, Meemken, D. 2021. Assessment of the effectiveness of pre-harvest meat safety interventions to control foodborne pathogens in broilers: a systematic review. Current Clinical Microbiology Reports (2021).

https://doi.org/10.1007/s40588-021-00161-z

 Rodrigues da Costa, M., Pessoa, J.C, Meemken, D. Nesbakken, T. 2021. A Systematic Review on the Effectiveness of Pre-Harvest Meat Safety Interventions in Pig Herds to Control Salmonella and Other Foodborne Pathogens. Microorganisms, 9, 1825.

https://doi.org/10.3390/microorganisms9091825





Systematic Review

A Systematic Review on the Effectiveness of Pre-Harvest Meat Safety Interventions in Pig Herds to Control *Salmonella* and Other Foodborne Pathogens

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Thank you for the attention. Please join us at **RIBMINS**



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