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Antimicrobial Residues and Resistance in Biofilms from Livestock Farms: A Scoping Review

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INTRODUCTION

- ✓ Biofilms are complex microbial communities that form on biotic and abiotic surfaces within livestock farming environments.
- ✓ Within biofilms, bacteria can efficiently exchange genetic material, including antimicrobial resistance genes (ARGs), potentially serving as reservoirs and amplifiers of antimicrobial resistance (AMR).

AIM

- ✓ This scoping review aimed to summarize the current knowledge on AMR, ARGs, and antimicrobial residues (ARs) in biofilms from poultry, swine, and cattle farms.

METHODS

PRISMA-ScR extension for scoping reviews

Tricco, A.C., Lillie, E., Zarin, W., et al. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. Ann. Intern. Med., 169, 467-473

Databases: PubMed, Scopus, Agricola, Web of Science

Search String: "("Poultry or Cattle or Swine") AND ("Antimicrobial resistance OR Antimicrobial resistance genes OR Antimicrobial residues") AND ("Biofilm") AND ("Farm")"

Inclusion Criteria: Original research studies in English and French, investigating AMR, ARGs and ARs within biofilms in poultry, cattle and swine farms

Exclusion Criteria: Studies in other languages, not original research, review, systematic review or meta-analysis

Data Extraction

- ✓ **Studies imported in Zotero for deduplication and then in Rayyan for the two-phase screening**
  1. **Title/ Abstract**
  2. **Full Text**

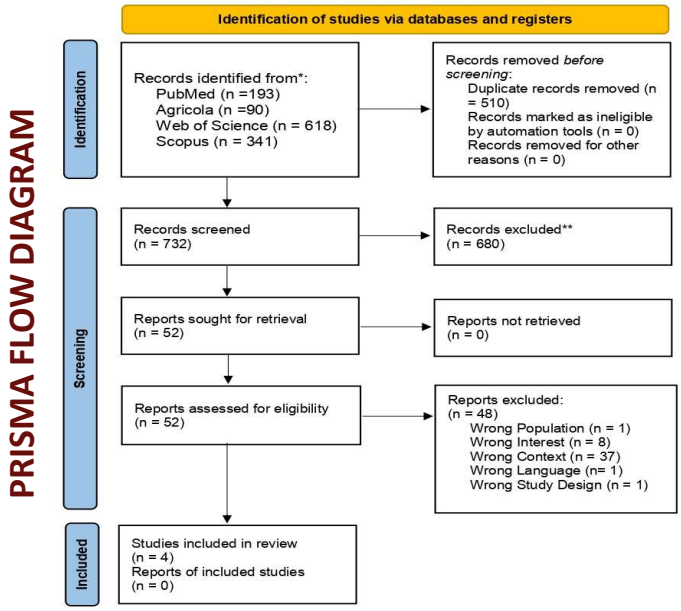
Data Charting
Microsoft® Excel Spreadsheet

PAPERS INCLUDED IN THE ScR

1. Abelseoud H., Ismael E., Moustafa G.Z., *et al.* (2021). Hygienic studies on biofilms in drinking water systems in poultry farms: isolation, molecular identification, and antibiotic sensitivity. *J. Anim. Health. Prod.*, 9, 443-454.
2. Ahangaran M.G., Zinsaz P., Pourmahdi O., *et al.* (2022). Tetracycline resistance genes in *Escherichia coli* strains isolated from biofilm of drinking water system in poultry. *Afr. J. Biomed. Res.*, 26, 447-445.
3. Grakh K., Mittal D., Prakash A., *et al.* (2022). Characterization and antimicrobial susceptibility of biofilm-producing Avian Pathogenic *Escherichia coli* from broiler chickens and their environment in India. Vet. Res. Commun. 46, 537-548.
4. Hayer, J.J., Heinemann, C., Schulze-Dieckhoff, *et al.* (2022). A risk-oriented evaluation of biofilm and other influencing factors on biological quality of drinking water for dairy cows. *J. Animal. Sci.*, 100, skac112.

RESULTS

- ✓ A total of **1,242** studies were identified across the databases.
- ✓ After the two-phase screening, only **4** studies met the eligibility criteria and were included in the ScR.



Study characteristics and evidence of AMR, ARGs, and ARs from the 4 studies included

Reference	Country	Animal species	AMR, ARGs, and ARs from farm biofilms			
			Bacteria isolated from on-farm biofilms	AST	ARGs	ARs
Aboelseoud *et al.*, 2021	Egypt	Layer	*Staphylococcus saprophyticus*, *Enterococcus faecalis*, *Enterococcus casseliflavus*, *Pseudomonas aeruginosa* (3), *Sphingopyxis terrae*, *Bacillus luti*, *Acinetobacter kookii*	DD	NA	NA
Ahangaran *et al.*, 2022	Iran	Broiler	*Escherichia coli*	DD	*tetA*, *tetB* (multiplex PCR)	NA
Grakh *et al.*, 2022	India	Broiler	Avian Pathogenic *Escherichia coli*	MIC (Vitek System)	NA	NA
Hayer *et al.*, 2022	Germany	Dairy Cow	*Escherichia coli* (27) Methicillin-resistant *Staphylococcus aureus* (MRSA) (2) Resistant *Escherichia coli* (6) Resistant *Acinetobacter* spp. (38) Resistant *Pseudomonas* spp. (26) Resistant *Citrobacter* spp.(3)	NA	NA	NA

AST: antimicrobial susceptibility testing, **DD:** Disk Diffusion, **MIC:** Minimum Inhibitory Concentration, **NA:** Not applicable

CONCLUSIONS

- ✓ Significant **gap** in scientific evidence regarding AMR, ARGs, and ARs in biofilms from livestock farms.
- ✓ Need for **further research** to clarify the role in the spread of AMR in the livestock sector.