



HAL
open science

Therapeutic alternative to the use of antibiotics in chicken farming: What about detection of ESBL *Escherichia coli*

Meriem Mtibaa, Ahlem Mahjoub, Maha Dardouri, Sana Azaiez, Jean Yves Madec, Marisa Haenni, Wejdene Mansour

► To cite this version:

Meriem Mtibaa, Ahlem Mahjoub, Maha Dardouri, Sana Azaiez, Jean Yves Madec, et al.. Therapeutic alternative to the use of antibiotics in chicken farming: What about detection of ESBL *Escherichia coli*. 34th European Congress of Clinical Microbiology & Infectious Diseases, Apr 2024, Barcelona, Spain. 2024. anses-04564974

HAL Id: anses-04564974

<https://anses.hal.science/anses-04564974>

Submitted on 1 May 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Therapeutic alternative to the use of antibiotics in chicken farming: What about detection of ESBL *Escherichia coli*

Meryem Maher Mtibâa^a, Ahlem Mahjoub^a, Maha Dardouri^a, Sana Azaiez^a, Jean-Yves Madec^b, Marisa Haenni^b and Wejdene Mansour^a

^aLaboratory of Biophysical Research, Metabolic Pharmacology and Applied Pharmacology, Faculty of Medicine Ibn Al Jazzar Sousse, University of Sousse, Sousse, Tunisia

^bANSES – Université de Lyon, Unité Antibiorésistance et Virulence Bactériennes, Lyon, France

Introduction

Antibiotic resistance is a significant challenge in the agricultural sector, stakeholders are intensifying their efforts to seek alternative strategies (2). The overuse and misuse of antibiotics in intensive farming, particularly in industrial chicken production, have contributed to the emergence and spread of antibiotic-resistant bacteria (1). Plant-based antimicrobials is an interesting option to explore, and a bibliographic search highlighted thyme and rosemary as potential alternatives. This shift also underscores the need for sustainable practices that prioritize animal welfare, food safety, and environmental protection.



Aim of the study

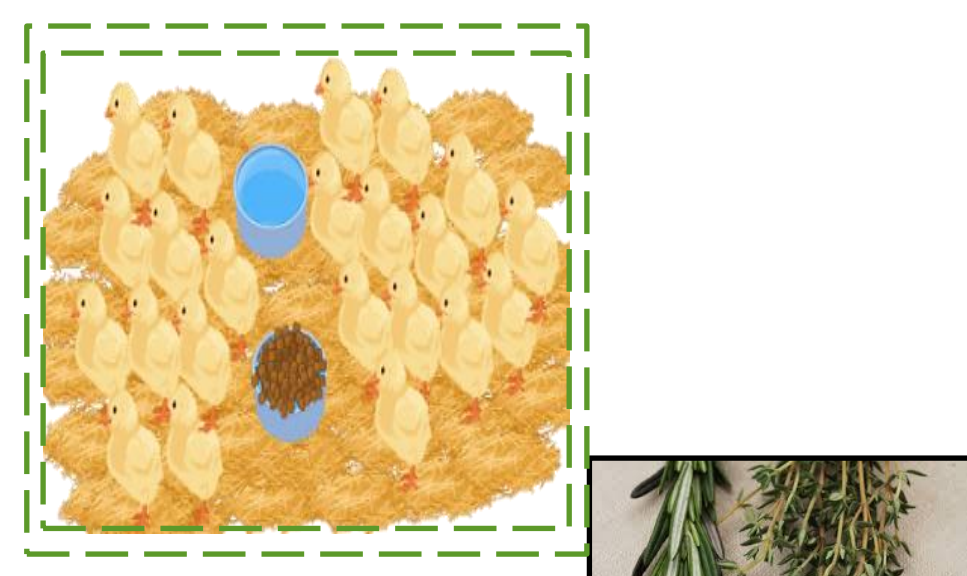
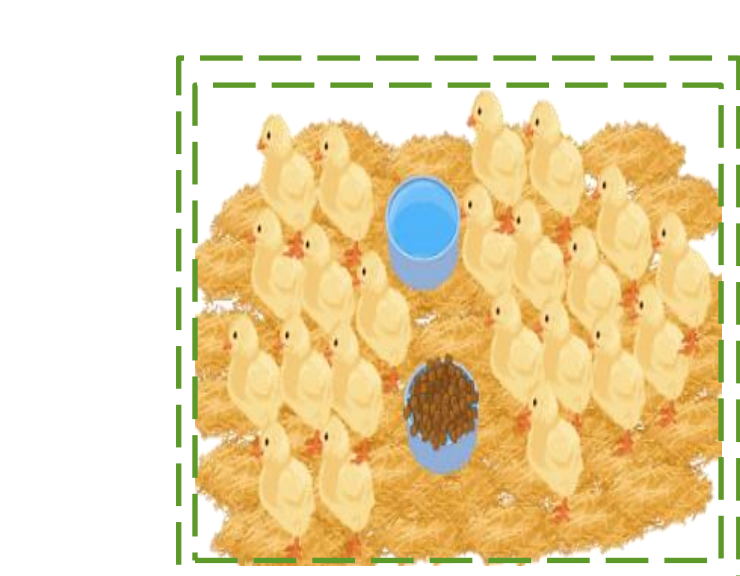
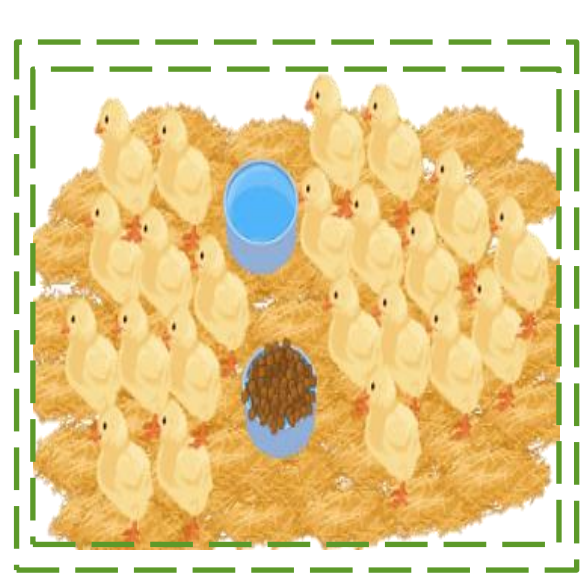
To investigate the potential of thyme and rosemary as alternatives to antibiotics in industrial chicken production, and to evaluate their impact on the prevalence of ESBL-producing *E. coli* and animal health.

Methodology

Experimental study

150 chicks have undergone an adaptation period during 5 days

Banded and divided into 3 groups 10 birds each with 5 replicates



Group 1 :Control group

Group 2: Water + antibiotic (colistin + tilmicosin) as a preventive measure

Group 3: Food + 20g (10g thyme+10g rosemary) /kg

1

Once a week, the evolution of the animals' weight and mortality in the three groups was recorded,

Weekly

Cloacal swabs

Body weight

Mortality

2

cloacal swab were cultured on antibiotic-supplemented media to detect *E. coli* producing an extended-spectrum beta-lactamase (ESBL)

Nutrient broth → 24h

3µg/ml CTX

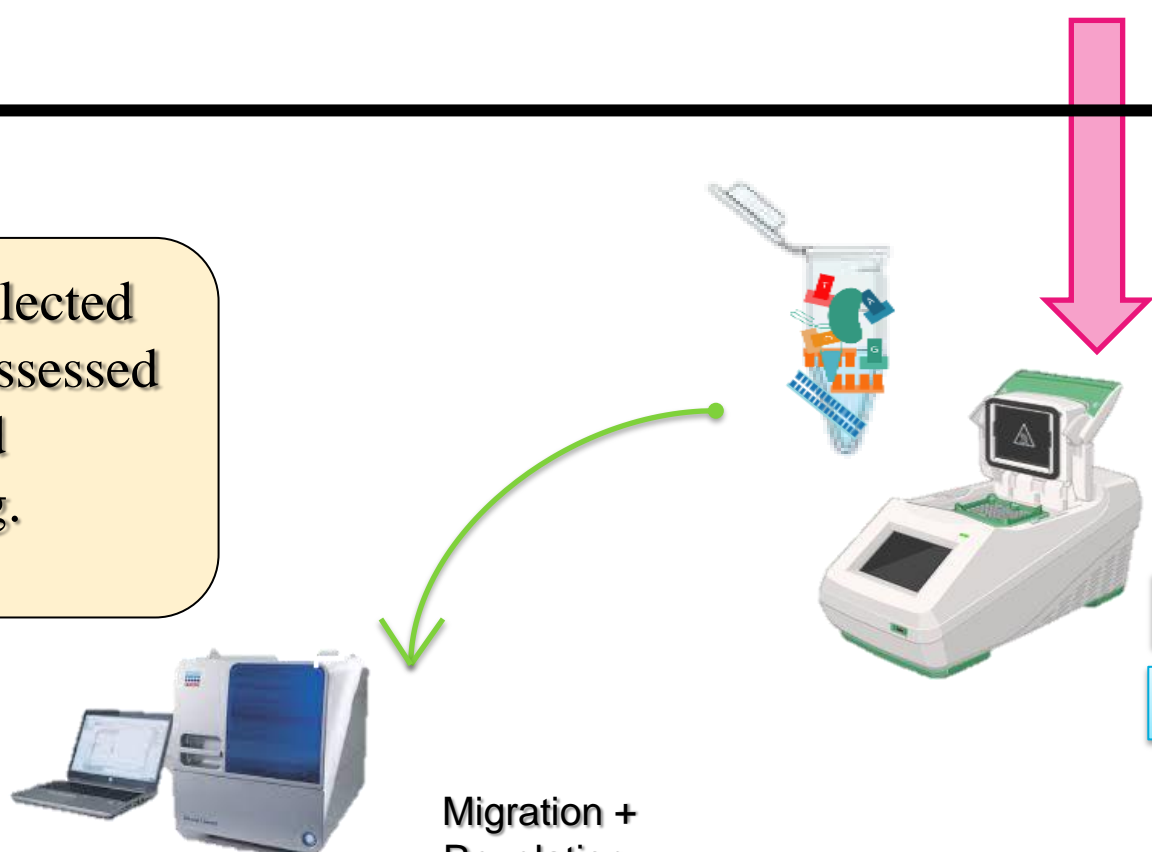
MacConkey agar

Antibiogram + ESBL TEST

Identification

3

Clonality of the collected *E. coli* isolates was assessed by MLVA and phylogrouping.



Migration + Revelation

PCR phylogrouping

PCR MLVA

Figure 1. Materials and methodology process used in this study.

Results

1 Day 1 to day 21 of the experiment

All animals remained free from ESBL-producing *E. coli* up to the 21st day of the experiment. After the 21st day:

- **Antibiotic-treated group:** 23.8% of the chickens presented ESBL-producing *E. coli* belonging to the phylogroup A. One major clone (C9) and a minor one (C1) were identified by MLVA profiling.
- **Control and plant-treated groups:** all chickens remained ESBL-negative.

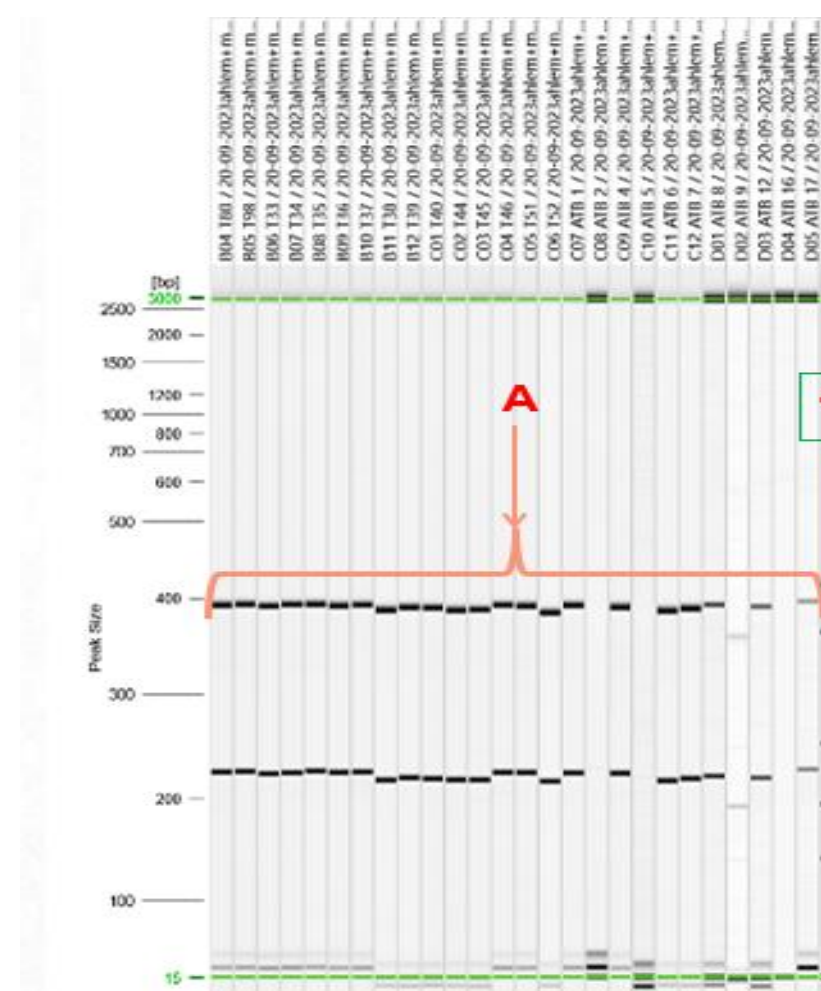


Figure 2: "Phylogroup PCR Analysis"

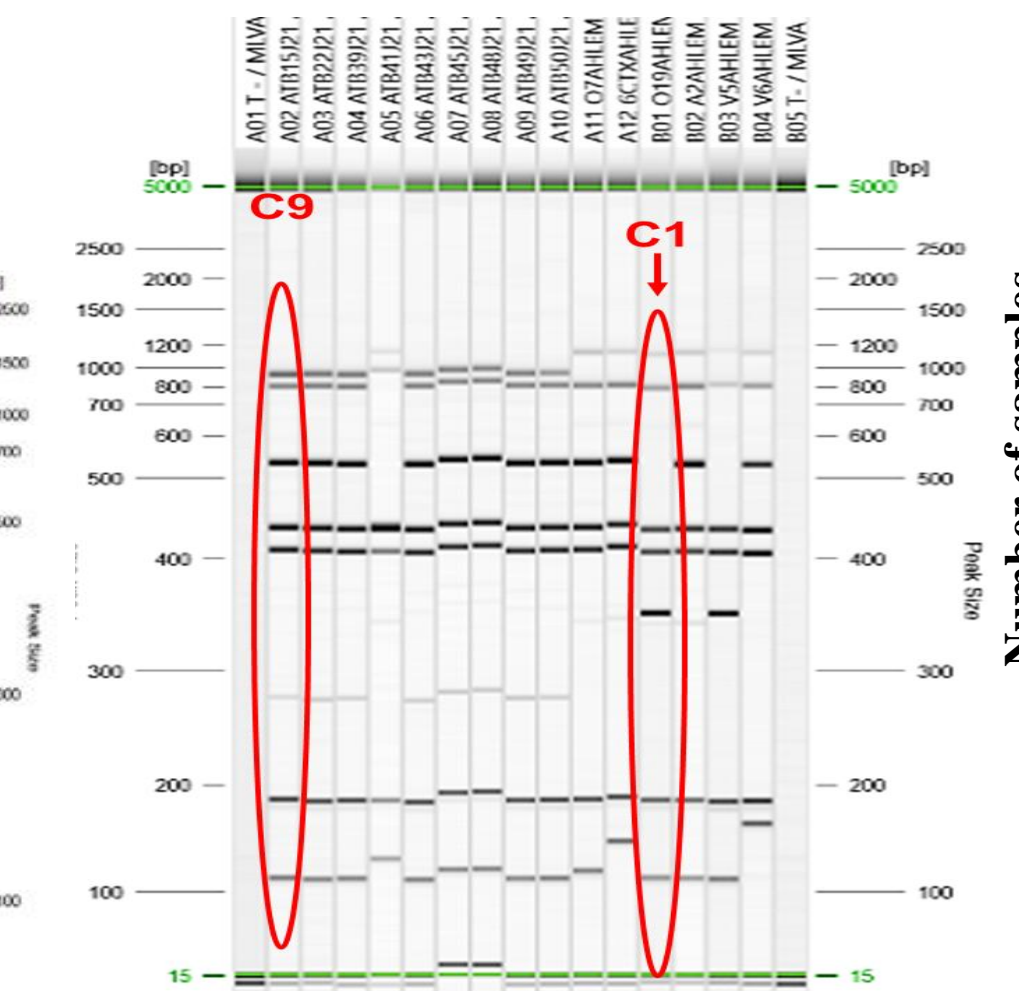


Figure 3: MLVA PCR Analysis in the group treated with antibiotics

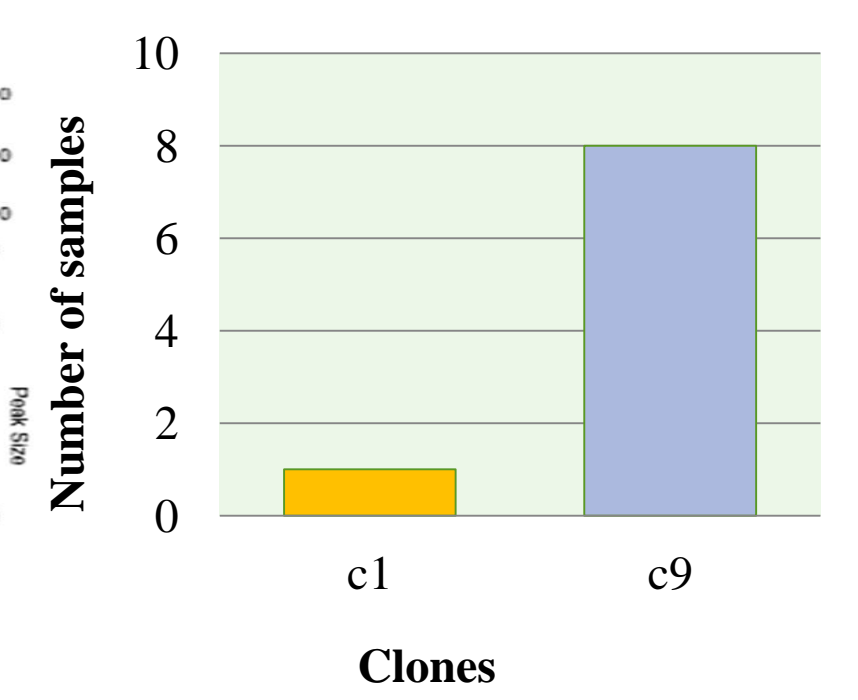


Figure 4: Bar chart depicting the prevalence of the two identified clones in the group treated with antibiotics

2 Day 36 of the experiment

At day 36, all three experimental groups were colonized by ESBL-producing *E. coli*.

- The proportions of colonization were notably higher in the antibiotic-treated group (74%), followed by the plant-treated group (57%), and finally the control group (51%).
- The spread of the *E. coli* C1 belonging to phylogroup A was confirmed.
- Importantly, no mortality was reported in the group treated with plants. In contrast, mortality rates of 6% and 3% were respectively reported in the control and antibiotic-treated groups.

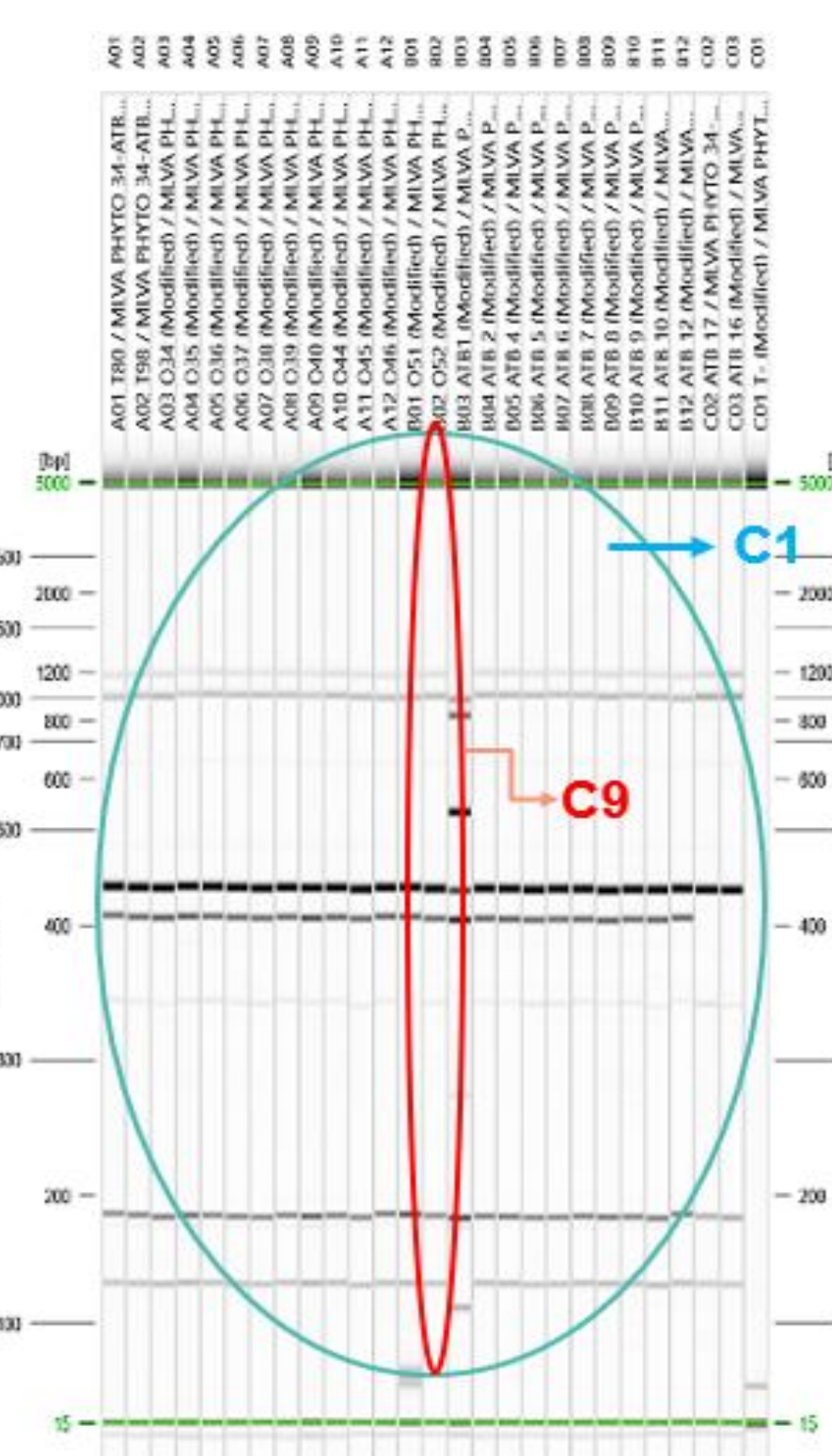


Figure 5 : MLVA PCR Analysis in the 3 groups

Groups	Mortality rate % (1-38 D)		E.Coli βLSE % (D21)		E.Coli βLSE % (D38)	
	p-value	p-value	p-value	p-value	p-value	p-value
Control (n=48)	5.9	.37	0.0	10 ⁻³	51	.02
Antibiotic (n=42)	2.3	.46	23.8	10 ⁻³	73.8	.01
TRP-20g (n=50)	0.0		0.0		56.7	

Table 1: Comparison of treatments' effect on mortality rate and ESBL *E. coli*

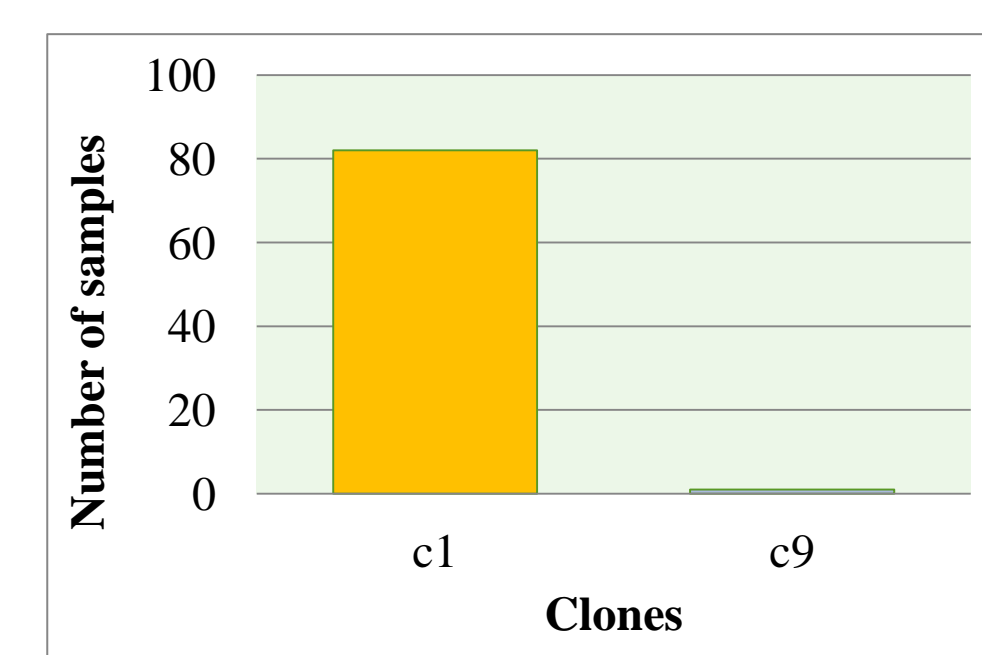


Figure 6: Bar chart depicting the prevalence of the two identified clones in the 3 groups

Our results underscore the complex interplay between antibiotic usage, plant-based interventions, and the dynamics of ESBL-producing *E. coli* colonization in poultry. Further investigation is warranted to elucidate the underlying mechanisms driving these observations and to explore the potential of plant-based interventions as sustainable alternatives to antibiotics in poultry farming practices.

Conclusion

The use of plants presents a promising option for enhancing industrial poultry production. Our findings revealed a notable absence of animal mortality and a reduced occurrence of ESBL-producing *E. coli*. Of note, global proportions of ESBL-producing *E. coli* may have been impacted, as bacterial transmission could have occurred via airborne routes between groups. In summary, the combination of enhanced zootechnical performance and plant-based interventions warrants further investigation in this field.

References

1. Manyi-Loh C, Mamphweli S, Meyer E, Okoh A. Antibiotic Use in Agriculture and Its Consequential Resistance: Potential Public Health Implications. *Antibiotics*. 2018 Mar 30;23(4):795.
2. Zhou, Y, Li, L Zhang, et al. (2020). Antibiotic administration routes and oral exposure to antibiotic resistant bacteria as key drivers for gut microbiota disruption and resistance in poultry. *Front Microbiol* 11, 1319

Acknowledgements

This work is conducted as part of the Project Co-Fund ICARS-ENVIRE (Interventions to control the dynamics of antimicrobial resistance from chickens through the environment) and by the ministry of Higher Education Tunisia in collaboration with the French Agency for Food, Environmental and Occupational Health Safety (ANSES).

