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

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## 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

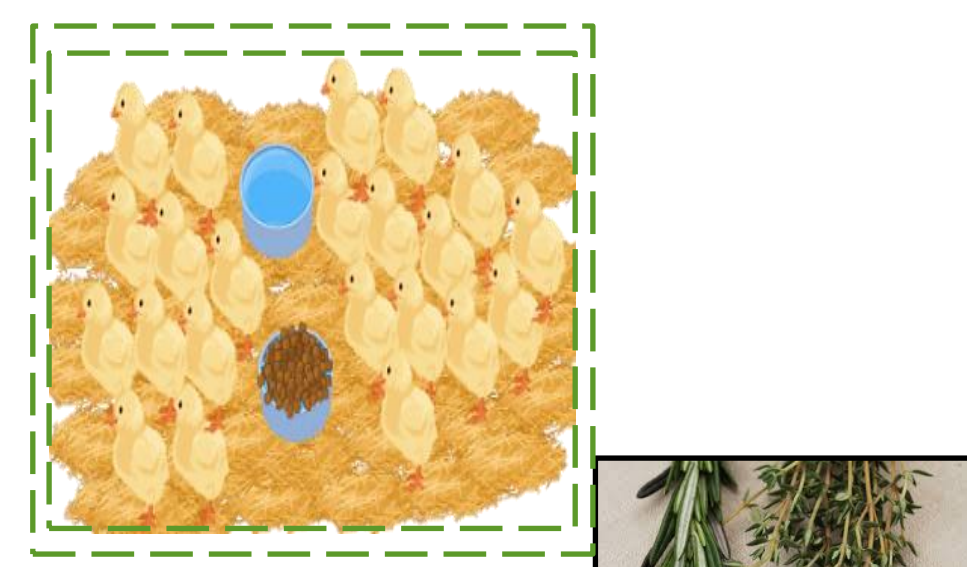
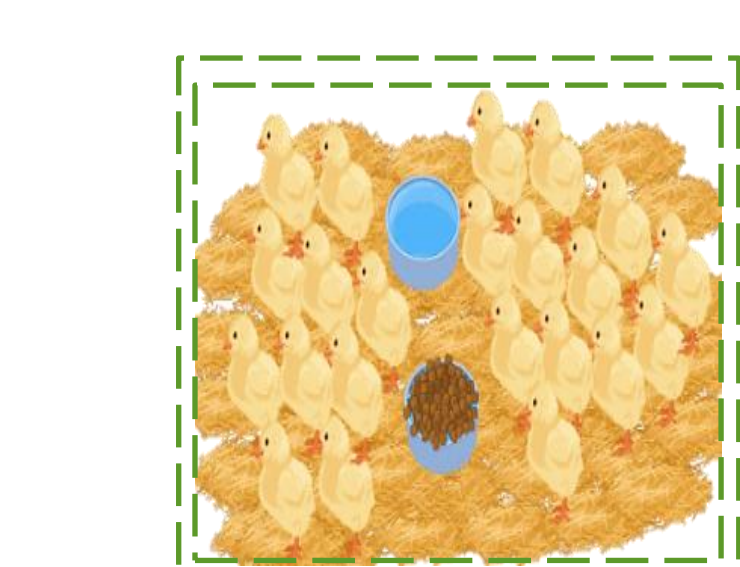
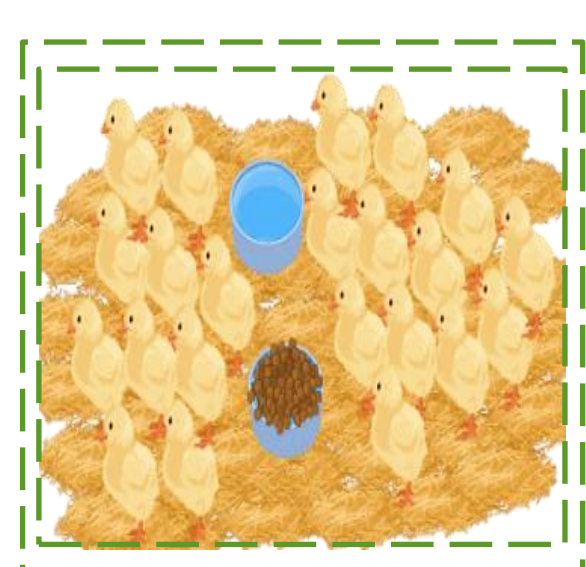
To investigate the potential of thyme and rosemary as alternatives to antibiotics in industrial chicken production, and to evaluate their impact on the prevalence of ESBL-producing *E. coli* and animal health.

## 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

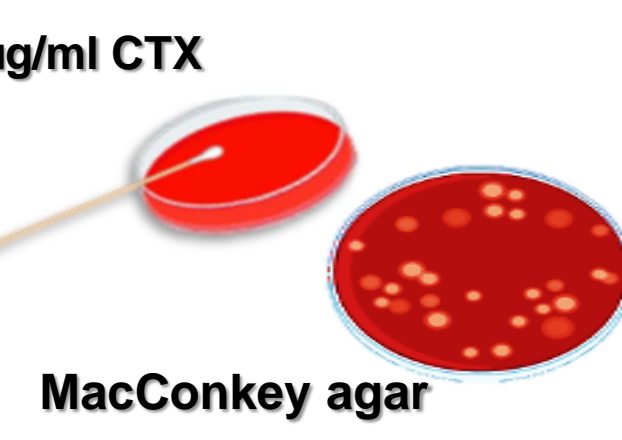
Body weight

Mortality

2

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

Nutrient broth → 24h

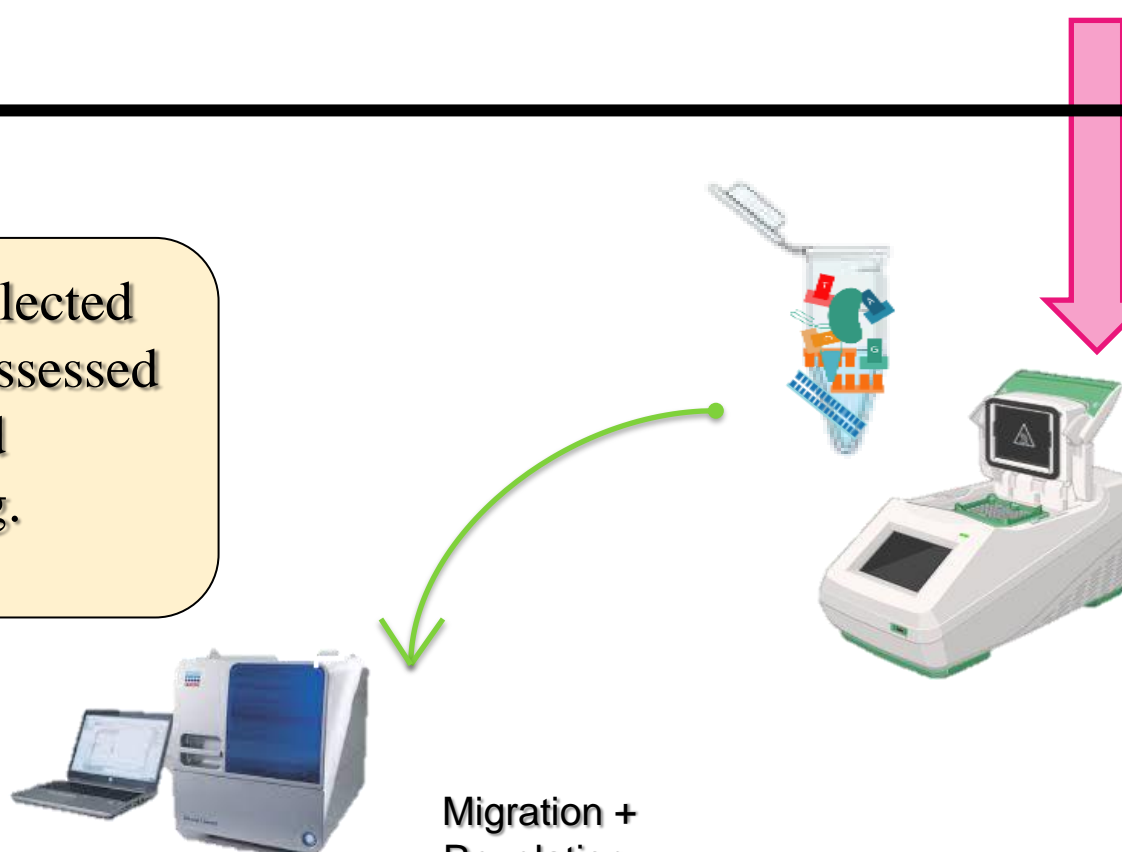


Antibiogram + ESBL TEST

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.

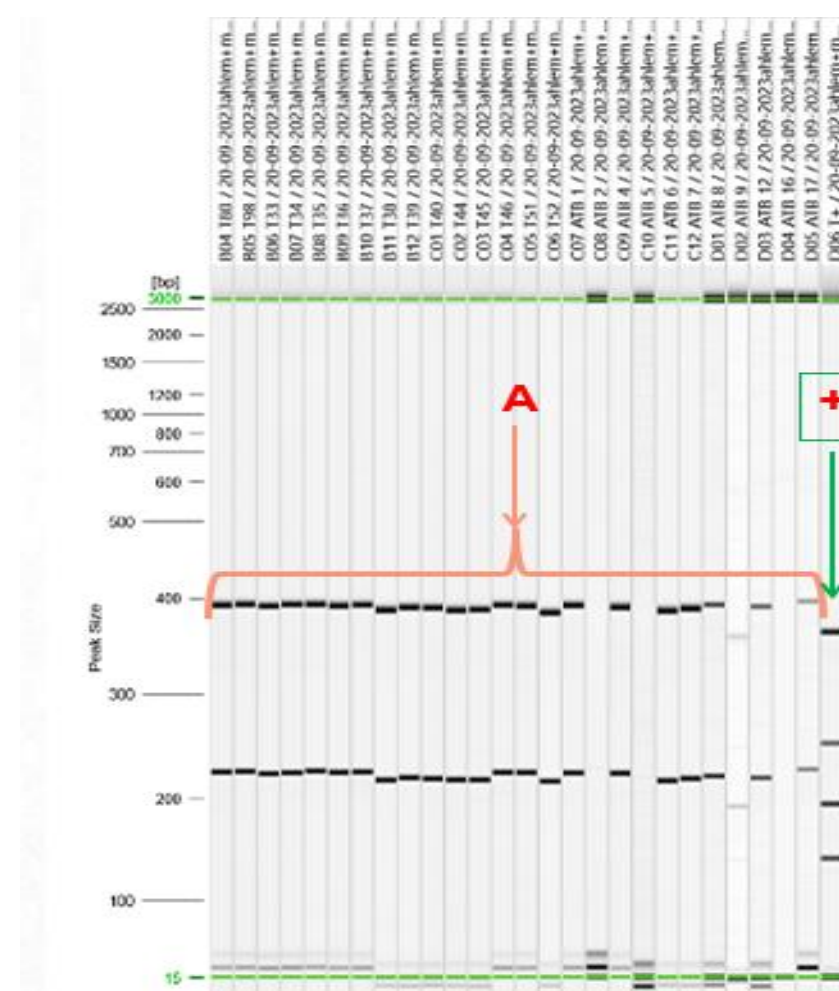


Figure 2: "Phylogroup PCR Analysis"

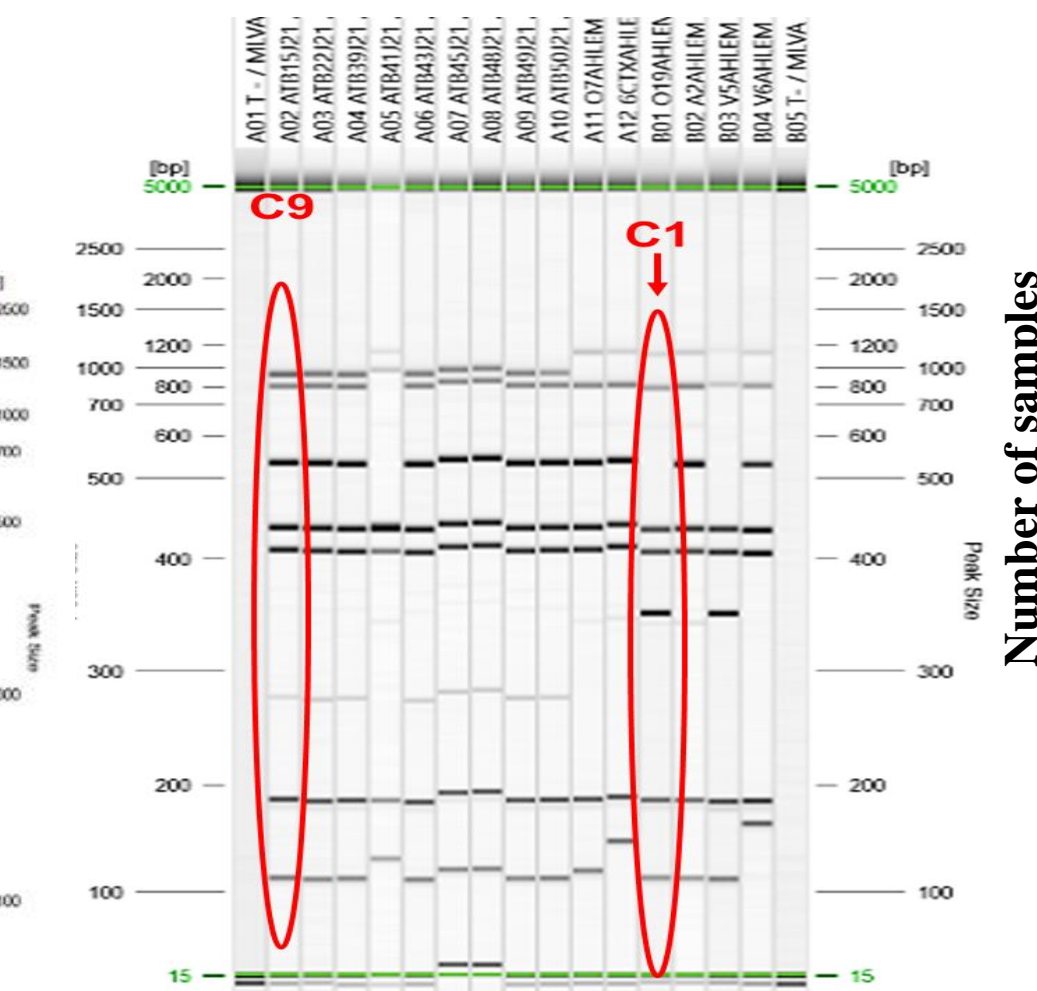


Figure 3: MLVA PCR Analysis in the group treated with antibiotics

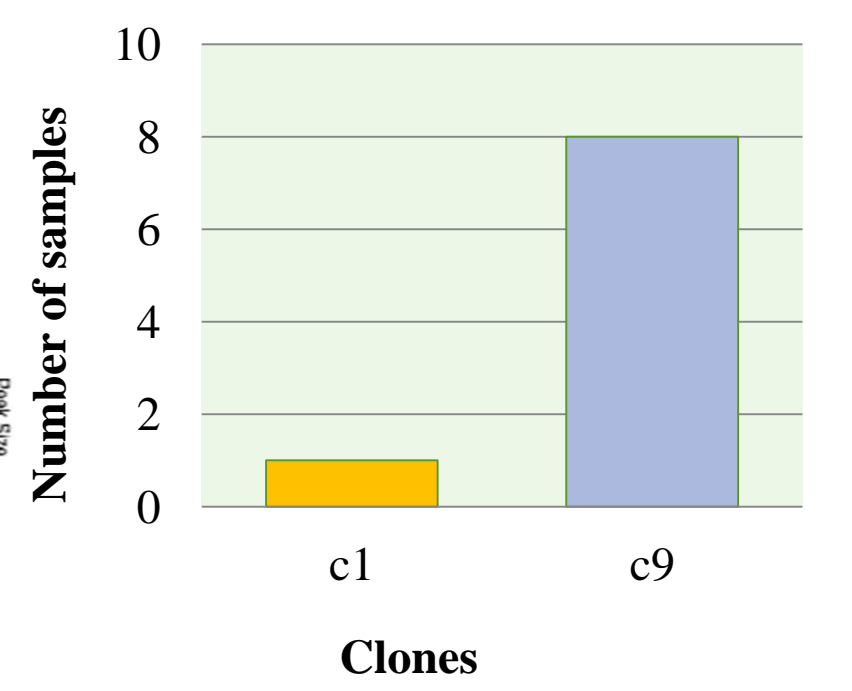


Figure 4: Bar chart depicting the prevalence of the two identified clones in the group treated with antibiotics

### 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.

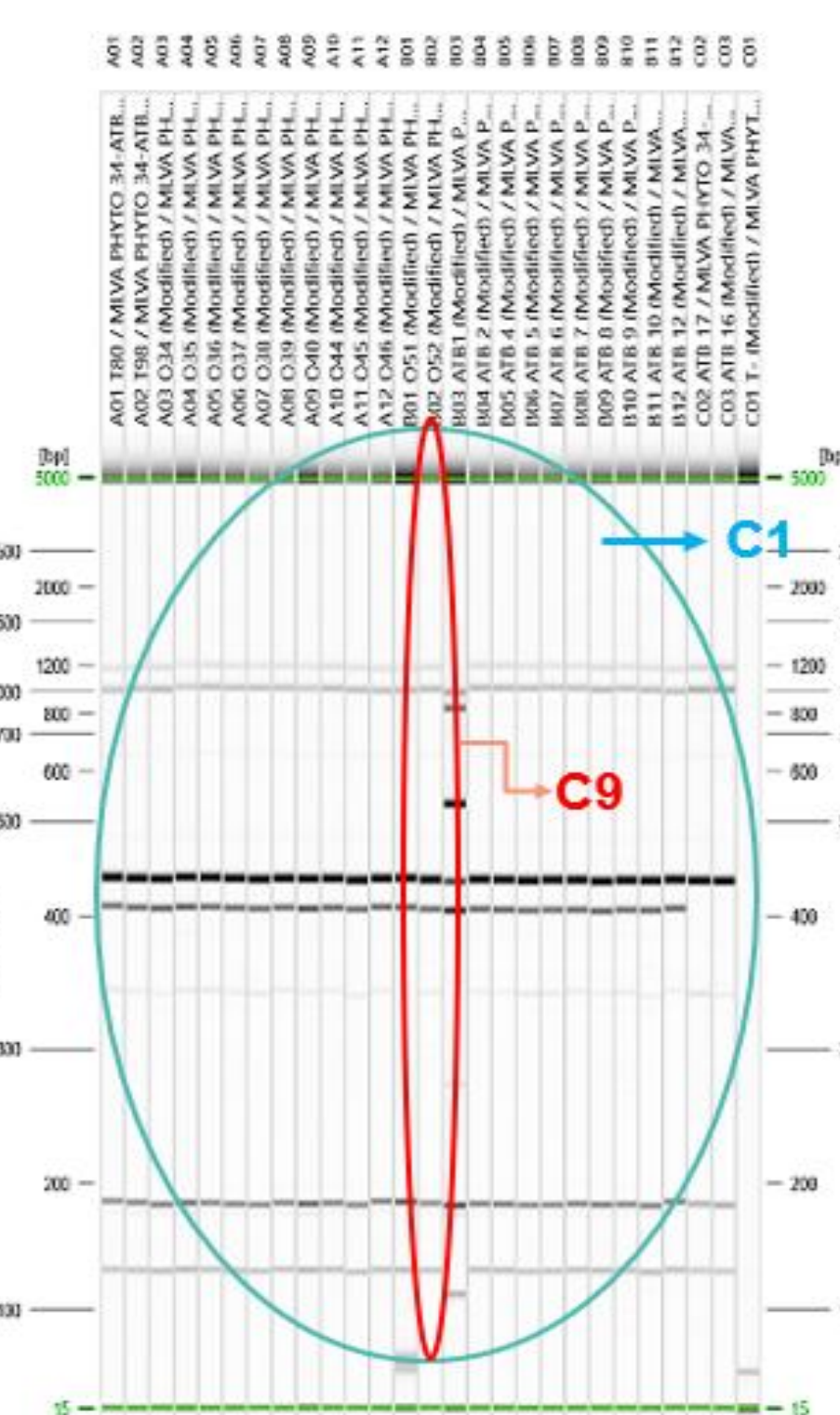


Figure 5 : MLVA PCR Analysis in the 3 groups

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 <sup>-3</sup>	51	.02
Antibiotic (n=42)	2.3	.46	23.8	10 <sup>-3</sup>	73.8	.01
TRP-20g (n=50)	0.0		0.0	10 <sup>-3</sup>	56.7	

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

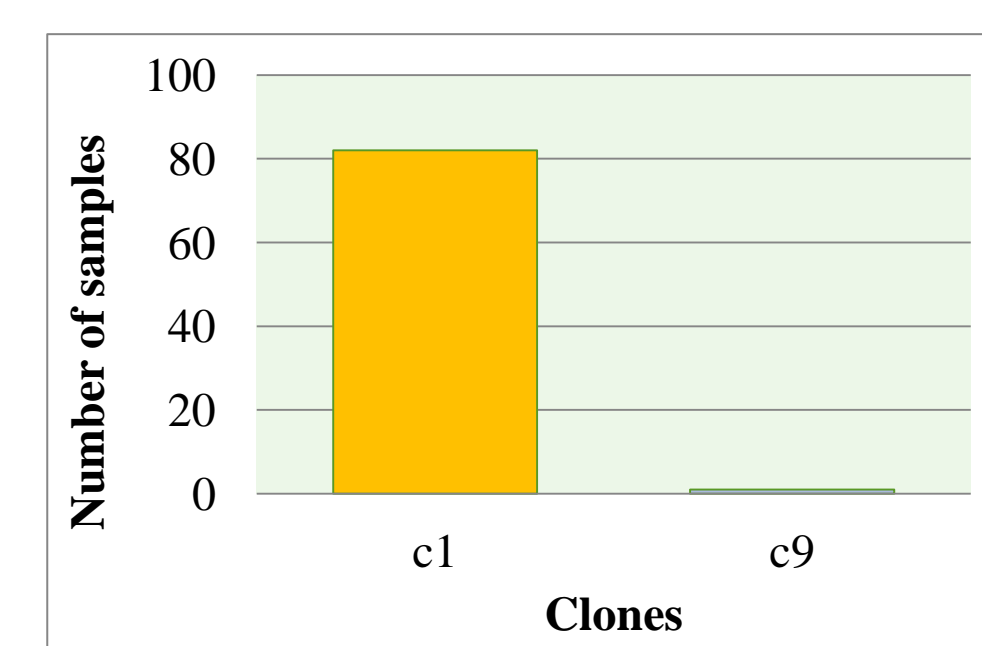


Figure 6: Bar chart depicting the prevalence of the two identified clones in the 3 groups

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. *Antimicrobial Resistance and Public Health Implications*. 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

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