ReAct Africa and South Centre
Annual Antimicrobial Resistance Conference - 2024

Therapeutic alternative to the use of antibiotics in chicken farming

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Background

Antibiotics are commonly used in broiler chicken farming to prevent disease, promote growth, and provide prophylactic benefits (1). However, their overuse leads to the excretion of antibiotics into the environment, accelerating the spread of antibiotic-resistant bacteria and genes. These bacteria are disseminated through animal feces, contributing to environmental contamination and multi-drug resistance (MDR)(2).

Alternatives such as phytotherapy, using plant extracts like thymol and carvacrol, have shown promise in improving animal health and performance of body weight gain while no studies assessed the impact of medicinal plants on antimicrobial resistance in chicken production. These extracts exhibit strong antibacterial effects invitro against pathogens like *E. coli*, *Clostridium perfringens*, and *Salmonella*, without affecting beneficial bacteria (3).

Methods and Materials

A total of 315 healthy, day-old commercial Arbor acres broiler chicks arrived at a clean and disinfected building. Chicks were individually numbered by tags, the have undergone cloacal sampling to check whether or not they had resistant Enterobacteriaceae on day 1 (D1), then divided into 9 groups each consisting of 35 chicks which received different treatments as shown in figure.1

On the 3rd day, all chicks, except the negative control group, were orally inoculated with 200µl of the 10^2 CFU suspension of ESBL-E. coli R56 (4) each, using a polyethylene tube attached to a syringe. Weekly, body weight and mortality measurements were taken, along with a cloacal swab. The swabs were inoculated onto MacConkey agar with the addition of 2µg/ml CTX and 4µg/ml Enrofloxacin. All samples were kept for further analysis to determine if they originated from the same strain R56 used for inoculation.

Results

Figure.2 represents the average weight of each group at different age.

The results of cloacal swabs are presented **in figure.3** witch represent resistant *E. coli* counted on MacConkey agar at different age.

Lactobacillus enumeration and antibiotic residue testing are in progress.

Figure 1. representation of the breeding plan

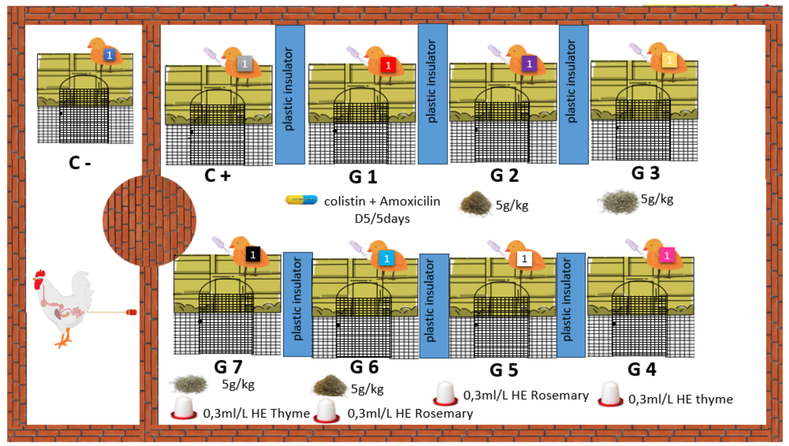
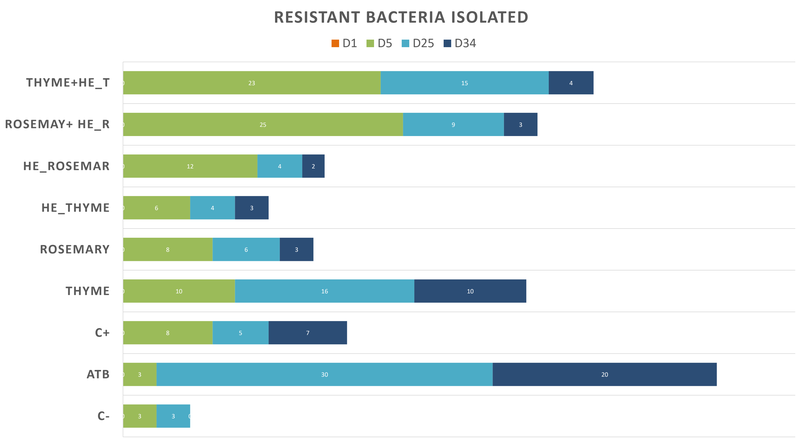


Figure 2. Average weight of each group at different age

Figure 3. Resistant bacteria isolated at different age



T: Thym, HE-T: Essential oil Thym, HE-Rosemary: Essential oil Rosemary, C: control, ATB: Antibiotic

Discussion

Our study revealed that the use of plants in industrial poultry production is promising, with low mortality observed and a reduction in ESBL (extended-spectrum beta-lactamase)-producing *E. coli*. These results suggest that plants may play a protective role, potentially by enhancing the animals' immune system or inhibiting the growth of pathogenic bacteria.

The observed benefits, including reduced mortality and pathogen load, indicate that natural solutions can replace antibiotics, which is crucial in combating antibiotic resistance.

Further research is necessary to understand the mechanisms by which plants reduce pathogens and to explore their long-term impact on animal health and meat quality. Overall, the integration of plants in poultry production offers significant advantages and warrants continued investigation to optimize their use especially in a context of a large dissemination of antimicrobial resistant bacteria in poultry production.

Conclusions

Our research showed no significant difference in mortality rate between different batches as well as average weight at d1. At D34, the highest average weight was showed in group receiving food added with 5g/kg rosemary and treated by 0,3ml/L of Rosemary essential oil, followed by the batch treated by essential oil of Rosemary compared with other batches not treated by medicinal plant (powder or essential oil).

The E. coli count showed an increase in the number of strains at D5 (48 hours after infection), which began to decline from D25 to the last day of rearing (D34) in all groups treated by thyme and rosemary (Powder or essential oil)The highest number of resistant E. coli was observed in the group treated with antibiotics.

In conclusion, reducing MDR bacteria involves limiting antimicrobial use in veterinary medicine and exploring alternative treatments to ensure sustainable and effective animal farming practices.

Public Health Implications

This work is conducted as part of the Project JPI-AMR - ENVIRE (Interventions to control the dynamics of antimicrobial resistance from chickens through the environment) and is financed by ICARS. The use of an alternative to antibiotics in poultry production will have an impact in the chain of dissemination of antimicrobial resistant bacteria and antimicrobial resistance genes in the animal context but also between the animal and the human context..

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