

Graduate students

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Abstract

Avian Pathogenic *Escherichia coli* (APEC) is the contributing agent behind the avian infectious disease colibacillosis, which causes substantial fatalities in poultry industries that has a significant impact on the economy and food safety. Several virulence genes have been shown to be concomitant with the extraintestinal survival of APEC. This study investigates the antibiotic resistance patterns and APEC-associated virulence genes content in *Escherichia coli* (*E. coli*) isolated from non-healthy and healthy broiler chickens from a commercial poultry farm in Qatar. A total of 158 *E. coli* strains were isolated from 47 chickens from five different organs (air sac, cloacal, kidney, liver, and trachea). Based on genetic criteria, 65% were APEC strains containing five or more virulence genes, and 34% were non-pathogenic *E. coli* (NPEC) strains. The genes *ompT*, *hlyF*, *iroN*, *tsh*, *vat*, *iss*, *cvi/cva*, and *iucD* were significantly prevalent in all APEC strains. *E. coli* isolates showed 96% resistance to at least one of the 18 antibiotics, with high resistance to ampicillin, cephalothin, ciprofloxacin, tetracycline, and fosfomycin. Our findings indicate high antibiotic resistance prevalence in non-healthy and healthy chicken carcasses. Such resistant *E. coli* can spread to humans, hence, special programs are required to monitor the use of antibiotics in chicken production in Qatar.

Introduction

Avian Pathogenic *Escherichia coli* (APEC) is the contributing agent behind the avian infectious disease colibacillosis, which causes substantial fatalities in poultry industries having a significant impact on the economy and food safety. Several virulence genes have been shown to be concomitant with the extraintestinal survival of APEC. This study investigates the antibiotic resistance patterns and APEC-associated virulence genes content in *Escherichia coli* (*E. coli*) isolated from non-healthy and healthy broiler chickens from a commercial poultry farm in Qatar.

Materials and Methods

Sample collection

- 47 chickens (15 healthy and 32 non-healthy) were used.
- 1 Sample was collected from 5 different organs (Air sacs, Trachea, Liver, Kidney and Cloacal), totaling 247 samples.

Bacterial isolation

- Using a selective medium CHROMagar *E. coli* plate.

Identification of APEC strains

- DNA extraction using QIAamp® UCP pathogen miniKit
- Following a multiplex PCR assays targeting 8 virulence genes (*ompT*, *hlyF*, *iroN*, *tsh*, *vat*, *iss*, *cvi/cva* and *iucD*) associated with APEC using previously published primers.

Phenotypic antibiotic susceptibility testing

- Using the standard Kirby-Bauer (K.B.) disk except for colistin, where the E-test method was used.

Genotypic characterization of colistin and ESBL resistant isolates

- DNA extraction from colistin-resistant isolates and multiplex PCR to screen for the most common genes, namely, *mcr-1*, *mcr-2*, *mcr-3*, *mcr-4*, and *mcr-5*.
- Following a Restriction Fragment Length Polymorphism (RFLP) Analysis

Data analysis

- Microsoft Office Excel, Graph Pad version 8 (San Diego, California, USA), and PAST software version 4.03 (Oslo, Norway) were used for clustering analysis.

Results

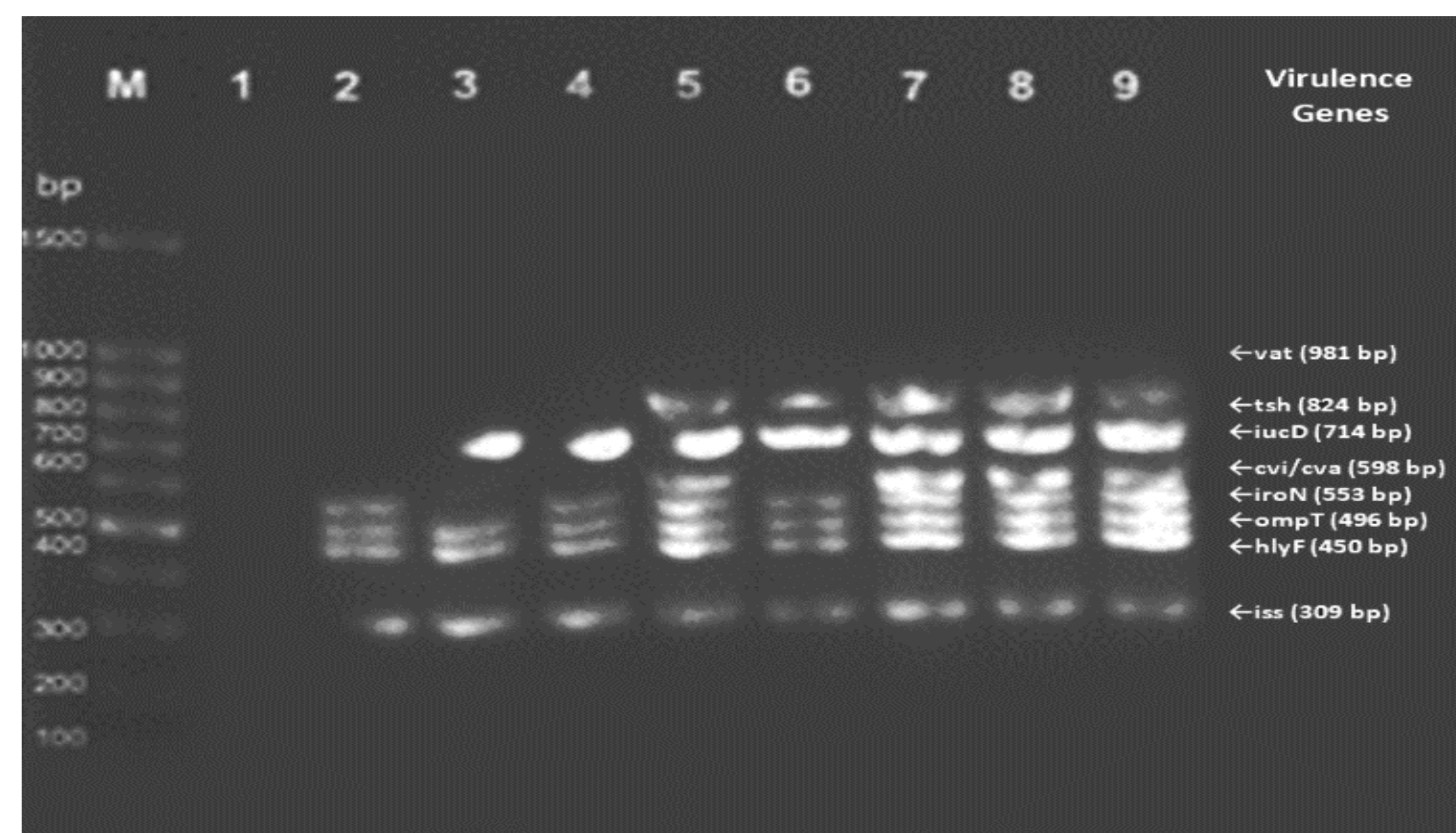


Figure 1. Detection of virulence genes among APEC isolated from non-healthy and healthy chickens.

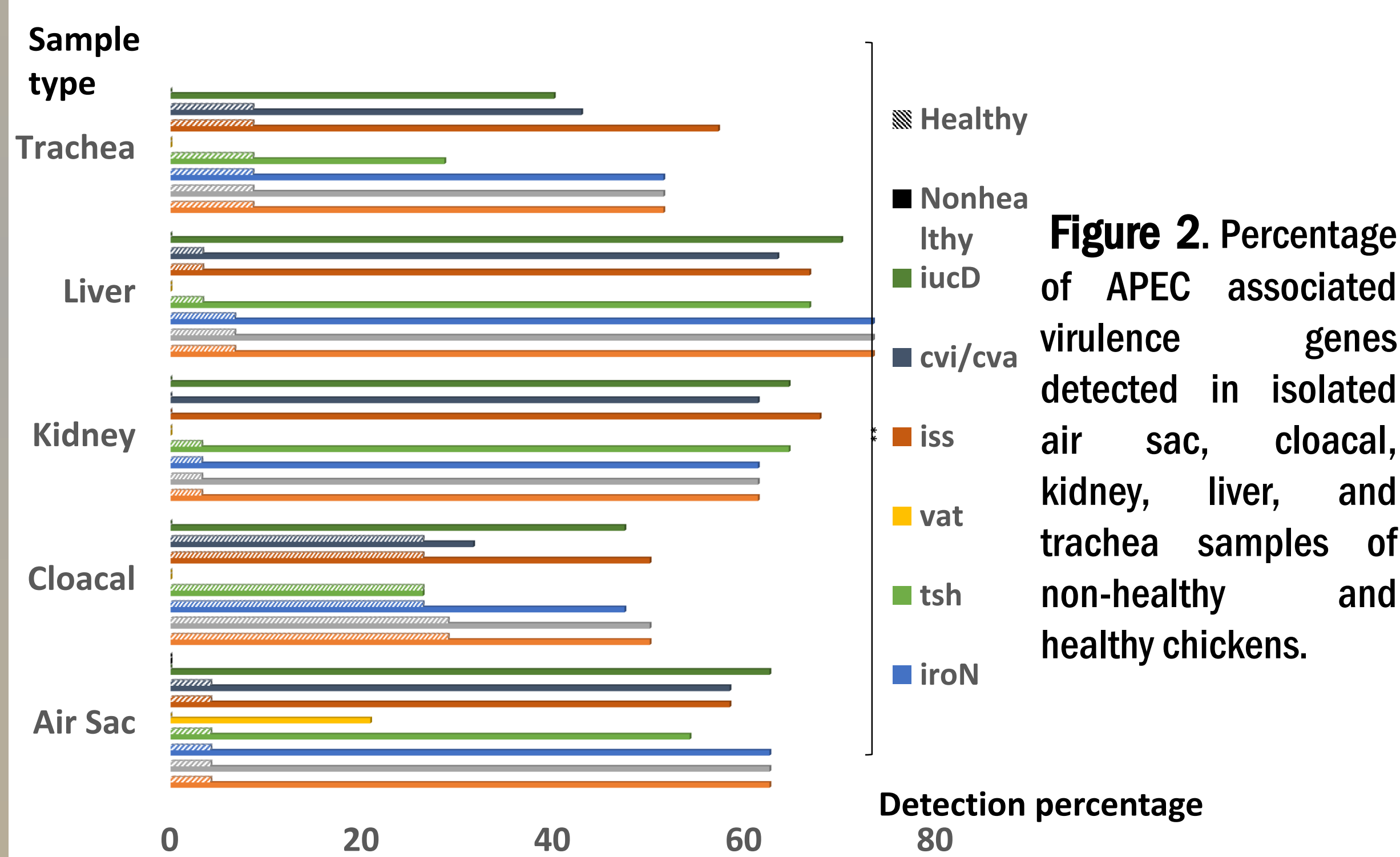


Figure 2. Percentage of APEC associated virulence genes detected in isolated air sac, cloacal, kidney, liver, and trachea samples of non-healthy and healthy chickens.

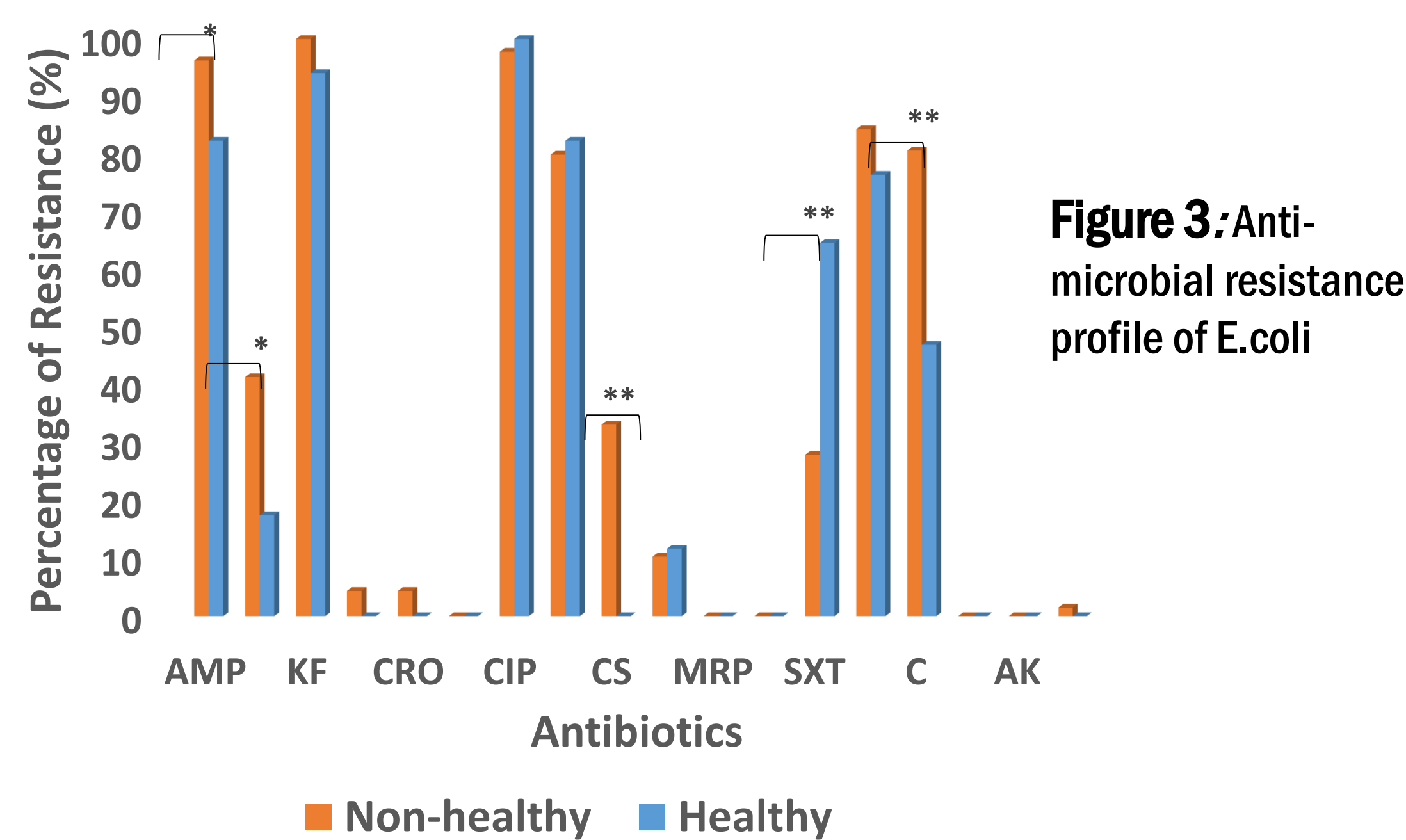


Figure 3: Anti-microbial resistance profile of *E. coli*



Figure 4: Detection of antibiotic resistant genes in phenotypically resistant *E. coli* from kidney, air sac, cloacal, trachea, and liver, samples of non-healthy chickens.

Discussion

- ❖ Detection of cases of resistant APEC strains in commercial poultry business is alarming.
- ❖ This study exhibited a high level of resistance, including 96% to about one antibiotic among *E. coli* isolates from both healthy and non-healthy chicken samples.
- ❖ High resistance of 96.3% and 82.4% to ampicillin, 100% and 94.1% to cephalothin, 97.8% and 100% to ciprofloxacin, 80% and 82.4% to tetracycline, 84.4% and 76.5% to fosfomycin was reported among non-healthy and healthy chickens, respectively.
- ❖ The *mcr-1* gene was available in all isolates showing colistin resistance, validating its function in colistin resistance.
- ❖ This research reported a significantly high level of MDR *E. coli* (99.3%) in the chicken samples.
- ❖ The increase of antibiotic-resistant strains, especially colistin and multidrug resistance strains in Qatar's poultry farms could easily spread to humans through chicken meat consumption and non-compliance with hygiene practices among farmworkers.

Conclusion

- ❖ It is Qatar's first study to genetically isolate Avian Pathogenic *Escherichia coli* (APEC) and its resistance in connection to antibiotics among broiler chickens.
- ❖ The findings validate the existence of APEC strains among chickens and high antibiotic resistance prevalence in healthy and non-healthy broiler chickens.
- ❖ *E. coli* can easily spread to people; hence, special programs are needed to manage the usage of antibiotics in Qatar's poultry industry and monitor the transmission and spread of APEC within this



Acknowledgement

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