Retail Chicken Carcasses as a Reservoir of Antimicrobial-Resistant Escherichia coli

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The dissemination of antimicrobial resistance (AMR) bacteria has been associated with the inappropriate use of antibiotics in both humans and animals and with the consumption of food contaminated with resistant bacteria, which poses a significant threat to the safety of the world's food supply. This study aims at determining the prevalence and antibiotic resistance profile of Escherichia coli (E. coli) isolated from local and imported retail chicken meat in Qatar. A total of 270 chicken carcasses were obtained from three different hypermarket stores. Overall, 216 E. coli were isolated and subjected to antibiotic susceptibility testing against 18 relevant antibiotics using disc diffusion test, micro dilution, double-disc synergistic test, multiplex-PCR and DNA sequencing. Nearly 89% of the isolates were resistant to at least one antibiotic. In general, isolates showed relatively higher resistance to sulfamethoxazole (62%), tetracycline (59.7%), ampicillin and trimethoprim (52.3%), ciprofloxacin (47.7%), cephalothin, and colistin (31.9%). Nine isolates (4.2%) were ESBL producers. Furthermore, 63.4% were multidrug-resistant (MDR). The percentage of MDR, ESBL producers, and colistin-resistant isolates was significantly higher among local isolates compared to imported chicken samples. We reported a remarkably high percentage of the antibiotic-resistant E. coli in chicken meat sold at retail in Qatar. The high percentage of MDR and colistin isolates is troublesome to the food safety of raw chicken meat and the potential of antibiotic resistance spread to public health. Our findings support the need for the implementation of one health approach to address the spread of antimicrobial resistance and the need for a collaborative solution.

BACKGROUND

The dissemination of antimicrobial resistance (AMR) bacteria has been associated with the inappropriate use of antibiotics in both humans and animals and with the consumption of food contaminated with resistant bacteria. In particular, the use of antibiotics as prophylactic and growth promotion purposes in food-producing animals has rendered many of the antibiotics ineffective. The increased global prevalence of AMR poses a significant threat to the safety world’s food supply. Furthermore, studies have revealed that antibiotic resistant Escherichia coli (E. coli) from food sources, such as poultry and poultry products, can spread to humans and potentially colonize human gut. Moreover, E. coli can transfer their resistant genes to pathogenic bacteria such as Salmonella in different environment. Additionally, resistant E. coli can cause urinary tract infection, meningitis, peritonitis, and septicemia. Escherichia coli is generally used as a sentinel for monitoring antibiotic resistance.

In Qatar, multi-resistant drug (MDR) particularly in gram-negative strains including E. coli and Klebsiella as well as colistin resistant bacteria has been reported in both humans and animals (25-27). However, there is no information available on antibiotic resistant E. coli on raw chicken meat at the retail level in Qatar. Here we report on the prevalence of antibiotic resistant E. coli isolates found on chicken carcasses sold at retail-level in Qatar.

METHODS

Chicken carcasses were rinsed in 250 ml of buffered peptone

Identification of the isolate using Biometric ID

Antibiotic susceptibility testing using Disc Diffusion method

Double-disc synergistic test

PCR

Sequencing

RESULTS

This figure displays different isolates harboring different bla genes. Multiplex PCR was performed for detection of CTX-M groups and PCR and detection of TEM and SHV. The amplification products of each isolate were run on the same lane for detection of bla genes. Lanes 1 to 3: blaTEM, Lane 4: blaCTX-M, Lanes 5 to 7: bla TEM, & bla TEM, Lanes 8 & 9: bla TEM, bla SHV & bla CTX-M. Lanes 10: bla NCTC 13191 E. coli positive control for blaTEM, NCTC 13198 E. coli negative control for blaTEM, NCTC 13461 E. coli positive control for blaCTX-M, NCTC 13464 E. coli positive control for blaCTX-M, NCTC 13462 E. coli positive control for blaCTX-M, NCTC 13462 E. coli negative control for blaCTX-M, NCTC 13462 E. coli positive control for blaCTX-M.

Fig. 1. Prevalence of antibiotic resistant E. coli isolates (n=216) by storage temperature and source in Qatar* * percentages are shown only for resistance with significant differences by storage temperature and source

Fig. 2: Detection of blaTEM, blaCTX-M, and blaSHV genes in E. coli isolated from retail chicken carcasses*

CONCLUSIONS

We reported a remarkably high percentage of the antibiotic-resistant E. coli in chicken meat sold at retail in Qatar. The high percentage of MDR and colistin isolates is troublesome to the food safety of raw chicken meat and the potential of antibiotic resistance spread to public health. Our findings support the need for the implementation of one health approach to address the spread of antimicrobial resistance and the need for a collaborative solution.

REFERENCES


Acknowledgements

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OBJECTIVES

- This study aims at determining the prevalence of antibiotic-resistant E. coli isolated from local and imported retail chicken meat in Qatar.
- Characterizing antibiotic resistance at phenotypic and genotypic levels.

Fig. 3: mcr-1 gene detection in colistin-resistant E. coli isolated from chicken carcasses

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