Faculty and Postdoc, Medical,
Biomedical and Health Sciences

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

Nahla O. Eltai[1], Hadi M. Yassine[1], Sara H. Al-Hadidi[1], Tahra El-Obeid[2], Asmaa A. Al Thania[1], Walid Q. Alali[3]

[1] Biomedical Research Center, Qatar University, [2] Department of Health Nutrition, College of Health Sciences, Qatar University, [3] Department of Epidemiology and Biostatistics, Faculty of Public Health, Kuwait University, Safat, Kuwait.

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 synergetic 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.
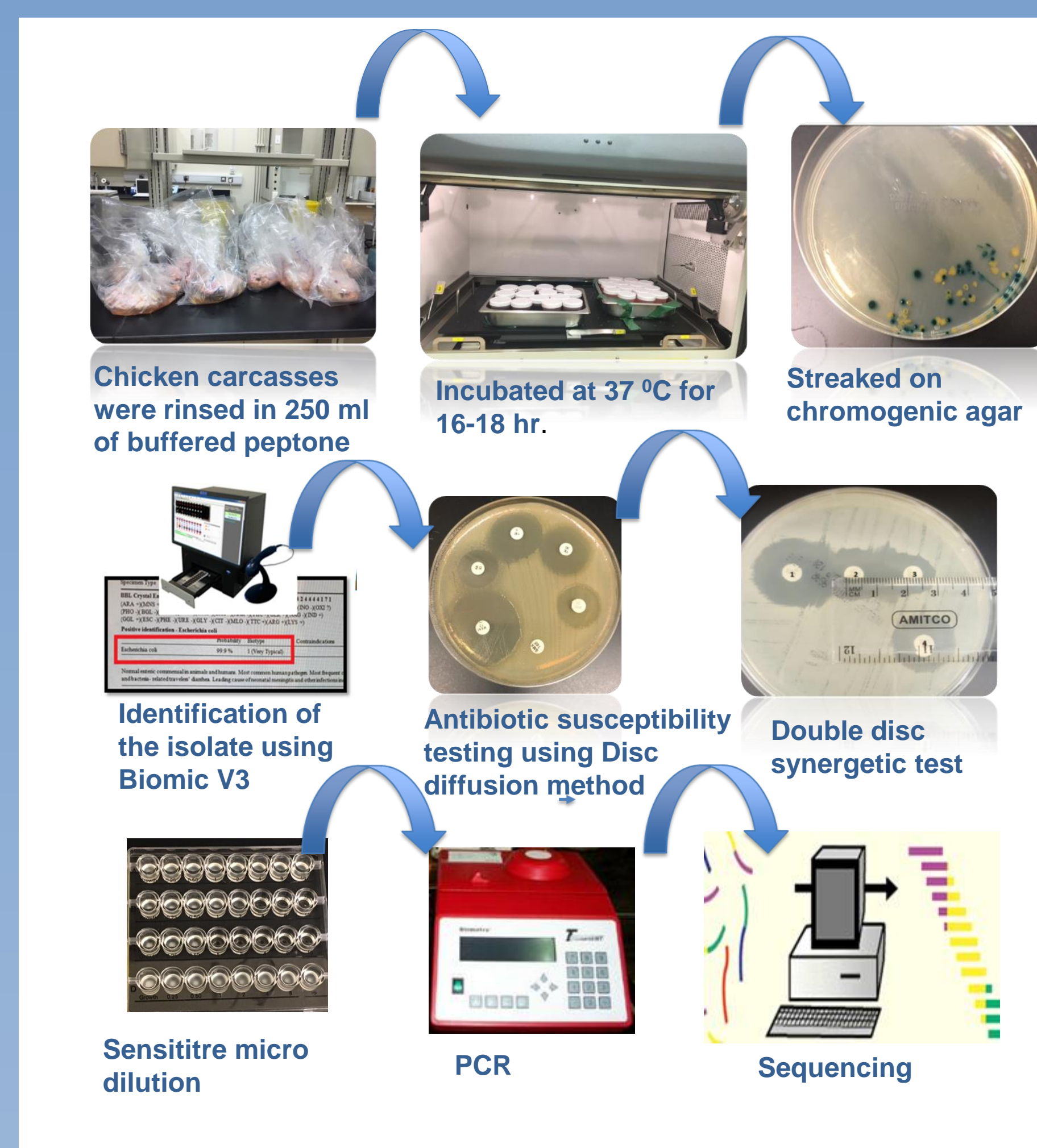
BACKGROUND

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-drug resistant (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.

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.

METHODS

Chicken carcasses were rinsed in 250 ml of buffered peptone

Incubated at 37 ⁰C for 16-18 hr.

Streaked on chromogenic agar

Identification of the isolate using Biomic V3

Antibiotic susceptibility testing using Disc diffusion method

Double disc synergetic test

Sensititre micro dilution

PCR

Sequencing

RESULTS

Fig. 1. Prevalence of antibiotic resistant *E. coli* isolates (n=216) by storage temperature and source in Qatar*
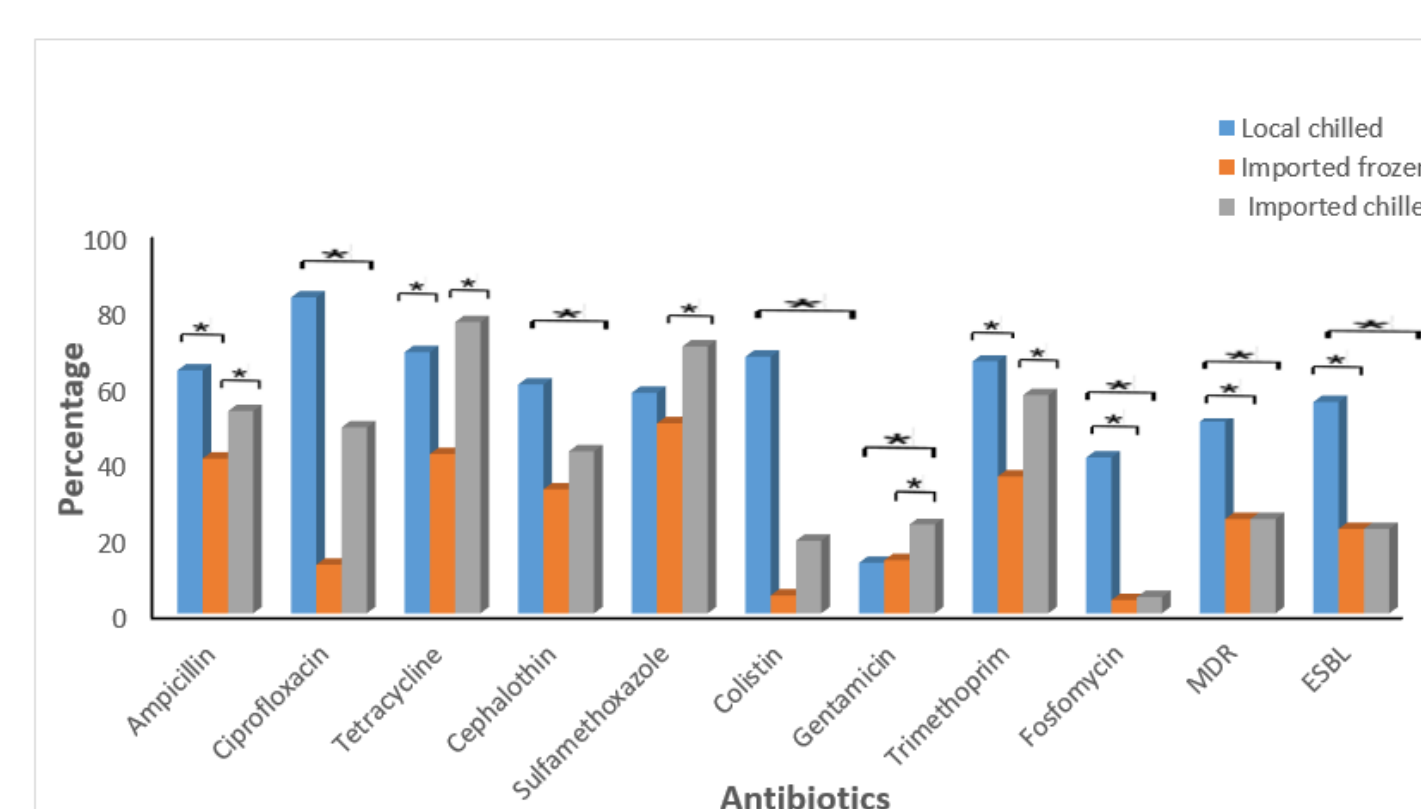
* percentages are shown only for resistance with significant differences by storage temperature and source
Significant difference P< 0.05 (Person Chi-square test); ESBL: Extended spectrum beta lactamase producer; MDR: Multi Drug Resistant

Fig.2: Detection of bla_{SHV}, bla_{TEM} and $bla_{CTX-M-G (1, 2)}$ antibiotic resistance genes in *E. coli* isolated from retail chicken carcasses*
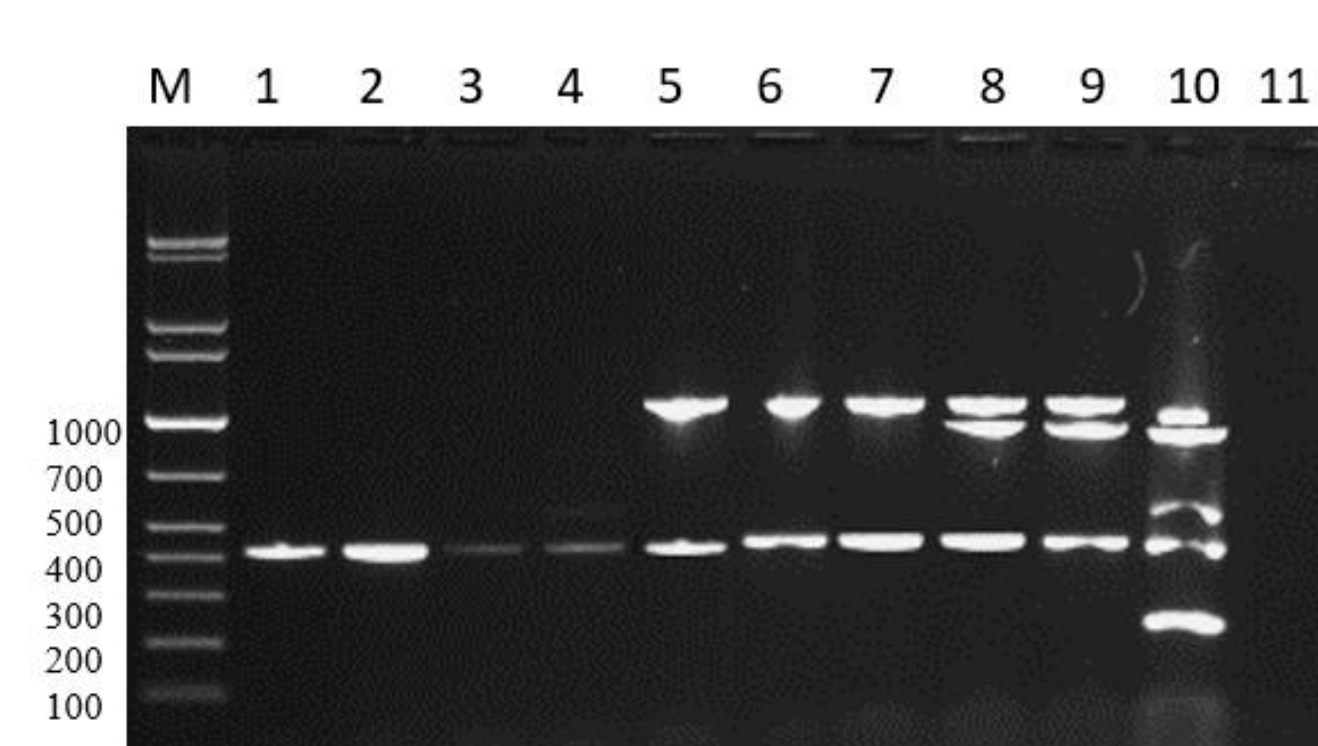
This figure displays different isolates harboring different *bla* genes. Multiplex PCR was performed for detection of CTX-M groups and PCR for detection of TEM and SHV. The amplification products of each isolate were run on the same lane for detection of bla genes. Lanes 1 to 3: $bla_{CTX-MG1}$; Lane 4: $bla_{CTX-MG (1, 2)}$; Lanes 5 to 7: $bla_{CTX-MG1}$ & bla TEM; Lanes 8 & 9: bla TEM, bla SHV & bla CTXM- Lane 10: bla NCTC 13351 *E. coli* positive control for blaTEM, NCTC 13368 *K. pneumonia* positive control for blaSHV, NCTC 13461 *E. coli* positive control for $bla_{CTX-MG1}$; NCTC 13462 *E. coli* positive control for blaCTX-MG2; NCTC 13464 *E. coli* positive control for $bla_{CTX-MG9}$; Lane 11: ATCC 25922 *E. coli* negative control

RESULTS

Fig. 3: *mcr*-1 gene detection in colistin-resistant *E. coli* isolated from chicken carcasses
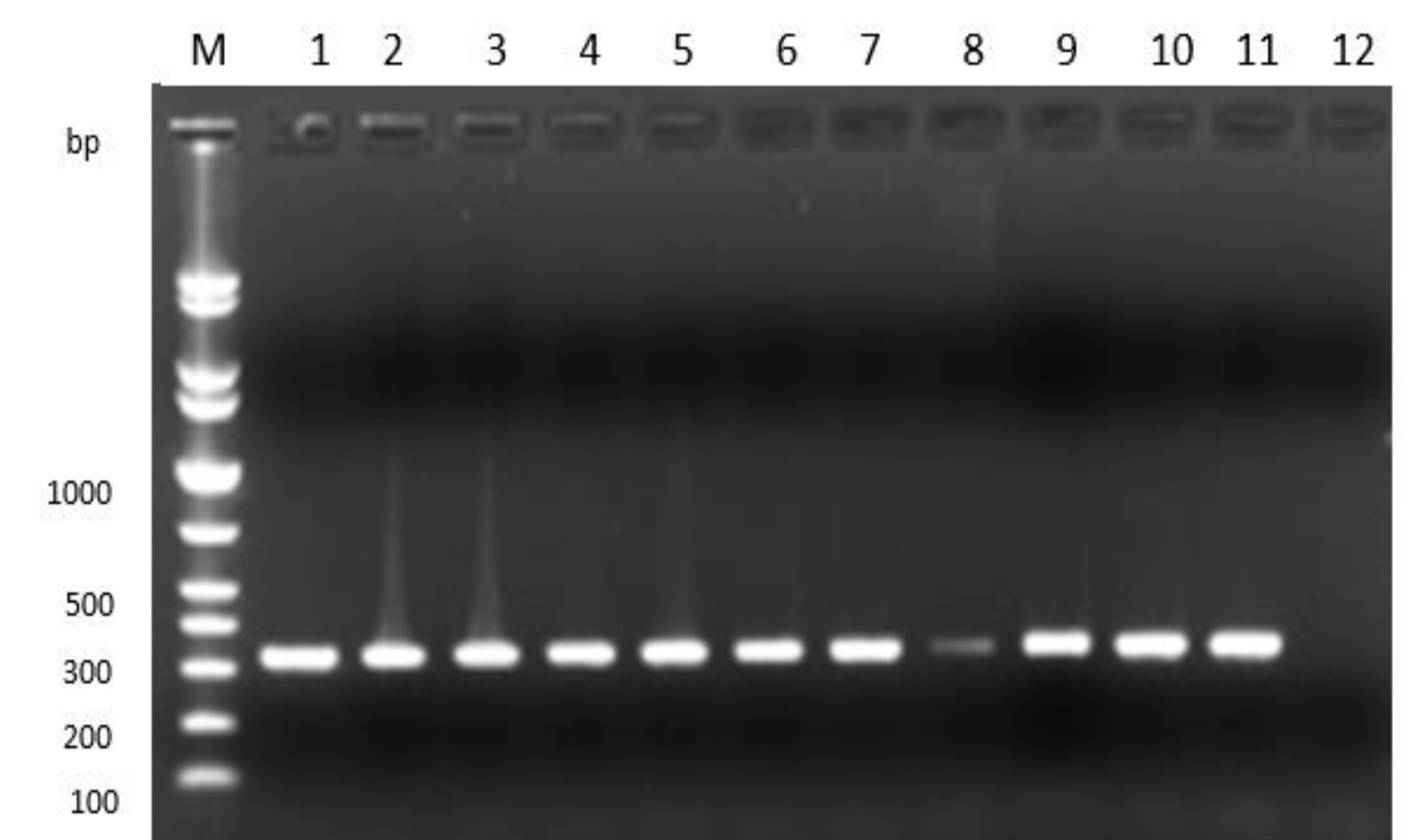
Representative samples are shown. Multiplex PCR was performed for detection of *mcr*-1, 2,3,4,5 genes. Resistance to colistin in 69 isolates was confirmed by PCR amplification of 320 bp fragment of *mcr*-1 gene. Lanes 1-11: PCR products of part of mcr-1 gene (320pb); Lane 12: ATCC 25922 *E. coli* (sensitive strain). M: molecular size (weight) standard marker; bp: base-pairs. The following illustrates the sequence of *mcr*-1 PCR product: (TATAAAAACGTTCTGACGCGACCGCCATCTTACCTTTTTTGATAAAAT CAGCCAAACCTATCCCATCGCGGACAATCTCGGCTTTGTGCTGACGA TCGCTGTCGTGCTCTTTGGCGCGATGCTACTGATCACCACGCTGTTA TCATCGTATCGCTATGTGCTAAAGCCTGTGTTGATTTTGCTATTAATCA TGGGCGCGGTGACCAGTTATTTTACTGACACTTATGGCACGGTCTAT GATACGACCATGCTCCAAAATGCCCTACAGACCGACCAAGCCGAGA CCAAGGATCTGA).

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

1. Eltai NO, Abdfarag EA, Al-Romaihi H, Wehedy E, Mahmoud MH, Alawad OK, Al-Hajri MM, Al Thani AA, Yassine HM. 2017. Antibiotic resistance profile of co
2. mmensal Escherichia coli isolated from broiler chickens in Qatar. Journal of food protection 81:302-307.
3. Eltai NO, Al Thani AA, Al-Ansari K, Deshmukh AS, Wehedy E, Al-Hadidi SH, Yassine HM. 2018. Molecular characterization of extended spectrum β-lactamases enterobacteriaceae causing lower urinary tract infection among pediatric population. Antimicrobial Resistance & Infection Control 7:90.
4. Ahmed MAS, Bansal D, Acharya A, Elmi AA, Hamid JM, Ahmed AMS, Chandra P, Ibrahim E, Sultan AA, Doiphode S. 2016. Antimicrobial susceptibility and molecular epidemiology of extended-spectrum beta-lactamase-producing Enterobacteriaceae from intensive care units at Hamad Medical Corporation, Qatar. Antimicrobial resistance and infection control 5:4.

Acknowledgements