

## ANTIBIOTIC RESIDUES AND ANTIBIOTIC RESISTANCE OF ESCHERICHIA COLI IN RAW MEAT

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### Abstract

Antibiotic residue in meat is a serious public health concern due to its harmful effects on consumer health. This study aimed at estimating the presence of commonly used antibiotics in meat samples using a qualitative rapid test (MeRA, Liofilchem®, Italy), and evaluating the antibiotic susceptibility of *E. coli* bacteria isolated from the meat, using the automated compact system Vitek 2 (BioMérieux, Marcy l'Etoile, France). A total of 60 samples (pork, beef, goat and chicken) of raw meat from sales points were analysed. Overall, MeRA test analysis showed that 14 (23%; 95% CI 14.4-35.4) of the samples tested positive for the presence of antibiotic residues. Furthermore, six strains (60%; 95% CI 31.2-83.1) were resistant to ampicillin, norfloxacin and fosfomycin, and two strains (20%; 95% CI 5.6-50) of *E. coli* were resistant to the trimethoprim/ sulfamethoxazole combination. Consequently, the *E. coli* bacteria under investigation exhibited resistance to four antibiotics, belonging to three classes, namely penicillins, fluoroquinolones and sulphonamides. The high percentage of positive meat samples to antibiotic residue highlights public health concerns. Moreover, the presence of antibiotic residues in raw meat is associated with the occurrence of multidrug-resistant strains of *E. coli*.

**Keywords:** meat, antibiotic residues, *E. coli* antibiotic susceptibility.

#### • Introduction

Antibiotics are widely used in food animal production to prevent and treat bacterial infections. However, the abuse of antibiotics has raised concerns about the presence of antibiotic residues in meat and other animal products, which can have negative consequences for human health.

Antibiotic residues in meat and meat products can occur when animals are given antibiotics before slaughter, or when antibiotics are used in the feed or water of animals that are used for food production. When animals are given antibiotics, an amount of the drug is excreted in the urine and feces, and part of it accumulates in animal tissues and products.

The presence of antibiotic residues in meat is a concern because it can lead to the occurrence of antibiotic resistance in human pathogens. When people consume food containing antimicrobial residues, they are exposed to low levels of drugs, which may induce the development of antibiotic resistance in microorganisms.

#### • Material and method

The study was carried out on raw meat of pork, beef, goat and chicken origin. The 60 samples collected were classified by origin and anatomical region. Detection of the antibiotic residues was done using MeRA test. The results have been interpreted based on the colour obtained after the incubation period. Samples with blue colour were considered positive - therefore with antibiotic residues, while the samples having yellow colour were interpreted as negative.

Microbiologic analysis. *Escherichia coli* was isolated using the procedures outlined in ISO 16649-2/2007 [28]. From each sample 10 g of meat were homogenized in a Stomacher (BioMérieux, Marcy l'Etoile, France) with 90 ml of peptone buffered solution.

Next step involved serial dilutions of the samples in sterile peptone water 0.5% up to the dilution 10<sup>-3</sup>. Subsequently, 1 ml from each dilution was transferred in a sterile Petri dish (in duplicate), and tryptone bile agar with X-glucuronide agar (TBX agar) was poured over the sample and then homogenised. The blue-green-coloured *E. coli* colonies that grew from the 10<sup>-3</sup> dilution were examined, using Gram staining and enumerated, according to ISO 16649-2/2007.

Antibiotic susceptibility detection for *Escherichia coli* strains was made using the automated Vitek 2 system (BioMérieux, Marcy l'Etoile, France). Antibiotic susceptibility was carried out using the AST-N204 card for Gram-negative bacteria. The used cards included a total of 16 antimicrobial substances, from 8 classes.

#### • Results and discussions

MeRA test result indicate that 14 (23.3%; 95% CI 13.74-35.4) of the samples tested positive for the presence of antibiotic residues. The distribution of positive samples depending on the species is as follows: pork - 8 (26.6%; 95% CI 14.1-44.4) samples, beef - 6 (30%, 95% CI 14.5-51.9) samples. The poultry and goat meat samples were negative for the presence of antibiotic residues.

The isolates (n=10) manifested the following resistance: FOF (100%), NOR (80%), AMP (40%), CTX (20%), CAZ (20%), CPM (20%), STX (20%). None of the isolates manifested resistance to AMC, TZP, AMK, GEN, ERT, MEM, IPM, CIP, NIT.

Out of the ten isolates, eight (80%, 95% CI 44.2 - 96.4) manifested resistance to the association NOR-FOF, however a more serious concern represented the eight strains that were classified as multidrug resistant (MDR). Out of these six (20%; 95% CI 27.3 - 86.3) strains manifested a resistance to three antimicrobials from three different classes, and four (40%; 95% CI 13.6 - 72.6) manifested resistances to five antimicrobials from three different classes.

Origin of meat	No. of isolates	No. of classes with resistance	Resistance to antimicrobial profile	Classes with resistance
Pork	6	3	AMP, NOR, FOF	β-lactams, fluoroquinolones, phosphonic acid derivative
	2	3	AMP, CTX, CAZ, CMP, FOF	β-lactams, cephalosporins, phosphonic acid derivative
	8	2	NOR, FOF	fluoroquinolones, phosphonic acid derivative

#### • Conclusions

Antibiotic residues in meat are a major concern as they can promote the development of antibiotic resistance and cause adverse effects on human health.

To reduce the risk of antibiotic residues in meat it is important to increase the awareness of farmers on the responsible use of antibiotics in meat-producing animals and to enhance surveillance and monitoring of antimicrobial use by the competent authorities.

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