

## ANTIBIOGRAM OF ENTEROTOXIGENIC AND ENTEROHAEMORRHAGIC *ESCHERICHIA COLI* ISOLATED FROM COWS AND CALVES

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### SUMMARY

Antibiograms of 100 isolates of *E. coli* including 22 of enterohaemorrhagic and 37 of enterotoxigenic groups were determined by disc diffusion technique by employing 13 antimicrobial drugs. Sensitivity of enterohaemorrhagic and enterotoxigenic isolates was highest to norfloxacin and ciprofloxacin (94.5-100%) and gentamicin (81.8-83.7%). All the isolates were resistant to tetracycline while moderate to high resistance was shown against polymyxin-B, nitrofurazone, chloramphenicol, cephalixin, cephadroxil and ampicillin. Resistance of these human pathogens to a number of antimicrobial drugs has great public health significance.

**Key words:** EHEC, ETEC, resistance

Due to indiscriminate use of antibiotics in animal husbandry to treat infections and to improve growth and feed efficiency of animals, antimicrobial resistance has become a public health threat. *E. coli* is known to be an important cause of diarrhea in man and animals. Five distinct groups including enterohaemorrhagic (EHEC) and enterotoxigenic (ETEC) *E. coli* causing diarrhea have now been identified and these two groups are responsible for serious disease conditions in humans. These groups of *E. coli* are present in the gut of man and animals and their environment and can be transmitted to man through the food supply. Keeping in view the public health significance of drug resistance among foodborne pathogens, the present study was undertaken to study the antibiogram of *E. coli* isolated from cows and calves.

Antibiograms of 100 isolates of *E. coli* including 22 isolates of EHEC and 37 of ETEC, were determined by disc diffusion technique (Bauer *et al.*, 1966). These *E. coli* were previously isolated from milk/ and faeces of cows and calves. The antibiotic discs (Hi-Media) employed were ampicillin (10 mcg), cephadroxil (30 mcg), cephalixin (30 mcg), chloramphenicol (30 mcg), ciprofloxacin (5 mcg), gentamicin (30

mcg), nitrofurazone (100 mcg), norfloxacin, (10 mcg), polymyxin-B (300 units), streptomycin (10 mcg), spectinomycin, (100 mcg), tetracycline (30 mcg) and trimethoprim (5 mcg). Their zones of inhibition around the discs were measured and interpreted according to the manufacturer's recommendations.

The study revealed maximum sensitivity of *E. coli* isolates to norfloxacin and ciprofloxacin (98%) and gentamicin (88%). These three drugs have earlier been considered very effective against *E. coli* isolates from diarrheic calves and travelers in India (Patil *et al.*, 1999, Villa *et al.*, 2000). Maximum resistance was observed against tetracycline (100%) followed by ampicillin (86%), spectinomycin (74%) and cephalixin, cephadroxil and nitrofurazone (71%). *E. coli* isolates from bovines, camels and goats have shown high resistance to tetracycline and ampicillin (Wray *et al.*, 1993, Singh *et al.*, 1996, Cid *et al.*, 1996). Two isolates of *E. coli* were resistant to all the 13 antibiotics used in this study which can be a matter of serious concern from public health point of view.

**Antibiogram of EHEC isolates:** Out of the 100 *E. coli* strains tested *in-vitro* for their sensitivity to various antimicrobial drugs, 22 belonged to non-O157 EHEC serotypes. The treatment of EHEC infection with antimicrobial

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**Table 1**  
**Percent antibiotic sensitivity of isolates of**  
**enterohaemorrhagic and enterotoxigenic *E. coli***

Antimicrobial drug (mcg/disc)	Number (%) of sensitive EHEC isolates (n=22)	Number (%) of sensitive ETEC isolates (n=37)
Ciprofloxacin (5)	22 (100)	35 (94.5)
Norfloxacin (10)	22 (100)	35 (94.5)
Gentamicin (30)	18 (81.8)	31 (83.7)
Trimethoprim (5)	16 (72.7)	7 (18.9)
Chloramphenicol (30)	16 (72.7)	13 (35.1)
Streptomycin (10)	14 (63.6)	13 (35.1)
Nitrofurazone (100)	08 (36.3)	10 (27.0)
Ampicillin (10)	04 (18.1)	0 (0.0)
Cephalexin (30)	04 (18.1)	7 (18.9)
Cephadroxil (30)	04 (18.1)	7 (18.9)
Spectinomycin (100)	02 (9.0)	22 (59.4)
Tetracycline (30)	00 (0.0)	00 (0.0)
Polymyxin-B (300 units)	08 (36.3)	16 (43.2)

have not been yet fully recommended. However, antimicrobial drugs are effective in reducing the severity of infection and risk of haemolytic uraemic syndrome in humans (Lane and Alexander, 1990, Takeda *et al.*, 1998). Resistance of EHEC to antimicrobial agents has also been reported (Kim *et al.*, 1994, Thomas *et al.*, 1996). Sensitivity pattern of 22 isolates of EHEC (Table 1) revealed highest sensitivity to norfloxacin and ciprofloxacin (100% each). The 81.8% isolates were sensitive to gentamicin and 72.7% isolates to trimethoprim and chloramphenicol. Such high percentage of sensitivity of EHEC to a similar group of antimicrobials have earlier been reported (Ito *et al.*, 1997, Sakata and Maruyama, 1998, Banerjee, 1999). The sensitivity of EHEC isolates to streptomycin, nitrofurazone, polymyxin-B, ampicillin, cephalixin, cephadroxil and spectinomycin varied from 9% to 63.6% while none of the isolates was sensitive to tetracycline. Based on the results of this study, ciprofloxacin and norfloxacin may be the drugs of choice against EHEC isolates of non-O157 serotypes.

**Antibiogram of ETEC isolates:** Among the 37 isolates of ETEC tested, 35 (94.5%) isolates were sensitive to norfloxacin and ciprofloxacin while 31 (83.7%) to gentamicin. Vila *et al.* (2000) reported a high sensitivity of ETEC isolates from travelers to ciprofloxacin and nalidixic acid. Patil *et al.* (1999) also showed sensitivity of *E. coli*

from diarrheic calves to norfloxacin (94.5%) and gentamicin (89.0%). Nitrofurazone was effective against 10 (27%) isolates while cephalixin, cephadroxil and trimethoprim were found least effective (Table 1). All the 37 isolates were resistant to tetracycline and ampicillin.

The present study reveals that isolates belonging ETEC and EHEC were highly sensitive to ciprofloxacin (94.5-100%), norfloxacin (94.5-100%) and gentamicin (81.8.-83.7%), but 100% resistant to tetracycline. These isolates showed moderate to high resistance to polymyxin-B, nitrofurazone, chloramphenicol, cephalixin, cephadroxil and ampicillin. Antimicrobial resistance is emerging and spreading among foodborne bacteria. These resistant bacteria when transmitted to human may be the cause of serious illnesses.

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