A new approach in eliminating enteropathogenic E. coli from the intestinal tract is the use of effective antibiotics (Nielsen et al., 1974). The prevalence of antibiotic resistance, especially to broad-spectrum antibiotics, is increasing (Gammelbo, 1971).

This development has been accompanied by the emergence of R-factors. The aim of this study has been to examine the incidence of resistance among enteropathogenic and non-enteropathogenic porcine E. coli strains to the following antibiotics: ampicillin, chloramphenicol, colistin (polymyxin B), neomycin, polymyxin B, streptomycin, sulfonamides, and tetracycline.

In order to study the susceptibility of the strains to the polymyxins antibiotics colistin and polymyxin B, it was also attempted to develop resistance in vitro by passage transfers in sub-inhibitory concentrations on neomycin, tetracycline, colistin, and polymyxin B.

The pathogenic strains were isolated from cases of diarrhoea in pigs. The non-pathogenic strains were isolated from healthy 9- to 12-week-old pigs in a market in Denmark.

Initially, the resistance patterns of the strains were determined by agar-diffusion. Inocula were prepared as described by Waddell (1962). The criteria of sensitivity, moderate resistance, and resistant.

The minimal inhibitory concentrations (M.I.C.) were tested against colistin and polymyxin B by a broth-dilution method. Doubling dilutions of the two antibiotics (0.1 to 64 mg/ml) were used.

Ten of the pathogenic strains and 5 non-pathogenic strains were studied as to development of resistance in vitro by repeated transfers in broth containing sub-inhibitory concentrations of colistin (0.1 mg/ml), polymyxin B (0.1 mg/ml), neomycin (2.5 mg/ml), and tetracycline (0.1 mg/ml). The strains were sensitive to 5-10 times these concentrations.

During 6 months, subcultures to fresh antibiotic containing media were made twice every week (52 transfers). The strains were then tested for M.I.C. against the 4 antibiotics.

The prevalence of resistance to individual antibiotics within the two groups of strains (enteropathogenic and non-enteropathogenic) did not differ statistically. 90-100% of all strains were resistant to streptomycin, sulphonamides, and ampicillin. Occurrence of the latter occurred rarely (2.5% per cent) whereas all (100%) were resistant to ampicillin. All strains were sensitive to colistin, polymyxin B, and neomycin. 90% of the strains were sensitive to colistin and polymyxin B, and 70% to neomycin. 40% were also sensitive to ampicillin.

After 52 repeated transfers of the 15 E. coli strains in sub-inhibitory concentrations of colistin, polymyxin B, neomycin, and tetracycline the M.I.C.'s were determined for all antibiotics. No significant changes were observed.

It was concluded that the in-vivo activity of the two antibiotics was identical. Most strains were resistant to tetracycline and colistin. The M.I.C.'s were determined for these antibiotics on 100 strains at a high level (60 and 100 mg/ml). One strain was resistant to colistin (40 mg/ml). Development of resistance to neomycin and polymyxin B was not demonstrated.

The present study clearly indicates that the incidence of resistance to a number of antibiotics is so high (90-100%) that a successful outcome of therapy is doubtful. A number of alternative antibiotics are available for prevention and therapy of E. coli diarrhoea. Colistin and polymyxin B represent such alternatives for several reasons. The drugs are bactericidal at quite low concentrations. They are not absorbed from the gut and the level of resistance in animal E. coli is negligible (Smith, 1970; Mercer, 1971). In addition, polymyxin antibiotics have no effect on the gram-positive bacterial flora.

Emergence of colistin/polymyxin-resistant organisms is due to selection of phenotypically resistant variants in a population of normally sensitive cells (Gammelbo, 1973). This adaptation, however, is unstable, and the strain revert to sensitivity when not exposed to antibiotic (Gilleland & Murray, 1976). This phenomenon in addition to the fact that R-factors transferring polymyxin or colistin resistance has not been demonstrated yet in enterobacteriaceae, probably explains why the level of resistance to these antibiotics remains low.

In animal husbandry, antibiotics are sometimes used prophylactically at low concentrations. Under such conditions, sub-inhibitory concentrations may be present occasionally. Our study has revealed the finding of others that the potential of low concentrations of polymyxin to select resistant variants is low (Ishizaki et al., 1976).

Conclusions:

The drug resistance potential of colistin and polymyxin B appears to be lower compared to a number of other antibiotics. This suggests that the use of these drugs in E. coli intestinal infections is a rational choice.