SHORT ARTICLES

THE INCIDENCE OF TRANSMISSIBLE ANTIBIOTIC RESISTANCE AMONGST SALMONELLAE ISOLATED FROM POULTRY IN ENGLAND AND WALES

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IN recent years an increased incidence of antibiotic-resistant strains of salmonellae has been reported in domestic animals in many parts of the world (for references, see Smith, 1967; Settnes, 1968). Much of this resistance is to the tetracyclines and is generally attributed to the widespread use of tetracyclines as feed additives. Coincident with the rapid development of the intensive method of rearing calves in Britain, a spectacular increase has occurred in the incidence of multiple-resistant strains of *Salmonella typhimurium* in calves so reared, much of the resistance being of the transmissible type (Anderson and Lewis, 1965). Since a high proportion of poultry in Britain is reared intensively it seemed worthwhile to survey salmonellae isolated from these animals for the presence of transmissible resistance factors; the results of such a survey are reported in this paper.

MATERIALS AND METHODS

Source of salmonella strains. All the strains examined were received from Mr W. J. Sojka of the Central Veterinary Laboratory of the Ministry of Agriculture, Fisheries and Food, Weybridge. They had been isolated originally from poultry at veterinary investigation laboratories in England and Wales in 1968.

Determination of antibiotic sensitivity. Approximately 0.1 ml of a 100-fold dilution of a 24-hr broth culture of each strain was spread evenly over the surface of a dried petri plate of Diagnostic Sensitivity Test Agar (Oxoid, CM261) and an Oxoid Multodisk (1744E) applied; there were eight individual disks as follows: (i) streptomycin 25 µg, (ii) ampicillin 25 µg, (iii) oxytetracycline 50 µg, (iv) chloramphenicol 50 µg, (v) neomycin 30 µg, (vi) nalidixic acid 30 µg, (vii) furazolidone 15 µg and (viii) sulphonamide 300 µg. The plates were incubated at 37°C for 24 hr. No difficulty was encountered in making readings; the zones of inhibition of growth surrounding the disks were either wide, very narrow or absent.

Transfer of antibiotic resistance. This was performed by the methods of Smith (1966), the recipient strain being a mutant of *Escherichia coli* K12F⁻ resistant to nalidixic acid.

RESULTS

In all, 167 strains of salmonellae originating from domestic fowls, ducks, turkeys and pheasants were examined. They belonged to the following serotypes, the numbers in brackets denoting the number of strains of each serotype: *chester* (3), *derby* (2), *dublin* (8), *enteritidis* (4), *gallinarum* (1), *give* (1), *heidelberg* (4), *indiana* (2), *infantis* (1), *kentucky* (1), *kinshasa* (3), *menston* (19), *montevideo* (4), *new haw* (1), *pullorum* (12), *reading* (1), *saintpaul* (1), *senftenberg* (6), *stanley* (17), *thompson* (8), *typhimurium* (55) and *virchow* (13).

Of the 167 strains, 3 were resistant to tetracyclines, streptomycin and sulphonamides, 2 to streptomycin and sulphonamides and 2 to the tetracyclines, the total number of resistant strains being 7 (4.2 per cent.). Six of these 7 strains were *S. typhimurium*, the incidence of resistant strains amongst the 55 strains of this serotype examined being 10.9 per cent.

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compared with 0.9 per cent. amongst the 112 strains belonging to serotypes other than *S. typhimurium*. The resistance possessed by all 7 strains was transferred to *E. coli* K12F- and this indicates that it was of the transmissible type.

DISCUSSION

The finding of a higher incidence of antibiotic resistance in *S. typhimurium* than in the other *Salmonella* serotypes is in agreement with the observations of other workers on salmonellae from poultry and from other sources (for references, see Smith, 1967; Settnes, 1968). As far as the present survey is concerned, this finding was not unexpected, because all the antibiotic resistance discovered was of the transmissible type; in in-vivo studies, *S. typhimurium* was found to be the best recipient of the R factors that control this type of resistance (Smith, 1970).

However, the incidence of resistance among the strains of *S. typhimurium* investigated in the present study was considerably lower than that found in strains from intensively reared calves in Britain by Anderson and Lewis (1965). This is undoubtedly related to the less frequent administration of antibiotics to poultry than to intensively reared calves in recent years. Furthermore, a more limited range of antibiotics is usually used for poultry. This probably accounts for the rather restricted resistance patterns found in the poultry strains of *S. typhimurium* involving resistance to tetracyclines, streptomycin and sulphonamides only. Much more complex patterns were found in calf strains by Anderson and Lewis, who frequently observed resistance to ampicillin, neomycin, chloramphenicol and furazolidone as well as tetracyclines, streptomycin and sulphonamides.

SUMMARY

Of 167 strains of salmonellae isolated from poultry in England and Wales in 1968, 7 (4.2 per cent.) were resistant to antibiotics; 3 strains were resistant to tetracyclines, streptomycin and sulphonamides, 2 to streptomycin and sulphonamides, and 2 to tetracyclines; they were all sensitive to ampicillin, neomycin, chloramphenicol, furazolidone and nalidixic acid. The incidence of resistance amongst the *Salmonella typhimurium* strains examined was 10.9 per cent. and 0.9 per cent. amongst the other strains. All the resistance was of the transmissible type.

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REFERENCES

ANDERSON, E. S., AND LEWIS, M. J.	.	1965.	<i>Nature, Lond.</i> , 206 , 579.
SETTNES, O. P.	.	1968.	<i>Nord. VetMed.</i> , 20 , 458.
SMITH, H. W.	.	1966.	<i>J. Hyg., Camb.</i> , 64 , 465.
"	.	1967.	<i>N.Z. Vet. J.</i> , 15 , 153.
"	.	1970.	<i>J. Med. Microbiol.</i> , 3 , 165.