Introduction

Salmonellae have been responsible for the majority of human bacterial food-poisoning cases worldwide in recent years (1-6). The aim of this study was to determine the antibiotic resistance profile similarities/differences of poultry meat, poultry intestine, and human fecal isolates (7-9). Therefore, we selected antibiotics that have been widely and solely used in the treatment of Salmonella enterica subsp. enterica Serovar Enteritidis (Salmonella Enteritidis) in humans (10-12). As is also widely known, poultry meat and poultry products have been shown to be major sources of this serovar (1,9,13-15).

Determination of the antibiotic resistance profiles of Salmonella Enteritidis isolates from different sources is important in order to predict possible clonal relations among the isolates (3,8). In this study we initially determined the antibiotic resistance profiles of human and poultry origin. Antibiotic resistance of 97 Salmonella Enteritidis isolates from 25 chicken meat, 25 chicken intestine and 47 human fecal samples was examined using the National Committee for Clinical Laboratory Standards (NCCLS, 1997) disk diffusion method. Resistance patterns of the isolates were as follows: Of the 25 chicken meat isolates 4 were resistant to some antibiotics. Two isolates (CM15 and CM22) were resistant to ampicillin (AMP), cefuroxime sodium (CMX), ceftriaxone (CRO), trimethoprim-sulphamethazole (SXT) and ampicillin-sulbactam (SAM). Of the other 2 isolates, CM20 showed resistance to ceftriaxone (CRO) and CM23 was resistant to chloromphenicol (C) and cephalexime (CL). Eight human isolates showed 4 different resistance patterns. Five (HF3, HF19, HF20, HF22, and HF25) were resistant to ampicillin (AMP), ampicillin-sulbactam (SAM), tetracycline (TE) and chloromphenicol (C), while resistance to chloromphenicol (C) and cephalexime (CL) was observed in HF32 and HF46. HF13 was resistant to both ampicillin (AMP) and ampicillin-sulbactam (SAM). One of the chicken intestinal isolates was found to be resistant only to cefuroxime sodium (CMX). There was no relationship between antibiotic resistance patterns for Salmonella isolates of different origins. Multiple antibiotic resistance patterns were observed in some isolates. It is important that some isolates of chicken intestine and meat origin showed resistance to antibiotics being used in humans.

Key Words: Antibiotic resistance, Salmonella Enteritidis, human feces, chicken intestine, chicken meat
isolates to antibiotics that have been widely and solely used in the treatment of Salmonella Enteritidis in humans (12). Then we examined whether the source of the determined resistances to these antibiotics was poultry meat or poultry meat products (16). This study was performed to determine and compare the resistance patterns of Salmonella Enteritidis isolates of human and chicken origin against the most commonly used antibiotics in humans.

Materials and Methods

A total of 97 Salmonella Enteritidis strains, consisting of 25 chicken meat, 47 human fecal (kindly provided by Dr. Suna Gedikoğlu, Uludağ University, Faculty of Medicine, Bursa, Turkey) and 25 chicken intestine isolates were used. All the isolates had been serotyped before in different Salmonella reference centers (WHO Collaborating Center for Reference and Research on Salmonella, Institut Pasteur, France, and Ankara University, Faculty of Medicine, Department of Microbiology, Ankara).

The following antibiotic disks were used: ampicillin (10 µg) (AMP), ampicillin-sulbactam (10/10 µg) (SAM), cephalexime (30 µg) (CL), ceftriaxone (30 µg) (CRO), cefuroxime sodium (30 µg) (CXM), ciprofloxacin (5 µg) (CIP), tetracycline (30 µg) (TE), trimethoprim-sulphamethazole (1.25/23.75 µg) (SXT), and chloromphenicol (30 µg) (C).

The antimicrobial sensitivity test was performed using the disk diffusion method described by the National Committee for Clinical Laboratory Standards (NCCLS, 1997) (17). Briefly, Salmonella Enteritidis isolates were plated on Xylose Lysine Tergitol 4 (XLT4 Agar) (Difco; 0234-17-9) agar and were incubated for 24 h at 37 °C. One colony was selected and inoculated into Brain-Heart Infusion (BHI) broth to prepare pure cultures and to adjust the inoculum turbidity to 0.5 McFarland. Each Salmonella culture (100 µl) was distributed evenly, using a glass streaker, onto Mueller Hinton agar (Difco; 0252-17-6) and antibiotic disks were placed onto the agar. Plates were incubated for 18 h at 37 °C and the inhibition zones were measured to interpret the results. Tests were carried out in duplicate for accuracy. Escherichia coli ATCC 25922 was used as a reference strain.

Results

Different resistance patterns were observed in 13 out of 97 Salmonella enterica subsp. enterica Serovar Enteritidis (Salmonella Enteritidis) isolates. Antibiotic resistance patterns are shown in detail in Table.

<table>
<thead>
<tr>
<th>Strain code</th>
<th>AMP¹¹</th>
<th>CXM¹</th>
<th>CRO³</th>
<th>CIP⁵</th>
<th>SXT⁹</th>
<th>TE³</th>
<th>C⁶</th>
<th>CL⁹</th>
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<td>CM* 15</td>
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<td>R</td>
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*Chicken meat  
¹Sensitive  
²Cefuroxime sodium  
³Resistant  
⁴Trimethoprim-sulphamethazole  
⁵Tetracycline  
⁶Ceftriaxone  
⁷Ciprofloxacin  
⁸Ampicillin-sulbactam  
⁹Ciprofloxacin

Table. Resistance patterns of Salmonella Enteritidis isolates from chicken meat, human feces and chicken intestines.
Out of 25 chicken meat isolates, 4 were resistant to some antibiotics. Two isolates (CM15 and CM22) were resistant to ampicillin (AMP), cefuroxime sodium (CXM), ceftriaxone (CRO), trimethoprim-sulphamethazole (SXT) and ampicillin-sulbactam (SAM). Of the other 2 isolates, CM20 showed resistance to ceftriaxone (CRO) and CM23 was resistant to chloramphenicol (C) and cephalaxime (CL). Eight human isolates showed 4 different resistance patterns. Five (HF3, HF19, HF20, HF22, and HF25) were resistant to ampicillin (AMP), ampicillin-sulbactam (SAM), tetracycline (TE) and chloramphenicol (C), while resistance to chloramphenicol (C) and cephalaxime (CL) was observed in HF32 and HF46. HF13 was resistant to both ampicillin (AMP) and ampicillin-sulbactam (SAM). One of the chicken intestinal isolates was found to be resistant only to cefuroxime sodium (CXM).

Discussion

Out of 25 chicken meat isolates, 4 were resistant to some antibiotics. A similar resistance pattern in Salmonella Enteritidis from chicken carcasses has been reported by Arvanitidou et al. (14). These resistance patterns in Salmonella of chicken meat origin should be considered a great risk for the treatment of human salmonellosis.

Of the 47 human fecal isolates, 8 were found to have 4 different resistance patterns as previously reported in other studies (8,16). Five (HF3, HF19, HF20, HF22, and HF25) were resistant to AMP, SAM, TE and C, while C and CL resistances were observed in HF32 and HF46 (18,19). The other isolate (HF13) was found to be resistant to both AMP and SAM (18,19).

One chicken intestinal isolate was resistant only to CXM. This antibiotic is not used for therapeutic purposes or as a feed additive in poultry. CXM has been widely used in the treatment of certain human infections, bovine mastitis, and feline and canine upper respiratory tract infections. Perhaps a Salmonella Enteritidis clone previously acquired resistance to cefuroxime while it was in a mammalian host, and then this resistant strain somehow found a way into a poultry environment and was transferred to the poultry gut.

It is interesting that there was no identical antibiotic resistance pattern among chicken meat, human and chicken intestinal isolates. The reason for this is unclear. In order to reveal if there are any isolates of identical antibiotic resistance patterns from chicken meat, human faeces, and chicken intestines, we are continuing to produce isolates from chicken meat and chicken intestines to increase the number of isolates and to carry out wide-scale investigations.

However, it is important for public health that we have determined some resistance similarities between CM and HF isolates. These resistances observed in HF isolates could have been transferred by various genetic means from CM isolates (18,19).

References


