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Antimicrobial resistance among *Salmonella enterica* serovar *Infantis* from broiler carcasses in Serbia

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Abstract. This study aimed to investigate antimicrobial resistance of *Salmonella* *Infantis* isolates from poultry carcasses in Serbia. A total of 48 *Salmonella* isolates were examined for antimicrobial resistance. A panel of 10 antibiotics was selected for testing. Isolates showed resistance to sulfamethoxazole, ceftazidime and cefotaxime (100%). However, the highest number of *Salmonella* *Infantis* isolates were sensitive to chloramphenicol. The usage of antibiotics in food producing animals could result in antimicrobial resistance pathogenic bacteria especially *Salmonella* spp. in poultry, which may be transmitted to humans through the food chain and increase risk of treatment failures.

1. Introduction

Poultry meat is essential for a complete diet, since it contains high amounts of highly digestible proteins, unsaturated lipids (mainly found in the skin and easily removed), B-group vitamins (mainly thiamin, vitamin B6, and pantothenic acid), and minerals (like iron, zinc, and copper) which makes it highly acceptable for consumption by consumers of all ages [1, 2]. However, poultry meat is involved in the transmission of several food-borne pathogens, which are distributed across the whole production chain, from chicken birth to the final product [3]. *Salmonella* food poisoning is one of the most common and widely distributed diseases in the world [4], whereby outbreaks are usually connected with consumption of contaminated poultry meat. Perhaps more concerning is the fact that multidrug resistance (MDR), is being increasingly detected among numerous *Salmonella* serotypes recovered from animals and humans worldwide [5, 6]. The recovery of antimicrobial-resistant *Salmonella* in foods of animal origin has raised concerns that loss of antibiotic efficiency may compromise the treatment of human salmonellosis, because antimicrobial-resistant strains appear to be more often associated with severe disease [7, 8]. It has been reported that *Salmonella* exhibiting lower susceptibility to several antibiotics such as fluoroquinolones (e.g., ciprofloxacin) and extended-spectrum cephalosporins (e.g., ceftiofur and ceftriaxone), which are important in treatment of human salmonellosis, in both adults and children, respectively [9, 10, 11]. Some authors have confirmed the presence of a *Salmonella enterica* subspecies *enterica* serovar *Infantis* (6, 7, r, 1, 5) in all 17 samples, and also same serovars isolated in the case of diseased humans [12]. Therefore, the aim of this study was to investigate the antimicrobial resistance of *Salmonella* *Infantis* isolated from broiler carcasses in Serbia.

2. Materials and Methods

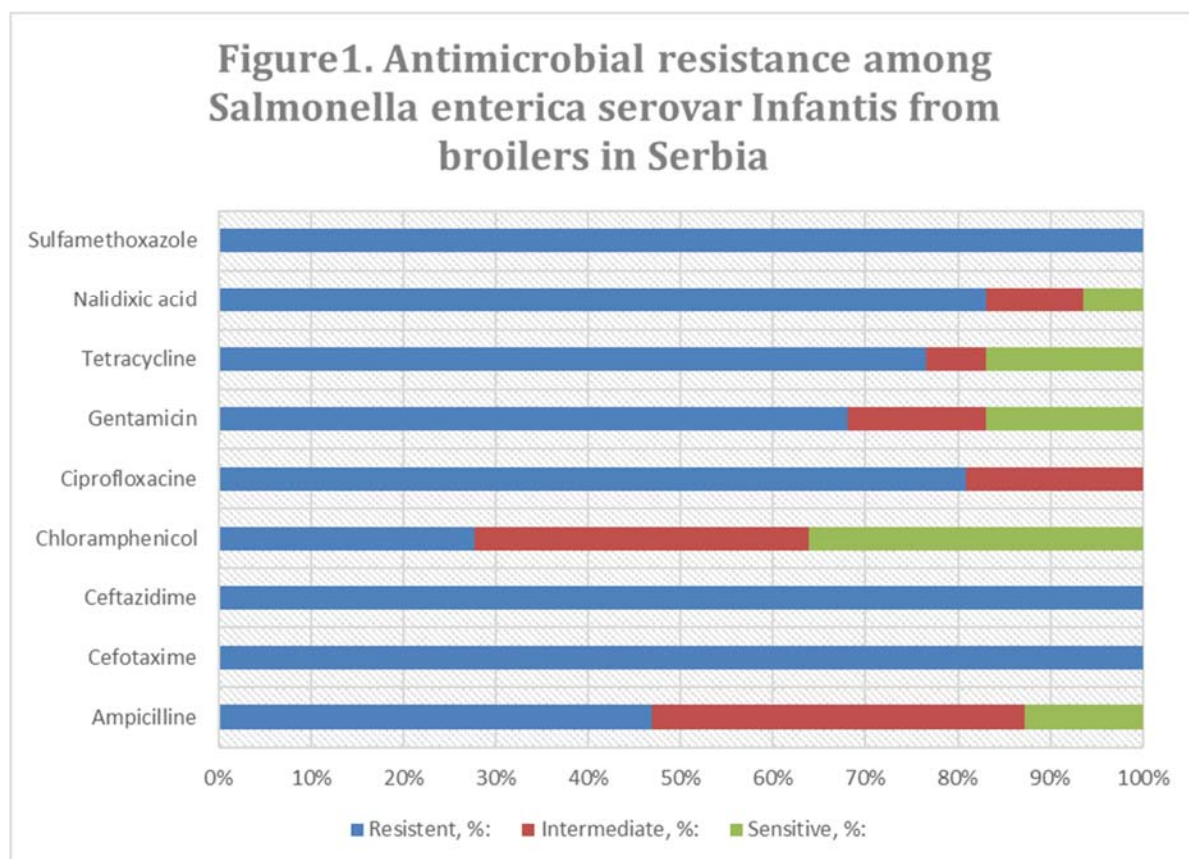
The study included a total of 48 *Salmonella* *Infantis* isolates, where 39 were originating from the broiler meat and 9 isolates were isolated from the skin of the broiler neck. The isolates were revitalized in 10 mL of BHI broth (Lab, UK), and incubated for 24h at 37°C. After incubation period, *Salmonella* suspensions



were transferred by sterile swabs on Mueller-Hinton agar, followed by antibiotic discs application (automatic applicator, Oxoid, UK), and incubated for 24 hours at 37°C. After 24 hours of incubation the growth inhibition zones were measured, and the results were interpreted according to Clinical and Laboratory Standards Institute (CLSI) 2006[] recommendations as sensitive, intermediate sensitive and resistant. The following antibiotic discs (Oxoid, UK) were used: ampicillin 10 mg, cefotaxime/clavulanic acid (cephalosporin) 30 mg, ceftazidime 10 mg + 30 mg, chloramphenicol 30 mg, ciprofloxacin (quinolone) 5 mg, gentamicin (aminoglycoside antibiotic) 30 mg, tetracycline 30 mg, nalidixic acid (quinolone) 30 mg, trimethoprim/sulfamethoxazole (inhibitors of folic acid) 30 µg.

3. Results and Discussion

From a total of 48 *Salmonella* Infantis isolates from poultry carcasses, all were resistant to sulfamethoxazole, ceftazidime and cefotaxime. However, the highest number of *Salmonella* spp. isolates were sensitive to chloramphenicol. Antimicrobial resistance (intermediate sensitive and sensitive) of *Salmonella* Infantis isolated from broiler carcasses is shown in Figure 1.



The usage of antibiotics in food producing animals could result in antimicrobial resistance pathogenic bacteria especially *Salmonella* spp. in poultry, which may be transmitted to humans through the food chain and increase risk of treatment failures. Due to the massive use of *S. Enteritidis* and *S. Typhimurium* vaccine as part of *Salmonella* the eradication programs, probably lead to the high prevalence of *S. Infantis* in the poultry [13]. The presence of *S. Infantis* in broiler meat in the recent years is constantly increasing [12]. *Salmonella* spp. isolated from poultry carcasses showed resistance to ampicillin and nalidixic acid (95.5%), tetracycline (91%) and cefotaxime (68.25%) [12]. However, our results show resistance to the same antibiotics, with the highest resistance to cefotaxime (100%) and the lowest resistance to ampicillin (47%).

Some authors compared the results of *Salmonella* antimicrobial resistance in 2007 to 2013-2014, where they found that resistance was significantly different [13]. In 2007, resistance was most frequently to amoxicillin and sulfamethoxazole [13], which coincides with our results, where resistance to sulfamethoxazole was 100%. During 2013 and 2014, we detected significant resistance of *S. Infantis* to nalidixic acid and tetracycline [13], also in accordance with our results (tetracycline 78%, nalidixic acid 82%). This indicates that *Salmonella* have a tendency to behave clonally as has been confirmed by genotype and resistotype [14].

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