

## Anti-Microbial Resistance of Non-Typhoid Salmonella in Egypt

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### Introduction

Nontyphoidal salmonellosis (NTS) is caused by numerous *Salmonella* species other than serovars Typhi and Paratyphi, [1]. NTS organisms are common contaminants of food. Poultry meat, eggs, milk, vegetables, and water have been reported as important sources for outbreaks of human *Salmonella* infection, poultry alone, accounting for up to 50% of salmonellosis outbreaks [2,3]. They are also carried by wild animals, rodents, birds, and reptiles, usually with no symptomatic disease [1]. These infections are identified as one of the most common food-borne zoonotic infection in developed and developing countries, but incidence between countries is variable [4]. In Egypt, NTS infections in poultry have increased in the last years [5]. There are excessive uses of antibiotics in zoonotic infections resulting in development of bacterial resistance that can be transmitted to humans by three ways, from direct contact with animals, from the consumption of eggs and meat or through the environment [6]. The resistance to some antibiotics, such as tetracycline, or chloramphenicol is a big challenge for the treatment of children because fluoroquinolones should not be used in this age group [7]. Several studies were performed to determine the prevalence and multidrug resistance of typhoidal salmonella but the existing data about NTS are little in African countries especially in Egypt. Shokry et al., 2015 provides important insight into prevalence and multidrug resistance of NTS in Egypt [8].

### The Study Design

The Study includes stool samples and clinical data from a major hospital (Minia Fever Hospital) located in Minia, Egypt, where five hundred stool samples were collected from patients with gastroenteritis, all the participants showed negative- Widal test that was necessary to be included in the study. The stool samples were examined by standard microbiological tests (*salmonella* shigella agar, MacConkey agar culture and different biochemical tests), and serological tests to isolate non-typhoid *Salmonella*. The antimicrobial susceptibility was tested by the disc diffusion method using a panel of 11 discs of different antimicrobial groups; tetracycline, chloramphenicol, sulphamethoxazole-trimethoprim, ampicillin, streptomycin, nalidixic acid, ofloxacin, ciprofloxacin, amikacin, ceftazidime, and cefotaxime. Results were interpreted according to the guidelines of the Clinical Laboratory Standard Institute [9]. Resistant isolates to at least one member of three different antimicrobial groups are considered as MDR. The Production of extended-spectrum  $\beta$ -lactamase was detected using the double disk synergy test. The tetracycline resistance-related gene (*tetB*) and chloramphenicol acetyltransferase enzyme coding gene (*cat*) were amplified by PCR

using the primers sets: *tetB*: F 5' GAGACG CAA TCG AAT TCG 3' and R 3' TTTAGTGGCTATTCTTCCTGCC5'. *Cat*: F: 5' GGT GAT ATG GGA TAG TGT T 3' and R: 5' CCATCA CAT ACT GCA TGATG 3'. PCR products were resolved on 1.5% agarose gel and visualized under a UV transilluminator. Antimicrobial sensitivity test performed and shown in Figure 1.

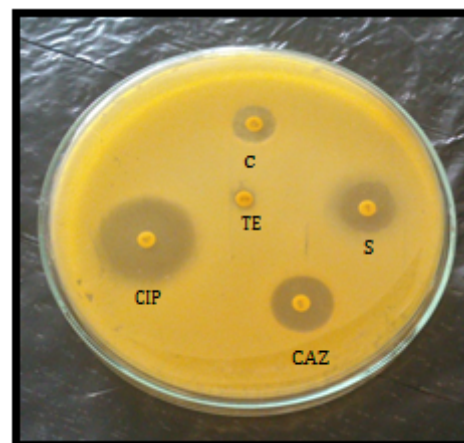


Figure 1: An example of antimicrobial sensitivity test.

### Results and Discussion

Of 500 samples, 4.4% (22/500) were NTS in the current study that proved the prevalence is decreased over the last years as compared with Abdelwahab, 1994 [10] who reported 7.34% of gastroenteritis as salmonellosis in the same locality. It also, seems to have declined in Tunisia based on data reported from 1994 to 2004 with the lowest isolation rate in 2004 for the entire surveillance period (CDC, 2008) [11]. The 2008 Annual Surveillance Report from New Zealand showed, as many other country reports, a decreasing rate of NTS. From this study and other studies, it appears to be a decline in NTS infections rates. Most of isolates were resistant to; ampicillin then tetracycline and trimethoprim-sulphamethoxazole, 27.3% of isolates only were resistance to chloramphenicol, that was a good result as chloramphenicol may return to be an effective drug as it is available and cheap drugs in treatment of NTS infections especially in developing countries. However most of isolates were sensitive to amikacin and ciprofloxacin. 18% of isolates were ESBL producers and 81.8% were multiple drug resistant (MDR). *tetB* and *cat* genes were detected in 64.7% and 50% of isolates resistant to tetracycline and chloramphenicol respectively. These genes can give a clue of the

resistance mechanism of tetracycline and chloramphenicol in resistant isolates.

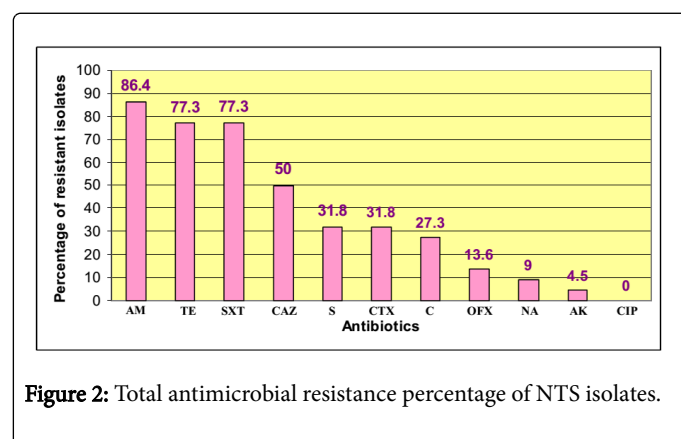
What additional reasons could have a role in tetracycline and chloramphenicol resistance?

May be other genes tet A, tet G or may be integrons or other causes so there is a lack of genetic information about the resistance.

Although the clinical data have been well analyzed in this study, there is a lack of information about invasive Salmonella. Also there is a lack of laboratory data where blood samples may be valuable to diagnose bacteremia.

What are the implications for the management of Salmonella Gastroenteritis?

Clearly Quinolones and amikacin are the treatment of choice. chloramphenicol may be an effective drug especially for children. The study proved high prevalence of MDR non-typhoid Salmonella isolates that represents a serious health problem, so continuous search for the mechanisms of resistance by molecular studies is important to save effective and cheap treatment for NTS infections in Egypt particularly children. The study gave a good data about these types of antibiotics as chloramphenicol. Antimicrobial resistance percentage of NTS isolates graphically shown in below Figure 2.



**Figure 2:** Total antimicrobial resistance percentage of NTS isolates.

## Conclusion

This study revealed high prevalence of MDR non-typhoid Salmonella. Screening studies like this could help in determining

effective measures to control NTS infections in this region, and the data could also be used for future medical references. More extensive search for the mechanisms of resistance by molecular.

Studies are important for effective management of NTS infections not only in Egypt, but also worldwide.

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