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The First Report of SHV-12 –Producing Environment Isolates of *Salmonella* Serovar Agona from Turkey Meat (Meknes – Morocco)

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Introduction

Nontyphoidal salmonellosis (NTS) is a major foodborne illness worldwide. Various animals (especially poultry, pigs, cattle, and reptiles) are reservoirs for Salmonella species, and humans generally become infected by eating undercooked or contaminated food [1].

Morocco and other countries in the world identified the recent emergence of multidrug –resistant isolates of Salmonella enterica serotype Kentucky and other serotype like Salmonella Typhimurium respectively displaying high-level resistance to ciprofloxacine and cephalosporin third generation.

Reports of clinical infections due to ESBL-producing strains in animals and particularly in food-producing species are few in number, in Morocco.

We reported the first Salmonella sérovars Typhimurium with penta-resistance profil (ACSTeSul) isolate from bovine meat in Morocco [2].

Overall, the incidence of S. Kentucky CipR increased continuously in Morocco during the period (2006 -2013). These strains were isolated from different sources (Turkey meat, seafood, Human and others)[3]].

In March 2008, a Salmonella enterica serotype Typhimurium strain was isolated from stool samples of 45 individuals who had attended a wedding ceremony in Errachidia, these people had eaten a tagine prepared with poorly cooked broiler chickens [4]. In November 2007, S. enterica serotype Newport strain was isolated from a pastry made with locally produced eggs during a food survey conducted in southern Morocco. The isolate was resistant to penicillins, céfoxitine (MIC 128 mg/L), ceftriaxone (MIC 64 mg/L)[4]. We report several occurrences of acquisition of extended-spectrum β-lactamase (TEM-3) from Salmonella Typhimurium [5], and carbapenemase (OXA-48, VIM-2) genes from the isolates of S. Kentucky ST198[6].

Between October 2011 and October 2012, a total of 192 samples of turkey meat (included 48 breasts, 48 legs, 48 gizzards and 48 livers) were collected every ten days from retail outlets in Meknes. Of these, 48 were from popular markets, 48 from artisanal slaughterhouses, and 48 from poulterers' shops and 48 from a supermarket in Meknes, Morocco.

Of the total of 192 samples examined, 24.5% (47/192) were contaminated with Salmonella. Out of the total 48 samples analyzed from popular markets, 19 (40.42%) proved to be Salmonella positive whereas out of 48 samples obtained from traditional slaughterhouses and 48 from poulterers' shops 14 (29.87%) and 8 (17%) contained Salmonella, respectively.

Among the 47 Salmonella isolates, 6 different serotypes were identified of which S. Saintpaul 46.8% was the most frequent, followed by S. Agona 17 % and S. Kentucky 17%, S. Typhimurium 8.5%, S. Infantis 6,3% and S. Bredeney (4,2%) [7]. Antimicrobial drug susceptibility was determined by the disk diffusion method and E-tests, as described [8].

Among the 17% (8/48) Salmonella Agona isolate, one strain was resistant to penicillins, ceftazidime, cefotaxime, ceftriaxone, Chloramphenicol, Streptomycin and Bacitracin, but was susceptible to other antimicrobial drug classes tested. A positive double- disk synergy test result suggested that these strains produced an ESBL. Isolate showed higher levels of resistance to ceftriaxone (MIC 16 mg/L). For identification of the ESBLs gene, we conducted PCR amplifications of blaTEM, blaSHV, and blaCTX-M group genes, as described [9]. Only the SHV amplicon was obtained, and DNA sequencing showed this amplicon to be 100% identical to blaSHV-12. Resistance to ESBLs and the blaSHV-12gene were transferred into Escherichia coli (K12J5) by conjugation. An plasmid (≈128-kb) was isolated from Escherichia coli transconjugant and the parental strain.

The standard pulsed-field gel electrophoresis (PFGE) of XbaI-digested chromosomal DNA showed six different profiles and only two isolates had the same pulsotypes [SA: (Amx,B) and SA: (B,S)] (Figure 1). However Salmonella Agona produced β-lactamase gene blaSHV-12 was more genetically diverse than others Salmonella Agona isolate in this study.

Our study provides further evidence for the dissemination of ESBL-producing Salmonella in Morocco. The emergence of the blaSHV-12 genes in Salmonella Agona isolate in turkey meat in Morocco are reported for the first time. The implementation of these Salmonella β-lactamse producing type SHV-12 in the farms will cause a dissemination of these bacteria in the environment.

Therefore, to control the further emergence of antimicrobial resistance, monitoring the food processing and the prudent use of antibiotics in animal husbandry is essential.

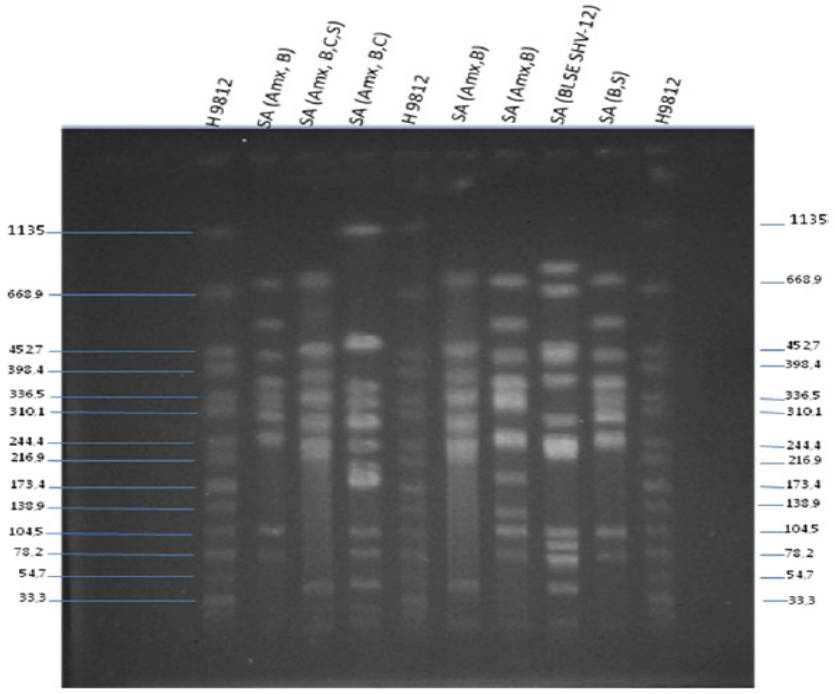

Fig1. *Representatives of XbaI-PFGE profiles obtained among S. enterica serotype Agona isolates from turkey meat during the period of study.(B: Bactrim, C: Chloramphenicol, S: Streptomycin).*

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