ANTIMICROBIAL RESISTANCE OF *Salmonella enterica* SEROVAR TYPHIMURIUM FROM VARIOUS MEATS RECEIVED IN VRI

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ABSTRACT. The antimicrobial drug resistance pattern of *Salmonella enterica* serovar Typhimurium of various meats received in Veterinary Research Institute (VRI) was evaluated for the period of 2009 to 2012. A total of 64 strains of *Salmonella typhimurium* were isolated from beef, pork and chicken meat. All isolates were tested for resistance against 12 different antimicrobial agents. Antimicrobial susceptibility of the isolates was conducted using the disk diffusion technique according to the standards of Clinical and Laboratory Standards Institute (CLSI, 2007). 49 isolates (76.5%) showed multidrug resistance (MDR) and they originated from pork (100%), chicken (75.0%) and beef (58.8%). *Salmonella typhimurium* isolates from beef and pork showed multiple antimicrobial resistance to tetracycline, streptomycin, nalidixic acid and ampicillin, while isolates from chicken meat showed common profile of multiple antimicrobial resistance to sulphamethoxazole, sulphonamides and tetracycline. Ceftriaxone and cefotaxime recorded as most sensitive drug for *Salmonella typhimurium* isolates.

Keywords: *Salmonella typhimurium*, multidrug resistance (MDR), beef, pork, chicken

INTRODUCTION

Salmonellosis caused by *Salmonella enterica* serovar Typhimurium is a worldwide food-borne zoonoses with public health concern (Wasyl *et al*., 2006; Yukino *et al*., 2011). A variety of foods have been known to harbour potential of transmitting salmonellosis to humans, including poultry, meat products, raw vegetables and fruits (Diana *et al*., 2012; Se-Yeoun Cha *et al*., 2013). The incidence of *Salmonella* has been studied recently in animal farms, meats, the environment including slaughter houses in many countries (Hanson *et al*., 2002; Frederick and Nurul Huda, 2012; Wang *et al*., 2013; Se-Yeoun Cha *et al*., 2013). Fresh produce has been identified as a potential transmission of pathogens to cause human illness where common practice in agricultural irrigation of using

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animal waste fertilizer and wastewater contributed to the main source of pathogen contamination (Madden, 1992; Lee *et al*., 2009).

Antimicrobial resistance is a common issue regarding *Salmonella* from meat products as reported by Roseliza *et al*., 2011. The main concern is the transfer of antibiotic resistance to human pathogens and this has been emphasized by the World Health Organization on the increasing number of non-typhoid *Salmonella* strains. The livestock and poultry industry in Malaysia has been closely monitored and developed by the Malaysian government in order to achieve self-sufficient domestic supply of food. Thus, well being and food security has come into the spotlight where constant monitoring of meat products is necessary. The aim of this study is to determine the antimicrobial resistance of *Salmonella typhimurium* isolated from various meat products in the country.

MATERIALS AND METHODS

The *Salmonella typhimurium* strains used in this study were received from Veterinary Public Health Laboratory and Regional Veterinary Laboratory in VRI for diagnosis over the period of 2009 to 2012. Antimicrobial susceptibility of the isolates was tested using the disc diffusion technique with commercially available antibiotic discs on Mueller-Hinton agar (Oxoid) according to the standards of Clinical and Laboratory Standards Institute (CLSI, 2007). The following antibiotic discs were used (Oxoid): ampicillin (10 µg), cefotaxime (30 µg), ceftriaxone (30 µg), cephalothin (30 µg), chloramphenicol (30 µg), gentamicin (10 µg), nalidixic acid (30 µg), streptomycin (10 µg), sulphamethoxazole (25 µg), sulphonamides (300 µg), tetracycline (30 µg), and trimethoprim (5 µg). The inhibition zones were measured and scored as sensitive, intermediate susceptibility and resistant, according to CLSI guidelines (CLSI, 2007).

RESULTS

A total of 64 strains of *Salmonella typhimurium* were tested for resistance against 12 different antimicrobial agents. 17 strains (26.6%) were isolated from beef, 15 strains (23.4%) were from pork while 32 isolates (50%) were from chicken meat. 49 isolates (76.5%) showed multidrug resistance (MDR) where they exhibited resistance to three or more antimicrobial classes used in this study. For the MDR strains, 15 isolates (100%) were isolated from pork meat, 24 isolates (75%) from chicken meat and 10 isolates (58.8%) from beef (Table 1). *Salmonella typhimurium* isolates from beef and pork showed multiple antimicrobial resistance to ampicillin, streptomycin, tetracycline and nalidixic acid, while isolates from chicken meat showed a common profile of multiple antimicrobial resistance to sulphamethoxazole, sulphonamides and tetracycline. Cefotaxime and Ceftriaxone

Table 1. Percentage of Salmonella isolates resistant to antibiotics from various meat sources

Antibiotic	% of resistant isolates from:			
	Beef (n=17)	Pork (n=15)	Chicken (n=32)	All meats (n=64)
Ampicillin	29.4	73.3	40.6	59.4
Cefotaxime	5.9	13.3	15.6	12.5
Ceftriaxone	0.0	6.7	6.3	4.7
Cephalothin	11.8	40.0	56.3	48.4
Chloramphenicol	0.0	13.3	21.9	18.8
Gentamicin	5.9	20.0	25.0	23.4
Nalidixic acid	29.4	80.0	40.6	60.9
Streptomycin	35.3	86.7	46.9	65.6
Sulphamethoxazole	23.5	40.0	81.3	70.3
Sulphonamides	17.6	46.7	62.5	60.9
Tetracycline	35.3	100.0	62.5	73.4
Trimethoprim	0.0	20.0	21.9	18.8
Multiresistant (Resistant to more than 3 classes of antibiotic)	58.8	100.0	75.0	76.5

recorded as the most sensitive drug for *Salmonella typhimurium* isolates.

DISCUSSION

The presence of *Salmonella typhimurium* in beef, pork and chicken were found in this study. This indicates that the meat or our food source might serve as a potential route to disseminate the multidrug resistant (MDR) strain of *Salmonella typhimurium* to the human population, and this is in agreement with other researchers (Lee *et al*., 2009; Adetunji and Isola, 2011; Diana *et al*., 2012; Kusumaningrum *et al*., 2012). The dissemination of MDR strains of *Salmonella typhimurium* to human population may be via contaminated food products or direct contact with infected animals. The multiple resistances observed were to those antimicrobials frequently employed and readily available in veterinary practices either as growth promoters in farm animals or to control infectious disease (Ali *et al*., 2009; Adetunji and Isola, 2011). Antibiotic treatment in farm animals may promote the emergence and spread of antibiotic resistant microorganisms to human population.

Antimicrobial resistance is the biggest challenge in virtually all areas of infectious disease, including viral, bacterial, fungal

and parasitic diseases (Weber and Courvalin, 2005). The significant health implication in this scenario is the loss of therapeutic usefulness of antibiotics especially in clinical cases. Currently, public health impact of multidrug resistance is often highlighted because resistance has shadowed the success of treatment in outbreaks of infectious diseases. Public awareness and health education on the negative effects from overuse of antibiotics other than for therapeutic purposes in farms should be assessed and carried out. Many articles and publications in several countries have discussions on the issue of antimicrobial resistance where infection control and reducing the discretionary use of antimicrobial drugs wherever possible is helpful although resistance will continue to evolve and spread as an evolutionary process (Harbarth and Samore, 2005). The drug resistant patterns reported for *Salmonella typhimurium* is important to constantly monitor the resistant pattern to provide suitable guidelines for treatment or better infection control. Government should make efforts to draw a guideline to strictly control the use of antibiotics in livestock, agriculture, community and healthcare settings. Moreover, the use of antibiotics in animal feed needs to be regulated to minimize the exposure for bacteria to develop resistance (Thi Thu Hao Van *et al*., 2007). A database for microbial resistance patterns can be designed to monitor the resistance pattern of antibiotics over time to aid the selection of antibiotics by clinical practitioners. Public awareness and health education to the layman through mass media on the side-effect of the abuse of antibiotics in farms should be carried out in efforts to reduce the dissemination of multidrug resistant bacteria. Consumers can play their role to ensure good food hygiene practices and thorough cooking to reduce or eliminate the risk of antibiotic resistant pathogens originating from animal products.

CONCLUSION

Salmonella typhimurium isolates from beef and pork showed multiple antimicrobial resistance to ampicillin, streptomycin, tetracycline and nalidixic acid, while isolates from chicken meat showed multiple antimicrobial resistance to sulphamethoxazole, sulphonamides and tetracycline. Cefotaxime and ceftriaxone recorded as most sensitive drug for *Salmonella typhimurium* isolates.

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