CHAPTER VI

DISCUSSION

Salmonellosis is a major public health problem because of its large and varied animal carrier states, and the lack of a concerted nationwide program to control *Salmonella*. This study follow the program to solve this problems by studied epidemiology typing in phenotyping characteristics and genotyping characteristic. Food animals such as poultry, pigs and cattle have been identified as reservoir of more than 2,500 serovars of *Salmonella enterica* (46, 47) which most of them have been described as the cause of human infections. However, a few serovars are responsible for the majority of human infections, especially *Salmonella enterica* serovar Typhimurium and *Salmonella enterica* serovar Enteritidis. Chicken have been illustrated as the major reservoir of *Salmonella* Enteritidis in many parts of the world(48). However, other serovars can be colonized in chicken and transmitted to human. Varieties of *Salmonella* serovars isolated from chicken in Thailand had been reported, such as the top 3 serovars isolated from native-chicken' feces were *Salmonella* Orion, *Salmonella* Enteritidis, and *Salmonella* Hvittingfoss; while in broilers' feces were *Salmonella* Virchow, *Salmonella* Paratyphi B, and *Salmonella* Amsterdam; and in chicken meat from supermarkets were *Salmonella* Enteritidis, *Salmonella* Hadar, and *Salmonella* Anatum(49). The increasing of *Salmonella enterica* serovar Schwarzengrund, isolated from human patients and chicken meat in Thailand during A.D. 2000-2002, was an interesting study to quest their epidemiological relation between human infection and contamination on chicken meat which might the indication for further monitoring of *Salmonella* Schwarzengrund in broiler chicken farms.

The epidemiological relation of *Salmonella* Schwarzengrund isolates found in human and chicken meat samples can be illustrated by comparing their antimicrobial resistant patterns. However, the conclusive epidemiological relation has to be based on their matching of DNA-fingerprints.

Antimicrobial resistant patterns of *Salmonella* Schwarzengrund isolated from human patients and chicken meat samples

1. *Salmonella* Schwarzengrund isolated from human patients and chicken meat samples in Thailand, during A.D. 2000-2002, had high-resistance to ampicillin (74 %), gentamicin (64 %), streptomycin (59 %), sulfamethoxazone (85 %), sulfamethoxazone+trimethoprim (77 %), tetracycline (73 %), nalidixic acid (96 %), and neomycin (51 %) but had low-resistance to ciprofloxacin, chloramphenical, cefotaxime, and cefotaxime+clavulanic acid (**Figure 4** and **Table 12**). It is certainly indicating the over-used or inprudent-used of antimicrobial drugs in human medicine as well as in food-animal industries. Since previous studies of antimicrobial resistant in food-animals (chicken and pigs) had revealed that *Salmonella* isolated from food-animals in Thailand were high-resistant to antimicrobial drugs, such as Chalermchaikit et.al. (2002) antimicrobial resistance patterns of *Salmonella* isolated from cloacal swabs of broilers were resistant to nalidixic acid 59.2 % and furazolidone 49.7 %; while *Salmonella* isolated from rectal swabs of pigs were resistant to ampicillin 75 %, tetracycline 95.8 %, nalidixic acid 45.8 %, and sulfamethoxazole 70.8 %. The increasing of antimicrobial resistance of nontyphoid-*Salmonella* has been a serious problem for public health worldwide. The high rate of resistance is hampering the use of conventional antimicrobials and the growing resistance to newer antimicrobial agents is aggravating the situation (55).

2. Patterns of antimicrobial resistant between *Salmonella* schwarzengrund isolated from human patients and from chicken meat samples had shown the similarily percentage of resistant to most of antimicrobial drugs tested ampicillin 34 and 76 %, gentamicin 57 and 65 %, streptomycin 18 and 35 %, sulfamethoxazone 94 and 99 %, sulfamethoxazone+trimethoprim 79 and 20 %, tetracycline 48 and 67 %, nalidixic acid 98 and 94 %, neomycin 4 and 7 %, ciprofloxacin 31 and 21 %, and chloramphenical 18 and 14 %, respectively. (**Figure 5**) The results might be suggested that *Salmonella* schwarzengrund isolated from human and chicken meat in Thailand had high probability of epidemiological related. The emerging of *Salmonella* resistant strains and other zoonotic foodborne pathogens have been ascociated with the widespread use of various

antimicrobial drugs in food-animal production as well as the irrational use of antimicrobial drugs in human (56-67).

3. Multiple-drug resistant patterns of *Salmonella* Schwarzengrund of *Salmonella* Schwarzengrund isolated from human patients and from chicken meat samples had shown the similarily percentage of multiple-drug resistant to most of antimicrobial drugs tested. (**Figure 6**) These results would support the preliminary conclusion that *Salmonella* Schwarzengrund isolates from human and chicken are epidemiological related. Multiple antimicrobial resistance in bacterial pathogens has became a common phenomenon in developing countries, including Southeast Asia that direct with Harvey et al.(1999) reported that *Salmonella* Schwarzengrund is a multiple-drug resistant bacteria(50). Since this circumstance is most likely related to the frequent use of over-the-counter antimicrobial drugs without proper or no medical supervision (68-70) as well as the variuos antimicrobial drugs have been available to public access and food-animal industries without proper regulations of drug control. Resistance to antimicrobial drugs of *Salmonella* have been reported with increasing frequency through out the world(5). However, this problem can be prevented and controlled by the cooperation of all stakeholders which are human medicine, veterinary medicine, food-microbiology, and food-animal industries.

Comparison of restricted fragments of chromosomal DNA from *Salmonella* Schwarzengrund isolated from human and from chicken meat samples by Pulsed-Field Gel Electrophoresis (PFGE)

The occurrence of PFGE patterns among *Salmonella* Schwarzengrund isolated from human and from chicken meat samples in Thailand during A.D. 2000-2002 had shown a high similarity. The dendrograms revealed there were two major clusters (A and B) of *Salmonella* Schwarzengrund isolated from human patients and chicken meat samples which showed similarity relations of 58-100 %. (**Figure 12-1, Figure 12-2,** and **Figure 12-3**) However, the genotyping analysis from dendrogram could not provide the relation of multiple-antimicrobial resistance strains between *Salmonella* Schwarzengrund isolated from human patients and chicken meat samples. The conclusive epidemiological relation of *Salmonella* Schwarzengrund found in human salmonellosis in Thailand was majority

from chicken meat source this result agree with those of other authors who reported that a high incidence of Salmonella on poultry especially chicken products could be a potential vehicle of resistant Salmonella food born infection to human, dominating other foods of animal origin as potential source of infection (56-67). The further epidemiological infection chain should investigate the sources or routes of *Salmonella* Schwarzengrund entering into the broiler-chicken farms and/or the broiler-processing plants.

Since varieties of food prepared from chicken meat are the major dishes in Thailand. The average consumption of chicken meat in Thailand is estimated over 30 kg./person/year which is the highest amount of protein source compared to pork and beef. Besides, Thailand is one of the major exporters of chicken meat and the estimated poultry-population in Thailand is almost 1,000 millions. The problem of *Salmonella* in food-animals, especially in broiler-chicken industries have been concerned for many years.