SALMONELLA CONTAMINATION IN SLAUGHTERING AND CUTTING PROCEESES OF THAI INDIGENOUS BEEF

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Abstract—**The present study was carried out to evaluate Salmonella spp. contamination in Thai indigineous beef carcasses, equipments, environments and beef during both processing. A total of sixty-one Thai indigenous beef from the central region of Thailand were used to evaluate the contamination of *Salmonella* spp. in slaughtering and cutting processes. The samples were taken during the processing and analyzed by ISO 6579:2002 method. In slaughtering processes, *Salmonella* spp. was found 8.20% (5 of 61) of pre-washing carcasses, 22.95% (14 of 61) of feces and 8.20% (5 of 61) of 24-h chilled carcasses. In cutting processes, *Salmonella* spp. was found 6.56% (4 of 61) of chilled carcasses before cutting, 12.50% (1 of 8) of cutting knives and 3.27% (2 of 61) of beef meat. The present study showed that *Salmonella* spp. contamination during slaughtering and cutting processes is feces, pre-washing carcasses, chilled carcasses and equipments. This study could be concluded that the contamination point in slaughtering and cutting processes could be aware and applied to develop and control for good hygiene, proper handling and sanitizing in processing for improving beef production standard and safety for consumers.**

Key Words— ***Salmonella* spp., beef, slaughtering processes, cutting processes**

I. INTRODUCTION

Salmonella infection is an important food borne bacteria causing food poisoning. Presently, there are many concerns for salmonellosis as the results of impact on public health of consumers (Ryan & Ray, 2004). Consequently, most of countries in the world including Thailand have set food standard for several kinds of food. It is recommended that the foods must be free from Salmonella spp. contamination. The earlier reported that the enormous spread of Salmonella in the beef production chain in Dakar, Senegal (Stevens et al., 2006). Similarly, Raksasiri & Lertpatarakomol (2009) showed Salmonella contamination was found in all tested beef samples from the local fresh markets and supermarkets of Petchaburi province, Thailand. This would imply that the Salmonella contamination can occur throughout the processes of beef production; from farm to table. Principally, slaughtering and cutting processes deem to be the important sources of Salmonella spread from cattle, equipment and environment to beef. Appropriate control measures should include an extensive education programs for proper hygiene and improvement of managements in slaughterhouse (Abdalla, Suliman, Ahmed & Bakhiet, 2009).

In Thailand, production of Thai indigenous beef is the large and key parts of beef production. The Thai indigenous beef is favorite food for the most of Thai people because its taste and properties are suitable for Thai food recipe. The factors affecting Salmonella contamination in Thai indigenous beef would be more similar to the risk factors as mentioned earlier.

The recent studies have demonstrated that *Salmonella* spp. contaminations of beef were regularly recognized during the slaughtering and cutting process (Legg, Khela, Madie, Fenwick, Quynh & Hedderley, 1999; McEvoy, Doherty, Sheridan, Blair & McDowell, 2003; Steele & McMullin, 2007). Hence, the aim of this study is conducted to evaluate *Salmonella* spp. contamination in Thai indigineous beef carcasses, equipments, environments and beef during both processing.

II. MATERIALS AND METHODS

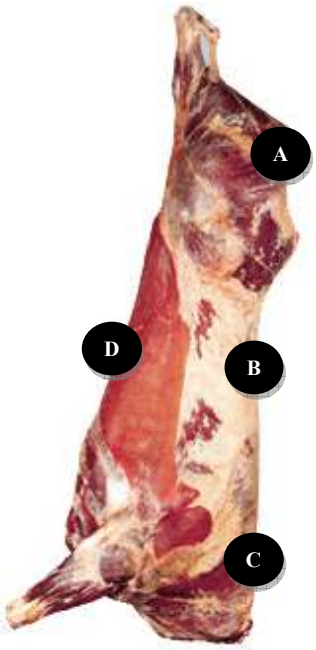
A total of sixty-one Thai indigenous beef from the western region of Thailand were selected in this study. The rearing system of these cattle is grazing in natural pasture or cut and carrying of fresh grasses. When the cattle have gained as slaughter weight, they were transported and slaughtered at a standard slaughterhouse in Nakhon Pathom. The floor of transportation truck was sampled by the swab technique; the sampling area is of 100 cm^2. In slaughterhouse, all cattle were driven to the slaughtering processes where the following activities take place: stunning, bleeding, dressing, evisceration, splitting, washing, weighing and chilling. The samples were taken from tap water, sticking knives, trimming knives, hands of staff, carcasses and wall of chilling room by the swab technique. The carcasses were sampled at three steps of the slaughtering processes: after evisceration, post-washing and after chilling.

For the carcasses after evisceration, pre-washing, the samples were taken by swabbing from four 25 cm^2 areas at each of the rump (A), loin (B), shoulder (C) and flanks (D), total area sampled is of 100 cm^2. Post-washing and after 24-hour chilled carcasses were taken by swabbing from four 25 cm^2 areas at each of axillary region of hideleg, axillary region of foreleg, interior surface of middle abdominal and interior surface of middle back (total area sampled is of 100 cm^2).

About 100 g of feces were collected from large intestinal of each carcasses and placed in a sterile bag. One hundred milliliters of tap water was collected in sterile bottle.

After chilling at 4°C for 24 hours in slaughterhouse, the carcasses were transported by refrigerated truck to the cutting plant in Bangkok and kept in chilling room for 24 hours before cutting. In cutting processes, the samples were taken from refrigerated truck, hands of loading staff, hands of cutting staff, wall of chilling room, air blower of chilling room, chilled carcasses before cutting, cutting knives, cutting board by the swab technique. The chilled carcasses before cutting were taken from 4 sites as post-washing carcasses by the swab technique; an area is of 100 cm^2. Beef samples were collected from 4 primal cuts from chuck, rib, loin and round, total sampled of 200 g. All swab samples were kept in sterile normal saline solution. There were analyzed *Salmonella* spp. by ISO 6579:2002 method.

Figure 1. Locations of sampling sites on carcasses; rump (A), loin (B), shoulder (C) and flanks (D)



III. RESULTS AND DISCUSSION

The proportions of the positive samples to *Salmonella* spp. in the current study is presented in Table 1. In slaughtering processes, *Salmonella* spp. was found 8.20% of pre-washing carcasses. Similarly, the establishment of Nouichi & Hamdi (2009) showed the contamination rate of bovine carcasses at 10%. In addition, Berends, Van Knapen, Mossel, Burt, & Snijders (1998) revealed that main risk factors of contamination are improper cleaning and disinfection. However, there was no Salmonella contamination in all post-washing carcass samples. In general, washing of beef carcasses consistently reduced bacterial populations. Steele & McMullin (2007) indicated that the reduction in beef carcass contaminants could be achieved through the carcass washing system.

The proportions of the positive fecal samples to *Salmonella* spp. (22.95%) of this study was higher than those reported in earlier study (McEvoy, Doherty, Sheridan, Blair & McDowell, 2003). Feces of live animals were mainly source of Salmonella contamination in beef production. Many domestic and wild animals become colonized and shed these bacteria in their feces with no apparent signs of illness (Wray & Wray, 2000; Sanchez, Hofacre, Lee, Maurer, & Doyle, 2002). Berends, Van Knapen, Snijders & Mossel (1997); Hollinger, Wray, Evans, Pascoe, Chapell, & Jones, (1998); McDonough, Fogelman, Shin, Brunner, & Lein, (1999) have noted that there is a strong correlation between the number of live animals that carry *Salmonella* spp. in their feces and the number of contaminated carcasses at the end of the slaughter line. Therefore, the process during evisceration must be carefully taken to prevent rupture of the intestines.

Salmonella spp. was found 8.20% of 24-h after chilled carcasses. Metabolic activities of most microorganisms will reduced at freezing temperatures. However, the warm temperatures will induce the growth of microorganisms. Moreover, Gill & Jones (1997) reported that blast chilling did not improve keeping quality of meat.

In cutting processes, *Salmonella* spp. was found 6.56% of chilled carcasses before cutting and 12.50% of cutting

knives. Nouichi & Hamdi (2009) reported the major sources of contamination are multiple contacts with contaminated tools and operator hands. The study of Legg, Khela, Madie, Fenwick, Quynh & Hedderley (1999) indicated that bare hands of worker were the risk of bacterial cross contamination in beef carcasses. This study finding suggested that the appropriate methods of beef carcass handling and equipment sanitizing should be applied during slaughtering and cutting operations.

Salmonella spp. was found 3.27% of beef meat. James, Thornton, Ketteringham, & James (2000) revealed that the microbial contamination of meat starts during processing on the slaughter line. The improper handling of animal carcasses might be the main factors for producing meat with high microbial load. The results of *Salmonella* spp. contamination in beef product is the most exposed to contamination. It is often contaminated by the digestive flora during eviscerating. The contamination from other sources such as animal skins, hands of staff and equipments, is also involved considering the non respect of slaughtering hygienic rules observed during this study.

Most of Salmonella serogroups were serogroup C and E. The *Salmonella* spp. in serogroup C contains mainly pathogenic *Salmonella* spp. and causes gastroenteritis in consumers. However, the next study could be considered to identify serovar of all isolated samples.

Table 1. The prevalence of *Salmonella* spp. and serogroup in each sample.

Samples type	No. of samples	No. of positive samples (%)	Serogroup	
			C (%)	E (%)
Slaughtering processes				
tap water	9	-	-	-
transportation truck	8	-	-	-
sticking knives	8	-	-	-
trimming knives	9	-	-	-
hand of slaughtering staff	3	-	-	-
pre-washing carcasses	61	5 (8.20)	4 (80)	1 (20)
post-washing carcasses	61	-	-	-
chilling room	9	-	-	-
feces	61	14 (22.95)	12 (85.71)	2 (14.29)
24-h chilled carcasses	61	5 (8.20)	4 (80)	1 (20)
Cutting processes				
refrigerated truck	6	-	-	-
hands of loading staffs	4	-	-	-
chilling room	8	-	-	-
air blower of chilling room	4	-	-	-
carcasses before cutting	61	4 (6.56)	-	4 (100)
cutting knives	8	1 (12.5)	1 (100)	-
cutting board	8	-	-	-
hands of cutting staffs	4	-	-	-
beef meat	61	2 (3.27)	1 (50)	1(50)

IV. CONCLUSION

The summary of *Salmonella* spp. contamination during slaughtering and cutting processes is feces, pre-washing carcasses, chilled carcasses and equipments. The contamination point in slaughtering and cutting processes could be aware and applied to develop and control for good hygiene, proper handling and sanitizing in processing plant for improving standard of beef production and safety for customers.

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