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Short Paper

Isolation and identification of Salmonellae from chicken carcasses in processing plants in Yazd province, central Iran

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Summary

This study was conducted to determine the prevalence of Salmonellae contamination of chicken carcasses in slaughterhouses in central Iran (Yazd province). 435 samples were obtained from liver, breast—before and after chilling—and bacteriological and serological examinations were done. The results showed that the rate of contamination of liver, breast meat—before and after chiller—were 8.1, 18.48 and 34.45%, respectively. Serological tests showed that *S. typhimurium* was the main contaminant of the samples (52.2%). Other isolated serotypes were *S. newport* (15.6%), *S. enteritidis* (12.2%), *S. havana* (8.9%), *S. dublin* (5.6%) and *S. paratyphi-B* (5.6%). Bacteriological examinations on water of chiller indicated that 33.3% of chill water samples were contaminated with *S. typhimurium*, 8.3% with *S. dublin* and 8.3% with *S. paratyphi-B.*

Key words: Salmonellae, Chicken, Carcasses

Introduction

Infectious diseases are main problems, especially in developing countries and cause the majority of illnesses and death around the world.

Food is the most important vehicle that transmits the microorganisms to human (Varnam, 1991), among these micro-organisms Salmonellae remains a major cause of food-borne human disease in most parts of the world (Soultose *et al*., 2003; Carraminana *et al*., 2004).

Poultry and poultry products are frequently contaminated with Salmonellae that can be transmitted to humans through the handling of raw poultry carcasses and products, or through consumption of undercooked poultry meat (Bailey and Cosby, 2003; Kimura *et al*., 2004).

Poultry meat is contaminated with Salmonellae not only by infected poultry, but also by cross-contamination with faeces, water, instruments and worker's hands during the slaughter process and handling. Chicken might thus provide the main transmission route of infection, especially with the increasing consumer demand for this food. This study was undertaken as a prelude to exposure assessment to determine Salmonellae contamination associated with chicken carcasses in different step of slaughter processing. The study was conducted over a nine-month interval to investigate trends in isolation rates during the period of sampling.

Materials and Methods

Sampling

Four poultry slaughterhouses were chosen in Yazd province, central Iran, and 435 samples were aseptically collected from 145 carcasses by systematic random

sampling method during summer 2003. Samples were chosen from breast (skin and meat) after dressing, and from liver after evisceration and again from breast (skin and meat) after chilling in cool water of the same carcasses.

The water of the continues chiller of each slaughterhouse was collected three times before starting slaughtering randomly to determine the contamination with Salmonellae.

Bacteriological and serological examinations

Bacteriological examinations for isolating of Salmonellae were done as the standard method (Varnam, 1991). A 25-g sample of raw chicken (breast and liver) was added to 225-ml of peptone water broth (PWB; Merck) whilst 25-ml of chill water was added to 225-ml of PWB.

All the tubes were incubated at 37°C for 18–24 hrs. The broth (0.1 ml) was inoculated in 10-ml selenite cystine broth (SCB; Merck) and incubated for over night at 42°C. Samples were subcultured onto Salmonella Shigella agar (SSA; Merck) and Brilliant green agar (BGA; Merck) and incubated for over night at 37°C. Presumptive Salmonella colonies were screened biochemically using triple sugar iron agar (TSI; Merck) and lysine iron agar (LIA; Merck) in conjunction with urease media (Merck) over night at 37°C.

Serological examinations were done to confirm the selected colonies with O and H antisera by direct agglutination method and the results were checked with Kaufman-white table (Mahon and Manuselis, 1995). All the isolates were confirmed by Department of Bacteriology of Razi Institute (Karadj, Iran).

Results

Results of the bacteriological examinations on 435 samples from 145 carcasses showed that 90 (20.7%) samples were contaminated with Salmonellae—12 (8.1%) liver samples, 28 (18.48%) meats before chilling and 50 (34.45%) meat samples after chilling (Table 1).

Table 1: Percentage of Salmonellae isolated from raw chicken obtained from slaughterhouses in Yazd province, central Iran

	No. of samples	Positive	
		n	(%)
Liver	145	12	(8.1%)
Meat (before chiller)	145	28	(18.48%)
Meat (after chiller)	145	50	(34.45%)
Total	435	90	(20.7%)

Six serotypes were revealed by serological tests. The Salmonellae serotypes isolated from samples were 47 (52.2%) *S. typhimurium*, 11 (12.2%) *S. enteritidis*, 14 (15.6%) *S. newport*, 8 (8.9%) *S. havana*, 5 (5.6%) *S. dublin* and 5 (5.6%) *S. paratyphi-B* (Table 2).

The results showed that, *S. typhimurium* was the dominant serotype contaminating carcasses. Indeed, the liver of the poultries contaminated with *S. typhimurium* and *S. newport*, while *S. dublin* and *S. paratyphi-B* were isolated only from meats after chilling.

Bacteriological examination on 12 samples of water of the continues chillers indicated that 33.3% of chill waters in the slaughterhouses were contaminated with *S. typhimurium*, one (8.3%) with *S. dublin* and one (8.3%) with *S. paratyphi-B*.

Table 2: Percentage of Salmonellae serotypes isolated from raw chicken obtained from slaughterhouses in Yazd province, central Iran

	Chicken serotypes							
	Liver		Breast (before cooling)		Breast (after cooling)		Total	
	n	(%)	n	(%)	n	(%)	n	(%)
S. typhimurium	10	11.1	16	17.8	21	23.3	47	52.2
S. enteritidis	-	-	5	5.6	6	6.7	11	12.2
S. newport	2	2.2	4	4.4	8	8.9	14	15.6
S. dublin	-	-	-	-	5	5.6	5	5.6
S. havana	-	-	3	3.3	5	5.6	8	8.9
S. paratyphi-B	-	-	-	-	5	5.6	5	5.6

Discussion

This study indicated that the percentage of Salmonellae-positive chickens was 34.45% at the end of the slaughtering process. There is only a few data on the percentage of chicken contamination with Salmonellae during slaughtering in Iran. A study in slaughterhouse of Shiraz showed that contamination of external and internal surfaces and liver of carcasses with Salmonellae were 2, 1.6 and 0.4%, respectively. Also, this study showed that 8.4% of carcasses were contaminated on one or more sites with Salmonellae (Nazer *et al*., 1998). However, some studies on chicken carcasses from retail shops have been shown that 19% of chickens were contaminated with Salmonellae in Ahvaz (Saidii asl, 1994). Nonetheless, a lower (8.5%) incidence of the organism was reported in Shahrekord (Kuhian, 1999).

Contamination of raw chicken has also been reported from the other countries. It depends on the regional variations. For example, the rate was 60% in Portugal (Antunes *et al*., 2003), 13.8% in Switzerland (Baumgartner *et al*., 1992) and 23.7% in Poland (Mikolajczyk and Radkowski, 2002).

Results of this study also showed that the contamination of the carcasses increased during the slaughtering process up to two folds. The highest percentage of Salmonellae-positive chicken samples were obtained from post-chilling step. Like other reviewers, this indicated that contamination of raw meat occur during slaughter and evisceration (Wallace *et al*., 1998). Indeed, we showed that, besides slaughtering and evisceration which contaminate carcasses, immersion of carcasses in chill water also increases the rate of contamination. It seems that the increase in the contamination rate of poultry carcasses after chiller step is attributed to not using a suitable counter-flow of hygienic water.

Serological examination revealed that *S. typhimurium* was the main isolated serotype in all of the samples. This is in close agreement with other studies which indicated that *S. enteritidis* and *S. typhimurium* are the most contaminants in chicken (Baumgartner *et al*., 1992; Nazer, 1998; Kuhian, 1999).

Regarding to our findings, *S. paratyphi-B* (man adapted serotype) and *S. dublin* (bovine adapted serotype) were isolated from water of chiller and chickens after chilling, thus water of chiller could be contaminated by cross-contamination with human or animal faeces or with ices used in chillers.

This study therefore demonstrated that chicken is a vehicle for potential cross-contamination of Salmonellae. Within the food industry, there is a need to reduce carcass cross-contamination during slaughtering and improve hygiene monitoring in processing plants to reduce the chance of contamination of the raw products.

Furthermore, it is important to be aware that chicken may cause infection and therefore implement procedures to reduce the risk of illness is necessary. This may be achieved through the implementation of HACCP system in food industries and other environments. A similar approach may be included in home hygiene. Using of fresh water and chlorination of chill water could reduce the chance of cross-contamination, particularly through this step (James *et al*., 1992).

Despite the growing concern of Salmonellae-contaminated chicken there is still a need for further research to identify all key areas that could contaminate the raw chicken during food processing and food preparation.

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