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Study of Enterobacteriacea Contamination Level in Premises of Poultry Slaughterhouse with HACCP System

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Abstract: Enterobacteriacea is one of important agents in food infection and a major cause of diarrhea in children worldwide therefore, in food quality control is important. In this study Enterobacteriacea infection frequency in the different stage of poultry slaughterhouse was evaluated. During 5 times in one of poultry slaughterhouse in Tabriz, each of two samples were sampling from skin swab, rectum swab after defeathering, after evisceration, after washing stage, after chiller stage and before packing and also from chiller water and scalder water. In samples of rectum swab, skin swab, after defeathering, after evisceration, after washing stage, after chiller stage and before packing were found positive sample of Enterobacteriacea. Statistical analysis results related to Enterobacteriacea contamination in different stage of slaughter poultry showed significant changes ($p<0.001$) but comparison of two successive slaughter stages showed no significant changes ($p>0.05$). Results showed although different poultry slaughtering premises in slaughterhouse cannot eliminate of Enterobacteriacea contamination but we can decrease the contamination Enterobacteriacea during different stages of slaughter with specific sanitation methods and HACCP as we see contamination rate of Enterobacteriacea decrease.

Key words: Enterobacteriacea, poultry, slaughterhouse, HACCP, food quality, Iran

INTRODUCTION

The consumption of poultry meat increased worldwide within the last decades (FAO, 1993; McNamara, 1997; Mead, 1997). Competition for an increased share of the poultry meat market centers on lowering the price, thus making poultry more attractive for the consumer. Therefore, modern poultry processing requires a high rate of throughput to meet consumer demand. With complete mechanization and automation, the number of slaughtered birds in many processing plants can reach 12,000 birds h^{-1} (James *et al*., 2000). During processing of poultry carcasses, microbial contamination inevitably occurs as a consequence of the processing procedures employed. At each stage of the process, ample opportunity exists for contamination of the carcass by microorganisms from the processing plant or by cross-contamination from other birds. Numbers of bacteria on carcass surfaces vary considerably at different stages of processing (Barnes, 1960; Lahellec *et al*., 1972; Mead and Impey, 1970) and increases and decreases in numbers have been demonstrated (Mead and Impey, 1970; Mead and Thomas, 1973; Notermans *et al*., 1973; Van Schothorst *et al*., 1972). Two kinds of poultry slaughtering are used in Tabriz. One is an automated poultry slaughtering process established recently, whereby automated systems are used for scalding, plucking, eviscerating, rinsing and packaging carcasses. Carcasses are then stored at 4°C before sale to supermarkets. The second is traditional slaughtering which is commonly practiced in shops under poor hygienic conditions. Thus, controlling microbial contamination in poultry meat during slaughtering, processing, storage, handling and preparation becomes a great challenge (Abanuslum *et al*., 2003; Gill and Badoni, 2005; Izat *et al*., 1989). Against such a background and recognizing an increase in consumer concerns and pressure in terms of reducing such human, societal and economic costs, there is considerable interest in the development and wider application of more robust and secure methods within poultry production and processing systems. One such system is Hazard Analysis and Critical Control Point (HACCP), a systematic, science based approach to process control designed to prevent, reduce or eliminate identified hazards in food products Kukay *et al*. (1996). It is generally accepted that the HACCP approach is the most effective way of reducing or eliminating contamination during food processing

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NACMCF (1998). Therefore, the aim of present study is to determine the Enterobacteriacea contamination level in premises of poultry slaughterhouse with HACCP system in Tabriz (center of East-Azerbaijan province) abattoirs.

MATERIALS AND METHODS

This research was performed during three separate visits to different stages of poultry slaughter and 10 samples are taken in each of slaughtering stages of poultry slaughter house in the city of Tabriz. Samples were:

- Rectal swab
- 25 cm^2 skin swab
- Meat sample after defeathering
- Meat sample after eviscerating
- Meat sample after cold water washing
- Meat sample after chilling
- Water of chiller
- Water of scalder
- Meat sample before packaging

These samples after collection holed in 3-4°C and then transferred to laboratory of food hygiene in Islamic Azad University Tabriz Branch for other steps. Also in this study enumeration of Enterobacteriacea according to one study by Goksoy *et al*. (2004) was done. Data were analyzed by using of spss (version 14) software and Paired t-test.

RESULTS AND DISCUSSION

Statistical analysis results related to Enterobacteriacea contamination in different stage of slaughter poultry showed significant changes ($p<0.001$) but comparison of two successive slaughter stages showed no significant changes ($p>0.05$). In samples of after defeathering and chiller water no positive case were observed. Also in samples of rectal swab from 10 samples, 7 positive samples were found. Table 1 shows the Commulative frequency of Enterobacteriacea contamination in different stages of slaughtering.

Figure 1 shows the Enterobacteriacea contamination frequency during stages of slaughter and by attention to this figure maximum of Enterobacteriacea contamination frequency in initial stage of slaughter were observed and during slaughter stages of contamination rate has been reduced and most of contamination rate was in rectal swab and skin swab samples. Figure 2 shows the prevalence rate of Enterobacteriacea contamination in different stages of slaughter and according to this figure 70% of rectal swab after defeathering, Meat sample after cold water washing and meat sample before packaging and 20% samples belong to chiller and scalder water infected to Enterobacteriacea were distinguished. Table 2 shows the average of infection to Enterobacteriacea in all stages of poultry slaughter. Table 3 shows the

Table 1: Commulative frequency of enterobacteriacea contamination

Groups	A	B	C	D	E	F	G	H	I
Positive	7	3	0	1	1	2	2	0	2
Negative	3	7	10	9	9	8	8	10	8
Total	10	10	10	10	10	10	10	10	10

A) Rectal swab; B) Skin swab; C) Meat sample after defeathering; D) Meat sample after eviscerating; E) Meat sample after cold water washing; F) Meat sample after chilling; G) Water of chiller; H) Water of scalder and I) meat sample before packaging

Table 2: Average of infection to Enterobacteriacea in different stages

Stages	Mean rank
Rectal swab	5.85
Skin swab	4.28
Meat sample after defeathering	3.11
Meat sample after eviscerating	3.50
Meat sample after cold water washing	3.50
Meat sample after chilling	3.89
Meat sample before packaging	3.89

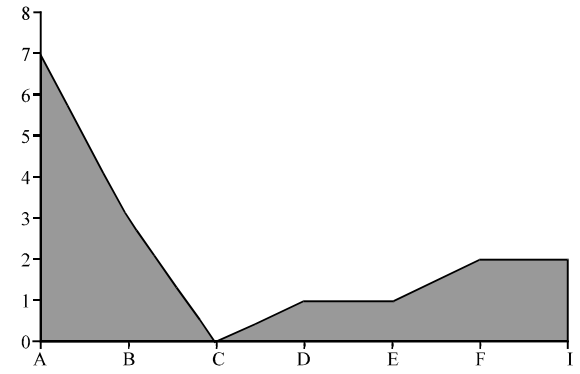

Fig. 1: The enterobacteriacea contamination frequency

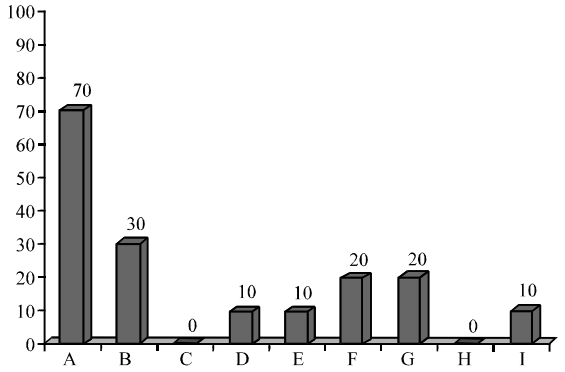

Fig. 2: The prevalence rate of enterobacteriacea contamination

Table 3: Comparison of contamination average of different poultry slaughter stages with them

Test statistics[a]	Values
N	9.000
Chi-square	22.000
Df	6.000
Asymp.sig.	0.001

a. Friedman test

comparison of contamination average of different poultry slaughter stages with them. Poultry arriving at poultry processing plants are generally highly contaminated with bacteria, especially with potential human pathogenic bacteria such as Coliform and Salmonella (Abu-Ruwaida *et al*., 1994; Geornaras *et al*., 1997; Kotula and Pandya, 1995; Mead *et al*., 1993). In fact there mechanism for attachment of microorganism to carcasses has been propounded that is consisting of: retention, entrapment and adhesion. By attention to this subject no time the carcasses without microorganism contamination will not saw.

The complete deleting for these carcasses not exist but deleting the intermediate contamination in different stages of slaughter processing exist (Bean *et al*., 1997; Thomas and Mcmeeking, 1984). According to Table 1, samples from rectum and skin swab shows contamination to Enterobacteriacea in comparison with other stages of slaughtering. Also infected samples to Enterobacteriacea in scalder water were observed and this subject is for entrée of feces and other infectious poultry surface that cases the increase in microbial properties of scalder water at initial time. Report of Canadian food inspection agency shows that the high temperatures for example 60°C in scalder water cases reduce in number of microorganism in comparison with short temperature. Of course cannot say definite that high temperature cases carcasses with minimum infection rate. Thus, has been reported; other stages of poultry slaughtering such as eviscerating and chilling have very importance role for microbial contamination rate in comparison with scalder water. Recently in slaughterhouse from multistage scalder has been used and this type of scalder shows the more effect in reducing the microbial contamination in comparison with primitive scalder (Bremner, 1996; CFIA, 1997). In Fig. 2 has been shown that in samples of after defeathering the infected sample to Enterobacteriacea were not observed and this subject is for deleting the feces which cases most reducing in microbial contamination rate, spraying by chloric water to carcasses also have positive effect in reducing the contamination rate. Also according to this figure in samples of after eviscerating in fected sample were observed which is for most handling the carcasses in this stage possibility because evacuation of crop and intestine and other parts of carcasses is with direct interference of workers. Researches shows if the carcasses only washed in end stages of eviscerating, the number of Enterobacteriacea very much will not reduce but during different stages of eviscerating with washing the carcasses can reducing the contamination rate (Blankenship *et al*., 1993). In fact washing the carcasses during different stages of slaughtering cases reducing the contamination rate of Enterobacteriacea and the good washing is dependent to enough presser and volume of water, the spraying method and amount of bactericide agent in water. The studies shows that the chilling with floating method cases reduce of total bacterial properties of poultry carcasses but in present study the positive infected sample to Enterobacteriacea after chilling has been found.

This subject is for carelessly of workers in shedding the ice in chiller possibility therefore, the chilling with floating metod as one common origin for intermediate contamination to microorganism has been demonstrated. The importance effective agents on microbial properties of poultry in chillers consist of bacterial contamination rate of carcasses before chilling, amount of existing water and alternate water, ratio of carcasses to water and use of bactericides (Blankenship *et al*., 1993). In samples belong to before the packaging, positive infected sample to Enterobacteriacea were observed which this subject is for packaging tables, hands and clothes of workers possibility because there are as carrier for this agents (NACMCF, 1997). Yersinia enterocolitica from Enterobacteriacea is one of important agents in food infection and a major cause of diarrhea in children worldwide therefore in food quality control is important and in present study was not isolated but in some studies this agent has been isolated from food samples that can be for low level of hygiene (Logue *et al*., 1996; Kechagia *et al*., 2007).

CONCLUSION

This study shows that although, the levels of microorganisms on the carcasses are reduced during modern poultry processing as far as the organisms considered here are concerned, cross-contamination by pathogens such as *Salmonella* sp. is widespread and occurs continuously. This should be reduced by implementing satisfactory manufacturing practices and effectively training plant workers in hygiene, safety and quality assurance. In addition, particular attention must be given to limiting flock infection with pathogens such as *Salmonella* and *Campylobacter* sp. during rearing.

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