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POTENTIAL MICROBIOLOGICAL HAZARDS IN BROILER CHICKENS DURING PROCESSING

F.A. KHALAFALLA [1], N.S. ABDEL-ATTY [1], SOAD, A. NASEF [2] and ADEL S. HANAFY [3]

[1] Department of Food Hygiene, Faculty of Veterinary Medicine, Beni Suef University
[2] Reference Lab for Veterinary Quality Control on Poultry Production, Animal Health Research Institute, Dokki, Giza
[3] Reference Lab for Veterinary Quality Control on Poultry Production, Animal Health Research Institute, Fayoum Branch

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ABSTRACT

Bacterial contamination of poultry carcasses during processing is undesirable and unavoidable consequently many potential microbiological hazards may be associated with preparation and processing of broiler carcasses. The aim of the present study was to obtain microbiological baseline data for broiler chickens at different processing steps in semi-automated small scale poultry abattoir located in Fayoum Governorate. Sampling was performed at 6 different processing points; after scalding, after defeathering, after evisceration, after washing, after chilling and after packaging. Carcasses were sampled by whole carcass rinse method and the rinsate was analyzed for coliforms (MPN), faecal coliforms (MPN), *E. coli* (MPN), *Staphylococcus aureus* count as well as isolation of *Salmonellae* and *Campylobacter jejuni.* Bacteriological examination recorded high bacterial counts (coliforms (MPN), faecal coliforms (MPN), *E. coli* (MPN) and *Staphylococcus aureus* count) in all sampling points. These counts increased during defeathering and evisceration then decreased after washing and chilling stage. *E. coli*, *salmonella*, *Staphylococcus aureus* and *campylobacter jejuni* were isolated by different percentages. The final packed carcasses were found to be heavily contaminated. The isolated E. coli serotypes were E. coli O_1 , O_{127} , O_{44} , O_{78} , O_{119} and O_{26} while the isolated salmonella serotypes were S. Virchow, S. Aba, S. Infantis and S. Kentucky.

Key words: Broiler - processing- hazards- coliforms- campylobacter- salmonella

INTRODUCTION

Broiler carcasses have relatively high frequency of contamination with pathogenic bacteria of public health significance including *E. coli*, *salmonella*, *campylobacters*, *Staphylococcus aureus* (Abu-Ruwaida *et al.,* 1994 and Althaus *et al.,* 2017). Special attention in poultry meat processing is paid to the fact that live birds enter the processing plant are heavy loaded with large number of different microorganisms residing externally on their skin, feathers or internally in the alimentary tract (Kotula and Pandya, 1995).

Poultry slaughter's is a multi-stage operation; commercial broiler processing operations include scalding, defeathering, evisceration, washing, chilling and packaging. During these various processing operations; opportunities exist for the contamination of the carcass from different sources such as the environment, contamination via scalding water and tanks, chilling tanks, knives, processing equipment such as defeathering machines, the hands of workers and also by cross-contamination from carcass to another (Afshin *et al.,* 2013 and Nidaullah *et al.,* 2017).

Poultry meat remains an important and probably the major source of human infection with *campylobacters*, *salmonellae*, *Escherichia coli* and *Staphylococcus aureus* which are currently recognized as the major bacterial pathogens associated with poultry and implicated in significant number of human foodborne diseases (Antunes *et al.,* 2016). Moreover, *Campylobacter jejuni* and salmonella are important human pathogens and recognized as the leader of bacterial caused gastroenteritis in humans and foodborne illness ranging from self-limiting gastroenteritis to a number of severe sequelae (Berrang *et al.,* 2000 and Foley and Lynne, 2008). Human infections with these pathogens can occur during the improper handling of raw chicken carcasses, by eating insufficiently cooked chicken and via cross-contamination of other foods by contact with knives

Corresponding author: Adel Samir Hanafy
E-mail address: vet_adel2010@yahoo.com
Present address: Reference Lab for Veterinary Quality Control on Poultry Production, Animal Health Research Institute, Fayoum Branch.

or cutting boards used to prepare contaminated raw chickens (Keener *et al.,* 2004).

Fecal indicator bacteria, especially fecal coliforms, are good microbial indicators of the potential presence of disease causing bacteria and also show the general sanitary quality of the food. Food contamination by *Escherichia coli* is closely associated with fecal contamination (Cason *et al.,* 2000). Coliforms, *Escherichia coli* and *Staphylococcus aureus* have been used in poultry products to assess microbiological safety and sanitation conditions during processing (Bean and Griffin, 1990).

Although foodborne hazards may be of physical, chemical or microbiological origin, there is currently widespread recognition that microbial foodborne hazards represent the greatest risk to consumers (Schirone *et al.,* 2017) therefore the aim of the current study is to investigate the potential microbial hazards contaminating broiler carcasses in semi-automated small scale poultry abattoir in Fayoum Governorate during processing through examination of broiler carcasses at different processing steps for coliforms (MPN), faecal coliforms (MPN), *E. coli* (MPN), *Staphylococcus aureus* count as well as isolation of *Salmonellae* and *Campylobacter jejuni.*

MATERIALS AND METHODS

Sampling procedure:

on each of 15 replicate survey days, 6 broiler carcasses (35-40 days of age) were collected after 6 processing steps, one carcass was removed from the shackle line after each step namely scalding, defeathering, evisceration, washing, chilling and packaging. A total of 90 carcasses were examined (six on each replicate). The abattoir use non-chlorinated tape water during different processing steps.

Carcasses were removed from the line at random using a clean pair of latex gloves for each carcass and individually placed into a separate sterile plastic bag. Individual carcasses were subjected to whole-carcass rinse technique with 400 ml of 0.1 % sterile buffered peptone water which added to each bag and shaken vigorously by hand for 1 min. After shaking, carcasses was removed aseptically and the collected rinsate was poured out of the bags into sterile specimen cups and placed in an ice box and transported to the reference laboratory for veterinary quality control on poultry production- Fayoum branch within 1 h for examination.

Microbiological analysis:

For microbiological analyses, serial dilutions of the collected rinsate of each carcass were performed in 0.1% buffered peptone water up to 10^{-6}. The collected rinsate was tested for:

1- Coliforms (MPN), faecal coliforms (MPN), *E. coli* (MPN) according to the three tube method technique recommended by FDA (2002).

2- Staphylococcus aureus count: The applied technique recommended by ISO 6888-1 (ISO, 1999).

3- Salmonella isolation was performed according to the technique recommended by ISO 6579 (ISO, 2002).

4- Campylobacter isolation was done according to the technique recommended by ISO 10272-1 (ISO, 2006).

All the identified E. coli and salmonella isolates were serologically identified by the slide agglutination test using polyvalent antisera for O and H antigens for salmonellae and O antigen for E. coli.

Statistical analysis:
The data were statistically analyzed by one way analysis of variance (ANOVA) using SPSS program (SPSS version 20, IBM Inc. Chicago, IL and USA). Group means of data were compared to determine significant differences in the number of bacteria recovered. All significant differences were determined at $P \leq 0.05$.

RESULTS

Data presented in table (1) revealed that contamination level for coliforms was 5.17, 5.47, 5.77, 5.54, 5.47 and 5.3 $\log_{10}$ cfu\ml of carcass rinse in scalding, defeathering, evisceration, washing, chilling and packaging, respectively. Moreover, the count of faecal coliforms was 5, 5.3, 5.54, 5.47, 5.3 and 5 $\log_{10}$ cfu\ml of carcass rinse. In addition, the *E. coli* (MPN) was 3.6, 4.6, 4.54, 4.3, 4, and 4.3 $\log_{10}$ cfu\ml of carcass rinse. The rate of *Staphylococcus aureus* contamination in the examined stages was 4.39, 4.9, 4.54, 4.17, 3.9 and 4.17 $\log_{10}$ cfu\ml of carcass rinse in scalding, defeathering, evisceration, washing, chilling and packaging, respectively.

Table 1: Bacterial counts of broiler carcasses at different processing steps (n= 15 examined carcasses in each step)

	scalding	Defeathering	Evisceration	Washing	Chilling	Packaging
Coliforms (MPN)	5.17 [a] ± 3.8	5.47 [a,b] ± 4.9	5.77 [b] ± 5	5.54 [a,b] ± 5	5.47 [a,b] ± 4.9	5.3 [a,b] ± 3.95
Faecal coliforms (MPN)	5 [a] ± 4.4	5.3 [a,b] ± 3.9	5.54 [b] ± 5	5.47 [a,b] ± 5	5.3 [a,b] ± 3.9	5 [a] ± 3.77
E. coli count (MPN)	3.6 [a] ± 3	4.6 [a] ± 3.3	4.54 [a] ± 4	4.3 [a] ± 2.17	4 [a] ± 2.7	4.3 [a] ± 3
Staphylococcus aureus count	4.39 [a,b] ± 3.3	4.9 [a] ± 3.6	4.54 [a,b] ± 3.84	4.17 [a,b] ± 3.3	3.9 [b] ± 3.3	4.17 [a,b] ± 3.4

Counts expressed as mean ± S.E\ml of carcass rinse

[a,b] Means within the same row with no common superscript are significantly different at $p \leq 0.05$

Based on the results from table (2) there was evidence for multiple contamination of the examined broiler carcasses in all the sampling points with *E. coli*, *Salmonella spp*, *Staphylococcus aureus* and *Campylobacter jejuni* with different percentages.

Table 2: Prevalence of isolated microorganisms in broiler carcass rinses collected at different steps of broiler processing (n = 15 examined carcasses in each step)

	scalding		Defeathering		Evisceration		Washing		chilling		packaging	
	No	%	No	%	No	%	No	%	No	%	No	%
E. coli	13	86.7 %	13	86.7%	13	6.7 %	12	80 %	13	86.7 %	13	86.7 %
Salmonella spp	5	33.3 %	7	46.7 %	6	40 %	8	53.3 %	7	46.7 %	5	33.3 %
Staphylococcus aureus	14	93.3 %	15	100 %	14	93.3 %	11	73.3 %	11	73.3 %	13	86.7 %
Campylobacter jejuni	9	60 %	11	73.3 %	12	80 %	10	66.7 %	10	66.7 %	9	60 %

The data reported here (table 3) showed the serotypes of isolated *Salmonellae* and *E. coli*. During scalding stage the isolated serotypes of *salmonella* were S.Virchow, S. Aba, S. Kentucky while the isolated serotypes of *E. coli* were O1, O127, O26. Furthermore, these serotypes were S.Virchow and O119 in defeathering. Moreover, in evisceration stage; S. Aba and O44 were the isolated serotypes. Similarly, in washing stage the isolated serotypes were S. Aba while O44 and O26 were the isolated *E. coli* serotypes. Meanwhile, chilling stage yield S. Aba, S.Virchow, S. Kentucky for *salmonella* and O26, O78 for *E. coli*. In addition, in packaging; S. Infantis and O78 were the isolated serotypes during this stage.

Table 3: Isolated serotypes of salmonella and E. coli during different processing steps

Stage	Salmonella	E. coli
Scalding	S.Virchow, S. Aba, S. Kentucky	O1, O127, O26
Defeathering	S.Virchow	O119
Evisceration	S. Aba	O44
Washing	S. Aba	O44, O26
Chilling	S. Aba, S.Virchow, S. Kentucky	O26, O78
Packaging	S. Infantis	O78

DISCUSSION

Contamination of broiler carcasses during processing can occur at numerous points such as scalding, plucking, defeathering, evisceration or chilling operations. These stages are more important with respect to cross-contamination during processing and have been linked to increase of prevalence or numbers of pathogens on carcasses.

Coliforms, Faecal coliforms and E. coli counts:

It was noted from table (1) that coliforms (MPN), faecal coliforms (MPN) and *E. coli* (MPN) levels increased after scalding (during defeathering and evisceration) stages then decreased during washing stage as the washing after evisceration subsequently removed some contaminant from the carcasses. The contamination was further decreased after chilling of the carcasses; this finding is agreed with that reported by Bashor *et al.* (2004) and Althaus *et al.* (2017).

There was a significant differences between the processing steps at which the evisceration process has the highest coliform and faecal coliform counts (5.77 $\log_{10}$ cfu\ml and 5.54 $\log_{10}$ cfu\ml), respectively while, there was no significant difference in relation to *E. coli* (MPN) between the different processing steps.

Birds delivered to slaughter are generally highly contaminated with bacteria such as Coliforms and *Salmonella, E. coli, Staphylococcus aureus* and *Campylobacter* which may present on their intestine especially the ceca and the colon or in the surface of the skin and feather (Berrang *et al.,* 2000).

At the scalding stage in the traditional poultry abattoirs a one single tank is used, many bacteria are washed from the carcasses results in the release of a large load of organic matter, microbes, and fecal material to the scalding water, these contaminants become suspended in the scalding water (Kotula and Pandya, 1995 and Cason *et al.,* 2000). In this way the scald tank water becomes rapidly contaminated with organisms of faecal origin increasing the risk of cross-contamination from one carcass to another (Baily *et al.,* 1987 and Reiter *et al.,* 2007).

The increase in bacterial count during defeathering is may be attributable to the escape of highly contaminated gut contents from the vent while carcasses are passing through automated feather picking machines. The external pressure exerted on the lower abdomen by the picker's rubber fingers causes release of gut contents which still present in the lower bowel and highly contaminated with enteric pathogens such as Coliforms, *E. coli*, *Salmonella*, and *Campylobacter* leading to an increase in the carcasses contamination (Berrang and Dickens, 2000 and Berrang *et al.,* 2001). In this context, Buhr *et al.* (2003) found that plugging the cloaca prior to scalding and picking decreased coliforms, *E. coli* in rinse samples. Moreover, Abu-Ruwaida *et al.* (1994) reported an increase in *E. coli* counts in broiler carcasses following evisceration.

Previous research have reported that, in general washing after evisceration step can be effective means to lower the bacterial counts and lessen the bacterial contamination on eviscerated broiler carcasses and be useful for pathogen control (Stopforth *et al.,* 2007 and Berrang and Bailey, 2009).

The non-significant reduction in bacterial count and incidence of isolated microorganisms during washing and chilling steps could be contributed to lack of application antimicrobial during these steps, this agreed with that reported by Northcutt *et al.* (2003 a) who found that the use of water in the washing stage during broiler carcasses processing without antimicrobial agent may not significantly reduce carcass coliform or *E. coli* counts. Moreover, Smith *et al.* (2005) who suggested that chlorine prevents cross contamination in immersion chilled broiler carcasses.

Mead *et al.* (2000) suggested that microbial cross-contamination can occur during chilling of poultry; one is via the handling of carcasses by operatives during loading of the chiller and another is by physical contact between adjacent carcasses, which is unavoidable in chiller tank. On the other hand, previously published reports suggested that the chilling stage significantly lower the bacterial count (Berrang and Dickens 2000). In this context, Jiménez *et al.* (2003) found that chilling step significantly lower the E. coli count from 3.44 $\log_{10}$ cfu\ml to 2.28 $\log_{10}$ cfu\ml and coliforms from 3.91 $\log_{10}$ cfu\ml to 2.68 $\log_{10}$ cfu\ml in chicken carcasses during processing.

Comparable level of coliforms in defeathering (5.4 $\log_{10}$) and packaging (5 $\log_{10}$) were detected by Abu-Ruwaida *et al.* (1994) while lower coliforms were reported by Northcutt *et al.* (2003 b) after washing (3.9 $\log_{10}$) and after chilling (2.6 $\log_{10}$) also Berrang and Dickens (2000) detected lower figure for coliforms at different broiler carcasses processing steps. Furthermore, lower figure for *E. coli* was reported by Berrang and Dickens (2000) at different steps. On the other hand, Cason *et al.* (2004) reported higher *E. coli* (6.3 $\log_{10}$ & 5.4 $\log_{10}$) and coliform counts (6.5 $\log_{10}$ & 5.7 $\log_{10}$) after washing and after chilling, respectively.

The numbers of *E. coli* are given in table (2) were 86.7%, 86.7%, 86.7%, 93.3%, 86.7% and 86.7% in scalding, defeathering, evisceration, washing, chilling and packaging, respectively. The isolated serotypes were *E. coli* O_1, O_{127}, O_{44}, O_{78} , O_{119} and O_{26} (table 3).

Higher *E. coli* percentage was reported by Althaus *et al.* (2017) while, lower *E. coli* percentage was reported by Gabeer *et al.* (2012) in different processing steps.

The high percentage of *E. coli* isolated in the current investigation could be attributed to the high prevalence of faecal contamination which occur as a result of rupturing of viscera during the evisceration process resulted in faecal contamination of carcasses and further contamination of processing water and that reported by (Mead, 1989).

Staphylococcus aureus count:

Data from table (1) showed that *Staphylococcus aureus* count significantly increased after the carcasses exit the picker (4.9 log $_{10}$) then significantly decreased during the chilling stage (3.9 log $_{10}$).

It was clearly shown from data in table (2) that contamination level of *Staphylococcus aureus* in broiler carcasses was 93.3%, 100%, 93.3%, 73.3%, 73.3% and 86.7% in scalding, defeathering, evisceration, washing, chilling and packaging, respectively.

Defeathering is generally considered to be one of the major sites of cross-contamination during broiler processing. The plucking process help in removal of the epidermal layer exposing the skin surface for colonization of bacteria implicating the rubber fingers of the defeathering machine as contamination source (Thomas and McMeekin, 1980 and Geornaras *et al.,* 1997). Direct contact between contaminated and uncontaminated carcasses and the action of the fingers of the picker machines are the possible mechanisms of bacterial cross-contamination during defeathering (Allen *et al.,* 2003). In this context, Allen *et al.* (2003) found that a marker organism inoculated onto post-scalding carcasses dispersed for ≤ 200 carcasses via feather removal. In this respect, Whittemore and Lyon, (1994) recovered 5.46 to 5.73 $\log_{10}$ Staphylococcus spp. from the rubber picking fingers.

The reason for the high prevalence of *Staphylococcus aureus* in this study may be attributed to the poor personal hygiene of the workers and non-hygienic practice adopted by workers as handling of carcasses by persons who are harboring staphylococci in their nose, skin, or in an infected lesion. High contamination rate as well as may be due to contamination from skin surface and through contaminated work surfaces and knives (Notermans *et al.,* 1982 and Lambrechts *et al.,* 2014).

Nearly similar results of *Staphylococcus aureus* count was reported by Abu-Ruwaida *et al.* (1994) while, Göksoy *et al.* (2004) detected higher *Staphylococcus aureus* count ranged from 6.9 $\log_{10}$ to 4.11 $\log_{10}$ in different steps moreover, Whyte *et al.* (2004) found lower *Staphylococcus aureus* count after defeathering (3 $\log_{10}$), after washing (2.48) and after chilling (2.3 $\log_{10}$).

Salmonella spp:

Contamination rate of broiler carcasses with *Salmonella* spp. observed in this study was 33.3 % in scalding, 46.7 % in defeathering, 40 % in evisceration, 53.3% in washing, 46.7 % in chilling and 33 % in packaging. The isolated serotypes were S. Virchow, S. Aba, S. Infantis and S. Kentucky (table 3).

Salmonella prevalence has been shown to increase during defeathering (table 2); this is thought to be due to carcass-to-carcass contamination in feather picking machines. In this context, Berrang *et al.* (2011) observed a significant increase in the prevalence of *Salmonella*-positive carcasses after defeathering. Moreover, (Smith *et al.,* 2007) declared that evisceration can lead to carcass contamination with *Salmonella* via crop leakage and intestinal rupture, which are considered major sources of carcass contamination with enteric pathogens.

In this study it was noticed that *Salmonella* numbers decreased from 46.7% in defeathering to 40 % after evisceration (table 2). In contrast, Lillard *et al.* (1984) reported a significantly higher *Salmonella* incidence from fully eviscerated carcasses than from non-eviscerated carcasses.

Nearly similar results for *Salmonella* were reported by Northcutt *et al.* (2003 b) who recorded that 55 % of broiler carcasses were positive after washing. Also, Cason and Hinton, (2006) detected 50% of carcasses were salmonella-positive after defeathering. Lower incidence of *Salmonella* (36% after washing) was reported by Cox *et al.* (2010) also, Rivera-pérez *et al.* (2014) reported lower figures of salmonella in different steps. On the other side, Abu-Ruwaida *et al.* (1994) and Carraminana *et al.* (1997) found a much higher *Salmonella* incidence ranged from 55% to 100% at different processing steps.

Campylobacter jejuni:

Results in table (2) revealed that *Campylobacter jejuni* contamination in broiler carcasses was 60%, 73.3%, 80%, 66.6%, 66.7% and 60% in scalding, defeathering, evisceration, washing, chilling and packaging, respectively.

Previous studies stated wide variations of the slaughterhouse prevalence of *Campylobacter* spp. contamination of broiler carcasses at different processing stages. Several investigators have reported a higher prevalence of *Campylobacter* spp. through broiler chickens processing than our study (Cason *et al.,* 1997 (94%); Bashor *et al.,* 2004 (80%-93%) and 71% by Franchin *et al.* (2007) while, others reported lower prevalence (Klein *et al.*, 2007 (51%) and Rahimi *et al.,* 2010 (56%)**)** at different processing steps. In addition, a comparable level was reported by Berrang *et al.* (2001) and Figueroa *et al.* (2009). Broiler carcasses become contaminated with *campylobacter*s because the live bird is frequently a symptomatic intestinal carrier of the organisms and dissemination readily occurs during processing (Baker *et al.,* 1987). In this context, Newel *et al.* (2001) demonstrated a link between *Campylobacter*-positive poultry at live receiving and *campylobacter*-positive carcasses following, scalding, feather removal, evisceration, and chilling. Furthermore, the feathers, skin, crop, and cloaca of birds brought to slaughter are often highly contaminated with *campylobacter* (Stern *et al.,* 1995 and Berrang *et al.*, 2000).

The high incidence of *campylobacter* obtained in our study may be attributed to the viscera rupture which is not an uncommon occurrence during manual evisceration technique; this is consistent with Izat *et al.* (1988) and Stern and Robach (2003) who reported an increase in the *Campylobacter* concentration on carcasses during the evisceration operation, the increase is a result of viscera rupture, leading to an increased faecal contamination of the broiler carcasses.

Based on our findings, it was noticed that the final packed carcasses were contaminated by different percentage of pathogenic bacteria; this finding support the earlier reports that demonstrate that the finished product was heavily contaminated (Abu-Ruwaida *et al.,* 1994). Similarly, Izat *et al.* (1988) and Berrang and Dickens, (2000) concluded that final product or fully processed broiler carcasses can be found contaminated with *campylobacter* after they exit the chill tank or as ready-to-cook carcasses. Moreover, Harrison *et al.* (2001) demonstrated that chicken package may be a potential source for cross-contamination with *Campylobacter* and *Salmonella* which found to be contaminated with 34% and 11% *Campylobacter* and *Salmonella*, respectively.

CONCLUSION

The present study demonstrates high levels of microbial contamination during processing of broiler carcasses which indicate insufficient sanitation and poor hygienic practices in the abattoir. The high percentage of *E. coli*, *Salmonella*, *campylobacter*, and *Staphylococcus aureus* obtained in our investigation render the poultry meat as a potential vehicle for transmitting food-borne diseases. Therefore, the application of hygienic measures is very important to reduce the bacterial contamination of broiler carcasses during processing in the abattoir. Furthermore, there is a need for implementation of hazard analysis and critical control point (HACCP) in poultry industry to provide safety food for consumer as it represents a systematic approach for controlling all the potential hazards which may be associated with poultry processing.

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REFERENCES

Abu-Ruwaida, A.S.; Sawaya, W.N.; Dashti, B.H.; Murad, M. and Al-Othman, H.A. (1994): Microbiological quality of broilers during processing in a modern commercial slaughterhouse in Kuwait. J. Food prot., 57: 887-892.

Afshin, J.; Saeid, S. and Reza, G. (2013): Study on salmonella contamination in poultry lean meat and meat with skin in Tabriz slaughter houses. African J. Biotechnol., 13: 181-184.

Allen, V.M.; Tinker, D.B.; Hinton, M.H. and Wathes, C.M. (2003): Dispersal of microorganisms in commercial defeathering systems. Br. Poult. Sci., 44: 53–59.

Althaus, D.; Zweifel, C. and Stephan, R. (2017): Analysis of a poultry slaughter process: Influence of process stages on the microbiological contamination of broiler carcasses. Italian. J. Food. Safety., 6: 190-194.

Antunes, P.; Mourão, J.; Campos, J. and Peixe, L. (2016): Salmonellosis: the role of poultry meat. Clin. Microbiol. Infect., 22: 110-121.

Bailey, J.S.; Thomson, J.E. and Cox, N.A. (1987): Contamination of poultry during processing. In: The Microbiology of Poultry Meat Products (Cunningham, F. E. and Cox, N. A. eds.) pp. 193-211. Academic Press, New York.

Baker, R.C.; Paredes, M.D.C. and Quereshi, R.Q. (1987): Prevalence of Campylobacter jejuni in eggs and poultry meat in New York State. Poult. Sci., 66: 1766–1770.

Bashor, M.P.; Curtis, P.A.; Keener, K.M.; Sheldon, B.W.; Kathariou, S. and Osborne, J.A. (2004): Effects of carcass washers on campylobacter contamination in large broiler processing plants. Poult. Sci., 83: 1232- 1239.

Bean, N.H. and Griffin, M. (1990): Foodborne disease outbreaks in the United States, 1973–1987: pathogens, vehicles, and trends. J. Food Prot., 53: 804-817.

Berrang, M.E. and Bailey, J.S. (2009): On-line brush and spray washers to lower numbers of campylobacter and Escherichia coli and presence of salmonella on broiler carcasses during processing. J. Appl. Poult. Res., 18: 74–78.

Berrang, M.E. and Dickens, J.A. (2000): Presence and level of Campylobacter spp. on broiler carcasses throughout the processing plant. J. Appl. Poult. Res., 9: 43–47.

Berrang, M.E.; Buhr, R.J. and Cason, J.A. (2000): Campylobacter recovery from external and internal organs of commercial broiler carcass prior to scalding. Poult. Sci., 79: 286–290.

Berrang, M.E.; Buhr, R.J.; Cason, J.A. and Dickens, J.A. (2001): Broiler carcass contamination with campylobacter from feces during defeathering. J. Food Prot., 64: 2063– 2066.

Berrang, M.E.; Meinersmann, R.J.; Cox, N.A. and Fedorka-Cray, P.J. (2011): Application of chlorine dioxide to lessen bacterial contamination during broiler defeathering. J. Appl. Poult. Res., 20: 33–39.

Buhr, R.J.; Berrang, M.E. and Cason, J.A. (2003): Bacterial recovery from breast skin of genetically feathered and featherless broiler carcasses immediately following scalding and picking. Poult. Sci., 82: 1646-1647.

Carraminana, J.J.; Yanguela, J.; Blanco, D.; Rota, C.; Agustin, A.I.; Arino, A. and Herrera, A. (1997): Salmonella incidence and distribution of serotypes throughout processing in a Spanish poultry slaughterhouse. J. Food Prot., 60: 1312-1317.

Cason, J.A.; Berrang, M.E.; Buhr, R.J. and Cox, N.A. (2004): Effect of prechill fecal contamination on numbers of bacteria recovered from broiler chicken carcasses before and after immersion chilling. J. Food Prot., 67: 1829–1833.

Cason, J.A.; Bailey, J.S.; Stern, N.J.; Whittemore, A.D. and Cox, N.A. (1997): Relationship between Aerobic bacteria, salmonellae, and campylobacter on broiler carcasses. Poult. Sci., 76: 1037–1041.

Cason, J.A. and Hinton, Jr. A. (2006): Coliforms, Escherichia coli, campylobacter, and salmonella in a counter flow poultry scalder with a dip tank. Int. J. Poult. Sci., 5: 846-849.

Cason, J.A.; Hinton, A. and Ingram, K.D. (2000): Coliforms, Escherichia coli, and salmonella concentrations in a multiple-tank, counterflow poultry scalder. J. Food Prot., 63: 1184-1188.

Cox, N.A.; Richardson, L.J.; Cason, J.A.; Ruhr, R.J.; Vizzier-Thaxton, Y.; Smith, D.P.; Fedorka-Cray, P.J.; Romanenghi, C.P.; Pereira, L.V.B. and Doyle, M.P. (2010): Comparison of neck skin excision and whole carcass rinse sampling methods for microbiological evaluation of broiler carcasses before and after immersion chilling. J. Food Prot., 73: 976-980.

FDA (2002): BAM (Bacteriological Analytical Manual) Chapter4: Enumeration of Escherichia coli and the Coliform Bacteria.

Figueroa, G.; Troncoso, M.; López, C.; Rivas, P. and Toro, M. (2009): Occurrence and enumeration of Campylobacter spp. during the processing of Chilean broilers. BMC Microbiol., 9: 94-99.

Foley, S.L. and Lynne, A.M. (2008): Food animal-associated salmonella challenges: Pathogenicity and antimicrobial resistance. J. Anim. Sci., 86: 173.

Franchin, P.R.; Ogliari, P.J. and Batista, C.R.V. (2007): Frequency of thermophilic Campylobacter in broiler chickens during industrial processing in a Southern Brazil slaughterhouse. Br. Poult. Sci., 48: 127–132.

Gabeer, G.A.K.; Suliman, S.E.; Ghali, A. and Abdalla, M.A. (2012): Microbial contamination of chicken carcasses during slaughtering process in Khartoum state, Sudan. Assiut. Vet. Med. J., 58: 1- 4.

Geornaras, I.; De Jesus, A.E.; Van Zyl, E. and Van Holy, A. (1997): Bacterial populations of different sample types from carcasses in the dirty area of a South African poultry abattoir. J. Food Prot., 60: 551–554.

Göksoy, E.O.; Kirkan, S. and Kok, F. (2004): Microbiological quality of broiler carcasses during processing in two slaughterhouses in Turkey. Poult. Sci., 83: 1427–1432.

Harrison, W.A.; Griffith, C.J.; Tennant, D. and Peters, A.C. (2001): Incidence of campylobacter and salmonella isolated from retail chicken and associated packaging in South Wales. Letters in Appl. Microbiol., 33: 450–454.

International organization for standardization, ISO, 10272 (2006): Microbiology of Food and Animal Feeding Stuffs - Horizontal method for enumeration of campylobacter spp. part 1 detection method. ISO, Geneva, Switzerland.

International Organization for Standardization, ISO, 6579 (2002): Microbiology of Food and Animal Feeding Stuffs - Horizontal Method for the detection of Salmonella spp. ISO, Geneva, Switzerland.

International organization for standardization, ISO, 6888-1 (1999): Microbiology of Food and Animal Feeding Stuffs - Horizontal method for the enumeration of coagulase-positive staphylococci (Staphylococcus aureus and other species) – part 1: technique using Baird-Parker agar medium. ISO, Geneva, Switzerland.

Izat, A.L.; Gardner, F.A.; Denton, J.H. and Golan, F.A. (1988): Incidence and level of Campylobacter jejuni in broiler processing. Poult. Sci., 67: 1568-1572.

Jiménez, S.M.; Tiburzi, M.C.; Salsi, M.S.; Pirovani, M.E. and Moguilevsky, M.A. (2003): The role of visible faecal material as a vehicle for generic Escherichia coli, coliform, and other enterobacteria contaminating poultry carcasses during slaughtering. J. Appl. Microbiol., 95: 451–456.

Keener, K.M.; Bashor, M.P.; Curtis, P.A.; Sheldon, B.W. and Kathariou, S. (2004): Comprehensive review of campylobacter and poultry processing. Compr. Rev. Food. Sci. Food Safety., 3: 105-116.

Klein, G.; Reich, F.; Beckmann, L. and Atanassova, V. (2007): Quantification of thermophilic Campylobacter spp. in broilers during meat processing. Antonie van Leeuwenhoek., 92: 267–273.

Kotula, K.L. and Pandya, Y. (1995): Bacterial contamination of broiler chickens before scalding. J. Food Prot., 58: 1326-1329.

Lambrechts, A.A.; Human, I.S.; Doughari, J.H. and Lues, J.F.R. (2014): Bacterial contamination of the hands of food handlers as indicator of hand washing effcacy in some convenient food industries. Pak. J. Med. Sci., 30: 755-758.

Lillard, H.S.; Hamm, D. and Thomson, J.E. (1984): Effect of reduced processing on recovery of foodborne pathogens from hot-boned broiler meat and skin. J. Food Prot., 47: 209-212.

Mead, G.C. (1989): Hygiene problems and control of process contamination. In: Processing of Poultry (Mead, G. C. Ed.) pp. 183–220. Elsevier Applied Science, London, United Kingdom.

Mead, G.C.; Allen, V.M.; Burton, C.H. and Corry, J.E. (2000): Microbial cross-contamination during air chilling of poultry. Brit. Poult. Sci., 41: 158-162.

Newell, D.G.; Shreeve, J.E.; Toszeghy, M.; Domingue, G.; Bull, S.; Humphrey, T. and Mead, G. (2001): Changes in the carriage of campylobacter strains by poultry carcasses during processing in abattoirs. Appl. Environ. Microbiol., 67: 2636-2640.

Nidaullah, H.; Abirami, N.; Shamila-Syuhada, A.K.; Chuah, L.O.; Nurul, H.; Tan, T.P.; Abidin, F.W.Z. and Rusul, G. (2017): Prevalence of salmonella in poultry processing environments in wet markets in Penang and Perlis, Malaysia. Vet. World., 10: 286-292.

Northcutt, J.K.; Berrang, M.E.; Dickens, J.A.; Fletcher, D.L. and Cox, N.A. (2003 b): Effect of broiler age, feed withdrawal, and transportation on levels of coliforms, campylobacter, Escherichia coli and salmonella on carcasses before and after immersion chilling. Poult. Sci., 82: 169-173.

Northcutt, J.K.; Berrang, M.E.; Smith, D.P. and Jones, D.R. (2003 a): Effect of commercial bird washers on broiler carcass microbiological characteristics. J. Appl. Poult. Res., 12: 435–438.

Notermans, S.; Dufrenne, J. and Van Leeuwen, W.J. (1982): Contamination of broiler chickens by Staphylococcus aureus during processing; incidence and origin. J. Appl. Bacteriol., 52: 275-280.

Rahimi, E.; Momtaz, H.; Ameri, M.; Ghasemian-Safaei, H. and Ali-kasemi, M. (2010): Prevalence and antimicrobial resistance of Campylobacter species isolated from chicken carcasses during processing in Iran. Poult. Sci., 89: 1015–1020.

Reiter, M.G.R.; Fiorese, M.L.; Moretto, G.; López, M.C. and Jordano, R. (2007): Prevalence of salmonella in a poultry slaughterhouse. J. Food Prot., 70: 1723–1725.

Rivera-pérez, W.; Barquero-calvo, E. and Zamora-sanabria, R. (2014): Salmonella contamination risk points in broiler carcasses during slaughter line processing. J. Food Prot., 77: 2031–2034.

Schirone, M.; Visciano, P.; Tofalo, R. and Suzzi, G. (2017): Editorial: Biological Hazards in Food.
Front. Microbiol. 7: 2154.

Smith, D.P.; Cason, J.A. and Berrang, M.E. (2005): Effect of fecal contamination and cross-contamination on numbers of coliform, Escherichia coli, campylobacter, and salmonella on immersion-chilled broiler carcasses. J. Food Prot., 68: 1340–1345.

Smith, D.P.; Northcutt, J.K.; Cason, J.A.; Hinton Jr. A.; Buhr, R.J. and Ingram, K.D. (2007): Effect of external or internal fecal contamination on numbers of bacteria on prechilled broiler carcasses. Poult. Sci., 86: 1241–1244.

Stern, N.J.; Clavero, M.R.; Bailey, J.S.; Cox, N.A. and Robach, M.C. (1995): Campylobacter spp. in broilers on the farm and after transport. Poult. Sci., 74: 937–941.

Stern, N.J. and Robach, M.C. (2003): Enumeration of Campylobacter spp. in broiler feces and in corresponding processed carcasses. J. Food Prot., 66: 1557–1563.

Stopforth, J.D.; O'Connor, R.; Lopes, M.; Kottapalli, B.; Hill, W.E. and Samadpour, M. (2007): Validation of individual and multiple-sequential interventions for reduction of microbial populations during processing of poultry carcasses and parts. J. Food Prot., 70: 1393–1401.

Thomas, C.J. and McMeekin, T.A. (1980): Contamination of broiler skin during commercial processing procedures: An electron microscopic study. Appl. Environ. Microbiol., 40: 133–144.

Whittemore, A.D. and Lyon, C.E. (1994): Microbiological profile of rubber defeathering fingers and carcasses from processing lines with single and triple stage scalders. Poult. Sci., 73 (Suppl 1): 24.

Whyte, P.; McGill, K.; Monahan, C. and Collins, J.D. (2004): The effect of sampling time on the levels of micro-organisms recovered from broiler carcasses in a commercial slaughter plant. Food. Microbiol., 21: 59–65.

المخاطر الميكروبيولوجية المحتملة في دجاج التسمين أثناء التجهيز

فتحى أحمد خلف الله ، ناصر سيد عبد العاطى ، سعاد عبد العزيز ناصف
عادل سمير حنفى

Email: vet_adel2010@yahoo.com Assiut University web-site: www.aun.edu.eg

يعد التلوث البكتيرى لذبائح الدواجن أثناء الذبح والتجهيز أمر غير مرغوب فيه ولا يمكن تجنبه ، وبالتالي قد تتواجد العديد من المخاطر الميكروبيولوجية المحتملة فى ذبائح دجاج التسمين أثناء التجهيز. الهدف من الدراسة الحالية هو الحصول على بيانات أساسية ميكروبيولوجية لدجاج التسمين عند خطوات التجهيز المختلفة في مجزر دواجن شبه الآلي يقع في محافظة الفيوم. تم إجراء أخذ العينات في ٦ نقاط مختلفة أثناء الذبح والتجهيز ؛ بعد السمط ، بعد نزع الريش ، بعد نزع الأحشاء ، وبعد الغسيل ، وبعد التبريد وبعد التعبئة والتغليف. تم أخذ العينات بواسطة طريقة شطف الذبيحة الكاملة وتم فحصها للبكتريا القولونية (MPN) ، والبكتريا القولونية البرازية (MPN) ،الإيشيريشيا كولاى (MPN) والمكورات العنقودية الذهبية بالإضافة إلى عزل السلمونيلا والكامبيلوباكتر جيجوناى. هذا وقد أظهرت نتائج الفحص أن العدد البكتيري للميكروبات القولونية ، الميكروبات القولونية البرازية وميكروب الإيشيريشيا كولاى وعد ميكروب المكور العنقودى الذهبى عالى في جميع المراحل التى تم فحصها. وقد تم ملاحظة أن هذه الأعداد زادت خلال مرحلتى نزع الريش ونزع الأحشاء ثم انخفضت بعد مرحلة الغسيل والتبريد. تم عزل الإيشيريشيا كولاي ، السالمونيلا ، المكورات العنقودية الذهبية والكامبيلوباكترجيجوناى بنسب مختلفة أيضاً وجد المنتج النهائى بعد التغليف ملوث بشدة بهذه الميكروبات. كانت عترات الإيشيريشيا كولاى المعزولة هي E. coli O1 و O127 و O44 و O78 و O119 و O26 بينما كانت عترات السالمونيلا المعزولة هي S. Virchow و S. Aba و S. Infantis و S. Kentucky.

الكلمات الدالة: دجاج التسمين - التجهيز - المخاطر - كوليفورم - السالمونيلا- الكامبيلوباكتر