Int.J.Curr.Microbiol.App.Sci (2020) *9*(12): 155-161

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 9 Number 12 (2020)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2020.912.021

Study of Microbial Contamination in Broilers and Drug Sensitivity in Modern Abattoirs in Khartoum State, Sudan

M. E. Elshinnawi*, M. I. M. Fangama, Y. A. Shuaib, E. S. M. Siham and M. A. Adalla

[1]*Department of Public Health, Ministry of Health, Qatar*
[2]*College of Veterinary Medicine, Sudan University of Science and Technology, Sudan*

**Corresponding author*

Keywords

Bacteria, Broilers, Drug, Contamination

Article Info

Accepted:
04 November 2020
Available Online:
10 December 2020

A B S T R A C T

This study was planned to investigate presence of bacterial contamination of broilers breast, back, leg and neck during slaughtering process. A total of 154 swab samples were taken after hanging in slaughter area, after bleeding, after scalding, after defeathering, after evisceration, after washing, after chilling, from slaughtering knives, scalding water, packing machine and hands of the workers. Total viable counts (TVCs) and isolation and identification of bacteria were used. All isolates were tested for some antibiotics (gentamyin, amoxicillin, ciprofloxacin, vancomycin, erythromycin, penicillin, chloranphenicol). The results revealed no statistical difference (P >0.05) between sites of the carcasses and critical points during slaughtering process. The isolated bacteria were *E. coli*, *Salmonella* spp., *Proteous* spp., *Pseudomonas* spp. and *Staphylococcus* spp. The poultry carcasses can be contaminated at any stage of slaughtering process. Therefore, hygienic measures must be managed to safe broiler meat for human consumption.

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 consumers. Therefore, modern poultry processing requires a high rate of throughput to meat consumers demand. With complete mechanization and automation, the number of slaughtered birds in many processing plants can reach 12000 birds per hour (Jame *et al.*, 2000).During the slaughter process of poultry different microorganisms contaminate meat and most frequently Gram-positive rod and micrococci and also Gram-negative bacteria in final product, including enterobacteria (\Mead, 1989; Zivkovic, 2001; Kozacinski *et al.*, 2006). Foodborne pathogens can be introduced also to the food during processing, storage and preparation from infected humans who handle the food or by cross contamination from other raw agricultural products (Hodberg *et al.*, 1994). Dirty worker hands, clothes, equipments of slaughterhouse acted as intermediate sources of contamination of meat (Gill, 1998; Gilmour *et al.*, 2004; Abdelsadig, 2006; Abdalla *et al.*,

2009). After evisceration with poor hygienic management considered as sources of microbial contamination. Also bacterial contamination on processed broiler carcasses can be originated from farms (Plant, environment, equipments and employees). Therefore the hygienic measures must be from farm which considers impact on the health of both animals and humans working in the poultry meat industry (Ahmed *et al.*, 2013). The contamination by bacteria can be caused on food in different parts of the carcass at any stage of operation (Kabour *et al.*, 2012). Bacterial contamination by *Salmonella* spp. using viable counts (Omer *et al.*, 2016) considered highest after washing and chilling than *E. coli*. Also bad drainage was identified to be most important rich factor associated with *Salmonella* spp. (Rammad *et al.*, 2014). Bird feathers participated in bacteria and contamination with table for manual pluck finishing during processed meat poultry and this leading to increase the bacterial load (Morar *et al.*, 2008). Hazard Analysis Critical Control Points (HACCP) is well- accepted systemic program for identification and control of microbiological hazards in all steps of poultry processing and industries and must be implemented this program to serve both external and internal market (Unnevehr and Jensen, 1996; McNamara,1997; Jimenez *et al.*, 2002; Galhardo *et al.*, 2006). The modern poultry industries can produce market ready broiler chickens in less than six weeks and this done through genetic selection, improved feeds and keen health management practices involving usage of antibiotic as therapeutic agents to treat bacterial diseases in intensive farming system (Apata, 2009). Resistant strains from the poultry gut readily soil poultry carcasses and when consume by human that alter his endogenous flora (Vander Bogaard and Stobberingh, 2001). Gene transferoccurs majorly *in vivo* between bacteria and gastrointestinal tract bacteria and pathogenic bacteria and identical resistant genes are present in diverse bacterial species from different hosts (Scott, 2002). The aim of the study to identify bacteria contaminated poultry carcasses and to determine the most effective antibiotic to isolated bacteria.

Materials and Methods

Area of the study

The swab samples were collected from broiler modern abattoir in Khartoum state- Sudan.

Collection of samples

A total of 154 swab samples were taken from the breast, back, leg and neck after hanging in the slaughter area, after bleeding, after scalding, after washing, after chilling, from slaughtering knives, scalding water, packing machine and hands of the workers (Bryan, 1980). The organism was removed from each swab by shaking for a few minutes in 10 ml sterile 0.5% peptone water.

Bacteriology

The isolation and identification of bacteria were carried out according to the methods of Barroow and Feltham (2003). The viable count (TVCs) of the isolated microorganism was also used (Harrigan and MacCance, 1976).

Antibiotic sensitivity test

All bacteria isolated were tested for resistance to some antibiotic and these were gentamyin (Gen), amoxicillin (Amc), ciprofloxacin(Cip), vancomycin (Van), erythromycin(Ery), penicillin(P), chloronphenicol (C), (Maxxi care medical laboratories Ltd, Nigeria) . The sensitivity test was used as described by Prescett *et al.*, (2005).

Statistical analysis

The collected data were analyzed with SPSS software (Statistical Package for the Social Science, version Il.5SSPS Inc and Chicago, IL, USA). All bacterial counts were converted to $\log_{10}$ CFU / Cm^{-2} for analysis and ANOVA were performed. Statistical significance was set at P value of <0.05.

Results and Discussion

As shown in Table 1 the highest level of TVCs in the breast 8.15±0.10, the back 5.5 ± 0.10 and the neck 9.50 ± 0.10 after evisceration. But the level increased in the leg (6.6±0.10) after bleeding. Statistically, there was no significant difference (P >0.05). The high level of contamination by *E. coli* was 62.5% after defeathering and *Salmonella* spp. was 50.0% after chilling, while *Proteus* spp. the contamination was (12.5%) at hanging, after scalding and after washing. But the bacterial level increased due to *Pseudomonas* spp. at washing only. The contamination of *Staphylococcus* spp. was 62.5% after scalding (Table 2).

Table.1 Comparison of Total viable count of bacteria ($\log_{10}$ CFU/ Cm^2) at different sites and operational points (No. 154) in broiler abattoir Khartoum state

Sites	Critical Control Points							p-value
	A	B	C	D	E	F	G	
Breast	5.35±0.04	5.56±0.10	3.62±0.50	6.48±0.10	8.15±0.10	5.54±0.10	3.45±0.04	**NS**
Back	3.34±0.04	4.60±0.01	5.38±0.10	5.29±0.10	5.56±0.10	2.13±0.03	5.46±0.10	NS
Leg	5.50±0.04	6.60±0.10	4.27±0.10	4.33±0.01	4.56±0.10	4.66±0.10	3.62±0.05	NS
Neck	6.38±0.04	5.65±0.10	4.61±0.10	5.57±0.10	9.50±0.10	6.54±0.10	5.54±0.10	NS

A: Hang slaughtering, B: After bleeding, C: After scalding, D: After defeathering, E: After evisceration, F: After washing, G: After chilling and NS: Not significant at P-value 0.05

Table.2 The number of bacteria isolated from operational points of the carcasses in broiler carcasses in abattoir, Khartoum state

CCPs	Isolated bacteria				
	E. coli	***Salmonella***	***Proteus***	***Pseudomonas***	***Staphylococcus***
At hanging (n=16)	0 (0.0%)	6 (37.5%)	2 (12.5%)	0 (0.0%)	8 (50%)
After bleeding (n=16)	4 (25%)	4 (25%)	0 (0.0%)	0 (0.0%)	8 (50%)
After scalding (n=16)	2 (12.5%)	2 (12.5%)	2 (12.5%)	0 (0.0%)	10 (62.5%)
After defeathering (n=16)	10 (62.5%)	2 (12.5%)	0 (0.0%)	0 (0.0%)	4 (25%)
After evisceration (n=16)	8 (50%)	4 (25%)	0 (0.0%)	0 (0.0%)	4 (25%)
After washing (n=16)	8 (50%)	2 (12.5%)	2 (12.5%)	2 (12.5%)	2 (12.5%)
After chilling (n=16)	6 (37.5%)	8 (50%)	0 (0.0%)	0 (0.0%)	2 (12.5%)
Total (n=112)	38	28	6	2	38

Table.3 Bacterial contamination in control points in broilers – Khartoum state

CCPs	Count $log_{10}CFU/cm^2$	Isolated bacteria				
		E. coli	*Salmonella*	*Proteus*	*Pseudomonas*	*Staphylococcus*
Slaughter Knife (n=6)	**4.43**	**3 (50%)**	**2(33.30%)**	**0(0.00%)**	**0(0.0%0)**	**2(33.30%)**
Scalding water (n=6)	**2.54**	**0(0.00%)**	**0(0.00%)**	**2(33.30%)**	**4(66.70%)**	**0(0.00%)**
Packing machine (n=6)	**2.59**	**1(16.70%)**	**0(0.00%)**	**0(0.00%)**	**0(0.00%)**	**4(66.70%)**
Total(n=18)	**-**	**4**	**2**	**2**	**4**	**6**

Table.4 Isolated bacteria from the hands of the workers (n-24) at some control points in broiler abattoir –Khartoum state

Point	Hands of workers					
	Count $log_{10}CFU/cm^2$	*E. coli*	*Salmonella*	*Proteus*	*Pseudomonas*	*Staphylococcus*
At hanging (n=6)	5.54	0(0.0%)	1(16.7%)	0(0.0%)	0(0.0%)	2(33.3%)
During evisceration (n=6)	9.49	0(0.0%)	1(16.7%)	1(16.7%)	2(33.3%)	2(33.3%)
Cutting (n=6)	5.48	4(66.7%)	0(0.0%)	0(0.0%)	0(0.0%)	1(16.7%)
Packing (n=6)	3.58	1(16.7%)	1(16.7%)	0(0.0%)	0(0.0%)	4(66.7%)
Total (n=24)	-	5	3	2	2	9

Table.5 Susceptibility of contaminated bacteria at control points in abattoir, Khartoum state

Antibiotic	*Staphylococcus*	*E. coli*	*Proteus*	*Salmonella*	*Pseudomonas*
Gem /10	3.0	2.5	2.4	2.4	2.3
Ame/ 10	2.8	2.4	2.4	2.2	2.0
Cip/5	2.5	2.5	2.2	2.3	2.1
Van/ 30	2.3	2.4	2.3	2.2	2.1
E/10	1.5	1.6	1.5	1.4	1.2
P/10	0.9	0.8	0.8	0.7	0.8
C/30	0.9	0.9	0.7	0.5	0.5

Gem: Gentamycin, Amc: Amoxicillin, Cip: Ciprofloxacin, Van; Vancomycin, E: Erythromycin; P: Penicillin and C: Chloranphenicol

The total viable count and contaminated bacteria of slaughter knives, scalding water and packing machine were shown in table 3. The organism *E. coli* was high in knives, but *Pseudomonas* spp. in scalding water and *Staphylococcus* spp. in packing machine. In table 4, the TVCs was high during evisceration (9.49 log_{10} CFU/cm^{-2}), but low in packing machine (3.58log_{10} CFU/cm^{-2}). While high level of contamination of *E. coli*(66.7%) at cutting, whereas *Staphylococcus* (66.7%) at packing. Table 5 summarized the sensitivity of bacteria isolated and all isolates were sensitive to gentamycin.

In the present study, there is no significant difference between the sites of the carcasses and critical operational points (P> 0.05) in (Table 1). This indicated that broilers can be contaminated by bacteria specially human

pathogenic bacteria (Goksoy *et al.,* 2004). The presence of *E. coli* and *Salmonella* spp, in all critical points (Table 2, 3 and 4) showed that these bacteria contaminated birds from farms and transportation (Kabour *et al.,* 2012; Ahmed *et al.,* 2013). The feathers and evisceration were considered the source of contamination of these gram negative bacteria (Morar *et al.,* 2008; Mohamed –Noor *et al.,* 2012). The species *Salmonella* in this study (Table 1) increases after chilling and this result in accordance with result of Afshin *et al.,* (2013) who reported that food borne disease caused by microorganism contaminated poultry meat. Also the presence of this organism after chilling in agreement with Thomas and McKeckin (1980); Rammad *et al*., (2014). But this result in contrast with Yang *et al*., (2002) who said that this species do not grow after chilling. The study showed that *E. coli*, *Pseudomonas* spp. and *Salmonella* spp. are bacteria contaminated broilers meat, this is in agreement with study of Jeffery *et al.,* (2003), Mead (2004) and Kabour *et al*., (2012) who reported that the hands of the workers are the source of contamination. In these results *Proteus* spp. and *Staphylococcus* spp. were found in control points. The contamination by these organisms may be due to farm litter or improper slaughtering process Mohamed –Noor *et al.,* 2012; Ahmed *et al.,* 2014, in this study all isolated bacteria were sensitive to gentamycin (Table 5). This amino glycoside is considered to be the drug of choice for treatment of bacterial infections, because of broad spectrum mechanism action in cell bacteria (Adams, 2001). In conclusion poultry carcasses can be contaminated at any critical control points, but applying of slandered methods of hygiene leading to safe broiler meat for consumption.

References

Abdalla, M.A., Siham, E. Suliman and Y.Y.H.A. Alian. (2009). Microbial contamination of sheep carcasses at modern slaughterhouse in Khartoum state. Sud. J. Sci. Anim. Hsub. 48 (1&2) pp. 51-56.

Abdalla, A.A., Siham, E. Suliman; Yassir, A. Shuaib; Mohamed, M.A. Bdalla (2013). Bacteriological study of poultry meat in semi-automatic abattoir in Khartoum state—Sudan. Journal of Agricultural and Veterinary Science, Vol. 4 (2), 8287.

Adams, R.H. (2001). *Veterinary Pharmacology* and *Therapeutics.* Eighth edition. A Blackwell Publishing Company, Iowa State Press, 2121 State Avenue, Ames, Iowa.

Abdelsadig MB. (2006). Study of some critical control points in Elkadaro slaughterhouse. MSc in public health. University of the Academy of Medical Science and Technology. 48: 1-2.

Ahmed A. Abdalla., S.E. Suliman., Yassir Adam Shuaib., and M.A. Abdalla. (2013). Bacteriological Study of Poultry Meat in Semi-Automatic Abattoir in Khartoum State, Sudan. *Journal of Agricultural and Veterinary Science* (SUST), Vol 14(2) PP.82-87

Afshin, J; Saeid, S. and Resa, G.(2013). Study on Salmonella contamination in poultry lean meat and meat with skin in Tabriz slaughterhouse, African Journal of Biotechnology, 13(1): 131-184.

Apata, D.F. (2009). Antibiotic resistance in poultry. Int. J. Poult. SCi., 8: 404=408

Barrow, G. I. and Feltham, R.K.A. (1993). Manual for the Identification of Medical Bacteria (3rd ed.), Cambridge University Press, Cambridge

Bell, R.G., Hathaway, S.C. (1996). The hygienic efficiency of conventional and inverted lamb dressing systems. *Journal of Applied Microbiology*. 81,

pp. 225- 234.

Bryan, F.L. (1980). Poultry and meat products (Edited by Sillcker, J.H; Elliot, R.P., Baird- Parker, A.C., Bryan, F.L., Christain, J.H.B., Clark, D.S., Olson, J.C. and T.A. Roberts): In Microbial Ecology of Foods, Vol.2:Food Commodities. Pp. 410-458.

Food and Agriculture Organization (FAO) (1993). Record poultry meat consumption. *Poult. Int*. 32: 70-72.

Galhardo, J.A., Lopes, M., Dliveira, J.T. (2006). Eficacia dos Tanques de pre-resfriament onareducao de contaminaco bactrianaemcarcacas de frago. Cicencias Agrarias

Gill, CO (1998). Microbiological contamination of meat during slaughter and butchering of cattle, sheep and pigs. In: DAVIES, A., BOARD, R (EdS.). The Microbiology of Meat and Poultry. 'London: Blackie

Glimour, A; K.A. Murry and R.H. Madden, (2004). Determination of the principal points of products contamination during beef carcass dressing process in Northern Ireland. J Food Prot, 67: 1494-1496.

G ö ksoy, E.Ö., Kirkan, S. and K ölc, F. (2004). Microbiological quality of broiler carcasses during processing in two slaughter houses in Turkey. Poultry Science, 83 (8), 1427-1432.

Harrigan, W.F. and McCance, M.E. (1976). Laboratory methods. In Food and Dairy microbiology. Academic Press New York.

Hedberg, C.W. MacDonald, K.L., Osterholm, M.T. (1994). Changing epidemiology of food- borne disease: a Minnesota perspective. Clin. Infect. Dis., 18: 671-682.

James, C., E.O. Gokso; E.L. Corry and S.J. James (2000). Surface pasteurization of poultry meat using steam at atmospheric pressure. J. Food Eng., 45: 111-117.

Jeffery, B; Donald, AB; Gill, CO. (2003). Implementation of validated HACCP system for the control of microbiological contamination of pig carcass at a small abattoir. Can. Vet. J. 44: 1.

Jimenez, S.M., Salsi, M.S. and Tiburzi, M.C.(2002). A comparison between broiler chicken carcasses with and without visible fecal contamination during the slaughtering process on hazard identification of *Salmonella* spp. Journal of Applied Bacteriology, 93(4), 593-108.

Kabour, A.K.G., S.E. Suliman; A. Ghali and M.A. Abdalla (2012). Microbial Contamination of Chicken Carcasses during Processing in Khartoum State. Assiut Vet. Med. J., Vol. 58No 134,279282.

Kozacinski, L., M. Hadziosmanovic; N. Zdolec (2006). Microbiological quality of poultry meat on the Croation market. Vet. Arhiv, 76, 305-313.

McNamara, A.M. (1997). Generic HACCP application in broiler slaughter and processing. National Advisory Committee on Microbiological Criteria for Foods. Food Prot., 26 (5): 462- 604, pp 579-604.

Mead G.C. (1989). Hygiene problems and control of process contamination. [Edited by Mead G.C.] In Processing of Poultry. Elsevier Science Publishers Ltd. 183-220.

Mead, G. C. (1997). Safety of Poultry Products Past, Present and Future. Meat and Poultry. News8, 26–27.

Mead, G.C. (2004). Microbiological quality of poultry meat: Review. Brazilian Journal of Poultry Science 6(3), 135 – 142.

Mohamed-Noor, S.E. YA Shuaib, S.E. Suliman; M.A. Abdalla (2012). Study

of microbial contamination of broilers in modern abattoirs in Khartoum state. AUDJG-Food Technology, 6(1), 74-80.

Morar, A., Milovan, G.H., Sala, C. and Stanchescu, I. (2008). Establishing the bacterial control points in poultry slaughterhouse. Lucrari Stuntsfice Medicina Veterinara, Vool.16: 704-708.

Omer, A.K., Mohamed, M.M., AwadAlkarim, A.A., Sluman, S.E., Abdalla, M.A. (2016). Detection of *Salmonella* spp. and *Escherichia coli* in poultry carcasses at abattoir in Khartoum state, Sudan. Sudan Journal of Science and technology, Vol. 17 (1): 66-72.

Prescott, L.M., J.P. Hearly, D.A. Klein (2005). Microbiology, 6th Edn. McGraw Hill Co., New York, London.

Rammad, S.Y., Suliman, S.E., Shuaib, Y.A., Abdalla, M.S. (2014). Prevalence and risk factors of Salmonella species in poultry at abattoir in Khartoum state. DOI: 10, 13140/RG2.1.313763.

Scott, K.P. (2002). The role of conjugative transportation in spreading antibiotic resistance between bacteria that inhabit the gastrointestinal tract. Cell. Mool. Life Sci., 59: 20712082.

Thamas, C.J. and McMeeken, T.A. (1980). Contamination of broiler carcass s, skin during commercial processing procedure: an electron microscopic study. Applied and Environmental Microbiology, 4 (1): 133-144.

Unnevehr, L.J, and H. H. Jensen (1996). HACCP as regulatory innovation to improve food safety in meat industry. Am. J. Agric. Econ., 20: 186-201.

Vander Bogaard, A.E. and E.E. Stobbrringh. (2001). Recent trend in antibiotic usage and bacterial resistance. Drugs, 65: 102110.

VizzierThaxton, Y., Cason, N.A., Cox, S.E. Morris and J.P. Thaxton (2003).The decline of academic poultry Science in the United States of America. World Poultry Sci. J., 59:303313.

Yang, H.S., Wang, Y. Li and M.G.Johnson (2002). Predictive models for the survival / death of *Campylobacter jejune* and *Salmonella typhimurium* in poultry scalding and chilling. Journal of Food Science, 67: 1836-1842.

Zikovic, J. (2001). Higijena I technologij a mesa. Veterinarsko-sanitrntnadzorzivatin jazaklanje I mesa. 1. Dio.11 dopunjenoizdanje. Uredioidopunio M. Hadziosmanovi. Veterinaskifakiltets veucilista u zaprebu.

How to cite this article:

Elshinnawi, M. E., M. I. M. Fangama, Y. A. Shuaib, E. S. M. Siham and Adalla, M. A. 2020. Study of Microbial Contamination in Broilers and Drug Sensitivity in Modern Abattoirs in Khartoum State- Sudan. *Int.J.Curr.Microbiol.App.Sci.* 9(12): 155-161.
doi: https://doi.org/10.20546/ijcmas.2020.912.021