OPEN ACCESS

Global Journal of Research in Agriculture & Life Sciences
ISSN: 2583-4576 (Online)
Volume 03| Issue 06 | Nov.-Dec. | 2023
Journal homepage: https://gjrpublication.com/gjrals/

Research Article

Evaluation of Bacterial Load in Broiler Meat in Slaughterhouses in Khartoum State

[1]Ekram I. Hassan, [2]Khalid R. Mohamed and [3]Elniema A. Mustafa*

[1]Animal Resource Researches Corporation, Khartoum, Sudan.
[2]Department of Microbiology, Faculty of Veterinary Medicine, Sudan University of Science and Technology.
[3]Department of Food Safety and Veterinary Public Health, College of Veterinary Medicine, University of Bahri, Sudan.

DOI: 10.5281/zenodo.10265971 **Submission Date: 27 Oct. 2023 | Published Date: 06 Dec. 2023**

***Corresponding author:** Elniema A. Mustafa
Department of Food Safety and Veterinary Public Health, College of Veterinary Medicine, University of Bahri, Sudan.

Abstract

A total of 70 swab samples were collected from two types of broiler slaughterhouses (automatic and manual), in Jabelawlia locality in Khartoum State. The objective of this study was to evaluate the bacterial count in broiler carcasses at three process steps during broiler processing. These were: after slaughtering, after scalding, and after chilling. The samples were collected from three sites in broiler carcasses namely: leg, neck, and brisket; in addition to workers' hands. All swab samples were transported in peptone water and examined in the laboratory for total Viable Count (TVC). The study revealed that the highest TVC in the automatic slaughterhouse was found in the worker's hands during scalding process step (12.0 ±10.9 cfu/ cm^2) and the lowest was in the brisket and worker's hands during the chilling process step (0.3 ± 1.7 cfu/ cm^2. The highest bacterial load in the manual slaughterhouse was found after the scalding process step in the legs (20.5 ± 14.3 cfu/cm^2), and the lowest was found in the neck after chilling process step (5.0±7.07). Means and standard deviation (SD) of TVC of in different process steps in the investigated slaughterhouses showed no significant differences. It could be concluded that TVC was high in manual slaughtering than in automatic slaughtering systems.

Keywords: Total Viable Count; Broiler contamination; Process steps; Slaughterhouse.

Authors' contributions

This work was carried out in collaboration between authors. Author (1) collected the research data, conducted laboratory analysis, and contribute to drafting the initial manuscript. Author (2) conceptualized the initial idea, performed supervision over the research, and drafted the initial manuscript. Author (3) edited, reviewed the final manuscript, and carried out correspondence duties. All authors read and approved the final manuscript.

INTRODUCTION

Meat is considered as an important source of proteins to man and is the most perishable of all important foods because of its rich nutrients that supports microbial growth (Ukut *et al.*, 2010).

Epidemiological data suggested that contaminated products of animal origin especially poultry contribute significantly to food borne diseases.

Each year, millions of people worldwide suffer from food-borne diseases (WHO, 2000), and illness resulting from the consumption of contaminated foods has become one of the most widespread public health problems in contemporary society (Notermans *et al.*, 1995).

Reduction of raw poultry contamination levels have a large impact on reducing the incidence of illness (Keener *et al.*, 2004).

WHO (2000) mentioned that the studies conducted by research institutions in Sudan on microbial contamination in meat processing plants revealed high levels of microbiological contamination due to the absence of implementation of GMPS and GHPS.

Moreover, contamination of meat can result from contaminated working surfaces, equipment and workers' hands used in the processing. Mustafa et al. (2016) reported that several factors contribute to meat contamination in Khartoum State, which are obviously seen from the poor handling during processing.

Several research studies evaluated microbial contamination of broiler carcasses in Khartoum State and recommended the implementation of the prerequisites programs of the HACCP system in poultry meat industry, as it involves the constant monitoring of all steps of the process (Youssif Ayman, 2015; Abdalla, et al., 2013). Other researchers recommended the direct implementation of the HACCP system (Ahmed, 2014; MOHAMED-NOOR et al., 2012).

MATERIALS AND METHODS

- **Study area and design**

An analytical study was carried out during the year 2018 in Jabelawlia locality in Khartoum State.

- **Data collection**

Microbiological tests were used to evaluate TVC from two types of poultry slaughterhouses namely: automatic and manual

- **Sample size and sampling technique**

A total of 70 sterile cotton swab samples were collected by skin scraping (outside layer) from leg, neck, brisket after three process steps: defeathering scalding, and chilling (table 1).

Any process steps of defeathering had different workers. Additionally, swab samples were collected from workers' hands after scalding and chilling process steps. Swabs were rubbed over an area of $1cm^2$ and were placed in 2 ml sterile normal saline and transported in ice box (4 °C) to the Central Veterinary Research Laboratory for microbiological analysis.

- **Microbial analysis**

Total Viable Count was performed using the method of Miles and Misra (1938).

- **Statistical analysis**

The collected data were coded and analyzed using Statistical Packaging for the Social Sciences (SPSS/PCversion21 for windows). Data were analyzed for Descriptive Statistical Analysis.

Table 1: Swabs samples from different sites and process steps in the investigated slaughterhouses

Sample site	Automatic slaughterhouse (No.)	Manual slaughterhouse (No.)	Total
Leg:			
After Defeathering	5	5	10
After Scalding	4	4	8
After Chilling	4	4	8
Neck:			
After Scalding	4	4	8
After Chilling)	4	4	8
Brisket:			
After Scalding	4	4	8
After Chilling	4	4	8
Workers' hands:			
After Scalding	3	3	6
After Chilling	3	3	6
Total	**35**	**35**	**70**

RESULTS

- **Bacterial load in automatic slaughterhouse**

The highest bacterial TVC in automatic slaughterhouse was found in the workers' hands during scalding process step (12.0 ±10.9 cfu/ cm^2) and the lowest was in the brisket and workers' hands during chilling process step (0.3 ± 1.7 cfu/ $cm^{2)}$ (table 2).

Table 2: Mean and standard deviation (SD) of TVC in different process steps in the automatic slaughterhouse

Site / Stage	Leg (n= 13)	Neck (n=8)	Brisket (n= 8)	Workers' hands (n =6)
After defeathering	2.6 ±5.9	not done	not done	not done
After scalding	9.9 ± 9.9	0.4 ± 2	5.7 ± 7.5	12.0 ±10.9
After chilling	6.0 ±7.7	5.7 ±7.5	0.3 ± 1.7	0.3 ±1.7

- **Bacterial load in manual slaughterhouse:**

The highest bacterial load in the manual slaughterhouse was found after the scalding process step in the legs (20.5 ± 14.3 cfu/cm^2), and the lowest was found after chilling process step in the neck (5.0±7.07). Workers' hands recorded 11.2 ±10.5cfu/cm^2 after scalding process step and 12.5±11.1cfu/cm^2 after chilling process step.

Table 3: Mean and standard deviation (SD) of TVC counts in different sites and process steps of broiler carcasses in the manual slaughterhouse

Site / Stage	Leg (n= 13)	Neck (n= 8)	Brisket (n= 8)	Workers' hand (n= 6)
After defeathering	17.1± 13.07	not done	not done	not done
After scalding	20.5 ± 14.3	18.1 ±13.4	17.0 ± 13.03	11.2 ±10.5
After chilling	10.5 ± 10.2	5.0 ± 7.07	8.9 ±9.43	12.5±11.1

As shown in table (4) the manual slaughterhouse means and standard deviation at different process steps was 17.1±13 cfu/cm^2 after slaughtering, 18.5 ±13.6 cfu/cm^2 after scalding, and 8.1±90 cfu/cm^2 chilling process steps. Workers' hands recorded 11.8±10.8 cfu/cm^2.

Automatic slaughterhouse means and standard deviation revealed 2.6 ±50, after slaughtering process step, 5.3±7.2 after scalding and 4.0 ±6.3 after chilling process step. Workers' hands recorded 0.6 ± 2.4 cfu/cm^2.

Table 4: Means and standard deviation (SD) of TVC of in different process steps in the investigated slaughterhouses

Process step	Mean (log10 cfu /cm²) & Standard deviation		Sig.
	Automatic slaughterhouse	Manual slaughterhouse	Significant difference
After defeathering	2.6 ± 5.0	17.1 ±13	*N.S.
After scalding	5.3 ± 7.2	18.5 ±13.6	*N.S.
After chilling	4.0 ± 6.3	8.1 ± 9.0	*N.S.
Worker's hands	0.6 ± 2.4	11.8 ± 10.8	*N.S.

*Not Significant

DISCUSSION

The aim of this study was to evaluate the bacterial count in broiler carcasses at three process steps during broiler processing in automatic and manual slaughterhouses.

This study revealed small variation in contamination of workers hands after scalding process step (dirty zone) in both the automatic and manual slaughterhouses (12.0 ±10.9 Vs 11.2 ±10.5), respectively. While higher variation in contamination of workers hands was recorded after chilling process step (clean zone) in both the automatic and manual slaughterhouses (0.3 ±1.7 Vs 12.5±11.1), respectively.

The higher contamination of workers hands specially in the automatic slaughterhouse may be due to lack of monitoring of hygienic practices of workers.

Lower results for average aerobic count of workers hands in the dirty zone were reported by Mohammed (2000) who found 8.54x105 CFU/10cm2 and 1.36x105 CFU/10cm2 in dirty and clean zone, respectively.

Very lower results for average aerobic count of workers hands were also reported by GABEER et al 2012 who found 1.3±0.02 and 1.4±0.01 log10 CFU cm2 at legs and breast sites, respectively.

This study revealed higher variation in bacterial count in the leg site after defeathering in both automatic and manual slaughterhouses (2.6 ±5.9 Vs. 17.1± 13.07).

Higher TVCs were recorded by MOHAMED-NOOR et al. (2012) who found 9.99±0.01 log10 CFU/cm2 in the back process step in automatic slaughterhouse in Khartoum State

The current study revealed higher TVCs contamination in brisket site after scalding process step in manual slaughterhouse (17.0 ± 13.03), while lower counts were recorded in automatic slaughterhouse (5.7 ± 7.5). The lower count in the automatic slaughterhouse may be attributed to the fact that appropriate scalding water temperature was used.

Higher findings (9.96 ±0.01log10 CFU/cm2) for contamination of the leg site after scalding process steps were reported by MOHAMED-NOOR et al. (2012) in automatic slaughterhouse in Khartoum State.

In this research higher TVC count were found in the leg and brisket sites (10.5 ± 10.2 Vs. 8.9 ±9.43), respectively after chilling process steps in manual slaughterhouse. While very low count (0.3 ± 1.7) was recorded in brisket site in automatic slaughterhouse. This study revealed that the TVC in the automatic slaughterhouse was influenced by the chilling process step.

This finding agrees with Irena *et al*. (2011), in Czech slaughterhouse who found that the total viable count (TVC) of poultry carcasses decreased during processing to 4.6 log cfu/cm2.

Higher counts in manual slaughterhouse may be attributed to lack of personal hygiene, dirty workers' hands, and contaminated equipment.

Slightly higher results were reported by GABEER et al (2012) and MOHAMED-NOOR et al. (2012) in automatic slaughterhouses in Khartoum State who recorded1.8±0.70 log10 CFU cm2 and 1.86±0.01 log10 CFU/cm2, respectively for contamination of brisket site after chilling process step.

Higher bacterial contamination in poultry meat carcasses in manual slaughterhouses may affect the quality of poultry meat (Omer and Abdelrahman, 2015).

Ways used to reduce higher bacterial counts in poultry processing plants are to apply a proper Food Safety Management System (Good Hygienic Practices (GHPs) and Good Manufacturing Practices (GMPs) (Akinnibosun and Imade, 2015; Howlett et al., 2010).

CONCLUSION

It could be concluded that higher bacterial contamination in poultry meat carcasses were found in manual slaughterhouse which may affect the quality of poultry meat and jeopardize consumers' health.

ACKNOWLEDGMENT

Authors would like to thank the staff members of Animal Resource Researches Corporation, Department of Microbiology, Faculty of Veterinary Medicine, Sudan University of Science and Technology and Central Veterinary Research Laboratory for their cooperation and support.

Competing Interest

The authors declare that they have no competing interests.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for profit sectors.

REFERENCES

1. Abdalla, A. A. Suliman, S. E. Shuaib, Y. A. and Abdalla M. A. (2013). Bacteriological Study of Poultry Meat in Semi-Automatic Abattoir in Khartoum State-Sudan. Sudan Journal of Science and Technology Vol. 14 Agricultural and Veterinary Sciences (JAVS No. 2).
2. Ahmed, H. A. (2014). Bacterial Contamination of Chicken Carcasses at Abattoir in Khartoum State-Sudan. A dissertation submitted to Sudan University of Science and Technology for partial fulfillment of the Requirement for Master Degree of Preventive Veterinary Medicine (M.P.V .M).
3. Akinnibosun, F.I. And Imade,O. S.(2015). Hygiene Assessment of the Performance of Food Safety Management System Implemented by Abattoirs in Edo State,Nigeria. J. Appl. Sci. Environ. Manage. Sept,2015. 19 (3) 521-529.

4. 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. Vol. 58 No. 134July 2012
5. Irena Svobodová, Gabriela Bořilová1, Radka Hulánková1, and Iva Steinhauserová (2011). Microbiological quality of broiler carcasses during slaughter processing. Department of Meat Hygiene and Technology, Faculty of Veterinary Hygiene and Ecology, University of Veterinary and Pharmaceutical Sciences Brno, Czech Republic 2CEITEC - Central European Institute of Technology, University of Veterinary and Pharmaceutical Sciences Brno, Czech Republic
6. Howlett, B., Bolton, D.J. and O'Sullivan, C. (2010) Development of Pre-requisite Programmes and HACCP Principles for Irish Beef Slaughterhouses. Teagasc – The National Food Centre ISBN 1 84170 3931.
7. Keener, K.M., Bashor, M.P; Curtis, P.A; Sheldon, B.W; Kathariou, S. (2004) Comprehensive review of Campylobacter and poultry processing. Compr Rev Food Sci Food Safety 3: 105- .
8. Miles, Aa; Misra, Ss; Irwin, Jo (1938): The Estimation of The Bacterial Power of The Blood. The Journal of Hygiene 38(6):732-49. Doi:10.1017/S002217240001158x.Pmc2199673.Pmid20475467
9. Mohamed-Noor, S.E., Shuaib, Y.A., Suliman, S.E. and Abdalla, M. A. (2012) Study of Microbial Contamination of Broilers in Modern Abattoirs in Khartoum State. Food Technology 36(1) 74-80.
10. Mohammed, A. M. (2000) Implementation of Hazard Analysis Critical Control Point (HACCP) System in a Poultry Processing Plant. A thesis submitted to the University of Khartoum in Partial fulfillment for the degree of Master of Veterinary Science
11. Mustafa, E., A., Salman, A., M., A., and Hamad, I., M. (2016). Review on Food Safety System with Reference to Meat Operations in Khartoum State, Sudan. RA Journal of Applied Research, (2)(07): 491-504.
12. Notermans, S.; G. Gallhoff, M., Zweitering and G. Mead (1995). Identification of critical control points in the HACCP system with aquantitative effect on the safety of food products, Food Microbiology 12, 93-98
13. Omer Khalifa, Abdelrahman Khalifa (2015) Studies on Salmonella spp. and Escherichia coli Contamination in Poultry Meat Carcasses at an Automatic Slaughterhouse in Khartoum State, Sudan A thesis Submitted to the College of Graduate Studies in the fulfillment of the Requirement of Attaining Master of Science in Veterinary Preventive Medicine and Public Health Sudan University of Science and Technology.
14. Ukut, I-O.E., Okonko, I. O., Ikpoh, I. S., Nkang, A.O., Udeze, A.O., Babalola, T. A., Mejeha, O. k and Fajobi, E. A. (2010). Assessment of Bacteriological quality of fresh meats sold in Calabar Metropolis, Nigeris. EJEAFChe, (1): 89-100.
15. WHO (2000). Food safety: Resolution of the Executive Board of the WHO. 105th session.
16. Youssif Ayman (2015). "Applicability of Hazard Analysis and Critical Control Points (HACCP) System in Beef Processing Factories in Khartoum State". EC Microbiology 1.2 (2015): 70-87.

CITATION
Ekram I. H., Khalid R. M., & Elniema A. Mustafa. (2023). Evaluation of Bacterial Load in Broiler Meat in Slaughterhouses in Khartoum State. In Global Journal of Research in Agriculture & Life Sciences (Vol. 3, Number 6, pp. 8–12). https://doi.org/10.5281/zenodo.10265971