



## Food safety and sanitation practices survey in very small halal and non-halal beef slaughterhouses in the United States

O.A. Al-Mahmood 

Department of Veterinary Public Health, College of Veterinary Medicine, University of Mosul, Mosul, Iraq

### Article information

#### Article history:

Received March 08, 2021

Accepted June 11, 2022

Available online June 12, 2022

#### Keywords:

Halal meat  
Food safety practices  
Sanitation practices  
Halal slaughterhouses  
Very small slaughterhouses

#### Correspondence:

O.A. Al-Mahmood

[omar.a.almoula@uomosul.edu.iq](mailto:omar.a.almoula@uomosul.edu.iq)

### Abstract

To determine food safety and sanitation practices and compare small halal and non-halal beef slaughterhouses in the United States, we conducted two web-based surveys using a similar questionnaire and data collection methods. Among the 80 halal slaughterhouses included in this study, 56.25% (45 out of 80) participated, while 63.75% (51 out of 80) participated in the non-halal slaughterhouse survey. This study showed no significant differences between halal and non-halal slaughterhouses regarding food safety and sanitation, food safety technologies, and microbiological testing practices. All halal and non-halal slaughterhouses conducted generic *E. coli* 100% for beef carcasses. The most common interventions used in halal slaughterhouses were a combination of treatments (cold water + hot water 180°F + organic acid) 31.1%. In contrast, the most common interventions used in non-halal slaughterhouses were only hot water 180°F 33.5%. The findings of this study can be used to describe food safety and sanitation practices in the halal meat industries and find areas for improvement.

DOI: [10.33899/ijvs.2022.133219.2191](https://doi.org/10.33899/ijvs.2022.133219.2191), ©Authors, 2023, College of Veterinary Medicine, University of Mosul.

This is an open access article under the CC BY 4.0 license (<http://creativecommons.org/licenses/by/4.0/>).

### Introduction

Halal foods are defined as free from pork/pork products and alcohol. In addition, halal meats are produced using a distinct method of animal slaughter, which has the most religious restrictions compared to the production of other halal foods (1). Halal is also meant to include high-quality food production practices regarding food safety and sanitation conditions (2). Food safety refers to the conditions and practices that prevent contamination of foods with illness-causing bacteria, viruses, parasites, or chemicals which are a significant public health concern worldwide (3). United States Department of Agriculture (USDA)/ Food Safety and Inspection Service (FSIS) is responsible for ensuring meat supply is safe, wholesome, and correctly labeled and packaged (4). FSIS inspects all raw meat, including imported products, and verifies compliance with the Humane Methods of Slaughter Act for livestock (4). Animals and carcasses handled during the slaughter process

can significantly affect human health regarding the spread of diseases (5). Therefore, it is essential to effectively prevent contamination from the intestinal contents during the animal de-hiding and evisceration (6). Foodborne disease is a preventable public health issue in the United States and worldwide. An estimated 9 million foodborne illnesses are attributed to significant pathogens per year, of which 12% are attributed to meat products (7). Awkward food safety practices and inadequate education and training of food workers are common sources of foodborne diseases (8). FSIS conducts carcass by carcass inspection at all federally inspected slaughter facilities, including halal slaughterhouses, and verifies that establishments follow food safety regulations. In 1995, USDA-FSIS Food Labeling Division approved a labeling policy to allow using "Halal" on meat and meat products which they are certified halal by Islamic authority (Halal Certifying Bodies) (9 CFR 412.1 (c) (1)). FSIS inspects more than 6,635 federal licensed slaughterhouses and food establishments. These food

establishments vary in size and type of manufacturing. According to the FSIS Meat, Poultry, and Egg Product Inspection Directory, the number of the halal slaughterhouses that have USDA registration in the United States is approximately 89, including 9 halal poultry slaughterhouses (9). In addition to the above number, many large slaughterhouses produce halal and non-halal meat and poultry, such as American Foods Group, Tyson Foods Inc, and pilgrim's pride corporation. In general, Research Triangle International (RTI International) conducted a food safety practices surveys in the federally inspected U.S. meat slaughterhouses in 2005 and 2015 to provide a nationwide assessment of the food safety practices (10).

However, no specific data is available on the level of food safety and sanitation practices at the halal slaughterhouses in the United States. Therefore, we aimed to conduct two web-based surveys. One survey is specific to very small halal beef slaughterhouses. The other one is specific for very small non-halal beef slaughterhouses. To determine the level of food safety and sanitation practices implemented in these slaughterhouses to prevent microbial contamination during the slaughtering procedure and allow comparisons between the two categories.

## Materials and methods

### Informed consent

The research protocol of this study was approved by the Clemson University Institutional Review Board (IRB). The IRB is a federally mandated body established under the Department of Health and Human Services (DHHS) regulations for the Protection of Human Subjects (45 CFR 46). Its purpose is to protect the rights and welfare of human subjects recruited to participate in research activities conducted under the auspices of Clemson University (CU).

### Target population

No specific database (list) was available for halal slaughterhouses in the United States. We contacted FSIS-Freedom of Information Act (FSIS-FOIA) and halal certifying bodies about the names and addresses of the halal slaughterhouses in the U.S to construct a list of halal slaughterhouses. Additionally, we used an online search and general database of the USDA (Meat, Poultry, and Egg Product Inspection Directory) to look for Muslim names and the word "Halal" to avoid missing any halal slaughterhouse in our list. To summarize our search, we found 80 pure halal beef slaughterhouses in the United States, and it is used in our survey. Also, FSIS- FOIA provided us a list containing 590 very small beef slaughterhouses to use in the food safety and sanitation practices survey of non-halal slaughterhouses.

### Survey instrument

The questionnaire was adapted from an instrument developed by RTI International and used to collect data

about food safety and sanitation practices, microbiological testing, employee food safety training, and slaughter operation characteristics (11). We modified the instrument by eliminating some questions and specific questions for the halal beef slaughter operations survey. We designed the questionnaire as a web-based survey (SurveyMonkey) and paper-pencil self-administered survey instrument. Two versions of the survey were available, one for non-halal beef slaughter operations which includes food safety and sanitation practices questions and one for halal beef slaughter operations which includes food safety and sanitation practices questions and series of questions about halal slaughter procedures. Pretesting the instrument was performed before it was administrated to our study sample to establish the instrument's validity and reliability and identify any areas of confusion or unfamiliar terms.

### Sample design

Managers of 160 very small beef slaughterhouses (halal and non-halal beef slaughterhouses) in the United States were asked to participate in this study. All halal slaughterhouses were included in our sample (n=80). We used a systematic sampling approach to select 80 non-halal beef slaughterhouses to represent the population (590 non-halal slaughterhouses). The purpose of using systematic sampling rather than random sampling was to ensure that the selected sample includes slaughterhouses with varying characteristics, such as geographic region (Northeast, Midwest, South, and West), type of species slaughtered, such as beef, lambs, goats, swine (pig), and poultry and density of halal beef slaughterhouses in the states. The reasoning behind this approach is that the distribution of halal slaughterhouses was not equal in each state of the United States. We selected non-halal beef slaughterhouses that match the same density of halal beef slaughterhouses in each state. Figure 1 describes the geographical distribution of the selected samples (slaughterhouses).

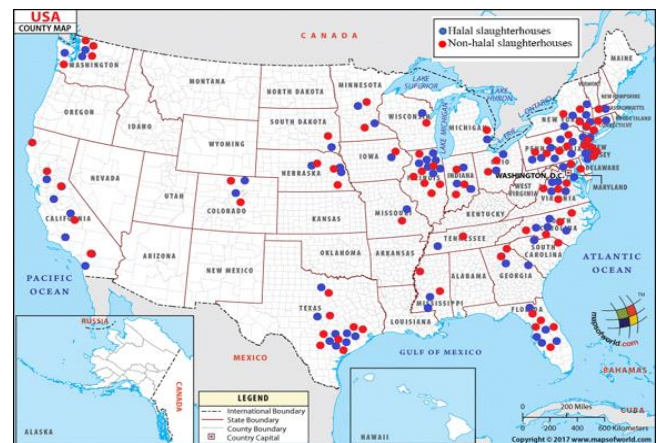


Figure 1: Geographical distribution of halal and non-halal selected samples (slaughterhouses).

**Email script and consent form**

A letter (email or physical mail) describing the project aims and a link to the web-based survey was mailed to all halal and non-halal beef slaughterhouses in our sampling frame. Consent was assumed when the respondent completed the survey. A total of three contacts were made (either email or physical mail) with each category (halal or non-halal operation).

**Survey administration**

The surveys were administered using similar procedures (11). The surveys were implemented for a period from August 2018 through January 2019. According to the slaughterhouse contact information, one option (mail or web-online option) was offered to the plant manager to complete the survey. A reminder postcard or email script was sent to each participant to complete the survey. Telephone calls were made to non-respondents and re-mailed the survey to non-respondents to encourage participation. All follow-up contacts helped to maximize the response rates.

**Data analysis**

Web-online survey responses (multiple choice answers) were entered into a database as a completed respondent. Physical copy survey responses were verified before data analysis. The response rate was calculated using the following equation: Response rate = Respondents/

(Respondents + non-respondents). All analyses were performed using JMP® 16.1 software (12). We conducted all statistical survey estimates by applying appropriate survey weights to the respondent record data. We computed proportions for questions in which respondents could select one or more responses from a list of responses. Respondents who did not answer a question were not included in calculating proportions. The Chi-square test was used to determine if there was a significant difference between the expected and the observed frequencies of the small halal and non-halal slaughterhouses, computed means for all quantitative data. Results were significant, with a P-value < 0.05.

**Results**

**Slaughterhouse characteristics**

Table 1 presents the summarized slaughterhouse characteristics of respondents in this study. Out of the 80 halal slaughterhouses included in this study, 56.25% (45 out of 80) participated (response rate), while 63.75% (51 out of 80) participated in non-halal slaughterhouse surveys. Respondents were from different states for halal and non-halal slaughterhouses (great diversity). All halal respondents 100% slaughtered cattle, sheep, and goats. Most respondents of non-halal plants 88.2% slaughtered both pigs and cattle, while 11.8% slaughtered pigs, cattle, sheep, goats, and deer.

Table 1: Characteristics of halal and non-halal slaughterhouses

Characteristics	Halal slaughterhouse n=45 Number or mean or % (range)	Non-halal slaughterhouse n=51 Number or mean or % (range)
Slaughterhouse area	2,800 ft <sup>2</sup> (1,000-5,000 ft <sup>2</sup> )	15,500 ft <sup>2</sup> (2,500-50,000 ft <sup>2</sup> )
Number of employees	8 (3-17 employees)	10 (2-24 employees)
Number of operation days	(2-5 days)	(3-5 days)
Number of cows slaughtered per week	19 (5-35 cows)	25 (4-75 cows)
Slaughter operation shifts	1 shift	1 shift
Slaughterhouse operation system	27% automated system	31% automated system
	73% non-automated system	69% non-automated system
	58% restraining pen includes head restraint (standing position)	45% restraining pen includes head restraint (standing position)
Cattle restraint methods	29% horizontal-traditional ground method	33% horizontal-traditional ground method
	13% conveyor restraints	22% mechanically turned cattle method (slaughter box)

**Food safety and sanitation practices**

The survey asked about various food safety and sanitation practices during slaughtering and processing. The survey also collected information on other practices that slaughterhouses may adopt to promote food safety (Table 2). USDA inspectors were presented in all halal and non-halal slaughter operations. Of the preharvest practices, 29% of halal slaughterhouses and 12% of non-halal slaughterhouses washed the cattle before slaughter. Clean-up times of unloading areas were 57.8% daily, 28.9% weekly, 13.3%

twice per month in halal operations, while 45.1% daily, 33.3% weekly, 11.8% twice per month, and 9.8% when needed in non-halal operations.

For practices used during slaughter, most of the slaughter operations used chemical detergents and/or hot water for cleaning and sanitizing food contact surfaces (slaughter tools). The frequency of hand sanitizer employees in the slaughter area was not different between halal and non-halal slaughter operations. Other food safety practices were performed to prevent microbial contamination which was

84.4% of halal operations were performed by cutting around the rectum to free it from the carcass, while 88.2% were performed the practice in non-halal operations. All food

safety and sanitation practices were not statistically different between small halal and non-halal slaughter operations.

Table 2: Food safety and sanitation practices used during the beef slaughter of halal and non-halal slaughterhouse

Food safety and sanitation practices	Halal slaughter (n=45)	Non-halal slaughter (n=51)
USDA inspector presents at slaughter	100% USDA inspected	100% USDA inspected
Clean-up times during slaughter day	57.8% one shift 42.2% two shifts	76.4% one shift 23.6% two shifts
Clean-up times of animal pens	57.8% daily 28.9% weekly 13.3% twice per month	33.3% daily 33.3% weekly 11.8% twice per month 21.6% when needed
De-hide carcass methods	57.8% only-skinning knife (manual) 28.9% skinning knife (manual) + mechanical up puller 13.3% mechanical down puller + side puller + air knife	78.4% only-skinning knife (manual) 11.8% Skinning knife (manual) + air knife + mechanical down puller 9.8% skinning knife (manual) + air knife
Knife systems used to remove the hide	57.8% one-knife system 28.9% two-knives system 13.3% three- knives system	66.6% one-knife system 21.6 two-knives system 11.8% three- knives system
Knife cleaned frequency	57.8% Between steps (from side to side) 42.2% between each carcass	68.6% between steps (from side to side) 31.4% between each carcass
Knife sanitized frequency	57.8% between steps (from side to side) 28.9% between each carcass 13.3% never sanitized	66.6% between steps (from side to side) 29.5% between each carcass 3.9% never sanitized
Brisket saw cleaned and sanitized frequency	100% between each carcass	88.2% between each carcass, 11.8% never sanitized
Brisket saw and knives cleaning method	71.1% hot water with detergent 28.9% hot water alone	55% hot water with detergent 45% hot water alone
Brisket saw and knife sanitizing method	100% hot water at 180 °F 57.8% always before handling the next unit of product	100% hot water at 180 °F 45% always before handling the next unit of product
Employees use hand sanitizer in the slaughter area (frequency)	28.9% no specific frequency 13.3% more than once per hour	33.5% more than once per hour 21.5% no specific frequency
Other slaughter practices performed to prevent microbial contamination		
• Plastic bags and ties are put on the bung before - evisceration	71.1% performed 28.9% never used	45% performed 55% never used
• The gastrointestinal tract is not punctured before evisceration	71.1% performed 28.9% never used	55% performed 45% never used
• The esophagus closed	57.8% performed 42.2% never used	55% performed 45% never used

**Food safety technologies and microbiological testing practices**

The most common interventions (antibacterial treatments) used in halal slaughter operations were a combination of treatments (cold water + hot water (180°F) + organic acid) 31.1% (Table 3). The most common

interventions used in non-halal slaughter operations were hot water (180°F) only 33.5%. Slaughterhouses may conduct food safety training for new hires and current employees. The training may be formal training conducted by professional trainers. More than half of halal slaughter operations provide formal food safety courses. On the other

hand, the most popular type of training in non-halal slaughter operations was informal, unscheduled on-the-job food safety training with 54.9% (Table 3). All halal and non-halal slaughter operations conducted generic *E. coli* 100%. Nearly 70% of slaughter operations

(halal and non-halal) conducted microbiological testing for *E. coli* O157:H7. All food safety technologies and microbiological testing practices used by halal and non-halal slaughter operations were not statistically different.

Table 3: Food safety technologies and microbiological testing practices used by halal and non-halal beef slaughter operations

Food safety technologies	Halal slaughter (n=45)	Non-halal slaughter (n=51)
Spinal cord removal	71.1% removed 28.9% not removed	76.4% removed 23.6% not removed
Carcass-to-carcass contact limited	71.1% individual slaughter 28.9% automated rail	100% individual slaughter
Decontamination or antimicrobial intervention treatment	31.1% cold water + hot water (180 °F) + organic acid 28.9% cold water + organic acid 26.7% hot water (180 °F) only 13.3% organic acid only	33.5% hot water (180 °F) only 23.5% organic acid + hot water (180 °F) 21.5% cold water + organic acid 21.5% cold water only
Food safety training (new employees)		
• Formal food safety course conducted by professional trainers	57.8% performed	54.9% performed
• Informal, unscheduled on-the-job food safety training	24.5% performed	21.5% performed
• Scheduled on-the-job food safety training conducted by operation personnel	13.3% performed	11.8% performed
• Written food safety training materials are given to new hires	4.4% performed	11.8% performed
Food safety systems in place	57.8% HACCP Plan + SSOPs + GMP* 28.9% HACCP Plan + SSOPs 13.3% HACCP Plan only	54.9% HACCP Plan + SSOPs + GMP* 23.5% HACCP Plan + SSOPs 21.5% HACCP Plan only
Environmental sampling is conducted to detect pathogens or indicator organisms.	57.8% once per month 42.2% never performed	45.1% once per month 9.8% once per week 45.1% never performed
Microbiological testing of hides before slaughter	100% never performed	100% never performed
Microbiological testing performed for carcasses		
• Generic <i>E. coli</i>	100% performed	100% performed
• <i>E. coli</i> O157:H7	71.4% performed	66.7% performed
• <i>Listeria</i> spp.	28.6% performed	33.3% performed
• <i>Salmonella</i> spp.	57.1% performed	44.4% performed

\* HACCP: Hazard Analysis Critical Control Point, SSOPs: Sanitation Standard Operating Procedures, GMP: Good Manufacturing Practice

## Discussion

USDA/FSIS conducts a carcass-by-carcass inspection at all federally inspected slaughter facilities, including halal slaughterhouses, and verifies that the slaughterhouse follows food safety regulations. Nearly all halal slaughterhouses were very small operations. However, all slaughter operations (very small, small, and large) followed the same

food safety regulations during the slaughter. Therefore, we aimed to conduct this study to see any differences between halal and non-halal slaughter processes as an ethnic factor (halal for Muslim consumers) that may influence the slaughter process. There are differences between ritual slaughter (halal) and conventional slaughter methods in the United States. For example, most halal slaughter is not automated, and the daily slaughter rate is low. Furthermore,

all slaughter steps are completed in a small slaughter hall, and the same worker is performed numerous tasks such as sticking, skinning, and evisceration on the same carcass (13).

This study showed no significant differences between halal and non-halal slaughter operations regarding food safety and sanitation practices, food safety technologies, and microbiological testing practices. This is due to several reasons: [1] both halal and non-halal slaughterhouses were the same size as slaughtering (both very small slaughterhouses). [2] both halal and non-halal operations were supervised by USDA/FSIS inspectors, resulting in strictly implemented food safety regulations. [3] the ethnic factor (the method of halal slaughter) had no effect on the slaughtering operations, which means there was no dereliction in applying food safety regulations in halal slaughterhouses.

Very small slaughterhouses are flexible in using various food safety practices before and during slaughter. There were no significant differences in the pre-harvest practices between halal and non-halal slaughter operations, such as de-hide carcass methods, brisket saw cleaned, sanitized frequency and other practices performed to prevent bacterial contamination. The techniques and practices used were almost the same in both operations. However, large-sized slaughterhouses use more food safety technologies than small or very small slaughterhouses that tend to rely more on unautomated equipment (14). Larger slaughterhouses have higher speeds in the slaughter lines because they rely more on automated equipment to accommodate higher production rates (10).

On the other hand, producing safe meat is the primary purpose of using different food safety programs such as HACCP, SSOPs, GMPs, and other topics relevant to food safety systems and microbiological testing practices. All food safety technologies and microbiological testing practices used by halal and non-halal slaughter operations were not statistically different. In this study, all very small slaughterhouses (halal and non-halal) had at least a HACCP plan documented in their plants. Written programs are required to allow slaughterhouses to design their practices and approaches to suit the needs of their operations and meet standard regulations (15,16). Various practices are applied during the slaughter process. For example, antimicrobial interventions (organic acid, hot water, and cold water) are used before carcasses enter the chilling room to reduce the bacterial load on beef carcasses. Approval of antimicrobial interventions may be affected by FSIS approvals of intervention methods over time (17,18).

Following USDA/FSIS, slaughterhouses must perform a generic *E. coli* test for beef carcasses. However, slaughterhouses may voluntarily conduct other tests for carcasses, equipment, and food contact surfaces such as *Listeria* spp., *Salmonella* spp., and *Staphylococcus* (19,20). Control measures for *E. coli* O157:H7 and *Salmonella* include implementing the HACCP program in beef

slaughterhouses and processing plants, proper handling during transport, proper cooking, and handling by consumers (21).

## Conclusion

Halal meat produced in very small halal slaughterhouses did not differ from those produced in non-halal slaughterhouses (very small operations) regarding food safety and sanitation practices application. Both halal and non-halal slaughterhouses (very small size) have demonstrated that they follow all food safety regulations required by the USDA/FSIS for meat production and processing. Results of the study provide an overview of the current status of food safety practices in the very small slaughterhouses (halal and non-halal) and can help focus on some areas for future research and awareness efforts to assist meat plants in improving their food safety practices.

## Acknowledgment

We would like to thank all the slaughterhouses that participated in this study. We appreciate their efforts.

## Conflict of interest

The author of this manuscript stated there is no conflict of interest regarding the writing process or data analysis.

## References

1. Bonne K, Verbeke W. Muslim consumer trust in halal meat status and control in Belgium. *Meat Sci.* 2008;79(1):113-23. DOI: [10.1016/j.meatsci.2007.08.007](https://doi.org/10.1016/j.meatsci.2007.08.007)
2. Ratanamaneichata C, Rakkarnb S. Quality assurance development of halal food products for export to Indonesia. *Proced Soc Beha Sci.* 2013;88:134-141. DOI: [10.1016/j.sbspro.2013.08.488](https://doi.org/10.1016/j.sbspro.2013.08.488)
3. United States Department of Agriculture/ Food Safety and Inspection Service. Slaughter Inspection 101; 2013. [\[available at\]](#)
4. World Health Organization. Food Safety: Key Facts. World Heal Organ Reg Off South-East Asia. 2020. [\[available at\]](#)
5. Ali MJ, Atiyah WR, Al-Fatlawi MA, Khlaif SF. Genotypic analysis of tick species infesting cattle in Al-Diwaniyah abattoir. *Iraqi J Vet Sci.* 2021;35(4):673-677. DOI: [10.33899/ijvs.2020.127772.1525](https://doi.org/10.33899/ijvs.2020.127772.1525)
6. Miller JM, Griffin PM. One health through eyes of clinical and public health microbiology. *Microbe.* 2012;7(1):23-27. DOI: [10.1128/microbe.7.23.1](https://doi.org/10.1128/microbe.7.23.1)
7. Painter JA, Hoekstra RM, Ayers T, Tauxe RV, Braden CR, Angulo FJ, Griffin PM. Attribution of foodborne illnesses, hospitalizations, and deaths to food commodities by using outbreak data, United States, 1998-2008. *Emerg Infect Dis.* 2013;19:407-415. DOI: [10.3201/eid1903.111866](https://doi.org/10.3201/eid1903.111866)
8. Tessema AG, Gelaye KA, Chercos DH. Factors affecting food handling Practices among food handlers of Dangila town food and drink establishments, Northwest Ethiopia. *BMC Pub Hlth.* 2014;14:1-5. DOI: [10.1186/1471-2458-14-571](https://doi.org/10.1186/1471-2458-14-571)
9. United States Department of Agriculture/ Food Safety and Inspection Service. Meat, Poultry, and Egg Product Inspection Directory. 2021. [\[available at\]](#)
10. Viator C, Cates S, Karns S, Muth M. Food safety practices in the U.S. meat slaughter and processing industry: Changes from 2005 to 2015. *J*

- Food Prot. 2017;80(8):1384-1392. DOI: [10.4315/0362-028X.JFP-16-378](https://doi.org/10.4315/0362-028X.JFP-16-378)
11. Cates SC, Viator CL, Karns SA, Siegel PH. Survey of meat and poultry slaughter and processing operations. Washington, DC, by RTI International, Research Triangle Park, NC; 2005. [\[available at\]](#)
  12. JMP®, Pro 16.1. SAS Institute Inc., Cary, NC, 1989-2021.
  13. Al-Mahmood O, Bridges WC, Jiang X, Fraser AM. A longitudinal study: Microbiological evaluation of two halal beef slaughterhouses in the United States. Food Cont. 2021;125:107945. DOI: [10.1016/j.foodcont.2021.107945](https://doi.org/10.1016/j.foodcont.2021.107945)
  14. Viator C, Muth MK, Brophy JE, Noyes G. Costs of food safety investments in the meat and poultry slaughter industries: results of an expert consultation. J Food Sci. 2017;82:260-269. DOI: [10.1111/1750-3841.13597](https://doi.org/10.1111/1750-3841.13597)
  15. Nel S, Lues JF, Buys EM, Venter P. The personal and general hygiene practices in the deboning room of a high throughput red meat abattoir. Food Cont. 2004;15:571-578. DOI: [10.1016/j.foodcont.2003.09.004](https://doi.org/10.1016/j.foodcont.2003.09.004)
  16. Wilcock A, Ball B, Fajumo A. Effective implementation of food safety initiatives: managers food safety coordinators and production workers' perspectives. Food Cont. 2011;22:27-33. DOI: [10.1016/j.foodcont.2010.06.005](https://doi.org/10.1016/j.foodcont.2010.06.005)
  17. Castillo A, Lucia LM, Mercado I, Acuff GR. In-plant evaluation of a lactic acid treatment for reduction of bacteria on chilled beef carcasses. J Food Prot. 2001;64:738-740. DOI: [10.4315/0362-028x-64.5.738](https://doi.org/10.4315/0362-028x-64.5.738)
  18. Koohmairie M, Arthur TM, Bosilevac JM, Guerini M, Shackelford SD, Wheeler TL. Post-harvest interventions to reduce/eliminate pathogens in beef. Meat Sci. 2000;71:79-91. DOI: [10.1016/j.meatsci.2005.03.012](https://doi.org/10.1016/j.meatsci.2005.03.012)
  19. Sheet OH, Hussein SA, Al-Chalaby AY. Detection of methicillin-resistant *Staphylococcus aureus* from broiler carcasses in Mosul city. Iraqi J Vet Sci. 2021;35(3):489-493. DOI: [10.33899/ijvs.2020.127052.1451](https://doi.org/10.33899/ijvs.2020.127052.1451)
  20. Assafi MS, Hado HA. Detection of methicillin-resistant *Staphylococcus aureus* in broiler and broilers farmworkers in Duhok, Iraq by using conventional and PCR techniques. Iraqi J Vet Sci. 2020;34(1):15-22. DOI: [10.33899/ijvs.2019.125757.1145](https://doi.org/10.33899/ijvs.2019.125757.1145)
  21. United States Department of Agriculture/ Food Safety and Inspection Service. Guidance for minimizing the risk of *Escherichia coli* O157:H7 and *Salmonella* in beef slaughter operations. 2002. [\[available at\]](#)

## دراسة استقصائية لممارسات سلامة الأغذية والصرف الصحي لعمليات ذبح الأبقار في مجازر الحلال وغير الحلال الصغيرة جدا في الولايات المتحدة

عمر احمد المحمود

فرع الصحة العامة البيطرية، كلية الطب البيطري، جامعة الموصل، الموصل، العراق

### الخلاصة

لتحديد مستوى ممارسات سلامة الأغذية والصرف الصحي وإجراء مقارنات بين مجازر اللحم البقري الصغيرة جدا الحلال وغير الحلال في الولايات المتحدة، أجرينا دراستين استقصائيتين على شبكة الإنترنت باستخدام استبيان مماثل وطرق مماثلة لجمع البيانات. من بين ٨٠ مجزرة حلالا تم تضمينها في هذه الدراسة، شارك ٥٦,٢٥% (٤٥ من ٨٠)، بينما شارك ٦٣,٧٥% (٥١ من ٨٠) في مسح مجازر غير الحلال. أظهرت النتائج عدم وجود فروق ذات دلالة إحصائية بين مجازر الحلال وغير الحلال من حيث ممارسات سلامة الغذاء والصرف الصحي وتقنيات سلامة الغذاء وممارسات الاختبارات الميكروبيولوجية. أجريت جميع المجازر الحلال وغير الحلال اختبار التحري عن بكتيريا الإشريكية القولونية العامة ١٠٠٪ لذبائح البقر. كانت المعاملات الأكثر شيوعا المستخدمة في مجازر الحلال عبارة عن مزيج من المعالجات (ماء بارد + ماء ساخن (١٨٠ درجة فهرنهايت) + حامض عضوي) ٣١,١٪. في حين أن المعاملات الأكثر شيوعا المستخدمة في مجازر غير الحلال كانت الماء الساخن (١٨٠ درجة فهرنهايت) فقط ٣٣,٥٪. يمكن استخدام نتائج هذه الدراسة لوصف ممارسات سلامة الأغذية والصرف الصحي في صناعات اللحوم الحلال وإيجاد مجالات للتحسين.