JOURNAL OF HALAL QUALITY AND CERTIFICATION

Microbiological status of Qurbani sheep carcasses after home slaughter

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ARTICLE INFO

Keywords:
Qurbani, sheep, microbiological examination, bacteria, prevention.

ABSTRACT

With the rise of the worldwide Muslim population, it is necessary to take steps to prevent foodborne illnesses during the slaughtering of animals at Eid-al-Adha. In Bosnia and Herzegovina, slaughtering is done at licensed slaughterhouse, but also at home, increasing the risk of contamination that can be dangerous and life threatening, especially for children, pregnant women or for older ill people. The sacrificed animals must be in good health, but the risk of pathogenic bacteria is still present, as they are commonly found on the skin and in the gastrointestinal tracks of the animals. However, little research has been done to determine the microbiological status of Qurbani carcasses. To gather this necessary data and determine the level of bacterial contamination, a microbiological examination of sheep's carcasses shortly after home slaughter was performed. The research was done in Visoko, Bosnia and Herzegovina, and the 30 samples were analyzed for presence of six different bacteria: *Salmonella spp*., *Listeria spp*., *E. coli*, *Enterobacteriaceae*, *Aerobic mesophilic bacteria* and *Staphylococcus spp.*, using ISO-certified methods. While *Salmonella* was not detected and the count of *Enterobacteriaceaeand Aerobic mesophilic bacteria* was within the legally allowed limits, the detection of *Listeria spp*., *E. coli*, and *Staphylococcus spp*. points to the need for more detailed testing of carcasses after slaughter. To assure the safety of Qurbani carcasses, it is necessary to focus more on preventative measures during home slaughter, as well as the education of people doing the home slaughtering.

1. Introductıon

Eid-al-Adha (Festival of Sacrifice) is one of two major holidays in Islam. The focus of the Eid-al-Adha celebration is a sacrifice of an animal, such as sheep, cow, goat, or camel in the name of Allah (Martin, 2004). One-third of the meat is given to the poor people, one-third is kept for themselves and their family, and the last part is given to their neighbors (Vlaisavljević, 2020). In Bosnia and Herzegovina, the slaughter is organized in two ways. It can be done at registered slaughterhouses, but the tradition of home slaughter still persists. Home slaughter is often done by the owner of the animal who lacks the proper knowledge and training regarding the prevention of food born illnesses. In European union, such method of slaughter is not legal. Other counties, such as the UK allow which permits slaughter by the Islamic method, but just in case that there is a licensed Muslim slaughterman and a licensed slaughterhouse under veterinary supervision law The Welfare of Animals (Slaughter or Killing) Regulations 1995 (Statutory Instrument (SI) No 1995/731 as amended by SI No 1999/400)). Slaughtering of healthy animals in fields, farms and other similar places is not permitted (Yunes, 2006).

Sacrificed animals have to be of a certain age and in a good health (Martin, 2004), which decreases the possibility of infection diseases, but improper dressing procedures increases the risk of cross contamination of the meat with pathogenic bacteria. The slaughter without veterinary inspection and in-home environment brings with it some risks that conventional meat does not have. Observing home slaughter in Bosnia and Hercegovina reveled that many common preventative measures are not followed enough, such as the cleaning and disinfections of knifes used for slaughter and dressing procedures and that the same knifes are used on more than one carcass without disinfection.
Data regarding the hygienic conditions in which home slaughters are performed is insufficient, so the goal of our study was the microbiological examination of sheep shortly after slaughter to determine the level of bacterial contamination of carcasses during manipulation after slaughter.

2. Materıals and methods

The samples, consisting of cotton swabs, there collected in Visoko, a city in Bosnia and Herzegovina, during Eid-al-Adha, in July 2021. In total, 30 samples from sheep carcass were collected, swabbing the area of neck muscle, trunk, and thigh muscles. The collected samples were stored in the refrigerator until delivered during the same day when a microbiological analysis was performed. The microbiological analysis of collected samples was performed in the laboratory of the Hygiene & Technology department at the Faculty of Veterinary Medicine-University of Sarajevo. The samples were analyzed for presence of six different bacteria: *Salmonella spp*., *Listeria spp*., *E. coli*, *Enterobacteriaceae*, *Aerobic mesophilic bacteria* and *Staphylococcus spp*. The analysis was performed in accordance to ISO standard methods (Eicher et al., 1997).

Table 1. ISO standard methods

MICROORGANISM	ISO METHOD
Salmonella spp.	BAS EN ISO 6579-1:2018
Listeria spp.	BAS EN ISO 11290-1:2018
Escherichia coli	BAS EN ISO 16649-2:2008
Enterobacteriaceae	BAS EN ISO 21528-2:2018
Aerobic mesophilic bacteria	BAS EN ISO 4833-1:2014
Staphylococcus spp.	BAS EN ISO 6888-1 / 2005/Amd 1 :2005

3. Results

We detected the presence of 5 out of 6 types of bacteria we tested for: *Listeria spp., E. coli, Enterobacteriaceae, Aerobic mesophilic bacteria* and *Staphylococcus spp. Salmonella spp.* was not detected in any of the samples, while only one sample was free of *E.coli.*

Table 1. Results - mean, min and max value (log cfu/cm^2)

MICROORGANISM	MEAN VALUE (log cfu/cm^2)	MAX VALUE (log cfu/cm^2)	MIN VALUE (log cfu/cm^2)
Salmonella spp.	/	/	/
Listeria spp.	1.66x10^2	Sample No 17: 5.9x10^2	No 29: 0.9x10
E. coli	0.71x10^2	No 24: 9.1x10^2	No 1: /
Enterobacteriaceae	2.3	No 29: 2.41	No 22. 25: 2.15
Aerobic mesophilic bacteria	3.63	No 29: 3,72	No 22.25:3.54
Staphylococcus spp.	9.03x10^2	No 18: 3.6x10^3	No 2: 4x10

The obtained results of the *Aerobic mesophilic bacteria*, *Enterobacteriaceae* and *Salmonella spp.* were compared to the limits posed by the (COMMISSION REGULATION (EC) No 2073/2005 on microbiological criteria for foodstuffs. All results were in the accordance to the current legislative, as *Salmonella spp*. was not detected in any samples, while the samples would be classified as acceptable when taking in account the detected number of *Aerobic mesophilic bacteria* and *Enterobacteriaceae*, indicating the need for better hygiene and good manufacturing practices.

Table 3.Permitted values of bacteria in the sample

Food categories	Microorganisms	Sampling plan n	Sampling plan c	Limits m	Limits M
Carcass of sheep	*Salmonella spp.*	50	2	Absent in the tested area of the body	
Carcass of sheep	*Aerobic mesophilic bacteria*			3.5 log cfu/cm^2 log of daily average	5.0 log cfu/cm^2 log of daily average
Carcass of sheep	*Enterobacteriaceae*			1.5 log cfu/cm^2 log of daily average	2.5 log cfu/cm^2 log of daily average

n – number of elementary units comprising the sample
c – number of sample units with values between m and M
m – lower limit value
M – maximum allowed value
Conformational testing didn't reveal the

presence of *Listeria Monocytogenes* or *Staphylococcus aureus.*

Table 4. Research results

MARK (SHEEP)	Salmonella spp.	Listeria spp. (cfu/cm²)	E. coli (cfu/cm²)	Enterobacteriaceae(log cfu/cm²)	Aerobic mesophilic bac. (logcfu/cm²)	Staphilococcus spp. (cfu/cm²
1	X	2x10	X	2,30	3,64	1,8x10²
2	X	3x10	9x10	2,28	3,63	4x10
3	X	1,7x10²	9x10	2,36	3,68	8,20x10²
4	X	4x10	0,1x10	2,34	3,66	7,4x10²
5	X	7x10	1x10	2,32	3,65	7,2x10²
6	X	8x10	1x10	2,34	3,66	4,8x10²
7	X	5x10	3x10	2,26	3,60	4,10x10²
8	X	5,2x10²	5x10	2,23	3,59	2x10²
9	X	1,1x10²	2x10	2,23	3,61	9,3x10²
10	X	7x10	2x10	2,28	3,63	4,6x10²
11	X	2,2x10²	3x10	2,30	3,64	1x10²
12	X	1,1x10²	2x10	2,23	3,61	1x10²
13	X	3,6x10²	1,7x10²	2,23	3,61	1,2x10²
14	X	2,7x10²	4x10	2,26	3,60	8,3x10²
15	X	7x10	4x10	2,18	3,56	8x10²
16	X	4,7x10²	5x10	2,34	3,66	1,5x10²
17	X	5,3x10²	5x10	2,34	3,66	1,5x10²
18	X	1,4x10²	1,8x10²	2,32	3,65	3,6x10²
19	X	2x10	1x10	2,34	3,66	2,5x10²
20	X	6x10	1x10²	2,32	3,65	4,3x10²
21	X	6x10	2x10	2,18	3,56	3,2x10²
22	X	7x10	4x10	2,15	3,54	5,4x10²
23	X	1,3x10²	3,8x10²	2,32	3,65	6x10²
24	X	3,3x10²	9,1x10²	2,32	3,65	2,1x10²
25	X	3x10²	1,2x10²	2,15	3,54	7x10²
26	X	1,4x10²	1x10	2,38	3,70	1x10²
27	X	1,2x10²	6x10	2,38	3,70	8x10²
28	X	6x10	5x10	2,38	3,70	6,3x10²
29	X	0,9x10	0,4x10	2,41	3,72	4,3x10²
30	X	3x10²	1,6x10²	2,34	3,67	1x10²
Max value		Mean value: 1,7x10²	Mean value:1x10²	Mean value:2,3	Mean value:3,63	Mean value:8,4x10²
Min value						

4. Discussion

All the examined carcasses were in accordance with the maximal allowed values set by the Food Safety Agency of Bosnia and Herzegovina. *Salmonellaspp* was not detected in any of the samples we tested. Phillips et al. (2001) determined a 0.1% percentage of *Salmonella spp.* positive samples while Nouichi and Hamdi (2012) reported one contaminated ovine carcass (1.11%). These differences could be attributed to a larger sample size.

Aerobic mesophilic bacteria were detected on every carcass and our results (3.63 log cfu/cm^2) are in accordance with those of Martinez et al. (2010), (3.53 log cfu/cm^2) who also obtained their results by swabbing. The percentage of carcasses in which *Enterobacteriaceae* were detected was higher in our study (100%) than in other studies, like these of Martinez et al (2010) (82.8%). Saad et al. (2011) found value of *Enterobacteriaceae* of 3.3 to 3.9 log cfu/cm^2, higher than the values we detected.

In addition to *Enterobacteriaceae and Aerobic mesophilic bacteria* which the carcasses must be tested for, our research also detected the presence of other potentially pathogenic microorganisms. *Staphylococcus spp.* as well as *Listeria spp.* were found in every of our 30 samples, while 29 samples tested positive for *E.coli*. These bacteria can pose a significant risk to human health, but the current legislation does not require the testing for their presence in carcasses during slaughter. *S. aureus* was detected on 32.6% of samples by Mørk et al. (2012), while Kocaman and Sarimehmetoğlu (2017) detected a lower occurrence of *Listeria spp.* at 30.7%, which can still pose a significant risk to human health.

The food born illnesses related to Qurbani meat are relatively rare, with only a few examples described in literature (Adamson et al., 2021). Animals must be healthy before they are slaughtered, which helps prevent the cases of food born illnesses related to their meat. This does not account for the common occurrences of cross contamination which lead to the detection of pathogenic bacteria on the carcasses. However, in Bosnia and Herzegovina, meat, especially Qurbani meat is traditionally cooked

for a long time at lower temperatures (Rosser et al., 2022). This means that the meat served is mostly free of all bacteria and safe for human consumption. The possibility of cross contamination during preparation indicates the need for better education of people doing the slaughter. The home slaughter of Qurbani during the Eid is a part of tradition of Bosnia and Herzegovina, but with the modern knowledge of risks related to meat and food born illnesses, traditions must evolve. The key to the survival of this type of slaughter is the education of those who are doing it on the subjects of food safety, cross contamination and proper hygienic practices.

5. Conclusıon

The food born illnesses related to Qurbani meat are relatively rare, with only a few examples described in literature (Adamson et al., 2023). Animals must be healthy before they are slaughtered, which helps prevent the cases of food born illnesses related to their meat. This does not account for the common occurrences of cross contamination which lead to the detection of pathogenic bacteria on the carcasses. However, in Bosnia and Hercegovina, meat, especially Qurbani meat is traditionally cooked for a long time at lower temperatures (Rosser et al., 2022). This means that the meat served is mostly free of all bacteria and safe for human consumption. The possibility of cross contamination during preparation indicates the need for better education of people doing the slaughter. The home slaughter of Qurbani during the Eid is a part of tradition of Bosnia and Hercegovina, but with the modern knowledge of risks related to meat and food born illnesses, traditions must evolve. The key to the survival of this type of slaughter is the education of those who are doing it on the subjects of food safety, cross contamination and proper hygienic practices.

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Mıkrobıološko stanje trupova kurbanskıh ovaca nakon kućnog klanja

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P O D A C I O R A D U

Ključne riječi:
Kurban, ovce, mikrobiološki pregled, bakterije, prevencija.

S A Ž E T A K

Sa porastom muslimanske populacije širom svijeta, neophodno je poduzeti korake da se spriječe bolesti koje se prenose hranom tokom klanja životinja na Kurban-bajrama. U Bosni i Hercegovini klanje se obavlja u ovlaštenim klaonicama, ali i kod kuće, čime se povećava rizik od kontaminacije koja može biti opasna po život, posebno za djecu, trudnice, starije i bolesne osobe. Žrtvovane životinje moraju biti dobrog zdravlja, ali rizik od patogenih bakterija je i dalje prisutan, jer se one obično nalaze na koži i u gastrointestinalnom traktu životinja. Međutim, malo je istraživanja urađeno da bi se utvrdio mikrobiološki status kurbanskog mesa. Da bi se prikupili ovi neophodni podaci i utvrdio nivo bakterijske kontaminacije, izvršeno je mikrobiološko ispitivanje ovčijih trupova ubrzo nakon kućnog klanja. Istraživanje je obavljeno u Visokom, Bosna i Hercegovina, a 30 uzoraka analizirano je na prisustvo šest različitih bakterija: Salmonella spp., Listeria spp., E. coli, Enterobacteriaceae, aerobne mezofilne bakterije i Staphylococcus spp., koristeći ISO certificirane metode. Dok salmonela nije otkrivena, a broj Enterobacteriaceae i aerobnih mezofilnih bakterija je bio u zakonski dozvoljenim granicama, detekcija Listeria spp., E. coli i Staphylococcus spp. ukazuje na potrebu detaljnijeg ispitivanja trupova nakon klanja. Da bi se osigurala sigurnost kurbanskog mesa, potrebno je više pažnje posvetiti preventivnim mjerama tokom kućnog klanja, kao i edukaciji ljudi koji obavljaju kućno klanje.