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Microbial Contamination of Horse Meat from Slaughterhouses in Jeneponto Regency

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Abstract

This research aimed to examine the microbial contamination at horse meat from traditional slaughterhouses in Jeneponto Regency to determine the quality of safe meat for human consumption. The study was conducted with a non-experimental design and observations using survey methods. Ten slaughterhouses were selected with the purposive sampling method, where meat samples were obtained and then analyzed with the total plate count method. The result showed that all samples from 10 horse slaughterhouses have more than $1x10^6$ CFU/gram, which did not meet the SNI requirements, presumed that the meat from horse slaughterhouses was not categorized as safe for consumption. This result indicated that horse slaughterhouses in this research need sanitation and design improvement, along with good slaughtering practices.

Keywords: contamination, horse, meat, slaughterhouses, total plate count

A. Introduction

The horse was bred for meat production in many countries, not only for leisure activities (Belaunzaran et al., 2015). Indonesia is no exception. In the Jeneponto Regency, South Sulawesi, where horses were deliberately raised, horse meat is popular. Its slaughtering was carried out every day in slaughterhouses in various areas. Characteristic of horse meat as described by Rossier (2003) small portion of fat around 10-14% with a significant percentage of muscle, around 70%, then intermuscular fat with smaller proportion. Horse adipose tissue distribution is different from cattle, with more internal and subcutaneous deposits. It was confirmed that the horse was an animal with lean body condition.

Lorenzo et al. (2014) reviewed that compared with other meat sources such as pork, beef, and poultry, fat and cholesterol levels in horse meat are lower (about 20% less), and n-3 fatty

acid and heme iron that relatively higher than possibly given positive impact for health. Junaid & D'hauteserre (2017) reported that besides the nutritional aspects, in Jeneponto, people consumed horse meat mostly motivated by hereditary habits and culture, and it became the icon of local cuisine.

There was 4118 horse slaughtered for consumption during 2019 (Badan Pusat Statistik Kabupaten Jeneponto, 2020). While horse slaughtering is the highest compared to other animals, it is still traditionally implemented in private slaughterhouses, with limited facilities, no proper hygiene, and uninfected controls. It leads to the risk of bacterial contamination of horse meat (Lestari et al., 2015). According to Tolistiawaty et al. (2016), one critical point in meat supply safety is slaughterhouses. In line with it, Soepranianondo & Wardhana (2019) stated that it is possible that in Indonesia, the slaughterhouses may contaminate the meat with microbes caused by workers' incompetence and disregard of hygiene protocols. Thus, microbial analysis is important to examine the microbe's contamination level in meat from slaughterhouses.

Examination by calculating the total plate count of microbes can determine the level of meat hygiene by using an indicator of the number of microorganisms that have contaminated it. The number of initial microbes in meat can increase over time and risk consumers' health (Sukmawati, 2018). This study was carried out to obtain information about microbial contamination at horse meat from traditional slaughterhouses to determine the quality of safe meat for human consumption.

B. Methodology

1. Research Design

The study was conducted in slaughterhouses with a non-experimental design (no manipulation on the variable) and observations with the survey method. Slaughterhouses were selected by the purposive sampling method. Requirements: slaughtering every day, easy access to the location, and willingness to be sampled. These requirements were needed because there are many slaughterhouses scattered in various areas in Jeneponto and some of them do not perform slaughtering every day. Ten slaughterhouses were selected, located in Balangloe, Paceko, Bontosunggu, Agang Jeune, Malolo, and Kelara, with 1-3 horses slaughtered every day.

2. The technique of Data Collection

Shortly after all slaughtering process finished around 3-6 p.m., a total of 25 grams of horses meat sample was collected in each slaughterhouse. Samples were stored aseptically in a sterile plastic bag and put in a cool box filled with ice cubes. The sample was then analyzed in Makassar Health Service Laboratory upon arrival with the Total Plate Count (TPC) method, which refers to Microba Contamination Testing Method for Meat from Standard Nasional Indonesia. Total Plate Count (TPC) is intended to show the number of microorganisms present in a product by counting bacterial colonies grown on agar media (SNI, 2008).

3. Research Instruments

The test result compared with the Requirements of Beef Microbiological Qualities according to SNI 3932: 2008 concerning Carcass and Beef Qualities. Until this research was reported, there was no availability of Horse Meat qualities standards in Indonesia. According to SNI 3932:2008, the maximum total plate count in beef was 1x106 CFU/gram.

4. The technique of Data Analysis

The result of horse meat microbial analysis in this research was descriptively analyzed by describing data collected without jumping to a general conclusion, according to Sugiyono (2019). Microbial contamination in horse meat was determined whether it meets SNI requirements for maximum TPC number or not and described the possible causes of contamination at slaughterhouses based on observations data.

C. Result and Discussion

The total plate count of horse meat from slaughterhouses was presented in Table 1. Compared with SNI 2008, all samples from 10 horse slaughterhouses have more than $1x10^6$ CFU/gram, which did not meet the SNI requirements. The lowest total plate count is 1.8×10^6 at slaughterhouse A, while the highest TPC was 8.7×10^6 at slaughterhouse F. Compared with research that was conducted by Gaznur et al. (2017) in the modern slaughterhouse, the highest TPC of beef is $5,7 \times 10^3$, which meet SNI standards. It was concluded that educated, modern slaughterhouses had hygienic conditions and activities, while traditional slaughterhouses with

no proper sanitation and personal hygiene produced contaminated meat. Research of Kim & Yim (2016) at livestock product from retail meat shops that implementing HACCP system showed that the microbiological aerobic plate count was below 10^6 CFU/gr indicated that an appropriate system that included sanitation procedures ensure a good quality product.

Table. Total Plate Count of Horse Meat from Slaughterhouses

No.	Slaughterhouses code	Total Plate Count (CFU gr^{-1})
1	A	1.8×10^6
2	B	1.0×10^7
3	C	8.4×10^6
4	D	2.1×10^7
5	E	5.7×10^7
6	F	8.7×10^7
7	G	2.0×10^7
8	H	1.4×10^7
9	I	2.5×10^7
10	J	9.1×10^6

Attractive factors of horse meat to consumers are color, tenderness, and flavors. Also, it is nutritional value characterized by high protein and low-fat content. Besides, consideration in horse meat consumption is also related to tradition, religion, access, and affordability (Balji et al., 2019). However, those qualities have no meaning without compliance with meat safety and hygiene.

As traditional slaughterhouses, inappropriate management was still applied in horse slaughterhouses in Jeneponto. There were no disinfection and proper cleaning activities at those places and the surrounding environment before and after the slaughtering process. Personnel was not equipped with gloves, masks, headgear, and other equipment needed. It was presumed involved in high TPC issues, where the slaughterhouses workers/personnel did not know proper slaughtering, hygiene procedures, along carcass and meat handling. In line with Afnabi et al. (2014), hygiene practices were applied best by slaughterhouses workers with at least primary education. Traditional slaughterhouses implemented bad hygiene practices and carcasses treatment with poor personnel management. Kuntoro et al. (2013) explained that carcass and meat quality was affected by environment conditions, slaughterhouse facilities and infrastructure, livestock condition before slaughter, slaughtering process and carcass handling, transportation process, sales process, and until meat processing. High contamination levels in slaughterhouses due to inadequate equipment sanitation and workers' hygiene could be a source of cross-contamination, affecting the final product's quality.

The building layout of horse slaughterhouses was not designed with separation of dirty and clean areas, exacerbated by the condition of the floor with holes and uneven surfaces. Horses that had been slaughtered would handle. It looked like washing, exsanguinations, skinning, evisceration, cutting at the same area on the floor. It did not have waste treatment facilities. Unavailability of the distinct area was between red offal, green offal, and horse carcass handling area. It allowed cross-contamination to occur and high TPC numbers in horse meat. These findings are similar to Haileselassie et al. (2013) in the abattoir of Mekelle, Ethiopia. There was no dividing of slaughtering, skinning, evisceration, chilling, cutting, and frozen division. According to Bakhtiary et al. (2016), bacterial contamination on carcasses samples was significantly high during the skinning dan evisceration process. It indicated the sources of contamination, which were hides and animal rectums. The condition is similar to findings of Bhandare et al. (2007) in abattoirs where the total viable count of meat in abattoirs increases (6.06±0.53 log CFU/cm^2) after the evisceration process but decrease after washing (5.13±0.58 log CFU/cm^2). Based on Bell (1997), high microbial contamination occurred at hiding removal at slaughterhouses due to direct contact with surfaces, feces, or hides. Contact between the carcass and unrinsed hands of workers would cause microbial contamination, comparable with contamination on carcass and hide contacts.

One of the major public issues from abattoirs and slaughterhouses was the inappropriate handling of meat. Sanitation and hygiene were substantial factors contributing to meat contamination at the abattoir (Ncoko et al., 2020). The high level of microbial contamination in horse meat affects the quality of the meat and is at risk of endangering consumers' health. Yunanda et al. (2020) stated that the shelf life of meat would be shorter as the total plate count

increases. Added by Jacob et al. (2015), physically and chemically, the meat would change rapidly. There were changes in color, consistency, and foul odor.

According to Stanciu (2015), consumption of horse meat is safe for humans with the provision of animal health, slaughtered in proper abattoirs, safe storing, and keeping the meat hygiene. In this study, those conditions have not been met. Therefore the horse meat safety for human consumption is still uncertain. Waldman et al. (2020) stated that Salmonella and Campylobacter easily transfer meat. Adeolu et al. (2019) explained that environmental and hygiene issues at abattoirs and the lack of meat inspection services had become a big concern of government, stakeholders, and the public. Health threat and death risks can be caused by meat with poor hygiene processing. Diseases could be caused by a lack of food hygiene, such as diarrhea that has been proven to infect children.

The initial high total plate number of the meat from slaughterhouses could escalate if not accompanied by proper meat handling and processing. During transportation to the retail, storage hygiene and condition generated higher aerobic plate counts on meat from abattoirs (Ahmad et al., 2013). Meat handling could be a solution to reduce the risk of further contamination, as described by Omer et al. (2015), who found that chilling for 24 hours reduced microbial load on the surface of carcass and the percentage of E. coli contamination; likewise, steam vacuum, and hot water surface pasteurization. In Jeneponto, horse slaughterhouses did not have proper meat and carcasses handling procedures, whereby meat was washed with water only before distribution to consumers or markets. As for meat to be transported to distant locations, it was put in a box filled with ice. It enabled a decrease in the quality of meat, both physically, chemically, and microbiologically. Personnel hygiene, slaughtering area and equipment sanitation, and slaughterhouses design correction were expected to improve horse meat quality, especially microbiologically.

D. Conclusion

Microbial contamination indicated by the total plate count of horse meat from horse slaughterhouses did not meet the SNI requirement, presumed that the meat was not categorized as safe for consumption. This result indicated that horse slaughterhouses in this research need sanitation and design improvement, along with good slaughtering practices. Possible critical points that must be considered are the time of evisceration, carcass washing, and packaging. Accordingly, in-depth investigation regarding the implementation of good slaughtering practices needs to be carried out further to determine the exact causes of the horsemeat contamination issue and which critical points most affect meat hygiene. Authorities in Jeneponto should monitor the slaughterhouses and the slaughtering process closely and regulate proper slaughtering practices.

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