



Salmonella sp. and *Staphylococcus aureus* contamination on food and hands of food handlers at Food Management Sites (TPM) Ulee Lheue Seaport

Nurliana^{1*}, Raudhah², Teuku Reza Ferasyi^{1,5}, Sugito³, Darmawi⁴, Wahyu Eka Sari^{1,5}

¹Laboratory of Veterinary Public Health, Faculty of Veterinary Medicine, Universitas Syiah Kuala, Banda Aceh

²Port Health Office, Banda Aceh

³Laboratory of Clinic, Faculty of Veterinary Medicine, Universitas Syiah Kuala, Banda Aceh

⁴Laboratory of Microbiology, Faculty of Veterinary Medicine, Universitas Syiah Kuala, Banda Aceh

⁵Center for Tropical Veterinary Studies-One Health Collaboration Center of Universitas Syiah Kuala

*Corresponding author: nurliana.nuna@unsyiah.ac.id

Abstract

This study aims to determine the presence of *Salmonella* sp. and *Staphylococcus aureus* bacteria in rendang meat, fried chicken, fried fish, and omelets, as well as in the hands of food handlers in the Food Management Place (TPM). Ulee Lheue Sea Port by using laboratory tests. The study used five samples of food and five samples of food handlers' hands taken from the Food Management Place (TPM) of Ulee Lheue Seaport. Bacterial analysis on food samples in the laboratory using the Total Plate Count (TPC) method. Meanwhile, the Replicate Organism Direct Agar Contact (RODAC) method was used to examine food handlers' hands. Laboratory tests resulted from five food samples and five food handlers' hand samples that *Salmonella* sp. was found in omelets, and *Staphylococcus aureus* was found in beef rendang, fried chicken, fried fish, omelets, and hand samples of food handlers. It is necessary to conduct hygiene and environmental sanitation counseling at TPM around Port of Ulee Lheue.

Keywords: Food, Salmonella sp., Staphylococcus aureus, Food handlers' hands

Background

Foods of animal origin, namely beef, chicken, eggs, and fish, contain high protein beneficial for human growth and health. Foods of animal origin and processed products are perishable and may contain biological, chemical, and physical substances. (Nurhayati *et al.*, 2015) The Centers for Disease Control and Prevention (CDC) reported that there were five microorganisms (the top five germs) that caused PBM in the United States, namely *Norovirus*, *Salmonella*, *Clostridium perfringens*, *Campylobacter*, and *Staphylococcus aureus* (CDC, 2020). Globally, more than 93 million PBM cases were caused by non-typhoid *Salmonella*, with 155,000 deaths annually, and 80.3 million cases were estimated to be from PBM (Tesfaw *et al.*, 2013). In 2018, there was food poisoning in Central Sulawesi, totaling 102 cases. The cause of the food poisoning was eating snacks in the form of yellow rice. Laboratory test results showed that all samples were positive for *Staphylococcus aureus* (Imanniarsari *et al.*,

2020). Port of Ulee Lheue, apart from crossing to Weh Island, is also an economic area where people make a living, including opening food stalls, restaurants, coffee shops, and cafes. Due to the many active people in the port area, the community needed to be protected from food and beverages that did not meet the requirements of hygiene and sanitation managed by the food stalls and restaurants not to endanger health (Kemenkes, 2003).

Materials and Method

Materials

This research was conducted at the TPM around Port of Ulee Lheue and the Veterinary Health Laboratory, Faculty of Veterinary Medicine, Universitas Syiah Kuala. Sample selection used the purposive sampling method, as many as five food samples and five food handlers hand samples. Food samples came from foodstuffs of animal origin, namely beef rendang, fried chicken, fried fish, and omelets. Furthermore, laboratory equipment used was a Petri dish, test tube, tube rack,

Erlenmeyer flask, micropipette, stomacher, spiritus burner, digital scale, incubator, autoclave, refrigerator, and cool box.

Methods

The method used for bacterial analysis in food samples was the Total Plate Count (TPC) method. Meanwhile, for examining food handlers' hands, the Replicate Organism Direct Agar Contact (RODAC)/ Replicate Organism Detection and Counting method used was the selective media of *Salmonella Shigella* Agar (SSA) and Mannitol Salt Agar (MSA).

Results

The research was carried out in November 2020 at the TPM seaport of Ulee Lheue. The results showed that some of the food served at TPM seaport of Ulee Lheue was contaminated by *Salmonella* sp and *Staphylococcus aureus* bacteria. The microbiological examination tests on four types of food of animal origin sold at TPM seaport of Ulee Lheue are presented in Table 1. The results of microbiological tests on four types of foodstuffs sold around the TPM seaport of Ulee Lheue showed that the processed foodstuffs contaminated with *Salmonella* sp. bacteria were omelets with a total number of bacteria, namely 2.2×10^2 CFU/g. Meanwhile, contaminated food originating from TPM outside seaport of Ulee Lheue, which was contaminated with *S. aureus* bacteria, namely beef rendang with a total number of bacteria of 4.4×10^6 CFU/g, while processed foodstuffs originating from TPM inside seaport of Ulee Lheue were contaminated with *S. aureus* bacteria, namely beef rendang, fried chicken, fried fish, and omelet with a total number of bacteria of 0.4×10^2 ; 4.3×10^3 ; 0.8×10^2 ; and 5×10^3 CFU/g (Table 1), respectively.

Based on the results of laboratory examinations, it showed that the omelet sample did not meet the requirements for consumption according to SNI 7388:2009. All food products of animal origin, such as beef, chicken, and other products must be free from contamination of *Salmonella* sp. (BSN, 2008). The presence of *Salmonella* sp. bacteria contamination in foodstuffs at

the TPM seaport of Ulee Lheue may be influenced by several factors, namely factors in food processing by food handlers, environmental sanitation factors in the processing place, and the environment of the business place as well as factors of raw materials used in food manufacture.

The results showed that the highest level of *S. aureus* bacteria contamination was beef rendang from TPM outside seaport of Ulee Lheue, with a total number of bacteria that was 4.4×10^6 CFU/g. In contrast, the food with the lowest level of contamination was beef rendang, which came from TPM in Port of Ulee Lheue with a total number of bacteria of 0.4×10^2 CFU/g. It showed that the most dominant bacteria contaminating food at TPM seaport of Ulee Lheue was *S. aureus*.

Based on observations at several TPM at seaport of Ulee Lheue, it can be seen that curtains did not cover the food sold, and also, the storefront cabinets were not appropriately used. Furthermore, the transportation to bring food from home to the business place still uses motorbikes and tricycles. Mundiatur stated that food transportation from the processing site to the storage or presentation area must receive special attention so that contamination does not occur quickly from insects, dust, or bacteria. The containers used for transportation must be clean, intact, solid, and not rusty (Mandiatur, 2015). The results of the microbiological examination on the hands of food handlers at TPM seaport of Ulee Lheue showed that they were not contaminated by *Salmonella* sp. but contaminated by *S. aureus*. In addition, all hand samples of food handlers at TPM both outside and inside Port of Ulee Lheue were contaminated with *S. aureus* on an average of 1.94 ± 0.12 log CFU/cm² (Table 2).

Discussion

The average bacterial contamination of *Staphylococcus aureus* on the hands of food handlers at TPM seaport of Ulee Lheue was higher than the report of Trindade *et al* (Trindade *et al.*, 2014), which was 1.63 ± 1.00 log CFU/cm² but slightly lower than the result reported by Lues and Van Tonder [9] which was 1.96 ± 0.02 log

CFU/cm². Rossi *et al.*, 2017 also found the presence of *S. aureus* bacteria on the hands of kitchen workers in two different schools, namely 4.0 log CFU/cm² and 2.7 logs CFU/cm², respectively. Lukman *et al.*, 1 stated that microbial contamination was < 5 CFU/cm². It could still be classified in the category of satisfactory sanitation level. Further investigation was needed if the number of microorganisms was 5-25 CFU/cm². However, if the number of microorganisms was > 25, it was classified as unsatisfactory. Then, the action was required to be taken as soon as possible. Bacterial contamination of *S. aureus* on the hands of food handlers at TPM seaport of Ulee Lheue showed hygiene and sanitation and poor food safety practices. According to Abdou *et al.*, 2019 and Trindade *et al.*, 2017 apart from the hands of food handlers, *S. aureus* bacteria contamination in food products could occur due to sneezing talking, laughing, letting hair fall into food, or using unclean clothes. According to Birawida *et al.*, 2019 gram-positive and negative bacterial contamination in food processing equipment was caused by poor personal hygiene. Rizqi *et al.* 2020, reported that the equipment storage technique used for food processing had a significant relationship with *E. coli* bacteria on the equipment (*p*-value 0.041). McIntyre *et al.* 2013, suggested that food handlers can be the primary means and source of food contamination, fast food. Soares *et al.* 2012, reported that most food handlers were contaminated with *Staphylococcus coagulase-positive*. Lee *et al.* 2017, also found that 48% of food handlers were contaminated with *Salmonella* sp (≥ 20 CFU/g) by hand. In addition to personal hygiene factors from food handlers, according to Fauzi *et al.* 2017, there is a significant effect between food hygiene and food processing with the TPC value obtained from the results of the microbiological examination. So, it can be said that the hygiene factor of food ingredients and food processing that does not meet the requirements can be one of the causes of microbial contamination. In addition, Illes *et al.* 2018, reported the presence of mesophilic aerobic bacterial

contamination in some school kitchen utensils that came into contact with food. Rohmah *et al.* 2018, reported that there was a relationship between hygiene and sanitation to bacterial contamination on food. Several factors affect the number and types of microbes contained in food, including the nature of the food (pH, humidity, and nutritional value), the environmental conditions of the food source obtained, and the conditions of processing or storage of food. The number of microbes that are too high can change the organoleptic character, resulting in changes in nutrition, nutritional value or even damage the food. Foodstuffs as ingredient can act as intermediaries or substrates for the growth of microorganisms that are pathogenic to humans (Bintis, 2017). Health and food processing have a big influence on the quality of the products served, so they need special attention. Balluka *et al.* 2015, suggested that the spread of disease through food is related to the improper practices of food handlers when serving food. Therefore, to avoid bacterial contamination of foodstuffs, it is necessary to control the dangers of microorganisms by improving personal hygiene, equipment and environmental sanitation.

Conclusion

Salmonella is found in the omelet, and *Staphylococcus aureus* is found in beef rendang, fried chicken, fried fish, omelet, and the food handler hand sample.

Conflict Of Interest

The authors declare no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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