

Case Study: Assessment of Microbial Quantification of Butchered Pork in Fresh Markets and Fresh Pork Shops in Nakhon Pathom, Thailand Activities

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ABSTRACT

In Thailand, finishing pigs are delivered to standard slaughterhouses after reaching market weight for slaughtering and carcass trimming, and are then delivered to fresh markets for consumers. For consumer safety, hygiene, and sanitation in fresh markets, measures should be taken to protect customer health, prevent unexpected foodborne diseases, and minimize economic losses. The objective of this study was to quantify the levels of microorganisms in pork chops sold at fresh markets and temperature-controlled shops in Nakhon Pathom province, Thailand. The results can be applied as guidelines for improving hygiene and sanitation in pork shops. We collected 5 samples from 2 fresh markets and 5 samples from temperature-controlled pork shops. Each sample had duplicate. The quantified microorganisms were as follows: total aerobic bacteria, coliforms, *Escherichia coli*, *Salmonella* spp., and *Staphylococcus aureus*. Unsurprisingly, some samples collected from fresh markets contained microorganisms exceeding the standard values. Similarly, certain samples from temperature-controlled pork shops also exceeded the standard. Therefore, the storage temperature at temperature-controlled pork shops has to be monitored and consistently maintained. Although cooking generally destroys most microorganisms in raw pork chops. However, one sample collected from fresh markets contained *Staph. aureus* 400 MPN/gram, can grow and produce enterotoxin at fresh markets. Enterotoxin is heat-stable, required only a low dose to cause illness, and resistant to typical cooking temperatures. We recommend strict control of enterotoxin production, *Staph. aureus* source, personal hygiene. Since temperature is considered, the main extrinsic factor influencing the growth of microorganisms in foods, The installation of temperature-controlled systems in fresh markets is one method to inhibit *Staph. aureus* growth. Due to humans as a *Staph. aureus* source, food handlers should be qualified as non-*Staph. aureus* carriers. Furthermore, because the human nasal cavity is a frequent habitat for *Staph. aureus*, food handlers must adhere to Standard Operating Procedures (SOPs), including washing hands frequently, not picking and blowing their noses.

Keywords: ACFS 6000-2004, fresh market, microbial contamination, pork retail establishments

INTRODUCTION

Most pork entrepreneur, therefore, focus on the production process, have surveillance, and maintain safety from upstream to downstream (Office of Agricultural Economics, 2022). Although there is farm biosecurity, hygiene at carcasses-trimming areas in the markets needs to be corrected. In other words, hygiene at carcass-trimming areas in the markets is improper. The good pork trimmings start from receiving live pigs for slaughter and verifying related documents. Pigs must arrive at slaughterhouses at least 2 hours before slaughter, and must not fast for more than 12 consecutive hours

(Thai Agricultural Standard 9004, 2024). Then pigs are then stunned by electric shock, cut at the main artery, and hung for 3–5 minutes to drain blood. To open pores at pork skin and facilitate hair removal, carcasses are scalded and dehaired using hot water at 60–65 °C. They are subsequently singed to eliminate remaining down and eviscerated for organ removal. After slaughter, lesions and tissue are examined. Finally, carcasses are washed and stored at 0–4 °C. During cutting and packing of pork pieces, pork must have a temperature lower than 7 °C. Also, pork must be delivered to temperature-controlled pork shops by temperature-controlled trucks. Another method of selling pork is not cutting and packing of pork pieces.

However, warm carcasses are delivered and trimmed at fresh markets.

Food safety is one of considered issues of consumers and includes the absence of microorganisms in food. Foodborne diseases cannot only be fatal, but they can also cause large economic losses. Since microorganisms are tiny, traditional pour plate or spread plate methods are alternative ways to observe living microorganisms. The advantage of spread plate method is to avoid the thermal shock to psychrophiles. Compared to spread plate method, the Most Probable Number (MPN) method is suitable for enumerating low numbers of viable microorganisms in food samples. The MPN method consists of 3, 4, or 5 inoculating replicate tubes of an appropriate liquid medium with each set prepared using three different sample dilutions. The MPN results are obtained by referring to the MPN table. Under specific circumstances, coliforms, including most strains of *Escherichia coli*, serve as indicators of fecal contamination and sanitation. In contrast, most *Salmonella* strains are recognized as human pathogens and represent a major concern in food safety. *Salmonellas* are now established as one of the most important causes of foodborne illness worldwide (Adams and Moss, 2008). Acute diarrheal disease remains a major public health issue. *Salmonella* spp. infection is one of the leading causes of acute diarrheal disease despite the preventive measures implemented (Popa and Papa, 2021).

In Thailand, *Salmonella* is a major cause of gastroenteritis in pig-based products, and we still lack information regarding sources of *Salmonella* contamination sources (Saenkankam et al., 2025). For example, a 4 years old Japanese man developed enteritis caused by *Salmonella* serovar Kedougou without bacteremia after returning from Chiang Mai, Thailand (Okumura et al., 2025). Due to *Staph. aureus* enterotoxin production is relatively mild and short-lived type of illness, staphylococcal food poisoning is perhaps more likely to be under-reported than others. However, *Staph. aureus* still causes foodborne outbreaks and cross-contamination in Thailand. As reported, one survey found *Staph. aureus* contamination in 110 pork samples from 12 fresh meat markets in Nongchok District, Bangkok, Thailand (Kanungpean et al., 2021).

The number of registered and operating pig slaughterhouses in Thailand is approximately 1,546. Most of them are located in Central Thailand. Nakhon Pathom Province has 17 licensed pig slaughterhouses and pork processing plants in several districts such as Mueang Nakhon Pathom, Kamphaeng Saen, Bang Len, and Sam Phran

(Nakhon Pathom Provincial Statistical Office, 2025). For pork production in Nakhon Pathom Province, living pigs from farms meeting Good Agricultural Practices (GAP) standards are delivered to slaughterhouses. Finally, carcasses are cut in half and trimming in Good Manufacturing Practice (GMP) certified cutting factories. Pork is sold at temperature-controlled pork shops.

In the metropolitan area, Nakhon Pathom Province is considered the largest pork market in the Central and Western regions (Nakhon Pathom Provincial Office of Agriculture and Cooperatives, 2019). Nakhon Pathom Province has certified under Good Manufacturing Practices (GMP) pig slaughterhouses, cutting plants, and producers selling pork at large fresh markets such as Thung Phra Meru Market and Sriwichai Market. Although many fresh markets are located in Nakhon Pathom Province, there is a lack of hygienic data on pork sold at these markets.

The objective of this study was to quantify microorganism amounts in pork chops sold in fresh markets and temperature-controlled pork shops in Nakhon Pathom Province, Thailand. The results in this study show that hygiene and sanitation at fresh markets and temperature-controlled pork shops had to be corrected. Particular concern is given to *Staph. aureus*, as it produces heat-resistant enterotoxins. Chill temperature, qualified food handlers as non-*Staph. aureus* carriers, and good personal hygiene are the *Staph. aureus* controlling methods in pork chops.

MATERIALS AND METHODS

This study is quantitative data research. The data will be used to develop guidelines for good hygiene practices for food handlers at both fresh markets and temperature-controlled pork shops, with the ultimate goal of enhancing food safety standards.

Pork samples at Thung Phra Meru Market and Sriwichai Market

Duplicate pork samples were collected from five fresh pork shops located at Thung Phra Meru Market and Sriwichai Market between 07:00 and 13:00 (Figure 1). Each sample consisted of 300 g of pork sirloin. All samples were aseptically packed into sterile, sealed plastic bags and transported under refrigerated conditions (≤ 4 °C), as summarized in Table 1. Microbiological quality analyses were performed, and results were evaluated in accordance with the National Bureau of Agricultural Commodity and Food Standards 6000-2004.

Pork samples collected from temperature-controlled pork shops at Mueang Nakhon Pathom District

Pork samples were also collected from five temperature-controlled pork shops in Mueang Nakhon Pathom District during the same sampling period (07:00–13:00) (Figure 2). Each sample consisted of 300 g of pork sirloin and was collected

in duplicate. Samples were aseptically packaged in sterile, sealed plastic bags and transported at temperatures not exceeding 4 °C (Table 1). Microbiological analyses were conducted, and the results were assessed according to the National Bureau of Agricultural Commodity and Food Standards 6000-2004.



Figure 1. Pork chops sold at Thung Phra Meru Market (a) and Sriwichai Market (b).



Figure 2. Pork chops sold at temperature-controlled pork shops in Mueang Nakhon Pathom District

Table 1. Sources of pork chops collected from fresh markets and temperature-controlled pork shops.

The type of selling pork chops	Sources of selling pork chops	Sample code	
Fresh markets	Thung Phra Meru Market (L-1)	L-1-1 L-1-2	
	Thung Phra Meru Market (L-2)	L-2-1 L-2-2	
	Thung Phra Meru Market (L-3)	L-3-1 L-3-2	
	Sriwichai Market (L-4)	L-4-1 L-4-2	
	Sriwichai Market (L-5)	L-5-1 L-5-2	
	Temperature-controlled pork shops	LG shop (S-1)	S-1-1 S-1-2
		BC shop (S-2)	S-2-1 S-2-2
		BG shop (S-3)	S-3-1 S-3-2
		CM shop (S-4)	S-4-1 S-4-2
		SM shop (S-5)	S-5-1 S-5-2

The tools used in this study

All samples were carried out by the Veterinary Research and Development Center (Western Region), Department of Livestock Development, Ministry of Agriculture and Cooperatives. Each sample was analyzed in duplicate for Total aerobic bacteria, coliforms, *E. coli*, *Salmonella spp.*, and *Staph. aureus* were quantified using AOAC (2000) Official Method 966.23C, AOAC (2000) Official Method 966.24, AOAC (2000) Official Method 967.26, and AOAC (2000) Official Method 975.55, as summarized in Table 2. The means were reported and compared with the National Bureau of Agricultural Commodity and Food Standards 6000-2004.

Statistical analysis

All data were analyzed for One-sample t-test to determine whether the observed mean values of microbial counts significantly deviated from the established limits set by the National Bureau of Agricultural Commodity and Food Standards (TAS 6000-2004). Statistical significance was evaluated at a confidence level of 95% ($p < 0.05$).

RESULTS AND DISCUSSION

Fresh markets selling pork and temperature-controlled pork shops are regularly monitored and are surveillance from government agencies. In order to improve good pig carcass management in fresh markets and temperature-controlled pork shops in Nakhon Pathom Province, we required microorganism analysis of pork samples. Food safety means not only slaughterhouse standards but also pork sold at both fresh pork shops and temperature-controlled pork shops. According to National Bureau of Agricultural Commodity and Food Standards 6000-2004, microorganism analysis includes total aerobic bacteria, coliforms, *E. coli*, *Salmonella spp.*, and *Staph. aureus*. Table 2 presents the microorganism amounts detected in all pork samples and Livestock Products Standards (Department of Livestock Development, Ministry of Agriculture and Cooperatives).

Table 2. The average of microorganism amounts found in pork chops collected from fresh markets and temperature-controlled pork shops

Microorganism	The quantified microorganism amounts		Standard ¹
	Fresh markets	Temperature-controlled pork shops	TACFS. 6000-2004
Total aerobic bacteria	6.10x10 ⁵ (2/5) ²	4.13x10 ⁴ (0/5)	≤5x10 ⁵ cfu/gram
Coliforms	9.50x10 ³ (3/5)	2.77x10 ² (0/5)	≤5x10 ³ MPN/ gram
<i>E. coli</i>	8.52x10 ³ (3/5)	6.10x10 ¹ (1/5)	≤10 ² cfu/ gram
<i>Salmonella</i> spp.	All detected	detected	Undetected in 25 grams of sample
<i>Staph. aureus</i>	55 (1/5)	10 (0/5)	≤10 ² MPN/ gram

¹Reference: Department of Livestock Development, Ministry of Agriculture and Cooperatives. 2008.

²The numbers in parenthesis show the numbers of pork chops having microorganisms exceeded the standard.

Total aerobic bacteria

Based on Livestock and Livestock Products Standards (Department of Livestock Development, Ministry of Agriculture and Cooperatives), total aerobic bacteria should not be than 5x10⁵ cfu/gram. Here, the findings show that two out of five pork samples collected from fresh pork shops at Thung Phra Meru Market and Sriwichai Market had total aerobic bacteria exceed than Livestock and Livestock Products Standards. Total aerobic bacterial amounts in the two samples were 1.1x10⁶ and 3.1x10⁶ cfu/gram. On the other hand, all samples collected from temperature-controlled pork shops at Mueang Nakhon Pathom District had total aerobic bacteria less than Livestock and Livestock Products Standards.

Coliforms

According to Livestock and Livestock Products Standards (Department of Livestock Development, Ministry of Agriculture and Cooperatives), coliforms in pork sample should be less than 5x10³ MPN/gram. Three out of five pork samples collected from fresh pork shops at Thung Phra Meru Market and Sriwichai Market had coliforms exceed than 5x10³ MPN/gram. Coliforms in the three samples were 9.2x10³, 1.5x10⁴, and 7x10⁴ MPN/gram. Unlike pork samples collected from fresh pork shops at Thung Phra Meru Market and Sriwichai Market, none sample gathering from temperature-controlled pork shops at Mueang Nakhon Pathom District had coliforms exceed than 5x10³ MPN/gram.

E. coli

Pork should match with Livestock and Livestock Products Standards (Department of Livestock Development, Ministry of Agriculture and Cooperatives), so pork chops should have *E. coli* less than 100 cfu/gram. Three out of five pork samples collected from pork fresh shops at Thung Phra Meru Market and Sriwichai Market had *E. coli* less than 100 cfu/gram. *E. coli* in three pork chops were 1.3x10², 1.5x10⁴, 7x10⁴ cfu/gram. Surprisingly, one out of five pork samples collected from temperature-controlled pork shops at Mueang Nakhon Pathom District having *E. coli* exceed than 100 cfu/gram. The number of *E. coli* in pork samples collected from temperature-controlled pork shops at Mueang Nakhon Pathom District was 4.6x10¹ cfu/gram.

Salmonella spp.

Unlike other Livestock and Livestock Products Standards, *Salmonella* spp. should not be found in 25-gram sample. The results demonstrate that the numbers of 25-gram samples collected from fresh pork shops in Thung Phra Meru Market and Sriwichai Market and temperature-controlled pork shops in Mueang Nakhon Pathom District having *Salmonella* spp. were five and three, respectively. In other words, the percentages of pork samples collected from fresh pork shops in Thung Phra Meru Market and Sriwichai Market and temperature-controlled pork shops in Mueang Nakhon Pathom District having *Salmonella* spp. were 100 and 60, respectively.

Staph. aureus

According to Livestock and Livestock Products Standards (Department of Livestock Development, Ministry of Agriculture and Cooperatives), pork should have *Staph. aureus* less than 100 MPN/gram. Although the mean MPN/gram of *Staph. aureus* found in five pork samples collected from fresh pork shops in Thung Phra Meru Market and Sriwichai Market was 55, the MPN/gram of *Staph. aureus* in one pork sample was 400. In contrast, none pork sample collected from temperature-controlled pork shops in Mueang Nakhon Pathom District had *Staph. aureus* exceed than 100 MPN/gram.

In this study, we quantified microorganism amounts of total aerobic bacteria, coliforms, *E. coli*, *Salmonella* spp., and *Staph. aureus* for improving hygiene of pork-selling shops and food handlers to match Livestock and Livestock Products Standards (Department of Livestock Development, Ministry of Agriculture and Cooperatives). Generally, poor hygiene is originated from dust, insects, dirt, storage temperature abuse, and cross-contamination such as knives and cutting boards. Pork selling shops should be monitored microbial inspection regularly. If pork selling shops have cleaning systems, hygiene controlling systems according to standards, cold rooms with proper temperature control, clearly separated areas, the shops can certify and comply selling pork with food safety standards.

In this study, we compared microorganism amounts between pork samples collected from Thung Phra Meru Market and Sriwichai Market with temperature-controlled pork shops located in Mueang Nakhon Pathom District. The results clearly show that pork sold at Thung Phra Meru Market and Sriwichai Market had higher food safety risks, compared to pork sold in temperature-controlled pork shops in Mueang Nakhon Pathom District. Many pork chop samples show the numbers of microorganisms including total aerobic bacteria, coliforms, *E. coli*, *Salmonella* spp., and *Staph. aureus* exceeding than Livestock and Livestock Products Standards (Department of Livestock Development, Ministry of Agriculture and Cooperatives). Therefore, it is necessary to improve hygiene of the involved personal hygiene, trimming areas, equipment used for trimming such as knives and cutting boards, transportation, storage temperature in fresh markets to meet standards similar to certified slaughterhouses to enhance food safety, reduce the risks of foodborne diseases, and protect consumer health. Pork shops should meet standards, have

strictly control system in order to get food safety and high-quality pork (Sangthongpinij, 2022).

Temperature is the primary extrinsic factor affecting the growth and survival of microorganisms in foods, and most pathogens multiply rapidly between 4 and 60 °C (Erkmen *et al.*, 2014). Temperature-controlled system requires higher cost, so fresh markets do not have this system in order to sell inexpensive pork chops. Based on the survey of microorganism contamination in pork sold at fresh market and temperature-controlled pork shops in Nakhon Pathom Province, most pork samples collected from fresh markets had microorganism contamination exceed than Livestock and Livestock Products Standards, compared to pork sold in temperature-controlled pork shops. Unsurprisingly, the normal temperature of Thailand is 27 °C due to one of tropical countries. The optimal temperature of these microorganisms is 30-40 °C, so they grow quickly at fresh markets.

Generally, coliforms are recognized as the indicator of sanitation. According to coliforms survey, fresh markets and temperature-controlled pork shops needed to improve personal hygiene and sanitation. Also, storage temperature at both places had to be corrected. Most salmonellas are regarded as human pathogens and are one of the most important causes of foodborne illness worldwide. In addition to foodborne pathogens, some strains are originated from pigs such as *S. enterica*. *Salmonella* spp. can grow from temperatures just above 5.1 up to 47.1 °C. The results show that most temperature-controlled pork shops at Mueang Nakhon Pathom District did not chill enough to control *Salmonella* spp. growth. Finally, the principal habitat of the *staphylococci* is the skin, skin glands and the mucous membranes of warm-blooded animals, for example pigs. Also, about 30–50% of healthy people carry out *Staph. aureus* in their nose and nasal cavity (Erkmen and Bozoglu, 2016). Although *Staph. aureus* associated-outbreaks were less than *Salmonella* spp., *Staph. aureus* requiring only 4 hours at warm temperature produces heat-stable enterotoxin, and only 10 ng toxin per gram of contaminated food is sufficient to cause symptom. (Seo and Bohach, 2014) (Adams, A.R. and Moss, M.O., 2008) In addition to low dose of heat-stable enterotoxin production, normal cooking temperature of foods cannot destroy Staphylococcal enterotoxin (Erkmen and Bozoglu, 2016).

Based on this study, the following recommendations are proposed as guidelines for managing pork carcass fabrication in fresh markets and temperature-controlled pork shops:

1.) Good sanitation plays a critical role in eliminating microbial reservoirs and preventing cross-contamination throughout the supply chain. Aligning with Thailand's Food Management Strategy (National Food Committee, 2017), retailers must prioritize consumer safety by implementing rigorous cleaning protocols for equipment and food-contact surfaces. Furthermore, establishing adequate infrastructure for hand and tool washing, alongside systematic waste management, is essential for maintaining the microbiological quality of pork products.

2.) Personal hygiene and food handlers are a primary vector for pathogens including *Staphylococcus aureus* (Erkmen, and Bozoglu, 2016). stringent personal hygiene is imperative. Handlers should undergo mandatory annual physical examinations to ensure they are not asymptomatic carriers. Additionally, the consistent use of protective gear and the avoidance of high-risk behaviors, such as unprotected coughing or wearing jewelry during operation, must be strictly enforced.

3.) Chill storage refers to the preservation of food, particularly fresh pork, at temperatures between 0–5 °C (Adams and Moss, 2008). Traditional fresh markets in Thailand generally lack the infrastructure required for temperature maintenance. To sustain temperatures below 5 °C, these markets must install temperature-control systems. Furthermore, temperature-controlled pork retail shops should strictly monitor and calibrate their storage temperatures, as microbial loads in some samples were found to exceed established safety standards.

4.) Standard Operating Procedures (SOPs) and Sanitation Standard Operating Procedures (SSOPs) should be formalized to ensure continuous sanitary conditions. These protocols must encompass comprehensive hand-washing techniques, the use of complete protective attire (hairnets, masks, and disinfected boots), and the systematic cleaning and storage of equipment after each use to mitigate contamination risks. (Adams and Moss, 2008).

5.) Hazard Analysis and Critical Control Points (HACCP) is a systematic approach designed to ensure food safety. By identifying potential hazards during production and distribution, establishing preventive parameters, and validating corrective actions, stakeholders can manage safety risks more effectively than through end-product testing alone (Buchanan and Williams, 2014).

Conclusions

The microorganism amounts in pork chops sold at fresh markets and temperature-controlled pork shops have to be monitored regularly since some samples did not match with the standard. Due to warm temperature at fresh markets in Thailand, microorganisms can grow rapidly and some of them are foodborne pathogens. We concerned *Staph. aureus* since it can produce heat-stable enterotoxin and healthy human can be the *Staph. aureus* carriers. We suggest to install the temperature-controlled system at fresh markets. Food handlers should be qualified as non- *Staph. aureus* carriers, have annual physical exam, and follow Standard Operating Procedure (SOP) such as wash hands frequently, not pick and blow their noses.

References

- Adams, A.R. and Moss, M.O. 2008. Food Microbiology, 3rd Edition, RSC Publishing, Cambridge, U.K. ISBN 978-0-85404-284-5.
- AOAC International. 2000. Official Method 966.23C. In Official Methods of Analysis of AOAC International (17th ed.). AOAC International, Gaithersburg, MD, USA.
- AOAC International. 2000. Official Method 966.24. In Official Methods of Analysis of AOAC International (17th ed.). AOAC International, Gaithersburg, MD, USA.
- AOAC International. 2000. Official Method 967.26. In Official Methods of Analysis of AOAC International (17th ed.). AOAC International, Gaithersburg, MD, USA.
- AOAC International. 2000. Official Method 975.55. In Official Methods of Analysis of AOAC International (17th ed.). AOAC International, Gaithersburg, MD, USA.
- Buchanan, R.L., and Williams, E.N. 2014. Chapter 42: Hazard analysis and critical control point system: Use in managing microbiological food safety risks. pages 1039-1077. In Food Microbiology: Fundamentals and Frontiers. 4th Ed. Doyle, M.P. and Buchanan, R.L. (Eds.) ASM Press. Washington, D.C ISBN-13: 978-1-55581-626-1
- Erkmen, O., and Bozoglu, T.F. 2016. Food microbiology: Principles into practice. Volume1: Microorganisms related to foods, foodborne diseases, and food spoilage. John Wiley & Sons, Ltd. West Sussex, U. K. ISBN 978-1-119-23776-1
- Honikel, K. O. 1993. Quality of fresh pork-review. In: Pork quality: genetic and Metabolism factors. CAB international, Wallingford, UK.: 201-216.
- Kanungpean, D., Takai, S., and Kakuda, T. 2021. Contamination and antimicrobial susceptibility testing of *Staphylococcus aureus* isolated from pork in fresh markets, Nongchok District, Thailand. Veterinary Medicine International. Article ID: 6646846 <https://doi.org/10.1155/2021/6646846>
- Montville, T.J., and Matthews, K.R. 2014. Chapter 1: Physiology, growth, and inhibition of microbes in foods. in Food Microbiology: Fundamentals and Frontiers.

- Nakhon Pathom Provincial Office of Agriculture and Cooperatives. 2019. Nakhon Pathom Provincial Office of Agriculture and Cooperatives. 2019. Data for planning the development of agricultural products (pigs). Retrieved from <https://www.ops.moac.go.th/nakhonpathom-dwl-files-411691791809>
- Nakhon Pathom Provincial Statistical Office. 2025. Nakhon Pathom Provincial Statistical Office. Number of animals permitted for slaughter as food. Retrieved from https://nakhonpathom.gdcatalog.go.th/dataset/dld-dld_sh
- National Bureau of Agricultural Commodity and Food Standards. 2004. Thai agricultural standard TAS 6000-2004: Pork. Ministry of Agriculture and Cooperatives, Thailand.
- National Food Committee. 2017. The Second Strategic Framework for Food Management in Thailand, 2017–2036. Announced on August 11, 2017. Retrieved from <https://extranet.who.int/ncdccc/data/TheSecondStrategicFrameworkforFoodManagementinThailand.pdf>
- Office of Agricultural Economics. 2022. The swine raisers association of Thailand. <https://www.url-of-the-document.com>
- Okumura, N., Yamamoto, R., Akazawa-Kai, N., Tsuge, K., Ohkusu, M., Ishiwada, N., and Itoh, N. 2025. Bacterial enteritis caused by *Salmonella Kedougou* after returning from Thailand: A case report. *Journal of Infection and Chemotherapy*. 31 (4): 102625. <https://doi.org/10.1016/j.jiac.2025.102625>
- Popa, G.L. and Papa, M.L. 2021. *Salmonella* spp. infection - a continuous threat worldwide. *Germs*. 11(1):88–96. doi: 10.18683/germs.2021.1244
- Saenkankam, I., Apiwatsiri, P., Supimon, N., Pachanon, R., Hampson, D.J., and Prapasarakul, N. 2025. Comparative analysis of *Salmonella* contamination in pork slaughtering facilities: Implications for food safety. *Food Control*. 167: 110793. <https://doi.org/10.1016/j.foodcont.2024.110793>
- Sangthongpinij, C. 2022. Food microbiology. Department of Veterinary Public Health, Kasetsart University. pages 3-18. 4th Ed. Doyle, M.P. and Buchanan, R.L. (Eds.) ASM Press. Washington, D.C. ISBN-13: 978-1-55581-626-1
- Seo, K.S., and Bohach, G.A. 2014. *Staphylococcus aureus*. In *Food Microbiology: Fundamentals and Frontiers*. pages 547-573. 4th Ed. Doyle, M.P. and Buchanan, R.L.(Eds.) ASM Press. Washington, D.C. <https://doi.org/10.1128/9781555818463.ch16>