

Chapter 1: Introduction

1.1 Background of the Study

Indonesia is a maritime country with a massive potential for marine resources, owing to its 80,000 kilometers of coastline. Among the many resources besides fish are bivalves or more known as clams. Bivalves embed themselves into the seabed soil and filter feeds from the surrounding water (Dame, 2012). Filter-feeding of bivalves allows a high potential to accumulate many types of pollutants and harmful pathogenic bacteria, such as *Vibrio* sp. (Destoumieux-Garzón, 2020). The Indonesian Ministry of Fisheries released data in 2011 on the production of clam-type commodities at around 50.000 to 55.000 tons per year (SIDATIK, 2021). The main motive for the cultivation of clams is their nutritional content, especially protein (Kartika, 2014). A popular clam species consumed among Indonesians is the blood cockle (*Anadara gradosa*) (Devi, 2019).

Seaside culinary restaurants are a common way for the consumption of blood cockles. This method is popular because of the desire to get the cockle as fresh as possible. One such place with that description in Jakarta is Pasar Ikan Muara Baru. Pasar Ikan Muara Baru was renovated from late 2018 to 2019 and officialized in 2020 by the Indonesian government. The market took inspiration from other Asian countries with similar facilities. The modernization of the old market added a food court area located on the second floor. Customers generally bring their purchased seafood from the market to the food court to be directly cooked and consumed. Due to its new status, no studies were made on the food safety aspects of seafood sold in that market. The lack of proper food storage procedures observed in the selling area showed a possible increased risk of food contamination (*Appendix 1*). Thus, there is a need to test the food safety of the blood cockle sold in Pasar Ikan Muara Baru.

Vibrio bacteria are indigenous in coastal marine environments. Their obligate requirement of sodium ions allows this bacterial species to grow abundantly in both marine and brackish waters (USFDA, 2004). This requirement of salt places the bacteria as a member of the halophilic bacteria group (USFDA, 2004). *Vibrio* sp. is characterized as a gram-negative, rod-shaped, motile with single

polar flagellum bacteria. The bacteria can produce catalase and ferment glucose with no gas by-products (USFDA, 2004). *Vibrio sp.* of various kind accounts for 75% of seafood-related food-borne disease cases, with one notable species being *Vibrio cholerae* accounting for 43% of those cases (USFDA, 2004; Scallan, 2011; Wright, 2018). Studies on *Vibrio sp.* detection in Jakarta waters and markets are limited, as most studies focused on areas outside of Jakarta, such as Yogyakarta, Kalimantan, and Sulawesi (Ihsan, 2017; Devi, 2019; Suliyarningsih, Zainul, & Ismunanti, 2020). The occurrence of gastrointestinal disease outbreaks caused by *V. cholerae* has been previously studied in North Jakarta by Lesmana and his colleagues in 2001 and 2002. The study found that the most probable cause of the outbreak was the unsanitary conditions of the housing area but suggested that exposure to contaminated seafood could also be a cause in several cases studied. Regulation from Indonesia's Food and Drug Administration (BPOM) number HK.00.06.1.52.4011 in 2009 stated the limit of *Vibrio cholerae* within mollusks, crustaceans, and Echinodermata to be negative per 25 grams of raw or cooked seafood.

Vibrio cholerae is a known heat-labile bacterium, but some studies suggested that the bacteria have increased survival against high temperatures. The bacteria can survive on the surface of mollusk shells for up to 7 minutes at 65°C once it has established a colony (Castro-Rosas & Escartin, 2005). Cooking time is also as essential as the cooking temperature factor. A research discovered that *Vibrio cholerae* survived boiling at less than 10 minutes or steamed at less than 30 minutes (Rabbani & Greenough III, 1999). When exposed to low temperatures, such as cold food storage, *Vibrio cholerae* adapts itself by entering a state of viable but non-culturable (VBNC). This state allows the bacteria to survive for a few weeks up to a few months at refrigeration (4°C) and frozen (-20°C) temperatures within seafood (Waturangi, 2015).

The spread of seafood handling knowledge could be insufficient (Yamamoto, 2008). Proper knowledge of seafood handling, including proper cooking and storage, may not be educated enough for those working in retail or cooking at home (Yamamoto, 2008). This lack of knowledge shows the importance of assessing the food safety of raw and cooked seafood products sold in Pasar Ikan Muara

Baru. Assessment is crucial to prevent the potential spread of *Vibrio cholerae* cases in the area due to its popularity.

1.2 Statement of the Problem

Based on the background of the study, the following problems were formulated:

1. How is the presence of *V. cholerae* within raw and cooked blood cockle sold in Pasar Ikan Muara Baru?
2. Will the cooking process in the food court sufficient to eliminate halophilic bacteria inside the blood cockle bought from the market?

1.3 Objectives of the Study

Based on the research problems, the objectives of this study are:

1. To isolate *Vibrio cholerae* from cooked and raw sample in Pasar Ikan Muara Baru.
2. To evaluate the food safety in food court in Pasar Ikan Muara Baru to eliminate halophilic bacteria form the blood cockle sample.

1.4 Hypotheses

The hypotheses in this study are:

1. Null hypotheses (H₀)
 - a. Cooking does not cause significant changes in the presence of halophilic bacteria within cooked blood cockle sold in Pasar Ikan Muara Baru.
 - b. There is no presence of *Vibrio cholerae* within raw and cooked blood cockle sold in Pasar Ikan Muara Baru.
2. Alternative hypotheses (H_a)

- a. Cooking significantly decreases the presence of halophilic bacteria within cooked blood cockle sold in Pasar Ikan Muara Baru.
- b. There is a presence of *Vibrio cholerae* within raw and cooked blood cockle sold in Pasar Ikan Muara Baru.

1.5 Significance of the Study

Based on the research problems, the significance of this study are:

1. **The Body of Knowledge**, through information regarding the presence of *Vibrio cholerae*, within seafood sold in Jakarta and could be used as literature for future research in food safety in Indonesia.
2. **Academia**, through findings of pathogenic bacteria presence in Pasar Ikan Muara Baru and to open new doors for research into methods of improvement of food safety in Indonesian fish markets.
3. **Society**, through information regarding the safety of products sold in the market, whether raw or cooked directly in the food court area, which could raise awareness on the importance of proper food handling.

1.6 Scope and Limitation of the Study

The type of clams used in this study was raw blood cockles sold in Pasar Ikan Muara Baru. The cooked samples originated from raw batches purchased from the market were handed over to the nearby food court to be cooked. The requested dish was a with a basic dish of clams and white garlic that is stir-fried. The detection of *Vibrio cholerae* only extended to an estimation of total viable colonies, salt tolerance test, gram staining, and a biochemical test series through API20E and catalase test. The API20E itself, being only a biochemical test, could only produce a presumptive identification of the bacteria species. The limitations encountered in this study were the inability to take specific measurements of cooking parameters which include temperature, salt usage, water usage, specific

identification of additional ingredients, and cooking time. Other limitations were related to time and budget, which prevented the writer from using a more precise identification method through PCR and sequencing. Measurements of humidity and temperature during sampling were conducted as additional supporting data.