Chapter 1

Introduction

1.1 Background

Regulations concerning food sanitation remain a critical issue in developing countries like Indonesia, where food can easily transmit pathogens, leading to foodborne diseases (Muna and Khariri, 2020). Foodborne disease, or ilness is a disorder caused by the ingestion of food and/or beverages that has been contaminated with bacteria, viruses, or parasites. These harmful organisms would then reproduce in the human body and trigger infection. Even with the renowned advancement in the medical world, the number of foodborne diseases is still at a high level, with about 600,000,000 cases and 420,000 deaths annually (World Health Organization, 2022). In Indonesia itself, based on the latest data gathered by Indonesia's Ministry of Health, the prevalence of Indonesian people contracting diarrhea due to foodborne illnesses is 8%, or roughly one in twelve people (Indonesia Ministry of Health, 2018). Though the pathogens that cause foodborne illnesses are many, some pathogens are particularly concerning. The first one is *Salmonella typhimurium,* which is the most common strain of Salmonella that causes acute gastroenteritis, while it is a self-limiting infection, children and immunocompromised people are still at a very high risk. There is also EHEC, which poses severe long-term health risks, including kidney failure and other complications (Rizki et al., 2022; Joseph et al., 2020). The persistence of foodborne diseases bringing these health threats accentuates the need to urgently enhance food safety regulations and practices.

To do this, the things that need to be improved will be the screening of foodborne pathogens (Singh & Puniya, 2024). The current method of detection that is commonly used right now is Polymerase Chain Reaction (PCR), which provides an exceptionally sensitive and accurate result. However, it has its drawback, which is the need for specific equipment and a high

price tag (Jayamohan et al., 2021). Due to this, it has some room for improvement, possibly in finding a better method as the golden standard. One promising method of detection is the improvement and optimization of the Loop-mediated Isothermal Amplification (LAMP). LAMP is a molecular biology technique that allows for specific and sensitive DNA amplification, enabling it to detect pathogens with a very high effectivity (Yang et al., 2024). Compared to the widely used and current golden standard of detection; Polymerase Chain Reaction (PCR), LAMP offers advantages in terms of time efficiency, labor requirements, material costs, and reduced contamination risk during testing (Soroka et al., 2021).

By integrating LAMP into food safety protocols, we can significantly improve early detection of foodborne pathogens (Gao et al., 2024). This proactive measure not only addresses existing gaps in food safety but also aligns with broader efforts to modernize food safety systems in developing countries. Enhanced regulations and innovative detection methods are essential for safeguarding public health and ensuring food security in regions vulnerable to foodborne illnesses (Kumar et al., 2024). Furthermore, adopting LAMP could lead to increased consumer confidence in food products, ultimately fostering economic growth in the agricultural sector by reducing the burden of foodborne diseases on healthcare systems (Zhang et al., 2025).

In addition to its applications in food safety, LAMP's versatility extends to medical diagnostics, where it can provide timely and accurate diagnoses of pathogenic infections (Wang et al., 2023). This dual applicability highlights its potential as a transformative tool not only for improving public health outcomes but also for enhancing overall community resilience against infectious diseases. As we move forward, investing in research and development of such innovative technologies will be crucial for addressing the challenges posed by foodborne pathogens and ensuring a healthier future for populations at risk (McClements et al., 2021).

1.2 Objective

The objective of this study is to development a LAMP reaction for efficient Detection of *Salmonella typhimurium* and *Enterohemorrhagic Escherichia coli* virulent genes by optimizing the reaction using different time and temperature, testing the sensitivity and specificity of the designed primer by using both colorimetric and non-colorimetric LAMP assay.

1.3 Hypothesis

This study will be able to develop and optimize an LAMP reaction for efficient Detection of *Salmonella typhimurium* and *Enterohemorrhagic Escherichia coli* virulent genes.