

Chapter 1

Introduction

1.1. Background

Noodles are considered as traditional food staples in Asia and are starting to be popular in countries outside Asian region (Bhise *et al.*, 2014; Niu & Hou, 2020). In Middle Eastern countries, consumption of noodles and similar products is very high (Çabuk & Yılmaz, 2020). There are two common types of noodles which are white salted and alkaline noodles (Weng *et al.*, 2020). The short time preparation as well as its low cost and can be stored for a long time make noodles a good vehicle for nutrition supplements incorporation, such as protein incorporation (Nilusha *et al.*, 2019; Çabuk & Yılmaz, 2020). Three basic ingredients of noodle are wheat flour, water, and salt (Cato & Li, 2020). However, wheat flour is generally high in carbohydrates but low in protein as well as other nutrients (Nilusha *et al.*, 2019). Thus, protein enrichment of noodles by the usage of various high-protein ingredients to increase its nutritional properties has become very common recently (Çabuk & Yılmaz, 2020). Generally, noodles contain protein only around 11 - 15% per dry basis (Mahmoud *et al.*, 2012). Soybeans, shrimp protein powder, or fish powder are the examples of ingredients used to increase protein in noodles or other pasta products (Nilusha *et al.*, 2019). The protein enrichment is done because protein is an important macronutrient in the human diet. Protein provides the required amino acids that support growth and body maintenance and the recent protein requirement for adults is around 0.8 grams per kilogram body weight (van der Zanden *et al.*, 2014; El-Sohaimy *et al.*, 2020).

Food enrichment, in this study is protein, is done to restore the lost nutrients due to processing, handling, or storage. The aim of enrichment is to prevent deficiency of nutrients in specific populations or general populations (Mannar & Khan, 2016). In several studies, adding protein to food from other protein sources is called protein enrichment (Storck *et al.*, 2013; Beelen *et al.*, 2016; Phongthai *et al.*, 2017). The increase in protein content inside the food could make the food to be able to be claimed as high protein or protein-source food. However, the claiming of the food should follow

the regulation from the official regulatory bodies, such as *Badan Pengawas Obat dan Makanan* (BPOM), European Union (EU), and FDA regulation.

In a recent study, insects are also used to produce flour, energy bars, and many more due to its balanced amino acid profile. Current research is also focusing on applying insects to fortify foods like bread, cookies, or pasta to increase their nutritional value (Melgar-Lalanne *et al.*, 2019). Insects also contain lysine, tryptophan, and threonine and are also high in iron, zinc, calcium, and biotin (Dobermann *et al.*, 2017; Lee *et al.*, 2020). Cricket is one of the insects that have been widely sold (Melgar-Lalanne *et al.*, 2019). House cricket (*Acheta domesticus*) contains protein around 64.4 - 73.6 grams/100 grams of dry matter (Bessa *et al.*, 2020). Besides cricket powder, another possible ingredient for protein enrichment in noodles is nutritional yeast. Nutritional yeast is produced from *S. cerevisiae* that has been killed by heating to produce nutritive ingredients (Jach & Serefko, 2018). Inactive yeast can be added to food to enhance the taste of the final product (Stam *et al.*, 1998) or to improve flavor in food processing only (Halász & Lásztity, 1991). *S. cerevisiae* is rich in protein, peptides, and vitamin B₁₂ (Jach & Serefko, 2018). It is used in bread production as the main leavening agent (Struyf *et al.*, 2017). Nutritional yeast contains 55.56 grams of protein per 100 grams (USDA, 2019).

Based on the aforementioned information, protein enrichment by adding cricket powder and nutritional yeast in noodles is possible and may help to produce noodles that can be claimed as protein source or high protein food. Nonetheless, in pasta, additives that are rich in protein can cause changes in culinary traits (cooking quality) (Duda *et al.*, 2019), which are indicated by Water Absorption Capacity (WAC), Swelling Index (SI), Cooking Loss (CL). The addition of cricket powder and nutritional yeast may also affect the color of the noodle which is also the other important physicochemical properties of the noodles. Those physicochemical properties are the cooking qualities parameters of pasta products as well. The cooking qualities of pasta products are the ultimate test for acceptability of a pasta product itself (Sissons *et al.*, 2012).

1.2. Objective

This study aims to investigate:

- a. The increase in protein content in noodles by addition of cricket powder and nutritional yeast to be claimed as protein-source or high protein food based on BPOM, European Union (EU), and Food and Drug Administration (FDA) regulation
- b. The changes in physicochemical properties of the noodles after addition of cricket powder and nutritional yeast

1.3. Hypothesis

H₀: a. The addition of cricket powder and nutritional yeast does not show any difference in the protein content of the noodle and the noodle cannot be claimed as protein-source or high protein food based on BPOM, EU, and FDA regulation

b. The addition of cricket powder and nutritional yeast shows no changes for all parameters (moisture, water absorption capacity, swelling index, and cooking loss) after addition of cricket powder and nutritional yeast

H₁: a. The addition of cricket powder and nutritional yeast shows a difference in protein content of the noodle and the noodle can be claimed as protein-source or high protein food based on BPOM, EU, and FDA regulation

b. The addition of cricket powder and nutritional yeast shows significant changes for all parameters (moisture, water absorption capacity, swelling index, and cooking loss) after addition of cricket powder and nutritional yeast

1.4. Scope of Research

This study will be focused on:

- a. The physicochemical properties assessments of the noodles after addition of cricket powder and nutritional yeast which include the physicochemical properties such as color (L*, a*, and b* values), cooking loss, water absorption capacity (WAC), and swelling index (SI).

- b. The control and commercial samples along with two selected noodles that have similar physicochemical properties to the control and commercial noodle samples were analyzed further for their proximate analysis.

1.5. Research Significance

This study can help to increase the usage of cricket powder and nutritional yeast in the food industry as a protein source in foods. Future studies can also be done to assess the consumer's acceptance towards the noodles enriched with cricket powder and nutritional yeast.