CHAPTER 1

INTRODUCTION

1.1 Background Research

Based on the research done by Derbyshire (2017), most consumers can be categorized as one of three types of consumers: meat consumers, meat avoiders, or meat reducers, of which flexitarian is categorized into the meat reducers group. Derbyshire further explained that flexitarian diets (FDs) are types of diet that apply a similar principle as a vegetarian diet but allows for the occasional consumption of fish or meat, thereby not following a strictly vegetarian diet. The term flexitarian itself is derived from the words "flexible" and "vegetarian." People with flexitarian diets understand the importance of meat as a protein, fat, and micronutrient source. However, they are also aware of the environmental impact and ethical sides of consuming meat products. Other than that, meat consumption, especially processed meat, is believed to increase the risk of several diseases such as cardiovascular disease, cancer, and type 2 diabetes. Thus, the demand for meat alternatives increased, especially among flexitarians, as they intended to eat fewer meat products and reduce environmental impact (Curtain & Grafenauer, 2019).

Meat analogs, commonly referred to as plant-based meat alternatives (PBMA), are food products that resemble the aesthetic, organoleptic, and chemical characteristics of a traditional meat product without incorporating animal products (Bohrer, 2019). PBMA can be divided into three categories: traditional processed plant-based protein products, the first generation of PBMA (PBMA 1.0), and the new generation of PBMA (PBMA 2.0). The traditional process plant-based protein product examples are tofu, tempeh, and seitan. Meanwhile, the most popular first-generation PBMA product example is texturized vegetable protein (TVP). The traditional and first-generation PBMA is already acceptable by vegetarians. However, it is still unacceptable by meat consumers because it is unable to replicate traditional meat products. So, in the new generation of PBMA, researchers aim to create products that can mimic the overall experience of eating meat, including its appearance, aroma, taste, and even nutritional content. Even though many animal-based products can be replicated, the

development of plant-based burger patties is the primary product of this new generation of PBMA (He et al., 2020).

Generally, there are two main determining factors of creating plant-based meat such as taste and texture. However, the scope of activity in this research is focused on the improvement of texture and not the taste. Furthermore, the topic of the new generation of PBMA is currently trending among researchers. However, it still lacks published literature; thus, it creates a gap in the research (He et al., 2020).

The current formulation of plant-based patty development consists of water, texturized vegetable protein (TVP), soy protein isolate (SPI), vital wheat gluten (VWG), coconut oil, cocoa butter, potato starch, methylcellulose, and flavorings. The main challenges in developing a plant-based patty are obtaining the desired texture, mouthfeel, and cohesiveness to mimic an actual beef patty. This is a common and biggest problem when developing plant-based meat in general, as Sun et al. (2020) reported. Various factors could affect the texture of the existing plant-based patty; however, it is hypothesized that the problems occur mainly due to improper starch addition.

Starch is commonly added into plant-based meat production as a filler and binding agent because it can enhance the binding ability between protein, lipid, and water constituents during plant-based meat production (Kyriakopoulou et al., 2019; Kilincceker, 2018). Thus, starch is able to improve the texture in terms of springiness and hardness as well as the cohesiveness, water holding capacity, and quality of cooking (Kyriakopoulou et al., 2019). Moreover, the addition of starch could also improve product stability by reducing the alteration of taste, aroma, texture, and color of the plant-based meat since starch could also act as a gelling agent and its ability to bind with water (Kilincceker, 2018). Therefore, one of the ways to improve the texture and storage properties is to modify the starch added into the existing plant-based patty formulation.

According to research surveys of the commercial plant-based patty, potato starch and cornstarch are the most common types of starch used. This is due to the different characteristics exhibited within these two types of starch and their ability to yield a product according to the

producer's needs. Nonetheless, each individual's effect or a combination of starches added to the product and the method of incorporation to the plant-based patty formulation is still unclear.

One way to improve starch's binding ability is to gelatinize the starch prior to mixing it with the plant-based patty base. Then, during the heating process, the starch proceeds gelatinization that ultimately increases the binding ability of the starch. Thus, this research aims to investigate the effect of gelatinized potato starch and cornstarch addition and combination on the physicochemical and storage properties of the plant-based patty.

1.2 Problem Formulation

The problem formulation of the research were:

1. Does the addition of gelatinized starch in the formulation allow for the texture to more closely mimic real meat?
2. Does the addition of gelatinized starch in the formulation affect the physicochemical properties of the plant-based patty?
3. Does the addition of gelatinized starch in the formulation affect the storage properties of the plant-based patty?

1.3 Objectives

1. To investigate the effect of gelatinized potato starch, cornstarch, and combination of both starches with varying concentrations to aid in mimicking the textural properties of the plant-based patty to commercial beef patties and improve the physicochemical properties of the plant-based patty.
2. To observe the physicochemical properties of plant-based patty modified with gelatinized potato starch, corn starch, and a combination of both starches with varying concentrations throughout the storage period.

1.4 Hypothesis

The null hypothesis of this thesis was:

- HO1: The addition & combination of gelatinized starches will not change physicochemical properties.
- HO2: The addition & combination of gelatinized starches will not improve the storage properties.

which is tested against the alternative hypothesis:

- HA1: The addition & combination of gelatinized starches will change physicochemical properties. The expected changes include the texture could mimic real meat texture with low cooking loss value, increase moisture retention, and improve texture.
- HA2: The addition & combination of gelatinized starches will improve the storage properties. The expected changes include insignificant changes in cooking loss, moisture retention, and texture during storage.

1.5 Scope of Research

The scope of work of this thesis was:

- Manipulation of different types (corn and potato) and starch concentration towards the current plant-based patty formulation.
- Storage properties assessment through physicochemical analysis of each treatment by measuring its moisture retention, cooking gloss, hardness, and springiness of the modified plant-based patty throughout storage.

1.6 Importance of Research

The importance of this research was to improve the texture of the current prototype of a plant-based patty through the addition and combination of gelatinized starch so it could resemble the texture of a traditional beef patty. In addition, this research could also widen the application of starch in other plant-based meat products, especially plant-based patties.