Chapter 1. Introduction

This chapter discusses the popularity of gluten-free products with emphasis on pasta, alongside the challenges and scientific research required that is brought upon with gluten-free pasta. In completion, it presents the background, objective, and hypothesis of this research.

1.1 Background

In the past few years, consumer awareness of health and uses of food products have increased. The public that sees these alternative diets often interpret it as being more healthy compared to normal food items. This is caused by the health halo effect, where healthy consumers follow trends that have certain health benefits that they do not necessarily need such as gluten free (GF). In consequence, the GF market of foods expanded quickly into the public food market instead of just serving as an alternative for consumers with gluten-related disorders. It benefits both normal consumers and those with gluten-related disorders as now more research and development are being done for products. However, not all products have a GF alternative that fulfills the sensory aspects for the customer (Capriles et al., 2023). The main problem with GF products is the lack of gluten network that gives viscoelasticity and some nutritional value in the products itself. It significantly reduces the textural quality of the product which in turn steers away consumers from buying those products (Mostafa et al., 2025). Therefore more research has to be made to accommodate future studies and capitalize on this opportunity in the market.

One such product is pasta, which is a traditional Italian dish that is mostly made out of flour. It is considered a staple in Europe due to its nutritional value and easy manufacturing. It contains very low amounts of fat and a high amount of digestible carbohydrate, which is made from a cheap source such as normal wheat. This makes it a cheap and easy source of energy for consumers to enjoy. Because of this, pasta has gained popularity around the world in recent years, expanding beyond

Europe into other regions. With larger markets to handle, demands will also change in both quantity and quality of the product. Certain consumers have different nutritional needs that normal pasta could not provide such as high fibre content or GF requirements. However, the process or innovation behind these products are less focused compared to the sensory qualities, which is expected to compare with the normal semolina pasta product by the consumers (Bresciani et al., 2022).

The main challenge of pasta making is to create the texture and chewiness that pasta is often associated with. It can be boiled down to the gluten network, which is a network of polymers (gluten) that is strengthened by fillers such as starch. As the dough gets kneaded, the starch particles align and form an arrangement with the polymer network. This is what gives the desirable texture such as chewiness in wheat products. The polymer network can be imitated by using hydrocolloids, which will form a similar structure to gluten that also serves the same purpose. Different kinds of hydrocolloids will give out different properties depending on the chain length that it produces (Brandner et al., 2018). Longer chain and higher molecular weight hydrocolloids will yield a higher viscosity since it promotes the formation of intermolecular bonds. Degree of branching will also determine the gelation of the hydrocolloid, as high degree of branching prevents neighbouring molecules from sticking to the system. It prevents the formation of junction zones and in turn prevents larger gel networks from forming (Goff & Guo, 2019). All of these factors allow hydrocolloids to significantly improve the properties of GF products, as it supports the formation of networks inside of the food matrix. This has turned hydrocolloids into a necessary ingredient for most GF food formulations (Ali et al., 2024).

As the main ingredient, an alternative from flour that does not have gluten should be used. Vegetables serve as a good base both from the nutritional and environmental perspective. They are a source of fiber and bioactive compounds. Cauliflower for instance, contains potassium, vitamin K, folic acid, and vitamin C. Other bioactive compounds such as glucosinolates and flavonoids that can reduce inflammation are also contained in cauliflower. However, the heat sensitive compounds will not last

through processing that involves higher temperatures (Gallardo et al., 2024). However, the sensory aspects of the products might be inferior to the original form. *Brassica* plants in general, which include cauliflowers, have a high concentration of glucosinolates which break down into isothiocyanates. It contributes greatly to the bitter taste in the vegetables, however also exhibits anticarcinogenic potential. These sulfite compounds are the main aroma emitters for cauliflower and are responsible for the unique cooked taste and smell. However, some consumers do not like this sensory aspect, and steered away from cauliflower products (Wieczorek et al., 2017). In addition to this, sensory analysis of GF pasta has also been scarcely done, where only 30% of scientific studies published between 2012 until 2022 in scopus included sensory analysis as a part of it (Capriles et al., 2023). Therefore, sensory analysis of the resulting product should be evaluated to properly understand the acceptability of the product. By doing this, a proper assessment of the physical and sensory properties of GF pasta can be done.

1.2 Objective

To identify the effects of different konjac glucomannan and *k*-carrageenan ratios (1:2, 1:1, 2:1) on the properties of gluten free pasta made from cauliflower and arrowroot flour by using physical analysis (texture profile analysis, color analysis, swelling capacity, moisture analysis) and sensory analysis (triangle test).

1.3 Hypothesis

With this objective in mind, there are several assumptions that should be tested. Previous studies involving GF pasta have found that hydrocolloids significantly affect the physical properties of pasta, which leads to better cooking quality and product. Therefore, a hypothesis can be formulated where;

H0: Different hydrocolloid formulations would not significantly affect the physical and sensory properties of gluten free pasta made from cauliflower.

H1: Different hydrocolloid formulations would significantly affect the physical and sensory properties of gluten free pasta made from cauliflower.