Chapter 1

Introduction

1.1 Background

Gummy candy is a popular type of confectionery that is well-loved by all age groups and is typically made with sugar, water, and gelling agents, often gelatin (Amjadi et al., 2018; Roudbari et al., 2024). However, recently the development of functional gummies has gain attention due to rising nutritional awareness. Functional gummy is essentially gummy that contains an active compound such as Iron (Tarahi et al., 2023). Iron is an essential nutrient for the body, and one of the sources to obtain it is chicken liver as it contains 28.7 mg of iron per 100 grams (Qu et al., 2021). Despite its nutritional value, some are reluctant to consume chicken liver due to the gaminess; therefore, to increase consumption, chicken liver could be added to the gummy candy as it is popular among all age groups. The acceptability of gummy it self heavily depends on the gelling agents as well as hydrocolloid to enhanced the desirable chewy texture of the gummy (Gunes et al., 2022).

Hydrocolloid is an important ingredient in making a gummy candy as it aids in the gelling process, which gives the gummy shape and structure (Ge et al., 2021). Hydrocolloid itself, by definition is an ingredient that is used to improve or develop structure in food and it is a polysaccharide with some addition of protein (Goff & Guo, 2019). Most often, gummy candy uses gelatin as the main hydrocolloid or gelling agent, it gives the gummy a chewy texture while also entrapping the moisture from all the sugars and syrups by forming a gel networks (Rawat et al., 2024). Gelatin is known for the triple helices that yield in a rigid and firm 3D network that is often perceived as rubbery (Wang & Hartel, 2021). Not to mention overtime gelatin are prone of aging and water loss which harden the gummy's texture, therefore in commercial gummy, gelatin is often mixed with other hydrocolloids to improve the texture of end products as it has a synergistic effect in

the formation of gel network (Tarahi et al., 2023). For instance, iota carrageenan is typically used with gelatin as it improves the overall texture of the gummy and reduces the possibility of waterloss as it aid in the entrapment of water thus the texture of the gummy would remain soft (Wang et al., 2023). Other than as a gelling agent, hydrocolloid is crucial in the emerging 3D food printing industry as it improve the overall rheological properties of the food ink so it would be able to retain it shapes after it is printed (Bhuiyan et al., 2024).

3D Food printing is a novel technique in the food industry that is still being developed in which the food or also called edible ink is printed layer by layer through a nozzle with the assistance of a machine and hydrocolloids into the desired shapes (Neamah & Tandio, 2024). 3D-printed food can be applied to numerous sectors namely confectionery and baking as recently gummies and chocolate are some of the most popular 3D-printed food (Liu et al., 2017). 3D printed functional gummies have been extensively researched as it is a promising way to make a highly customizable product for the target market as it could produce visually appealing products with the specific dosage of the active ingredients and texture (Zhou et al., 2023).

With the background, there are still some gaps regarding the development of the 3D Printed gummy fortified with chicken liver. Therefore this research includes the formulation of the gummy base with various dosages of gelatin - iota carrageenan mixture and 3D food printing impact on the gummy texture and sensorial acceptance

1.2 Objective

This research has 2 objectives which are:

1. Evaluate the impact of the various dosages of iota carrageenan and gelatin mixture on the chicken liver gummy textural properties and sensorial acceptance

2. Investigate the impact of 3D printing on the textural properties and sensorial acceptance of the 3D printed gummy and conventional gummy.

1.3 Hypothesis

Each objective has 2 hypotheses:

H_0: The addition of iota carrageenan and gelatin mixture in various dosages has no significant effect on the gummy textural properties and sensory acceptance

H_1: The addition of iota carrageenan and gelatin mixture in various dosages has a significant effect on the gummy textural properties and sensory acceptance

Meanwhile, for the second objective, the hypothesis is:

H_0: 3D Printing has no significant impact on the textural properties and sensorial acceptance between the 3D printed gummy and conventional gummy

H_1: 3D printing has a significant impact on the textural properties and sensorial acceptance between the 3D printed gummy and conventional gummy