Chapter 1

Introduction

1.1 Background

Cereal snack bars, also known as bar-shaped snacks made of cereals and binding agents as the main ingredients, as well as other additional ingredients commonly incorporated to specify flavour variants, are currently popular due to the fast-paced lifestyle because they are convenient, portable, and also accessible. (Sharma *et al.*, 2014; Yadav & Bhatnagar, 2015; da Silva *et al*. 2016). Based on the study of Bower & Whitten (2000), with flavor as the most important attribute and texture as the second most significant factor, sensorial properties have the biggest effects on the preference of many population segments. Despite this, innovation in physical properties of cereal bar product remains far behind those in flavor profiles where their significance is frequently overlooked and understudied, considering that human sensorial perception is made up of combinations of complex interactions that go far beyond flavor profiles.

Most commercialized cereal bars were claimed to be nutritious and healthy snacks as they contain ingredients such as nuts, fruits, and oats. However, several brands of these products have a high level of hidden saturated fats and sugar (sucrose). However, high sugar intake in the human diet not only contributes to weight gain due to high amounts of calories intake, but also can increase the risk of other health problems such as inflammation, high blood pressure, diabetes, cardiovascular disease, and also cancer (Vermunt *et al.*, 2003). Moreover, high intake levels of sugar also have been correlated to obesity, cellular aging, and dental diseases such as erosion (Prada, M. *et al.*, 2022). Therefore, when producing the cereal bar, substituting sugar for another low- or non-caloric sweetener can be a healthier option.

However, when sugar is substituted as the majority main ingredient of baked goods, the texture, flavor, and appearance (as in color) may all be adversely affected (Gao *et al.*, 2017). This is due to sugar's ability to act as a binder that hold the cereal components together, control sweetness, the amount of air and air bubbles inside the product, absorb moisture, and limit starch's swelling. Therefore when replaced, these properties of baked goods can be affected, which was proven in a scientific study by Martínez-Cervera, Salvador, & Sanz in 2014 that analyzed the structural properties of a muffin that was affected when the sucrose levels are decreased. In addition, sucrose when toasted at high temperatures will undergo a chemical event called caramelization or Maillard Reaction (when there is an amino acid) responsible for the brown color of baked products (Capuano *et al.*, 2008). According to Chen *et al.* (2002)'s study regarding the effect of sucrose level on baked jerky, baked beef jerky with a higher level of sucrose tends to be more acceptable to the consumer in terms of flavor and texture, whereas the higher level of sucrose will decrease the moisture content of the product.

Physical attributes can be analysed using objective (instrumental) tests or intrinsic subjective tests (sensory analysis). However, according to the research of Ruiz-Capillas *et al.* (2021) and Drake (2022), sensory evaluation has a higher affinity as an assessment method for product innovation and development prior to market release than instrumental device analysis; but, using humans as measurement performers results in generalisation inaccuracy because they are subjective and susceptible to psychological bias. As a result, the study aimed to investigate, compare, and determine sugar substitutes that are the most identical to the control (sucrose) based on texture, colour, and moisture measurements using appropriate instrumental device analysis. The textural features that will be measured include hardness (firmness), springiness, chewiness, and cohesiveness/crumbliness, which according to KIM *et al.* (2009) best correspond with the sensory texture attributes of cereal bars. While color will be measured based on LAB values.

1.2 Objective

Investigate the effect of different sugar substitutes on the formulation of cereal bars based on texture, moisture content, and color in comparison to the control (sucrose) cereal bar.

1.3 Research scope

The scope of work of this study is:

1. Formulate different cereal bars using sucrose and different sugar substitutes (xylitol, isomalt, erythritol, and sorbitol).
2. To analyze the texture, color, and moisture of the formulated cereal bars using the appropriate instrument consisting of a Texture Analyzer, Moisture Analyzer, and Colorimeter.

1.4 Hypothesis

The following are this study's hypotheses:

1. H0: There are no significant differences between the control group (sucrose) bar and the sugar-substituted formulated bar in terms of texture, color, and moisture characteristics.
2. H1: There are significant differences between the control group (sucrose) bar and thsugar-substituted formulated bar in terms of texture, color, and moisture characteristics.