

Chapter 1

Introduction

This chapter presents the background and rationale of the study by outlining the relevant context, key challenges, and scientific foundation underlying the development of the proposed product, as well as the research objectives and hypotheses.

1.1 Background

Mountaineering is a physically demanding sport and necessitates constant focus and awareness as placing hikers in a lower atmospheric pressure environment and frequently in hazardous and unpredictable weather situations (Permadani & Jannah, 2022; Karpęcka-Gałka et al., 2023). Mountain climbers face both physical and physiological challenges, including fatigue and reduced appetite at high altitudes (>2,500 m). Limited access to fresh food, combined with appetite suppression caused by the high-altitude environment, often leads to “mountain anorexia”, which often leads to improper nutrient intake.

A study by Karpęcka-Gałka et al. (2023) found that mountain climbers have a substantially lower average energy intake (2776.8 ± 878 kcal) compared to their estimated requirement (4559.5 ± 425 kcal). During expeditions, they primarily rely on convenient, energy-dense foods such as chocolate bars, freeze-dried meals, energy gels, snacks, dried meat, canned products, nuts, and instant meals, while nutrient-rich foods like fruits, vegetables, dairy, and protein sources are consumed infrequently due to limited availability. Consequently, their dietary pattern is characterized by excessive fat intake, insufficient protein consumption, low fiber, and overall inadequate energy intake.

Only a small proportion of climbers (7.1%) meet recommended dietary guidelines, while the majority report high consumption of sweet, carbohydrate-rich snacks (75%), with 78.6% indicating a preference for sweet options during expeditions (Karpęcka-Gałka et al., 2023). Commonly consumed foods include sugar and confectionery (85.7%), nuts and seeds (67.9%), wholegrain cereals (64.3%),

and refined cereal products (57.1%), which are energy-dense and provide carbohydrates and some dietary fibre. Nevertheless, overall fibre and carbohydrate intake is still insufficient, highlighting a gap between current consumption patterns and nutritional requirements. Freeze-dried foods are also widely preferred (57.1%) for their convenience, such as desserts, oatmeal, fruit, porridges, soups, and lunch dishes, although nearly half of climbers report gastrointestinal discomfort following consumption.

Preliminary findings from a dietary habit survey involving 44 mountain climbers revealed that commonly consumed commercial snacks, such as chocolate paste, honey, and cereal bars, are predominantly carbohydrate-based with glucose and sugar as major ingredients, primarily due to their practicality (33.6%), ease of consumption (27.3%), and ability to provide quick energy (28.2%), taste (18.6%), and affordability (15.7%). However, these products generally lack nutrient-dense inclusions such as seeds that could improve fibre content and micronutrient diversity. Accordingly, this study proposes the development of a pear fruit leather product as an alternative to available snacks incorporated with chia seeds, particularly as fruit has been identified as one of the least consumed food groups in the mountaineering diet.

The sensory characteristics of fruit leather, including color, flavor, aroma, and overall nutritional profile, are influenced by the type of fruit and the additional ingredients used (Rivai et al., 2023). In addition, dried fruit products typically contain a minimum of 40% sugar (calculated as sucrose), which aligns with climbers' preference for sweet foods and may help alleviate fatigue, as prolonged physical activity is associated with the depletion of carbohydrate (glycogen and glucose) stores (Fuchs et al., 2019). The inclusion of chia seeds is of particular interest due to their high protein, dietary fiber, ω -3 fatty acids, and essential micronutrient content, which contribute to prolonged satiety and improved postprandial blood glucose regulation (Ayaz et al., 2017; Chen & Luo, 2024; Khalid et al., 2022; Knez Hrničič et al., 2019). However, despite these advantages, the incorporation of chia seeds presents formulation challenges. Their high mucilage and soluble fiber content readily

absorb water and form a gel-like structure upon hydration, increasing water retention within the product matrix and potentially affecting the texture, mouthfeel, physicochemical stability, and overall quality of the final product.

1.2 Objective

The purpose of this research is to create pear fruit leather utilizing chia seeds as the independent variable while assessing its physicochemical characteristics and acceptance using sensory evaluation.

The aim of this research includes:

- To develop and formulate fruit leather guided by insights from primary market research and Just-About-Right (JAR) hedonic penalty sensory assessment.
- To determine consumer acceptability of the fruit leather incorporated with different concentrations of chia seeds through a 9-point hedonic scale and the preference ranking.
- To analyze the physicochemical properties and stability of the developed fruit leather, assess key parameters including color, water activity, moisture content, pH value, and puncturing force.

1.3 Hypothesis

The hypothesis of this research includes:

- Null hypothesis (H0): There is no significant difference in acceptability, preference, and physicochemical stability in different concentrations of chia seeds incorporated in pear fruit leather.
- Alternative hypothesis (H1): There is a significant difference in acceptability, preference, and physicochemical stability in different concentrations of chia seeds incorporated in pear fruit leather.