

## I. INTRODUCTION

### 1.1. Background of the Research

Snack food is one of the fastest growing segments in the food industry (Liu *et al.*, 2011). It is appreciated by different age groups of consumers due to the fact that it is affordable and tasty (Hashempour-Baltork *et al.*, 2018), including puffed snacks (Mishra *et al.*, 2014). However, most of the snacks available are poor in nutritional content (Natabirwa *et al.*, 2020). Many extruded snacks, mainly made with corn, are high in saturated fatty acids and *trans* fatty acids. In addition, the major ingredients of snacks are cereal, which is poor in protein and essential amino acids content (Hashempour-Baltork *et al.*, 2018).

Currently, consumers are becoming conscious of the significance of health problems, especially in diet (Arribas *et al.*, 2017). The growing and increasingly demanding market targeted popular foods for incorporation of nutrients as the effective vehicle (Goubgou *et al.*, 2021). Extruded snacks have a great potential to deliver nutrients since they are consumed regularly and are demanded highly by consumers (Kumar *et al.*, 2018).

Cereals play a significant part in the human's nutrition. Cereals are generally high in starch content, but lower in other nutrients such as protein, dietary fiber, and fat. Along with pseudocereals, such as millet, rice, and quinoa, cereals provide a good alternative for people with celiac disease due to gluten-free properties, also for vegetarian diets and for consumers who are aware of the importance of a healthier diet (Arribas *et al.*, 2017).

Adlay (*Coix lacryma-jobi*) is a grass crop which has a high nutritional value and has long been used as a traditional medicine in China (Yang *et al.*, 2008). Numerous studies have reported about the beneficial effects of consuming adlay seed for the human's body (Zhang *et al.*, 2019). Adlay has been a topic of interest in recent years due to its nutritional value (Yang *et al.*, 2008). It has been mainly used as soups, broths, and drinks. It has also been used in several researches as a snack (Weng *et al.*, 2022). Nonetheless, adlay utilization has some drawbacks, such as poor flowability and mouthfeel, and cooking difficulties (Zhang *et al.*, 2019).

Extrusion is a technology that utilizes high-temperature and short time (HTST) physical treatment, which is efficient and versatile. It has been used in a wide range of grain processing. This technology has been increasingly applied in the production of convenience goods, including puffed snacks (Zhang *et al.*, 2019). Extrusion could enhance the acceptability of a product, along with its texture, taste, and appearance (Heldman *et al.*, 2018).

Incorporation of new food materials into the extrudates could be done with functional ingredients that are relatively unpalatable, such as botanicals. One of the potential materials that can be used for fortification in various food products to enrich and improve the nutritional value is *Moringa oleifera* leaf, (Oyeyinka *et al.*, 2023). *M. oleifera* leaf can be utilized for medication, food, and industrial purposes and considered as a very nutritious ingredient. The protein content of *M. oleifera* leaf is higher compared to the protein found in egg and soybean along with the wide range of amino acids, including glutamic, aspartic acid, arginine, and zeatin (Su and Bin., 2020). However, addition of *M. oleifera* leaf could alter several sensorial properties, such as undesirable taste and appearance (Oyeyinka & Oyeyinka, 2018).

According to Badan Pengawas Obat dan Makanan (2021), products could be categorized as a source of protein if the protein content in the food is minimum 20% from the amount listed in *acuan label gizi* (ALG), which is 60 grams for the general category. Extrusion process could be used to enhance the acceptability of adlay puffed snacks and *M. oleifera* leaf powder (MOLP) could be used to increase the nutritional value of the extrudates. Thus, this study is aimed to develop adlay snacks supplemented with *M. oleifera* leaf powder as a source of protein snacks.

## 1.2. Objectives

The objectives of this research includes :

1. To develop puffed snacks made from adlay supplemented with *M. oleifera* leaf powder.
2. To study the effect of different concentrations of *M. oleifera* leaf powder incorporated towards the proximate composition of the adlay puffed snacks.
3. To study the effect of different concentrations of *M. oleifera* leaf powder incorporated towards the sensorial properties of the adlay puffed snacks.

## 1.3. Scope of the Project

The scope of this project mainly was focused on :

1. To do part of the project from a larger project which consist of proximate, antioxidant, sensorial properties, and physicochemical properties analysis. This project will only cover the proximate analysis and sensorial properties of the developed product.

2. Sample preparation with a different ratio of moringa leaf powder to the adlay puffed snacks.
3. Analysis of proximate composition (protein, fat, ash, moisture content, and carbohydrate)
4. Analysis of sensory properties (sensory acceptance, color and texture analysis) of different samples.
5. Statistical analysis of the data obtained using SPSS.

#### 1.4. Hypothesis

The hypothesis for this study are as follows:

$H_0$  : there is no significant difference in proximate analysis of adlay puffed snacks supplemented with different concentrations of moringa leaf powder.

$H_1$  : there is significant difference in proximate analysis of adlay puffed snacks supplemented with different concentrations of *M. oleifera* leaf powder.

$H_0$  : there is no significant difference in sensorial properties of adlay puffed snacks supplemented with different concentrations of moringa leaf powder.

$H_1$  : there is significant difference in sensorial properties of adlay puffed snacks supplemented with different concentrations of *M. oleifera* leaf powder.