I. INTRODUCTION

1.1 Background

Unhealthy Snacks are often correlated with high salt, low antioxidant, high saturated fat, and high energy density, causing a disadvantage to human health, such as obesity. Hence, the demand for healthy snacks is rising (Hess et al., 2017; Verhoeven et al., 2015; Lucan et al., 2010; Hess & Slavin, 2018). According to Mattes 2018, snacking contributes 15-30% of daily energy expenditure, which causes body energy imbalance which contributes a lot of daily energy. Several factors cause people to snack: hunger, location, distraction, and environment (Bellisle, 2014; Myhre et al., 2015; Higgs, 2015).

While doing something, we usually snack to overcome boredom, and this phenomenon could cause frequent snacking. Frequent snacking causes terrible habits because the consumer overlooks the nutrition facts and calories (Wansink, 2011). Mindless eating is often caused by environmental factors such as emotion and food choice (Warsink, 2010). Furthermore, Food Addiction also contributes to food-related diseases, which will cause overconsumption of energy (Davis et al., 2014; Swinburn et al., 2011; Taubes, 2013). Thus, consumers must be mindful of choosing healthy snack products.

Global trends toward healthy snacks are increasing since society is more concerned about their health (Popkin et al., 2021). Adlay comes from the millet group, where it is origin from China. Adlay is a low-glycemic carbohydrate safe for diabetic people (Tan et al., 2017). However, Adlay is considered low in antioxidants. Hence, fortification using other materials could be the solution to enrich the nutrient and antioxidant quantity. On the other hand, Moringa leaves are abundance in nutrients and antioxidants and are easily cultivated (Jattan

et al., 2021). Moreover, Adlay and Moringa combination consists of vast amounts of nutrition important for human health (Gopalakrishnan et al., 2016). Furthermore, antioxidants from adlay and moringa are abundant in overcoming free radicals that damage human cells (Sreelatha & Padma, 2009; Wang et al., 2013).

Antioxidants have enormous benefits for a snack due to their preservative properties to reduce the radical that causes rancidity (Zehiroglu, C., & Ozturk Sarikaya, 2016). Furthermore, antioxidants also contribute to preventing diseases caused by Reactive Oxygen Species (ROS) due to respiratory in cells or even in the ecosystem (Liu et al., 2018).

However, the combination of moringa and adlay in snacks has not been developed since both materials have different geographic locations. Where moringa leaves are commonly found in Nothern Pakistan, and India. On the other hand, adlay is frequently found in central Asia such as China and Taiwan (Popoola & Obembe, 2013; Weng et al., 2022). Developing healthy snacks using extrusion will be beneficial since it is proven to retain their nutritional quality and improve texture (Agarwal & Chauhan, 2019).

Moreover, an extruder is a versatile machine that is easy to use and has low production costs (Choton et al., 2020). However, the texture will be determined by the starch content in the raw material. Hence, it is essential to analyze the textural in different formulations. Furthermore, Adlay and Moringa are rarely used as snack material, although both are high in nutrients and bioactive compounds. Moreover, adding antioxidants to snacks is a promising strategy for improving health benefits (Yuksel et al., 2020).

Thus, in this experiment, the researchers would develop healthy snacks using the extrusion method with different ratios of adlay and moringa leaves and analyze their effect on the extruded snacks' antioxidant activity and puffiness texture. Furthermore, due to high-

temperature food processing, the antioxidant activity would be examined before and after the extrusion process, and the percentage of degradation would be observed.

1.2 Objective

1. Determine extrusion effects towards the antioxidant activity of adlay and moringa snacks
2. Analyze the extrudates antioxidant content using different ratios of adlay and moringa
3. Determine the effect of different formulations on the textural quality of adlay and moringa snacks

1.3 Hypothesis

1. H_0: There is no significant difference of different moringa and adlay ratio on textural properties

   H_1: There is significant difference of different moringa and adlay ratio on textural properties
2. H_0: there are significant differences in antioxidant levels between treatments content after extrusion will be insignificant

   H_1: There are is significant difference between antioxidant content after extrusion Degradation of antioxidant content after extrusion will be significant
3. H_0: Adding moringa on adlay puff snacks will increase the antioxidant significantly

   H_1: Adding moringa on adlay puff snacks will cause insignificant increase in antioxidant quantity

1.4 Scope of the Project

Sensorial, physicochemical properties, proximate and antioxidant analysis were performed in the big project. However, in this research only focused antioxidant properties.

Protocol preparation of extrusion method

- Protocol preparation of extrusion method
- Evaluation of antioxidant scavenging activity using the DPPH method of raw materials and the final product
- Evaluation of the total phenolic content of raw materials and the final product
- Evaluation of the total flavonoid content of raw materials and the final product
- Evaluation of ferric reducing power of raw materials and the final product
- Evaluation of the texture profile of snacks using texture profile analysis to identify the acceptable texture and antioxidant content