

# I. INTRODUCTION

## 1.1 Background

Staple foods are mostly chosen as the main source of energy (Maulani et al., 2019). Since the current lifestyle of society, pasta is now utilized as an alternative staple food. Pasta is quite popular among many people since it tastes nice and is simple to prepare. Furthermore, the price is reasonable and there are a variety of tastes to appeal to a wide range of consumers, from children to adults. Healthy pasta made with nutritious elements can be used as an alternate method to avoid malnutrition (Rachmat et al., 2023). One type of pasta found on the Indonesian market is macaroni. Macaroni, which is a pipe-shaped food, is a homogenized product of flour, egg, with or without additional ingredients (Husnal, 2016). Besides its unique shape, good taste and quality, macaroni contains high carbohydrates, especially starch which can fulfill the human nutritional needs (Gustinada, 2018).

Most macaroni is often prepared with wheat flour. Wheat products have been linked to an increase in type 2 diabetes, obesity, and wheat gluten proteins can induce a variety of negative responses, for those who have gluten allergy, celiac disease, and autism (Shewry and Hey, 2016). In order to overcome this problem, gluten-free pasta (GFP) is produced to meet individual needs that cannot consume wheat products (Tonnutti & Bizzaro, 2014). Especially since the availability of knowledge on nutrition and health, as well as diagnostic procedures for gluten-related problems, it has increased the number of Gluten-free products (GFP) consumers (Nascimento et al., 2014). As well in Indonesia, gluten-free products are currently being introduced by the food industry (Raseya & Ali. 2022).

Sago starch is chosen as the alternative of wheat flour replacement (Septiyani et. al., 2021). Sago has a potential to be an alternative food source because it has high carbohydrates, and has excellent enough properties to completely substitute or replace wheat flour used in macaroni products. Except for the elasticity level, sago flour has similar characteristics to wheat flour when uses as pasta mixture (Rachmat et al., 2023). However, it has a weakness which is low protein content only around 0.7 - 0.80% per 100 grams (Fauziyah & Indrawati,

2017). To overcome that, plant protein can be the solution to achieve the higher protein content. It could be preferable because save the environment, to make food more affordable and safe, to meet growing consumer demand, and to prevent protein-energy malnutrition. One of the examples of plant-protein that can be used was oyster mushroom. Oyster mushrooms are chosen because they have high protein content around 10.5 - 30.4% per 100 gram (Sumarmi, 2006). Also oyster mushrooms are chosen as the plant- protein source since oyster mushrooms are abandoned in Indonesia and done to overcome the low protein content in sago (Wardani, 2014)

While oyster mushrooms are used as the protein source. Tapioca modified starch is also used for gluten-free product structuring (Marti & Pagani, 2013). It is used in macaroni since it has low retrogradation, viscosity and gel forms are more smoother and considered Generally Recognized as Safe (GRAS) since this starch are made by physical modification which is gelatinization (Koswara, 2009 ; Scartion & Clerici, 2022).

This research is aimed to develop fortified macaroni based on sago starch supplement with oyster mushroom and modified starch flour also utilizing the potential of local ingredients, which has high nutritional value and can also be a substitute material in support of the diversification of food items. Furthermore, proximate analysis will also be conducted to evaluate the macronutrient, ash, and water content of the sago-based macaroni that was done to determine the nutritional value of the macaroni sago - enriched with oyster mushroom so it could fulfill the nutritional requirement.

### **1.2 Research Objective**

To evaluate the effect of oyster mushroom concentration on macronutrient, ash, and water content of sago-based macaroni.

### **1.3 Scope**

The research scope involves the development of macaroni with the addition of oyster mushroom flour and modified starch that are considered as high protein foods followed by proximate analysis, including carbohydrates that would be analyzed by different proteins

using kjeldahl method and fats using soxhlet method. Other components, such as water and ash content, are also included that will be analyzed using an oven and furnaces, respectively.

#### **1.4 Hypothesis**

Hypothesis for this research is that the mushroom enriched sago-based macaroni will have higher protein, fat, carbohydrate, ash, and water content compared to the sago-based macaroni. The more the concentration of mushroom flour increases, the more the amount of protein in sago-based macaroni increases