

Conference Paper

## Processing of Red Dahlia Tubers in Produce Inulin Extract and Material Proximate Testing

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### ABSTRACT

Dahlia tubers from Berastagi, North Sumatra, are plants that contain carbohydrates and contain high levels of inulin. Inulin is very good as a dietary fiber and has other physiological functions such as lowering blood sugar and blood fat, anticancer, regulating intestinal microbial flora, increasing absorption of minerals and vitamins. Currently, the utilization of dahlia tubers is not optimal in the community and is considered as agricultural waste, therefore it is necessary to manage dahlia tubers in producing inulin extract and study the proximate material, considering that previous studies still obtained varying results. This study aimed to obtain inulin extract and its yield value and to measure the proximate material of red dahlia tuber. The extraction method used is based on the solubility of inulin in water at a temperature of 80° C. And precipitation are carried out with 70% ethanol. Proximate examination of the material consisted of water content using the heating method, ash content using the gravimetric method, fat and crude fiber content using the Soxhlet method, determination of protein content using the Macro Kjeldhal method, and carbohydrate content using the proximate method using the carbohydrate percentage formula. The results obtained were 48,25% Inulin Flour yield, the proximate results obtained 80,8% water content, 0,36% ash content, 0,33% total fat content, 1,29% crude fiber content, protein content 1,15%, Carbohydrate content 14.6%. From this study, it can be concluded that dahlia tubers contain high carbohydrates and low-fat content, have crude fiber and protein that can be used as low-calorie foodstuffs.

*Keywords: Dahlia tubers, inulin, proximate test*

### Introduction

Dahlia is a species of flowering plant from the Asteraceae family which is rich in inulin in the tuber. The inulin contained in the dahlia tuber reaches 15-20%. Inulin is a natural high-fiber food that has a fructose compound at the terminal end. Inulin as a substrate and inducer for inulinase production. The development of modern biotechnology has resulted in the main products of inulin, namely fructose and fructooligosaccharides. Fructose can be used by people with diabetes mellitus because it is a low-calorie sugar (Singh et al., 2019).

Inulin has a hypoglycemic effect by increasing glucose transport by activating the insulin-dependent phosphatidylinositol 3-kinase/Akt (PI3-K/Akt) pathway and the AMP-activated insulin-independent protein kinase (AMPK) pathway. In addition, inulin can also reduce HbA1c which is the gold standard in controlling blood sugar levels. Inulin can also reduce hyperglycemia, insulin resistance (IR), and hyperlipidemia, reduce oxidative stress and increase insulin and leptin levels in rats with type 2 diabetes (Wan et al., 2020).

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The importance of inulin processing by the industrial world in producing fructose as healthy food, namely a low-calorie sweetener that can be used as an alternative sweetener in diabetics, therefore inulin management is a very important concern. Fructose is the safest and most beneficial sugar for health. In addition, Inulin can also be found in asparagus, artichokes, onions, garlic, wheat, and bananas (Singh et al., 2018).

The direct fructose production from inulin by inulinase requires only one step of the enzymatic reaction and produces 95% fructose so it is more efficient, compared to fructose production from starch which requires several steps and produces lower fructose (Saraswati et al., 2017). Inulinase is obtained from microbial sources such as bacteria, fungi, and yeast by enzymatic management (Rawat et al., 2021). The inulinase acts as a catalyst in the hydrolysis of inulin which will form fructose as an important nutrient in a variety of foods (Mohan et al., 2018).

Inulinase is an Inulinolytic enzyme that hydrolyzes inulin which is divided into endonuclease which will produce fructooligosaccharides that act randomly on the internal glycosidic linkages of inulin, while exoinulinase will produce fructose sequentially on the external non-reducing end of inulin (Singh et al., 2020).

Dahlia tubers besides producing inulin as a source of fructose and fructooligosaccharides, it is also important to study the proximate of materials that previously had different values. The results of previous studies found that the processing of dahlia tubers into inulin extract resulted in a yield value of 48.20% with an inulin content of 80.09%, Proximate measurements of the ingredients found that the water was 79.90%, Ash 3.83%, Fat 1.39%, Crude Fiber 8.06%, Protein 5.92%, and Carbohydrate 80.80%. Proximate measurements of ingredients are carried out to determine the nutritional content of a food ingredient to calculate the calorific value of a food ingredient that can be used as a basic ingredient for making food (Mangunwidjaja et al., 2014).

Dahlia tubers were chosen as a food source because apart from having high levels of inulin, they also contain carbohydrates and fiber that can be used as basic ingredients or a mixture of functional foods, and the results of previous studies found that the mixture of flour dahlia tubers has an aroma that can add flavor to the functional food (Trihaditia & Sundayati, 2020).

Inulin can also be used as a basic ingredient for making instant milk for children, adults, and the elderly because it plays a role in increasing the absorption of calcium for the growth of bones and teeth. In addition, it can be used in making ice cream and yogurt (Indah et al., 2020). In addition, inulin can be used to make baby pudding to meet the nutritional needs of babies and increase calcium absorption (Kristanti & Hermiati, 2019).

Inulin is the main source of prebiotics that can be obtained from gembolo tuber (*Dioscorea bulbifera*), lesser yam (*Dioscorea esculenta*), yam bean (*Pachyrhizus erosus*), and dahlia tuber (*Dahlia pinnata*). Prebiotics are useful for increasing the population of Lactobacillus, Bifidobacterium, and Bacteroides, and inhibiting the growth of Escherichia coli and Clostridium, this can improve health (Crespo et al., 2020). The results of previous studies found that inulin from the Radix Codonopsis species is a natural intestinal antioxidant that has the potential as a prebiotic to improve health (Zou et al., 2021).

Inulin derived from Asparagus can regulate the gut microbiota by stimulating the growth of Prevotella, Megamonas, and Bifidobacterium and reducing Haemophilus so that inulin has the potential as a food supplement or drug to improve health (Sun et al., 2020).

The results of another study showed that fructan-type inulin from Platycodon grandiflorus (PGF) is a natural source of prebiotics by increasing lactobacillus proliferation as well as immunomodulating intestinal epithelial cells and stimulating the expression of anti-inflammatory factors (Pang et al., 2019).

The importance of using dahlia tubers as a source of inulin in the pharmaceutical and health world as well as the industrial world, it is important to conduct initial research on the management of red dahlia tubers from Berastagi, North Sumatra in producing inulin extract and proximate testing of ingredients, considering that previous studies still have different results.

## Material and Methods

This type of research is descriptive by observing the inulin content of red dahlia tubers and the proximate content of the material consisting of water content, ash content, protein content, fat content, and carbohydrate content. This research was conducted in September 2021. In the Biomolecular Laboratory, Faculty of Medicine, Universitas Prima Indonesia. The dahlia tuber material is obtained from Berastagi, North Sumatra, at the age of 8 months.

### *Inulin Level*

Extraction of dahlia tubers to obtain inulin flour is done by cleaning the dahlia tubers with running water, then chopping them and blending them in a blender. Heating was carried out at a temperature of 80°C, the filtrate was soaked with 70% ethanol 1:2 then cooled to 0°C for 18 hours, then left at room temperature and centrifuged at 9000 rpm to obtain a wet precipitate I, then repeated to obtain wet precipitate II, and III and then wet inulin I, II, and III were heated at a temperature of 60°C to get dry inulin, and then the yield value was calculated (Horiza et al., 2017; Rubel et al., 2018).

### *Material proximate analysis*

Proximate analysis of red dahlia tuber material can be tested from the content of water, ash, fat, crude fiber, protein, and carbohydrates according to AOAC (*Association Of Official Analytical Chemist*) (Rivera-Espejel et al., 2019; Yudhistira et al., 2021). Water content and ash content using the Gravimetric method, protein content using the Khedjal method, fat content using the Soxhlet method, carbohydrate content using the Carbohydrate by difference method (Hilman et al., 2021).

## Results and Discussion

The results of the measurement of the extraction yield of inulin flour red dahlia tuber can be seen in Table 1.

Table 1. Yield value of inulin flour

No	Parameter	Weight	Yield Value %
1.	Dahlia tuber wet weight	2.500 gr	48,25%
2.	Dahlia tuber dry weight	123,14 gr	
3.	Inulin flour weight	59,42 gr	

The results of the proximate analysis of materials from red dahlia tubers consist of water content, ash content, total fat, crude fiber, protein, and carbohydrates. The results of the proximate analysis of Dahlia tuber material can be seen in Table 2.

Table 2. Proximate analysis of materials

No	Parameter	Results %
1.	Water content	80,8
2.	Ash content	0,36
3.	Total fat	0,33
4.	Crude fiber	1,29
5.	Protein	1,15
6.	Carbohydrate	14,6

The results showed that dahlia tubers contained quite high levels of inulin which showed a yield value of 48.25%. Inulin is a natural prebiotic that cannot be digested so that it stimulates the growth of beneficial bacteria such as increasing the growth of lactobacillus which is useful for inducing the production of short-chain fatty acids (SCFA's) in the colon, this will reduce inflammation in the intestinal mucosa (Akram et al., 2019).

In addition, Inulin also plays a role in having a hypoglycemic effect by lowering blood sugar levels, HbA1c, insulin resistance (IR), hyperlipidemia, reducing oxidative stress, and increasing insulin and leptin levels in T2DM rats (Nishimura et al., 2015; Valenlia et al., 2018).

Inulin is a polysaccharide with  $\beta$ -2,1 fructosyl-fructose bonds. Inulin is an important dietary component in the application of the food industry because it has many benefits such as: as a dietary fiber, has high calories, has an effect on fat metabolism, reduces constipation, improves intestinal microflora, reduces the risk of gastrointestinal disease, increases absorption of calcium, magnesium, and potassium, iron, increases appetite, boosts the immune system, increases intestinal absorption, and as a basic ingredient for other food products (Shoaib et al., 2016).

The results also showed a high carbohydrate content of 14.6%. This shows that Dahlia tubers are a low-calorie source of carbohydrates and sugar. This situation is good for people with diabetes mellitus. The results of previous studies showed an increase in insulin sensitivity, increased glycogen synthesis, and facilitated glucose transport by activating the PI3K/Akt pathway (Liu et al., 2019).

Dahlia tubers have a crude fiber content of 1.29%. Where dahlia tuber as a natural food fiber that is soluble in water plays a role in improving health and improving metabolic syndrome. However, the use of insoluble fiber in foods and is rich in fat is at risk of developing liver cancer (Singh et al., 2018).

The water content in dahlia tubers has the highest content of 80.8%. Water is one of the important elements in food ingredients to maintain the continuity of the biochemical processes of a food ingredient. The water content of a food ingredient can affect the quality and shelf life of food. So that the measurement of water content will be very important in improving the quality of food. Because the high water content can affect the increase in spoilage of a food ingredient. So food needs to be managed properly through the drying process (Nadia, 2021). With the results of the research above, it can be used as a basis for determining food ingredients in dahlia tubers. And as basic data for further research on the use of dahlia tubers for health and the production of other foodstuffs.

## Conclusion

Dahlia tubers contain inulin, carbohydrates, and high water content, as well as low-fat content, have crude fiber and protein that can be used as low-calorie foodstuffs, as a determinant of basic ingredients that can be used for the world of health and pharmacy, and other food industries.

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