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Proximate Analysis of Maranta Arundinacea L. Flour

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Abstract. *Maranta arundinacea* L., also known as arrowroot, are underground rhizomes, or tubers from which arise reed-like, erect stemmed plant. This can be considered as a non-conventional raw material for flour. In Bustos, Bulacan, history tells that arrowroot starch is the primary ingredient of its chief town product which is Minasa, a local biscuit. In the process of extracting starch from the arrowroot, the waste rhizome is collected and grinded as arrowroot flour. This paper seeks to probe the ash content, moisture content, crude fat, crude protein and carbohydrates present on the arrowroot flour. In the proximate analysis it showed that the waste rhizome flour contains 2.03% ash, 8.15% moisture, 0.36% crude fat, 1.86% crude protein and 87.6% carbohydrates. Based on the result, it implies that the rhizome waste product of the arrowroot starch extraction can be made as a flour and can have a potential of producing products that may increase the value of the production of arrowroot in the town of Bustos in Bulacan.

Keywords: Arrowroot; arrowroot flour, Bustos; Maranta arundinacea; proximate analysis

1. Introduction

The town of Bustos in Bulacan, Philippines Maranta Arundinacea L., also known as arrowroot and locally known as sago, has its historical value because it is the original raw material of its chief town product, which is Minasa. However, in the study of Santos & Villegas (2014), it was found out that the practice of planting and propagation of arrowroots in the town has slowly disappeared and maybe soon come to its decline. Moreover, in a study by Santos, Duay & Mendoza (2017), it was found out that the knowledge of pupils from selected public elementary schools in Bustos about the planting and propagation of arrowroot plus its cultural, historical and socio-economic significance to the town also declined due to the decrease in the practice of propagation and planting of arrowroot. Arrowroot is a plant resource close to the heart of Bustos, Bulacan residents; however, because of the changing times, the culture of its propagation also has changed. Thus, this research is an offshoot of the studies mentioned above that

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probed the potential of arrowroot in producing other products and potentially increase the plant's socio-economic value.

Maranta arundinacea L., also known as arrowroot, are underground rhizomes or tubers that arise reed-like, erect stemmed plants. Arrowroots can be considered as a non-conventional raw material for starch and flour. According to Malinis and Pacardo (2012), arrowroot is an erect, smooth dichotomously branched perennial herb, 0.4 to 1.0 meters high and growing from freshly fusiform rootstock. Moreover, its leaves are ovate-oblong, 10 to 20 centimeters long, thin petioled, acuminate, rounded at the base, and green. According to Qodliyati et al. (2018) that fiber roots can be found in arrowroot plants. The rod-shaped rhizome is above ground at first, then enters the earth and expands into a fleshy organ. The rhizome is bent like an arrow, white, meaty, and covered in overlapping scales. Arrowroot’s rhizome has a diameter of 2-5 cm and a length of 20-40 cm. Historically, according to Moraes and Berti Filho (2005), arrowroot is a popular name for Maranta arundinacea L. In the study, it was found out that arrowroot originated from the family of Marantaceae.

In Brazil, arrowroot is a common ingredient in some Brazilian food in some regions, and it is continuously farmed by families in the country (Vieira, Colombo, Puiatti, Cecon, & Silvestre, 2015). According to Villas-Broas & Franco (2016), that arrowroot starch has the advantage of excellent digestibility. Thus the plant has grown a potential economic value. The arrowroot starch is a potential novel alternative (Tarique et al., 2021b) because of its various advantage, as it is versatile, non-poisonous, ecological, blood-adaptable, and bio-accumulate (Sandoval Gordillo et al., 2014; Winarti et al., 2019). Moreover, according to Lim (2016), the use of the by-products of arrowroot shows a potential of wheat flour alternative because of its suitability for the diet of individuals with gluten intolerance. Because of these properties and uses of the by-products of the rhizome, it will have great potential in the food industry.

In the analysis of Erdman & Erdman (1984) with the components of the arrowroot rhizomes, the air silage and processing residues of thick and thin rhizomes are composed of 10.8 – 21.1 % crude protein; 11.1 – 30.2% crude fiber; 3.8 – 17% ash; and in-vitro digestibility of dry matter of 38.5 – 60.3%. Moreover, according to Priadi, Imelda & Soetisna (2000) that arrowroot has its advantage to health because compared to other tubers such as potatoes, yams and cassava it has low calories. In the analysis, it was found out that arrowroot starch contains 80 %

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amylopectin and 20% amylose. Moreover, in their study, natural antioxidant compounds of polyphenols are found in arrowroot tubers.

There are several reported medicinal benefits of arrowroot. In the study of Villarnayor & Jukema (1995) shows that the methanolic extract of arrowroot at 200 and 400 mg/kg doses in rats and brine shrimp showed an antidiarrheal activity however it has slight cytotoxic effect. Moreover, in the study of Priadi, Imelda & Soetisna (2000), it was found out that the ethanolic extract of the tubers reduces the concentration of SGPT and SGOT with a most effective dose of 500 mg/kg. Potential antioxidant compounds such as phenolic, flavonoid, alkaloids and saponin compounds are found in arrowroot plants, wherein the antioxidant activity of fresh tuber extract is higher than fresh leaf extract (Ramadhani et al., 2017).

Given the historical, cultural and economic value of arrowroot in the town of Bustos, Bulacan and the industrial, nutritional and medicinal value of the products of arrowroot, it is imperative to have a scientific analysis of the chemical components of one of its byproducts which is the arrowroot flour. There are myriads of studies about the proximate analysis of arrowroot starch extract, however there are only few literature that cites about the contents of the rhizome byproduct which is flour. According to Capiña and Capiña (2017) that about 28% of waste rhizome or sapal is generated in every extraction of arrowroot starch. However, this waste rhizome are barely utilized by farmers. Although some farmers use the fresh arrowroot waste or sapal into pig feeds. The study also probed the proximate analysis of the arrowroot flour which are grinded waste rhizomes (sapal) and found out that the results are comparable to arrowroot starch.

With the potential of utilizing arrowroot flour to produce potential products, it is the initiative of the researchers to also investigate the proximate analysis of the arrowroot waste product (sapal) harvested in Bustos, Bulacan. The analysis involves the measurement of the proximate composition of a food product. The proximate composition of foods includes moisture, ash, lipid, protein and carbohydrate contents (Proximate Composition Analysis, 2016).

Moreover, an in-depth analysis and result will serve as baseline information to future researches and products about arrowroot. This will open opportunities to Bustoseños to expand more the horizon of the plants consumption and use.

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2. Methodology

MATERIALS USED

Table 1

Materials used in the Production of Flour from the Arrowroot Rhizome

MATERIALS
Tub
Basin
Knives
Chopping board
Grater
Weighing scale
Sieve / Cheesecloth
Food blender
Zip Lock
Brush
Wooden spon

PRODUCTION OF FLOUR FROM RHIZOME

Arrowroot rhizomes are collected, inspected, sorted in size and weighed. After this process, the tubers were thoroughly washed. After washing, the rhizomes were peeled and sliced. Next in the process is grating the rhizome in preparation for the extraction of the liquid containing the starch. After the extraction using a fine cheesecloth, the arrowroot rhizome waste residues were collected and washed and sun dried. The dried rhizome waste residue or *sapal* that weighed10 kg were collected and wrung out to get the left over granules of flour. A food processor or blender was used to obtain a finer texture. Almost 5% of flour were obtained from leftover granules out of the 10 kg of dried waste rhizome (*sapal*) resulting to 513 grams which was submitted to DOST REGION III

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laboratory for proximate analysis. The obtained flour from arrowroot is off-white in color and the texture is coarser compared to arrowroot starch.

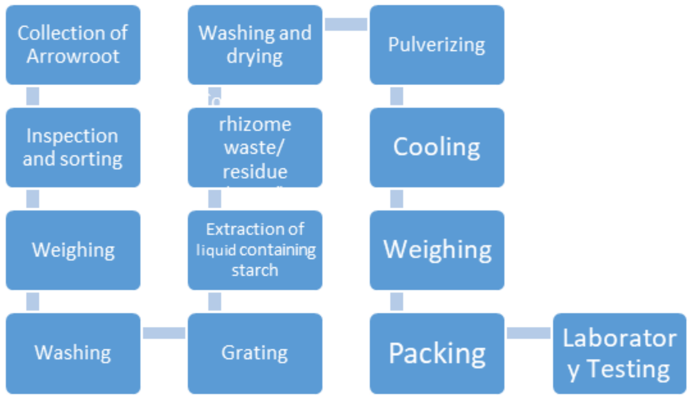

Figure 1 Diagram of the Production of Flour from Rhizome Waste / Residue.

3. Results and Discussion

Table 2

Proximate composition of the Flour from Arrowroot Rhizome Waste or Residue

Test Parameter	Method	Result
Ash Content	TM – 201 With reference to AOAC Methods of Analysis 18th Ed., Official Method 930.05, Furnace Ashing, 525 °C, 30 hrs	2.03%
Moisture Content	TM – 203 With reference to AOAC Methods of Analysis 18th Ed., Official Method 934.01, Vacuum Oven Drying, 95-100 °C, 5 hrs	8.15%
Crude Fat	TM – 202 With reference to Velp Fat Hydrolysing Unit and Fat Extractor Manuals Using Petroleum Ether	0.36%
Crude Protein	TM-204 With reference to AOAC Methods of Analysis 18th Ed., And Velp Scientifica Distillation Apparatus Operation Manual, factor for % Nitrogen content conversion to protein = 6.25	1.86%
Carbohydrates	By Computation: % Carbohydrates = 100% – (% Ash + % Moisture + % Fat + % Protein)	87.6%

Note. The results in this report are those obtained during the time of analysis and refer only to the particular sample submitted.

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It can be gleaned in Table 2 the results of the proximate analysis from the DOST Regional Standards and Testing Laboratory, Regional Office III of the sample arrowroot starch that it contains 2.03% ash content, 8.15% moisture content, 0.36% crude fat, 1.86% crude protein and 87.6% carbohydrates. In a parallel result from the study of Capiña, & Capiña (2017), the proximate of arrowroot flour results 2.71 % ash, 11.39% moisture content, 0.05% crude fat, 1.27% crude protein, 6.12% crude fiber and 78.46% nitrogen free extract.

A proximate analysis is a method to determine the approximate amount of a sample material. The results of the proximate analysis can give information about the safety of the material that they do not contain hazardous chemicals. The analysis also identifies whether they are healthy enough to be consumed by humans or animals (*What Is Proximate Analysis?*, 2012).

4. Conclusions

Based on the result of the proximate analysis of arrowroot flour, it implies that the rhizome waste product of the arrowroot starch extraction can be made as a flour and can have a potential of producing products that may increase the value of the production of arrowroot in the town of Bustos in Bulacan. It is also a significant finding that we can collect an amount of 5% out of the weight of 10 kg of arrowroot waste or sapal which is from the residue of extraction of starch and these residues can be made as flour.

Furthermore, it can be recommended that future researchers look on the possibilities of developing a food product made out of the arrowroot starch. Moreover, future studies maybe done in the possibility of arrowroot starch as a substitute for wheat flour in gluten-free recipes as well as an ingredient in baking cookies and bread. Additionally, this study recommends that more scientific researches be done to establish potential utilization of arrowroot flour not only for human consumption. Lastly, the study suggests to investigate the plausible use of the rhizome waste or sapal in the production of arrowroot flour for a more increase in yield. Consequently, a proximate analysis is recommended for the flour out of the sapal.

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