Proximate Analysis of IBA (*Averrhoa bilimbi*) Powder as Souring Agent

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ABSTRACT

This experimental research study determines the proximate analysis of iba powder as a souring agent. The procedure includes sampling, preparation, drying, and powdering. The powdered iba was subjected to laboratory analysis such as crude protein, crude fat, crude fiber, moisture, ash, and calcium. Results revealed that iba powder is not only a nutritious food but also a potential material for souring agents.

Keywords: Iba Powder, Souring Agent, Proximate Analysis

INTRODUCTION

Souring agents are integral to Filipino cuisine, where native fruits and acids impart characteristic tartness to many dishes. Kamias (*Averrhoa bilimbi*), a fruit-bearing tree native to Southeast Asia, is widely used in the Philippines for its pronounced acidity (Slow Food, 2022). Common souring agents include citrus (e.g., calamansi, lemon, lime), green mango, tamarind, tomato, vinegar, and cultured dairy such as yogurt (RecipeTips.com, 2023). Mendiola (2022) categorize eight traditional souring ingredients-calamansi, green mango, guava, pineapple, tamarind, tomato, batuan, and kamias-underscoring the culinary and cultural diversity of sour flavors across the Philippines.

Balimbi (Iba fruit) is a seasonal sour fruit that yields abundantly during its harvest period. Despite its potential as a culinary acidulant, considerable portions of the Balimbi crop remain underutilized or discarded because preservation and value-adding practices are limited. The fruit's high acidity and fruit-matrix composition make it a promising candidate for conversion into concentrated souring agents, powdered ingredients, and fermented products that could extend shelf life and broaden commercial uses.

Proximate composition is fundamental to food-product development, regulatory compliance, and safety assessment. Standard proximate parameters such as moisture, ash, crude protein, crude fat, and carbohydrate with acidity metrics (pH and titratable acidity) inform processing design, shelf-life prediction, and nutritional labeling. Historically, nutritional and proximate analyses have guided formulation and quality control since the establishment of systematic food chemistry methods in the 19th century; today, they remain central to meeting food-labeling regulations and ensuring consumer safety and marketability. Thus, this study characterizes the proximate composition and key physicochemical properties of Balimbi fruit and evaluates processing pathways to produce shelf-stable, value-added souring ingredients.

Objectives of the Study

This study aimed to determine the proximate analysis of iba powder as a souring agent.

Specifically, this aims to answer:

1. determine the proximate analysis of iba powder as a souring agent.
    a. crude protein'
    b. crude fiber;
    c. crude fat;
    d. ash;
    e. moisture content;
    f. calcium.

METHODOLOGY

Whole fruits of Balimbi (iba) were collected from identified sites in the First District of Iloilo (municipalities of Miagao and Tigbuan). Harvesting excluded over-ripe specimens; only mature, firm fruits were sampled. Collected fruits were transported to the laboratory and washed under running potable water to remove dirt and surface contaminants, then drained. Fruits were cut into thin slices to promote uniform drying and facilitate subsequent milling. Sliced fruits were arranged on drying trays and covered with white cotton cloth to protect the samples from dust and insects during drying. After reaching the target moisture content, dried slices were milled to a fine powder, packaged in airtight containers, and stored under specified conditions prior to laboratory analyses.

Process Flow

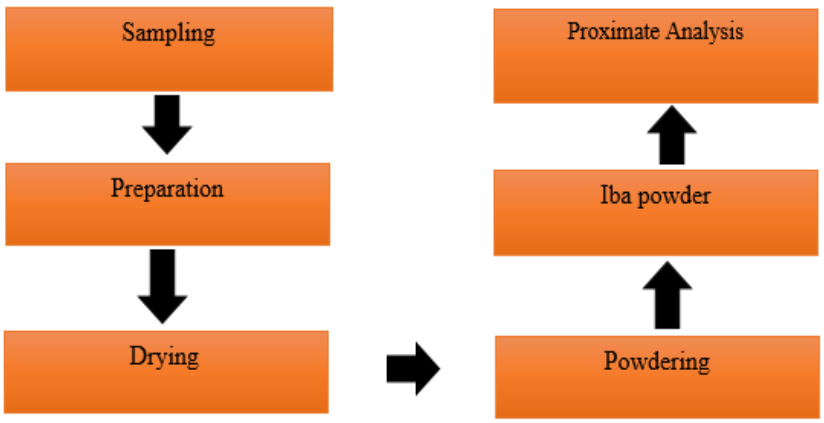

Figure 1: Process Flow of the Study

Result and Discussion

Proximate Analysis of Iba Powder

Table 1: Laboratory Result as to proximate analysis of Iba powder

Proximate Analysis	Percentage Composition (%)
Crude protein	8.82
Crude Fat	4.12
Crude Fiber	9.23
Crude Ash	4.16
Moisture (Oven Drying)	15.48
Calcium	1.61

The table presents the proximate analysis of Iba powder, focusing specifically on its crude protein content, which is determined through a chemical analysis that estimates protein levels based on nitrogen content. Crude protein encompasses both protein nitrogen and non-protein nitrogen (NPN), where nitrogen, being a critical component of amino acids, can be utilized by rumen microorganisms for protein synthesis. The analysis indicates that Iba powder contains 8.82% crude protein, significantly higher than tamarind, which shows 2.5% for green pulp and 2.9% for ripe pulp. This suggests that Iba powder is nutritionally superior in protein content compared to tamarind. Further research by Diana Luise (2021) highlights that reducing dietary crude protein can lead to decreased fermentation of undigested dietary protein in the large intestine, resulting in lower inflammation of the intestinal mucosa and reduced post-weaning diarrhea in piglets, without adversely affecting their overall performance. Conversely, Anderson Hay & Grain (2019) emphasizes that maintaining proper crude protein levels in forages is vital for livestock nutrition; insufficient crude protein can hinder the digestion process managed by bacteria, leading to decreased intake and digestibility of feed. Overall, crude protein serves as a key metric in evaluating feed quality and ensuring adequate nutrition for various livestock, underscoring its importance in diet formulation and animal health.

On the other hand, the term "crude fat" refers to the crude mixture of fat-soluble material present in a sample, also known as ether extract or free lipid content. It serves as a traditional measure of fat in food products, with a measured crude fat result of 4.12%, significantly higher than the 0.1% found in tamarind pulp, whether green or ripe. According to Bhandar (2022), multiple clinical specialties advocate for lowering fat content in the average diet to reduce the risk of cardiovascular morbidity and mortality. Low-fat diets are defined as those in which 30% or less of calories derive from fat, with a general guideline indicating that a food item containing 100 calories should have 3 grams or less of fat to be considered low-fat. Fats play an essential role in nutrition, but their intake must be limited. The National Cholesterol Education Program (NCEP), following Adult Treatment Panel III (ATP III) guidelines, recommends reduced saturated fat intake to less than 7% of total calories and cholesterol to below 200 mg/day. Additionally, polyunsaturated fats should make up to 10%, while monounsaturated fats should constitute up to 20% of total caloric intake. Literature indicates that modifying serum cholesterol levels can prevent atherosclerosis, and decreasing fat intake is an effective strategy for lowering serum cholesterol concentration. Clinicians widely advocate for a low-fat diet to lower cardiovascular-related risks. Conversely, Amer (2022) notes that the Dietary Reference Intake (DRI) for fat is set at 20 to 35% of daily calories. The author identifies potential adverse effects from low-fat diets, including heightened sensitivity to sunburn, mood imbalances, hormonal disruption, persistent hunger, inadequate vitamin absorption (specifically A, D, E, and K), and increased cravings. To optimize health, a balanced diet inclusive of moderate fat intake is recommended for overall well-being. Dr. McClements (2003) emphasizes the importance of accurately assessing total fat content in foods for five key reasons: economic (preventing loss of expensive ingredients), legal (compliance with nutritional labeling standards), health (development of low-fat food options), and quality (influencing food properties), and processing (determining processing conditions based on lipid content).

In addition, the crude fiber refers to one type of dietary fiber, the type that remains as residue after food receives a standardized laboratory treatment with dilute acid and alkali. The treatment dissolves all the soluble fiber and some of the insoluble fiber in a food. More importantly, the residue or crude fiber is primarily composed of cellulose and lignin. They are insoluble stimulate digestion and also encourage the production of important intestinal bacteria (Lakna, 2022). Based on the results of the present study in terms of crude fiber, 9.23% is higher compared to the tamarind of 5.0% for green and 5.2% for ripe pulp. Thili (2016) Crude fiber is a part of insoluble fiber found in the edible portion of the plant cell wall. It is basically cellulose material obtained as a residue of the chemical analysis of vegetable substances. The main health benefit of crude fiber is that it facilitates regular bowel movement. Leafy greens, whole grains, and beans (black beans) are some common examples of crude fiber. Ganovski, K (2021) established that crude fibers should range from 22 to 25 percent of the dry matter in order to achieve the best digestion effects. The lacking percentage of fiber on the tea can be increased by adding green leafy vegetables to the diet.

Similarly, ash is the inorganic residue remaining after the water and organic matter have been removed by heating in the presence of oxidizing agents, which provides a measure of the total amount of minerals within a food. Analytical techniques for providing information about the total mineral content are based on the fact that the minerals (the analyte) can be distinguished from all the other components. McClements, J (2003). Ash content of

iba powder is 4.16 which is higher in value compared to tamarind powder which means there is a possibility of the presence of other substances in the powder. Food Science (2012) Ash or mineral content is the portion of the food or any organic material that remains after it is burned at very high temperatures. The ash constituents include potassium, sodium, calcium and magnesium, which are present in larger amounts as well as smaller quantities of aluminum, iron, copper, manganese or zinc, arsenic, iodine, fluorine and other elements present in traces. Although minerals represent a small proportion of dry matter, often less than 7% of the total, they play an important role from a physicochemical, technological and nutritional point of view. Proximate analysis is important for nutritional evaluation. Fresh foods rarely is greater than 5%. Pure oils and fats generally contain little or no ash; products such as cured bacon may contain 6% ash and dried beef may be as high as 11.6% based on weight basis. Further study should be done in pomelo peel tea in order to determine the minerals present in it. Prescisa (2022) reported that the ash content in food refers to the minerals and inorganics left after the food sample has been heated to a very high temperature removing moisture, volatiles, and organics. The most common minerals and inorganics are calcium, magnesium, sodium and potassium but in smaller quantities there can also be traces of manganese, zinc, iron and others. Food normally has around 7% ash content, however this can vary. Ash content in food can be an indication of how much processing has taken place as natural foods have a lower ash content compared to more processed food. Pure oils and fats can have an ash content as low as 0% but processed dried meats can contain up to 12% ash. Measuring the ash content in food is important for a few reasons. Ash content can affect different characteristics of food including physiochemical and nutritional properties. Ash Determination of food samples is part of the proximate analysis necessary for nutritional evaluation. This ensures the safety of foods, making sure there are no toxic minerals present. The ash content in food can also impact the taste, texture and stability of foods so it is vital to know the mineral content for quality control purposes.

The moisture content refers to the number of water molecules that become incorporated into a food product. Moisture can enter into a product in a number of ways, it could be related to the production method of the product, the atmospheric moisture in the food production area, the packaging method of the product, or it can be related to the method of food storage. Moisture content has a lot to do with a food product's characteristics, including its physical appearance (shape, color, etc.), texture, taste, weight (which can impact the cost) in addition to factors that affect the product's shelf-life, freshness, quality, and resistance to bacterial contamination, (Sarah Moore ,2020). Moisture content of iba powder is 14.58% which lower in value than the other souring agent, this simply showed that it can have a longer shelf life than the other. Excess water in a food product can cause an increase in the rate of microbial growth, which can not only spoil a product before it reaches the shelves but could also decrease the length of time it can stay fresh for. This has a significant impact on whether or not the products reach their advertised use-by date. Maintaining specific characteristics of a product is essential to customer satisfaction, loyalty, and ultimately revenue and profits. Wesolowski, P (2013) reports. Moisture content analysis is a critical component of material quality and is essentially a function of quality control in most production and laboratory facilities. From biological research organizations, and pharmaceutical manufacturers, to food producers and packers, moisture content control greatly influences the physical properties and product quality of nearly all substances and materials at all stages of processing and final product existence.

Lastly, calcium is a mineral most often associated with healthy bones and teeth, although it also plays an important role in blood clotting, helping muscles to contract, and regulating normal heart rhythms and nerve functions. About 99% of the body's calcium is stored in bones, and the remaining 1% is found in blood, muscle, and other tissues. (The President and Fellows of Harvard College, 2023). Iba powder contains a calcium of 1.61 %. The reviews below specifically looked at the effect of calcium on various health conditions. Scroll down for links to more information on the health effects of specific foods rich in calcium. Clinical reviews found that calcium lowers Blood pressure, Cardiovascular disease, Bone health, Colorectal cancer, and Kidney stones, (The President and Fellows of Harvard College, 2023).

CONCLUSION

Iba powder is not only a nutritious food but also a potential material for souring agents.

RECOMMENDATIONS

Since Iba powder is a good ingredient as a souring agent, the researchers would like to recommend the following:

1. It is highly recommended to test the Iba powder in terms of microbial and nutrition facts assessment;
2. Farmers are encouraged to plant more Iba trees;
3. Preserve Iba fruit in the form of powder;
4. Further study is encouraged.

Conflict of Interest

The authors declare that they have no conflict of interest.

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