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Nutritive Value and Economic Sustainability of Banana Blossom *(Musa acuminata colla)* Cookies

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Abstract

This study explores the potential of Banana blossom *(Musa acuminata colla)* flour as an alternative ingredient in cookie production. It aims to assess the nutritive value of banana blossom, determine the process of preparing cookies using Banana blossom flour, identify the best proportion for baking, evaluate sensory acceptability, examine shelf life, and assess its economic viability as an additional source of income. Given the increasing demand for healthier and sustainable food alternatives, this study highlights the potential of Banana blossom flour as a nutritious and cost-effective option.

The study employed descriptive and research and development (R&D) methods and involved students, parents, and teachers from Pinaglabanan National High School, Pinaglabanan, Goa, Camarines Sur, as respondents. Three Proportions of Banana blossom flour cookies were tested: Proportion 1 (½ cup of Banana blossom flour), Proportion 2 (1 cup), and Proportion 3 (1 ½ cups). Sensory evaluation was conducted to assess the cookies' color, taste, aroma, texture, and appearance. The shelf life was determined through physical observation, and economic sustainability was analyzed based on production costs and market potential.

The findings revealed that every 100-gram serving of Banana blossom contains dietary fiber 5.74g, protein 1.6g, carbohydrate 5.7g, calcium 56 mg, phosphorous 56.4g, vitamin E 1.07mg Kcal 51g, iron 56.4mg, copper 13mg, potassium 553.3mg and magnesium 10.07mg. Preparing banana blossom flour involves peeling, sorting, cleaning, drying, pulverizing, and packaging. Among the tested proportions, proportion 3 (1 ½ cup of banana blossom flour) produced the most acceptable cookies, characterized by a dark chocolate brown color, moderately sweet and slightly bitter taste, sweet aroma, and a perfectly moist and firm texture. Sensory evaluation results showed that proportion 3 had the highest acceptability with a weighted mean of 3.50, indicating a high preference among

respondents. The cookies were observed to maintain their quality for up to 10 days when stored at room temperature, after which texture changes and mold growth were observed. Additionally, the economic sustainability of banana blossom cookies was promising due to the low production costs associated with the abundant availability of banana blossoms in the local community. The product's novelty and health benefits appeal to eco-conscious consumers, suggesting that with effective marketing and strategic pricing, banana blossom cookies can achieve market success while also supporting local economies and creating job opportunities.

This study concludes that incorporating Banana blossom flour in cookies offers a nutritious, economical, and sustainable alternative to traditional ingredients. Following proper flour preparation techniques ensures product quality, and Proportion 3 (1½ cups of Banana blossom flour) is the most suitable for achieving optimal sensory attributes. The moderate acceptability of all proportions suggests that banana blossom cookies can be further improved to meet consumer preferences. With effective marketing strategies, this innovative product has the potential to create livelihood opportunities, support local economies, and contribute to sustainable food systems.

Keywords: Banana blossom (Musa acuminata colla), Nutritive value, Cookies, Sustainability

Introduction

There has been a growing emphasis on sustainable food choices in recent years, sparking a shift towards local, abundant, and often overlooked resources. Among these is the banana blossom, an edible part of the banana plant that is typically underutilized and wasted despite its nutritional value and culinary potential. The banana blossom, found in large quantities in many tropical and subtropical regions, has long been known for its health benefits and versatility. However, its use remains limited and often overlooked in mainstream food products. This study explored the banana blossom as a unique ingredient in the baking industry, specifically in cookie production, and also seeks to introduce a new nutritious and eco-friendly product. Leveraging such resources, we can create economically viable and environmentally friendly alternatives supporting local economies and food sustainability.

Exploring the potential of utilizing banana blossoms, an often-overlooked by-product of banana cultivation, as a key ingredient in cookies. Incorporating banana blossoms into cookies. From an economic sustainability perspective, the use of banana blossoms represents a cost-effective approach to reducing agricultural waste and adding value to an underutilized resource. Sourcing banana blossoms locally, especially in banana-producing regions, and producing banana blossom cookies can help support local economies while minimizing environmental impact. This research aims to create a functional food product that not only offers nutritional advantages but also caters to health-conscious consumers seeking plant-based and sustainable food options and also investigates the feasibility of commercializing banana blossom-based products, assessing their potential market demand and profitability, thus contributing to both sustainable food practices and economic development in rural agricultural communities.

Cherished for their indulgent texture and rich flavor, Cookies offer an excellent platform for culinary innovation. This study explored the gastronomic allure and the economic viability of this unique fusion by integrating banana blossom into cookie recipes. The research assessed the acceptability of banana blossom cookies across various demographic segments, providing insights into consumer preferences. Additionally, it will evaluate the market potential of these innovative cookies, highlighting the possibilities for commercial success.

Due to the strains caused by current allied global food systems that result in health and environmental harm, there is an increasing need to revamp these systems to become more sustainable worldwide. According to the European Commission (2020), food system transformation is required to shift towards a more sustainable and healthy diet, ensuring holistic food and nutrition security. However, to be clear, hunger and food security are both local and global concerns. According to the Food and Agriculture Organization (FAO, 2020), an estimated 690 million people are experiencing hunger in the world in 2019, with 381 million undernourished, and current trends indicate that these rates are growing faster, especially in Africa. Globalization is shaping food options and choices: 77 percent of processed food sales worldwide are controlled by just 100 large firms. Therefore, national food systems must put children's nutrition at the heart of their work because their nutritional needs are unique, and meeting them is critical for sustainable development (UNICEF, 2019).

A new set of global development goals, known as the Sustainable Development Goals, or SDGs, were agreed upon and established by the United Nations' member nations in 2015 as the Millennium Development Goals approached their final stage. The SDGs aim to envision a world where economic, social, political, and environmental development can be sustained on all levels. Understanding the significance of a healthy population for national, human, and global growth, the second objective (SDG2) of these aims is eradicating world hunger (FAO, 2015). Specifically, it aims to eliminate all forms of malnutrition and to boost agricultural productivity and income, particularly for farmers and small-scale entrepreneurs.

Sustainability Development Goal 2 Targets by 2030 to "End hunger, achieve food security and improved nutrition, and promote sustainable agriculture. The broader goal of achieving zero hunger encompasses various aspects of sustainable agriculture, food security, and improved nutrition. Banana blossom, being a potential source of food, could contribute to achieving this goal, especially if its cultivation and utilization align with sustainable practices.

Innovative solutions are needed to address social and economic challenges while safeguarding the environment to achieve sustainable development and meet the United Nations Sustainable Development Goals (SDGs) by 2030. One of the key goals, SDG 2, aims to end hunger by establishing sustainable food systems that ensure access to nutritious food for all.

Despite having one of Asia's fastest-growing economies, the Philippines has had difficulty converting economic growth into human development because of natural disasters and violence. Rep. Jericho Nograles introduced House Bill (HB) 1532 in 2019 to fight hunger and malnutrition through school feeding programs, public nutrition campaigns, and social transfer programs. It is sometimes called the Zero Hunger Bill or the Right to Adequate Food Framework Act. In January 2020, President Rodrigo Duterte established an inter-agency task force on hunger

eradication through Executive Order 101, which helped the Executive Branch back HB 61, a related bill co-authored by Jericho and Karlo Nograles.

As a result, the nutritional status of students in the Philippines Department of Education is a growing concern. Research has shown that many students are not meeting the value of good nutrition, which can have long-term implications for their health and development. Additionally, food choices among students in schools often consist of processed foods high in sugar, salt, and saturated fats, contributing to poor dietary habits and potential health issues. This is in consonance with the DepEd Memorandum No. 037, s.2023 or 2023 Nutrition Month Celebration which states that:

> *Nutrition Month is celebrated every year to raise public awareness about the value of good nutrition. The national celebration is in line with the Philippine Development Plan's Targets of improving Filipino consumers' access to affordable, safe, and nutritious food and attaining a sufficient and stable supply of food commodities.*

The memorandum aims to engage consumers to support improvement in levels of diet quality towards sustainable health diets, generate stakeholders' participation at various levels on actions towards enabling access to affordable, sustainable healthy diets, and call for support for the Philippine Development Plans of Action for Nutrition (PPAN) 2023-2028 as the framework for action to improve nutrition security, ensuring they grow healthy and ready to learn.

There has been a growing emphasis on sustainable food choices to achieve zero hunger, sparking a shift towards local, abundant, and often overlooked resources. Among these is the banana blossom, an edible part of the banana plant that is typically underutilized and wasted despite its nutritional value and culinary potential. Its use remains limited and often overlooked in mainstream food products. This study contributed to this objective by exploring the possibility of banana blossom-infused cookies as a culinary innovation. The study sought to introduce a new nutritious food source by investigating its acceptability. It explored its potential as an income-generating opportunity, aligning with SDG 2's focus on eliminating hunger and fostering economic empowerment (Goal 2: Zero Hunger 2015 (2023).

Locally, communities in Camarines Sur, where agriculture is a significant source of livelihood, are impacted by limited access to markets and the need for sustainable income opportunities. Farmers and small-scale food producers in these areas face economic uncertainties and struggle with the cyclical nature of agricultural work. By incorporating banana blossoms into food products, such as cookies, this study aims to introduce a unique and healthful product that can drive local economic growth and reduce waste.

One such resource with untapped potential is the banana blossom, an edible flower of the banana plant widely available in tropical regions like the Philippines. Despite its availability, banana blossom is often discarded or overlooked, especially in large-scale food production, due to a lack of awareness of its nutritional benefits and culinary versatility.

This study on banana blossom flour presents an innovative approach to addressing food waste while promoting agricultural sustainability. Transforming an often-overlooked by-product of banana plantations into a valuable ingredient, this research contributes to food security and sustainable consumption. Utilizing banana blossom flour in cookie production not only enhances nutritional value but also provides an accessible and cost-effective alternative for local bakers. The study is particularly relevant to Barangay Pinaglabanan, Goa, Camarines Sur, where banana trees are abundant. Encouraging the use of this underutilized resource, the research seeks to empower

the community with a sustainable means of income generation. Incorporating banana blossom flour into baked goods fosters creativity and resourcefulness among local bakers, allowing them to craft unique products that highlight indigenous ingredients. Beyond economic benefits, this initiative strengthens local identity by celebrating the region's agricultural heritage. It champions self-sufficiency, reduces reliance on imported baking materials, and inspires innovation in food production. Ultimately, this research aims to bridge the gap between sustainability and economic opportunity, proving that local resources can drive both nourishment and livelihood.

Nutritive Value of Banana Blossom

The banana blossom, also known as the banana heart, is a highly nutritious edible flower. It is rich in essential nutrients such as dietary fiber, vitamins (A, C, and E), minerals (iron, potassium, calcium), and antioxidants, making it a valuable food ingredient. Traditionally used in various cuisines, its health benefits include anti-inflammatory, anti-diabetic, and digestive properties. With its potential to enhance the nutritional quality of food products, banana blossom is gaining interest in food science and product development. The following literature and studies explore its nutritional composition and functional properties.

The banana blossom, also known as the banana heart (Musa acuminata colla), is the flower of the banana tree. It is a common ingredient in Southeast Asia cuisine, including the Philippines, and is appreciated for its distinct flavor and nutritional value. This present study basically utilizes Banana blossom (Musa acuminata colla) to produce banana blossom flour. The flour is then used in baking products like cookies, showcasing its potential in innovative food applications in baked products.

Banana Blossom, a by-product of banana cultivation, is easily accessible and affordable to people because of the low cost of vegetables. Banana blossoms are the edible flowers of banana plants, and their transformation into a snack product is a testament to the creative fusion of tradition and innovation. Banana blossoms are a good source of minerals. The young and mature flowers or florets can be eaten after properly processing. Natural drying of banana blossoms involves direct sunlight drying to extend shelf life and preserve the vegetable's nutritional benefits. Once processed, they can be eaten as a snack, used in traditional dishes, or ground into flour for cooking or baking (Thagunna & Bishal, 2023).

Some studies make different baked products made of banana flour, squash flour, potato flour, carrot flour, etc. The researchers used Banana Blossom as flour for baked products in this study. Banana Blossom is a source of food and raw materials for household instrument production and income generation for many local communities. Banana Blossom (Musa acuminata Colla) can be eaten raw and used as a flavor. Hearts are low in calories and contain small amounts of essential minerals such as calcium, potassium, phosphorus, copper, and zinc (Singh & Yadav, 2018).

According to Singh (2017), the raw banana blossom flour per 100g contains notable amounts of contained Calories (51 Kcal), protein (1.6 g), fat (0.6 g), carbohydrate (9.9 g), Fibre (57 g), calcium (56 mg), phosphorus (73.3 mg), iron (56.4mg), copper (13mg), potassium (553.3 mg), magnesium (48.7 mg) and vitamin E (1.07). further mentioned that besides having quality protein, fiber minerals, and vitamins, banana blossom is proven to have significant therapeutic value (namely lowers menstrual bleeding, facilitates lactation, helps in overcoming diabetes, anemia and ulcer, reduces anxiety, helpful in weight loss and good for gastrointestinal health).

According to Sharma, Shukla, and Golani (2019), banana blossom (100g) contained dietary fiber (5.74g), protein (1.6g), carbohydrate (5.7g), fat (0.6g), phosphorous (56.4mg), vitamin E(1.07mg) Kcal (51g), Calcium (56mg), iron (56.4mg), copper (13mg), potassium 553.3mg, magnesium (10.07mg). Dietary fiber plays an essential role in lowering serum cholesterol levels, preventing obesity, and normalizing blood glucose and insulin levels. Fiber aids in the maintenance of our body structure, the reduction of cholesterol, and the prevention of obesity. Antioxidants

aid in the protection of the immune system against a variety of diseases. Considering all these factors, this study aims to find out the proximate composition, antioxidant activity, vitamin C, total phenolic, and flavonoid content of banana blossom powder.

According to the study of Arya Krishnan and Sinija (2016), the Proximate composition analysis showed that 100g of banana blossom powder contains approximately 1.76-189 g of moisture, 1.29-1.98 g of protein, 0.41-0.46 g fat, 4.19–3.08 mg ash, 15.48–15.32 mg fiber, and 93.42-95.17 mg of carbohydrate. Due to its relative abundance in many localities and high nutritional content, banana blossom is widely used as a vegetable ingredient in various salads, soups, and even curry recipes in many localities in the Philippines. The banana tree's large and dark purple-red flower (also known as the blossom or heart) that rises from each bunch of bananas has a slightly bitter and starchy flavor. Its substantial bracts, or leaves, enclose small delicate florets. Banana blossom is rich in proteins, dietary fiber, vitamins (e.g., vitamin C), flavonoids (especially quercetin), and biologically active compounds like tannin and α-tocopherol.

Moreover, the study by Sharmila et al. (2017) stated that carbohydrate content in banana blossom is 9.9g/100g Protein, determined by the Kjeldhal method, and thereafter, a conversion factor of 6.25 was used to calculate the total nitrogen to crude protein. 12.5% of protein was reported /100g of banana flower.

Traditionally, based on the study by Tamanna Tasnima et al. (2020), dietary-related diseases are promoted through the promotion of food products enriched with high protein, vitamins, minerals, and dietary fiber from locally available fruits and/or vegetables. The blossom of the banana heart is a good source of high-quality protein, dietary fiber, vitamins, and minerals such as magnesium, iron, and copper; it is also a good source of flavonoids. Banana blossom is generally consumed as a vegetable in Bangladesh. The blossom is consumed with rice or wheat bread as a salad by people in different Asian countries. It also helps us sustain ourselves during difficult times by providing essential nutrients and a reliable food source.

However, according to Ragab et al. (2016), banana blossoms are regarded as a by-product or sometimes a waste material in banana farming. The banana blossom is enormous and grows at the end part of the bunch. It blooms in a dark purple-red color. Bananas would grow from the little blossoms. It is a vegetable that can be incorporated into one's diet. Outside of the mature blossom, there is a hard husk. It is also used as an ingredient for preparing noodles and soup. It is sometimes served as a salad also. Banana blossoms are consumed in raw form in some parts of the world. The blossom of the banana has exceptional therapeutic capabilities that aid in the prevention of anemia, diabetes, obesity, and a variety of other ailments and it has a beneficial nutrient profile. It is high in minerals like phosphorus, calcium, potassium, copper, magnesium, and iron, which are necessary for a variety of bodily functions.

Likewise, in the study of Sarker (2022), the Musa acuminata (banana) tree flower was obtained from the local area in Tangail district, Bangladesh. Banana blossoms were collected from the local gardens of the Santosh area. Common maturity characteristics (size, shape, and color) were observed in matured uniform samples without any bruising or deformities. First, I sorted the blossom, removed the bracts by cleaning it with distilled water, and stayed on clear tissue paper to reduce extra water. The banana flower will remove the calyx and pistil and then dried at 60°C for 12 hours in a tray drier. The sample pieces were ground in a grinder and passed through a 200μm mesh. The powder or flour was stored in an airtight plastic box for the subsequent analysis. The carbohydrate content of the sample was high (95.92%), suggesting that it could be an excellent source of energy.

On the other hand, according to Lau et al. (2020), the purpose of the study was to obtain the best composition of the nutritional value of the flour produced from the banana blossom of banana heart. The present study aims to perform a preliminary approach to evaluate the potential of the use of banana flowers as an innovative food

ingredient, for which a nutritional characterization of materials was performed. Based on their nutritional values, bananas and their by-products have demonstrated exceptional potential in a number of food industries. This article intends to provide an overview of the nutritional composition and bioactive compounds found in bananas and their by-products. It also aims to discuss its application in the food industry.

More so, according to Suprayitno et al. (2022), the banana blossom, commonly employed as a dietary vegetable, represents one of the lesser-utilized components of the banana plant. It contains proteins, dietary fiber, vitamins, flavonoids (especially quercetin), tannin, and β-tocopherol. Based on their nutritional values, bananas and their by-products have demonstrated exceptional potential in a number of food industries. It also aims to discuss its application in the food industry.

Furthermore, in the study by Rompies et al. (2021), fiber has many functions, such as reducing energy intake and reducing obesity risk. Dietary fiber plays a vital role in regulating energy intake and preventing obesity by aiding in early signals of satiation and extending signals of satiety. Fiber provides numerous health benefits, from improved bowel function to slowed digestion and absorption of carbohydrates and fats and lower risk for certain diseases. There is still much agricultural waste, such as banana blooms and banana leaves, which have to be used for efficient products like coffee, dehydrated vegetables like banana strings, tea, herbs and spices, and baked products.

Banana flowers are high in nutrients like fiber and starch, as well as other bioactive substances. However, its application to health products is currently limited. Both the inner and outer bracts of culinary banana flowers include dietary fiber with functional features such as decreased bulk density, increased oil-holding capacity, water-holding capacity, and water-swelling capacity, making it potentially one of the greatest low-calorie and high-fiber components. Also, banana blossom can be used in salads, stir-fries, soup, and in addition to dishes like pork humba. Their unique texture and ability to absorb flavors make them a versatile ingredient in various cuisines, particularly in Southeast Asian Dishes (Begum & Deka, 2019).

Similarly, in the study by Lau et al. (2020), the inflorescence of bananas contains a significant amount of carbohydrates and proteins, with a low-fat content and a high moisture level, indicating a short shelf life. Banana inflorescences are considered a rich source of beneficial unsaturated fatty acids like α-linolenic, oleic, and linoleic acids (accounting for more than 60% of total fatty acids). Other studies found that linoleic acid dominated among all the fatty acids present in the banana inflorescence. It accounted for 84.80% of the total fatty acid concentration. Thus, it is also considered a good source of unsaturated fatty acids that can reduce the risk of heart disease.

According to Singh et al. (2018), bananas are a rich source of bioactive compounds such as carotenoids, flavonoids, phenolics, amines, ascorbic acid, and vit. e that possesses antioxidant activities beneficial for human health. Phenols are one of the major bioactive compounds in bananas that offer antioxidant effects and health benefits. The most prominent classes of flavonoids reported in bananas are flavanols, such as kaempferol quercetin, myricetin, and cyanidins. They act as defensive scavengers against oxygen-derived free radicals and reactive oxygen species (ROS), which are liable for aging and diverse diseases.

Similarly, in the study of Pushpaveni et al. (2019), The banana blossom also contains various nutritional values that are similar to banana fruits. Due to the presence of many different bioactive elements found in the blossom extract, this part of the banana plant has been traditionally consumed for its tremendous health benefits. These include saponins, flavonoids, glycosides, tannins, steroids, and phenols. Every 100g of banana flower offers a lot of nutritious benefits like 51 kcal, 1.6g of protein, 0.6g of fat, 9.9g of Carbohydrates, 5.7g of fiber, 56mg of calcium, 73.3mg of Phosphorous, 56.4mg of iron, 13mg of copper, 553.3 mg of potassium, 48.7mg of magnesium and 1.07mg of Vitamin E. The flowers are widely used to treat Allergies, infections, bronchitis, dysentery, Joint pain,

and better blood circulation. Apart from this, the flowers are also used to manage diabetes and anemia, help nursing mothers, boost mood and reduce anxiety, and help to reduce free radical activity and menstrual bleeding. The major bioactive principles that are found in the methanol extract of flowers are glycosides, tannins, saponins, phenols, steroids, and flavonoids.

Furthermore, in the study of Mishra et al. (2017), Incorporating banana flowers to produce cookies showed a nutrient-rich profile, particularly fiber and iron, which helped produce red blood cells. Also, it can be utilized as a galactagogue to increase maternal milk production in lactating working women; it could be used as an alternative daily menu for postpartum mothers. It can deal with those who have inadequate production of breast milk, especially after giving birth, who experience milk production problems, so it is best advised for breastfeeding mothers to consume banana bud or the banana flower. It is the best food for babies to increase milk production.

Similarly, in the study of Acharya et al. (2021), Banana blossom has an anti-spoilage effect on food products, and fibers extracted from it are used for decorative purposes. It has a starchy flavor and is also claimed to be high in vitamin C content. The effects of fiber and antioxidants on the human body are significant. It has a starchy flavor and is also claimed to be high in vitamin C content. The effects of fiber and antioxidants on the human body are significant. Fiber aids in the maintenance of our body structure, the reduction of cholesterol, and the prevention of obesity.

The nutrient composition of the flesh of Musa acuminata Colla has been studied widely. The nutrient composition, especially proximate nutrient contents of the flesh, has previously been reported. These unique nutritional values of banana blossoms should be maximized, and the incorporation of this banana blossom in food products can be performed for value addition. People of all ages always favor convenience foods that are palatable and have high nutritional benefits. Bakery foods are very popular all over the world. The bakery foods industries are popularly becoming the most prominent food industries in the world as a whole. The demand for bakery products like bread, cake, biscuits, etc., is increasing day by day at a rate of 10.07% per year. Due to the high nutritional quality of both young and mature flesh of \ Musa acuminata Colla, the flesh of Musa acuminata colla vegetable could be served as a raw ingredient for various food uses in the future.

Process of the Banana blossom and Best Proportion

Banana blossom undergoes specific processing techniques to enhance its usability in food production. The process typically involves cleaning, slicing, dehydrating, and grinding to produce banana blossom flour, which can be incorporated into various food products. Determining the best proportion of banana blossom as an ingredient is crucial for maintaining nutritional value, texture, and sensory appeal. The following literature and studies explore different processing methods and optimal formulations to maximize their potential in food applications.

Banana blossom flour is derived from Musa acuminata colla, the flower of the banana plant, specifically the blossom or heart that grows at the end of a banana cluster. The petals and inner parts of the blossom are cleaned, dehydrated, and finely ground to create the flour. This flour is known for being gluten-free and rich in fiber, vitamins, and antioxidants, making it a nutritious alternative for various recipes. The procedures may affect the

quality of the finished product depending on the proportion of banana blossom flour used in baking cookies. Through observation and the process, the best proportion may be easily achieved.

The oldest technique of manufacturing flour in history was grinding the grains between stones. Other methods included the saddles tone (a cylindrical stone that was rolled against grains held in a stone bowl), the quern (a disk-shaped horizontal stone that spun on top of grains held on another horizontal stone), and the mortar and pestle (a stone club striking grains held in a stone bowl). These methods can be achieved using one's hands.

Then, the millstone was developed; it is a vertical disk-formed stone disk that would roll over the grains that were sitting on another horizontal stone, shaped in the form of a disk as well. The millstone was handled by humans or animal power. The Romans were wiser and began to use waterwheels to power the millstones. In Europe, in the twelfth century, windmills were used to power the millstones (Goodmills Group, 2023).

Moreover, Grain Feed and Milling Magazine (2022) stated that flour is an essential ingredient for making bread and other baked goods like cookies. It is a fine powder of different varieties of grains. Various types of flour are being sold in the market. Nowadays, the process of producing flour has distinct stages. First, it is essential to ensure that the grain is clean by removing and separating dirt. Next, it should be washed with water to remove the outer layer bracts. Then, it is ready for grinding, and lastly, it is where the wheat grains are rolled, broken, and rolled during the milling process to get a powdered form or substance. Milling is the separation of the bran and germ from the endosperm, and it is performed through grinding. The quality of the wheat determines the type(s) of flour to be produced (Food Source Information, 2023).

However, Nipa and Mondal (2021) stated that drying is the oldest method for processing and preserving freshly harvested agricultural produce. Humans have long practiced drying, and the quality of the finished product greatly depends on it. The purpose of drying is to reduce the moisture content to a certain level to prevent microbial deterioration and most chemical reactions within the food components.

According to Eshak (2016), the maximum accepted addition of plant parts to bakery products ranges between 10% and 40%, depending on the plant part used and the modified product. Bread is a staple food that is eaten daily, and its consistency and sensory characteristics are important to consumers. Banana parts, particularly WGBF, have been mainly used as a wheat substitute; however, it reduces the volume of the bread and results in crumb darkening and increased water activity. Both flour types were analyzed in terms of their functional properties (bulk density, swelling power, solubility, swelling capacity, water absorption index, and viscosity) and were used to make gluten-free cookies.

Similarly, the study of Khoozani et al. (2019) used WGBF to improve and boost the nutritional quality of the bread without altering its digestibility. They investigated two flour types, WGBF prepared by freeze-drying) Moreover,

ODF (prepared by air oven drying at 50◦C) at four percentages (0%, 10%, 20%, and 30%) of fortification. At ≥ 20% fortification, there was a marked decrease in the energy value and a rise in humidity, fiber content, and browning index, particularly in ODF bread samples.

In the same study by Fernando P.A.T et al. (2018), research was conducted on the utilization of banana blossoms in the nutritional enrichment of biscuits. The blossom of the banana plant (Musa paradisiaca) is an excellent source of crude fiber in the human diet. Consumption of dietary fiber is known to lower blood cholesterol levels, normalize blood glucose levels, promote laxation, and lower the risk of colon cancer and breast cancer. Banana blossom was processed into flour by dehydration, followed by powdering. Pre-treatment was carried out prior to the dehydration. The result was that the powder consisted of 14.54% of crude fiber. Low moisture gain and less color change in the product packed in polyethylene (150 gauge) were observed during storage for four weeks compared to the product packed in polypropylene (150 gauge). Banana blossom flour is used to supplement rice flour in the percentages of 0, 3, 5, 10, and 15 for biscuit production.

According to the study by Subagyo et al. (2018), bananas have a high nutritional value. It is a good source of energy due to its high level of starch and sugar, as well as being a source of vitamins A and C, potassium, calcium, sodium, and magnesium. It is easy to digest and free from fat and cholesterol. It helps reduce the risk of heart disease when used regularly and is recommended for patients suffering from high blood pressure, arthritis, ulcers, gastroenteritis, and kidney disorders. The various commercial products made from bananas are pulp, puree, jam, jelly, juice, toffee, wine, halwa, fig, flour, flakes, canning of banana, deep-fat fried chips, powder, fruits bar, squash, brandy, etc. before it perishes. Techniques can be employed to preserve fruits and vegetables. Among them, drying and dehydration are some of the most important techniques that are widely practiced because of considerable savings in packaging, storage, etc. Generally, during dehydration, fruits are subjected to a conventional tray dryer or vacuum dryer, which does not keep the original flavor, texture, color, and some nutrients.

Based on the study of Amir Amini Khoozani (2019), the Banana (Musa spp.) is one of the most widely cultivated and widely consumed fruit crops in the world. Bananas are native to Southeast Asia and are grown in over 130 countries throughout the tropical and subtropical regions of the world. With an annual world production of around 114 million metric tons from an area of 5.6 million ha (FAO, 2018), bananas are among the world's major food crops, after rice, wheat, and maize. From this, total banana production is about 50% consumed in cooked form, which is often term plantains, while the rest is dessert types.

In addition, Tamanna Tasnim et al. (2020) states that banana blossoms contain antioxidants and can reduce the risk of chronic diseases such as cardiovascular disease. Banana blossoms, as a source of dietary fiber, can also control obesity and diabetes. Few research reports are available on the incorporation of banana blossoms in food items.

The reported incorporation of banana blossom flour in plain cake results in a significantly improved retention of color and enhanced functional properties.

Based on the study by Tamsen et al. (2018), banana blossoms were washed and soaked with brine for 20 minutes to prepare a nugget paste. The banana blossom was then steamed for 30 minutes. After that, it was ground and mixed with TVP, premix, and potato flour in a food processor. Then, the ground mixture was poured into the tray and kept in the freezer for 45 minutes. The prepared paste was molded and immersed in a batter before it was finally breaded with breadcrumbs. The prepared nuggets were stored at 4°C until further use. All analyses of the nuggets were performed after the frying step (product ready for consumption).

Based on the study by Kraithong et al. (2021), most foods derive their characteristic flavor from bioactive compounds derived from plant sources present at levels ranging from parts per billion to parts per million. On the broad canvas of nature, some plant species evolved with far higher levels of flavor compounds than others. In the present paper, banana blossoms were used as a source of flavor and to test their potential in flavoring other foods. Essential oils extracted by a solvent method using dehydration banana blossoms are found ready for use in soft drinks and confectionery. Banana blossoms were pre-treated with 0.2% lactic acid solution to minimize enzymatic browning reaction and then dehydrated. The dehydrated banana blossoms were powdered, and extraction was done using ethanol and water. It was observed that ethanol-extracted flowers gave the maximum yield.
According to the study of El Ashmawy (2016), drying is the removal of moisture from the food in order to reduce microbial activity and damage to the product and extend the storage life. Knowledge of the kinetics of banana drying is necessary to monitor and improve the banana drying process, as well as the quality of the final product. Unfortunately, the quality of dried products is significantly reduced compared to that of the original food staff. Several researchers have proposed the idea of combining microwave heating and low-temperature vacuum. It was found that a microwave vacuum was considered an alternative way to improve the quality of the dried product.

Moreover, according to the study of Sidhu and Zafar., (2018), the Banana Blossom is an herbaceous flowering plant belonging to the Musaceae family of the genus Musa, which is one of the most under-utilized and low-cost vegetables available in India. The banana plant is often farmed economically for its fruits, and male flowers are regarded as agricultural by-products. However, with an increase in vegetarianism and the vegan population in developed countries as well as in developing countries, there is also a demand for vegetarian probiotic products such as fermented vegetables.

In addition, Patil (2020) states that the populace suffering from lactose intolerance seeks non-dairy fermented food to alleviate symptoms induced by dairy consumption. Regular consumption of fermented foods is firmly linked to a wide range of health advantages, notably anti-carcinogenic, probiotic properties, antimicrobial activity, vitamin and mineral synthesis, immune function enhancement, and antinutrient reduction. The procured banana blossom

was cleaned by removing calyx and pistils, chopped into fine pieces, rinsed thoroughly in distilled water, and dehydrated for one hour at room temperature. 70 g of chopped banana blossom was gently mixed with 20% (w/w) of lemon juice and 10% (w/w) of rock salt, and the mixture was placed in a pre-sterilized airtight glass bottle.

According to Angeles (2018), in "Siling Labuyo (Capsicum Frutescene) Flavored Cakes and Cookies," the study was also focused on using siling labuyo as flavoring in cakes and cookies, and it also undergoes a drying process. Drying chili pepper or Siling Labuyo was the same as the steps used to dry the banana blossom before pulverizing. It is placed under the heat of the sun for at least 4 hours. Sun drying was the primary process, but a dehydrator can be an alternative if the sun is not around. After drying, it should be stored in an airtight container to prolong its shelf life. This study is similar to the present study. The researcher applied the same method of processing the flour. They underwent sun drying and were pulverized to get the fine texture of flour; the only difference is the use of raw material.

Moreover, the study of Hade (2023), the study produced eggplant (Solanum melongena) Flour as an alternative ingredient in making pasta noodles. The process involved in making eggplant flour is sliced thinly and arranged in trays for quick drying. In the same procedure in making a Banana blossom, the researcher used the sun drying method and pulverizing of dried eggplant to produce a powdery and delicate texture and stored in an airtight jar or container to avoid contamination and prolong the shelf life.

According to Francisco's study (2019), the different processes involved in producing pili pulp flour were gathering, washing, drying, peeling, and sifting. The pili pulp flour was subjected to determination of nutritive value and evaluation of the acceptability of different delicacies and baked products produced. This process is used in the present study to prepare Banana blossom flour for baked products like cookies.

Similarly, the study of Pardiñas (2018) utilized pili pulp as one of the ingredients in making fish jerky. It underwent different processes like blanching, peeling, and dehydrating. Similar to the present study, they dehydrate the Banana blossom to prolong the shelf-life of the material and to get the sound characteristics of Banana blossom flour.

Level of Acceptability of Innovative Products

The success of any newly developed product, particularly in the food industry, depends on its level of acceptability among consumers. Innovative products that incorporate alternative ingredients, such as banana blossom flour, require sensory evaluation and market testing to assess their feasibility and potential demand. The following literature and studies explore various methods used to measure acceptability and the key factors influencing consumer perception of innovative food products.

The acceptability of Banana blossom flour in cookies varies among individuals and communities in terms of factors such as color, taste, aroma, texture, and appearance. Nutritional value, cultural perceptions, accessibility, and experimental appeal would all play a role in determining how acceptable it is. Ultimately, it would depend on personal preferences and willingness to try new ingredients in baking.

According to Palczak et al. (2020), in their study about macaroons incorporating banana blossoms are recognized as cookies made from sweet meringue and ground almonds, offering a distinct flavor and texture that enriches the sensory experience. Their cost-effectiveness and popularity drive the choice of macaroons for this research. Incorporating banana blossoms with the corn-based SAGIP Nutri-Pack into macaroons could significantly enhance the nutritional value of these snacks. The best mixture of 700 grams of banana blossom with 300 ml of condensed milk was the best formula for making desserts. Similar to the present study, the researcher used pulverized banana blossoms to achieve the acceptability of banana blossom cookies.

In the study of Lau et al. (2019), the utilization of banana inflorescence as an ingredient for functional food was comprehensively discussed. Nutritional and bioactive constituents of the tree are explained extensively as well. However, there is still a lack of references as to the utilization of banana inflorescence, such as in a study where 1-2% of the banana inflorescence extracts are added to pork burgers. The results show that the addition of hydroethanolic extract to the banana inflorescence has no adverse effect on the physicochemical and sensory properties of the product.

However, in the study of Rodrigues et al. (2020), Banana inflorescence extracts were used as antioxidants of meat products, which control the oxidation of lipids during storage. The process was done naturally. The acceptability did not change, although 2% of the extract was added to the product. Furthermore, with 4%,6%, and 8% banana inflorescence extracts added to a plain cake, there was a significant change in the sensory and physical properties as this was correlated to the % of extract added. The ash content, as well as the fat and protein content, have been found to be increasing as the level of the extract increases.

Additionally, Schmidt et al. (2016) studied the nutritional and bioactive constituents of the tree extensively as well. However, there is still a lack of references as to the utilization of banana inflorescence, such as in a study where 1-2% of the banana inflorescence extracts are added to pork burgers. The results show that the addition of hydroethanolic extract to the banana inflorescence has no adverse effect on the physicochemical and sensory properties of the product.

However, the study of Ogundijo D. et al. (2022), the study about the use of Banana blossom as raw material for making Pickles is a preserved food with the incorporation of salt or vinegar. Pickling is a process of preserving food that lasts for months. It involves two processes: (1) brining and (2) acidification of the ingredients with the

use of vinegar or lemon. The process itself affects the texture and flavor of the food, and they test their knowledge about the product in terms of its aroma, texture, appearance, and taste. The best ratio of fruit flesh of banana blossom and sugar was trials three fruit flesh of banana blossom 60% and sugar 40%. In the present study, the researcher conducted 3 trials to get the best proportion of Banana Blossom flour. The difference was that the previous research used fresh flesh of Banana Blossom while the present study used dried Banana blossom.

Moreover, the study by Soverano (2016) processed wine from luba fruit out of experimentation. He found out that the treatments were significantly varied in terms of taste, aroma, and appearance. Soverano's study on processed wine from luba fruit found that different treatments significantly impacted the taste, aroma, and appearance of the wine. This suggests that the methods used in processing the wine can greatly influence its sensory qualities. Further research could explore which specific treatment methods are most effective in producing desired flavor profiles, scents, and visual characteristics in lubas fruit wine.

However, Lalugan (2016) focused on the utilization of Indian Mango fruits as the main ingredients of wine. Sensory evaluation was used to determine the acceptability level of the product in terms of appearance, color, clarity, aroma, and taste. The psych-chemical composition of different samples of Indian Mango wine was evaluated in terms of alcohol content and levels of acidity. The study found that Indian Mango wine has a unique aroma and taste that was well-liked by the participants in the sensory evaluation. The alcohol content of the wine varied depending on the fermentation process used, with some samples having higher alcohol content than others. The acidity levels in the wine also varied, with some samples being more acidic than others.

In the study by Soberano et al. (2022), Banana blossoms were used as a source of flour for baking. The Banana blossoms were cleaned, peeled, discarded, and dried for two to three days under the heat of the sunlight. The blossom was then ground into powder form. Banana blossom flour, honey, eggs, milk, butter, vanilla, and baking powder are the ingredients for muffins. The researchers aim to determine the essential aspects of Baked Muffins, including the following terms: Product Description, Ingredients, tools, and equipment. Lastly, the acceptance of the sensory quality of the product will be assessed with the following criteria for further evaluation of the level of liking of herb-flavored muffins using banana blossom-based flour in terms of appearance, aroma, taste, texture, and smell. In this study, the researchers utilized three treatments. Similar to the current study, they assess the level of acceptability of banana blossom flour in baked cookies. The difference between the previous study and the present study was that they used the banana blossom as a filling in baked muffins. In contrast, in the current study, they used the banana blossom as flour to mix in the mixture of banana blossom cookies.

Additionally, the Aisya et al. (2020) study aimed to improve the quality of banana blossom juice. Specifically, it was intended to determine what fruit juices can be added to banana blossom juice to improve its quality, compare the sample taste, color, and aroma, and determine the cost of production of the different samples. The similarity of

this study is that they used banana blossom to make an innovative product. The difference is that this previous study used banana blossoms to make juice, while the present study used banana blossoms to make flour that is used in baking products like cookies.

Moreover, Burce (2016) conducted a study on the acceptability of black plum seeds as a main ingredient for coffee. Black Plum Seeds are common fruits that are frequently eaten while the seeds are discarded, unaware of their various uses and nutritional value. The study found that the majority of participants found the idea of using black plum seeds as a main ingredient for coffee to be acceptable. Participants reported enjoying the taste of the coffee and were surprised to learn about the nutritional benefits of black plum seeds.

Furthermore, the study of Sarte (2016) focused on utilizing banana pith as the main ingredient in different recipes such as banana pith pickles, banana pith chutney, banana pith fritters "okay," and banana pith patties, and banana pith balls. The study was significant because the sensory evaluation was used to determine the degree of acceptability of food products from banana pith. The findings of the study showed that banana pith can be successfully incorporated into various dishes, with participants rating the banana pith pickles and banana pith chutney as highly acceptable in terms of taste, texture, and overall preference. The banana pith fritters, patties, and balls also received positive feedback, indicating that banana pith can be a versatile and nutritious ingredient in cooking.

Biao et al. (2020) studied creating a healthier version of a cookie by replacing some of the wheat flour with mushroom flour. The impact of incorporating different levels of powdered mushroom flour on the rheological properties of the cookie dough and the final cookies was therefore determined. Panelists were trained for descriptive analysis of cookies' sensory evaluation. Then, they were asked to evaluate the color of the cookies first and then to assess their mouthfeel, texture, and flavor. Freshly made cookies were served on plates with random three-digit codes to prevent any potential bias. The overall acceptability of cookies was calculated from the average values of all the above sensory parameters. Panelists rinsed their mouths with water between sample evaluations. A nine-point hedonic scale was used for sensory evaluation. In conclusion, our results showed that cookies with acceptable textures and appearances could be produced by replacing up to 15% of wheat flour with mushroom flour.

Similarly, De Brito (2019) conducted a study on muffins using four formulations from different alternative flours, such as eggplant flour. The first formulation uses rice flour, and the other three formulations use eggplant flour with the addition of 5, 10, and 25%. The products were evaluated using color, taste, odor, texture, and overall impression. The 15% flour eggplant flour proved to be a good alternative for use in bakery products that add nutritional value.

Branco et al. (2017) developed tagliatelle pasta that substitutes wheat flour with different concentrations of green banana mixed pulp and peel flour. The pasta formulations that were prepared to replace the wheat flour showed the highest ash content and the best sensory acceptability of all the formulations. It was concluded that it was possible to develop a tagliatelle pasta with satisfactory acceptance by replacing the wheat flour with a green banana mixed pulp and peel flour.

Moreover, Beatriz (2019) studied the level of acceptability of Cocus Nucifera Cupcakes in terms of sensory characteristics and shelf-life. Three different proportions of the recipe were developed and rated by the five groups of respondents. The sensory attributes were employed in evaluating the product. Lastly, the results of the sensory evaluation show that the first trial had the most acceptable proportion and was interpreted as highly satisfactory. Based on the ocular observation conducted on the shelf-life of the Cocus Nucifera cupcakes, it was found that the cupcake lasts for six (60 days and is fit for human consumption at room temperature).

Also, Castro (2019) studied the level of acceptability of innovative recipes from squash (Squash candy, Puto de Kalabasa, Nutri-Nuggets Squash, Dynamite Squash Blast, and Pasta de Kalabasa) in terms of sensory evaluation and shelf-life. Parents, teachers, and students were chosen to determine the acceptability of the innovative squash recipes. Overall, the level of acceptability of squash innovative recipes ranged from "acceptable to highly acceptable" in terms of color, taste, aroma, and appearance. On the other hand, shelf-life varies between recipes when at room temperature and refrigerated.

In the study of Bantog (2015) studied an ice cream utilizing ripe Tiessa and pili pulp. The researcher applied developmental, descriptive, and evaluative methods to determine the acceptability of the finished product. The findings of the study by Bantog (2015) showed that the ice cream utilizing ripe Tiessa and pili pulp was well-received by participants. The developmental, descriptive, and evaluative methods used in the study helped determine the acceptability of the finished product. Overall, the findings of this study indicate that utilizing ripe Tiessa and pili pulp in ice cream production is a viable option and has the potential to be popular among consumers.

Ramiriz (2021) revealed that crust and filling preparations were subjected to organoleptic tests using the 9-point hedonic scale in terms of food attributes by different panelists, including food experts, students, and professors. There were four treatments for crust and filling. Results showed that in terms of odor, texture, flavor, and general acceptability, all the treatments for fillings were rated very much. In contrast, for the crust, the texture and taste were rated moderately. Results showed that there is a highly significant mean difference in the respondents' group/panelists' perception of crust and filling texture, odor, and flavor but no significant difference in camote pie's general acceptability. Nutrition facts of camote pie for 900g content based on 2015 Recommended Energy and Nutrient Intakes (RENI) and the Philippine Dietary Reference Intakes (PDRI) adult requirements of 19 to 29 years

old male showed that calories (kilocalories) are 13%, cholesterol (milligrams) is 30%, total carbohydrate is 15% and protein is 8%.

The study of Alano (2023) found that the best composition of candy dragon fruit peel using sensory characteristics of color, aroma, taste, texture, and appearance as indicators was revealed to be trial 3 with a 3.17 average rating. The respondents favored the bright pink color as compared to the light pink color, preferred the sweet aroma and taste, and flavors the slightly soft and chewy texture and can be prepared in the community because of the availability of ingredients, tools, and equipment, and easy-to-follow procedures.

Hasan et al. (2020) evaluated the nutritional compound, hardness, and organoleptic properties of emergency food in the form of cookies prepared from Saba banana flour, soy flour, and Moringa flour. The treatment in this research used a single factor, namely a different composition of the flour, with three variables and three replications. It was also evaluated as a hedonic sensory test in terms of color, taste, aroma, and texture. The results showed that all treatments fulfill the calorie requirement of emergency food. In terms of hardness, F2(banana flour 15%, soy flour 15%, and Moringa flour 15%) resulted in the most complex texture of cookies but still eatable. Organoleptic test results showed that cookies with the use of 20% banana flour, 20% soybean flour, and 5% moringa flour were favored by the panelists.

Augustyn et al. (2021) characterized the chemical and organoleptic properties of yellow sweet potato flakes with the addition of moringa leaf flour to determine the best treatment. Flakes made from yellow sweet potato flour are one of the products with the addition of moringa leaf flour to increase the added value of the two commodities. The organoleptic characteristics of color, taste, aroma, crispness, and overall appearance are accepted.

Ewunetu et al. (2023) conducted a study on the physicochemical and sensory evaluation of bread made from composite flours of wheat, carrots, and bananas. The research aimed to enhance the nutritional value of bread by incorporating carrot and banana flour into wheat flour. The study found that the sensory scores varied with the increasing addition of carrot and banana flour to wheat flour. Still, there was no significant difference in the overall acceptability of the bread, except for the control. Consumers generally preferred the bread from a specific blending ratio (60% wheat flour, 20% carrot flour, and 20% banana flour). Still, bread from composite flours with substitutions for both carrot and banana flours was also well accepted. Overall, the study demonstrated that bread of acceptable quality can be produced from composite flour of wheat, carrots, and bananas, which could contribute to increased nutrition and help prevent malnutrition.

Method

The study utilized descriptive, experimental, and Research and Development (R & D) methods to meet the objectives or problems of the study. These three research methods were essential in the conduct of this research

and added to its validity. The descriptive method was used to describe the finished product's level of acceptability in terms of color, taste, aroma, texture, appearance, shelf life, and economic desirability. A score sheet was answered and analyzed to describe the level of acceptability of the product. In the three trials, the experimental method was utilized to display various ingredients' proportionality and find the appropriate recipe preferred by the respondents.

Specifically, Banana blossom to produce flour was subjected to the experiment. Three (3) samples using different proportions were prepared to show the various proportions of ingredients used. The method also determined which among the three (3) samples and recipes was acceptable to the respondents. Research and development were used to develop a new and improved product to meet the demands of the market. It was also used to gather data during the production of banana blossom flour in baked products like cookies. On its output, a try-out or score sheet was given to the respondents for sensory evaluation. The responses gathered were analyzed based on highly acceptable to least acceptable remarks and described the level of acceptability of the finished product. Production was defined in terms of the best composition and preparation of banana blossom flour in baked products like cookies.

Results and Discussion

Nutritive Value of Banana Blossom

The banana blossom, scientifically known as Musa acuminata Colla, also known as a banana heart, is a fleshy purple-skinned flower shaped like a tear that grows at the end of a banana fruit cluster. In recent years, researchers have promoted food products enriched with protein, vitamins, minerals, and dietary fiber to address diet-related diseases.

Banana blossom is a rich source of nutrients and antioxidants, offering multiple health benefits; it contains dietary fiber, which helps lower blood cholesterol levels, regulate blood glucose and insulin levels, prevent constipation, and reduce the risk of colon and breast cancer. Traditionally, it has been used to treat bronchitis, constipation, and peptic ulcers. The antioxidants in banana blossom also aid in reducing oxidative stress and improving overall health benefits.

The incorporation of banana blossom into the baking industry, particularly in products like banana blossom cookies, can provide both nutritional and economic advantages. Utilizing banana blossom in food production supports job opportunities, promotes sustainable agriculture, and enhances local economies. Additionally, its nutrient profile makes it a natural energy booster, supports heart health, aids digestion, and strengthens the immune system.

Several studies have supported the health benefits of banana blossom. According to Singh (2017), as shown in Table 1, 100 grams of raw banana blossom flour contains notable amounts of Calories (51 Kcal), protein (1.6

g), fat (0.6 g), carbohydrate (9.9 g), Fibre (57 g), calcium (56 mg), phosphorus (73.3 mg), iron (56.4mg), copper (13mg), potassium (553.3 mg), magnesium (48.7 mg) and vitamin E (1.07).

Furthermore, Tamanna Tasnima et al. (2020) highlighted that banana blossom is an excellent source of flavonoids, which contribute to its therapeutic properties. These include reducing menstrual bleeding, facilitating lactation, managing diabetes and anemia, reducing anxiety, aiding in weight loss, and improving gastrointestinal health. The evidence suggests that banana blossoms are valuable functional foods with significant health and economic benefits. The integration into food products, such as cookies, not only promotes healthier lifestyles but also fosters local economic development. The continued exploration of banana blossoms as an ingredient in food production could lead to further innovation in health-oriented food products. Based on Table 1, the nutritive value of banana blossoms is shown.

Table 1

Nutritive Value of Banana Blossom per 100g

Nutrients	Quantity
Calories	51 Kcal
Protein	1.6 g
Fat	0.6 g
Carbohydrates	9.9 g
Fiber	57 g
Calcium	56 mg
Phosphorus	73.3 mg
Iron	56.4 mg
Copper	13 mg
Potassium	553.3 mg
Magnesium	48.7 mg
Vitamin E	1.07 mg

Source: Singh, S. (2017). Banana blossom: an understated food with high functional benefits. International Journal of Current Research 9(1), pp. 44516-44519. International Journal of Current Research [Online]. Available at: http://www.journalcra.com/article/banana-blossom-understated-food-high-functional-benefits (Accessed: November 10, 2018)

In another study by Pushpaveni et al. (2019), banana blossoms also contain various values that are similar to banana fruits. Due to the presence of many different bioactive elements found in the blossom extract, this part of the banana plant has been traditionally consumed for its tremendous health benefits. These include saponins, flavonoids, glycosides, tannins, steroids, and phenols. The flowers are widely used to treat Allergies, infections, bronchitis, dysentery, Joint pain, and better blood circulation. Apart from this, the flowers are also used to manage diabetes

and anemia, help nursing mothers, boost mood and reduce anxiety, and help to reduce free radical activity and menstrual bleeding.

Based on the nutritional data and existing studies, incorporating banana blossom into food products, such as cookies, provided numerous health benefits, such as energy boosting, digestive support, and improved heart health. Additionally, the medicinal potential of banana blossom adds value to its usage in modern health and wellness products. Developing banana blossom cookies benefited communities by improving health outcomes and creating economic opportunities through sustainable food production. This initiative aligned with the need for healthier dietary choices and supported local agriculture, contributing to both nutritional well-being and economic growth.

The functional benefits of banana blossoms have made them a viable alternative ingredient in baking, particularly in developing healthier cookies. This innovation, supported by Schumpeter's Innovation Theory, emphasized the impact of adopting more nutritious and more sustainable ingredients like banana blossom flour in food production. This approach could address unhealthy lifestyle trends and the increasing prevalence of diet-related diseases.

Based on the nutritional data and existing studies, incorporating banana blossom into food products, such as cookies, can offer numerous health benefits, such as energy boosting, digestive support, and improved heart health. Furthermore, the medicinal potential of banana blossom adds value to its usage in modern health and wellness products. By developing banana blossom cookies, communities can benefit not only from better health outcomes but also from increased economic opportunities through sustainable food production. This initiative aligns with the need for healthier dietary choices and the empowerment of local agriculture, contributing to both nutritional well-being and economic growth.

Process of Producing Banana Blossom Flour

The following procedures (Figure 5) were undertaken to achieve the desired result: peeling, collecting and sorting, cleaning, drying, pulverizing, and finally, storing or packaging. This section discusses these procedures in detail, highlighting their importance in producing Banana blossom flour.

The process of producing Banana blossom flour involves multiple steps that contribute to the final quality and usability of the product. Each stage plays a crucial role in ensuring that the Banana blossom is adequately prepared for consumption and use in baking. The collection and sorting of young and mature vegetables safeguard the use of the most suitable ingredients, while steps like drying and pulverizing aim to preserve the vegetable's quality and extend its shelf life.

The preparation of the banana blossom was properly reflected established methods from various studies, such as those by Arya et al. (2016) and Nipa and Mondal (2021), which demonstrate the effectiveness of washing, drying, and pulverizing in reducing moisture and preventing spoilage. The procedures followed in making Banana blossom flour were methodical and optimized for ease of execution and quality control. The first stage, collecting and sorting, focused on selecting mature banana blossoms, ensuring that only high-quality ingredients are used. The peeling process, which involves removing the outer covering, prepares the vegetable for further processing. Arya et al. (2016) supported the step of washing the vegetables after peeling, emphasizing the need for cleanliness to remove any residual dirt or contaminants. The grinding process helped refine the texture of the banana blossom, making it suitable for drying. Drying was a critical step, as it

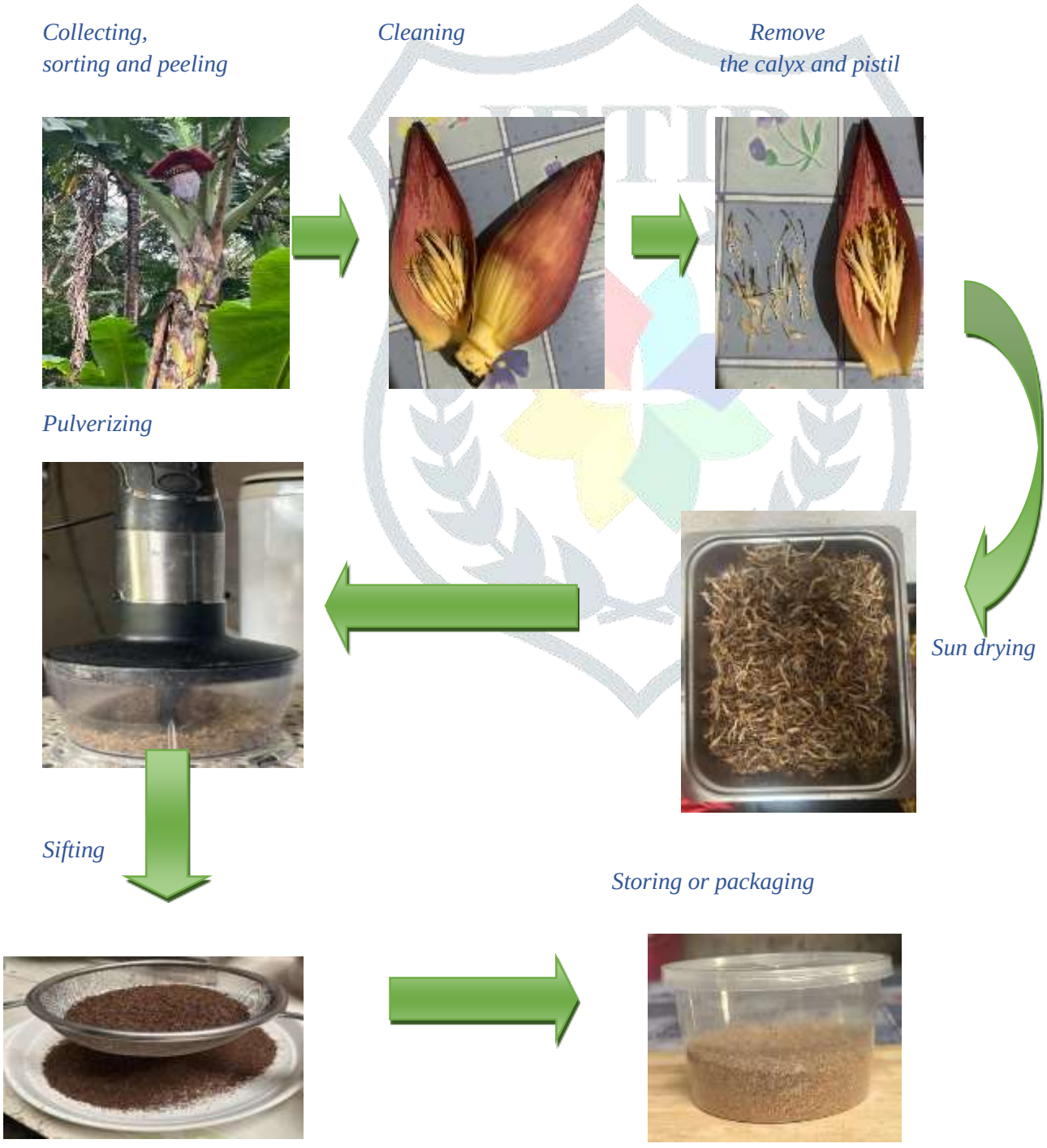

Figure 5

Procedures for making Banana Blossom *(Musa acuminata colla)* Flour

reduced moisture content, preventing spoilage and microbial deterioration. Nipa and Mondal (2021) highlighted the importance of proper. Drying techniques to extend the shelf-life of fruit-based products. Depending on weather conditions, the researcher either sun-dried the banana blossom for 3 to 4 hours or used a dehydrator for 30 minutes, ensuring flexibility in the process to avoid microbial contamination.

After drying, the next step was pulverizing the vegetable into a fine powder using a blender. This transformation resulted in a brown, semi-fine flour with a fragrant aroma, marking the final product. The last stage, storing or packaging, ensured that the banana blossom flour was kept in a clean, sealed container to prevent contamination and prolong its shelf-life. This step is crucial for maintaining the quality and safety of the product until it is used in baking.

The procedures involved in producing Banana blossom flour were systematic and practical in transforming raw banana blossom into a usable flour form. The meticulous approach of sorting, peeling, cleaning, drying, and pulverizing ensured that the flour produced was of high quality and ready for use in baking. This process not only followed traditional methods but was also supported by scientific studies, as referenced, demonstrating the importance of each step in achieving a desirable outcome. Proper packaging further contributes to the flour's shelf life, making it a practical and sustainable ingredient for various baking applications, including banana blossom cookies.

Best Proportion of Banana blossom Flour in Baking Cookies

The use of alternative ingredients in baking has become a significant focus in recent years, especially with the rise in health-conscious consumers and sustainability efforts. Banana blossom (*Musa acuminata colla*), known for its high starch content, has gained attention as a potential alternative to traditional flour. The primary objective of this study was to explore the best proportion of Banana blossom flour for making cookies. The researcher conducted three trials with different proportion of Banana blossom flour and compared the results in terms of the butter mixture's consistency, dough characteristics, and baked product attributes such as color, texture, and overall acceptability.

Through experimentation, the researcher determined that Proportion 3 was the best proportion. This trial used the highest amount of banana blossom flour and resulted in cookies with the most desirable texture—

moist, soft, and palatable. The starch content of Banana blossom contributed to achieving a balance between moisture retention and structural integrity. Proportion 3 a dark chocolate color, combined with its chewy texture, was also the most visually appealing, which was a critical factor in consumer satisfaction. As cited in the Theory of New Product Development (Gurbuz, 2018), which emphasizes that consumer satisfaction is central to the success of any new product.

The study not only focused on the physical characteristics of the cookies but also the sensory attributes, ensuring they met consumer expectations. The result confirmed the crucial role of starch in achieving the desired structure, texture, and moisture retention in the cookies. As supported by studies like those by Singh (2017) and Tamanna Tasmina et al. (2020) confirmed that banana blossom contained starch essential for maintaining moisture and softness. Proportion 3 demonstrated the best balance, producing the most desirable cookies in terms of palatability and overall consumer satisfaction.

This study aimed to determine the best formulation for achieving the desired texture, palatability, and overall consumer satisfaction. The illustration of the different proportions of banana blossom cookies is presented in Appendix J. Table 2 shows the researcher's observation of the three proportions in terms of the characteristics of the butter mixture and baked cookies. The researcher performed three trials using different proportions of Banana blossom flour, each producing distinctive results: Proportion 1

Banana blossom cookies

Proportion 1 (1/2 cup)	**Proportion 2 (1 cup)**	**Proportion 3 (1 1/2 cup)**
½ cup of Banana blossom Flour	1 cup of Banana blossom Flour	1 ½ cup of Banana blossom Flour
½ cup Melted Butter	½ cup Melted Butter	½ cup Melted Butter
½ cup Brown sugar	½ cup Brown sugar	½ cup Brown sugar
2 pcs whole eggs	2 pcs whole eggs	2 pcs whole eggs
1 tsp vanilla	1 tsp vanilla	1 tsp vanilla
1 tsp baking soda	1 tsp baking soda	1 tsp baking soda
1 tsp salt	1 tsp salt	1 tsp salt
Chocolate chips	Chocolate chips	Chocolate chips

PROCEDURE

Baking cookies using banana blossom flour requires step-by-step preparation. First, all the needed ingredients are prepared. Then, the oven is pre-heated to 150˚F. Next, 8X8 inch parchment paper is placed in the pan.

Afterwards, in a mixing bowl, whisk together the melted butter and sugar until smooth and without sugar lumps, then set aside. In another mixing bowl, add the egg and vanilla extract and mix until light and fluffy.

Then, the butter and egg mixture was mixed until well combined. Then, the banana blossom flour, baking soda, and salt were gradually added and mixed until all ingredients were thoroughly combined. Lastly, the chocolate chips were added. Cover the dough for 30 minutes. Scoop each dough using a tablespoon and place it into a baking tray. Finally, bake for 15 to 20 minutes at 150 ˚F and let cool. Pack the finished baked cookies.

Figure 2
Flow Chart in Making Nipa fruit Brownies
This chart shows the step-by-step procedure for making Cookies made in Banana blossom.

Appendix J

Illustration of the Different Formulations of Nipa fruit (*Nypa fruticans)* in Brownies

	Banana blossom flour	**Butter**	**Cooked Cookies**
PROPORTION 1			
	Creamy and sticky	Moist and soft	

PROPORTION 2



Slightly creamy, slightly moist, and soft

PROPORTION 3



Slightly dry Soggy, dry, and cracking

Table 2

Comparative Table of the Three Proportions

Quality Attributes	Proportion 1	Proportion 2	Proportion 3
	Characteristics/Observation		
Butter Mixture	Light Chocolate brown Creamy and sticky	Slight Dark Chocolate brown Slightly Creamy	Dark Chocolate brown Slightly Moist and soft
Baked Brownies	Moist and soft	Slightly dry	Soggy, dry, and cracking

Resulted in a butter mixture that was creamy and sticky. The Baked cookies were moist and soft, with a light chocolate brown color. Proportion 2 had a slightly creamy and sticky butter mixture. The baked cookies were slightly moist and soft, with a lighter chocolate brown color. While acceptable, the results were not as desirable as proportion 1. Proportion 3 yielded a slightly moist and soft butter mixture, leading to cookies that were soggy, dry, and cracking, this proportion was the most acceptable in terms of texture and flavor the color was the lightest among the three, and the texture was less favorable. These findings align with the studies mentioned earlier that emphasize the role of starch in providing structure and retaining

moisture in baked goods. In this case, the differences in proportions directly influenced the overall consistency and quality of the cookies.

Through experimentation, the researcher determined that Proportion 3 was the best. This trial used the highest amount of banana blossom flour and resulted in cookies with the most desirable texture—moist, soft, and palatable. The starch content of Banana blossom contributed to achieving a balance between moisture retention and structural integrity. Proportion 3 a dark chocolate color, combined with its chewy texture, was also the most visually appealing, which was a critical factor in consumer satisfaction. As cited in the Theory of New Product Development (Gurbuz, 2018), which emphasizes consumer satisfaction is central to the success of any new product. The study not only focused on the physical characteristics of the cookies but also the sensory attributes, ensuring they met consumer expectations.

These findings suggested that banana blossom flour was a viable alternative ingredient for baking, particularly in achieving the best balance of flavor, texture, and overall acceptability. The study contributed to research on alternative ingredients in baking while highlighting the potential economic benefits of banana blossom flour especially in regions where it was abundant. Additionally, the study aligned with the Sustainable Development Goal (SDG) 2: Zero Hunger, as it explored locally sourced and sustainable food ingredients. By experimenting with banana blossom flour in cookies, the research opened opportunities for broader application in other baked goods. This could benefit both health-conscious consumers and communities striving to establish sustainable food systems.

Ultimately, the study determined that Proportion 3 of banana blossom flour was the most successful in producing cookies with the ideal texture, color, and overall quality. The findings reinforced the importance of starch in maintaining moisture and structure in baked goods. This research not only provided an innovative approach to utilizing banana blossom flour in baking but also contributed to sustainable food practices and local economic growth.

Level of Acceptability of Banana blossom
***(Musa acuminata colla)* Cookies**

The development of new food products using alternative ingredients can provides healthier and more sustainable options while contributing to local economies. This study examined the acceptability of cookies made with banana blossom flour (Musa acuminata Colla) among respondents from Pinaglabanan National High School, Goa, Camarines Sur. Specifically, it assessed the sensory attributes—color, taste, aroma, texture, and appearance—of cookies made with three different proportions of banana blossom

flour. The results of the sensory evaluation shown in Table 3 were analyzed to determine the proportion that yielded the most favorable consumer acceptability.

Color. In terms of color, Proportion 1 was rated the highest, with an average weighted mean of 3.28, indicating it was highly acceptable among all respondents. Its dark chocolate brown color was preferred, consistent with the findings of Mohammad (2020), which emphasized the importance of banana blossom flour in cookies. Proportion 2 scored 3.13, while Proportion 3 scored 3.03 average weighted mean, making them moderately acceptable in terms of color. The use of banana blossom flour in proportion 1 gave it a rich, dark hue that contributed to its higher acceptability.

Table 3
Acceptability levels of proportion in Sensory Characteristics

Quality	Types of Proportion					
	Proportion 1		Proportion 2		Proportion 3	
	WM	Int	WM	Int	WM	Int
Color	3.28	VHA	3.13	MA	3.03	MA
Taste	3.00	MA	3.00	MA	3.43	VHA
Aroma	3.15	MA	3.32	VHA	3.33	VHA
Texture	3.30	VHA	3.15	MA	3.55	VHA
Appearance	3.53	VHA	3.62	VHA	3.78	VHA
Overall	3.25	MA	3.24	MA	3.42	VHA
Rank	**2.5**		**2.5**		**1**	

Taste. It was a crucial factor in determining the overall acceptability of the cookies. Proportion 3 scored 3.43, indicating that it was very sweet and had no aftertaste, which the respondents preferred. Both Proportions 1 and 2 scored 3.00, which can be interpreted as moderately sweet and having no after taste. According to Komal and Kaur (2019), cookies should have a balance of sweetness and an intense chocolate flavor, which was achieved in Proportion 3 due to the balance between banana blossom flour and chocolate chips.

Aroma. Aroma plays a key role in food acceptability, as it influences the perception of taste. Both Proportion 2 and 3 achieved the average weighted mean of 3.33, which can be interpreted as sweet-smelling. Proportion 1 scored 3.15, indicating that the aroma was aromatic across all proportions but was most appreciated in the said proportion. The pleasing aroma in all three versions was attributed to ingredients such as chocolate chips, vanilla, and butter, as highlighted by Mohammad et al. (2020).

Texture. Texture was another significant aspect, especially in baked products like cookies. Proportion 1 obtained the highest average weighted mean of 3.55 for texture, reflecting a Very highly acceptable moist and soft consistency that respondents favored. It was followed by Proportion 1, which scored 3.30, which was also interpreted as perfectly moist. However, Proportion 2 got a 3.15 average weighted mean, making it the latter less favorable due to its drier and stricter consistency. The study by Shamilla (2015) emphasized that the amount of flour impacts the texture of cookies, which was confirmed in this research, where the balance of Banana blossom flour in Proportion 3 led to a better texture.

Appearance. The appearance is crucial as it creates the initial impression of a product. Proportion 3 was rated 3.78 average weighted mean, which can be analyzed as firm and whole in terms of appearance. It was followed by Proportion 2, which scored 3.62, described also as firm and whole. Proportion 1 scored slightly lower 3.53 average weighted mean, but it was still very highly acceptable. The cookies in Proportion 2 and Proportion 3 had a more visually appealing look compared to Proportion 1, which was critical to consumer acceptance, as noted by Lalugan (2016).

As presented and interpreted in Table 3 and Table 4, based on the sensory evaluation results, Proportion 3 emerged as the most acceptable proportion, with a weighted mean of 3.42, followed by Proportion 1 3.24 and Proportion 2, scored 3.24, which were rated as moderately acceptable across all sensory attributes—color and aroma. Aroma, texture, and appearance—especially in the categories of color and texture, where it outperformed the other proportions.

Table 4
Acceptability levels of proportion in
Sensory Characteristics

Proportions	Quality Attributes	Weighted Mean				Average Weighted Mean	Int
		A	B	C	D		
P1	Color	2.90	3.50	3.30	3.40	3.28	VHA
	Taste	2.50	2.70	3.50	3.30	3.00	MA
	Aroma	2.90	3.20	3.30	3.20	3.15	MA
	Texture	3.20	3.80	3.20	3.00	3.30	VHA

	Appearance	3.80	3.60	3.20	3.50	3.53	VHA
	Overall	**3.06**	**3.36**	**3.30**	**3.28**	**3.25**	**MA**
P2	Color	2.70	3.40	2.90	3.50	3.13	MA
	Taste	2.70	2.90	2.90	3.50	3.00	MA
	Aroma	3.70	3.40	2.70	3.50	3.32	VHA
	Texture	3.30	3.40	2.50	3.40	3.15	MA
	Appearance	3.50	3.80	3.30	3.90	3.62	VHA
	Overall	**3.18**	**3.38**	**2.86**	**3.56**	**3.24**	**MA**
P3	Color	2.90	2.60	3.30	3.30	3.03	MA
	Taste	3.70	3.60	2.80	3.60	3.43	VHA
	Aroma	3.20	3.60	3.00	3.50	3.33	VHA
	Texture	3.70	4.00	3.30	3.20	3.55	VHA
	Appearance	3.80	3.80	3.60	3.90	3.78	VHA
	Overall	**3.46**	**3.52**	**3.20**	**3.50**	**3.42**	**VHA**

The findings suggest that the balance of Banana blossom flour and chocolate chips in Proportion 3 contributed to its success. The dark chocolate color, moist texture, and balanced sweet-bitter taste made Proportion 3 the most preferred choice among the respondents. The use of Banana blossom flour, which is neutral in flavor, allowed the chocolate chips, sugar, and butter to shine through, creating a product that was both appealing and palatable to the respondents.

This study highlights the potential of Banana blossom flour as a viable alternative ingredient in baked goods, aligning with sustainable food practices and local economic development. The findings supported the Sustainable Food System (SFS) Theory, which emphasizes a comprehensive framework addressing the multifaceted challenges of producing, distributing, and consuming food sustainably (Walter Willett, 2019). By utilizing Banana blossom, local farmers can tap into a new market, adding value to a naturally abundant resource and contributing to the community's economic well-being.

Furthermore, the research supported the Sustainable Development Goal (SDG) 2: Zero Hunger, promoting the use of locally sourced ingredients to create affordable and nutritious food products. The successful incorporation of Banana blossom flour in cookies demonstrates its potential for broader application in the baking industry, providing an innovative solution that benefits both health-conscious consumers and local producers.

The Proportion (P3) of Banana blossom cookies proved to be the most acceptable among the three proportions tested, based on the sensory evaluation of respondents from Pinaglabanan National High School, Goa, Camarines Sur. The high ratings for color, texture, and appearance underscore the potential of banana blossom flour as an alternative ingredient in baked goods. By contributing to both local economic development and sustainable food practices, this study opens the door for future research and the expansion of banana blossom flour products in the food industry.

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Shelf-Life of Banana Blossom Cookies through

Physical Observation

Identifying the shelf life of banana blossom (Musa acuminata) in cookies was crucial for determining the lifespan of the finished product, mainly if it was to be used.

Figure 6

Shelf-Life of Banana Blossom Cookies at Room Temperature

Number of Days and Observation	Proportion 1 (P1)	Proportion 2 (P2)	Proportion 3 (P3)
Day 1-10			
Observation	Constant shelf-life and safe for human consumption with quality in terms of sensory attributes.		
Day 11-13			
Observation	P1 was slightly moist. P2 and P3 has already few spots of molds.		
Day 14			
Observation	Increased and visible molds in all three proportions on the 14th day and the next succeeding days. P3 contains many molds due to		

	the lower moisture content coming from butter. Banana blossom helps preserve the shelf-life of the finished product because of less moisture and adds hardiness to the cookies.

Commercially. Understanding the shelf life allows consumers to identify the expiration date quickly and ensures the product remains safe to consume. The shelf-life of banana blossom cookies is shown in Figure 9. Shelf life was defined as the period during which the baked product retains acceptable qualities, such as color, taste, aroma, texture, and appearance. In this study, determining the shelf life of Banana blossom cookies is vital for assessing their commercial viability. To determine the shelf life, the researcher employed sensory evaluation and ocular observation to monitor the qualities of the cookies made using three different Proportions of Banana blossom flour: Proportion 1, Proportion 2, and Proportion 3. These cookies were observed daily at room temperature, using the researcher's sensory abilities to evaluate the texture, color, appearance, and other sensory attributes. The study tracked how these characteristics changed over time.

The findings revealed that the quality of the cookies remained stable for the first 10 days of storage. Up to the 10th day, the texture, color, and appearance of all three Proportions (P1, P2, and P3) remained consistent. However, changes began to manifest on the 11th day, particularly in Proportion 3, where the cookies became slightly dry and showed early signs of mold formation. This suggested that Proportion 3 did not maintain the desired moist texture. By the 12th day, mold began to appear in Proportion 2 as well. By the 14th day, mold was present in all three proportions, indicating that the cookies were no longer safe for consumption.

The findings of this study align with those of Angeles (2018), Hade (2023), and Francisco (2019), which highlight those drying raw materials, such as fruits and vegetables, extends their shelf life by reducing moisture content. The drying process preserves the nutrients, concentrates the flavor, and enhances the compactness of the product, making it more convenient and versatile for year-round use. Based on the observations, it was evident that the shelf life of banana blossom cookie products texture begins to degrade, and mold formation starts, making it unsafe for consumption. This information was critical for determining the commercial potential of banana blossom cookies and for guiding proper storage recommendations to ensure consumer safety.

Economic Sustainability of Cookies made from Banana blossom

The Economic sustainability of a product is crucial in determining its potential success in the market, especially when introducing a new, innovative product. In this study, cookies made from banana blossom flour were developed as an alternative to traditional cookies, with an emphasis on promoting sustainable food production and supporting local communities. Evaluating the economic sustainability of these cookies is essential to assess whether they were a viable product in terms of resource efficiency, energy use, and marketability. This section explores the various economic factors related to the production, pricing, and market potential of banana blossom cookies.

The Economic Sustainability of banana blossom cookies was assessed through several key factors. First, the cost of raw materials was found to be low, as banana blossom was abundantly available in the local community, which significantly reduced production costs. The production process itself, while straightforward, required an initial investment in labor and equipment to convert the vegetable into flour and incorporate it into cookies. However, the novelty of the product boosted its market appeal, particularly among consumers who value sustainability and health-conscious foods. This appeal to eco-conscious markets and those seeking alternatives to traditional sweets increases the potential for profitability. Additionally, the low cost of raw materials, combined with the potential for local production, offers an opportunity for economic empowerment in rural areas, enhancing the product's overall economic sustainability.

Based on the evaluation, it was inferred that banana blossom cookies offer moderate to high economic sustainability. The affordability of Banana blossom as a raw material, which is locally sourced, reduces production costs, making the product accessible to a broader market. Furthermore, the unique selling point of using a less common, eco-friendly ingredient increases its marketability, catering to consumers who are looking for healthy, sustainable food options. However, the potential success of the product is not solely based on these factors; it also depends on effective marketing, consumer acceptance, and pricing strategies.

The analysis of the economic sustainability of banana blossom cookies shows that the product can be both profitable and sustainable, given the right market conditions. The low cost of Banana blossom and its availability in the local area contribute to lower production costs, allowing for competitive pricing in the market. Additionally, the novelty of the product, combined with its health and environmental benefits, increases its potential appeal to a growing segment of consumers looking for innovative and sustainable food options. The challenge lies in scaling production and ensuring consistent quality, but the economic

potential remains high, especially in local and eco-conscious markets. Furthermore, the potential for creating local jobs and supporting rural economies adds to the overall economic appeal of the product.

These findings align with previous studies on the economic potential and versatility of banana blossom as an ingredient in food production. For instance, Palczak et al. (2020) discovered that a mixture of macaroons incorporating banana blossoms is recognized as cookies made from sweet meringue and ground almonds, offering a distinct flavor and texture that enriches the sensory experience. The best mixture of 700 grams of banana blossom with 300 ml of condensed milk was the best formula for making desserts. The high sensory acceptability of their product demonstrates banana blossom potential in the commercial market, aligning with the high marketability of banana blossom cookies.

Furthermore, Lau et al. (2020) demonstrated the use of banana blossoms as raw material for the utilization of banana inflorescence as an ingredient in functional food. Nutritional and bioactive constituents of the tree are explained extensively as well. However, there is still a lack of references as to the utilization of Banana inflorescence like in a study where 1-2% extracts of the banana inflorescence are added to pork burger, and the results show that the addition of hydroethanolic extract of the banana inflorescence have no adverse effect on the physicochemical and sensory properties of the product.

These results echo the sensory appeal and acceptability of banana blossom cookies. Similarly, Eshak (2016) explored the potential of old Banana blossom endosperms for flour production, revealing that Banana blossom could be successfully applied to gluten-free cookies. The study underscored the versatility of Banana blossom flour, a finding that complements the successful use of Banana blossom flour in cookies, as explored in this research. The high consumer acceptability of Banana blossom flour-based products further supports its economic sustainability for new product development.

Moreover, Khoozani et al. (2019) examined how banana blossom flour can improve and boost the nutritional quality of bread without altering its digestibility. Banana blossom flour can positively influence product characteristics while maintaining sensory acceptability. This finding was particularly relevant to the current study, which evaluates the economic sustainability of using Banana blossom flour in cookies, both as a novel ingredient and as a potential income source for local communities.

Lastly, the study by the Philippine Statistics Authority (2020) demonstrated the commercial potential of Banana blossoms by producing and selling them in the market. This successful commercialization of a Banana blossom-based product supports the broader market potential for Banana blossom cookies, reinforcing the product's economic sustainability. Utilizing banana blossoms for various food items can enhance the town's recognition as a leading banana product producer.

Conclusions

The study concluded that Banana blossom (Musa acuminata Colla) contains essential nutrients that contribute to better health, making its incorporation into cookies a beneficial alternative for guilt-free consumption. The production of banana blossom flour follows specific procedures, and adhering to them correctly ensures efficiency and high-quality output. Among the tested proportions, Proportion 3, which contained a more significant amount of Banana blossom flour, was found to be the most suitable due to its ability to produce soft and moist cookies. All three proportions were moderately acceptable in terms of sensory attributes such as taste, aroma, texture, and appearance, while the color of Proportion 3 was rated highly acceptable. Additionally, the study found that banana blossom cookies have a shelf life of approximately 10 days at room temperature, after which changes in texture, appearance, and mold growth make them unsuitable for consumption. These findings provide valuable insights for commercial production and consumer awareness regarding the quality and expiration of banana blossom cookies.

Recommendations

Future researchers are encouraged to explore other sources of the nutritive value of Banana blossom and compare their benefits using different cooking methods. In producing Banana blossom flour, using a blender instead of grating can result in a finer texture. After blending, the flour can be dried in a dehydrator and then ground in a rice mill for a smoother consistency. Researchers may also modify or add ingredients to enhance the texture, appearance, and palatability of Banana blossom cookies. While all proportions tested in the study were moderately acceptable to respondents, continuous research and development are recommended to achieve a highly acceptable product. Future studies can utilize the finished product and experiment with different brownie recipes to improve taste and commercial viability. Proper preparation, appropriate ingredient selection, and adequate storage or packaging can help extend the cookies' shelf-life. Based on the findings, storing Banana blossom cookies in a controlled environment is recommended to maintain their quality. At the same time, packaging methods that prevent moisture and microbial growth should be considered to extend viability. Further research on additives or preservatives is also suggested to prolong shelf-life without compromising sensory attributes. Additionally, conducting a microbial test on Nipa fruit brownies is recommended to ensure food safety and quality.

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References

Afrizal, Fauzi ; & Pato, Usman (2017).Utilization of Nipa palm (Nypa Fruticans) Fruit as Raw Material for Making Jam. https://jom.unri.ac.id/index.php/JOMFAPERTA/article/view/16866

Acharya Shwetha, Ramesh C. R., Tazeen Humeera (2021) PRODUCTION OF NATURAL BANANA BLOSSOM CONCENTRATE

Aisya Masmuni Wahda, Zakaria Fatmah, & Daud Wirna, (2020). The effects of banana blossom (Musa Acuminate Colla) consumption on increased breast milk production in the work area of Talaga Jaya. Journal La Lifesci, 1(4), 1-7.

Alano, Rizza S.B (2023). Dragon fruit peel Candy:A source of Income. Unpublished Master's Thesis, Naga College Foundation (NCF), Naga City.

Angeles, Melissa B. (2018). Siling Labuyo (Capsicum Frutescence)- Flavored Cakes and Cookies. Unpublished Master's Thesis, Naga College Foundation, Naga City.

Arya Krishnan S., & Sinija V. R., (2016). Proximate composition and antioxidant activity of banana blossom of two cultivars in India. International Journal of Agriculture and Food Science Technologyhttps://scimatic.org/show_manuscript/672

Augustyn G.H., Lawalata V.N., Sipahelut S.G. (2021) Characteristics of yelllow sweet potato flakes(Ipomoea batatas L.) with the addition of moringa leaf flour (Moringa oleifera).

Bantog, Miriam A. (2015),"Coco-Pili Bar: A Development Study", Unpublished Master's Thesis Bicol University, Legaspi City.

Beatriz, Myla L. (2019). Cocus Nucifera Cupcake: Insights and Implications for a Healthier and Happier Mother Earth, Unpublished Master's Thesis, Naga College Foundation, Naga City.

Begum Yesmin Ara, Deka Sankar Chandra, 2019. Chemical profiling and functional properties of dietary fibre rich inner and outer bracts of culinary banana flower. J. Food Sci. Technol. 56 (12), 5298–5308.

Biao Yuan, Chen Xin, Wong Song, Chen Guo, Mcclements David , and Zhao Liyan (2020), impact of mushroom (Pleurotus eryngii) Flour upon Quality attributes of wheat dough And functional cookies baked product. Food Science and nutrition: 8(1) 361-370. https://doi.10.1002/fsn.1315

Branco-Castelo Vannessa, Guimaraes Janaina, Souza Livia, Guedes Silva, Silva Marcella, Patricia, Ferrao, Luana, Miyahira, Roberta, rangel Guimaraes, Renata, Freitas, Suzana, Citelli, Marta, zago, Lilia (2017). The use of green banana (Musa balbisiana) pulp and peel flour as an ingredient for tagliatelle pasta, Brazilian Journal of Food technology,20,10.1590/1981-6723.11916.

Burce, Cherry B. (2016). Black plum seed as main ingredients for coffee, Unpublished Master's Thesis, Naga College Foundation, Naga City.

Castro, Cyrell S. (2019). Innovative Recipes from Squash (Cucurbita Maxima Duchesne) For A Home-School Income-Generating Project. Unpublished Master's Thesis, Naga College Foundation, Naga City.

Children, Food and Nutrition. (n.d.). https://files.eric.ed.gov/fulltext/ED599360.pdf

De Brito M.A, Morato P.N., & Benedetti S. (2019). Elaboration of muffin of banana gluten free and addition of the eggplant flour.REBRAPA- Brazilian Journal of food Research.019 Vol.10 No.4 pp.62-72 ref.18.https://www.cabrdirect.org/cabdirect/abstract/20219912367.

El Ashmawy Nasser Mohaned, and Ahmed Khaled Abdel-Mohsen Agricultural (2016) Effect of Vacuum Drying System on Drying Time and Quality of Banana Slices El.

Eshak Nareman S., (2016). Sensory evaluation and nutritional value of Bal- ady flat bread supplemented with banana peels as a natural source of dietary fiber. Annals of Agricultural Science, 61(2), 229–235. http://doi.org/10.1016/j.aoas.2016.07.002

European Commission Directorate-General for Research and Innovation. Food 2030. Pathways for Action. Research and Innovation Policy as a Driver for Sustainable, Healthy and Inclusive Food Systems; European Commission Directorate-General for Research and Innovation: Brussel, Belgium, 2020.

Fernando Pradeep Anuruddha T., Thilakarathne Buddhika M.S.K., Mahindarathna Prasad P. and Subodinee A.A.M. (2018) DEVELOPMENT OF FIBER RICH RICE BASED BISCUIT https://doi.org/10.17501/gen.2017.1102

Food and Agriculture Organization (FAO). (2020). The State of Food Security and Nutrition in the World 2020. Retrieved from http://www.fao.org/documents/card/en/c/ca9692en.

Food Source Information (2023). Flour. Food Source Information.Com.

Francisco, Lotis A. (2019). Utilization and Development og Pili (Canarium Ovatum) Pulp as flour, Unpublished Master's Thesis,Bicol State College of Applied Sciences and Technology(BISCAST), Naga City.

Goal 2: Zero Hunger (Retrieved 2023). Sustainable Development Goals. https://www.un.org/sustainabledevelopment/hunger/.

Goodmills Group (Retrieved, 2023). Flour Production: Process, Evolution, and Perspectives. GoodmillsGroup.Com. https://www.goodmills.com/flour-production-process-evolution-and-perspectives/

Grain Feed & Milling Magazine (2022). How flour(maida) is made, different processes of making flour (maida. Grain Feed & Milling Magazine. Com. https://www.gfmdhaka.com/news/how-flourmaida-is-made-different-processes-of-making-flourmaidahttps://fsi.colostate.edu/flour-draft/.

Gurbuz Esen. (2018). Theory of New Product Development and its Applications. Marketing. InTech. Retrieved May 12, 2023 from https://www.intechopen.com/chapters/59751.

Hade, Janine N. (2023). Eggplant (Solanum Melongena): "An Alternative main ingredients in producing Pasta Noodles." Unpublished Master's Thesis, Naga College Foundation (NCF),Naga City.

Hasan Nurul Wahyuni, Putri Tri Puspita, Zainal (2020). Preparation of cokkies from banana flour, soy flour, and Moringa leaf flour as an emergency food product.https://doi.org/10.1088/1755-1315/486/1/012059.

Khoozani Amir Amini (2019) Physicochemical and Sensory Characteristics of Banana Blossom Nuggets https://www.academia.edu/64195508/Physicochemical_and_Sensory_Characteristics_of_Banana_Blossom_Nuggets

Khoozani Amir Amini, Birch John, & Bekhit Alaa El-Din Ahmed, (2019). Production, appli- cation and health effects of banana pulp and peel flour in the food industry. Journal ofFood Science andTechnology, 56,548–559. https://doi.org/10.1007/s13197-018-03562-z

Kraithong Supaluck, Issara Utthapon (2021) Review On: Production of Natural Banana Blossom Concentrate

Kurhade Ankeeta, Patil Sonal, Sonawane Sachin, Waghmare Jyotsna, Arya Shalini, 2016. Effect of banana peel powder on bioactive constituents and microstructural quality of chapatti: unleavened Indian flat bread. J. Food Meas. Charact. 10 (1), 32–41

Lalugan, Elizabeth B. (2016). "Indian Mango (Mangifer Indica) Wine.Unpublished Master's Thesis, Legaspi, City.

Lau Beng Fye, Kong Kin Weng, Leong Kok Hoong, Sun Jian, He Xuemei, Wang Zhengxing, Mustafa Mohammad Kais, Ling Tau Chuan, & Ismail Amin, (2020). Banana inflorescence: Its bio - prospects as an ingredient for functional foods. Trends in Food Science & Technology, 97,14–28. https://doi. org/10.1016/j.tifs.2019.12.023

Masresha Gebeyehu ewunetu, Atnafu Alemneh Yazie, Fikadu Wondemagegn (2023). Nutiritional Enhancement of Bread produced from Wheat,Banana, and carrot Composite flour.https://doi.org/10.1155/2023/1917972

Mishra P., Tewari M., & Tiwari D. K., (2017). Development and evaluation of cookies prepared by banana flower, lotus stem and finger millet for anaemic adolescent girls. Annals of Horticulture, 10(2), 235–239. https://doi.org/10.5958/0976-4623.2017.00042.1

Muhammad Doni RA, Tuenter Evelien, Patria Giselle D., K Foubert, L Pieters and K Dewettink (2020). Food Chem 340 127983

Nipa Jamilah F., & Mondal Mushfiqur H.T (2021). Thin layer drying kinetics of taro root (Colocasia esculenta l.). AgricEngInt: CIGR Journal Open access at http://www.cigrjournal.org.

Nipa Jannatul Ferdows, & Mondal Md.Hasan Tarek, (2021). Thin layer drying kinetics of taro root (Colocasia esculenta l.). AgricEngInt: CIGR Journal Open access at http://www.cigrjournal.org

Ogundijo D., Agcaoili Josiefel,2022 Level of Acceptability of Banana Inflorescence (Musa Paradisiaca) Pickle.

OSC. (2020, September 28). Government calibrating National Food Policy to address rising hunger numbers amid pandemic––Nograles. Philippine Information Agency. Retrieved from https://pia.gov.ph/news/articles/1054505.

Palczak Magdalena Sulewska, Katarzyna, & Nowak, Robert (2020). Nutritional benefits and applications of banana blossoms. Food Science and Nutrition, 8(5), 1234-1245.

Pardiñas, R. (2018),Fish Jerky made from Tilapia pili pilp, and Oyster Mushroom. Unpublished Master's Thesis,Bicol State College of Applied Sciences and Technology(BISCAST), Naga City.

Philippine Statistics Authority. (2020). Agricultural production statistics of the Philippines. Retrieved from https://psa.gov.ph

Priya Mishra, Mitali Tewari, & Dileep Kumar Tiwari, (2017). Development and evaluation of cookies prepared by banana flower, lotus stem and finger millet for anaemic adolescent girls. Annals of Horticulture, 10(2), 235–239. https://doi.org/10.5958/0976-4623.2017.00042.1

Pulugutha Shamala. What are the benefits of banana flower. https://www.livestrong.com/article/401844-what-are-the-benefits-of-banana-flowers/2017

Pushpaveni C., Visagaperumal D., & Vineeth Chandy. 2019. A Review on Banana Blossom: The Heart of Banana. World Journal Pharmacognosy Research. 8(11): 440-450.

Ragab M., Osman M. F., Khalil M. E., and Gouda M. S., (2016). Banana (Musa Sp.) Peels as a Source of Pectin and Some Food Nutrients. Journal of Sustainable Agricultural Sciences, 42(4): 88-102.

Rahaman Sk Mehebub & Saha Bidyut (2023). Application of biosurfactants as emulsifiers in the processing of food products with diverse utilization in the baked goods. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/baked-goods

Ramiriz, R.M., (2021). Technology Process and Standardization of Sweet Potato (Imomoea Batatas Lina) Pie, Volatiles & Essent oil 8(6),2870.

Ravinder Singh, Ravinder Kaushik and Saurabh Gosewade Abstract (2018) Bananas as underutilized fruit having huge potential as raw materials for food and non-food processing industries: A brief reviewRavinderesearchgate.net/profile/RavinderKaushik2/publication/327136284_Bananas_as_underutilized_fruit_having_huge_potential_as_raw_materials_for_food_and_nonfood_processing_industries_A_brief_review/links/6249e8d657084c718b83533c/Bananas-as-underutilized-fruit-having-huge-potential-as-raw-materials-for-food-and-non-food-processing-industries-A-brief-review.pdf

Rockström Willett, W., Loken Johan B., Springmann, Marco, Lang, Tim, Vermeulen, Sander & Murray, Christopher J. L. (2019). Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. The Lancet, 393(10170), 447-492. https://doi.org/10.1016/S0140-6736(18)31788-4

Rodrigues Angela Souza, Kubota Hashime, Silva da Giacomelli, dos Santos Alves Jamila, Hautrive Tiffany Prokopp, Rodrigues, Geangela Souza ,Campagnol,P.C.B., (2020) Banana Inflorescences:A cheap raw material with great potential to be used as a natural anti-oxidant in meat products. Meat Sci. 161, 107991.

Rompies Ronald, Mayulu Nelly, Nurkolis Fahrul, Faradila F. ,Kepel Billy J., Natanael Hans, 2021. Antioxidant capacity of snack cookies made from mango and pineapple fermentation. Food Res. 2021; 5(5), Pp. 145-148.

Sarker Anchita, Sudipto Das Shuvo, Most Tahera Akter Takey, Md. Hadaytullah, Md. Sajib Al Reza,Md. Abu Zubair (2022) Determination Of Proximate Composition, Antioxidant Activity, Vitamin C, Total Phenolic And Flavonoid Content Of Banana Blossom Powder For Optimization Of Its Use. https://afst.valahia.ro/wp-content/uploads/2023/03/IV.5_Sajib.pdf

Sarte, Dexter C. (2016). Food products from the banana pith (Musaceae Zingiberales), Unpublished Master's Thesis, Bicol State College of Applied Sciences and Technology (BISCAST), Naga City.

Saul McLeod (2019). Likert Scale Definition, Examples, and Analysis. Simply Psychology. https://www.simplypsychology.org/likert-scale.html.

Schmidt Marcio M., Prestes, R. C. Kubota, E.H., Scapin, G. Mazutti, M.A., (2015). Evaluation of antioxidant activity of extracts ofbanana inflorescences (Musa cavendishii). CyTA – Journal ofFood, 1–8. (ahead-of-print). doi:10.1080/19476337.2015.1007532

Shamala Pulugutha. What are the benefits of banana flower. https://www.livestrong.com/article/401844-what-are-the-benefits-of-banana-flowers/2017

Sharma Vishal, Shukla Kavita Varma, Golani Pradeep, 2019. Traditional and medicinal effect of banana blossom. International Journal of Scientific Development and Research, vol. 4, p. 377-381.

Sharmila Yamuna Devi P., 2015. Development and evaluation of banana blossom incorporated dark chocolate. Kodaikanal. 4 (4), 1409–1411.

Sidhu Jiwan S., & Zafar Tasleem A., (2018). Bioactive compounds in banana fruits and their health benefits. Food Quality and Safety, 2(4), 183–188. https://doi.org/10.1093/fqsafe/ fyy019

Singh Shilpi, (2017). Banana blossom: an understated food with high functional benefits. International Journal of Current Research 9(1), pp. 44516-44519. Available at: http://www.journalcra.com/article/banana-blossom-understated-food-high-functional-benefits (Accessed: 10 November 2018).

Singh Shilpi, Singh S. K., & Yadav A. K., (2018). Mineral and antioxidant content of banana blossoms. Journal of Agricultural and Food Chemistry, 66(15), 3893-3900.

Soberano Donabelle R., Parojenog Robin C., Crisologo Vincent Bernell E. 2022 Sensory Evaluation of Herbs Flavored Muffin Using Banana Blossom "Saba" (Musa Acuminata X Balbasiana) Flour

Soverano, John Rey SR. (2016) Lubas (Spondias Pinnata) Wine (Unpublished Master's Thesis, Bicol State College of Applied Sciences and Technology (BISCAST), Naga City.

Subagyo Asmato, Chafidz Achmad Banana pseudo-stem fiber: preparation, characteristics, and applications. Banana Nutrition-Function and Processing Kinetics, 2018.

Suprayitno Eddy, Adi Slamet S., Sulistiyati Titik Dwi, 2016. Diversification of mackerel tuna (Euthynnus affinis) products Volume 15 856 2021Potravinarstvo Slovak Journal of Food Sciences as processed fishcake, nugget, cracker, meatball, and meat floss products at the TPI Tempursari beach tourism site, Lumajang. IOSR Journal of Humanities and Social Science, vol. 21, no. 11, p. 14-17

Tamsen Maryann, Shekarchizadeh Hajar, Soltanizadeh Nafiseh. (2018). Evaluation of wheat flour substitution with amaranth flour on chicken nugget properties. Journal of Food Science and Technology, 91, 580-587.

Tasnim Tamanna, Das Pabitra Chandra, Begum Anjuman Ara, Nupur Asmaul Husna and Mazumder Anisur Rahman (2020) Journal of Agriculture and Food Research 2 (2020) 100071 https://www.sciencedirect.com/science/article/pii/S2666154320300521

Thagunna Bishal, Kandel Kamana, Lamichhane Bijaya (2023). Banana Blossom: Nutritional Value, Health Benefits and Its Utilization. Reviews in Food And Agriculture, 4(2): 66-70.

Timothy Sandefur (2020). Innovation. Retrieved from https://www.econlib.org/ in September 2024.

Unicef2019chromeextension://kdpelmjpfafjppnhbloffcjpeomlnpah/https://www.unicef.org/media/60811/file/sowc-2019-exec-summary.pdf