



# EXPLORING THE POTENTIAL OF BLUE TERNATE AS A FUNCTIONAL INGREDIENT IN THE DEVELOPMENT OF HEALTHY POTATO-BASED PRODUCT

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## ABSTRACT

*"Clitoria ternatea, commonly known as butterfly blue ternate, belongs to the Fabaceae family. In the culinary landscape, particularly in the Philippines, its vibrant blooms are widely utilized as a natural food colorant for tea, juices, and traditional delicacies like 'kakanin.' The striking combination of bright deep-blue and white hues adds aesthetic appeal to various dishes.*

*Beyond its culinary applications, this plant holds significance in animal nutrition, as goats can be fed on it, owing to its favorable flavor and nutritional content. Moreover, the leaves, blossoms, and roots of Clitoria ternatea are reported to possess valuable medicinal properties, including analgesic, antipyretic, and anti-inflammatory attributes.*

*The plant's diverse benefits extend to antioxidant, anti-diabetic, anti-microbial, anti-anthelmintic, hepatoprotective, and anti-asthmatic qualities, contributing to its potential in addressing a spectrum of health concerns.*

*This study delves into the composition of Clitoria ternatea flowers, considering both their nutritional elements and chemical analysis. The findings presented herein underscore the multifaceted utility of Clitoria ternatea, not only as a culinary enhancer but also as a source of valuable compounds with significant implications for health and nutrition."*

**KEYWORDS** – *Clitoria ternatea, Chemical analysis, Biological effects, functional ingredient.*

## INTRODUCTION

Butterfly Pea is known as Asian Pigeon Wings, Blue Bell Vine, Blue Pea, Cordofan Pea, and Darwin pea, scientifically known as *Clitoria ternatea* is an amazing brain-boosting herb native to tropical equatorial Asia. *Clitoria ternatea* has been consumed for centuries as a memory enhancer, brain booster, anti-stress and calmativ agent which is good for school children. Butterfly Pea is full of health-promoting antioxidants, flavonoids, and peptides and has shown considerable promise in animal studies as a natural remedy for a range of health complaints according to Kazuma, K., et.al (2003).

The following are the benefits of Butterfly pea (*Clitoria ternatea*) that are good for grade school and high school students. It helps improve eyesight since it contains an antioxidant called proanthocyanins, which increases blood flow to the capillaries of the eyes. It also helps improve hair growth since it is rich in bioflavonoids, butterfly pea can promote hair growth and reduce greying of hair. It also improves skin since it stimulates collagen and elastin synthesis, which helps rejuvenate the skin and lessen wrinkles and other signs of aging. Butterfly pea is also considered an aphrodisiac, particularly for women, and used to treat menstruation problems or white vaginal discharge or (leucorrhea)

which most of the girls in the high school department encounter during their periods.

This flower is also used to enhance cognitive function and boost brain function, which is very important, especially to school children. This butterfly pea help promotes normal urination, which in turn lowers blood pressure. This is also a good analgesic since it has been used traditionally as a local anesthetic as it has been shown to help relieve pain and swelling. There are also studies that say that this has a calming effect on the body, and it also helps reduce stress and anxiety which is good for students nowadays. It is also used in common cold, cough, and asthma as it acts as an expectorant and reduces the irritation of respiratory organs. There are studies that show that butterfly pea is anti-cancer and anti-tumor since this can cause cancer cell death by disrupting cell membrane integrity. Aside from that, it is also anti-diabetic, anti-HIV, anti-microbial, anti-convulsant, and anti-pyretic as studied by Neda, G.D. et al (2013)

It has recently attracted a lot of interest as it has potential applications both in modern medicine and agriculture and as a source of natural food colorants and antioxidants. Here in the Philippines, it's very uncommon that Filipinos will plant butterfly



pea plants or *Clitoria Ternatea* in their backyards, particularly in the cities where they only have limited space. We seldom see butterfly pea flowers on the shelves of supermarkets despite the so many health benefits that we can get by consuming and using these flowers in our cookery activities.

This butterfly pea flower becomes in demand during this pandemic since many people were able to show the importance and benefits of this herb on their TikTok and YouTube accounts. Aside from blue ternate the researcher also used ipomoea batatas Lam also known as sweet potato. This sweet potato is a well know prostrate annual herb that is smooth and shiny. It belongs to the plant family Convolvulaceae. It is cultivated for its tubers that are red, white, or yellow in color. The leaves are ovate-cordate and lobed. When fully mature it puts forth many purple, funnel-shaped flowers arranged on long stalks. The seeds are smooth and shiny. This ingredient is also medicinal and can be used as medicine for those who are having diarrhea and can work as a laxative.

This paper will help promote the value and benefits that we can get with these butterfly pea flowers. Since butterfly pea flower is rich in anthocyanins, which are the antioxidant compounds responsible for its' unique, striking, vibrant blue color. This plant also contains several other antioxidants, including *kaempferol* this is a compound that has been studied extensively for its cancer-fighting properties. It also contains p-Coumaric acid which could have anti-inflammatory, antimicrobial, and antiviral effects and may help protect against disease. It is also loaded with vitamins A, C, and E and is considered caffeine-free according to (*Khurian 2010*). This butterfly pea flower is generally considered safe when used in moderation. Because of this, the researcher embarked on the development of food products utilizing butterfly pea as one of the base ingredients. The end goal was to come up with products that are affordable and nutritious to supplement the nutritional needs of elementary and high school students at San Isidro Integrated school.

According to the study made by Manju Latu Zingare et al., in 2009, the following are the agronomic information in propagating the Blue Ternate pea plant.

- (1) Soil Adaptation – blue ternate is well adapted to grow in a wide range of soil types with pH ranges 5.5 – 8.9 from deep alluvial to sandy including calcareous soils. It is extremely well adapted to heavy clay alkaline soils, especially on clay soils but also grows well in moderately fertile soils.
- (2) Water Requirement- It requires approximately 400mm of rainfall but also performs well under irrigation areas and grows from drier to fair drought tolerant areas. Due to the nature of Blue Ternate, it cannot tolerate prolonged inundation or water logging but can tolerate short-term flooding.

- (3) Favorable temperature and sunlight – It need moderate temperature down to 25 degrees Celsius but is not suited to locations with frequent frosts or severe frost, but it stands up well in hot summer temperatures and has low frost tolerance. It is moderately shade tolerant but can normally grow in full sunlight

(4) Fertilizer Requirement – Blue ternate is normally grown in soil containing phosphorus (P) and sulfur (S) which may be required as fertilizers if sown in infertile soils; and

(5) Propagation – The blue ternate pods contain around 20% of hard seed according to the seasonal conditions in where it is produced and grow rapidly in warm-moist weather. It is harvested manually by hands and is propagated from seed or by cuttings by Manju Latu Zingare, (2009).

#### DEVELOPMENT OF BLUE TERNATE FLOWERS

The researcher planted this blue ternate plant following the agronomic information in propagating blue ternate pea plant as shown in these pictures below:

Dry the collected blue ternate seeds for two days



Seeds were placed in a wet towel for two days until they sprouted as seen in the picture.



It was planted in wet organic soil.



THE PLANT STARTED GROWING AS SHOWN IN THE PICTURE



AFTER 20 DAYS OF PLANTING



AFTER 30 DAYS OF PLANTING



AFTER 40 DAYS THE RESEARCHER STARTED HARVESTING THE FLOWERS NEEDED FOR HER RESEARCH

adheres to the DepEd order no. 023 s.2020 which is the operational guidelines on the implementation of the school-based feeding program for the school year 2020-2021. This is also to maintain its commitment to providing good nutrition to learners amidst the Covid-19 pandemic. This will also help address hunger and encourage learners to eat nutritious food and contribute to the improvement of their nutritional status, provide nourishment for their growth and development, help boost their immune system, and enhance and improve their health and nutrition.

This study aims to develop new products using powdered blue ternate as one of the base ingredients. These powdered ternate will be used as one of the basic ingredients in preparing and cooking sweet potato ternate fries, and creamy ternate dip.

Specifically, it aimed to answer the following questions:

1. What are the nutritional values derived from the powdered flowers of blue ternate?
2. Is powdered blue ternate hygienically safe for consumption?
3. Is it safe and healthy to add powdered blue ternate to sweet potato fries and sweet potato dip; and
4. What is the level of acceptability of products with powdered blue ternate based on the assessment result obtained from potential consumers?

The general purpose of this study was to develop healthy food products using powdered blue ternate flowers that will be added to mashed sweet potato fries and creamy ternate dip. The determination of the nutritional value of the product, the acceptability of the products, and their shelf life will also be studied.

It will be conducted to the students and teachers at San Isidro Integrated school. The nutrient content was only an estimate of the actual products. Time and budget constraints would not allow the researchers to do chemical analysis and observe the shelf life for a longer period. The acceptability of the product was determined through a subjective evaluation using the sensory attributes of adults.

The study was confined to the utilization of blue ternate powder and sweet potatoes as the primary ingredient in all the products developed. The products used were based on existing, commercially available food products popular among grade school and Junior High school students. To observe strict adherence to the established procedures for processing. The addition of dried and powdered blue ternate to the ingredients was the only modification made in this study. Thus, subjecting the products to nutrient analysis was not necessary. Developing blue ternate powder is required since the ternate powder will be added to the products that were developed in this study.

This paper also wants to address the health and nutrition concerns of elementary and Junior High school students at San Isidro Integrated school here in Cabanatuan City. This paper also



## METHODS

The study endeavored to produce food products from Butterfly pea flowers and sweet potatoes to help supplement the dietary needs of grade school and high school students. Specifically, it aimed to prepare snacks acceptable to consumers particularly the grade school and junior high school students at San Isidro Integrated school; and to foster dissemination and promotion of this innovation to the school and community. The researcher will use descriptive-qualitative method of product development. The respondents were 20 potential consumers who like to eat sweet potato fries. The researcher will apply random sampling. Data were analyzed using frequency count and percentages.

The following steps were optimized to facilitate the optimal production of blue ternate pea flowers and sweet potatoes.

### STEPS IN PREPARING BLUE TERNATE FLOWERS

Figure 1 shows the steps in preparing blue ternate flowers before the development of the products using the blue ternate flower as one of the based ingredients. The researcher collected the needed number of flowers and washed them thoroughly. Then it was dried for three days under the heat of the sun. The dried flowers were pounded until pulverized. Powdered flowers were collected and placed in a closed container until needed.



**DRYING THE COLLECTED BLUE BUTTERFLY TERNATE FLOWERS**



**PULVERIZED BLUE TERNATE FLOWERS**

The following are the steps in preparing sweet potato products using powdered blue ternate flowers as additives and colorants:

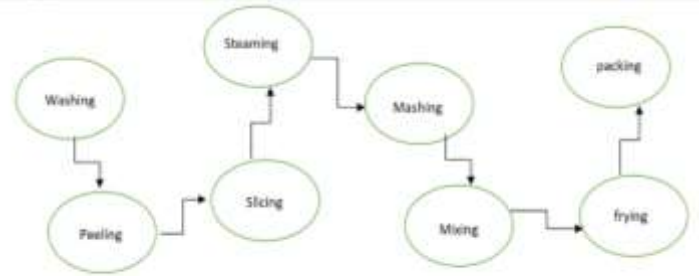


Figure 2

Figure 2 shows the procedure followed by the researcher from the start of the activity up to the last part of the development of the products. It started with washing the potatoes until clean. It was followed by the peeling of the sweet potatoes. It was sliced according to the desired size and shape before steaming it. After steaming it was followed by mashing. Then other ingredients were mixed with it and form it into desired shapes before frying and packing.



**PREPARATION OF THE NEEDED MATERIALS FOR THE PRODUCT DEVELOPMENT**

Prepare all the necessary tools and cooking materials and ingredients needed before the development of the product.



1. Wash thoroughly and prepare sweet potato



2. Peel and slice the sweet potato into desired shapes.



4. Boil and drain the potato thoroughly



5. Mash the sweet potato evenly using fork or blender.



6. Prepare all the necessary ingredients needed.



7. Combine all the ingredients in a bowl.



8. Add the powdered blue ternate then mix.





Form the mixture into desired size and shapes



**SECOND TRIAL RESULT**



**THIRD TRIAL RESULT**



**FINAL PRODUCT WITH PACKAGING**



#### DURING EVALUATION STAGE

The tables below were the trials of the products that were modified and developed by the researcher using powdered blue ternate or the *Clitoria ternatea* (butterfly pea) flowers and sweet potatoes as the main ingredient in preparing sweet potato ternate dip and sweet potato ternate fries. The table below shows the results of the trial made by the researcher.

Table 1 shows the results of the trial 1 to 3 of the researcher.

**Table 1**

#### Materials: Sweet potato ternate dip

Ingredients	Trial 1	Trial 2	Trial 3
Powdered blue ternate	1 tbsp	1 tbsp	1/8 tsp
Mashed Sweet potato	3/4 cup	1/2 cup	1/2 cup
Mayonnaise	1/2 cup	1/2 cup	1/2 cup
Garlic powder	1/2 tsp	1/2 tsp	1/2 tsp
Black pepper	1/4 tsp	1/4 tsp	1/4 tsp
Cornstarch	Not included	1 tsp	Not included
ketchup	2 tsp	1 tsp	1 tsp
Worcestershire sauce	1 tsp	1/2 tsp	1 tsp

#### Sweet Potato Dip Procedure

##### Ingredients

- 1/2 cup mayonnaise
- 2 tablespoon ketchup
- 1 teaspoon Worcestershire sauce
- 1/2 teaspoon garlic powder
- 1/4 teaspoon black pepper
- 1/8 teaspoon powdered blue ternate
- 1/2 cup mashed sweet potato

##### Instructions

1. Prepare and wash all the needed ingredients
2. Pare, slice, and steam the sweet potatoes
3. Mix all ingredients together until smooth
4. Cover and store refrigerated until needed.

The trials were done using different measurements for some ingredients. This was done since there are parts of the study where the researcher noticed that some ingredients are lacking, and some are needed. This is also the reason why the researcher used different amounts of ingredients and some ingredients were not included in other trials. In trial 1 as shown in the table, the researcher did not include cornstarch since it was not available during trial 1.

The researcher noticed after observing the result of the first trial that cornstarch should be added. During the second trial, ketchup was not included since it makes the color of the developed product a little darker, so the researcher decided to remove it in the second trial, this is also to show the natural color of blue ternate which is purple, also in the third and last trial. In the third trial, the researcher added an additional 1/2 tsp of cornstarch since during the trial the researcher noticed that it is better to add an additional 1/2 tsp of cornstarch. The result of the third trial shows that the measurements were just enough for the product that is being developed by the researcher, as shown in the pictures below.







Table 2

## Sweet Potato Ternate Fries

Ingredients	Trial 1	Trial 2	Trial 3
Sweet potato	2 cups	2 cups	2 ½ cups
Salt	1/8 tsp.	1/8 tsp.	1/8 tsp.
Cornstarch	2 tbsp.	1 ½ tbsp.	1 tbsp.
Blue ternate powder	1/8 tsp.	1/8 tsp.	1/8 tsp.
Cooking oil	2 cups	2 cups	S cups
Ground pepper	A pinch of pepper	A pinch of pepper	A pinch of pepper

## Sweet Potato Fries Procedure

1. Peel and cut sweet potatoes into small chunks.
2. Fill a large pot with water and add 1 teaspoon of salt. Add potatoes and bring to a boil. Cook until fork-tender, about 20 minutes.
3. Drain and transfer to a large bowl, add salt, pepper, blue ternate powder, crushed garlic, and shredded cheese. Mash the potatoes into a smooth puree. Add cornstarch and mix/mash.
4. Transfer into a piping bag fitted with a round tip and pipe into long strips on a cutting board.
5. In a wide pan heat oil to 350F (180C). Fry mashed potato strips until golden brown and drain excess oil.

The following are the methods, where blue ternate was used:

- Blue ternate extract was used to add color to the dip
- Powdered blue ternate was sprinkled on the dip

## Consumer Reactions as perceived by the five senses

Determining how food products affect consumers' senses is one of the most important goals of the food industry. It also is a primary concern for nutritionists and dietitians who develop healthier recipes. Therefore, consumer reaction as perceived by the five senses is considered a vital measure of food development. Because no apparatus can substitute for the senses in evaluating food, humans are used as test subjects done by Taur, D.J. and Patil, R.Y. (2011)

The evaluation of the food products was anchored on sensory science theory of Venkateswaran, R. (2015), which gives

importance to the value of sensory science in evaluating the characteristics of physical matter. In this method, food is uniformly prepared and presented to the respondent who records their evaluations of the product on a sensory evaluation sheet that is decoded and analyzed through statistical procedures.

Sensory evaluation is a scientific testing method for the accurate measurement of human responses as perceived by the five senses. Sensory evaluation according to Gatchalian, M.M. (2019), to be objective, must be with a considerable degree of reliability and validity. For food products, the sensory qualities are appearance, texture, aroma, and taste. Appearance is sensed by the eye. The texture is the mechanical stimulation of the sense organs represented by the tongue, gums, and the hard and soft palate. Aroma considers the fragrance or odor of a product as perceived by the nose. Taste is the perception of the stimulus through the taste buds which are primarily located on the tongue.

The general concept advocated in this study is graphically illustrated in figure 3.

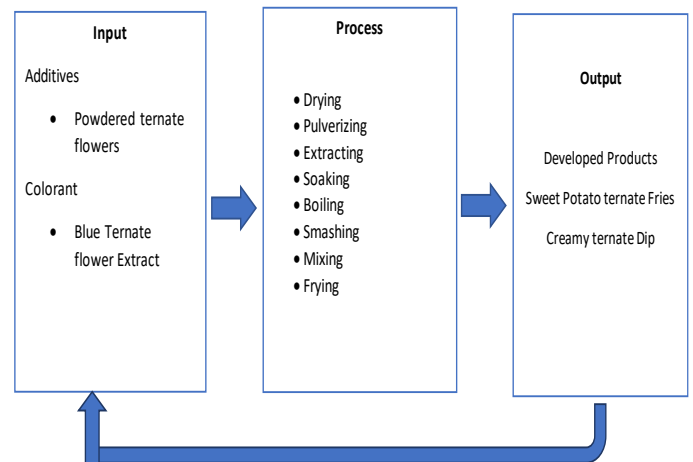


Figure 1: The Process of the product development from the preparation to the finished product

Development of the food products was carried out in San Isidro Integrated School, Cabanatuan City. Butterfly pea flowers were collected, thoroughly washed, and air-dried. With the use of a blender or food processor, the leaves were ground finely and kept in sealed bags at room temperature. This was done prior to the development of each product to ensure clean and safe materials, free of any contamination. Stocking of materials was not done to prevent the development of molds and other undesirable microbes. For products requiring extracted butterfly pea flowers, the fresh butterfly pea flowers were processed right at the preparation process

The standard procedures for the preparation of the products developed were carefully observed. The addition of ground butterfly pea flowers among the ingredients was an added procedure. At least one cup of ground flowers was added for every volume set in the standard procedure.





The developed food products were subjected to evaluation by TLE teachers in the elementary and secondary levels in San Isidro Integrated school who are specialists in food. Likewise, as they are the primary target consumers, grade school and Junior High School students were involved to ensure the acceptability of the products.

## RESULTS AND DISCUSSION

### Nutrient values of Blue Ternate

There are studies that showed that using the powdered blue ternate product was hygienic and safe for consumption. Since there are so many studies and products produced using powdered ternate as additives and colorants, we can say that it is safe to use it for the development of these products.

**Table 3. Acceptability of blue ternate**

Reasons to use	Number	Percentage
Naturally produced with no preservatives	4	20.0
Plenty of health benefits	8	40.0
Suited for their taste	3	15.0
All reasons (attractive color, convenience, it has a pleasant odor, health, and wellness benefits)	5	25.0
Total	20	100.0

Based on table 3, the results of the acceptability of the developed product such as blue ternate fries and blue ternate dip the result showed that 4 potential consumers or 4 or 20%, positively accepted blue ternate fries and dip, 8 or 40% agreed that blue ternate product has plenty of health benefits, 3 or 15% agreed that the developed products are suited to their taste and 5 or 25% agreed that the products have attractive color, pleasant odor, and is convenient to use if it is readily available in the market in nice and convenient packaging.

Developed products such as blue ternate fries and blue ternate dip had shown good indicators of marketability because of their nutritional value, as indicated in the results. Overall results showed that the developed product using powdered blue ternate has positive acceptability. If we based on the context of market acceptability, it is considered that the possibility of producing product using powdered blue ternate have a high market segment in terms of consumers. In terms of economic profitability, it will cater to the future source of livelihood for those who are involved in large and sustainable production.

The products developed were Potato Ternate Fries and Creamy Ternate Dip using powdered blue ternate and sweet potatoes as the basic ingredients. Potato ternate fries are a refreshing twist on the classic French fries. Fried mashed potato ternate sticks are made of mashed sweet potatoes and powdered butterfly ternate flowers. These homemade mashed potato fries are crispy on the

outside and soft and cheesy on the inside. They are easy to make and perfect as a snack especially made for grade school and high school students.

Product development, packaging, and value-adding for the commercialization of sweet potato blue ternate fries and sweet potato blue ternate dip are highly recommended. Mass production of this product will boost backyard growers of sweet potato products and blue ternate flowers to start a small-scale –business of selling plants’ vegetative parts for propagation. Having stated the health and wellness benefits of blue ternate, the researchers also recommend the propagation of this herb in the backyards of every household for the consumption of the family.

Butterfly blue ternate or *Clitoria ternatea* or is found to possess a significant number of advantages and natural properties against several diseases and ailments in the human body. Based on this study, Kurian, J. (2010), it is hoped that the butterfly pea flowers can be cultivated as one of the leading crops in the world that will be accepted by medical practitioners due to their natural properties and effectiveness in combating several well-known diseases and ailments and as additives and colorants for a food product.

Further research is encouraged to use other parts of this herbal plant such as leaves, stems, fruits, and roots to further develop its nutritive potential and medicinal benefits.

## REFERENCES

1. Manju Latu Zingare, (2009), "Agronomic Information in Propagating Blue Ternate Pea Plant," Retrieved July 2, 2022
2. Kazuma, K., Noda, N. and Suzuki, M. (2003). "Malonylated flavonol glycosides from the petals of *Clitoria ternatea*. *Phytochemistry*," 62(2), 229-237. [https://doi.org/10.1016/S0031-9422\(02\)00486-7](https://doi.org/10.1016/S0031-9422(02)00486-7)
3. Department of Health – Bureau of food and Drugs DOH (2004), "Administrative Order No. 153 s. 2004: "Revised Guidelines on Current Good Manufacturing Practice, packing, repacking, or holding food". Retrieved from HTTP: [www.doh.gov.ph](http://www.doh.gov.ph).
4. Malik J., Karan M., Vasisht K., 'Nootropic, anxiolytic and CNS-depressant studies on different plant sources of shankpushpi *Pharm Biol.*, 2011
5. Gatchalian, M.M. 2019. "Sensory Evaluation: A Must in Food Innovation Food Pacific Manufacturing", *Journal*. Vol. XIX NO.9 ISSN 1608-7100 Ringier Trade Media Ltd. 20/F 235 Wing Lok Street Trade Centre, Hong Kong
6. Properties of flowers of *Clitoria Ternatea*: Retrieved via [www.ifrj.upm.edu](http://www.ifrj.upm.edu). July 20, 2022
7. Neda, G.D., Rabeta, M.S. and Ong, M.T. (2013). "Chemical composition and anti-proliferative properties of flowers of *Clitoria ternatea*". *International Food Research Journal*, 20(3), 1229- 1234.
8. Venkateswaran, R. (2015). "Medicinal Uses of Butterfly Pea": Retrieved from [www.wildturmeric.com](http://www.wildturmeric.com) August 2, 2022.
9. Johnson, Amy (2009), "The cooking Foodie.com". Retrieved via <http://shewearsmanyhats.com/>



10. Kurian, J. (2010). "Amazing Healing Plants." Saraburi, Thailand: Reprinted by Philippine Publishing House Manila,
11. Taur, D.J. and Patil, R.Y. (2011). "Evaluation of the antiasthmatic activity of *Clitoria ternatea* L. roots". *Journal of Ethnopharmacology*, 136(2), 374-376.  
<https://doi.org/10.1016/j.jep.2011.04.064>