



RESEARCH PAPER

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Sensory evaluation of blue Ternate (*Clitoria ternatea*) juice concentrate

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Abstract

Blue ternate flowers gain growing attention due to its various health benefits. These are commonly used to produce fresh juices or teas which have relatively low shelf-life. Using descriptive research design, this study aims to develop blue ternate juice concentrate and evaluate its sensory attributes in terms of taste, color/appearance, smell and texture based on a 9-point Hedonic scale. The study revealed that the blue ternate juice concentrate is an extremely acceptable product with a weighted mean of 8.64 for taste, 8.76 for color/appearance, 8.60 for smell, and 8.58 for texture, resulting in an overall weighted mean of 8.65. The researchers suggest that further analyses on its nutritional contents and shelf-life life might be conducted for quality assurance prior to commercialization.

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Introduction

The Philippines is a tropical country home to abundant flora and fauna. Among the plants considered bountiful in the country and in Asian tropical regions of India, Sri Lanka, Malaysia, Burma, and the Philippine islands is *Clitoria ternatea* widely known as blue ternate or butterfly pea (Senarathna, Mudalige, and Dias, 2021; Silalahi, 2020). Blue ternate is a pasture legume plant from the *fabaceae* family (Angeloni, Rey, and Mroginski, 1992) perennial in various types of soil. This species has shown strong adaptability to heavy clay soils which signifies its usefulness in restoring natural grasslands (Rojas-Sandoval, 2021). *Clitoria ternatea* has multiple purposes providing bioactive compounds for medicinal use aside from it being used as an ornamental plant (Gomez and Kalamani, 2003).

Anthocyanins also termed as “ternatins” are among the notable chemical components of blue ternate flowers as it provides a characteristic blue color and cyclotides (Oguis *et al.*, 2019). The abundance of anthocyanins makes blue ternate an ideal source of natural additives that can enhance the appearance and nutritive values of the products when commercialized (Pasukamonset *et al.*, 2016). Moreover, cyclotides supply proteins that are antimicrobial, insecticidal, anthelmintic, cytotoxic and antiviral (Camarero, 2011). The impressive nutritional profile of blue ternate gives wonderful benefits for human health such as promoting weight loss, detoxifying the body, pacifying the mind, enriching skin texture and improving hair growth (Netmed, 2021).

Up to date, there are varieties of products which utilize blue ternate. Some used this plant as an added ingredient for homemade herbal tea with moringa leaves and mangosteen (Carion, 2019) and ‘lambanog’ coconut vodka (Bonina and Herrera, 2022). Others used it as edible flowers for gastronomy-based industries in local and international cuisines (Gamata and Alejandro, 2021), while some used its extracts for beverages (Lakshan *et al.*, 2019). Moreover, studies have been conducted to utilize blue ternate extracts in the production of health teas, juice, and even in food supplements because of its high nutritional and

medicinal values. Among the various benefits that can be derived from blue ternate are its antioxidant, antidiuretic, and antimicrobial properties (Ranaweera and Chandana, 2021; Devi, Boominathan, and Mandal, 2003; Indrianingsih *et al.*, 2021). Research on the potential functional properties of blue ternate flowers found that beverages, such as teas and juices, incorporated with it have manifested health benefits (Lakshan, Jayanath, Abeysekera, and Abeysekera, 2019). Not much is mentioned about utilizing the flower of blue ternate as in Ayurvedic medicine, only the roots, seeds, and leaves are widely used for brain tonic promoting memory and intelligence (Mukherjee, Kumar, Kumar, and Heinrich, 2008).

Blue ternate is presently getting attention in the Philippines, but is still considered one of the more underutilized plants in the country although much has been known about its traditional, medicinal, and nutritional properties. Little is known about other activities of blue ternate flowers except that these are a source of flavonoids and anthocyanins (Kazumea, 2003). Only a handful of legumes are grown on large areas and enter commercial markets. In the Asia Pacific regions, many potential indigenous food legumes are under exploited and untapped leaving the expansion and commercialization of such crops underutilized (Durst and Bayasgalanbat, 2014).

In this study, blue ternate flowers are utilized to develop blue ternate juice concentrate in the Province of Misamis Occidental being a prime location of rich produce of blue ternate because of its abundant sunlight and humid conditions. With a variety of juice concentrate from several fruits using additives widely spread in the market, the researchers opted to use organic ingredients mainly, water, calamansi, ginger, and sugar, in the production to preserve the nutritional values of blue ternate. *Citrofortunella macrocarpa*, or the local calamansi, is another staple citrus fruit in the Philippines (Titong, 2020) widely popular as juice or condiment. *Zingiber officinale*, commonly known as ginger, is usually used as spice in foods (Maizura, Aminah, and Wan Aida, 2011). Both the calamansi and ginger have exhibited strong antioxidative properties making them highly recommendable to be used in the

composition of the blue ternate juice concentrate. In addition to the existing few products which utilize blue ternate, this study aims to develop a blue ternate juice concentrate as a food innovation which may be considered for commercialization as it might have a more acceptable taste with longer shelf-life compared to other existing blue ternate products such as teas and juices. Further, this study aims to evaluate the sensory attributes of the juice concentrate based on the profile of the respondents.

Sensory evaluation was used to assess the sensory attributes of the juice concentrate through the survey prepared for the respondents. The study employed the 9-point Hedonic scale because of the approximate information it yields relating to the acceptability level of different product attributes (Stone and Sidel, 1985); thus, establishing the overall acceptability of the juice concentrate from the respondents.

Materials and methods

Research Design

The study advocated for a sensory evaluation of the product as part of a descriptive research design following the guidelines of scientific research. It consists of a hypothesis, a researcher-controllable variable, and variables that may be measured, computed, and compared (Berger, Maurer, and Celli, 2017). Sensory evaluation is the science of measuring, analyzing, and interpreting people's reactions to items as seen through their senses. It is a way of assessing whether product differences are noticed, its causes, and whether one product is preferred over another (Stone, 2018).

Research Locale

The blue ternate juice concentrate was developed at Purok Laurel, Cagay-anon, Sinacaban, Misamis Occidental. This location was chosen due to accessibility of raw materials and tools needed for the study. The respondents were also taken from the same area to evaluate the sensory attributes of the product being developed.

Research Procedure

The figure below shows the process flow of the product developed. The ingredients included 0.50kg

of blue ternate flowers, 0.07kg of calamansi juice, 0.05kg of ginger, 0.25kg sugar, and 0.70kg of water. First, each ingredient, specifically the blue ternate flowers, gingers and calamansi, was washed thoroughly. The ginger was then peeled and sliced prior to boiling. Next, the ginger was boiled under low heat for 25 minutes, adding the blue ternate flowers into it for another five minutes. Both the ginger and blue ternate flowers were then taken out, adding sugar and calamansi juice into the ginger-blue ternate water mixture 5 minutes before serving.

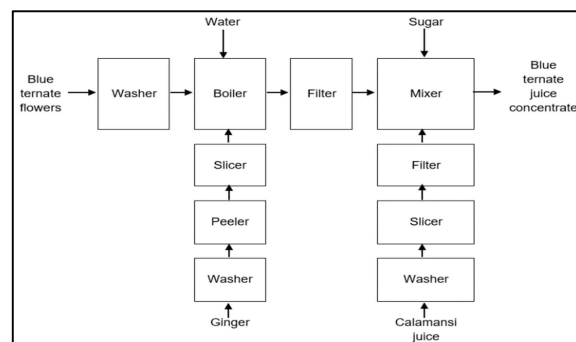


Fig. 1. Methods employed in the study.

Data Collection

Consent forms were distributed to 50 respondents who were selected through snowball sampling which allowed the respondents to assist researchers in identifying other potential subjects.

Data Analysis

The sensory attributes of the blue ternate juice concentrate were evaluated in terms of taste, color/appearance, smell and texture using hedonic scale which is composed of nine (9) categories ranging from “dislike extremely” to “like extremely” (Peryam and Pilgrim, 1957). The data collected were then analyzed using weighted mean and interpreted according to the description below:

Results and discussion

Profile of the Respondents

Table 1 presents the profile of the respondents who tasted the product, mainly the frequency with respect to age and sex. Here, the age interval of the respondents with the highest frequency of 54% is 20-40 years old, while respondents of 19 years old and

below and 41 years old and above have the frequency of 16% and 30%, respectively. Majority were female with 31 respondents followed by male with 19. The distribution clearly indicates that the respondents were the target audience for evaluating the sensory attributes of the blue ternate juice concentrate.

Table 1. Frequency of Respondents.

Variables	f	%
Age		
13-19 years old	8	16
20-40 years old	27	54
41 and above	15	30
Sex		
Male	19	38
Female	31	62

Sensory Evaluation

Table 2 shows the results of the collected data that consists of the sensory evaluation of the blue ternate juice concentrate in terms of taste, color/appearance,

smell, and texture. The researchers used weighted mean as the statistical method to analyze the gathered data.

In terms of taste, 32 out of 50 (64%) respondents extremely liked the blue ternate juice concentrate while 18 out of 50 (36%) liked it very much.

With respect to color/appearance, 38 out of 50 (76%) respondents said that they extremely like the product while 12 out of 50 (24%) said that they like it very much. In terms of smell, 31 out of 50 (62%) respondents extremely liked the product, 18 out of 50 (36%) liked it very much and only 1(2%) liked it moderately. Finally, in terms of texture, 29 out of 50 (58%) said that they extremely like it and 21 out of 50 (42%) said that they like it very much. On average, the majority of the respondents said that they extremely like the blue ternate juice concentrate and a few of the respondents said that they like it very much.

Table 2. Sensory Evaluation of the Blue Ternate Juice Concentrate.

Indicators	Like Extremely (9)	Like Very much (8)	Like Moderately (7)	Like Slightly (6)	Neither like nor Dislike (5)	Dislike Slightly (4)	Dislike Moderately (3)	Dislike very much (2)	Dislike Extremely (1)	Weighted Mean
Taste	32	18	0	0	0	0	0	0	0	8.64
Color/ Appearance	38	12	0	0	0	0	0	0	0	8.76
Smell	31	18	1	0	0	0	0	0	0	8.60
Texture	29	21	0	0	0	0	0	0	0	8.58

Since the sensory evaluation of the blue ternate juice concentrate in terms of taste is 8.64 which is within the range of 8.12-9.0, this implies that it has an extremely acceptable taste. An extremely acceptable color/appearance has also been observed on the product as it obtained a weighted mean of 8.76. Moreover, both the smell and texture of the product are also extremely acceptable as it obtained a weighted mean of 8.60 and 8.58, respectively, which are still within the range of 8.12-9.0. As the overall weighted mean is 8.65, this indicates that the blue ternate juice concentrate is extremely acceptable with respect to the sensory evaluation conducted in terms of taste, color/appearance, smell, and texture.

As stated by Everitt (2009), on a nine-point scale, a mean liking score of 7 or greater is usually indicative of highly acceptable sensory quality; thus, a product

reaching this score might be securely utilized as a good representation of target quality. On this foundation, products from a study collection can be chosen to serve as physical references for illustrating sensory quality as realistically representative of the customers' tolerance limitations. As we have seen on Table 2, the sensory evaluation of the blue ternate juice concentrate in terms of taste, color/appearance, smell, and texture has passed the liking score of 7 which indicates a highly acceptable sensory quality (Everitt, 2009).

Conclusion

A blue ternate juice concentrate was developed. Its acceptability in terms of taste, color/appearance, smell and texture was determined using a sensory evaluation based on the 9-point hedonic scale. Overall, the blue ternate juice concentrate is an extremely acceptable product as it obtained a

weighted mean of 8.65 composing of 8.64 for taste, 8.76 for color/appearance, and 8.60 and 8.58 for smell and texture, respectively. Although the formulation obtained is extremely acceptable, an organic sweetener might be used to replace the white sugar for a healthier product. Moreover, analyses for the nutritional content and shelf-life might be conducted to ensure quality of the product prior to commercialization.

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