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FORMULATION DRINK HEALTH MATERIAL BASE OF BUTTERFLY PEA FLOWER (*Clitoria ternatea* L.) AND BUSINESS DESIGN INNOVATION

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Abstract: The COVID-19 pandemic has increased the use of herbal supplements, creating opportunities for developing butterfly pea flower (Clitoria ternatea L.) as a health beverage. This study aimed to formulate a stable, preferred product and design its business scheme. Four formulations were tested with 2 grams of butterfly pea flower, varying mint leaves (0.8 g or 0.5 g), and lemon (0.35 g or 0.5 g). A hedonic test with 20 semi-trained panelists determined the most preferred formula. The selected formula underwent moisture content analysis using the thermogravimetric method at 105°C. Shelf life was evaluated with the ASLT Arrhenius model at 25°C, 35°C, and 45°C over 20 days, assessing moisture content, organoleptic properties, and pH. Microbial contamination, including Total Plate Count (ALT) and Yeast and Mold Count (AKK), as well as heavy metal levels (As, Hg, Cd, Pb) using AAS, were also examined. Results showed the most preferred formulation was formula 2, with 8.13% moisture content and a shelf life of 6.9 months at 25°C in sealed packaging. The aroma was the most affected parameter during storage. Microbial analysis recorded ALT at 3×10^3 CFU/g and AKK at 5×10^2 CFU/g. Heavy metal content met BPOM and SNI standards. Thus, Formula 2 was identified as the best formulation for commercial development.

Keywords: Health Beverage, Butterfly Pea Flower, Business

Abstrak: Pandemi COVID-19 telah meningkatkan penggunaan suplemen herbal, menciptakan peluang untuk mengembangkan bunga kacang kupu-kupu (Clitoria ternatea L.) sebagai minuman kesehatan. Penelitian ini bertujuan untuk merumuskan produk pilihan yang stabil dan merancang skema bisnisnya. Empat formulasi diuji dengan 2 gram bunga kacang kupu-kupu, berbagai daun mint (0,8 g atau 0,5 g), dan lemon (0,35 g atau 0,5 g). Tes hedonik dengan 20 panelis semi-terlatih menentukan formula yang paling disukai. Rumus yang dipilih menjalani analisis kadar air menggunakan metode termogravimetri pada suhu 105°C. Umur simpan dievaluasi dengan model ASLT Arrhenius pada 25°C, 35°C, dan 45°C selama 20 hari, menilai kadar air, sifat organoleptik, dan pH. Kontaminasi mikroba, termasuk Total Plate Count (ALT) dan Yeast and Mold Count (AKK), serta kadar logam berat (As, Hg, Cd, Pb) menggunakan AAS, juga diperiksa. Hasil menunjukkan formulasi yang paling disukai adalah formula 2, dengan kadar air 8,13% dan umur simpan 6,9 bulan pada suhu 25°C dalam kemasan tertutup. Aroma adalah parameter yang paling terpengaruh selama penyimpanan. Analisis mikroba mencatat ALT pada 3×10^3 CFU/g dan AKK pada 5×10^2 CFU/g. Kandungan logam berat memenuhi standar BPOM dan SNI. Dengan demikian, Formula 2 diidentifikasi sebagai formulasi terbaik untuk pengembangan komersial.

Kata kunci: Minuman Kesehatan, Bunga Kacang Kupu-Kupu, Bisnis

INTRODUCTION

In recent years, there has been a global shift in consumer preferences toward natural and plant-based ingredients in health and food products. This trend is supported by increasing awareness of sustainable living, where natural products are perceived as safer, more affordable, and with fewer side effects (Kaur et al., 2024). Consequently, the market for functional beverages that offer health benefits beyond basic nutrition is expanding rapidly.

Functional beverages are often formulated with ingredients believed to support immune function, improve digestion, or provide antioxidant protection (Putra, 2020). Butterfly pea flower (*Clitoria ternatea*), a plant native to Southeast Asia, has attracted interest due to its vibrant anthocyanin content (mainly ternatins), antioxidant capacity, and traditional medicinal use (Kong et al., 2023).

Butterfly pea flower tea, typically made from dried petals, is rich in flavonoids, phenolic compounds, and anthocyanins, which exhibit anti-inflammatory, antidiabetic, antimicrobial, and neuroprotective properties (Mukherjee et al., 2008). The vibrant blue color of the petals also serves as a natural food colorant, and the beverage changes to purple when acid, such as lemon, is added, enhancing consumer appeal.

The increasing popularity of this flower-based drink, especially during the COVID-19 pandemic, reflects consumer behavior favoring immune-boosting herbal products (Cording, 2024). Post-pandemic, functional drinks are predicted to remain in demand, particularly those that combine traditional knowledge with scientific validation (Natarajan et al., 2022). In product development, organoleptic tests using hedonic scales (1–5) are conducted to assess sensory acceptance (taste, aroma, color). The formulation with the highest score is selected for production. Mint leaves and lemon are commonly added to enhance flavor and health value, where mint supports digestion and lemon contributes vitamin C (Wardana et al., 2024).

Packaging design involves using moisture-resistant foil sachets stored in cardboard boxes. Shelf-life is estimated through Accelerated Shelf-Life Testing (ASLT) using the Arrhenius model, which monitors physicochemical changes (color, pH, moisture) at elevated temperatures (25°C–45°C) to predict product stability (Aghdam et al., 2021). Marketing strategies focus on digital platforms such as Instagram, Shopee, and Tokopedia to reach health-conscious youth. Branding emphasizes the product's natural origin, aesthetic appeal, and health benefits (Hagen, 2021). Initial targets are set at 20 boxes per quarter, with potential for expansion through collaboration with herbal cafes and health shops. Sustainability is embedded in the business model using eco-friendly packaging and minimal-carbon processes, aligning with current consumer demand for ethical products (Research & Markets, 2024).

METHOD

Materials

This uses various materials, including the flower *Clitoria ternatea* L., mint leaves (*Mentha piperita)*, and lemon (*Citrus limon*). Additional substances cover distilled water, table salt (NaCl), granulated sugar (glucose), peppermint, and orange essential oils. In addition, research also uses material chemistry like sour citrate, quinine sulfate, MSG, caffeine anhydrous, and various solution standard metal heavy like cadmium (Cd), lead (Pb), arsenic (As), and mercury (Hg). The growth media bacteria used are PDA (Potato Dextrose Agar) and NA (Nutrient Agar).

Tools

The tools used in the study include a blender, oven, 40 mesh sieve, and various receptacle storage, such as pocket tea made from cellulose and plastic packaging. Laboratory equipment covers glass measuring, beaker glass, Erlenmeyer, spatula, micropipette, autoclave, spectrophotometer atomic absorption, and incubator for analysis microbiology, used tube reactions, petri dishes, colony counters, and climatic chambers.

Procedures

The study started with determining the plant species for the flower telang, mint, and lemon at the Faculty of Mathematics and Natural Sciences, University of Indonesia. The selection test panelists were done against 26 candidates' panelists 20-28 years old; the latter 20 people were selected as semi-trained panelists. Evaluation includes hedonic tests and age tests, saved through questionnaires, interviews, and taste and aroma testing.

Material Preparation and Processing

Clitoria ternatea L. flowers, mint leaves (*Mentha piperita)*, and lemon (*Citrus limon*) are dried at 40°C for 24 hours (butterfly pea flowers & mint leaves) and 20 hours (lemon). Telang flowers and mint leaves are ground using a blender until fine (40 mesh, 0.425µm). After the seeds are removed, the lemon is cut into small pieces. A mixture of butterfly pea flower powder, mint leaves, and lemon pieces is combined in a large container according to the predetermined formula.

Telang Flower Health Drink Formula

Four formulas have different compositions regarding the quantity of mint leaves and lemon.

Ingredients	Formula (g)			
	1	2	3	4
Telang flower	2	2	2	2
Mint leaves	0.8	0.5	0.5	0.8
Lemon	0.35	0.35	0.5	0.5
Total	**3.15**	**2.85**	**3**	**3.3**

Lemon is added to provide a fresh sour taste and lower pH, which changes the butterfly pea flower color to purple. Mint leaves enhance flavor and aroma.

Product Packaging

The ingredient mixture is packaged in tea bags made of cellulose/PP with a pore size of 53.5242 µm. The tea bags are sealed using a sealing machine with a heat level 3. They are then repackaged in silver-colored plastic sachets and sealed.

Hedonic Test (Consumer Preference)

A test was conducted on 20 semi-trained panelists using a scale of 1-5 (strongly dislike to strongly like). Each formula was evaluated based on color, aroma, taste, aftertaste, and overall preference. The results were analyzed using the Kruskal-Wallis method to determine significant differences between formulas.

Shelf-Life Determination

Shelf life was estimated using the Accelerated Shelf-Life Test (ASLT) based on the Arrhenius model. Samples were stored at 25°C, 35°C, and 45°C for 20 days, with measurements every 5 days on moisture content, pH, and sensory attributes (color, aroma, taste). Degradation kinetics were analyzed to determine the reaction order (zero or first-order), and rate constants (k) were calculated. The Arrhenius equation was used to model temperature dependence and predict shelf life at ambient temperature. Data analysis was conducted using Microsoft Excel.

pH Testing and Organoleptic Evaluation

pH was tested using universal pH indicator paper. Organoleptic testing was conducted with 10 panelists to assess the product's color, aroma, and taste at different storage temperatures.

Moisture Content Testing (Thermogravimetry)

The sample was dried in an oven at 105°C and weighed before and after drying. Moisture content was calculated based on the weight difference before and after drying. According to BPOM 2014, the moisture content standard is ≤10% for simplicia, which needs to be brewed before use.

Microbial Contamination Testing (ALT & AKK)

Microbial contamination testing uses the Total Plate Count (ALT) and Yeast and Mold Count (AKK) methods. Samples are inoculated on Nutrient Agar (NA) for ALT and Potato Dextrose Agar (PDA) for AKK, then incubated at a specific temperature. After incubation, the growing colonies are counted to determine the level of microbial contamination.

Heavy Metal Testing (Pb, Cd, Hg, As) with AAS

Heavy metal testing using Atomic Absorption Spectroscopy (AAS) begins with sample preparation through carbonization and acid addition. The sample is then filtered and analyzed using AAS to measure the levels of Pb, Cd, Hg, and As based on a calibration curve, determining the concentration of heavy metals in the sample.

RESULT AND DISCUSSION

The determination of plants in this study was conducted in the Laboratory of the Faculty of Mathematics and Natural Sciences, Department of Biology, University of Indonesia, Depok. The determination results show that the plants used in this study are *Clitoria ternatea* L. from the Fabaceae family, *Mentha x piperita* L. from the Lamiaceae family, and *Citrus x limon* (L.) Osbeck from the Rutaceae family. These results confirm that the plants used align with the research needs.

Meanwhile, the panelist selection test was conducted over two weeks to obtain semi-trained panelists with the desired abilities and sensitivities for the hedonic test. A total of 26 panelist candidates, aged 20 to 28 years, were recruited from the JABODETABEK area, with the majority being women. The selection of more female panelists was based on women's tendency to have more sensitive taste and smell senses compared to men, although certain physiological conditions such as menstruation and pregnancy can influence the consistency of their evaluations. The panelist selection process involved several stages, including filling out questionnaires, interviews, basic taste tests, basic aroma tests, and ranking tests. The questionnaires and interviews aimed to assess the candidates' habits, preferences or dislikes, biodata, and interests. The questionnaire was distributed online through communication platforms such as WhatsApp and Line. As a result of the recruitment process, 26 individuals agreed to participate in the selection stage.

In addition to gender, the age range was essential in the panelist selection. Candidates were chosen from the 20–28 age group because this group has high mobility, which increases the risk of disease transmission, such as COVID-19. Additionally, human sensory sensitivity to taste and aroma declines with age. Based on the data collected, most panelists were 21 years old (10 people), followed by those aged 26 (5 people), with the rest distributed within the 20–28 age range. The domicile of the panelists was another essential factor, as it influenced accessibility during the selection and hedonic tests. Most panelists were from Depok (17 people), followed by Bogor (2 people), South Jakarta (2 people), East Jakarta (3 people), and others from Bekasi and North Jakarta. The panelists' last education level was also recorded, consisting of 17 high school graduates, eight undergraduate graduates, and one diploma (D3) graduate.

Regarding occupation, most panelists were students (17 people), while the rest included private-sector employees (7 people) and entrepreneurs (2 people). Physiological factors that could affect the panelists' sensory sensitivity were also considered, including smoking habits, medical history, and the consumption of certain medications. The results showed that 23 panelists were non-smokers, while 3 were active smokers. From a health perspective, 24 panelists had no history of diseases that could affect taste and smell, while 2 had conditions such as asthma and chronic flu.

Certain medications' consumption was also considered as it could influence organoleptic test results. Interviews revealed that one panelist consumed paracetamol, which can cause side effects such as sore throat and canker sores. Another panelist took vitamin B12, which can lead to nausea, vomiting, and headaches, while another used a medication containing budesonide and formoterol fumarate, which may affect taste and smell sensitivity. Considering these various factors, the panelist selection was conducted carefully to ensure valid and reliable data in this study.

The basic taste test evaluated the panelists' ability to distinguish the five primary taste categories: sweet, salty, sour, bitter, and umami. This test aimed to ensure that the panelists' taste senses functioned adequately. Based on the basic taste test results, panelists were given sample solutions with specific concentrations: 16 g/L sucrose for sweet taste, 3 g/L table salt for salty taste, 1 g/L citric acid for sour taste, 0.2 g/L quinine sulfate for bitter taste, and 0.06 g/100 mL monosodium glutamate (MSG) for umami taste. Mineral water was used as a mouth rinse between each taste test. Each sample was poured into a 30 mL plastic cup and labeled with a three-digit code, such as 674 for sucrose (sweet), 745 for table salt (salty), 546 for citric acid (sour), 359 for quinine sulfate (bitter), and 674 for MSG (umami). Panelists were asked to identify the taste of each sample and provide a description. Scores were assigned based on accuracy: 2 points for correct identification with an appropriate description, 1 for correct identification with an insufficient or swapped description, and 0 for incorrect identification and description.

The test results showed that all panelists recognized and distinguished the sweet taste from the mouth rinse. A similar result was observed for the salty taste test, where all panelists correctly identified the taste. The panelists could also recognize and differentiate the sour sample from the mouth rinse in the sour taste test. The bitter taste test yielded similar results, with all panelists providing correct answers and descriptions.

However, in the umami taste test, 16 panelists successfully identified and accurately described the taste, while five panelists recognized the taste but failed to differentiate it from the mouth rinse. Another five panelists could not correctly identify the umami taste and perceived the sample as having no additional flavor. Based on the final score calculations, five panelists obtained a score of 80%, meaning they correctly identified four out of five samples. Another five panelists scored 90%, as they recognized all samples but made an error in describing one taste. The remaining 16 panelists achieved a score of 100%, successfully identifying and describing all samples correctly. This test was considered valid if a panelist obtained a minimum score of 80%, indicating the ability to recognize at least four out of five tastes with accurate descriptions.

Table 1. Degrees of Fineness of Raw Materials

Material	Number Sieve	Powder Passed (%)
Butterfly Pea Flower Powder	40	100
Mint Leaf Powder	40	100

The skin part is not thrown away because it gives a strong citrus aroma compared to the fruit.

Making Butterfly Pea Flower Health Drink

Powdered flower butterfly peas, mint leaves, and pieces of small lemon are mixed in a large receptacle with a particular comparison by the formula in Table 2.

Table 2. Butterfly Pea Flower Health Drink Formula (grams)

Material	Formula 1	Formula 2	Formula 3
Butterfly Pea Flower	2.0	2.0	2.0
Mint Leaves	0.8	0.5	0.5
Lemon	0.35	0.35	0.5
Total	3.15	2.85	3.0

Powder flower butterfly pea, mint leaves, and pieces of small lemon, then stir until mixed up evenly. Mixture: This pocket tea, with each weight, is appropriate for the table above. Packaging process: (1) Tea bags were filled in the formula and closed using a tool sealer with overheated level 3; (2) Tea bags that have been sealed and packed in plastic sachets are silver-colored; (3) The Plastic sachet was then sealed return-use tool *sealer.*

Hedonic Test for Determining the Selected Formula

Acceptance tests for some drink formulas, such as health flower telang, were done using an organoleptic (hedonic) test method involving 20 semi-trained panelists. Tested parameters: (1) Color; (2) Aroma; (3) Flavor; (4) *Aftertaste*; (5) Evaluation overall. A panelist considered accepting the sample If given a score of 3, 4, or 5.

Table 3. Mode Value and Percentage Panelists

Characteristics	Formula 1	Formula 2	Formula 3	Formula 4
Color	4 (60%)	4 (60%)	4 (50%)	4 (50%)
Flavor	2 (55%)	4 (50%)	3 (60%)	4 (45%)
Aroma	2 (50%)	4 (45%)	4 (35%)	2 (40%)
Aftertaste	1 (55%)	3 (45%)	2 (45%)	4 (45%)
Overall	4 (45%)	4 (60%)	4 (50%)	4 (50%)

Hedonic test results show that: (1) Color: All formulas have mode value 4 (like); (2) Taste: Formula 2 and 4 have mode value 4 (like), while Formula 1 gets value 2 (no like); (3) Aroma: Formulas 2 and 3 get the mode value of 4 (like), while Formulas 1 and 4 are only 2 (do not like); (4) Aftertaste: Formula 4 has the highest mode value (4 = like); (5) Overall: All formulas have mode value 4 (like), with Formula 2 having the highest percentage.

Table 4. Percentage Formula Acceptance

Characteristics	Formula 1 (%)	Formula 2 (%)	Formula 3 (%)	Formula 4 (%)
Color	69	69	64	62
Flavor	52	65	62	62
Aroma	54	64	59	59
Aftertaste	38	57	52	58
Overall	57	69	64	62

Shelf Life Determination

Table 5. Changes in water content during storage at different temperatures

Code	Water Content (%)				
	0	5	10	15	20
K-25	8.13	8.58	8.87	10.06	9.74
K-35	8.13	9.73	8.72	10.42	10.96
K-45	8.13	9.08	16.85	12.2	18.67
TK-25	8.13	8.9	9.18	11.53	12.26
TK-35	8.13	9.74	8.03	11.63	13.9
TK-45	8.13	11.47	18.53	17.44	19.11

The health department uses shelf-life prediction for product administration purposes. The product's shelf-life prediction is determined using the ASLT method with the Arrhenius model, with an increase in moisture content as a parameter.

Based on the observed moisture content values over a 20-day storage period at three different conditions (25°C, 35°C, 45°C), moisture content increased and decreased. The increase in moisture content is suspected to be due to the product absorbing humidity from the surrounding air. Meanwhile, the reduction in moisture content, which occurred on the tenth day of packaged and unpackaged samples at 35°C, is suspected to be due to moisture evaporation from the product. This evaporation is caused by temperature and storage duration, which accelerate the evaporation process during storage.

Based on the calculations, the optimal storage for butterfly pea flower health drinks is in plastic sachet packaging, stored at 25°C in dry conditions.

Table 6. Table of Shelf Life Calculation Results

Code	Critical Moisture Point Value	Initial Moisture Content Value	Increase in Moisture Content Rate	Shelf Life (Days)	Shelf Life (Months)
K-25	10	8.13	0.009029045	207.1093999	6.903646664
K-35	10	8.13	0.017823566	104.9172765	3.497242551
K-45	10	8.13	0.033711009	55.47149296	1.849049765
TK-25	10	8.13	0.199248729	9.385254366	0.312841812

TK-35	10	8.13	0.323008086	5.789328754	0.192977625
TK-45	10	8.13	0.507966579	3.681344554	0.122711485

The parameter with the highest correlation coefficient (R^2) for packaged products is aroma. Meanwhile, moisture content is the parameter with the highest correlation for unpackaged products. This means that the R^2 value for packaged products is 0.9988, indicating that 99.88% of aroma changes are influenced by storage duration. In contrast, 89.58% of the moisture content changes for unpackaged products are influenced by storage duration.

The parameters that have been tested and previously described sufficiently represent product feasibility for shelf-life prediction. However, microbial contamination testing should also be included as a shelf-life parameter, as microbial contamination is a crucial factor affecting product safety for consumption. Micro contamination testing was not included in the shelf-life testing parameters due to the long incubation time required for bacteria (24–48 hours) and mold (3–5 days). This is impractical compared to the shelf-life testing schedule, which requires testing every five days. Additionally, the preparation of necessary equipment, such as laboratory glassware, is extensive, and there is a lack of testing personnel, as all shelf-life parameter testing was conducted solely by the author. Due to these considerations, microbial contamination testing was not included as one of the shelf-life testing parameters.

Total Plate Count (TPC) and Yeast and mold Count (YMC) Testing

The Total Plate Count (TPC) test aims to determine the growth of aerobic mesophilic bacteria, while the Yeast and Mold Count (YMC) test identifies the presence of fungi. Microbes in the drink formula may originate from the sample processing stage, including its conversion into powder and packaging. Additionally, air exposure and storage conditions significantly influence the microbial count in the butterfly pea flower health drink. Based on microbial contamination tests conducted on sample dilutions from 10^{-1} to 10^{-6}, the number of colonies decreased as the dilution level increased. This is due to the decreasing concentration of the sample. The detailed results of TPC for each formula are:

Formula 1: 3.8×10^2 CFU/g

Formula 2: 4.47×10^2 CFU/g

Formula 3: 3.15×10^2 CFU/g

Formula 4: 3.70 × 10^2 CFU/g

Meanwhile, the YMC results are:

Formula 1: 1.52 × 10^2 CFU/g

Formula 2: 9.13 × 10^1 CFU/g

Formula 3: 1.3 × 10^2 CFU/g

Formula 4: 1.76 × 10^2 CFU/g

From these microbial contamination test results, it can be concluded that all butterfly pea flower health drink formulas meet quality standards according to the regulations issued by the Indonesian Food and Drug Authority (BPOM) for tea bags and BPOM Regulation No. 12 of 2014 for powdered beverages that must be dissolved in hot water before consumption. This is because the TPC and YMC values of the four tested formulas remain below the permissible limits. The low microbial growth may be due to antimicrobial compounds in the health drink formula, which originate from one of its main ingredients, the butterfly pea flower. Ideally, microbial contamination testing should also be included as a parameter for shelf-life testing, as microbial contamination is a crucial factor affecting product safety for consumption. However, it was not included due to the long incubation time required for bacteria (24-48 hours) and mold (3-5 days). This was impractical compared to the shelf-life testing schedule, which required testing every five days. Additionally, the preparation of necessary equipment, such as laboratory glassware, was extensive, and there was a lack of testing personnel, as all shelf-life parameter testing was conducted solely by the author. Due to these considerations, microbial contamination testing was not included as one of the parameters in the product's shelf-life study.

Heavy Metal Contamination Testing

Heavy metal testing aims to determine the levels of heavy metal contamination in the butterfly pea flower health drink formula and compare them with the standards set by BPOM (Indonesian Food and Drug Authority) and SNI (Indonesian National Standard). The heavy metals tested include lead (Pb), arsenic (As), cadmium (Cd), and mercury (Hg). According to the examination results compared with BPOM's permissible limits, the maximum allowable Pb level in powder products, as per BPOM 2014, is ≤10 mg/kg. Based on the Pb metal test results, all formulas meet the requirements, as the Pb content remains below the permissible threshold. For Cd, BPOM 2014 sets the maximum permissible level at ≤0.3 mg/kg. According to the Cd test results, all formulas comply with the standards. However, Cd levels in formulas 1, 3, and 4 nearly exceed the BPOM limit. The allowable limit for powder products, according to BPOM (2014), is ≤5 mg/kg. Based on the test results, formula 2, which was selected as the representative formula for formulas 1, 3, and 4, meets the requirements as its level remains below the prescribed threshold. For Hg, BPOM 2014 sets the maximum permissible level at ≤0.5 mg/kg. According to the Hg test results, formula 2, which represents the other formulas (1, 3, and 4), meets the requirements, as its Hg level remains below the permissible limit. Heavy metals in herbal ingredients or plants may result from environmental contamination, such as air pollution, soil contamination, and water used in the plant's growing environment.

Business Design Innovation

Butterfly Pea Flower Health Drink is a beverage industry business that uses butterfly pea flowers as its main ingredient, combined with mint leaves and lemon slices, to enhance flavor and health benefits. With a vision to become the community's favorite high-quality and trusted beverage brand, this business is committed to providing affordable herbal products for all segments of society. Located in South Jakarta and established in 2021, the business markets its products through e-commerce, Instagram, and WhatsApp. Its marketing strategy includes educating consumers about herbal benefits, attractive packaging, and selling hampers for various occasions. The product is packaged in tea bags with silver sachet plastic for convenience and hygiene. Priced at IDR 30,800 per 10 tea bags, this beverage offers added value through its beneficial herbal ingredients.

A SWOT analysis highlights strengths such as easily accessible raw materials, affordable prices, and increasing public awareness of herbal consumption, while challenges include market competition and product durability without preservatives. The production process uses ingredients sourced from Sleman and Bogor, with initial investments covering raw materials, production tools, and marketing expenses. In developing this business, modern businesses (including online businesses) can be designed with a vast capacity and business scale, with coverage in every city or even every country (Kusuma et al., 2020). In addition, in the future, it can also be developed as a startup, namely a group or organization as a company that is still a pioneer in producing products in the technology sector (Maghfirah & Suranto, 2023).

This study has several limitations. First, the panelists were predominantly women aged 20–28 from the JABODETABEK area, which may not represent the broader population's preferences in sensory evaluation. Second, physiological factors such as menstruation, medication use, and individual health history could have influenced taste and aroma sensitivity. Third, the shelf-life test was limited to a 20-day period under only three temperature conditions, so long-term shelf-life predictions require further validation under more diverse storage conditions.

CONCLUSION

Based on the research conducted to formulate a health drink using butterfly pea flowers as the main ingredient, the following conclusions can be drawn:

The formulation utilized butterfly pea flowers, mint leaves, and dried lemon slices. The processing steps included drying, refining the ingredients, mixing them in specific ratios, and packaging the final product in tea bags to ensure practical and convenient consumption.

Organoleptic evaluation through a hedonic test involving 20 panelists revealed that sensory attributes such as color, aroma, taste, and aftertaste significantly influenced the acceptability of the drink. Among the three tested formulas, Formula 2 (F2) received the most favorable responses.

F2 achieved the highest mode values and acceptance percentages across multiple parameters—particularly taste (65%) and aroma (64%). Furthermore, the overall acceptance for F2 reached 69%, indicating that it was the most preferred formulation and could be considered the best option for a butterfly pea flower-based health drink.

Significance of Findings:

The results indicate that a combination of butterfly pea flowers, mint, and dried lemon can produce a health beverage that is both appealing and well-received by consumers. This finding is significant in promoting natural, plant-based drink alternatives with potential antioxidant and wellness benefits. It also supports the development of functional beverages from locally available ingredients, which can contribute to food diversification and sustainable product innovation.

Future Recommendations:

Further research is recommended to analyze the nutritional content and health benefits of the final formulation, particularly its antioxidant capacity and potential physiological effects. Expanding the panel size and demographic diversity in sensory evaluations would enhance the generalizability of the findings. In addition, shelf-life studies and consumer market testing should be conducted to assess the product's commercial viability. Exploring other natural additives or sweeteners may also improve the taste and broaden consumer appeal.

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