Comparison of *Eleutherine bulbosa* Derivated Products as an Immunostimulant Supplement for Preventing COVID-19 Transmission

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Abstract. The COVID-19 pandemic that occurred in most areas of the world caused many negative effects, including health, social and economic declined. One alternative to prevented it is to make immunostimulant supplements from natural resources that are available in surrounding environment along with encouraging development of home industries to produce them. In Kalimantan, Indonesia, one of the natural sources that have been utilized and proven locally as a medicinal plant is Bawang Dayak (*Eleutherine bulbosa*). One of its functions is as an immunostimulant supplement, but until now there has not been much research on the manufacture of *E. bulbosa* as a home industry product that functions as an immunostimulant supplement. *E.bulbosa* was demonstrated high antioxidant activity 1.48 µg/ml IC50 value and significantly increased immunity. The *E.bulbosa* was also contained iso-eleutherine and iso-eleutherol which have the potential as an anti-virus. In this study, several *E. bulbosa* derivated products, namely teabags and infusions, were introduced and compared starting from technical process, economic analysis, and storage period. Recent study showed that 1 kg of *E. bulbosa* can produce about 20 boxes of teabags (10 tea bags/box) that can be stored for 6-12 months, with a total profit reached 2-3 times of total production cost. While, 1 kg *E. bulbosa* was produced 16 bottles containing 330ml infusion drink which can be stored for 3-5 days in refrigerator, and it was provided 2 times profit of total production cost. However, these two products can be used as an alternative to stay healthy along with increase in added value and income for communities.

1. Introduction

The corona virus that led to Covid-19 pandemic is similar to the pathogen SARS-CoV (viral respiratory disease of zoonotic origin) that caused epidemic in 2003. This SARS-CoV-2 virus has affected many people, not only in China but spreading to almost all countries and territories in a short time, until now [1]. Diseases caused by pathogenic microbes such as viruses can enter and attack the body, so improving the body's immune system is very important. The immune system is the body's defense mechanism in protecting against viral, bacterial, parasitic infections and eliminating other external substances [1; 2]. Covid-19 is the same as other viruses that it will be attacked when the body's immunity is weak. Covid-19 disease can be cured by itself (self-limiting disease) which can be cured with body’s immunity, a strong immune system is the way to fight this virus. The immune system protects against viruses and diseases and produces antibodies to kill pathogens itself [3]. It has a focal role in the improvement of the immune system require a sufficient supply of immune system, including by consuming ingredients that have a role as an immunostimulant. Immunomodulation or immunostimulant are materials that can stimulate the body's natural defense against pathogens [4].
Meanwhile, the COVID-19 pandemic has evolved not only a health crisis but also worst economic and labor market downturn since at least the Second World War. Various attempts have been made by the government to increase economic growth so that Indonesia can avoid an economic recession. The government encourages the development of micro and small, micro, and medium businesses as the people’s economic motor that can boost economic growth and national economic recovery. One of the people’s economic booster alternatives can be offered is development home industry to produce immunostimulant supplement for preventing COVID-19 transmission. This is not only an alternative to occurred the health, social and economic crisis, but also to encourage the utilization of abundant natural resources as an immunostimulant material both in the short and long term.

In the recent studies, the treatment of such disease can be possible by phytochemicals which are found in specific plants species as a medicinal plant which is considering of local wisdom, including Bawang Dayak (E. bulbosa). The medicinal plants/herbs are traditionally used in many therapeutic practices, if not as the main, then as the accompanying therapy in combination with medications, aimed at boosting immunity for prevention [1]. The discovery of immunostimulant agents from medicinal plants devoid of toxic side effects, with enhanced bioavailability and that can be used for a long duration, is of great importance [5]. Besides being used for hereditary to treat various diseases, E. bulbosa are also believed to increase the body's immunity with a very simple usage. Other information related to the manufacture of innovative products, until now has not widely known. This study aimed to introduce several E. bulbosa derivative products, namely teabags and infusions, and its compared with starting from manufacturing process to economic analysis.

![Bawang Dayak (E. bulbosa) origin from traditional market in Samarinda, East Kalimantan, Indonesia.](image)

**Figure 1.** Bawang Dayak (E. bulbosa) origin from traditional market in Samarinda, East Kalimantan, Indonesia.

2. **Material and Methods**

This research was conducted in collaboration with Al-Fajr Islamic Boarding School, Samarinda, East Kalimantan, Indonesia. Some of E. bulbosa (Iridaceae) derivative products will be introduced as herbal drinks including tea and infusion fluid/brewed water. The main raw material was used two kilogram of E. bulbosa that it bought from traditional market, and divided into one kilogram for teabag and one kilogram for brewed water production. Various equipment was used in this research mostly home equipment as usual. During preparation process and production, E. bulbosa was weighted, chopped, and air/oven dried, and then prepared for teabag and infusion fluid products.
In this study, *E. bulbosa* bulbs were collected from traditional market in Samarinda, East Kalimantan, Indonesia. Thus, one kilogram of *E. bulbosa* bulbs was chopped, and oven dried in 60°C for ± 72 hours. After wilting and softening, samples have reduced the size using knife and smoothed with a blender to obtained *E. bulbosa* bulbs powder. After that, the *E. bulbosa* bulbs powder was filtered to get a uniform size. In the next step, the filtered material is weighed and packed into a tea bag (± 2 g/teabag). Furthermore, *E. bulbosa* bulbs in a tea bag brewed with hot water as a usual tea, thus the “tea water” (± 200 cc/teabag) ready to be consumed as a healthy beverage (herbal tea) product that it will be introduced in this study.

![Figure 2. E. bulbosa was chopped and oven-dried condition.](image)

**Figure 2.** *E. bulbosa* was chopped and oven-dried condition.

Meanwhile, one kilogram of *E. bulbosa* was cleaned, chopped, air/oven dried, and then boiled (5 L water) it in a large stainless-steel pot until it boils (900°C for 15 minute). After it cooled, then filtered and put it on a plastic bottle and it was ready to be consumed and marketed. Data analysis was performed descriptively.

![Figure 3. Production Process of Bawang Dayak (E. bulbosa) Tea.](image)

**Figure 3.** Production Process of Bawang Dayak (*E. bulbosa*) Tea.
3. Results and Discussions
Herbal remedies can be consumed during covid 19 should increase body immunity contain antioxidant and polyphenol-rich food [6]. One of the medicinal plants with high antioxidants that are easily found in the Kalimantan market and easy to consume is *E. bulbosa* [7]. *E. bulbosa* has some biological activities as immunostimulant, anti-inflammation, antioxidant and others activities [8]. *E. bulbosa* demonstrated high antioxidant activity 1.48 µg/ml IC50 value and increase immunity significantly [9]. *E. bulbosa* contains *iso-eleutherine* and *iso-eleutherol* which have the potential as anti-virus and naphthalene, naphtoquinone, anthraquinone, stigmasterol, stigmasterol-3-O-β-D-glucopyranoside, and kadsuric acid [10]. The chemical content of *E. bulbosa* can be dissolved in water, therefore household-scale industrial products in the form of herbal teas and infusion drinks are the right choice to be developed.

3.1. Comparison of Technical Process of *E. bulbosa* Derivated Products
The products diversification of *E. bulbosa* were introduced as beverage products i.e., *E. bulbosa* tea and infusion fluid products. The technical process of *E. bulbosa* derivated products can be seen in Table 1.

| Technical steps          | Herbal tea                                         | Infusion fluid                             |
|-------------------------|----------------------------------------------------|---------------------------------------------|
| Materials               | 1 kg *E. bulbosa*                                   | 1 kg *E. bulbosa*                           |
| Material preparations   | *E. bulbosa* was peeled, cleaned of remain leaves. | *E. bulbosa* was peeled, cleaned of remain leaves. |
| Impurity: 351 g         | Impurity: 346 g                                    | Netto : *E. bulbosa*: 649 g                 |
| Netto : *E. bulbosa*: 649 g | Netto : *E. bulbosa*: 654 g                         |                                             |
| Manufacture process     | *E. bulbosa* was chopped, and oven dried 60°C for ± 72 hours. | *E. bulbosa* was chopped, added 5 liters of water, then boiled at 90°C for 15 minutes. |
|                         | The results obtained were 509 g, then powdered and sieved. |                                             |
|                         | Coarse powder was ready to filled into teabags 417 g. | After cooled, filtered, and packaged in a 300 ml bottles. |
|                         | Each teabag was contained 2g; 1 box was contained 10 teabags. |                                             |
| Total product yielded   | 20 boxes @ 10 teabags                              | 16 bottles @ 300 ml                         |

Impurities of residual leaves and skin of *E. bulbosa* bulbs can reach 34.6% and 35.1%. Thus, it should be removed in order to produce a good quality product. The higher quality of materials used will be produced the better herbal product [11].

The making of *E. bulbosa* teabags was intended for consumers who likes the tradition of warm tea drinking with family or colleagues. In contrast, infusion drink was dedicated for consumer segment who

Figure 4. Production Process of Bawang Dayak (*E. bulbosa*) Infusion Water.
likes ready-to-drink beverage. Product diversification is expected to accelerate selling derivative products in the market [12] and increase the income of herbal product makers [13].

3.2. Comparison of Economic Value of E. bulbosa Derivated Products

According to the economic analysis includes an assessment of the costs, benefits, and cost-effectiveness of the action, as well as assessments of the costs, benefits and cost-effectiveness of some derivated products of E. bulbosa will be presented in the following Table 2.

| Estimated materials requirements | E. bulbosa Tea each box @ 10 tea bag (IDR) | E. bulbosa infusion drink each bottle (IDR) |
|---------------------------------|------------------------------------------|---------------------------------------------|
| E. bulbosa                     | 200                                      | 300                                         |
| Product packaging              | 4,100                                    | 800                                         |
| Others: labours, depreciation tools, production energy | 1,900                                    | 1,000                                       |
| Total cost                     | 6,200                                    | 2,100                                       |
| Estimated selling price        | 20,000                                   | 5,000                                       |
| Profit                         | 13,800                                   | 2,900                                       |
| Total products yielded         | 20 boxes @ 10 teabags                   | 16 bottles @ 330 ml                         |
| Estimated total profit         | 276,000                                  | 46,400                                      |

E. bulbosa tea production was required a longer time than that E. bulbosa infusion drinks. A longer product manufacturing process tends to require more labor [14] and energy [15]. Therefore, the labors, depreciation tools and production energy cost of E. bulbosa tea production is higher than that E. bulbosa infusion drinks.

It can be seen in Table 2 that E. bulbosa tea product was required more packaging cost. After the tea powder was made, it filled into a teabag and packaged in a box containing 10 tea bags. In contrast, the E. bulbosa infusion drink was only packaged in plastic bottles. Each product should package in the right material [16] due to more packaging will requires higher costs [17].

Consumers could use one box of E. bulbosa tea to make 10 cups of E. bulbosa tea, while one bottle of E. bulbosa infusion drink was only used for one drink. Therefore, the price of one box of E. bulbosa tea was higher than the price of one bottle of E. bulbosa infusion drink. Products with a higher selling
price tend to provide higher profits [18]. Products with higher profits tend to be easy to sell and dominate the market [19]. A recent study was indicated that *E. bulbosa* tea product provided 2-3 times profit, while infusion drink was provided 2 times profit of total production cost which can be predicted significantly improve the local community’s income.

### 3.3. Comparison of Storage Periods of *E. bulbosa* Derivated Products

The main difference affecting storage period is the moisture content. *E. bulbosa* tea had a low water content (< 10%). Moisture content in tea below 9% will inhibit the growth of yeast and mold [20]. The storage period of *E. bulbosa* tea was ranged about 6-12 months. The long storage period can provide opportunities for the distribution of *E. bulbosa* tea products into larger areas.

*E. bulbosa* infusion drink was only 1 day storaged at room temperature or it can be storaged for 3-5 days in the refrigerator. The infusion drink uses water as a medium. Yeasts and molds are easy to grow in low concentrations of water [21]. The fast storage period resulted in the distribution of *E. bulbosa* infusion drink was only can sold locally.

### 4. Conclusions

The *E. bulbosa* is a source of natural ingredients that have been known hereditary and it utilized for various diseases. Even empirically, *E. bulbosa* is believed to cure diseases only by drying the tubers and chewing them, directly. In this study, the innovation of *E. bulbosa* derivative products was introduced as nutritious herbal drinks, namely tea and infusion. These innovation products manufactures were considered more practice, convenience, low production costs, with maximum profits and benefits. Although production cost is more expensive, tea product can represent the contemporary product with more optimal profits compared to infusion products, but the efficacy of these two products will not reduce.

The *E. bulbosa* has also been trusted as an immune booster when the body's condition is weak. This is indispensable during the COVID-19 pandemic which requires a sufficient supply of immune system. In this study, both products were introduced as materials that can stimulate the body's natural defense against pathogens. In addition to the health benefits, these two products can also be used as an alternative to creative economy businesses that are be able to absorb labor and generate additional income for communities. This means that development of these immunostimulant products can prevent many negative effects of the COVID-19 pandemic, including health, social and economic declined.

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