Consumer acceptance on product diversification of Bengkirai (Shorea laevis): Attitudes, expectations and perception

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Abstract. Bengkirai/Irai (Shorea laevis) is one of the potential species of Dipterocarps that is widely known as an antioxidant source that it can be utilized as a traditional herbal medicine for forest communities in East Kalimantan. However, no product diversification of Irai was introduced in the industrial scale yet. This study is therefore intended to introduced some products diversification of Irai as featured NTFPs products to give better understanding that herbal medicine is not a herbal product that it has been bitter tastes or old-fashioned. Besides, this study is also aimed to compare the difference in consumers’ attitudes, expectations, and perceptions towards product diversification of Irai if they have or do not have experience with those products. In this study, some products diversification of Irai were introduced, and divide into beverages (Irai tea and Irai beer) and desserts (Irai Plain Pudding and Irai silky Pudding). Organoleptic or consumer sensory analysis of these products was tested on 50 adult panelists by using a Hedonic scale with 5 classifications (very dislike, dislike, neutral, like, and very like). Data analysis was performed descriptively by using Excel and presented in the graphic. If organoleptic assessment that significantly affected observational variables, then advanced test (T-test) followed by using SPSS 16. Sensory analysis for dessert products showed there was a statistically significant difference in taste (T-test = 0.005) and flavor (T-test = 0.01). While there was no significant difference in all sensory parameters in beverage products. A recent study was also indicated that these products provided 2-3 times the economic benefit. It means these products need to be developed into a new business by developing an entrepreneurial spirit for improved a local community’s income.

1. Introduction
Bengkirai/Irai (Shorea laevis) is one of the potential species of Dipterocarps family that it mostly grows in tropical rain forests in Kalimantan [1]. Besides being known to produce good quality wood for buildings, furniture, etc. [2], Irai is also widely known as a traditional herbal medicine for forest communities in East Kalimantan. Forest communities utilize boiled Irai leaves to reduce high blood pressure, relieve neck aches, fatigue, and make body refresh. Bengkirai leaves contained antioxidants such as alkaloids and triterpenoids that can be inhibited free radicals entering the body, therefore the content of Bengkirai leaf antioxidant compounds has high potential as functional foods or beverages [3]. Meanwhile, there has been no other form of presentation for Irai products, the importance of a form of presentation that is applicable and diversified without affecting its efficacy.

Diversification of food products needs to be done to increase higher nutrients values and active compositions contained in these food or beverage products [4]. Food and beverage ingredients from Irai leaves are a good alternative source of antioxidants for the community and are expected to have added value both in terms of taste, economic value, and its benefits in human health. Product diversification
strategy is also very important as an effort to increase non-timber forest products [5] and to reduce Irai wood harvesting. Such as product diversification will require social entrepreneurship so that it’s not only benefits but also increases the number of people who want to work by gathering jobs that promise sustainability.

In order to support the diversification of the product from natural materials into industrial innovation, it is necessary to conduct a market and competitiveness test of these products. The industry of natural product needs to be developed and innovated in order to compete with ever tastier, healthier, safer, more convenient, more sustainable, cheaper, and more varied products on the market. All the developed product preparations were organoleptically evaluated using the Hedonic scale [6,7]. The organoleptic test used the scoring tests on taste, texture, color, and aroma/flavor while the overall acceptance was determined by the hedonic test [8,9].

Some alternative diversified products from natural ingredients which are predicted to be more quickly accepted and will be consumed regularly by ordinary people are drinks and snacks. Herbal drinks can be packaged in the form of herbal teas. Herbal tea is a form of tea, has a medicinal function, and can be taken daily [10]. As for snack products that are commonly consumed by all communities is pudding. Pudding is a dairy dessert, easy to make, with a variety of flavors [11]. Pudding is semi-solid food, contained starch, sugar, salt, gum such as carrageenan, and sometimes milk is added [12]. Milk also was one of the main components in desserts [13]. Adding milk to the pudding will increase nutritional value than traditional pudding [14].

This study is therefore intended to introduced some products diversification of Irai as featured NTFPs products to give better understanding that herbal medicine is not a herbal product that it has been bitter tastes or old-fashioned. Besides, this study is also aimed to compare the difference in consumers’ attitudes, expectations, and perceptions towards product diversification of Irai if they have or do not have experience with those products.

2. Materials and Methods

2.1. Raw materials

Some products diversification of Irai were produced from Irai leaves which its origin from nursery, arboretum, and natural forest in East Kalimantan. In this study, Irai leaves was collected from natural forest in Labanan, Berau, East Kalimantan. Thus, Irai leaves were withered process that is air-dried at room temperature to reduce water content up to 70%. Air-dried samples were placed on metal trays and placed in a room temperature between 25-27°C for 12 hours. After wilting and softening, samples have reduced the size using scissors and smoothed with a blender to obtained Bengkirai leaves wet powder. After that, the wet powder was oven-dried at 50°C for 4 hours, then filtered to get a uniform size. In the next step, the filtered material is weighed and packed into a tea bag (± 2 g/bag). Furthermore, Irai leaves in a tea bag brewed with hot water as a usual tea, thus the “tea water” (± 200 cc/teabag) ready to be processed into the beverage (Irai tea and Irai beer) and dessert (Irai plain pudding and Irai silky pudding) products will be introduced in this study.
2.2. *Organoleptic or consumer sensory analysis*

Organoleptic or consumer sensory tests are highly relevant to assess the most important attributes of a product that are related to quality perception and acceptability [15]. Descriptive sensory analysis is traditionally conducted using panelists and has the purpose of developing the sensory profile of a product by evaluating the intensities of the main descriptors. This type of sensory analysis is usually used in new product development and to assess the quality of the same formulation in the different batches produced [15]. Based on observing, touching, and sniffing senses, the organoleptic analysis was carried out by a human panel [16]. Organic evaluation of herbal as drugs by means of the organ of sense (skin, eye, tongue, nose, and ear) or macroscopic evaluation of herbal drugs by color, odor, taste, size, shape, and special features, like touch-feeling, and texture [17]. In this study, organoleptic analysis of beverage products (Irai tea and Irai beer) and dessert products (Irai pudding and Irai silky pudding) were tested on 50 adult panelists by using Hedonic scale with 5 classifications (very dislike, dislike, neutral, like, and very like).
2.3. Data analysis
Data analysis was performed descriptively by using Excel and presented in graphical form. Furthermore, if organoleptic assessment that significantly affected observational variables, then advanced test (T-test) followed by using SPSS 16.

3. Results and Discussion
3.1. Irai beverage products
The products diversification of Irai leaves were introduced as beverage products i.e. Irai tea and soft drink beverage namely Irai beer (Figure 3). These beverage products are made based on easy, inexpensive, and current considerations, without reducing their efficacies. These products are designed to suppress the perception of ordinary people that products with the aim of prevention or treatment will be like as usual herbal products that even certain people consume them. In addition, lay perception about the content of caffeine in tea beverage products and or caffeine-containing beverages, it actually has a negative effect on health. Coffee, tea, caffeinated soda, and energy drinks are important sources of caffeine in the diet but each present with other unique nutritional properties [18]. Irai Leaf has several uniqueness; besides its distinctive taste, Irai leaf does not contain caffeine so that the negative risk of caffeine can be avoided. Rigorous reviews of caffeine toxicity conclude that consumption of up to 400 mg caffeine/day in healthy adults is not associated with adverse effects [19,20,21].

In order to maintain quality, purity, potency, safety, and efficacy of herbal drugs (product of medicinal plants) need sensory/organoleptic analysis as consumer acceptance [22,23]. In this study, organoleptic analysis of Irai tea and Irai beer was tested on 50 adult panelists included taste, flavor, color, and an appearance by using Hedonic scale with 5 classifications (very dislike, dislike, neutral, like, and very like) will be shown in the following graphic, respectively.
3.1.1. Irai beverage products taste
As can be seen in Figure 4, there was no significant difference of taste between Irai tea and Irai beer (T-test = 0.33). Although not statistically significant, the difference percentage in taste preferences for Irai tea and Irai beer products showed different habits and perceptions of panelists. Panelists of Irai beer tend to have the same drinking habits as drinking of soft drinks, which is drunk directly when bubbling. Indeed, if it is drunk immediately it will have a fresh effect, but after the bubble (CO₂) runs out it will return to its original taste. When CO₂ is formed spontaneously, the taste of the drink increases, but after the CO₂ runs out, the taste returns to its origin [15].

Figure 3. Irai tea (a), and Irai beer (b)

3.1.2. Irai Beverage products flavor
According to the organoleptic test, it can be shown that percentage of the flavor of Irai beer similar to Irai tea. The flavor of these products was not much different because even though it turns into bubbly, it does not change the original flavor of Irai beer which is similar to the flavor of Irai tea. Although some panelists have different expectations about the flavor of Irai beer, in this study, it is presented as original
Irai beer that caused response tends similar to irai tea. Herbal tea and sodas (carbonated drink) for consumption must avoid any flavoring agent [18]. Irai beer and Irai tea, both have brought distinctive and unique flavor. The tea flavor is caused by the presence of volatile aromatic compounds, the extraction process of chemical components of herbal teas such as carbohydrates, proteins, sugar reduction groups when brewing, as well as the oxidation of polyphenol compounds and their derivatives such as catechins to theaflavins and theaburigin which gives a distinctive flavor [24].

![Figure 5. Organoleptic tested on Irai beverages flavor](image)

3.1.3. Irai beverage products color
There was no significant difference (T-test = 0.65) of color between Irai beer and Irai tea percentages (Figure 6.). The panelists showed almost similar response for two products, the difference in color was only Irai beer produced bubble. After the bubbling is finished (about 1-2 minutes), it will return to its original color as Irai tea. The habit of tea drinking was also predicted to be able to contribute an impression of the color of these two products. In this study, many panelists liked the color of tea which was not too thick or natural like these products. The level of color density of tea affected tannin levels. The higher concentration of a teabag caused lower in tannin content. This is due to several factors, one of which is if tannin compounds are exposed to light and air for longer, then tea colors will be changed to become more dark/concentrated [25]. The color of the drink was influenced by the basic ingredients in the drink [26]. Irai beer and Irai tea had the same basic ingredient, i.e. Irai leaves.

![Figure 6. Organoleptic tested on Irai beverages color](image)
3.1.4. Irai beverage products appearance
In general, these products showed similar responses in the appearance tested, thus no statistically analyzed for those as can be seen in Figure 7. Panelists liked the appearance of Irai beer at the beginning of bubbling even though after a few minutes it would return to normal, like as usual tea. bubbles provided a permanent effect when mixed with sugar in drinks [27]. Irai tea and Irai beer did not use sugar, so there was no difference in their appearance. The appearance of Irai tea, itself is considered normal by panelists, the appearance should be that Herbal can be well received, even if it will be marketed.

![Figure 7. Organoleptic tested on Irai beverages appearance](image)

3.2. Irai dessert products
According to the current government’s strategy to confirm national food security, one of the priority programs is increasing diversification and community food security, especially from natural resources [28]. Therefore, this study introduced Bengkirai diversification products (Irai plain pudding and Irai silky pudding) which is origin from Dipterocarps forest ecosystem (Figure 8).

![Figure 8. Irai plain pudding (original) (a), and Irai silky pudding (b)](image)
3.2.1. Irai dessert products taste
It can be concluded that there was a statistically significant difference (T-test = 0.005) of taste between Irai plain pudding and Irai silky pudding (Figure 9). The Panelists have very liked Irai silky Pudding significantly more than Irai plain pudding. Introducing of dessert products that are commonly consumed is an initial consideration taken to introduce Bengkirai product diversification as an alternative food ingredient. The taste-tested on these products showed that prevalence or habit of consuming pudding leads the panelists’ perceptions of taste that they normally know and like.

The presence of milk in the silky pudding is very popular among panelists, especially those who are younger. In adults, prefer low fat as milk taste than sweet or original taste of pudding [29]. Whereas plain/original flavors are mostly preferred by older, assuming that it contains more efficacies. The addition of flavor in this product is expected not to replace the efficacy that already exist, but rather to give impression that the efficacy of herbs is not necessarily as usual herbal taste.

3.2.2. Irai dessert products flavour
There was a statistically significant difference (T-test = 0.01) of flavour between Irai plain pudding and Irai silky pudding. Panelists were extremely like Irai silky pudding more compare to Irai plain pudding due to Irai silky pudding preferred milk flavor dominantly. The flavor of milk was preferred in pudding [30]. The tendency of younger people to favor silky pudding also influences assessment. While, the fresh flavor of herbs in plain pudding has more acceptable due to more health benefits for older people’s perception.
3.2.3. Irai Dessert products color

It can be seen in Figure 11, both of color tests showed similar results. Although the taste and flavor differences are very significant, the color matter tends to be ignored by panelists. It’s probably due to the level of preference for a product is relative [31].

3.2.4. Irai dessert products appearance

In general, the colors of the two products are similar even though there are additional ingredients. Adding milk to the herbal pudding cannot change the color of the pudding. As a comparison, in okra pudding even added by milk, okra color still dominant than milk [12].
are adults. The age level greatly influences the assessment that is directly related to their habits, expectations and perceptions of a product.

![Figure 12. Organoleptic tested on Irai desserts appearance](image)

### 3.3. Economic benefit of Irai derivate products

As important as customer sensory analysis, economic considerations are needed to identified market opportunities for these products. The economic value was estimated according to calculation of the most economical price standard due to promotional prices yet (Table 1). Even though, it still benefits two to three times of production costs. This fact will provide great product development opportunities with promising continuity.

**Table 1. Estimation of economic value for Irai derivate products.**

| Estimated Production Costs Per pcs (IDR) | Selling Price Per pcs (IDR) | Remarks |
|-----------------------------------------|-----------------------------|---------|
| Teh Irai                                | 1,250*                      | 5,000   |
| Bir Irai                                | 1,500*                      | 5,000   |
| Irai Plain Pudding                      | 1,750*                      | 5,000   |
| Irai Silky Pudding                      | 2,250*                      | 5,000   |

* costs per pcs not including packaging cost yet

Consumers buying decision is very complex. Usually purchasing intention is related to consumers behavior, perception, and attitude. Purchase behavior is an important key point for consumers during considering and evaluating of certain products [32].

### 4. Conclusion

The product diversification of Bengkirai was introduced as a beverage (Irai beer and Irai tea) and dessert (Irai plain pudding and Irai silky pudding) products. These products are made based on convenient, inexpensive, and contemporary considerations, without any reduction of its efficacies. Organoleptic or consumer sensory analysis of beverage products showed that younger consumer preferred Irai beer more than Irai tea. Meanwhile, consumer sensory analysis for dessert products described that elder panelists preferred Irai Plain Pudding more than Irai silky pudding. However, Irai silky pudding is a promising
offer for younger, in addition to its function for health as well as for healthy snacks. According to their attitudes, expectations, and perceptions, it can be concluded that the level of sensitivity of panelists tends to be more sensitive, first in taste, flavor, color, and appearance, respectively. On the other hand, there was no statistically significant difference of taste, flavor, color, and appearance for those beverage products. While sensory analysis for dessert products showed that there was a statistically significant difference on taste and flavor.

A recent study was indicated that these products provided 2-3 times economic benefit which can be improved the local community’s income. It means these products need to be developed into a new business by developing the entrepreneurial spirit of the farmer groups, especially women’s involvement. The development of product diversification is expected to have competitiveness in marketing, and it will support a community’s economy. These products diversification was required social entrepreneurship, so that it’s not only benefits but also increases the number of people who want to work by gathering jobs that promise sustainability. This present study also provided an innovation of herbal medicine that it would be predicted in attracting consumers to the market to promote general positive image consumers for having more healthy food and beverages, and positive accepting about herbal medicine not bitter as usual.

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