The Consumer Preferences for New Sumatran Camphor Essential Oil-based Products using a Conjoint Analysis Approach

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Abstract. Camphor resin has been harvested from the Sumatran camphor tree (Dryobalanops aromatica) since the seventh century on the western coast of Sumatra, Indonesia. High beneficial compounds contained, a-pinene, 1.8-cineole, camphene, limonene, and p-cymene reveal the opportunities for prospective utilization as an anti-viral, expectorant, and immune system booster with a relaxing fragrance. The objective of the study was to determine consumer preferences for new Sumatran camphor essential oil-based products. Forty consumers were asked to provide an assessment of personal care products combination. A conjoint analysis approach was assisted by a computer with SPSS 14.0 program. The influence of five product profiles on consumer preferences including functionality, scent variant, packages, volume, and prices were examined. The results show that higher utility values indicate a greater preference. The highest utility value is indicated by the scent variant, this illustrates the respondent’s preferences for their preferred scent. Moreover, the scents (importance value 52.15) is the most influential on overall preferences. This means that there is a large preference differentiation between product profiles containing most and least desired scents. This is due to the preference for a particular scent is personal and unique which might have affected personal perception, which is closely related to initial recognition for a particular scent as an olfactory memory. The highest consumer’s preference is an inhaler product with floral scent, package roll-on, volume 6 ml, and price IDR50,000. Products with inhalation functions are intended to obtain a relaxing effect, reduce anxiety, and calm the mind, improve the respiratory system and immune system.

1. Introduction
The Covid-19 pandemic has raised global awareness to improve the body’s immune system. Apart from healthy eating and regular exercise, increased immunity can also be achieved from a healthy and calm mind, including through aromatherapy [1]. This is in line with increasing awareness of holistic medicine and organic product utilization [2]. The application of organic compounds for treatment has also triggered concerns about synthetic drugs side-impact that have been used [2][3].

Some of the essential oils which have potential as aromatherapy are camphor and styrax oils [1][4][5]. Ancient communities applied camphor as a raw material for medicine and perfume. Recently, camphor oil derived from Dryobalanops tree is much required for thawing blood clots in blood vessels of the heart and human brain [6]. The camphor’s scent has been also identified as an organic compound with a relaxing effect on the mind [5].
Camphor and styrax resin has become a magnet for foreign nations to the Nusantara and spread their fragrance to various parts of the world. Incense is a valuable resin harvested from the incense tree (Styrax spp.) and has been a major trading commodity since the 7th century [7][8]. Thousands of tonnes of raw resin are shipped overseas, while a variety of derivatives in the form of pharmaceuticals, perfumes, beauty, and multi-million dollar foodstuffs are imported each year. The export volume of incense resin reached 5,541 kg with a value of US $ 96,900, while import of final product in the form of beauty products in 2020 reached the US $ 401 million [7][9].

Currently, efforts to increase the value-added of processing essential oils from tropical forest products are growing [1][3][10]. Camphor and incense and resins are processed by extraction techniques to produce essential oils and hydrosols. However, these distillation products have not been developed into innovative organic care products. Although several similar products were identified in the market, these products were still very expensive.

Considering the multi-dimensional spectrum of camphor and incense oil, both as a source of livelihood and socio-cultural development in Nusantara [7][11], it is necessary to increase value-added through processing essential oil raw materials into innovative and economical products. Although the resins have been used as preservative, anti-bacterial, and fragrance [1][5][12], the practical use of incense and camphor as aromatherapy has not been found. Various studies have shown that both essential oils contain Phyto-pharmacy as antiviral, antiseptic with a calming aroma, improve the nervous system, restore balance to the body, and improve blood circulation [3][5][12]. Regarding these various benefits, innovation in aromatherapy products is considered prospective as a healthy product.

The objective of the study was to develop aromatherapy products based on Sumatran camphor essential oil, as well as to find out consumer preferences for these innovative products. This research developed innovative products that utilized camphor oil as aromatherapy products in the form of perfumes and inhalers. The innovative products are expected to increase the value-added of non-timber forest products and reduce dependence on health imports based on camphor.

2. Methods

2.1. Materials
The main ingredients used were essential oils of camphor, incense, eucalyptus, lime, castor, and rose centifolia. Besides, 10 mL, 6, and 3 ml bottles in roll-on or spray form are needed. The equipment used is a steam distillatory, placards, and computer with SPSS 14 for windows.

2.2. Essential oil extraction
The essential oil was extracted in two ways, namely distillation and solvent extraction. Camphor oil and incense are extracted from the leaves using a steam distillation apparatus. This method has been applied to various related studies[1][7][10]. The two essential oils obtained are the main ingredients used as a mixture of aromatherapy products.

2.3. Aromatherapy formulation
Aromatherapy products consisted of one or a combination of various essential oils with different concentrations. In this research, aromatherapy products were developed using essential oils of camphor oil as top-note and incense as the base-note and combined with other essential oils. The combinations of various concentrations of essential oil used are shown in Table 1. By the formulation tested, each essential oil was poured into a measuring cup with a total volume of 40 ml. Then, the glass is shaken until the essential oil mixture is homogeneous.
Table 1. Ingredients and amounts used in various inhaler and perfume formulations

| Formulation | Volume (mL) (%) | Total |
|-------------|----------------|-------|
|             | Camphor | Benzoin | Eucalyptus | Castor oil | Lime | Rose |       |
| Inhaler     |         |         |         |           |      |      |       |
| I1          | 5 (12.5)| 15 (37.5)| 10 (25.0)| 10 (25.0) | 40 (100) |      |
| I2          | 10 (25.0)| 10 (25.0)| 10 (25.0)| 10 (25.0) | 40 (100) |      |
| I3          | 15 (37.5)| 5 (12.5)| 10 (25.0)| 10 (25.0) | 40 (100) |      |
| Perfumes    |         |         |         |           |      |      |       |
| P1          | 5 (12.5)| 15 (37.5)|         |           | 15 (37.5)| 5 (12.5) | 40 (100) |      |
| P2          | 10 (25.0)| 10 (25.0)|         |           | 15 (37.5)| 5 (12.5) | 40 (100) |      |
| P3          | 15 (37.5)| 5 (12.5)|         |           | 15 (37.5)| 5 (12.5) | 40 (100) |      |

2.4. Aromatherapy Product Evaluation
To evaluate consumer acceptance of aromatherapy products, forty respondents were selected to be asked about their expression about innovative products (sensation after inhalation, sensitivity, scent, and willingness to continue using). The value of each formulation profile was determined according to the Likert scale with three scale options: high (pleasant); moderate (moderate); low (intolerable).

The conjoint analysis approach was applied to determine consumer preferences for the products being tested. This approach was also applied in previous studies [1]. The assessment of consumer proficiency began with an orthogonal design resulting in a data file containing the orthogonal main effect design which allows statistical testing of multiple factors without testing any combination of factor levels. This design was performed using the Display Design procedure [13].

This study also examined consumer preferences on functionality, scents, packaging, volume, and prices of an innovative product. There were 2 factor levels for functionality (inhaler; perfumes) and 3 levels of scent; 2 levels of packaging (roll-on, spray); 3 volumes (3; 6; and 10 ml); and 3 prices (IDR 20,000; 35,000; 50,000). Table 2 displays the variables used with; label and value.

Table 2. Variables of consumer preferences for aromatherapy products

| Factors | Value | Label          |
|---------|-------|----------------|
| Functionality | 1, 2 | Inhaler, Perfume |
| Scents | 1, 2, 3 | Scent#1, Scent#2, Scent#3 |
| Package | 1, 2 | roll_on, spray |
| Volume | 1, 2, 3 | 3 ml, 6 ml, 10 mL |
| Prices | 1, 2, 3 | IDR35,000, IDR50,000, IDR70,000 |

The next step was to create a combination of factor levels which presented as product profiles for each subject. The orthogonal-generation design procedure created orthogonal arrays, which were referred to as orthogonal designs [13]. After the design was generated, consumer preferences were obtained through interviews with forty respondents who used aromatherapy products. Respondents were asked to rank 27 product profiles from most liked to least liked.

3. Results and Discussion
3.1. Aromatherapy formulation profiles
Since the last decade, consumers have become more selective about their personal care products used. Although many similar products are available, high-quality products and competitive prices will satisfy customer satisfaction and increase product loyalty. The aromatherapy product in this study was a research innovation that explores the fragrance formulation of camphor oil and incense, known as divine resin, and used by almost all religions and beliefs in the world.

To evaluate consumer acceptance of aromatherapy products, forty respondents were asked about their expressions of tested aromatherapy products. Respondents' responses to each profile of aromatherapy product formulations are shown in Table 3.
The combination of these three essential oils with the right composition and the presence of the same active compound components harmonized the aroma with minimal contraindications so that the resulting aroma had a relaxing and calming effect on the mind. Based on the comparison of

Table 3. Value of the respondent's expression for each aromatherapy formulation profile

| Formulation | Sensation after inhalation | Sensitivity | Scents | Willingness to continue to use |
|-------------|-----------------------------|-------------|--------|-------------------------------|
|             | high | medium | low | high | medium | low | high | medium | low | high | medium | low | high | medium | low | high | medium | low | high | medium | low | high | medium | low | high | medium | low |
| Inhaler     |      |        |     |      |        |     |      |        |     |      |        |     |      |        |     |      |        |     |      |        |     |      |        |     |      |        |     |
| I1          | 40.0 | 37.5   | 22.5| 35.0 | 37.5   | 27.5| 40.0  | 37.5   | 22.5| 37.5  | 37.5   | 25.0|     |        |     |      |        |     |      |        |     |      |        |     |      |        |     |
| I2          | 47.5 | 37.5   | 15.0| 37.5 | 40.0   | 22.5| 45.0  | 35.0   | 20.0| 40.0  | 40.0   | 20.0|     |        |     |      |        |     |      |        |     |      |        |     |      |        |     |
| I3          | 37.5 | 40.0   | 22.5| 30.0 | 35.0   | 35.0| 37.5  | 37.5   | 25.0| 37.5  | 35.0   | 27.5|     |        |     |      |        |     |      |        |     |      |        |     |      |        |     |
| Perfumes    |      |        |     |      |        |     |      |        |     |      |        |     |      |        |     |      |        |     |      |        |     |      |        |     |      |        |     |
| P3          | 27.5 | 35.0   | 37.5| 25.0 | 37.5   | 37.5| 30.0  | 35.0   | 35.0| 30.0  | 35.0   | 35.0|     |        |     |      |        |     |      |        |     |      |        |     |      |        |     |
| P4          | 35.0 | 35.0   | 30.0| 30.0 | 37.5   | 32.5| 35.0  | 40.0   | 25.0| 32.5  | 40.0   | 27.5|     |        |     |      |        |     |      |        |     |      |        |     |      |        |     |
| P6          | 32.5 | 37.5   | 30.0| 25.0 | 42.5   | 32.5| 37.5  | 37.5   | 30.0| 25.0  | 37.5   | 37.5|     |        |     |      |        |     |      |        |     |      |        |     |      |        |     |

Forty questionnaires were validated, on average 80.0% of respondents stated their willingness to continue using aromatherapy products (high and medium). Furthermore, about 40% of respondents stated that their level of satisfaction was high and 40% moderate. This shows that most respondents have a pleasant preference for freshness and relaxation sensation after inhaling aromatherapy, appropriate sensitivity levels for a sense of smell, and refreshing aromas.

After inhaling various tested aromatherapy formulations, as many as 47.5% of respondents gave the highest value to the sensation of refreshing and relaxation. This sensation was produced by the inhaler I2 formulation (Table 3). The relaxing and invigorating effect with a slightly pungent citrus-like fragrance comes from p-cymene and limonene compounds. At room temperature, the two compounds which are abundant in eucalyptus oil and volatile camphor have a rather strong aroma, but in combination with incense oil which has a milder aroma, the resulting combination is more pleasant. Limonene compounds are also found in oranges or lemons which have long been known to relieve anxiety and depression, as well as fight bacterial infections and treat ulcers. Meanwhile, p-cymene compounds were identified to reduce anxiety, refresh, and increase libido [5][6].

A distinctive aroma likes turpentine but softer was also smelled as an initial sensation. This aroma was derived from a-pinene and b-pinene which are found in both essential oils [5][6]. This colorless, alcohol-soluble compound had a fresh pinewood scent and was believed to help reduce inflammation, kill bacteria, improve cognitive function, and reduce anxiety. However, at higher concentrations such as scent#3, the composition of a-pinene, b-pinene, limonene, and p-cymene produced a pungent aroma and gave a nose-piercing sensation when inhaled.

The first sensation when inhaling essential oils came from top-note aroma; volatile compounds from camphor and eucalyptus oil. Regarding a lighter molecular content, the compounds contained were first captured by the olfactory sensor, while the essential oil which was the base-note (incense), would release its aroma after 10-15 minutes. Furthermore, a warm spicy and piercing taste with an aroma similar to cinnamon and cloves came from b-caryophyllene and eugenol compounds contained in camphor oil and incense. Regarding the ability to bind to CB2 receptors in the endocannabinoid system, b-caryophyllene had powerful anti-inflammatory and antioxidant effects that could help relieve pain and anxiety, treated seizures, and reduced cholesterol [14].

After a few minutes, the sweet, spicy honey-like balsamic scent is also pleasant. This aroma was produced by the compounds of benzyl cinnamate, cinnamic acid, styrene, and benzoic acid found in incense oil [12][15]. Apart from being used in the perfume and food flavoring industry, benzoic acid was also used as a food preservative and anti-fungal. After an initial impression of pungent and refreshing aroma, linalool content contained in camphor and eucalyptus oil would produce a soft floral aroma. A study found that linalool decreased aggressive behavior in mice [16].

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The combination of these three essential oils with the right composition and the presence of the same active compound components harmonized the aroma with minimal contraindications so that the resulting aroma had a relaxing and calming effect on the mind. Based on the comparison of
respondents' responses to the aroma of various formulations, the essential oil combination based on scent #2 produced a softer aroma.

The subtle aroma sensation comes from the 1.8-cineole compound which had a similar aroma to rosemary essential oil [12]. This compound was found in camphor, incense, and eucalyptus essential oils. The compound has anti-bacterial, anti-fungal, and anti-viral properties which potential to improve the respiratory system by cleansing the lungs thereby increasing blood circulation and immune system [6]. The fragrance smells like sweet almonds, a slightly pungent smell, and a floral pattern, which is identified as allyl benzoate and benzaldehyde which contain incense oil [15].

3.2. Production cost

A simple study had been conducted to estimate the costs associated with producing aromatherapy products. Table 4 shows the cost of commercial raw materials used to produce 40 ml using scent #2. From this data, it is estimated that the production cost of inhaler products is around IDR 149,500 or IDR 3,738/ml. Meanwhile, the production cost for perfume is IDR 189,950 or IDR 4,749/ml.

| Essential oils            | Package (ml) | Unit Price (IDR) | Amount used (ml) | Real cost (IDR) |
|---------------------------|--------------|------------------|------------------|-----------------|
| Camphor oil              | 100          | 250,000          | 10               | 25,000          |
| Incense oil              | 10           | 72,000           | 10               | 72,000          |
| Eucalyptus oil           | 50           | 200,000          | 10               | 40,000          |
| Castor oil               | 100          | 125,000          | 10               | 12,500          |
| Rose centifolia oil      | 20           | 247,000          | 5                | 61,750          |
| Lime oil                 | 100          | 208,000          | 15               | 31,200          |
| Total cost Inhaler       |              |                  | 40               | 149,500         |
| Total cost Perfumes      |              |                  | 40               | 189,950         |

Recently, artisanal aromatherapy has become fashionable, but it is generally considered a high-quality item, produced with good raw materials, and therefore expensive. On the online site, pure camphor aromatherapy product price USD 16.22 for a 10 ml pack. Meanwhile, this innovative product is only sold at IDR 70,000 for similar packaging with a production price of only IDR 37,737.

3.3. Consumer preferences

Consumer preferences for aromatherapy products tested were calculated from utility score and relative importance value. This utility value was a numerical score that measures how much each product feature affects the customer's decision [13]. Table 5 shows the utility scores for the four factors tested.

| Factor     | Utility value | Standard error |
|------------|---------------|----------------|
| Functionality | Inhaler 6.836 | 0.873          |
|            | Perfumes 3.472 | 0.792          |
| Scents     | Scent#1 4.285 | 0.781          |
|            | Scent#2 8.421 | 0.693          |
|            | Scent#3 8.164 | 0.721          |
| Package    | roll_on 1.608 | 0.823          |
|            | spray 0.341   | 0.942          |
| Volume     | 3 ml 2.352    | 0.528          |
|            | 6 ml 3.813    | 0.748          |
|            | 10 ml 5.837   | 0.914          |
| Prices     | IDR35,000 -3.167 | 0.428          |
|            | IDR50,000 -6.318 | 0.725          |
|            | IDR70,000 -9.697 | 1.083          |
| (Constant) | 5.017         | 12,524         |
A higher utility value indicates a greater respondent preference for an aromatic product profile. Based on Table 5, the highest utility value is shown by scent#2 (8.421). This illustrates the respondent's greatest preference for scent an aromatherapy product after inhaling. Scent #2 created a soft, sweet, and refreshing aroma with a relaxing effect. Conversely, the lowest utility value is shown by scent#3. The lowest preference for this aromatherapy variant was due to stinging, pungent, and life-piercing aroma sensation due to high concentration of camphor and eucalyptus oils and low concentration of incense oil which had a milder aroma in its composition.

Table 5 shows that most of the respondents prefer aromatherapy products that were packaged in roll-on form than spray. Consumers preferred to easily adjust the volume of essential oil inhaled in a roll-on package. The release of more volatile compounds at a time when using a spray package resulted in a more pungent aroma sensation received by the olfactory sensor. With a larger package, a volume of 10 ml was preferred because this size is still considered ergonomic and could accommodate enough contents for intensive aromatherapy use.

Overall, the highest consumer preference was a soft refreshing aroma in form of an inhaler product with scent#2, a package roll-on, 6 ml medium volume, for IDR 50,000. As expected, Table 5 also shows that there is an inverse relationship between prices and utility. In this case, the higher price will encourage lower utility. The range of utility values (highest to lowest) for each factor provides a measure of how important a factor to overall consumer preferences. Factors with larger utility ranges played a more significant role than factors with smaller utility ranges [13].

Furthermore, Table 6 shows the important value for each factor of aromatherapy products. The results show that scent (importance value 52.15) has the highest effect on overall consumer preferences. This shows that there is a significant difference in consumer preferences for the profile of products containing the most desirable and least preferred aromas. This difference in response was because each personal preference for certain scents was personal and unique [1][17][18].

Table 6. The relative importance of aromatherapy product factors

| Factors  | Value |
|----------|-------|
| Functionality | 16.15 |
| Scents | 52.15 |
| Packet | 2.28 |
| Volume | 11.25 |
| Prices | 18.28 |

The results also show that package and volume have the lowest importance value (2.28 and 11.25, respectively). This shows the small role of these two factors in determining overall consumer preferences. Price and functionality have fairly high relative importance values of 18.28 and 16.15, respectively, but not as important as scents. This was suspected because of the narrow price range. The consumers also considered that the price offered was still relatively affordable for a quality product even when it was compared to other similar aromatherapy products.

Ultimately, the study findings showed that product testing was essential before it was launched to the market. Regardless of how effective and efficacious an aromatherapy product was, if consumers did not like the aroma, which was possible due to differences in perceptions of the product, it could be predicted that the product would fail experience in the market.

4. Conclusion

Aromatherapy products were developed using camphor essential oil in combination with camphor oil and other essential oils. The combination of these essential oils and the presence of similar active compound components harmonized the aroma with minimal contraindications so that the resulting aroma had a relaxing and calming effect on the mind. Based on the conjoint analysis, scent variants had the greatest influence on overall consumer preferences. The highest consumer preference was aromatherapy products with a soft yet refreshing aroma profile, roll-on package, 6 ml medium volume,
priced at IDR 50,000. This was influenced by the respondents' perceptions, which were closely related to the initial recognition of certain aromas as sensory memory of aromas.

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