ORIGINAL ARTICLE

Development of Herbal Tea Using Daun Rerama (*Christia Vespertillonis*), Kaduk (*Piper Sarmentosum*) and Stevia (*Stevia Rebaudiana*)

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Abstract:

The herbal tea was developed using Daun Rerama (*Christia Vespertillonis*), Kaduk (*Piper Sarmentosum*) And Stevia (*Stevia Rebaudiana*) as the main ingredients. Sensory evaluation was conducted and mean score for colour, aroma, taste, aftertaste and overall acceptability for herbal tea was 3.76 ± 0.926, 3.56 ± 1.261, 3.32 ± 1.651, 3.52 ± 1.503 and 3.76 ± 1.091 respectively while for commercialized tea was 6.20 ± 0.866, 5.40 ± 1.000, 3.08 ± 1.801, 3.20 ± 1.683 and 3.84 ± 1.091 respectively. Moreover, results from ANOVA showed that there was significant difference ($P < 0.05$) between the two samples only in colour and aroma. Besides, sensory shelf life test was conducted and mean score for colour, aroma, taste, aftertaste and overall acceptability for herbal tea that had been stored for three months was 3.88 ± 1.054, 3.48 ± 1.194, 3.44 ± 1.635, 3.48 ± 1.418 and 3.76 ± 1.589 respectively while for freshly made herbal tea was 3.76 ± 0.926, 3.56 ± 1.261, 3.32 ± 1.651, 3.52 ± 1.503 and 3.76 ± 1.091 respectively. Moreover, results from ANOVA showed that there was no significant difference ($P > 0.05$) between the two samples in all of the sensory attributes. In conclusion, the acceptance of the herbal tea quite low compared to commercialized tea. Despite of low mean score on each sensory attributes, the acceptance of the herbal tea after three months period of storage was the same as the herbal tea that was freshly made.

Keywords: *Christia Vespertillonis*, *Piper Sarmentosum*, *Stevia Rebaudiana*), herbal tea

1. INTRODUCTION

Amounts of deaths due to non-communicable diseases (NCDs) were estimated to rise rapidly for the next 25 years, such that the entire amount of NCD-related deaths was estimated to rise worldwide to 52 million by 2030 where from the number, 42 million (81%) were estimated to take place in low and middle income countries (LMICs) [1]. Recently, ischaemic heart disease remained as the principal cause of death in Malaysia where the percentage of deaths caused by this disease was 13.9% with 37 deaths per day in 2017 as compared to 24 deaths per day in 2007, followed by pneumonia (12.7%), cerebrovascular diseases (7.1%), transport accidents (4.6%) and malignant neoplasm of trachea, bronchus and lung (2.3%) [2]. Based on the statistics, it had indicated that most of the causes of deaths in Malaysia were due to NCDs.

However, it was important to realize that Ministry of Health Malaysia had carried out initial phase of healthy lifestyle campaign since 1991 concentrating on diseases as well as promoting healthy dietary pattern and physically active lifestyle [3]. The campaign was continued and the next phase was launched in 1997 to 2002 with the main objective that focused on behavioural changes. Furthermore, another campaigns were carried out in 2004 to 2012 with six

substantial theme related to healthy lifestyle. At the present time, health consciousness among Malaysian citizen had increased due to lot of campaigns that had been carried out by Ministry of Health Malaysia. In addition, those with health consciousness were not only aware and concerned about their wellness, but also being ready to take action in order to improve their health [4]. And fortunately, this condition had gradually changed food consumption pattern in Malaysia.

In the meantime, functional food that had medicinal properties which could prevent or cure some disease had gained its popularity and could be said as the most current food consumption pattern in Malaysia [5]. Not to mention, in the present day foods were not only consumed in order to deliver essential nutrients as well as to satisfy hunger for consumer but also to increase physical and mental well-being as well as to prevent nutrition-related diseases [6]. In fact, functional food was divided into five categories which were dairy products, beverages, soft drinks, bakery and snack bars [7]. The most prevalent functional food that had been commercialized in Malaysia which was said to provide a lot of health benefits was herbal drink such as *Tongkat Ali* and *Kacip Fatimah* among the Malays and *Ginseng* among the Chinese [5].

Recently, there had been a worldwide changed from the usage of modern medicines back to herbal products [8]. The practice of herbal products could be said as the oldest technique to deal with sickness originated from a wide range of plant origin that could be considered as foods, dietary supplements, cosmetics, and herbal medicines [9]. An estimation made by WHO showed approximately 80% of world population relied on herbal medicine for their health care instead of modern medicine mainly due to the side effects and high cost of modern medicine where herbals were commonly accessible in their natural form as they could be grown and picked from own garden or purchased from stores [8]. Furthermore, individual who utilized herbals, took part in the usage of home remedies and performed an alternative health care philosophy might possibly be affected from traditional practices or media and marketing [10].

First thing to remember, development of food products was driven by market and consumer [11]. This emphasized the importance to identify recent issues as well as consumer's current trends of food consumption in order to ensure the product had been developed would meet consumer's preferences. As had been mentioned earlier, functional food had gain popularity in Malaysia and there had been a worldwide changed from the usage of modern medicines back to herbal products. Consequently, there was a need for developing a product that met the criterion. Hence, this research primary aim was to develop an herbal tea product using Daun Rerama (*Christia vespertillonis*), Kaduk (*Piper sarmentosum*) and Stevia (*Stevia rebaudiana*) in the hope that the herbal tea could provide significant benefits regarding NCDs as combination of these herbal had several health benefits for instance antimalarial, antitumor, antidiabetic, anti-hyperglycemic, antihypertensive, anti-inflammatory, antimicrobial as well as antioxidant.

2. METHODOLOGY

Ingredients and Material Selection

The main ingredients used for preparation of the herbal tea including dried Daun Rerama (*Christia vespertillonis*), Kaduk (*Piper sarmentosum*) and Stevia (*Stevia rebaudiana*) were purchased from Ethno Resources Sdn Bhd. In addition, the tea bags were purchased from Daiso Japan.

Herbal Tea Production

The herbal tea production was conducted in Food Preparation Lab at Universiti Teknologi MARA, Puncak Alam Campus. Firstly, sorting process was carried out to remove all of the physical impurities such as stems. After that, bruising process was conducted where this process involved blending all of the leaves using blender dry mill for 30 s to break down the cell wall in the leaves that would facilitate oxidation [12]. Next, the leaves were left to let oxidation occurred for one hour. Then, all of the herbal leaves were weighed based on Table 1 and mixed together before being packed into the teabags. After being packed, all of the samples were placed in air tight plastic bag and the bag was then placed in opaque tin canister made from tinplated steel. Lastly, the canister was stored in a dark and dry location at room temperature. The aim was to prevent the oxidation from continued.

Table 1: Herbal Tea Formulation in Each Teabag

Ingredients	Weight per teabag (g)
Daun Rerama (*Christia vespertillonis*)	1
Daun Kaduk (*Piper sarmentosum*)	2
Daun Stevia (*Stevia rebaudiana*)	1

Herbal Tea Preparation

One teabag was for 250 ml of water. As for sensory evaluation and sensory shelf life test, four teabags were placed into a measuring jug and 1000 ml of freshly boiled distilled water was poured over the teabags. The herbal tea was allowed to infuse for 6 min. After that, before the teabags being removed, the fluid soaked in the teabags were allowed to drain into the measuring jug for 30 s [13].

Sensory Evaluation

The sensory evaluation was conducted in Food Sensory Laboratory at Universiti Teknologi MARA, Puncak Alam Campus. Twenty five panelists were recruited among students in UiTM Puncak Alam Campus. The inclusion criteria were the person with good health and free of illness related to sensory properties, nonsmokers, and not color blind. Meanwhile, the exclusion criteria were the person with strong likes or dislikes on tea and with known allergies to the herbals. There were two blinded samples being evaluated in the procedure which were herbal tea that had been developed as well as commercialized tea. There were five characteristics that had been measured, which were colour, aroma, taste, aftertaste and overall acceptability. The evaluation was marked on 7-point hedonic scale, which was an affective test method, where the categories were characterized with phrases representing various grades of affect and those labels were arranged consecutively to suggest a single range of likes and dislikes [14]. This method suitable to be applied to untrained panelists [15].

Sensory Shelf Life Test

The sensory shelf life test was conducted in Food Sensory Laboratory at Universiti Teknologi MARA, Puncak Alam Campus. As a matter of fact, shelf life was defined as the period while the food product stay safe, preserve wanted sensory, chemical, physical and microbiological characteristics as well as obey with any label statement of nutritional data when stored under the recommended conditions [16]. In this research, sensory shelf life test basically consisted of sensory evaluation which was done on the herbal tea samples that had been stored for three month at room temperature. The procedure for sensory shelf life test and the previous initial sensory evaluation was the same. Accordingly, results obtained from this sensory shelf life test were compared with the previous initial sensory evaluation where the herbal tea was freshly made.

Statistical Analysis

All data from sensory evaluation and sensory shelf life test were analysed using Statistical Package for Social Science (SPSS) version 25.0. The analysis involved was Analysis of Variance (ANOVA) and descriptive statistics.

3. RESULT AND DISCUSSION

Sensory Evaluation

Table 2 showed sensory evaluation results of sample A and sample B. First thing to remember, the evaluation was marked on 7-point hedonic scale where 7 (like very much), 6 (like moderately), 5 (like slightly), 4 (neither like nor dislike), 3 (dislike slightly), 2 (dislike moderately) and 1 (dislike very much). Another key point, sample A was herbal tea made of Daun Rerama (*Christia vespertillonis*), Kaduk (*Piper sarmentosum*) and Stevia (*Stevia rebaudiana*). Meanwhile, sample B was commercialized tea. There were five sensory attributes that had been measured, which were colour, aroma, taste, aftertaste and overall acceptability.

First of all, as for colour, mean score for sample A was 3.76 ± 0.926 which indicated as dislike slightly. Meanwhile, mean score for sample B was 6.20 ± 0.866 which indicated as like moderately. Accordingly, as could be seen, sample A scored lower than sample B where this revealed that the panelists preferred colour of sample B more than sample A. Furthermore, results from ANOVA showed that the *P*-value for colour was 0.000 which was less than 0.05. Thus, this indicated that the null hypothesis was rejected and it could be concluded that there was significant difference between the two samples. The eye observed the initial quality of food after receiving information such as colour where it might exactly point out ripeness, strength of dilution and the degree to which the food had been heated [17]. In this situation, sample A had a dark brown colour while sample B had a bright brown colour. The dark brown colour of sample A might be due to Daun Stevia (*Stevia rebaudiana*) where the extract from this plant usually had dark brown colour appearance [18]. Based on the results, it had indicated that the bright brown colour of sample B looked more appealing to panelists compared to dark brown colour of sample A that looked duller where this condition had altered the presumptions about the tea.

Besides that, as for aroma, mean score for sample A was 3.56 ± 1.261 which indicated as dislike slightly. Meanwhile, mean score for sample B was 5.40 ± 1.000 which indicated as like slightly. Accordingly, as could be seen, sample A scored lower than sample B where this revealed that the panelists preferred aroma of sample B more than sample A. In addition, results from ANOVA showed that the *P*-value for aroma was 0.000 which was less than 0.05. Hence, this indicated that the null hypothesis was rejected and it could be concluded that there was significant difference between the two samples. It was easier to smell hot foods compared to cold ones due to the relationship between volatility of aroma with temperature [19]. Both of the samples were prepared in hot temperature. Hence, aroma from both of the samples could be easily identified by the panelists. The leaves of numerous *Piper* species were naturally aromatic and had a pungent smell [20]. Similarly, the extract from Daun Stevia (*Stevia rebaudiana*) usually had a foul smell [18]. Consequently, combination of the herbals had created a strong unpleasant aroma in sample A and the volatility of the aroma was intensified with hot temperature.

Furthermore, as for taste, mean score for sample A was 3.32 ± 1.651 which indicated as dislike slightly. Meanwhile, mean score for sample B was 3.08 ± 1.801 which also indicated as dislike slightly. Besides that, results from ANOVA showed that the *P*-value for taste was 0.626 which was more than 0.05. So, this indicated that the null hypothesis was accepted and it could be concluded that there was no significant difference between the two samples. Daun Kaduk (*Piper sarmentosum*) had a pungent taste [21]. Likewise, although Daun Stevia (*Stevia rebaudiana*) was known for natural sweetener, however its bitter taste tends to increase with concentration for both stevioside and rebaudioside A [22]. Combination of the herbals would create a pungent and bitter taste which could be said as the reason for sample A being disliked by the panelists. However, as could be seen, sample A scored higher than sample B where this revealed that the panelists preferred taste of sample A more than sample B. Daun Stevia (*Stevia rebaudiana*) had a sweet and refreshing taste that could remain in the mouth for hours [23]. The natural sweet taste of sample A had become the reason for panelists to prefer sample A rather than sample B which had no added sweetener or flavour.

Additionally, as for aftertaste, mean score for sample A was 3.52 ± 1.503 which indicated as dislike slightly. Meanwhile, mean score for sample B was 3.20 ± 1.683 which also indicated as dislike slightly. Furthermore, results from ANOVA showed that the *P*-value for aftertaste was 0.482 which was more than 0.05. Thus, this indicated that the null hypothesis was accepted and it could be concluded that there was no significant difference between the two samples. All steviol glycosides in Daun Stevia (*Stevia rebaudiana*) had an astringent as well as persistent aftertaste where rebaudioside A was the least astringent and persistent aftertaste and was rated to have the most favourable sensory attributes among the four major steviol glycosides [22]. Based on this evidence, it had revealed the cause for panelists to score very low in term of aftertaste for sample A. However, as could be seen, sample A scored higher than sample B where this revealed that the panelists preferred aftertaste of sample A more than sample B. The reason for aftertaste was the same as the taste where Daun Stevia (*Stevia rebaudiana*) had a sweet and refreshing taste that could remain in the mouth for hours [23]. The sweet and refreshing taste that remained in the mouth was known as aftertaste.

Last but not least, as for overall acceptability, mean score for sample A was 3.76 ± 1.091 which indicated as dislike slightly. Meanwhile, mean score for sample B was 3.84 ± 1.091 which also indicated as dislike slightly. Moreover, results from ANOVA showed that the *P*-value for overall acceptability was 0.830 which was more than 0.05. Thus, this indicated that the null hypothesis was accepted and it could be concluded that there was no significant difference between the two samples. The main reason might be because of the taste of both samples where taste was the most influential aspect in a person's preference on food or beverage [24]. Mean score on taste for both of the samples were quite low. This was due to no added sweetener in both of the samples. Thus, the taste of both samples purely came from the ingredients in each teabag itself. However, as could be seen, sample A scored lower than sample B where this revealed that the panelists' overall acceptability for sample B

was higher than sample A. This might be because of the flavour of sample B was better than sample A. Flavour was the combined senses of taste and aroma [24]. Although mean score on taste for both of the samples were quite low, but mean score on aroma for sample B was higher than sample A. Hence, this could possibly affect the panelists' overall acceptability on sample B.

Table 2: Sensory Evaluation Results[a]

Sensory Attribute	Sample A[b]	Sample B[c]
Colour[d]	3.76 ± 0.926	6.20 ± 0.866
Aroma[d]	3.56 ± 1.261	5.40 ± 1.000
Taste[e]	3.32 ± 1.651	3.08 ± 1.801
Aftertaste[e]	3.52 ± 1.503	3.20 ± 1.683
Overall Acceptability[e]	3.76 ± 1.091	3.84 ± 1.091

[a]The test was marked on 7-point hedonic scale where 7 (like very much), 6 (like moderately), 5 (like slightly), 4 (neither like nor dislike), 3 (dislike slightly), 2 (dislike moderately) and 1 (dislike very much).

[b]Sample A = Herbal tea made of Daun Rerama (*Christia vespertillonis*), Kaduk (*Piper sarmentosum*) and Stevia (*Stevia rebaudiana*).

[c]Sample B = Commercialized tea.

[d]The results from ANOVA showed that the parameter had significant difference between the two samples (P < 0.05).

[e]The results from ANOVA showed that the parameter had no significant difference between the two samples (P > 0.05).

Sensory Shelf Life Test

Table 3 showed sensory shelf life test results of sample A and sample B. The evaluation was marked on 7-point hedonic scale where 7 (like very much), 6 (like moderately), 5 (like slightly), 4 (neither like nor dislike), 3 (dislike slightly), 2 (dislike moderately) and 1 (dislike very much). Sample A was herbal tea made of Daun Rerama (*Christia vespertillonis*), Kaduk (*Piper sarmentosum*) and Stevia (*Stevia rebaudiana*) that had been stored for three months while sample B was herbal tea freshly made of the same ingredients. There were five sensory attributes that had been measured, which were colour, aroma, taste, aftertaste and overall acceptability.

First of all, mean score for sample A on all the sensory attributes that had been measured which were colour, aroma, taste, aftertaste and overall acceptability was 3.88 ± 1.054, 3.48 ± 1.194, 3.44 ± 1.635, 3.48 ± 1.418 and 3.76 ±1.589 respectively. As could be seen, all of the mean scores were in the dislike slightly range. Meanwhile, mean score for sample B on all the sensory attributes that had been measured which were colour, aroma, taste, aftertaste and overall acceptability was 3.76 ± 0.926, 3.56 ± 1.261, 3.32 ± 1.651, 3.52 ± 1.503 and 3.76 ± 1.091 respectively. In the same way as sample A, all of the mean scores were in the dislike slightly range. Moreover, results from ANOVA showed that there was no significant difference between the two samples in all of the sensory attributes. This revealed that, despite of low mean score on each sensory attributes, the acceptance of the herbal tea after three months period of storage was the same as the herbal tea that was freshly made.

For the purpose to ensure the results obtained from sensory shelf life test were as accurate as possible, the samples were stored using product's final packaging. Packaging was an important factor in extending shelf life where it could reduce product deterioration attributable to abiotic spoilage. Abiotic spoilage was defined as physical or chemical changes occurred due to factors such as temperature, moisture, oxygen, light and volatile matter altering odour and flavour

[25]. Main deterioration mechanisms that usually occurred in herbal tea products were volatile loss and absorption where the resulting changes would be flavour loss and off-flavour respectively. In the final analysis, based on the results obtained from sensory shelf life test, it could be concluded that the packaging used played its role effectively to prevent volatile loss from samples as well as volatile absorption from surrounding into the samples. The packaging used also had contributing role in reducing product deterioration from other abiotic factors.

Table 3: Sensory Shelf Life Test Results[a]

Sensory Attribute	Sample A[b]	Sample B[c]
Colour[d]	3.88 ± 1.054	3.76 ± 0.926
Aroma[d]	3.48 ± 1.194	3.56 ± 1.261
Taste[d]	3.44 ± 1.635	3.32 ± 1.651
Aftertaste[d]	3.48 ± 1.418	3.52 ± 1.503
Overall Acceptability[d]	3.76 ±1.589	3.76 ± 1.091

[a]The test was marked on 7-point hedonic scale where 7 (like very much), 6 (like moderately), 5 (like slightly), 4 (neither like nor dislike), 3 (dislike slightly), 2 (dislike moderately) and 1 (dislike very much).

[b]Sample A = Herbal tea made of Daun Rerama (*Christia vespertillonis*), Kaduk (*Piper sarmentosum*) and Stevia (*Stevia rebaudiana*) that had been stored for three months.

[c]Sample B = Herbal tea freshly made of Daun Rerama (*Christia vespertillonis*), Kaduk (*Piper sarmentosum*) and Stevia (*Stevia rebaudiana*).

[d]The results from ANOVA showed that the parameter had no significant difference between the two samples (*P* > 0.05).

4. CONCLUSION

Upon the development of the herbal tea, after a few trials and optimization, the best ratio for the combination of the herbals was identified where the chosen ratio for weigh of Daun Rerama (*Christia vespertillonis*), Kaduk (*Piper sarmentosum*) and Stevia (*Stevia rebaudiana*) was 1:2:1 g in each teabag. However, even though the best formulation of the herbal tea had been used in sensory evaluation, all mean scores for each sensory attributes for the herbal tea were quite low where this revealed that the acceptance of the herbal tea quite low compared to commercialized tea. Last but not least, in sensory shelf life test, despite of low mean score on each sensory attributes, the acceptance of the herbal tea after three months period of storage was the same as the herbal tea that was freshly made.

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