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SENSORY EVALUATION, PHYSICOCHEMICAL AND ANTIOXIDANT ANALYSIS OF TINUKTUK DRINK, A HERBAL-BASED DRINK ORIGINATED FROM SIMALUNGUN, INDONESIA: PRELIMINARY STUDY

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ABSTRACT

Tinuktuk is a traditional Simalungun food, consisting of herbs and spices, that has been consumed for generations. Traditionally, it is believed to prevent disease. Lifestyle changes, especially after the pandemic, have driven the functional beverage market. Functional beverage innovation by elevating plant-based, natural, and sustainable local culture is important. This study evaluated the antioxidant activity of dried tinuktuk powder and obtained the most preferred tinuktuk-based beverage formulas (TDs) based on sensory acceptance, comparing brewing techniques using tea bags and teapots. Tinuktuk powder has a variable 2,2-diphenyl-1-picrylhydrazyl (DPPH) antioxidant in the range of 13 - 45% lower inhibition compared to vitamin C (75%). Infusion of tinuktuk powder with a ratio of 10% (b/v) showed the most acceptable compared to 4 and 7%. The results of the study showed that TDs had a pH ranging from 4.2 - 4.8. The pH in this study may be appropriate to maintain the bioactivity of phenolic compounds in the formulated beverage. The total dissolved solids at 3.2 - 4 °Brix which may be influenced by the ingredients used. The formula with the highest antioxidant activity (45%) was also in an acceptable score for hedonic sensory properties, including colour, aroma, appearance, and taste in the range between 3.3 – 3.7 ('like' – 'very like'). The results of the study show the potential of tinuktuk-based drinks as a source of antioxidants with good sensory properties. The brewing technique using tea bags or teapots in this study showed better antioxidant capacity when using teapots. This shows that antioxidant extraction is better using teapots. Thus, the selection of the right brewing method and brewing time can improve the quality and acceptance of the drink. The relationship between brewing methods and their influence on viscosity and flavor perception has also been reported recently. These findings demonstrate the importance of how functional beverages are prepared, which may guide future research aimed at improving the functional properties of herbal drinks.

Key words: Functional beverages, Functional food development, Herbal-based drinks, Traditional beverages

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INTRODUCTION

Indonesian cuisine is very closely with the use of herbs and spices. Herbs- and spices-based tea is mainly designed as infused tea-like beverages and it is believed to be beneficial in disease prevention and intervention [1]. Traditionally, this type of beverage is called 'jamu' [2]. Herbal-based beverages can vary in ingredients depending on the traditional culture, region and religion. Several studies have reported the health benefits of herbal-based drinks originated from Indonesia as presented recently [1]. To mention a few, instant herbal drinks [3], functional drinks of turmeric extracts, cloves and cinnamon [4], as well as a mixture of java tea, sappan wood, ginger, turmeric and different types of lime in a formulated beverage [5]. Herbs have been well known for their biological properties, mainly due to their high content of bioactive compounds which are then available in the formulated beverages. The main bioactive compounds of herbal drinks are polyphenols, including phenolic acids and flavonoids. Those bioactive compounds are responsible for the biological properties of herbal-based traditional drinks [6 - 11]. Tinuktuk, is one of the examples of traditional heritage in Indonesia, belonging to Simalungun tribes in Sumatera Utara. Tinuktuk is a mixture of various herbs and spices and has been used as a beverage since ancestry. Tinuktuk mainly consist of red ginger, onion, garlic, aromatic ginger, black pepper, candlenut, torch ginger, salt, sichuan pepper, lime sour and various other spices. Those herbs are milled and mixed to form a viscous sauce and used as ready-to-use ingredients for foods and/or drinks. In beverage formulation, this ingredient is considered as a type of jamu. Tinuktuk as an infused beverage has been consumed since the ancestry of the Simalungun tribe and it is believed that tinuktuk drinks contribute to physical health. However, the scientific proof of this belief is very scarce although it is generally accepted that herb-based drinks benefit human health and fitness. Recently, three different tinuktuk drinks were formulated for bioactive compounds identification [12]. The study showed that different tinuktuks contained different levels of flavonoids, phenolic compounds, alkaloids and saponins.

Lifestyle changes especially after COVID-19 pandemic have driven the functional beverage market [13,14]. In different regions of Asia, Africa, Europe and the Americas, consumers are looking for products that offer additional health benefits [15,16]. This shift has shaped consumer preferences for herbal drinks and forced producers to innovate by elevating the nuances of local culture based on plants, natural-based and sustainable ingredients [17,18]. Currently in Indonesia the café industry is growing rapidly, this reflects the growth of consumer preferences for convenience and variety of drinks [19]. The increasing demand on ready-to-drink has been reported in Indonesia [20], delivery platforms accommodate a mobile

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urban lifestyle. Harmonizing ingredient formulation and product innovation remains a challenge in providing herbal drinks to the community.

As mentioned above, the study on tinuktuk-based drinks (TDs) has never been reported, although the bioactive compounds of tinuktuk have been evaluated [12]. The presence of flavonoids, phenolics, alkaloids and saponins in the formulated tinuktuk powders may contribute to its antioxidant properties. This study aimed to investigate the antioxidant capability and hedonic sensory acceptability of TDs. It was hypothesized that the long traditional consumption of tinuktuk in the Simalungun region might have contributed to the health benefits shown by antioxidant capability. The study was carried out on three different TDs, demonstrating the various formulatons traditionally prepared by the local community.

MATERIALS AND METHODS

Study Design

Materials

Red ginger, garlic, shallot, aromatic ginger, candlenut, piper ningrum, torch ginger, salt, sichuan pepper, lime sour, java tumeric, tumeric, lemongrass, galangal, clove, and rice, were purchased from a traditional market in Lubuk Pakam, Sumatera Utara, Indonesia. DPPH (1,1-diphenyl-2-picrylhydrazyl) was purchased from Sigma, and other chemicals used were analytical grade.

Experimental design

A total of 3 formulations of tinuktuk powders were prepared as presented in Table 1. Firstly, the DPPH antioxidant activity of the dried powder was assessed. After that, hedonic sensory evaluation was done at three different concentrations (4, 7 and 10%; w/v) of each formulated powder. The highest acceptability was tested for pH, viscosity and total soluble solid (TSS). After that, the best antioxidant formulation, namely formulation B, was evaluated for their sensory acceptability by different brewing techniques and brewing times using tea bags and brewing teapots. Physicochemical tests were carried out for the drink and antioxidant tests.

Preparation of ingredients and tinuktuk mixtures

The preparation of the ingredients and tinuktuk mixtures were carried out following the conventional steps conducted by the local community in Simalungun as reported in previous studies [12, 23]. Black pepper was roasted for 8 min at 80°C, candlenut and cloves were separately roasted for 4 min at 80°C. This time and temperature were set to reach the roasting quality standard as practised by the local community in Simalungun. The selected amount of torch ginger and lime was separately crushed and pressed to obtain liquid extracts. This preparation was carried out manually using daily kitchen utensils. Other ingredients were used freshly. Each of

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the ingredients were separately ground and mixed properly. After all ingredients were mixed (as listed in Table 1), lime juice was added. After that, the mixture was dried using a cabinet dryer at 50 °C for 10 h. The dried mixture was then milled using a blender (Philips) and sieved to pass 80-mesh sieving. The sieved tinuktuk was stored in a controlled temperature (24 °C) and ready for TDs preparation. Three different tinuktuk powder were obtained as presented in Table 1.

Antioxidant DPPH activity of formulated tinuktuk powders

The DPPH (2,2-diphenyl-1-picrylhydrazyl) antioxidant analysis was carried out following procedures described previously with some modifications [21]. The stock DPPH solution (0.24 g/L) was diluted with methanol to produce several DPPH solutions with an absorbance of 1.1 ± 0.02 at 515 nm. In the test tube, 2.85 mL of DPPH working solution was combined with 0.15 mL of tinuktuk herbal drink extract. The mixture was then left at room temperature in a dark room for 15 minutes. The absorbance of the solutions was measured at 515 nm wavelength using a spectrophotometer (V-630, Jasco, Jepang). The absorbance of methanol and DPPH solution without TDs was also measured as a blank. The following formula calculates radical scavenger activity:

% Inhibition = [(Ab − Ae)/Ab] × 100

Where Ab is blank absorbance, and Ae is the sample absorbance.

Preparation of beverages for sensory evaluation

To obtain TDs, tinuktuk powder was brewed in water at 80-90°C following the traditional practice by the local community, with an infusion time of 10 minutes and stirring 2 times as proposed in previous research for tea infusion [22]. For tea bag, 10 g of tinuktuk powder was packed into a tea bag and then infused for 10 min; for tea pot, the 10 g of tinuktuk powder was added into the tea pot manually followed by the addition of water. For sensory assessment, three different concentrations (4, 7, and 10%; w/v) were used for each formulation. After brewing, TDs were evaluated for sensory analysis.

Hedonic sensory evaluation of beverages

A total of 104 panelists with ages ranging from 19 – 25 years voluntarily participated from the Department of Nutrition, Medan Health. Prospective panellists were selected and asked for their willingness to take part in a sensory evaluation after being informed about their rights and privacy. There was no compulsion to participate, and participants could withdraw at any time. Before the sensory evaluation, the panellists were briefed on this sensory evaluation but were not informed about the details of the product.

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The sensory analysis was done on three different concentrations of each three different formulated powders. Therefore, a total of nine samples were tested with three replicates. Using the Excel program, random numbers were arranged to obtain 27 random group numbers containing 3 numbers each. Every time a sensory evaluation was performed, a functional drink was brewed. The TDs (10 cc) were provided in sloki labelled glasses, according to the layout. Each panellist was given a form containing the panellist's identity and organoleptic test instructions as well as assessment criteria including colour, aroma, appearance and taste. The rating was expressed on a hedonic scale with the following criteria: very much like (5), really like (4), like (3), less liked (2), and dislike (1). To prevent bias, the panellists were given mineral water to gargle after each sample assessment.

Determination of pH, TSSs and viscosity of selected beverages

The highest hedonic sensory acceptability was examined for pH and TSS. The pH was measured using a pH meter (Mediatech, Indonesia). Viscosity was measured using an Ostwald viscometer. The TSS was performed using a hand refractometer (0-30 0brix) (Mettler Toledo, Indonesia).

Statistical analysis

The data were presented descriptively, and the sensory evaluation data was analyzed using the Statistical Package for Social Sciences (SPSS) version 24 program. A homogeneity test was carried out, followed by a one-way variance analysis (ANOVA) test, with a confidence level of 95%. To determine the difference between samples, the Duncans Multiple Range Test (DMRT) was used.

RESULTS AND DISCUSSION

Yield and visual appearance of formulated tinuktuk powder

The ingredients used for three different formulations and the obtained powders are presented in Figure 1a and 1b, respectively. Although no color measurement was done, powder B was clearly lighter than A and C, from the visual observation. The colour of formula A dried tinuktuk was light brown, while formula C was dark brown. On the other hand, formula B showed more yellowish and lighter appearance than that of powder A and C. Most likely, black pepper and turmerics were responsible for the modification in color of the tinuktuk powders. Powder C contained a higher amount of black peppers and turmeric thus generating a darker powder. The difference in yellowish color observed in powder A and B might be due to the different turmeric used. Variation in tinuktuk visual appearance occurred due to the difference in ingredients composition. Practically in Simalungun culture, this variation is a common phenomenon as has been reported recently [23]. It was observed that in three main regions in Simalungun, there are six local producers who have their own ingredients and thus contribute to variation in physical appearance. From the yield

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perspective, all formulas generated the same level of powder yield, which ranged from 41.3 – 41.9%.

(a)

(b)

Figure 1: Tinuktuk ingredients (a), and tinuktuk powders (b)

Antioxidant activity DPPH of tinuktuk powder

The DPPH antioxidant activity of formulated tinuktuk powders are presented in Figure 2. The results showed that tinuktuk B had a higher inhibition percentage compared to that of A and C. These results might be due to the different ingredients used. Tinuktuk B had 45% inhibition against DPPH while A and C had 16.5% and 14%, respectively. Formula B contained a higher amount of red ginger, onion, garlic, and other ingredients (Table 1). Those ingredients contain bioactive compounds which are responsible for various antioxidant activities. For instance, ginger has been reported for containing bioactive compounds such as gingerol, shogaol and zingerone [24-26], onions have pharmacological compounds [27], and garlic contains allicin, ajoene and other organosulfur constituents such as S-allyl-L-cysteine [28]. By this, the presence of red ginger, onion, and garlic might have given a higher contribution to the DPPH antioxidant capacity. Compared to DPPH activity in Vitamin C, all the samples had a lower antioxidant activity. Vitamin C contained 74.98% inhibition while the tinuktuk powder had at a range of 13.9 – 44.9%. Although it was lower than vitamin C, this result showed that the formulated powder possessed

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antioxidant capability as a beverage ingredient. Vitamin C is a pure substance which cannot be consumed as a food or beverage. The formulated powder is a traditional-herbal based ingredient which has been consumed as a food. In assessing antioxidant activity of herbal-based drinks, a comparison is often made to that of pure standard compounds such as Vit. C or Vit. E. A lower antioxidant activity of formulated herbal-based beverages compared to that of Vit. E was also identified [5].

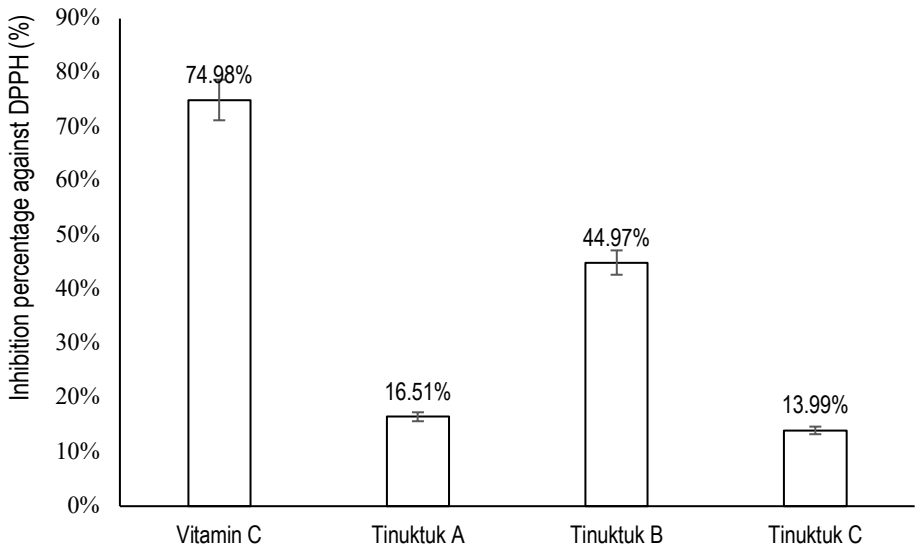

Figure 2: Antioxidant activity of tinuktuk powders

The antioxidant capacity of the tinuktuk powders is due to the bioactive compounds present in respective ingredients used in the formulation. Although no bioactive compounds identification was carried out in the current study, it is widely accepted that those ingredients used contain bioactive compounds as listed in Supplementary Table 1. The presence of bioactive compounds in each ingredient and their biological properties are responsible for the presence of flavonoids, phenolics, alkaloids and saponins in the tinuktuk powders, as reported previously [12]. The formulated tinuktuk powders contain flavonoids at a range of 4.6 – 5.1 mg QE/g extract, phenolics at 19 – 23 mg GAE/g extract, alkaloids at 31.5 – 34.1%, and saponins at 0.94 – 1.4% [12]. The variability of these compounds affected its antioxidant activity as observed in the current study. Further investigation in other antioxidant parameters need to be explored to understand the mechanism of action of the tinuktuk powder as an antioxidant source. Tinuktuk is formulated for various purposes including herbal drink and/or cuisine in local diets. Although challenging, the investigation on other types of foods should be carried out in the near future. The current study, which is a preliminary investigation, opens future research possibilities, including detailed bioactive compositions and other bioactivity in vivo or in vitro.

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Sensory acceptability of formulated beverages

Sensory hedonic acceptability of nine beverages were examined on color, aroma, appearance, and taste for three different infusion concentrations (4, 7 and 10%) and the results are shown in Table 2. The visual appearance of the TDs at different concentrations for sensory assessment are presented in Figure 3. In general, the most acceptable properties for colour, aroma, appearance and taste were obtained with the concentration of 10%. The results showed that beverage B and C had a significant ($p<0.05$) higher color acceptability compared to that of beverage A, regardless of the concentration level. The higher concentration received a higher color acceptability for beverages A and B. Color perception of the beverages seemed highly related to the ratio of ingredients used. As mentioned previously, there were different amounts particularly in turmeric and black pepper added. The combination of dark color from black pepper and yellowish from turmeric in beverage C generated a dark-brown solution which might have tea-like appearance. Thus, it induced the tea-like feeling. This can be aligned with the evaluation on appearance score. The highest acceptability of appearance was observed in beverages C, while the lowest acceptability (significant at $p<0.05$) was observed in beverages A.

The color and appearance acceptability for beverages B and C ranged from 3.6 – 3.8 which described 'like' – 'really like'; while beverage A had a range of 2.7 – 3.2 which described 'less liked' – 'like'. The aroma of all formulated beverages was acceptable, ranging at 3.1 – 3.5 which depicted 'like' – 'very like'. Similar to color and appearance, most of the highest acceptability was perceived in 10% infusion. The same result was also observed for taste acceptability. The result showed that only beverage A with 4% infusion gave the lowest acceptability, (2.8) described as 'less like' – 'like'. The other formulated beverages had scores at a range of 3.0 – 3.4 demonstrating the 'like' category.

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(a)

(b)

(c)

Figure 3: Visual appearance of tinuktuk-based drinks: formula A (a), formula B (b), and formula C (c) at different concentration of assessment at 4% (left), 7% (middle) and 10% (right side)

The taste of herbal-based beverages can be challenging due to the presence of phenolic compounds which have a bitter taste. Tinuktuk has a unique characteristic due to its composition. According to Malongane [29], combining sensory and chemical analysis can provide more insight into the characteristics of the product. Identifiable sensory qualities (colour, taste, residual flavour, and overall) and studies on fitness and antioxidants will help improve consumer satisfaction and stimulate the

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development of new products. In order to improve the acceptability of tinuktuk drinks to a higher level, modification in ingredients can be carried out, particularly the addition of exotic unique ingredients. Another possible way is masking the undesirable odor and color by nanoencapsulation process as previously conducted [5]. Therefore, future work in improving the acceptability still can be expected.

TSS, pH and viscosity of selected beverages

The TSS, pH and viscosity of the selected beverages (beverages with 10% infusion) were evaluated and the results are presented in Table 3. The results showed that there was significant difference ($p<0.05$) in pH of the beverages which ranged from 4.2 – 4.8. The highest pH was given by formula B (pH 4.8) and the lowest pH was given by formula A (pH 4.2). The difference in pH might be due to the different amountsof lime added in the formulation. In addition to that, the presence of phenolic acids might contribute to the pH of the beverages. Many studies state that phenolic components are more effective in lowering pH, and the structure of hydroxyl clusters plays an important role in helping to maintain antioxidant activity. However, if the pH of herbal drinks is less than 5.5, they should be labelled and it is recommended to gargle after drinking [30]. In other words, the pH in the current study might have been suitable in maintaining the bioactivity of the phenolic compounds in the formulated beverages.

The highest TSS was obtained in formula C, which was 4.0 0Brix. Compared to other studies, this obtained value is considerably lower. The TSS of beverages could increase gradually in certain periods of time, depending on its ingredients. Some plant materials including herbs and spices could increase the TSS such as turmeric [31], rosella [21], and Curcuma Zedoaria Roscoe [32].

The impact of brewing and infusion on the selected formula

Antioxidant activity DPPH

The selected TDs formula was then further investigated for their antioxidant capability by different brewing and time infusions. As shown in Figure 4, TDs brewed with teapots had a higher antioxidant capability compared to that of tea bags. This phenomenon shows that the brewing methods affected the migration of the bioactive compounds from the tea matrix into the water, although the particle size and brewing temperature were at the same level in all brewing methods. The results showed that brewing using teapots had a better performance in dissolving the bioactive compounds into the water [Figure 5]. Brewing and infusion are two important factors in order to optimize the health benefits of tea [33] . In tea brewing techniques, several factors need to be taken into consideration such as temperature and time [33-34]. Several studies have shown the significant difference between tea bags and tea pots in bioactive extraction from tea. By this, the formulated TDs in the current study

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enhanced the formulated TDs from the sensory point of view and also from the biological properties. Similar investigations have been carried out recently to optimize the performance and acceptability of formulated tea [36-38].

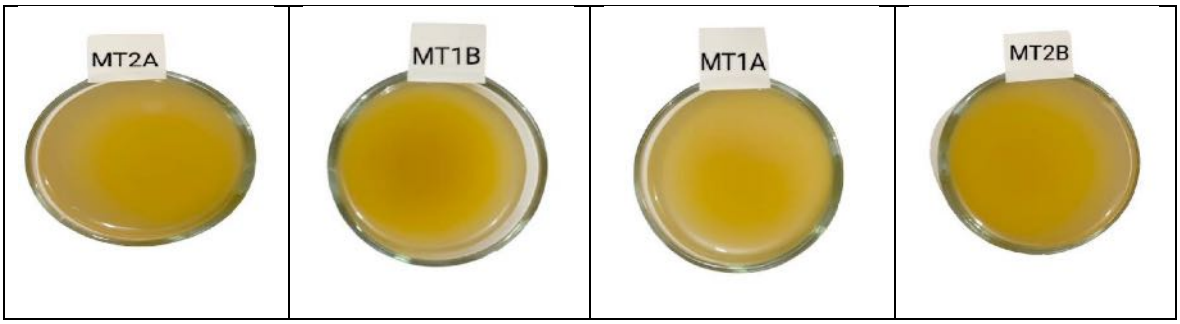

Figure 4: Visual appearance of tinuktuk-based drinks: MT1A: TDs, Tea bags 10 Minutes, MT1A: TDs, Tea bags 15 Minutes, MT2A: TDs, brewing teapots 10 Minutes, MT2B: TDs, brewing teapots15 Minutes

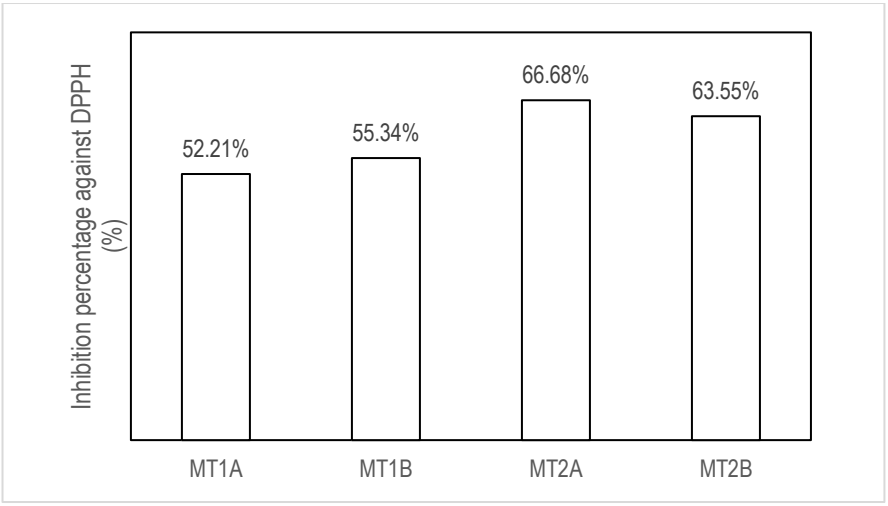

Figure 5: Antioxidant activity of tinuktuk drinks (TDs) with different brewing methods and times

TSS, pH and viscosity

The results showed that brewing using tea bags and tea pots had a lower TSS value, higher pH, and lower viscosity compared to that of direct immersion into the brewing water, as shown in Table 3 and 4. The lower TSS value might be due to incomplete dilution of sugar into the water, thus increasing the pH. A higher pH and lower viscosity might increase the sensory acceptability of the formulated TDs. By this, selecting a proper brewing method and time infusion could enhance the quality and acceptability of the drinks. The relation between brewing methods in affecting the viscosity and taste perception has also been reported recently [39-41].

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CONCLUSION AND RECOMMENDATIONS FOR DEVELOPMENT

The study presented the preliminary results of Tinuktuk powder, a herbal-based ingredient from the Simalungun tribe, had an acceptable hedonic sensory and showed antioxidant capacity against DPPH. The brewing technique using tea bags or teapots in this study showed a better antioxidant capacity using teapots. Modification in ingredient amounts and types can modulate the acceptability and antioxidant activity. Future investigation on other in vitro antioxidant parameters, chemical composition, toxicity test, and in vivo evaluation for understanding its mechanism in managing non-communicable diseases is seemingly important. In addition, a deeper consumer preference study is needed for the commercialization purpose of the products.

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Ethical statement

Ethical approval for hedonic sensory analysis is not required by national laws. It is confirmed that the appropriate protocols for protecting the rights and privacy of all participants were utilized during the execution of the research, for example no coercion to participate, full disclosure of study requirements and risks, written or verbal consent of participants, no release of participant data without their knowledge, ability to withdraw from the study at any time. No vulnerable populations (children, individuals with diminished physical or intellectual capacity, the socially or economically vulnerable or institutionalized individuals) were used in the research.

Author Contributions

Conceptualization, N.T, E.J and J.S; methodology, N.T, E.J and H.S. Formal analysis and writing—original draft preparation, N.T and E.J, data cleaning and management, visualization and validation, N.T, E.J, J.S and H.S.; writing—review and supervision, N.T and E.J. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare that they have no conflict of interest.

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Table 1: Composition of tinuktuk formulation

No	Ingredient	Formula A(g)	Formula B (g)	Formula C (g)
1	Torch ginger	150	150	150
2	Red ginger	100	100	50
3	Aromatic ginger	50	50	50
4	Galangal	25	25	-
5	Garlic	50	100	100
6	Shallot	50	100	100
7	Candle nut	50	50	50
8	Piper ningrum	50	50	100
9	Sichuan Pepper	50	50	50
10	Lime sour	-	150	150
11	Java Tumeric	25	-	25
12	Tumeric	-	25	25
13	Lemongrass	50	-	-
14	Clove	8	-	-
15	Rice	50	-	-
16	Salt	12	25	25

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Table 2: Sensory acceptability of tinuktuk-based drinks at different concentrations

Tinuktuk drinks		Hedonic sensory parameters			
Tinuktuk powder	Concentration (%)	Colour	Aroma	Appearance	Taste
A	4	2.65 ± 0.62^{a}	3.06 ± 0.72^{b}	2.73 ± 0.65^{b}	2.79 ± 0.66^{a}
	7	3.13 ± 0.68^{b}	3.26 ± 0.67^{b}	3.20 ± 0.71^{b}	3.01 ± 0.72^{a}
	10	2.93 ± 0.72^{b}	3.49 ± ±0.66^{b}	2.96 ± 0.78^{b}	3.12 ± 0.76^{b}
B	4	3.60 ± 0.61^{d}	3.45 ± 0.72^{a}	3.52 ± 0.67^{a}	3.12 ± 0.83^{b}
	7	3.68 ± 0.69^{e}	3.53 ± 0.74^{b}	3.55 ± 0.67^{a}	3.23 ± 0.77^{b}
	10	3.68 ± 0.69^{e}	3.32 ± 0.65^{a}	3.60 ± 0.68^{a}	3.36 ± 0.77^{a}
C	4	3.73 ± 0.68^{e}	3.37 ± 0.70^{a}	3.72 ± 0.61^{b}	3.02 ± 0.71^{a}
	7	3.57 ± 0.67^{c}	3.36 ± 0.75^{a}	3.48 ± 0.67^{b}	3.23 ± 0.71^{b}
	10	3.83 ± 0.73^{f}	3.52 ± 0.67^{b}	3.75 ± 0.76^{b}	3.26 ± 0.73^{b}

Note: Numbers followed by different superscript letters in the same column show a noticeable difference in values ($p<0.05$). post hoc (DMRT) of the ANOVA test. The hedonic test is measured from 1-5 (dislike. dislike. like. somewhat like. very. very like) for all parameters.

Table 3: The TSS and pH, of tinuktuk-based drinks at 10% concentration

Parameters	Tinuktuk-based drinks		
	A	B	C
pH	4.22 ± 0.01^{a}	4.82 ± 0.00^{b}	4.65 ± 0.01^{ab}
Viscosity (cP)	1,59 ± 0,01	1,57 ± 0,02	1,57 ± 0,02
Total Dissolution (^{0}Brix)	3.6 ± 0.05^{b}	3.2 ± 0.05^{c}	4.0 ± 0.10^{a}

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Table 4: The TSS and pH of tinuktuk-based drinks with different brewing methods and times

Parameters	MT1A	MT1B	MT2A	MT2B
pH	5.22 ± 0.05	5.30 ± 0.05	5.22 ± 0.05	5.78 ± 0.05
Viskosity (cP)	1.29 ± 0.02	1.30 ± 0.01	1.31 ± 0.01	1.42 ± 0.01
Total padatan terlarut (°Brix)	1.80 ± 0.00	1.85 ± 0.00	1.80 ± 0.00	2.25 ± 0.00

MT1A : TDs, Tea bags 10 Minutes
MT1A : TDs, Tea bags 15 Minutes
MT2A : TDs, brewing kettle 10 Minutes
MT2B : TDs, brewing kettle15 Minutes

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