Utilization of noni fruit (*Morinda citrifolia L*) and green tea (*Camellia sinensis*) on herbal tea drinks for diabetes mellitus

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ABSTRAK

Latar Belakang: Teh herbal merupakan salah satu produk minuman campuran teh dan tanaman herbal yang memiliki khasiat dalam membantu pengobatan suatu penyakit. Teh herbal umumnya campuran dari beberapa bahan yang biasa disebut infusi/tisane. Infusi/tisane terbuat dari kombinasi daun kering, biji, kayu, buah, bunga dan tanaman lain yang memiliki manfaat.

Tujuan: Penelitian ini bertujuan untuk mengetahui perbedaan karakteristik inderawi, mutu dan kandungan aktivitas antioksidan, serta penerimaan masyarakat terhadap produk teh herbal.

Metode: Desain penelitian ini adalah true eksperimental design yang diambil secara acak di Kota/ kabupaten Bekasi. Jumlah sampel yang digunakan adalah 35 panelis dengan menggunakan kuesioner hedonik (kesukaan) dan organoleptik. Teh herbal diformulasikan dalam bentuk konsentrasi yaitu F1 (buah mengkudu kering 0,4 gr, teh hijau 1,6 gr, stevia 1 gr), F2 (buah mengkudu kering 0,7 gr, teh hijau 1,3 gr, stevia 1 gr), dan F3 (buah mengkudu kering 1 gr, teh hijau 1 gr, stevia 1 gr). Perbedaan antara formula dianalisis menggunakan Kruskal Wallis dan dilanjutkan dengan menggunakan Mann Whitney dan daya terima diuji oleh pengukuran aktivitas antioksidan menggunakan DPPH.

Hasil: Hasil menunjukkan bahwa analisis perbedaan kualitas teh herbal indikator rasa menunjukkan ada perbedaan F1 dengan F2 dan F1 dengan F3 dari hasil uji statistik didapatkan nilai p< 0,05. Uji aktivitas antioksidan pada teh herbal paling tinggi yaitu F2 sebesar 33,6%. Kualitas teh herbal tidak sesuai dengan SNI dengan kadar air >8%, sedangkan kadar abu sesuai dengan SNI sebesar <8%. Daya terima pada teh herbal paling banyak memilih F2.

Kesimpulan: Teh herbal yang terdiri dari buah mengkudu, teh hijau dan daun stevia dapat di terima oleh masyarakat.

KATA KUNCI: aktivitas antioksidan; buah mengkudu; teh herbal; teh hijau

ABSTRACT

Background: Herbal tea is one of the products of mixed tea and herbal plants that have the efficacy in helping the treatment of a disease. Herbal tea is generally a mixture of some ingredients commonly called infusion/Tisane. Infusion/Tisane is made from a combination of dried leaves, seeds, wood, fruit, flowers and other plants that have benefits.

Objectives: The research aims to determine the difference in the characteristics of the sensing, quality and content of antioxidant activity, as well as the public acceptance of herbal tea products

Methods: The design of this research is True experimental design taken randomly in the city/Regency of Bekasi. The number of samples used are 35 panelists with a hedonic (favorite) and organoleptic questionnaire. Herbal tea is formulated in the form of concentration F1 (dried noni fruit 0.4 gr, Green tea 1.6 gr, stevia 1 gr), F2 (dried noni fruit 0.7 gr, Green tea 1.3 gr, stevia 1 gr), and F3 (dried noni fruit 1 gr, green tea 1 gr, stevia 1 gr. Differences between formulas are analyzed using Kruskal-Wallis and in continued with Mann-Whitney, while the receiving power is tested by calculating the score. Measurement of antioxidant activity using DPPH test.

Results: *Results showed that the quality difference analysis of herbal tea indicator flavor indicates there is a difference of F1 with F2 and F1 with the F3 of the statistical test results obtained the value P < 0.05. Test the antioxidant activity in the highest herbal tea is F2 by 33.6%. The quality of herbal tea is not in accordance with SNI with water content > 8%, while ash content corresponds to SNI of < 8%. Power Accept on herbal tea most select F2.*
Conclusions: *The herbal tea consisting of noni fruit, green tea and stevia leaves can be received by the community*

INTRODUCTION

Diabetes Mellitus is a serious chronic disease that occurs because the pancreas does not produce enough insulin (the hormone that regulates blood sugar or glucose), or when the body cannot effectively use the insulin it produces (1). Diabetes Mellitus is an important public health issue, being one of four priority uncontagious diseases targeted by world leaders (1). The criteria for diagnosis of Diabetes Mellitus glucose levels in the blood with a value of <126 mg/dl in a fasting state for a minimum of 8 hours, a value of <200 mg/dl in a fasting state 2 hours before the examination is declared high or suffering from Diabetes Mellitus. Globally, the WHO estimates that 442 million adults aged 18 lived with Diabetes Mellitus in 2014. The largest number of people suffering from Diabetes Mellitus are estimated to be from Southeast Asia and the Western Pacific, accounting for about half of the world's diabetes cases. Worldwide, the number of diabetics with Diabetes Mellitus has increased in 1980 and 2014, increasing from 108 million to 422 million (1).

The International Diabetes Federation (IDF) found 382 million people were living with diabetes worldwide in 2013. By 2035 that number is expected to increase to 592 million (2). The results of data (3), based on the diagnosis of doctors in the population (age > 15 years) compared to 2013 experienced an increase of 2%. Diabetes Mellitus prevalence based on the diagnosis of doctors and the lowest age of 15 years is found in NTT province, which is 0.9% while the highest prevelence in DKI Jakarta province is 3.4% for West Java province by 1.7 % (3,4). DM prevalence in Bekasi city based on doctor diagnosis and age >15 years by 2.7 % (5). In people with Diabetes Mellitus disease often complications from other diseases such as heart attack, stroke, severe leg infection and risk of amputation, as well as late-stage kidney failure.

One of the causes of Diabetes Mellitus is the wrong habits and diet. Generally people with diabetes mellitus are very fond of sugary foods and drinks (eating should be full regardless of the amount and type of food). Sugary and fatty foods and drinks are foods and drinks with a high energy density (35). One of the food ingredients that has functional properties to control blood glucose is noni fruit and green tea. The noni plant (Morinda citrifolia L.) received attention from the public due to empirical facts as well as scientific research evidence stating that the fruit is efficacious to treat some degenerative diseases such as cancer, tumors, and diabetes. Some types of drug-efficacious compounds that are already known in the fruit are antraquinone (cell rejuvenation), damnacanthal (a deterrent to the development of cancer cells), xeronin, proxeronin, and others (8). Some of the results of research on the fruit are obtained efficacy to increase endurance, recovery of the body's cells, lower blood pressure, eliminate headaches, stabilize blood sugar, anti-cancer, anti-inflammatory, anti-bacterial, antioxidant and anti-allergic (9).

Tea is the second most consumed drink in the world after water, which is about two-thirds of the world's population (6). Tea consumption began to become part of the lifestyle of Indonesians, along with a level of understanding and awareness about the back to nature movement as well as the tendency of people to consume substitution foods or drinks as a diet high in fat, cholesterol, and low in fiber. Green tea is one type of tea that does not go through the fermentation process. Based on the results of green tea research has a catechin content which is a compound of the polyphenol group. This compound is known to be effective in lowering the risk of cardiovascular disease, Diabetes Mellitus, weight loss, as antiinflammatory, antiviral and antibacterial (7).

The noni plant (Morinda citrifolia L.) received attention from the public due to empirical facts as well as scientific research evidence stating that the fruit is efficacious to treat some degenerative diseases such as cancer, tumors, and diabetes. Some types of drug-efficacious compounds that are already known in the fruit are antraquinone (cell rejuvenation), damnacanthal (a deterrent to the development of cancer cells), xeronin, proxeronin, and others (8). Some of the results of research on the fruit are obtained efficacy to increase endurance, recovery of the body's cells, lower blood pressure, eliminate headaches, stabilize blood sugar, anti-cancer, anti-inflammatory, anti-bacterial, antioxidant and anti-allergic (9).

Based on the similarity of efficacy between green tea and fruit, it is important to stabilize blood sugar. The research will make a mixed formula of both ingredients to be used as herbal teas. Herbal teas can be consumed as a practical healthy drink without disrupting daily routines and maintaining the health of bodies (10). Herbal tea as a functional food alternative that is expected to improve the taste of each ingredient used without reducing its efficacy.

Taking into account the above description, this research was conducted to find out how the effect of the addition of noni fruit on green tea in the manufacture of herbal tea drinks.

MATERIALS AND METHODS

This research is a quantitative study using the design of Complete Randomized Design (RAL) with 2 repetitions. The study measured all variables (free and bound) studied conducted at the same time and did not conduct further monitoring of research subjects. This research consists of 5 stages namely: 1) Manufacture of extracts 2) Beverage making 3) Calculation of antioxidants 4) Hedonic and Organoleptic test 5) Physical Test.

This research will be conducted at Labolatorium Vicma Lab Indonesian and Bekasi City/Regency held in March-July 2020, both from data retrieval, processing and interpretation. The study used primary data. The study consisted of free and bound variables and control variables. Where the free variables in this study are the addition of noni fruit and green tea and variables tied to this study are herbal tea drinks. Using 35 panelists from STIKes Mitra Keluarga students and the community with inclusion (like herbal tea drinks and willing to be panelists) and exclusion (not being sick).

The ingredients used to make herbal teas are dried noni fruit, green tea, and stevia leaves. The chemicals used are DPPH powder, and methanol. Equipment in making herbal teas are scales, measuring glasses, blenders, knives, plates. The tool analyzes the antioxidant activity of pumpkin measuring, test tubes, spatulas, beaker, multipipette, incubators, and spectrophotometers. Water content analysis tool using pumpkin measuring, test tube, spatula, beaker, multipipette, incubator, and spectrophotometer. Ash content analysis tools include furnaces, ovens, analytical balance sheets, desikators, porcelain cups, and tongs.

Making Herbal Tea

The stage of making herbal tea through the process of making fruit powder noni includes the fruit steamed washed and peeled, the fruit sliced or cut into small pieces and then dried with a black cloth covered, blended until smooth so that it becomes a noni fruit powder. The process of fertilization of

herbal tea drinks includes steaming fruit powder, green tea and stevia leaves wrapped with the paper, dipped in hot water as much as 200 ml, stirred until it turns reddish brown, herbal tea drink.

Table 1. The Composition of The Ingredients for Making Herbal Tea Drinks

Materials	Weight of Ingredients in Formula (grams)		
	F1	F2	F3
Dried noni fruit	0.4	0.7	1
Green tea	1.6	1.3	1
Dried stevia leaves	1	1	1
Total	3	3	3

Source: (11)

Antioxidant Activity Analysis Test

The testing of the sample activity is carried out the first manufacture of the sample solution by weighing the material 2 grams, then put in a cup measuring 75 ml, then simmer pure water and brewed with 70º C, pour into a cup that has contained the ingredients, cover and leave for the next 6 minutes the manufacture of dpph solution (0.5 mM), then weigh 9.8 mg of DPPH powder then dissolved with methanol up to 50 mL. After the manufacture of the sample solution was carried out a test of the antioxidant activity of radical catchers carried out by DPPH method according to (25) with modifications: as much as 0.5 ml of tea brew with concentration added into 2 ml of DPPH 0.1 mM, the mixture is then skoked and inkubasi at room temperature for 30 minutes in the dark then this solution is then measured absorbance at max 516 nm. The same treatment is also done for blanko solution (DPPH solution that does not contain test material) blanko solution consists of 2 ml DPPH 0.1 mM and 1 ml methanol p.a.

Water Content Analysis Test

The observed quality parameters are moisture content. Measuring water content is done by conditioning the oven at the temperature to be used until it reaches stable condition then heat the cup and cover it in the oven at 105±2 º C for approximately 1 hour and chill in the desikator for 20-30 minutes,

then weigh with the analytical balance sheet (W_o), then put 5 grams into the cup and weigh (W_1), heat the cup containing it in the oven at 105±2 º C for 3 hours, then transfer immediately into the desikator and chill for 20-30 minutes then weigh, then warm up for 1 hour has interval ≤ mg (W_2) after which count the water content (12).

Ash Content Analysis Test

Measuring ash levels is done by conditioning the oven at the temperature to be used until it reaches stable condition then heat the cup in the oven at 525±25º C for approximately 1 hour and chill in the desikator for 30 minutes, then weigh with the analytical balance sheet (W_o), then put 5 grams in the cup and weigh (W_1), then heat the cup containing it in the oven at a temperature of 105±2 º C until the H_2O is gone, then place the cup containing the sample in the furnace at a temperature of 525±25 º C until white ash is formed, add water to the ash, dry it in a water bath then continue on the electric heating then ash it back at 525±25º C until the time difference of 2 weighing does not exceed 1 mg, then transfer it immediately into the desikator and chill for 30 minutes then weigh (W_2) after which count the total ash content (12).

Sensory Test

Sensory tests are used to assess the acceptance rate and sensory level of panelists agains each herbal tea formulation. Hedonic and organoleptic tests were conducted by 35 untrained panelists by scaling on hedonic test forms and organoleptic tests with a value range of 1-5. The hedonic test is (1) very dislike (2) dislike (3) neutral (4) likes (5) very fond of the criteria of assessment of color, aroma and taste. Organoleptic test color criteria: (1) clear, (2) slightly yellowish, (3) yellow, (4) reddish yellow, and (5) brownish yellow, Aroma criteria: (1) very flavorful, (2) flavorful, (3) slightly flavorful, (4) unsweet, and (5) very unsweet, (4) very unsweet, taste criteria: (1) very bitter, (2) bitter, (3) somewhat bitter, (4) not bitter, and (5) very un bitter.

Data processing to be conducted for organoleptic tests is carried out data analysis using

validity and data reability tests. The data obtained tested the normality of Shapiro-wilk, the Kruskal-Wallis and Mann-Whitney tests used to analyze differences between groups. Data analysis is done with SPSS Statictics version 15.0. While the hedonic test data that has been collected is then tabulated using Microsoft Excel. This research has received ethics approval from Muhammadiyah University Health Research Ethics Commission Prof. Dr. Hamka with No. 03/20.03/04348

RESULTS AND DISCUSSION

Sensing Level

Sensing levels performed with orgaleptic tests included colors, aromas and flavors performed by 35 untrained panelists. Organoleptic testing on herbal tea drinks aims to see the effect of the addition of dried noni fruit and the addition of different green tea in the category of color, aroma and taste with the level of sensory whack.

Table 2. Analysis of Differences in Quality of Herbal Tea Addition of Noni Fruit, Green Tea and Stevia Leaves

Indicator	Median	Sig	Description
Color			
F1 (123)	4		
F2 (456)	4	0.344 > 0.05	No difference
F3 (897)	4		
Aroma			
F1 (123)	4		
F2 (456)	4	0.125 > 0.05	No difference
F3 (897)	4		
Taste			
F1 (123)	3		
F2 (456)	4	0.019 < 0.05	There is a difference
F3 (897)	4		

Description: *Kruskal-Wallis Test* * Significant p value <0.05

The results of the analysis of indicators of the color, aroma and taste of herbal teas show there are differences in the taste indicator with the median F1 is 3, while the median F2 and F3 are 4. There is

noticeable difference in median taste between the formulas. Statistical test results are obtained p value 0.019 so it can be concluded there is a significant noticeable difference between taste against F1, F2, and F3.

Table 3. Results of Analysis of Differences in Quality of Herbal Tea Addition of Noni Fruit, Green Tea and Stevia Leaves Color Indicators

Sample	Mean Rank Difference	Sig	Description
F1 (123) and F2 (456)	0.14	0.975 > 0.05	No difference
F1 (123) and F3 (897)	-5.8	0.203 > 0.05	No difference
F2 (456) and F3 (897)	-5.78	0.209 > 0.05	No difference

Description: *Mann-Whitney Test* * Significant p value <0.05

The results of the analysis on the color of herbal tea showed no difference in F1, F2, and F3 with statistical test results obtained a p value > 0.05 so it can be concluded there is no significant difference of F1 between F2, F1 between F3, and F2 between F3.

Table 4. Results of Analysis of Differences in Quality of Herbal Teas Addition of Noni Fruit, Green Tea and Stevia Leaves Aroma Indicators

Sample	Mean Rank Difference	Sig	Description
F1 (123) and F2 (456)	1.6	0.725 > 0.05	No difference
F1 (123) and F3 (897)	8.54	0.062 > 0.05	No difference
F2 (456) and F3 (897)	7.32	0.107 > 0.05	No difference

Description : *Mann-Whitney Test* * Significant p value <0.05

The results of the analysis on the aroma of herbal tea showed no difference in F1, F2, and F3 with statistical test results obtained a p value > 0.05 so it can be concluded there is no significant difference of F1 between F2, F1 between F3, and F2 between F3.

Table 5. Results of Analysis of Differences in Herbal Tea Quality Addition of Noni Fruit, Green Tea and Stevia Leaves Taste Indicators

Sample	Mean Rank Difference	Sig	Description
F1 (123) and F2 (456)	-12	0.008 < 0.05	There is a difference
F1 (123) and F3 (897)	-10.08	0.027 > 0.05	There is a difference
F2 (456) and F3 (897)	1.38	0.764 > 0.05	No difference

Description: *Mann-Whitney Test* * Significant p value <0.05

The results of analysis on the aroma of herbal tea showed there were differences in F1 (dried noni fruit 0.4 gr, green tea 1.6 gr, stevia 1 gr) with F2 (dried noni fruit 0.7 gr, green tea 1.3 gr, stevia 1 gr) and F1 (dried noni fruit 0.4 gr, green tea 1.6 gr, stevia 1 gr) with F3 (dried noni fruit 1 gr, green tea 1 gr, stevia 1 gr) with statistically obtained test results p value < 0.05 then can be concluded there is a significant difference.

Acceptance Rate

The acceptance rate was carried out with hedonic tests covering colors, aromas and flavors performed by 35 untrained panelists. Hedonic testing on herbal tea drinks aims to see the effect of the addition of dried noni fruit and the addition of different green the in the color, aroma and flavor categories with the level of reception of panelists. The results of the data obtained from the average score with qualitative descriptive methods in the form of questionnaires were conducted by 35 panelists by the community and nutrition students.

Table 6. Results of the Analysis of The Level of Acceptance of Community Panelists on Herbal Tea

Sample	Average Aspects			Total Percentage	Criteria
	Color	Aroma	Taste		
Formula 1(123)	3.86	3.94	3.80	77.33	Like
Formula 2(456)	3.74	3.60	3.43	71.81	Like
Formula 3(897)	3.97	3.86	3.80	77.52	Like

Source: Primary Data

The calculation of the level of public acceptance of herbal tea with the addition of noni fruit, green tea and stevia leaves from the color, aroma, and taste aspects of the highest favored herbal tea is F3 with a percentage of 77.52%. While the lowest preferred is F2 with a percentage of 71.81%.

Table 7. Results of Analysis of the Level of Acceptance of Nutrition Student Panelists on Herbal Tea

Sample	Average Aspects			Total Percentage	Criteria
	Color	Aroma	Taste		
Formula 1(123)	3.69	3.46	3.06	68.00	Like
Formula 2(456)	3.69	3.54	3.20	69.52	Like
Formula 3(897)	3.74	3.31	3.14	68.00	Like

Source: Primary Data

The calculation of the level of acceptance by nutrition students towards herbal tea with the addition of noni fruit, green tea and stevia leaves from aspects of color, aroma, and taste obtained the highest favored herbal tea is F2 with a percentage of 69.52%. While the lowest are F1 and F3 with a percentage of 68%.

Antioxidant Activity Test

The results of the above analysis showed that the highest antioxidants are in F2 (dried noni fruit 0.7 gr, green tea 1.3 gr, stevia 1 gr) at 3.36 gr/100gr, while the lowest antioxidant is in F1 (dried noni fruit 0.4 gr, green tea 1.6 gr, stevia 1 gr) at 1.6 gr/100gr.

Table 8. Results of Analysis Average Antioxidant Activity

Sample	Konst. EAC (gr/100 gr)
Formula 1 (123)	1.60
Formula 2 (456)	3.36
Formula 3 (897)	2.73

Source: Vicmalab Laboratory Results 2020

Water Content Test

Table 9. Results of Analysis Average Water Content

Sample	Water Content (%)
Formula 1 (123)	10.71
Formula 2 (456)	11.37
Formula 3 (897)	11.25

Source: Vicmalab Laboratory Results 2020

The results of the above analysis showed that the highest water content in F2 (dried noni fruit 0.7 gr, green tea 1.3 gr, stevia 1 gr) was 11.37%, while the lowest water content was in F1 (dried noni fruit 0.4 gr, green tea 1.6 gr, stevia 1 gr) by 10.71%.

Table 10. Results of Analysis Average Ash Levels

Sample	Ash Content (%)
Formula 1 (123)	6.68
Formula 2 (456)	6.60
Formula 3 (897)	7.03

Source: Vicmalab Laboratory Results 2020

The results of the above analysis showed that the highest ash content is in F3 (dried noni fruit 1 gr, green tea 1 gr, stevia 1 gr) is 7.03%, while the lowest water content is in F2 (dried noni fruit 0.7 gr, green tea 1.3 gr, stevia 1 gr) is 6.60%.

Color

Based on Mann-Whitney's analysis of the color of herbal tea drinks shows that there is no difference from each formula due to the color in herbal teas at each concentration does not differ 1 gr or more so there is no difference. In line with his research (13), stated that there were no noticeable differences in these color parameters both in sensory quality testing and hedonic testing. The resulting color is almost the same, this is because the color produced most of the color concentration is not too different far namely 50%, 60%, and 70% this also causes the color not to differ noticeable.

Aroma

Based on Mann-Whitney's analysis of the aroma of herbal tea drinks shows that there is no difference from any formula, due to the length of time herbal tea is deposited after brewing so that it can affect the aroma. The onset of direct or indirect aromas is always associated with the oxidation of polyphenol compounds, the onset of aroma is the result of protein decomposition. The volatile essential oil is also referred to as the source of the aroma of tea that is already a drink. This oil during processing will form another new aromatic substance. The aroma comes from carotenoid oxidation which produces volatile compounds (aldehydes and unsaturated ketones) (15).

The aroma of tea is one of the important aspects that affects the taste of tea. Several types of tea packed with different ingredients will give you different aromas and flavors as well. Similarly, tea stored for some time will also give you different flavors and aroma. The aroma of tea will change during storage because the tea is hygroscopic which is easy to absorb water. The increased moisture content in the tea during storage, the aroma of the tea will gradually decrease. Where the aroma and taste of the tea is strongly influenced by catechin compounds. The type of packaging and storage temperature is very influential on the change in water content then the next level of catechins will affect the aroma and taste of tea (15).

Taste

Based on Mann-Whitney analysis of the taste of herbal tea drinks shows that herbal teas in F1 with F2 and F1 with F3 there are significant differences

in the taste aspect. This is because green tea in general has a more bitter taste, a sepat flavor, and is less fragrant compared to black tea and oolong tea (16).

The bitter taste and sepat in green tea is caused by the presence of polyphenol compounds (catechins) that are dominant in tea. In addition, caffeine and saponin compounds also contribute to bitter taste (17). The higher the catechin means the more beneficial it is for health. But on the contrary, judging by taste, it has an inverse comparison (18).

Acceptance Rate

The results of this study showed from the level of public acceptance of herbal teas from aspects of color, aroma, and taste obtained the highest favored herbal tea by the public is F3 with a concentration of 1 green tea, 1 gr of noni fruit, 1 gr of stevia leaves amounting to 77.52%. The average public acceptance rate is 39 years old so it affects the color, aroma and taste. According to (19), gradually some biological functions will deteriorate including the tissue's ability to regenerate and maintain its normal structure and function.

At the level of admission of nutrition students to herbal tea drinks from aspects of color, aroma, and taste obtained herbal tea the highest favored by students is F2 with a concentration of 1.3 gr green tea, 0.7 gr of noni fruit and 1 gr stevia of 69,52%. Admission level of students aged 21-23 years so it has no effect on color, aroma and taste.

According to (20), the higher the concentration of green tea then the more bitter the taste of green tea (21). states that alkaloid compounds are more present in tea leaves than their stems. So it can be said that the higher the quality of green tea, the more bitter the taste of green tea caused by the content of caffeine and L-theanine and also the more sepat or typical (ketir) due to the content of tannins in tea. In addition, the addition of noni fruit in F2 with a concentration of 0.7 gr, preferably because the aroma and taste does not cause too much bitterness and a pungent smell. According to (22), the bitter taste of the fruit is caused by the content of alkaloids. If the addition to the fruit is more and more, then the taste of the tea will become more bitter and cause a

sharp stench. This aroma is caused by the presence of capillary acid and kaproic acid in the noni fruit (8).

A person's level varies so it cannot be imposed. According to (23) differences of opinion, the difference in sensitivity in feeling and kissing. Although it can detect, everyone has different likes.

Antioxidant Activity

In this study, test antioxidant activity on herbal teas using testing methods using DPPH. The antioxidant test method using DPPH is one of the quantitative test methods to find out how much herbal tea activity as an antioxidant. Testing methods using DPPH are conventional methods and have long been used for the application of antioxidant compound activity (24).

Spectrophotometric measurements of antioxidant activity are performed at a wavelength of 517 nm which is the maximum wavelength of DPPH. This test method using DPPH is based on decreased absorbance due to DPPH discoloration, in which DPPH will react with hydrogen atoms from free radikan-lowering compounds forming a more stable DPPH-Hydrazinin. DPPH reagents that react with antioxidants will experience a change in color purple to yellow, color intensity depending on the ability of antioxidants (25).

The results showed that the highest antioxidants in F2 with fruit consentransi noni dry 0,7 gr, green tea 1.3 gr, and stevia leaves 1 gr by 3. 36 gr/100 gr. This is supported according to research (26) that drying with the sun does not make the antioxidant levels contained in it damaged due to drying temperature because the temperature tends to be lower compared to the use of temperature in drying oven method or roasting. In the noni fruit, the drying process is carried out using the heat of the sun so that the antioxidant content in the dried noni fruit is not damaged. According to (27), drying time affects antioxidant activity, the longer the drying time then antioxidant activity will also decrease.

Storage at room temperature for approximately 2 months can result in changes in antioxidant activity. This is supported according to (28) studies stating that antioxidant activity during 4 degree temperature storage during the 45 day storage period experiences

no change in antioxidant activity namely remains strong while storage of room temperature and temperature 35 degrees undergoes changes in antioxidant activity during storage of 45 days.

Water Content

The moisture content in the foodstings also determines the freshness and durability of the material. Water is also an important component in foodstings because water can affect the appearance, texture, and taste of food (29). Water content measurement aims to know the moisture content of products produced with various treatments so that it can be estimated the durability of the product. The water content of food ingredients greatly affects the quality of the food stuff. If the water content of the food stuff is not qualified then the food stuff will undergo physical and chemical changes characterized by the growth of microorganisms in food so that the food stuff is not eligible for consumption. The moisture content of the material decreases simultaneously. This is in accordance with the purpose of drying which is to reduce the water content contained in the material (30).

The results showed that the highest water content was F2 with a 0.7 gr noni fruit consentransi, 1.3 gr green tea and 1 gr stevia leaves. The water content produced by F1, F2, and F3 does not meet the quality standards of dry tea in packaging based on SNI 3836:2013 because it reaches the set requirement value of a maximum of 8%. Water content tends to increase in line with the increasing concentration of cider. This is in accordance with statement (31) that the noni fruit is a plant that has a high water content of 89.10%. The water content in the instant powder material determines the durability of the material. In addition, water content in foodstuffs also plays a role in the formation of organoleptic properties of products (32).

According to (26) states that the method of drying with the sun drying temperature tends to be lower so that the water content does not all do the evaporation process, the decreased water content in the tea is affected by the evaporation of water due to the length of drying. The longer the drying process and the higher temperature causes the evaporation

of water contained in herbal teas the higher the water content so that the lower the water content.

Tea is one of the important aspects that affects the taste of tea. Several types of tea packed with different ingredients will give you different aromas and flavors as well. Similarly, tea stored for some time will also give you different flavors and aromas. The aroma of tea will change during storage because the tea is hygroscopic which is easy to absorb water. The increased moisture content in the tea during storage, the aroma of the tea will gradually decrease. Where the aroma and taste of the tea is strongly influenced by catechin compounds. Thus, the type of packaging and storage temperature is very influential in the change in water content then the catechine content which will then affect the aroma and taste of the tea (15). During storage, the moisture content of the tea will increase if the humidity of the surrounding air is high enough. In addition to air humidity, the long storage factor and room temperature also affect the high content of tea water in the packaging. It turns out that there is a change in the moisture content in both kinds of teas that are packed with each package in storage for 10 weeks. The change in water content is not separated from the relative humidity influence (RH) of each storage room condition.

Ash Content

Ash content is an inorganic substance left over from the burning of a food stuff. Ash content is a parameter to indicate the value of inorganic ingredients (minerals) contained in an ingredient or product. The higher the value of ash content then the more inorganic ingredient content in the product. Inorganic material components in a material vary greatly in both type and quantity (33).

The results of this study showed that the ash level test can be known at the length of drying against the ash content of herbal teas with the addition of noni fruit, green tea and stevia leaves in each noticeable different treatment of herbal tea ash levels seen with different average results. Ash content in F1, F2 and F3 treatment meets the standard quality of dry tea in packaging based on SNI 3836:2013 because it reaches the set requirement value of 8%.

The noni fruit contains mineral components

such as iron, calcium, sodium and potassium. In the initial heating process until the process of evaporation there has been evaporation of water and substances contained in the noni fruit. The higher the ash content, the more mineral content. The exposure is in accordance with statement 34 which states that the higher the water content then the content of dry materials decreases and the components of fat and protein as dry materials increase so that the percentage of ash content decreases.

CONCLUSIONS AND RECOMMENDATIONS

The average acceptance rate by people in the most preferred color category was in formula 3 of 3.97. The average acceptance rate by nutrition students in the most preferred color category was in formula 3 of 3.74. The highest antioxidant activity analysis was in F2 at 3.36 gr/100gr. The lowest water content in F1 was 10.71% due to the high water content of the noni fruit by 89.10%. The highest ash content is in F3 at 7.03% so that it is in accordance with SNI.

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