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Analysis of Phytochemical Compounds and Antioxidant Activity From Non-Polar to Polar Solvent Extracts In Several Types of "Basa Genep" Constituent Spices

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***Abstract*— "Basa genep" is the main spice Balinese people use to process traditional cuisine. This study examines phytochemical compounds and antioxidant activity in extracts of several "Basa genep" constituent spices extracted with solvents with different polarity levels. The design used is a completely random design of 1 factor consisting of 6 treatments: ethyl acetate solvent, hexane, acetone, dichloromethane, ethanol, and methanol. Based on the results of the study, it was found that the constituent spices of "Basa genep", namely ginger, kaemfiera, galangal, turmeric, bird's eye chilli, red chilli, onion, and garlic extracted with solvents with different levels of polarity contain phytochemical compounds. The treatment of different types of solvents has a significant effect on the extract's phytochemical levels and antioxidant activity. The highest antioxidant activity is obtained in polar solvents, dichloromethane, acetone, and methanol. In ginger, kaemfiera, Turmeric, and garlic extracts, the highest IC50 values were obtained in dichloromethane solvent types with IC50 values of 25,027 ppm (powerful antioxidants), 93,643 ppm (potent antioxidants), 24,467 ppm (powerful antioxidants), and 288,437 ppm (fragile antioxidants). In Galangal, the highest IC50 (Inhibition Concentration 50%) value was obtained in acetone extract with an IC50 value of 82.863 ppm (potent antioxidant). In bird's eye chilli and red chilli, the highest IC50 value was obtained in methanol extract with IC50 values of 108,088 ppm (medium antioxidant) and 274,427 ppm (very weak antioxidant), respectively.**

***Keywords*— "Basa Genep", Seasoning, Phytochemical, Antioxidant, Solvent, Polar, Non-Polar**

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I. INTRODUCTION

Traditional Balinese cuisine is famous for having a strong and sharp taste. This is because of the typical essential ingredients of herbs and spices. One of the basic Balinese spices that are usually used is "Basa genep". "Basa genep" is a primary spice from various spices that produce sharpness of taste. "Basa Genep" is a spice that uses almost all wet and dry herbs. Wet seasoning consists of onion, garlic, and bird's eye chilli. In comparison, dry spices consist of coriander, pepper, candlenut, nutmeg, cumin, cardamom, and bird's eye chilli [1]. The type of seasoning used in making "Basa genep" contains various functional bioactive compounds. The constituent spices of "Basa genep" include ginger, kaemfiera, Turmeric, galangal, red chilli, bird's eye chilli, garlic, and onion.

Ginger is an essential spice in making "Basa genep". Ginger has long been known as a medicinal plant. Polyphenolic substances with strong antioxidant activity, such as 6-gingerol and its derivatives, are present in the ginger extract. Phytochemicals such flavones, isoflavones, flavonoids, anthocyanins, coumarins, lignans, catechins, and is catechins are responsible for their antioxidant activity [2]. Active ingredients including phenolics and terpene compounds are prevalent in ginger [3]. The three primary phenolic chemicals found in ginger are paradol, shogaol, and gingerol. The primary polyphenols in fresh ginger are called gingerols, and they include 6-gingerol, 8-gingerol, and 10-gingerol [4]. Ginger extract has been studied for its pharmacological effects, namely as an antioxidant [5], Antibacterial [6], Antiviral [7], Antifungal [8], anticancer [9], anti-inflammation [10] and anti-diabetic [11]. To date, phytochemical studies of kaemfiera have found many bioactive compounds, especially terpenoids, phenolics, diarylheptanoids, and flavonoids. The bioactive content found in kaemfiera extract has pharmacological effects. Extracts from Kaemfiera galanga showed anti-inflammatory, antioxidant, anti-tumour, anti-angiogenesis, antioxidants, and antibacterial effects [12][13][14][15][16]. Phytochemicals including tannins, phenols, alkaloids, flavonoids, steroids, terpenoids, glycosides, triterpenes, and saponins are found in turmeric. Ascorbic acid concentration in turmeric extract was determined to be 66,749 mg/100 ml. Additionally, the value of curcumin found in turmeric extract (Rf value 0.436) is comparable to that of pure curcumin. [17]. Thus far, the findings support the usefulness of turmeric as a medicine in pharmacological and pharmaceutical formulations. Specifically, a number of scientific studies report that the free radical scavenging activity of turmeric has been linked to a number of pharmacological benefits, including anti-inflammatory, antioxidant, anti-tumor, antibacterial, anticoagulant, and anti-diabetic effects [18][19][20]. Compounds contained in white Galangal are tannins, saponins, terpenoids, and flavonoids [21]. Sidabutar [22] also reported that white galangal plant extract contains flavonoids, saponins, terpenoids, and tannins. Galangal extract is pharmacologically able to provide antioxidant, anti-diabetic, antiulcer, antidiarrheal, antiemetic, analgesic, anti-inflammatory, antiparasitic and anticoagulant effects [23][24][25][26].

Bird’s eye chilli (*Capsicum frutescens* L.) is widely used to manufacture a popular spice and is known to have a number of health advantages due to the presence of many bioactive components. Bird’s eye chilli extract contains steroids, reducing phenols, sugars, alkaloids, saponins, flavonoids, and tannins [27]. The dried fruit of bird’s eye chilli has been used as a flavouring agent for centuries and is also associated with traditional medicine. Bird’s eye chilli has been studied to reduce the risk of heart attack and stroke, stimulate blood circulation, and reduce blood cholesterol and triglycerides [28]. This fruit also has analgesic, anti-inflammatory, anti-diabetic, antiobesity, anti-rhinitis, anticancer, and antipathoriatic properties [29]. Red chilli (*Capsicum annum* L.) is an essential source of capsaicin, a natural proto-alkaloid, a member of the vanilloid family of compounds [30]. Hall's research shows that the genus Capsicum contains antioxidant compounds such as phenolics, and carotenoids [31]. Hassan [32] also reported that Capsicum annuum L extract, which is red, yellow, and green, contains carotenoid compounds and has very high antioxidant activity. Pharmacologically, Capsicum annuum L extract can treat various human diseases, such as cancer, obesity, skin disorders, and cardiovascular diseases.

Garlic is one of the constituents of the “Basa genep”, which has also long been used as traditional medicine. Bioactive substances like polyphenols, alliin, sterols, allicin, ajoene, flavonoids, and polycarboxylic acids are abundant in allium plants [33][34]. Garlic *(Allium sativum* L.) contains allicin compounds of 380 μg/mL and alliin and 1410 μg/mL. Garlic also includes phenolic chemicals, such as p-coumaric acid, rutin, ferulic acid, isoquercitrin, quercitrin, gentisic acid, 4-hydroxybenzoic acid, kaempferol, and [35]. Garlic was shown to have biological effects such as its antioxidant activity [36], hypoglycemic and cardioprotective effects [37], antibacterial [38] anticancer [39], and antifungal properties [40]. Onion *(Allium cepa* L.var. aggregatum) contain flavonoids, tannins, alkaloids, and saponins that are antibacterial against *Staphylococcus aureus* [41][42[43]. This research is also confirmed by Faidah (2019), that onion ethanol extract (*Allium cepa* L. var-Aggregatum (lat. Aggregatum) contains alkaloid compounds, tannins, saponins, and flavonoids.

Extraction is a process of separating a substance based on differences in solubility. The extraction method significantly impacts the composition of the final extract. Getting the most extract that is enriched with the desired group of chemicals is one of the key goals of the extraction process [44]. By choosing the best extraction technique to maximize process parameters, this is achievable [45]. Reflux, maceration, percolation, and the Soxhlet (S.E.) method are the methods for removing bioactive chemicals from plant material that have been reported the most. Maceration is a widely used extraction method because the process is straightforward but has the disadvantages of long extraction time and low extraction efficiency [10]

One of the key elements influencing the chemical makeup and biological activity of plant extracts is the presence of solvents [46]. Based on the solubility principle of "like to dissolve like," which states that polar compounds only dissolve in polar solvents and non-polar and semi-polar compounds only dissolve in non-polar solvents, the solvents used in the maceration process are chosen accordingly. Depending on the polarity and solubility of the secondary metabolites, they can be extracted from plants using a solvent. As an illustration, three distinct types' solvents can be employed for extraction: hexane, ethyl acetate, and ethanol; these have dielectric constants (20 °C) of 1.90, 6.02, and 22.405, respectively, and are non-polar, semi-polar, and polar, respectively [47]. The difference in solvents used as solvents can determine the bioactive compounds contained in plant extracts based on their polarity.

The phytochemical components and antioxidant activity of non-polar to polar solvent extracts from the several spice varieties that comprise the "basa genep" have not been studied. Therefore, this study examines phytochemical compounds and antioxidant activities in sections of various kinds of “basa genep” constituent herbs extracted with solvents with different polarity levels.

II. Material and Methods

A. Material

The tools used in the study were a blender (Philips), autoclave, stirring rod, 1000 mL glass beaker (Pirex), petri dish (Pirex), Erlenmeyer 200 mL (Pirex), Uv-Vis spectrophotometer (Libra S60, U.S.A.), cuvette, vortex, 100 mL measuring cup (Pirex), incubator (Mammert), Laminer air flow (Eyela), drip pipette, micropipette, test tube, maceration container, rotary evaporator

(Buchi), receiver flask (Buchi) and vial bottle. The ingredients used in this study were ginger, Turmeric, kaemfiera, Galangal, red chilli, bird's eye chilli, onion, garlic, aqua dest, ethanol (Merck, Germany), methanol (Merck, Germany), Ethyl acetate (Merck, Germany), Dichloromethane (Merck, Germany), acetone (Merck, dichloromethane), hexane (Merck, Germany), D.P.P.H., Folinciaocalteau, Na_2CO_3 (Merck, Germany), $NaNO_2$ (Merck, Germany), $AlCl_3$ (Merck, Germany), NaOH (Merck, Germany), quercetin standards (Merck, Germany), gallic acid standard (Merck, Germany), tannic acid standard (Merck, Germany).

B. Methods

Research Design

This study used a one-factor complete randomized design consisting of 6 different maceration solvent treatments: solvents ethyl acetate, hexane, acetone, dichloromethane, ethanol, and methanol. The test was repeated three times so that 18 samples were obtained. The extract samples were further screened for phytochemicals, flavonoid levels, tannin levels, phenol levels, and antioxidant activity. The data obtained were statistically tested with the ANOVA test using S.P.S.S.

Research Procedure

Making Extracts of Spices Ingredients sorted and washed thoroughly, then drained. The sample is cut into small pieces and dried using an oven at 40 °C. The dry ingredients are then mashed using a blender to obtain simplicity. The next simplistic is macerated with 96% ethanol sea with a ratio of 1: 5. The maceration process is carried out for 24 hours. After that, filtering is carried out and continued with solvent evaporation with an evaporator to produce a thick extract. The viscous section is stored in vials for antibacterial activity testing.

Phytochemical Screening

Flavonoid Test
A sample of 1 gram is added to 10 ml of hot water, cooked for five minutes, and then filtered to the desired consistency. After obtaining 5 milliliters of filtrate, 0.1 grams of magnesium powder, 1 milliliter of concentrated hydrochloric acid, and 2 milliliters of amyl alcohol are added. The mixture is agitated, allowed to separate, and the color that forms on the layer of amyl alcohol is noted [48].

Tannin Test
A sample of 5 grams was extracted with 10 ml of distilled water, which was filtered and then diluted with distilled water until it was colorless. Add one or two drops of the iron (III) chloride reagent to two milliliters of solution. A blackish-green color shift is indicative of a sample that contains tannins [48].

Phenol Test
A 2 mL sample was pipetted, and a few drops of $FeCl_3$ were added. The presence of a greenish colour indicates a high or low content [48].

Alkaloid Test
A sample of 0.5 grams was heated in a water bath for two minutes, cooled, and filtered. One milliliter of 2 N hydrochloric acid and nine milliliters of distilled water were then added. We test for alkaloids using the filtrate. A volume of 0.5 milliliters of filtrate was transferred into each of three test tubes. Two drops of reagent are put to each tube, and the outcome is noted [48].

Test Steroids/Terpenoids
A cup filled with ether and 0.5 grams of ethanol-dissolved material is dried by evaporating it. Next, three drops of anhydrous acetic acid and five drops of H2SO4 (p) are added [48].

Saponin Test
A sample of 0.5 grams is added to 10 ml of hot water, the mixture is cooled and given a vigorous 10-second shaking to produce foam. I subsequently observed foam resistance by adding one drop of HCl 2 N. A continuous foam is indicative of saponins [48].

Quantitative Testing of Phytochemical Compounds with UV-Vis Spectrophotometer

Total Phenols
Determination of total phenol by Folin–Ciocalteau method [49]. Depending on the treatment, a total of 0.01 g of extract was diluted into 5 mL of citrate phosphate buffer. After pipetting 0.1 mL of the sample, 0.3 ml of 70% ethanol was added. 0.4 mL of folinciaocalteau was then added, and the mixture was incubated for a further 6 minutes. Following incubation, 4.2 mL of 5% Na_2CO_3 was added, and the mixture was vortexed and incubated for an additional 90 minutes. The wavelength at which the absorbance is measured is 760 nm. The measurements are contrasted with reference curves made using gallic acid. The calculation of total phenol is calculated using the following formula:

$$\text{Total phenols (mg GAE/g extract)} = \frac{CxVxFp}{w} \quad (1)$$

Description:
C = Sample concentration of linear regression results (mg/L)
F.P. = Dilution factor
V = Sample volume (L)
W= Sample weight (g).

Total Flavonoids
Determination of total flavonoids using a spectrophotometer with the $AlCl_3$ method refers to [50]. Depending on the treatment, a total of 0.01 g of extract was diluted into 5 ml of citrate phosphate buffer. One milliliter of sample was combined

with four milliliters of distillate water, and 0.3 milliliters of 10% NaNO2 solution was added. Following a 5-minute incubation period, 0.3 mL of a 10% AlCl3 solution and 2 mL of a 1% NaOH solution were added, and the mixture was then immediately measured at 510 nm using a spectrophotometer. Quercetin standard was used to establish a calibration standard from which the flavonoid content in the test sample was derived. The result was expressed as quercetin equivalent in mg QE/g extract. The calculation of total flavonoids is calculated using the following formula:

$$\text{Total flavonoids (mg QE/g extract)} = \frac{CxVxFp}{w} \quad (2)$$

Description:
C = Sample concentration of linear regression results (mg/L)
F.P. = Dilution factor
V = Sample volume (L)
W= Sample weight (g)

Total Tannins
The determination of total tannin extracts was analyzed using the Folin-Denis method by that carried out by [51]. Depending on the treatment, a total of 0.01 g of the section was diluted into 5 mL of citrate phosphate buffer. After diluting the sample to a maximum of 0.25 mL in the pipette, 2 mL of 5% Na2CO3 was added, along with 0.25 mL of Folin-Denis reagent and a vortex. After that, the solution is vortexed and incubated for half an hour. Using a spectrophotometer set to 725 nm in wavelength, absorbance is measured. Tannic acid is used to compare the findings to a standard curve. Tannic acid equivalents, or mg TAE/g extract, were used to indicate the overall tannin content of the sample.. The calculation of the total tannins is calculated using the following formula:

$$\text{Total tannins (mg TAE/g extract)} = \frac{CxVxFp}{w} \quad (3)$$

Description:
C = Sample concentration of linear regression results (mg/L)
F.P. = Dilution factor
V = Sample volume (L)
W= Sample weight (g)

Antioxidant Activity Testing

It was making a sample parent solution of 100 ppm each sample by dissolving 10 mg of the model at 100 mL of methanol P.A. Additionally, dilute each sample using P.A. methanol solvent, varying the concentration by 20 ppm, 60 ppm, 80 ppm, and 100 ppm. Next, a control solution comprising 1 mL of 50 ppm D.P.P.H. solution and 2 ml of P.A. methanol was made as a comparison. For the test samples, two milliliters each of the sample and D.P.P.H. solutions were made, and they were incubated at 27 °C for thirty minutes or until the color of the D.P.P.H. activity changed. Every example is triple-made. Using a Uv-Vis spectrophotometer set to 517 nm in wavelength, extract samples were all subjected to an absorbance value test. Analysis of antioxidant testing of the D.P.P.H. method was carried out by looking at the colour change of each sample after incubation with D.P.P.H.. If all D.P.P.H. electrons pair with electrons in the extracted sample, the sample colour will change from dark purple to bright yellow. Then the sample measured its absorbance value using a Uv-Vis spectrophotometer at a wavelength of 517 nm.

$$\% \text{ inhibisi} = \frac{A0-A1}{A0} x100\% \quad (4)$$

Description:
A1= Absorbasni treatment
A0= Absorbasni control.

III. Result and Discussion

C. Phytochemical Screening

In this study, several spices such as ginger, kaemfiera, Galangal, Turmeric, bird's eye chilli, red chilli, garlic, and onion were extracted with solvents with different levels of polarity. Ethyl acetate, hexane, acetone, dichloromethane, ethanol, and methanol are the solvents used. The purpose of extraction is to obtain phytochemical compounds contained in the sample. The extract obtained is then carried out by phytochemical screening to determine what compounds are included. The results of phytochemical screening tests can be seen in **Table 1**

TABLE 1.
RESULTS OF PHYTOCHEMICAL SCREENING TEST ON SEASONING INGREDIENTS CONSTITUENT OF "BASA GENEP" SEASONING

No	Sample	Solvent	Phytochemical Screening						
			Alkaloid (Mayer)	Flavonoid	Tannin	Phenol	Steroid	Terpenoid	Saponins
1	Ginger	Ethyl Acetate	-	+	+	+	-	-	-
		Hexane	-	+	+	+	-	-	-
		Acetone	-	+	+	+	-	-	-
		Dichloromethane	-	+	+	+	-	-	-
		Ethanol	-	+	+	+	-	-	-
		Methanol	-	+	+	+	-	-	-
2	Kaemfiera	Ethyl Acetate	-	+	+	+	-	-	-
		Hexane	-	+	+	+	-	-	-
		Acetone	-	+	+	+	-	-	-
		Dichloromethane	-	+	+	+	-	-	-

		Ethanol	-	+	+	+	-	-	-
		Methanol	-	+	+	+	-	-	-
		Ethyl Acetate	-	+	+	+	-	-	-
		Hexane	-	+	+	+	-	-	-
3	Galangal	Acetone	-	+	+	+	-	-	-
		Dichloromethane	-	+	+	+	-	-	-
		Ethanol	-	+	+	+	-	-	-
		Methanol	-	+	+	+	-	-	-
		Ethyl Acetate	-	+	+	+	-	+	-
		Hexane	-	+	+	+	-	-	-
4	Turmeric	Acetone	-	+	+	+	-	+	-
		Dichloromethane	-	+	+	+	-	-	-
		Ethanol	-	+	+	+	-	+	-
		Methanol	-	+	+	+	-	-	-
		Ethyl Acetate	-	+	+	+	-	-	-
		Hexane	-	+	+	+	-	-	-
5	Bird's Eye Chilli	Acetone	-	+	+	+	-	-	-
		Dichloromethane	-	+	+	+	-	-	-
		Ethanol	-	+	+	+	-	-	-
		Methanol	-	+	+	+	-	-	-
		Ethyl Acetate	-	+	+	+	-	-	-
		Hexane	-	+	+	+	-	-	-
6	Red chilli	Acetone	-	+	+	+	-	+	-
		Dichloromethane	-	+	+	+	-	-	-
		Ethanol	-	+	+	+	-	-	-
		Methanol	-	+	+	+	-	-	-
		Ethyl Acetate	-	+	+	+	-	-	-
		Hexane	-	+	+	+	-	-	-
7	Garlic	Acetone	-	+	+	+	-	-	-
		Dichloromethane	-	+	+	+	-	-	-
		Ethanol	-	+	+	+	-	-	-
		Methanol	-	+	+	+	-	-	-
		Ethyl Acetate	-	+	+	+	-	-	-
		Hexane	-	+	+	+	-	-	-
8	Onion	Acetone	-	+	+	+	-	-	-
		Dichloromethane	-	+	+	+	-	-	-
		Ethanol	-	+	+	+	-	-	-
		Methanol	-	+	+	+	-	-	-

D. Flavonoid Levels

Based on the study's results, different types of solvents significantly influence the flavonoid levels of the extract (**Table 2**).

TABLE 2.
FLAVONOID CONTENT (Mg Q.E./100G) OF "BASA GENEP" CONSTITUENT SPICES

No	Spices	Solvents					
		Ethyl Acetate	**Hexane**	**Acetone**	**Dichloromethane**	**Ethanol**	**Methanol**
1	Ginger	1810.760±271.502b	1834.393±252.124b	1683.787 ±182.524b	2249.863±282.250b	1526.047±141.208b	4054.883±298.5283a
2	Kaemfiera	232.727±34.452b	331.230±38.456ab	433.367±36.424ab	319.733±37.261ab	488.637±44.892a	474.097±52.562a
3	Galangal	393.467±46.824b	251.893±34.822b	214.330±22.145b	1734.993±186.834a	567.660±55.842b	176.553±22.422b
4	Turmeric	230.360±25.224c	276.903±26.248c	482.453±32.234b	163.950±12.283c	265.857±21.124c	1137.923±25.224a
5	Bird's Eye chilli	2112.557±125.214bc	943.230±102.331cd	3077.527±252.235b	1452.190±134.450cd	659.460±85.248d	5470.650±425.422a
6	Red chilli	276.460±15.2188c	423.393±28.246b	343.677±28.282bc	529.900±35.267a	336.500±25.422bc	376.760±15.324bc
7	Garlic	307.127±25.214c	120.233±11.568c	744.637±65.264b	288.693±21.282c	2193.217±215.284a	271.833±22.814c
8	Onion	1054.133±115.246bc	219.773±12.282d	1538.953±116.675ab	1968.243±124.426a	1488.973±115.281ab	725.710±68.342c

Description: At the 5% Duncan level, an intangible difference is displayed by the average value that is followed by the same letter on the same line.

E. Tannin Levels

Based on the study's results, all spice extracts contain tannin compounds. Different types of solvents affect the tannin levels in the extract (**Table 3**).

TABLE 3.

TANNIN CONTENT (Mg T.A.E./100G) OF "BASA GENEP" CONSTITUENT SPICES IN DIFFERENT TYPES OF EXTRACTION SOLVENTS

No	Spices	Solvents					
		Ethyl Acetate	**Hexane**	**Acetone**	**Dichloromethane**	**Ethanol**	**Methanol**
1	Ginger	6201.137±628.348b	4431.190±422.420b	6241.160±628.246b	7724.853±721.811b	4686.197±248428b	27442.443±828.244a
2	Kaemfiera	1519.113±128.181b	1804.167±118.246b	3125.607±286.118b	1599.593±118.222b	1884.060±122.246b	26370.393±922.428a
3	Galangal	7641.200±243.245bc	5926.733±534.455cd	3499.480±322.3481d	8575.310±811.248b	5536.597±218.345cd	21831.797±921.455a
4	Turmeric	1129.320±118.244b	1319.157±122.562b	1608.250±628.142b	1213.630±110.234b	1348.170±164.118b	29443.917±824.124a
5	Bird's Eye chilli	4004.133±426.256b	1908.343±134.345b	3931.907±228.245b	2718.070±212.824b	1724.150±114.424b	47538.423±1246.825a
6	Red chilli	1331.947±111.284b	1282.713±128.248b	1510.620±158.281b	1456.207±28.246b	1285.273±126.288b	18046.523±568.284a
7	Garlic	1515.370±112.263bc	1069.873±108.345c	1970.260±182.562bc	1312.777±116.468c	2468.437±148.568b	18558.567±1168.456a
8	Onion	2195.790±112.456bc	1367.340±124.286c	3341.087±312.445b	3832.063±321.789b	2361.857±184.666bc	19487.390±2148.645a

Description: At the 5% Duncan level, an intangible difference is displayed by the average value that is followed by the same letter on the same line.

F. Fenol Levels

The results showed that the type of solvent affected the phenol levels of the "basa genep" spice extract. The highest Phenol content was obtained in dichloromethane extract (**Table 4**).

TABLE 4.

PHENOL CONTENT (Mg G.A.E./100G) OF "BASA GENEP" SEASONING CONSTITUENTS IN DIFFERENT TYPES OF EXTRACTION SOLVENTS

No	Spices	Solvents					
		Ethyl Acetate	**Hexane**	**Acetone**	**Dichloromethane**	**Ethanol**	**Methanol**
1	Ginger	7772.057±78.224b	6388.153±64.282b	7309.587±71.384b	10786.663±112.426a	3055.420±33.567c	2933.430±18.824c
2	Kaemfiera	1337.263±12.258b	1345.443±12.6524b	1338.247±13.621b	14590.967±118.282a	1669.370±16.28b	1861.667±18.647b
3	Galangal	31461.340±324.682a	20763.410±221.228b	14055.900±112.284c	25330.393±2448.282a	6138.620±61.42d	2935.343±24.346d
4	Turmeric	1318.240±28.265c	1308.500±34.254c	1903.840±14.546bc	13349.727±12.456a	1386.580 ±14.688c	3564.680±23.686b
5	Bird's Eye chilli	3012.020±32.564cd	2042.193±21.282cd	4598.313±42.284c	26609.520±268.261a	1579.703±14.286d	7757.827±72.223b
6	Red chilli	1348.777±12.265bc	1106.673±10.266c	1469.353±14.562bc	12490.137±128.678a	1202.750±12.882bc	2006.667±20.456b
7	Garlic	1815.483±12.890b	907.603±92.146c	1600.013±18.256bc	25321.357±261.284a	2171.423±24.456b	1848.027±18.234b
8	Onion	2557.310±25.2566bc	1063.310±10.982c	3820.573±28.224b	32522.080±342.666a	2668.527±22.268bc	2161.880±45.668bc

Description: At the 5% Duncan level, an intangible difference is displayed by the average value that is followed by the same letter on the same line.

G. Antioxidant activity

According to the study's findings, the antioxidant activity of garlic, ginger, kaemfiera, galangal, turmeric, bird's eye chili, and red chili was significantly impacted by the type of extract solvent used. At the same time, the onion did not show significant differences (**Table 5**).

TABLE 5.

IC50 VALUE OF "BASA GENEP" SEASONING CONSTITUENTS ON DIFFERENT TYPES OF EXTRACTION SOLVENTS (PPM)

No	Spices	Solvents					
		Ethyl Acetate	**Hexane**	**Acetone**	**Dichloromethane**	**Ethanol**	**Methanol**
1	Ginger	32.351±2.866bc	40.390±3.226bc	41.800±4.218b	25.027±1.282c	145.547±12.262a	47.457±4.262b
2	Kaemfiera	1737.55±11.262b	101.070±8.342c	526.147±18.344c	93.643±3.382c	4017.567±24.484a	77.9533±7.484c
3	Galangal	164.043±6.843bc	587.860±52.672a	82.863±2.648c	354.560±8.248b	94.217±8.322c	106.957±2.649c
4	Turmeric	32.103±2.824c	277.560±12.862a	47.913±3.762bc	24.467±2.262c	103.670±11.846b	47.763±4.862bc
5	Bird's Eye chilli	185.55±12.69bc	748.189±52.6727a	168.966±12.682bc	153.368±12.871bc	256.546±22.455b	108.088±12.676c

6	Red chilli	379.300±32.276c	110.8567±112.678b	571.5067±56.678bc	481.9633±45.642bc	8921.0633±82.970a	274.427±22.562c
7	Garlic	1270.963±52.678ab	785.7133±62.634ab	1366.69±12.682ab	288.437±42.669b	1913.937±72.245a	1844.890±68.625a
8	Onion	288.643±22.682a	524.110±52.689a	571.507±55.670a	328.183±52.222a	349.910±22.245a	439.437±42.562a

Description: At the 5% Duncan level, an intangible difference is displayed by the average value that is followed by the same letter on the same line.

Based on the findings of screening tests for phytochemicals, all extracts were not detected to contain alkaloids. The Mayer test, a precipitation process brought on by ligand substitution, is used in alkaloid screening. Alkaloids' lone electron pairs of nitrogen can take the place of iodine ions in Mayer's reagent [52]. This forms a yellow precipitate by adding Mayer reagent to the extract test solution [53].

Screening test results showed all extracts tested positive for flavonoids. Flavonoids are polyphenolic compounds with several hydroxy groups that tend to be pola [54]. Flavonoids are tested for presence using concentrated Mg and HCl. The addition of Mg and HCl was carried out on the powder, extract, and each fraction of the dragon fruit stem formed a red colour; this indicates that the sample contains flavonoids. Flavonoid compounds will be reduced with Mg and HCl to produce red, yellow, or orange colours [53].

The study also reported that all test extract samples tested positive for tannins and phenols. Tannin and phenol testing is done by adding $FeCl_3$ [55]. Condensed tannins will provide a blackish-green color with this combination, while the hydrolyzed tannin group will give a blue-black color. When FeCl3 is added, it interacts with one of the hydroxyl groups in the tannin molecule, changing its color [52].

The results of the phytochemical screening test showed that the extract of the test sample was not detected to contain steroids. In comparison, terpenoid compounds were detected in turmeric ethyl acetate extract, turmeric acetone extract, and turmeric ethanol extract. In addition, terpenoid compounds were also seen in the acetone extract of Lombok chilli. Triterpenoids are compounds composed of long chains of C30 hydrocarbons which cause these compounds to be non-polar. Triterpenoid compounds with cyclic structures in alcohols, aldehydes, or carboxylic acids with OH groups cause these compounds to be semi-polar [54]. In steroid and triterpenoid testing, compound analysis is based on the ability of the mixture to form a colour with concentrated H_2SO_4 in acetic acid anhydride solvent [52]. The results obtained showed positive results, with the formation of a turquoise ring indicating the content of steroid compounds and a brownish ring indicating the scope of triterpenoids [53]

This study also reported that all spice extracts were not detected to contain saponin compounds. Saponins have non-polar groups, such as steroids and triterpenoids, but are more likely to be polar because of their glycoside bonds [52][54]. Saponins contain glycosyl groups acting as polar groups and steroid and triterpenoid groups functioning as non-polar groups [53]. Surface-active compounds with both polar and non-polar groups enable saponins to form micelles when they are shaken with water; polar structures will face outwards, while non-polar groups will face inward. In this condition, saponins will be shaped like foam [52]

In Galangal, red chilli and onion produce the highest levels of flavonoids in the solvent dichloromethane. While garlic extracted ethanol produced the highest levels of flavonoids. Flavonoid compounds are polar, so they are easily soluble in polar [56]. Methanol, ethanol, and dichloromethane are types of polar solvents [57][58][59], so they are more effective in extracting flavonoids. Riyani [60] state flavonoids dissolve in aquadest, ethanol, and methanol solvents. Meanwhile, Yulistian [61] reported flavonoids are also soluble in acetone solvent. The results showed that all types of spices that comprise the "Basa genep" contain flavonoids. The benefits of flavonoids include anti-inflammatory, antibacterial, anti-allergenic, and anti-diabetic effects [62].

The results showed that methanol solvent obtained the highest tannin levels in the extract. Tannins are polar polyphenol group compounds easily dissolved in polar solvents such as methanol [63]. Therefore, the highest tannin content is obtained in polar solvents. Tannin compounds, many O.H. groups cause polar properties; tannin compounds can dissolve in polar solvents such as methanol to extract tannins. Some studies say that tannins provide health effects, namely as antioxidants, anti-inflammatory, antiviral, and antimicrobial [64].

Phenol is a polar compound, so it is easily soluble in polar solvents [65]. Dichloromethane is a type of polar organic solvent [59], so it can dissolve phenols easily. In addition to dichloromethane extract, ethanol extract and methanol extract from the constituent spices of "basa genep" also contain high phenol levels. The study's findings are based on the investigation of Nakilcioğlu-Taş and Ötleş [66], which reported that the highest polyphenol levels of *Ficus carica* L. seed extract were found in methanol solvent extract. Allspice extracts that make up "base genep" contain phenol compounds. Phenols have functional properties such as antioxidant and antibacterial [67].

According to the study's findings, the antioxidant activity of garlic, ginger, kaemfiera, galangal, turmeric, bird's eye chili, and red chili was significantly impacted by the type of extract solvent used. At the same time, the onion did not show significant differences. In ginger, kaemfiera, Turmeric, and garlic extracts, the highest IC50 values were obtained in dichloromethane solvent types with IC50 values of 25,027 ppm (powerful antioxidants), 93,643 ppm (potent antioxidants), 24,467 ppm (powerful antioxidants), and 288,437 ppm (fragile antioxidants). In Galangal, the highest IC50 value was obtained in acetone extract with an IC50 value of 82.863 ppm (potent antioxidant). In red chilli and bird's eye chilli, the highest IC50 value was obtained in methanol extract with IC50 values of 108,088 ppm (medium antioxidant) and 379,300 ppm (very weak antioxidant), respectively. In contrast, the highest IC50 onion tends to be an Ethyl acetate extract of 288,643 ppm (very weak antioxidant). Molyneux [68] states that the smaller the IC50 value, the higher its antioxidant activity. The highest IC50 value is obtained in polar solvent types. Dichloromethane, ethanol, and methanol are polar solvents [57]. Polar solvents like water, methanol, dichloromethane and acetone are commonly used for extracting antioxidants from plant materials. These solvents have a high affinity for polar phytochemicals, which are often responsible for antioxidant properties [76]. Seasonings extracted with polar solvents also produce high levels of flavonoids, tannins, and phenols resulting in high antioxidant activity. The higher the phytochemical levels, the stronger the antioxidant activity because these phytochemical compounds have antioxidant activity [69]. Flavonoid compounds are primary antioxidants providing hydrogen atoms to free radicals [70]. Tannin compounds work as secondary antioxidants by stopping the formation of free radicals by chelating iron metal [71]. Phenolic compounds have a mechanism as antioxidants, namely through the ability of phenol groups to bind free radicals by donating hydrogen atoms through the electron transfer process so that phenols turn into phenoxyl radicals [72].

Therefore, there is a linear correlation between flavonoid, phenol, and tannin levels to the antioxidant activity of the material [73]. Tannins are phenolic compounds because the quantity of phenolic compounds in plant extracts is correlated with their antioxidant activity [74]. Additionally, total phenolic content and antioxidant activity have strong positive associations [75].

IV. CONCLUSION

Based on the results of the study, it was found that the constituent spices of "basa genep", namely ginger, kaemfiera, galangal, Turmeric, bird's eye chilli, red chilli, onion, and garlic extracted with solvents with different levels of polarity contain phytochemical compounds. The extract is also known to have antioxidant activity. The highest antioxidant activity is obtained in polar solvents, dichloromethane, acetone, and methanol. In ginger, kaemfiera, Turmeric, and garlic extracts, the highest IC50 values were obtained in dichloromethane solvent types with IC50 values of 25,027 ppm (powerful antioxidants), 93,643 ppm (potent antioxidants), 24,467 ppm (powerful antioxidants), and 288,437 ppm (fragile antioxidants). In Galangal, the highest IC50 value was obtained in acetone extract with an IC50 value of 82.863 ppm (potent antioxidant). In Lombok chilli and cayenne pepper, the highest IC50 value was obtained in methanol extract with IC50 values of 108,088 ppm (medium antioxidant) and 274,427 ppm (very weak antioxidant), respectively.

CONFLICT OF INTEREST

Authors declare no conflict of interest to disclose.

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