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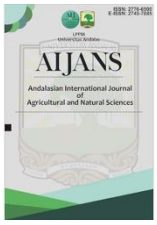

Article

Antioxidant Activity and Physicochemical Characteristics fo Dry Noodles With a Mixture of Wheat Flour and Kidney Bean Flour With The Addition of Butterfly Pea (Clitoria ternatea L.) Extract

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Abstract

This study aims to determine the antioxidant activity and physicochemical properties of dried noodles mixed with wheat flour and red bean flour with the addition of butterfly pea flower (*Clitoria Ternatea L.*) extract. The design used in this study used a completely randomized design (CRD) with 5 treatments and 3 replications. Data analysis using ANOVA and further test with Duncan's New Multiple Range Test (DNMRT) analysis at 5% level. The treatments used in this study were treatment A (20 ml water: 0 ml butterfly pea extract), B (15 ml water: 5 ml butterfly pea extract), C (10 ml water: 10 ml butterfly pea extract), D (water 5 ml: 15 ml butterfly pea extract), and E (0 ml of water: 20 ml of butterfly pea extract). The results of this study significantly affected the 5% level on the water content test, ash content, fat test, protein test, carbohydrates, antioxidant activity, and physical analysis of color. Based on the physical and chemical analysis of dried noodle products, the best treatment was in treatment C (addition of 10g telang flower extract) with a color test value of 232.98°Hue, an elasticity test of 26.50%, a moisture content of 6,36%, a ash 1.49%, fat content 2.14%, protein content 19.36%, carbohydrate content 70.63%, and

INTRODUCTION

Noodles are food products made from wheat flour or without the addition of other food ingredients and permitted food additives, with a distinctive noodle shape [1]. Noodles have wide variations depending on the composition, method of making and serving noodles and depending on the region of manufacture [2]. Based on the presentation stage and water content, noodle products on the market are fresh noodles (raw noodles), wet noodles, dry noodles and instant noodles. Fresh noodles or raw noodles are noodles that do not undergo a heating process after printing with a water content of around 35%. Wet noodles are fresh noodles that have undergone a boiling process with a water content of up to 52%. Dry noodles are fresh noodles that have been steamed and then dried until they reach a moisture content of 8-10%, while instant noodles are raw fresh noodles with the addition of steaming and drying processes with a water content of 5-8%, so that the shelf life is relatively longer [3].

Dry noodles are noodle products that are processed by mixing, printing, steaming and drying processes until the water content reaches 8-10% [4]. Dry noodles are dried by drying or using an oven at ±50oC, so they have a relatively long shelf life [5].

The main ingredient in making dry noodles is wheat flour. Wheat flour is a fine powder derived from wheat which is an important raw material for making noodles [6]. Wheat is an imported material, so other alternatives need to be made to reduce or replace wheat flour by utilizing local food commodities, one of which is red bean flour [7]. According to [8], red bean flour has a higher protein and calcium content compared to wheat flour, red bean flour has a protein content of 22.3 g/100 g and a calcium content of 502 mg/100 g while wheat flour has a protein content of 10 g/100 g and calcium 22 mg/100 g. In addition, according to [9] red bean flour also contains carbohydrates of 64.15 g/100 g, energy of 369.3 kcal/100 g and fiber of 4 g/100 g while wheat flour contains carbohydrates of 75 g/100 g, energy of 350 kcal and fiber of 0.3 g/100 g so that it can reduce the use of wheat flour in the manufacture of dry noodles. In the manufacture of dry noodles using wheat flour and red bean flour produces a brownish yellow color, this color looks less attractive so coloring is added, in this case the natural butterfly pea flower dye is used.

Butterfly pea flower (Clitoria ternatea L.) is a type of plant in Indonesia which has antioxidant activity and has single petals colored purple, blue, pink and white [10]. The color in the butterfly pea flower comes from the anthocyanin content. Anthocyanins are water-soluble flavonoids and are found in the fruit, flowers and leaves of butterfly pea flowers [11]. The anthocyanin content found in butterfly pea flowers can counteract free radicals [12]. Butterfly pea flowers can also be used as a natural food coloring [13]. In order not to affect the amount of water used in the noodle formulation, water was substituted with butterfly pea flower extract.

Preliminary research results with a formula of 100 grams of wheat flour, 25 grams of red bean flour, and 20 ml of water. The water used was substituted with 0 ml, 5 ml, 10 ml, 15 ml and 20 ml of butterfly pea flower extract. Based on the results of the preliminary research, dry noodles with attractive colors were obtained, namely in the formulation of 10 ml, 15 ml and 20 ml of butterfly pea flower.

Based on this description, further research was carried out on the antioxidant activity and physico-chemical characteristics of dry noodles mixed with wheat flour and red bean flour with the addition of butterfly pea flower extract (Clitoria ternatea L.).

EXPERIMENTAL SECTION

Materials

The materials used in this study included ingredients for making dry noodles, namely wheat flour, red bean flour, eggs, baking powder, table salt, butterfly pea flower extract and water. Materials used for laboratory analysis include distilled water, HCl, H2SO4, NaOH, methanol, DPPH, etc.

Instrumentation

The tools used in processing are ampia, baking pans, stoves, steamers, basins, analytical balances, analytical tools such as aluminum cups, ovens, flasks, desiccators, furnaces, porcelain cups, water baths, pH meters, beakers, Erlenmeyer, stand coolers, tissue, measuring flasks, spectrophotometers, test tubes, measuring cups, etc.

Research Implementation

The research design used in this study was a completely randomized design (CRD) with 5 treatments and 3 replications. The data were analyzed statistically using the F test and

if they were significantly different, followed by Duncan's New Multiple Range Test (DNMRT) at 5% significance level.

The treatment for making dry noodles is the effect of water substitution used with butterfly pea flower extract, namely as follows:

A = 20 ml of water: 0 ml of butterfly pea flower extract

B = 15 ml of water: 5 ml of butterfly pea flower extract

C = 10 ml of water: 10 ml of butterfly pea flower extract

D = 5 ml of water: 15 ml of butterfly pea flower extract

E = 0 ml of water: 20 ml of butterfly pea flower extract

Formulation Determination

The formulation used in making dry noodles is based on the formula made by [14] with modifications and based on pre-research. The formulation used in the study can be seen in Table 1.

Table 1. Dry Noodle Formulation

Material	A	B	C	D	E
Flour (g)	100	100	100	100	100
Red bean flour (g)	25	25	25	25	25
egg (g)	40	40	40	40	40
BakingPowder (g)	2	2	2	2	2
salt (g)	1,5	1,5	1,5	1,5	1,5
Butterfly pea extract (ml)	0	5	10	15	20
Water (ml)	20	15	10	5	0

Procedure

Making Butterfly Pea Flower Extract [15] modified

Butterfly pea flowers are cleaned using water. The extraction process is carried out by soaking the butterfly pea flowers in hot water at 60°C – 80°C with a ratio of 1:1 for 15 minutes. Furthermore, the filtrate with the residue from the butterfly pea flower was separated, then the butterfly pea flower extract was obtained.

Making Red Bean Flour [16] modified

Red beans are sorted and then soaked in water for 24 hours, then washed with water and drained for 15-20 minutes. Furthermore, the red beans were dried using an oven for ± 14 hours at 60°C. Then pulverized using a blender and sieved using an 80 mesh sieve to obtain red bean flour.

Making Dry Noodles [3] modified

The manufacture of dry noodles begins with weighing the ingredients according to the treatment formulation. Then mix all the ingredients in a bowl and knead until the dough is mixed. The mixed dough is then rested for 15 minutes before being shaped into sheets. Next, the noodle sheets are formed by thinning the dough and grinding it using ammpia, after which it is printed into noodle strands. Then the noodles are steamed with water at 100°C for 10 minutes. The steamed noodles were dried in an oven at 60°C for 3 hours.

RESULT AND DISCUSSION

Analysis of raw materials is a parameter that determines the nutritional content of a product. In the analysis of raw materials, tests were carried out on red bean flour and dried butterfly pea flowers. The results of raw material analysis on red bean flour and dried butterfly pea flowers can be seen in Table 2.

Table 2. Raw Material Analysis of Red Bean Flour and Dried Eggplant Flowers

Analysis	Red bean flour ± SD	Dried Eggplant Flowers ± SD
water content %	8,21 ± 0,50	23,30 ± 0,27
ash content %	2,90 ± 0,01	-
fat content %	1,37 ± 0,09	-
Protein content %	21,68 ± 0,19	-
Antioksidant %	-	27,74 ± 5,62

The water content of red bean flour is 7.51%, while in dried butterfly pea flowers it is 23.30%, the results of the water content in red bean flour are close to the results of [17] of 8.73%. The water content obtained in this study complies with the quality requirements for flour as a food ingredient listed in [1], with a maximum moisture content of 14.5%. The results of the ash content of red bean flour were obtained at 2.90%. Red beans contain minerals in the form of 80 mg/100 g calcium, 400 mg/100 g phosphorus, and 5% iron [18]. The fat content of red bean flour was obtained at 1.37%. Red bean flour protein content was obtained at 21.68%. This result is higher than the research of [19] which obtained a protein content of red bean flour of 19.48%, however in [17] study the results of protein content of red bean flour were 21.86%, these results are close to the results of research conducted.

The antioxidant activity of butterfly pea extract in this study was 27.74% at a concentration of 10,000 ppm. The antioxidant activity obtained in this study was greater than [20]'s research, where the antioxidant activity of the butterfly pea flower obtained was 24.47% at a concentration of 10,000 ppm. In addition, the results of the antioxidant activity of the butterfly pea flower are not much different from the research of [21] where the antioxidant activity of the butterfly pea powder was obtained at 29.86% at a concentration of 1,000 ppm.

Color Test

Based on analysis of variance, it shows that the level of water substitution with butterfly pea flower extract has a significant effect on the level of $\alpha = 5\%$ on the color of dry noodles. The results of the analysis of the color of dry noodles can be seen in Table 3.

Table 3. Dry Noodle Color

Comparison (Water : Butterfly Pea Flower Extract)	Color (°*Hue*) Mean ± Standard Deviation
A (water 20 ml : BFE 0 ml)	123,05 ± 1,22 a
B (water 15 ml : BFE 5 ml)	199,78 ± 0,98 b
C (water 10 ml : BFE 10 ml)	232,98 ± 0,50 c
D (water r 5 ml : BFE 15 ml)	242,01 ± 0,87 d
E (water 0 ml : BFE 20 ml)	257,09 ± 0,29 e
KK = 0,40%	

The more the comparison of the butterfly pea flower extract, the higher the °Hue value obtained. The blue color in the dried noodles is produced by the extract of the butterfly pea flower which contains anthocyanins. Factors that affect the stability of anthocyanins include pH, temperature, light and oxygen [22]. Anthocyanin colors have a color between red, violet and blue which can change due to changes in pH from 4-10 [23].

Elasticity

Based on the analysis of variance, it showed that the level of substitution of water with butterfly pea extract had no significant effect at the level of α = 5% on the elasticity of the noodles. The results of the analysis of noodle elasticity can be seen in Table 4.

Table 4. Noodle Elasticity

Comparison (Water : Butterfly Pea Flower Extract)	Elasticity (%) Mean ± Standard Deviation
E (water 0 ml : BFE 20 ml)	26,33 ± 0,33
D (water 5 ml : BFE 15 ml)	26,44 ± 0,76
C (water 10 ml : BFE 10 ml)	26,50 ± 0,12
B (water 15 ml : BFE 5 ml)	26,68 ± 0,64
A (water 20 ml : BFE 0 ml)	26,89 ± 0,38
KK = 1,89%	

The higher the addition of butterfly pea extract, the higher the elasticity value produced. Noodle making is influenced by the gluten content in wheat flour. According to [24], wheat flour contains gluten. Gluten is elastic so that it affects the elasticity and texture of the noodles produced [5]. Gluten consists of gliadin and glutenin. Gliadin has a function as an adhesive and makes the dough elastic, while glutenin has a function to keep the dough firm and retain CO2 gas so that the dough continues to expand and form pores.

Water Content

Based on the analysis of variance, it shows that the level of water substitution with butterfly pea flower extract has a significant effect at the level of α = 5% on the water content of dry noodles. The results of the analysis of the water content of dry noodles can be seen in Table 5.

Table 5. Dry Noodle Moisture Content

Comparison (Water : Butterfly Pea Flower Extract)	Water Content (%) Mean ± Standard Deviation	
A (water 20 ml : BFE 0 ml)	5,83 ± 0,11	a
B (water 15 ml : BFE 5 ml)	6,17 ± 0,04	b
C (water 10 ml : BFE 10 ml)	6,36 ± 0,09	b
D (water 5 ml : BFE 15 ml)	6,79 ± 0,23	c
E (water 0 ml : BFE 20 ml)	7,10 ± 0,25	c
KK = 2,62%		

The higher the ratio of the butterfly pea extract, the higher the water content of the dried noodles produced. This is due to the water content of butterfly pea flower is higher than the water content of red bean flour, which is 8.21% (raw material analysis). According [1] the water content of dry noodles is a maximum of 10%, this shows that the value of the water

content of dry noodles in this study is still in accordance with the water content limits of dry noodles according to SNI.

Ash Content

Based on the analysis of variance, it was shown that the level of water substitution with butterfly pea flower extract had a significant effect at the level of α = 5% on the ash content of dry noodles. The results of the analysis of the ash content of dry noodles can be seen in table 6.

Table 6. Dry Noodle Ash Content

Comparison (Water : Butterfly Pea Flower Extract)	Ash Content (%) Mean ± Standard Deviation
A (water 20 ml : BFE 0 ml)	1,41 ± 1,01 a
B (water 15 ml : BFE 5 ml)	1,45 ± 0,03 ab
C (water 10 ml : BFE 10 ml)	1,49 ± 0,04 bc
D (water 5 ml : BFE 15 ml)	1,54 ± 0,03 c
E (water 0 ml : BFE 20 ml)	1,59 ± 0,02 cd
KK = 2,08%	

The higher the addition of butterfly pea extract, the higher the ash content of the dried noodles produced. Butterfly pea flowers contain minerals such as potassium of 1.25 mg/g, calcium of 3.10 mg/g and magnesium of 2.23 mg/g [25], so that the difference in the level of substitution of water with butterfly pea extract causes differences in the resulting mineral content. The ash content of a food ingredient increases with increasing substitution of additional ingredients [26]. The quality requirements for dry noodles according to [1], have a maximum ash content of 3%. This indicates that the ash content of the resulting dried noodles meets the quality requirements of the dried noodles.

Fat Content

Based on the analysis of variance, it was shown that the level of substitution of water with butterfly pea flower extract had a significant effect at the level of α = 5% on the fat content of dry noodles. The results of the analysis of the fat content of dry noodles can be seen in table 7.

Table 7. Dry Noodle Fat Content

Comparison (Water : Butterfly Pea Flower Extract)	Fat Content (%) Mean ± Standard Deviation
A (water 20 ml : BFE 0 ml)	1,66 ± 0,02 a
B (water 15 ml : BFE 5 ml)	1,89 ± 0,09 b
C (water 10 ml : BFE 10 ml)	2,14 ± 0,04 c
D (water 5 ml : BFE 15 ml)	2,40 ± 0,02 d
E (water 0 ml : BFE 20 ml)	2,65 ± 0,04 e
KK = 2,44%	

The higher the addition of butterfly pea extract, the higher the fat content of dry noodles. According to [27], butterfly pea flowers contain 2.5% fat / 100 grams of fat. With the difference in the addition of butterfly pea extract, the fat content of the dried noodles is also different where the higher the addition of the butterfly pea extract, the higher the fat content of the dried noodles.

Protein Content

Based on the analysis of variance, it was shown that the level of water substitution with butterfly pea flower extract had a significant effect at the level of α = 5% on the protein content of dry noodles. The results of the analysis of dry noodle protein content can be seen in table 8.

Tabel 8. Dry Noodle Protein Content

Comparison (Water : Butterfly Pea Flower Extract)	Protein Content (%) Mean ± Standard Deviation
A (water 20 ml : BFE 0 ml)	19,06 ± 0,15 a
B (water 15 ml : BFE 5 ml)	19,21 ± 0,01 b
C (water 10 ml : BFE 10 ml)	19,36 ± 0,03 c
D (water 5 ml : BFE 15 ml)	19,51 ± 0,04 d
E (water 0 ml : BFE 20 ml)	19,66 ± 0,02 e
KK = 0,38%	

The higher the addition of butterfly pea extract, the higher the protein content produced. This is because the butterfly pea flower has a protein content of 0.32% [27]. In addition, the protein content of dry noodles comes from the protein content of the ingredients used. Wheat flour has a protein content of 11% [3], red bean flour has a protein content of 21.68% (raw material), while egg yolk contains 16% protein [28]. According to [1] the protein content of dry noodles is at least 10%, this shows that the protein content of dry noodles in this study is still higher with the limit of protein content of dry noodles according to [1]. Protein is a source of amino acids containing the elements C, H, O and N which are not owned by fat and carbohydrates and has a function as a regulatory and building agent [29].

Carbohydrate

Based on the analysis of variance, it was shown that the level of substitution of water with butterfly pea flower extract had a significant effect at the level of α = 5% on the carbohydrate content of dry noodles. The results of the analysis of dry noodle carbohydrate levels can be seen in table 9.

Table 9. Dry Noodle Carbohydrate Content

Comparison (Water : Butterfly Pea Flower Extract)	Carbohydrate Content (%) Mean ± Standard Deviation
A (water 20 ml : BFE 0 ml)	72,03 ± 0,10 a
B (water 15 ml : BFE 5 ml)	71,26 ± 0,07 b
C (water 10 ml : BFE 10 ml)	70,63 ± 0,05 c
D (water 5 ml : BFE 15 ml)	69,75 ± 0,29 d
E (water 0 ml : BFE 20 ml)	68,80 ± 0,52 e
KK = 0,39%	

The higher the addition of butterfly pea extract, the lower the carbohydrate content of the dried noodles produced. The carbohydrate content of dry noodles obtained in this study was calculated by difference, namely by subtracting 100% of the total from the total components such as water, ash, fat and protein). According to [30] carbohydrate levels calculated by difference are influenced by other components such as water content, fat ash and protein. So that the higher the component, the lower the carbohydrate content, conversely the lower the component, the higher the carbohydrate content [30].

Antioxidant Activity

Based on the analysis of variance, it was shown that the level of water substitution with butterfly pea flower extract had a significant effect at the level of α = 5% on the antioxidant activity of dried noodles. The results of the analysis of the antioxidant activity of dry noodles can be seen in Table 10.

Table 10. Dry Noodle Antioxidant Activity

Comparison (Water : Butterfly Pea Flower Extract)	Antioxidant Activity (%) Mean ± Standard Deviation
A (water 20 ml : BFE 0 ml)	20,90 ± 2,18 a
B (water 15 ml : BFE 5 ml)	28,70 ± 6,04 b
C (water 10 ml : BFE 10 ml)	33,32 ± 2,81 bc
D (water 5 ml : BFE 15 ml)	38,63 ± 2,79 c
E (water 0 ml : BFE 20 ml)	42,74 ± 9,85 c
KK = 16,89%	

The higher the addition of butterfly pea extract, the higher the antioxidant activity of the dried noodles produced. This is due to the antioxidant activity of the raw material for butterfly pea flower extract, which is 27.74% at a concentration of 1,000 ppm. The use of raw materials such as red bean flour also contributes to antioxidant activity. According to [31], red bean flour contains an antioxidant activity of 56.21%.

The antioxidant content found in the butterfly pea flower is thought to originate from the flavonoid compounds found in the butterfly pea flower, especially anthocyanins. Anthocyanins are part of flavonoid compounds which act as bioactive compounds because they have antioxidant properties [32]. Anthocyanins are useful for capturing free radicals in the body and as antibacterials in food ingredients [33]. The phytochemical content of the butterfly pea flower includes tannins, flabatanins, saponins, triterpenoids, carbohydrates, phenolphthavonoids, flavanol glycosides, proteins, alkaloids, anthraquinones, anticyanins, stigmasite 4-ene-3,6 diones, volatile oils and steroids [10].

CONCLUSION

Based on the results of the research that has been done, it can be concluded as follows:

1. Based on the results of the study, the level of water substitution with butterfly pea extract was significantly different at the 5% level for chemical analysis, namely testing for water content, ash content, fat content, protein content, carbohydrates, antioxidant activity, and physical analysis of color test.
2. Based on the best research results of water substitution with butterfly pea extract, namely treatment C (10 ml water : 10 ml sea cucumber extract) with the following average values: color 232.98° Hue (blue-green), elasticity test 26.50%, water content 6.36%, ash content 1.49%, fat content 2.14%, protein content 19.36%, carbohydrate content 70.63%, and antioxidant activity 33.32%.

REFERENCES

[1] [BSN]. Badan Standarisasi Nasional. 2015. *SNI 8217 : 2015 Mie Kering*. Badan Standarisasi Nasional. Jakarta

[2] Jatmiko, G. P dan T. Estiasih. 2014. Mie dari Ubi Kimpul (xanthosoma sagittifolium) : Kajian Pustaka. *Jurnal Pangan dan Agroindustri*. Vol. 2 No. 2: 127-134.

[3] Made, A. 2008. Membuat Mie dan Bihun. Jakarta: Cetakan XI. Penebar Swadaya. Mulyadi. 2014.Studi Pembuatan Mi Kering Ubi Jalar Kuning (ipomoea batatas)

(Kajian Penambahan Telur dan CMC). Prosiding Seminar Nasional BKS PTN Barat :1186-1194.

[4] A.F. Mulyadi, S. Wijana, I. A. Dewi, W. I. Putri. 2014. Karakteristik Organoleptik Produk Mie Kering Ubi Jalar Kuning (Ipomoea batatas) (Kajian penambahan telur dan CMC). Jurnal Teknologi Pertanian, 15 (1): 25-36.

[5] Widyaningsih dan Martini. 2006. Peningkatan mutu bakso instan dengan prosedur chitossan. Jurnal Pengawetan 9(4): 307-313

[6] Mulyadi, A.F.; Wignyanto, dan A.N. Budiarti.2013. Pembuatan Mie Kering Kemangi (Ocimum sanctum L.) dengan Bahan Dasar Tepung Terigu dan Tepung Mokaf (Modified Cassava Flour) (Kajian Jenis Perlakuan dan Konsentrasi Kemangi)

[7] Pertiwi, D A. (2017). Substitusi Tepung Kacang Merah pada Mie Kering dengan Penambahan Ekstrak Bit. Skripsi. Universitas Slamet Riyadi Surakarta. Surakarta.

[8] Made, A. 2009. Sehat dengan Hidangan Kacang dan Biji-bijian. Jakarta: Penebar Swadaya

[9] TKPI, 2017. Tabel Komposisi Pangan Indonesia. [Online] Available at: https://www.panganku.org/id-ID/view [diakses 06 Agustus 2023].

[10] Budiasih, K. S. (2017). Kajian potensi farmakologis bunga telang (Clitoria ternatea). In *Prosiding Seminar Nasional Kimia UNY* (Vol. 21, No. 4, pp. 183-188).

[11] Zussiva, A., Laurent, K.B., dan Budiyati, S. 2012. Ekstraksi dan analisis zat warna biru (Anthosianin) dari bunga telang (Clitoria ternatea) sebagai pewarna alami. *Jurnal Teknologi Kimia dan Industri.* 1 (1): 356-365

[12] Bun, S., Marpaung, M.A., dan Rahmawati, D. 2016. Minuman antioksidan dari campuran ekstrak bunga Clitoria ternatea, Hibiscus sabdariffa, Ipomoea tricolor. Prosiding Seminar Nasional 2016 Patpi, 18-20 Agustus 2016. Makassar Sulawesi Selatan: 179-185.

[13] Nijikuluw, C. 2013. Color characteristic of butterfly pea (Clitoria ternatea L) anthocyanin extracts and briliant blue. Skripsi. Institut Pertanian Bogor.

[14] Nesya, A. (2021). *Pengaruh Penambahan Bubuk Teh Hijau (Camellia sinensis) Terhadap Karakteristik Mie Basah* (Doctoral dissertation, Universitas Andalas).

[15] Purwaniati, A.R.A. 2020. Analisis Kadar Antosianin Total Pada Sediaan Bunga Telang Dengan Metode pH Diferensial Menggunakan Spektrofotometer Visible. *Jurnal farmagazine.* Vol VII no. (1)

[16] Yasa I. W. S., Nazaruddin, dan S. Saloko. 2009. Keefektifan berbagai jenis tepung kecambah kacang meningkatkan mutu makanan sapihan tradisional. Prosiding Seminar Nasional. Jurusan Teknologi Pertanian Fakultas Pertanian Universitas Mataram. Mataram

[17] Marzia, A.D. 2018. Pengaruh Penambahan Tepung Keladi Kimpul (Xanthosoma sagittifolium) dan Tepung Kacang Merah (Phaseolus vulgaris L.) Terhadap Karakteristik Mutu Crackers. [Skripsi]. Padang. Universitas Andalas [BPKPP] Badan Ketahanan Pangan dan Penyuluhan Provinsi DIY. 2014. Data Kandungan Gizi Bahan Pangan dan Olahan.

[18] [BPKPP] Badan Ketahanan Pangan dan Penyuluhan Provinsi DIY. 2014. Data Kandungan Gizi Bahan Pangan dan Olahan.

[19] Pangastuti, H.A., D.R, Affandi, dan D. Ishartani. 2013. Karakteristik Sifat Fisik Kimia Tepung Kacang Merah (Phaseolus vulgaris L.) dengan Beberapa Perlakuan Pendahuluan. Jurnal Teknosains Pangan 2 (1):20-29.

[20] Muharni. 2018. Pengaruh Penambahan Ekstrak Bunga Telang (*Clitoria ternatea L.)* Terhadap Karakteristik Mutu Sirup Daging Buah Pala. [Skripsi]. Padang: Universitas Andalas.
[21] Gusmayanti, M.D. 2022. Pengaruh Penambahan Bubuk Bunga Telang (*Clitoria ternatea L.)* Terhadap Karakteristik Cookies Mocaf. [Skripsi]. Padang: Universitas Andalas.
[22] Basuki, N., Harijono, Kuswanto, & Damanhuri. 2005. Studi Pewarisan Antosianin pada Ubi Jalar. Agravita27 (1): 63 – 68. ISSN: 0126 – 0537.
[23] Werawatganone P, Maungsiri W. Effect of micelles and pH on stability of clitoria ternatea color extract. http://www.aapsj.org/abstracts/AM_2008/AAPS2008-001050.PDF . diakses pada tanggal 06 Agustus 2023
[24] Permatasari, S. Widyastuti, S. dan Suciyati. 2009. Pengaruh Rasio Tepung Talas dan Tepung Terigu Terhadap Sifat Kimia dan Organoleptik Mie Basah. Bali: UNUD
[25] Widyaningsih, T. D. Dan E. S. Murtini. 2006. Alternatif Pengganti Formalin Pada Produk Pangan. Trubus Agrisarana, Surabaya.
[26] Susanto, A. 2011. Pemanfaatan Umbi Bengkuang untuk Minuman Sinbiotik. [Skripsi]. Universitas Pembangunan Nasional "Veteran", Jawa Timur.
[27] Neda, G.D., M.S. Rabeta dan M.T. Ong. 2013. Chemical composition and anti proliferative properties of flowers of Clitoria ternatea. International Food Research Journal 20(3): 1229-1234
[28] Mahmud, M. 2009. Tabel Komposisi Pangan Indonesia. PT. Gramedia. Jakarta
[29] Winarno FG, Fardiaz D. 2004. Pengantar Teknologi Pangan. Jakarta: Gramedia Pustaka Utama
[30] Fatkurahman, R., Atmaka, W., dan Basito., 2012. Karakteristik Sensoris dan Fitokimia Cookies dengan Sbustitusi Bekatul Beras Hitam (*Oryzae sativa L*) dan Tepung Jagung (*Zea Mays L.)* Jurnal Teknosains Pangan Vol. 1 No. 1 Oktober 2012.
[31] Booy, S., Made, Y., dan Pratiwi, D. 2021. Pengaruh Perbandingan Tepung Kacang Merah (Phaseolus vulgaris. L) dan Tepung Daun Pegagan (Centella asiatica (L.) Urban) Terhadap Karakteristik Cookies.: Jurnal Ilmu dan Teknologi Pangan. 10 (3) 2021 536-547
[32] Priska. M., Peni. N., Carvallo. L dan Ngapa. D. 2018. Rivew: Antosianin dan Pemanfaatannya. Cakra Kimia (Indonesian E-Journal of Applied Chemistry). Volume 6 (2). Hal : 2302-7274.
[33] Migliorini, A. A. et al. (2019) 'Red Chicory (Cichorium intybus) Extract Rich in Anthocyanins: Chemical Stability, Antioxidant Activity, and Antiproliferative Activity In Vitro', Journal of Food Science, 84(5), pp. 990–1001. doi: 10.1111/1750-3841.14506.