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Garlic extract (*Allium sativum*) improves the taste of dried moringa noodle products (*Moringa oleifera*)

Ekstrak bawang putih meningkatkan cita rasa produk mie kelor kering

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Abstract

Moringa leaves are plants that have antioxidants and are rich in nutritional value. Panelists said they liked the aroma and taste parameters of dried moringa noodles by adding moringa leaf extract using the pressing method. Adding garlic is needed to cover the aroma and taste because garlic has a distinctive and robust flavor component. The purpose was to improve the taste of dried moringa noodles by adding garlic extract. This experimental research was a completely randomized design. Dried moringa noodles were obtained by adding garlic extract concentrations of 0% (F0), 5%(F1), 10%(F2), and 15%(F3). The hedonic test used 30 untrained panelists with parameters of taste, aroma, color, and texture. The hedonic data were tested for normality using the Kolmogorov-Smirnov test, followed by the ANOVA nova test. If there was a significant difference, continued by the Duncan test with 95% CI. The results of the hedonic test of dry moringa noodles with the addition of garlic extract for taste (p=0,000) showed panelists preferred dry moringa noodles F1 and aroma (p=0,113), color (p=0,104), and texture (p=0,081) there was no significant difference for the treatment of adding garlic extract. F1 dry moringa noodles are safe to use as a food ingredient and contain nutritional value. In conclusion, adding garlic extract can improve the taste of dry moringa noodles (F1).
Keywords: Garlic, hedonic, moringa noodles

Abstrak

Daun kelor merupakan tanaman yang memiliki antioksidan dan kaya akan nilai gizi. Panelis menyatakan agak suka pada parameter aroma dan rasa mie kelor kering penambahan ekstrak daun kelor metode *pressing*. Penambahan bawang putih dibutuhkan untuk menutupi aroma dan rasa tersebut, karena bawang putih memiliki komponen cita rasa yang khas dan kuat. Tujuan penelitian adalah memperbaiki cita rasa mie kelor kering dengan penambahan ekstrak bawang putih. Penelitian eksperimen ini dengan desain Rancangan Acak Lengkap. Mie kelor kering diperoleh dengan penambahan ekstrak bawang putih konsentrasi 0%(F0), 5%(F1), 10%(F2), dan 15%(F3). Uji hedonik menggunakan 30 panelis tidak terlatih, dengan parameter rasa, aroma, warna, dan tekstur. Data hedonik diuji normalitasnya menggunakan Kolmogorov Smirnov, dilanjutkan ke uji ANOVA dan bila ada beda nyata dilanjutkan ke uji Duncan dengan CI95%. Hasil uji hedonik mie kelor kering penambahan ekstrak bawang putih untuk rasa (p=0,000). Panelis lebih menyukai mie kelor kering F1 serta aroma (p=0,113), warna (p=0,104), dan tekstur (p=0,081) Tidak ada perbedaan nyata untuk perlakuan penambahan ekstrak bawang putih. Mie kelor kering F1 aman digunakan sebagai bahan pangan dan mengandung nilai gizi.

Kesimpulan, penambahan ekstrak bawang putih dapat memperbaiki cita rasa mie kelor kering (F1).
Kata Kunci: Bawang putih, hedonik, mie kelor

Introduction

Moringa plants can be used as an alternative to natural preservatives because they contain bioactive compounds that function as antioxidants (Dhakad et al., 2019; Ma et al., 2020; Rugha, 2021; Yong-Bing et al., 2019). This is reinforced by research on Moringa leaves having bioactive compounds such as phenols, flavonoids, terpenoids, alkaloids, tannins, steroids, and saponins (Marcus & Nwineewii, 2015; Rachmawati & Suriawati, 2019; Salimi et al., 2019). Phenols, polyphenols, and flavonoids (flavonols, isoflavones, flavones, catechins, and flavonoids) in Moringa leaves function as natural antioxidants (Puspitasari, 2017; Salim & Eliyarti, 2019).

The Moringa leaf extract pressing method is better than the Moringa leaf extract infusion method (Rizkayanti et al., 2017). The advantages of the Moringa leaf extract pressing method include nutritional values of protein 1,065%, calcium 108,975 mg/100 g, and iron 4,65 mg/100 g, as well as antioxidant activity IC50 with the DPPH method of 26,13 ppm (very strong activity) (Fachriyah et al., 2020; Suriawati & Rachmawati, 2021; Yuliani & Dienina, 2015). Based on these advantages, the moringa leaf extract squeezing method can be applied to foods such as dry noodles. Dried Moringa noodles added with Moringa leaf extract, after being stored for 10 weeks, are still in good condition with nutritional values for protein (12,95%), calcium (104,06 mg/100 g), and iron (4,65 mg/100 g), and still have antioxidant activity (Manggara & Shofi, 2018; Mardiah, 2017; Suriawati & Rachmawati, 2021). In the hedonic test with the taste and aroma parameters of dried moringa noodles, panelists expressed some liking for the product (Suriawati & Rachmawati, 2021). This condition is very unfavorable for the development of dry moringa noodles, especially if they are used as an alternative to noodles with better nutritional value compared to instant noodles. Based on this, it is necessary to add other ingredients, such as garlic, that can mask the taste and aroma of dried moringa noodles.

Garlic (*Allium sativum*) is a plant that contains sulfur, including diallyl thiosulfate (*allicin*) and diallyl disulfide (*ajoene*) (Borlinghaus et al., 2014). Allicin is the most abundant organosulfur compound in garlic and is responsible for its taste, aroma, and pharmacological properties (Jang et al., 2018; Lawson & Hunsaker, 2018). This compound will appear when garlic is crushed.

Dried Moringa noodles need to be substituted with Moringa leaf extract, and the pressing method needs to be improved for taste and aroma. Therefore, it is necessary to conduct research on making dry noodles substituted with Moringa leaf extract using the pressing method with the addition of garlic extract to improve their taste, but this research has never been done. Based on this, the purpose of the study was to improve the taste of dried moringa noodles (*Moringa oleifera*) with the addition of garlic extract (*Allium sativum*).

Methods

Research design

This study used a complete randomized design with three repeats. The garlic-flavored dry moringa noodle formula was developed with the basic ingredients of wheat flour, moringa leaf water extract, squeezing method, and various concentrations of garlic extract. The parameters observed in this study include aroma, taste, color, and texture. Informed consent was given to respondents prior to the study. The study did not have any negative consequences. This research was approved by the Jakarta Health Research Ethics Commission II (LB.02.01/I/KE/35/072/2022).

The research was carried out from ethical submission to data analysis for 6 months (February–July, 2022). The research location is at the Food Laboratory of the Department of Pharmaceutical and Food Analysis, Poltekkes Kemenkes Jakarta II, Jl Raya Ragunan No. 29 C Pasar Minggu South Jakarta-12540. Before research in the laboratory is conducted for the analysis of materials and products produced, the research protocol is submitted to the Health Research Ethics Commission (KEPK) Poltekkes Jakarta II to obtain ethical approval. After

approval by KEPK, we prepare moringa leaf extract and garlic extract by pressing. The extract obtained is used for the manufacture of noodles.

Tools and materials

The tools used for making garlic-flavored dried moringa noodles are digital scales, noodle makers, blenders, spatulas, dough containers, rolling pins, and ovens.

The main ingredients used for making extracts are aquade, moringa leaves (Moringa oleifera), and garlic (Allium sativum). The raw material for making moringa noodles is wheat flour. Other ingredients include table salt, aquades, sodium carbonate, and CMC.

Making garlic-flavored dried moringa noodles (Suriawati & Rachmawati, 2021).

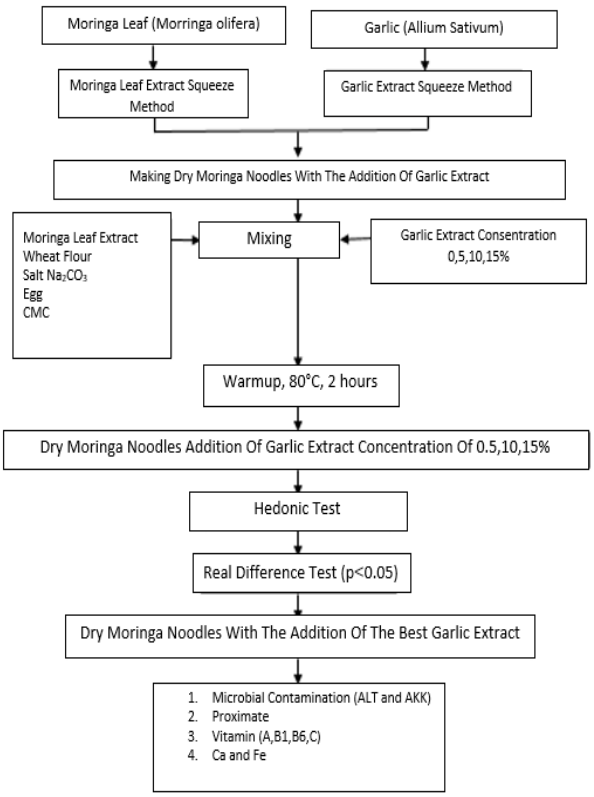

Figure 1. Research flow chart

Making moringa leaf extract, garlic extract, dried noodles, and hedonic test (Figure 1). Moringa leaf extract and garlic extract are carried out by the squeeze method. The result of the Moringa leaf extract used is the juice extract because it contains nutritional value (Rachmawati & Suriawati, 2019) and active substances that function as antioxidants (Suriawati & Rachmawati, 2023). While garlic extract has a function as an antimicrobial (Suriawati & Rachmawati, 2022) and antioxidant (Jang et al., 2018),

Fresh moringa extract is obtained by adding 40 g of moringa leaves to 200 mL of water in a blender. Once finely filtered using sterile flannel into sterile Erlenmeyer. The extract obtained is made into a 100% solution.

Garlic extract is obtained by placing 500 g of single garlic that has been peeled and chopped into a blender, and the results are squeezed using a 100-mesh sieve made from cloth. The squeeze is then centrifuged twice at a speed of 10,000 rpm for five minutes each. Supernatants were collected, and extraction results were obtained with 100% content.

The formula for garlic-flavored dry moringa noodles in this study can be seen in Table 1. Noodle dough is mixed by hand for ± 10 minutes until the dough is smooth. Next, the dough is divided into several parts, pressed using a rolling pin, and printed using a noodle maker. The resulting noodles are steamed for 10 minutes, then dried at 80°C for 2 hours in the oven.

Table 1. Formulation of garlic-flavored dried moringa noodles

Material name	Formula			
	F0	F1	F2	F3
Flour (g)	1000	1000	1000	1000
Salt (g)	10	10	10	10
Na_2CO_3 (g)	5	5	5	5
CMC (g)	10	10	10	10
Water (mL)	350	0	0	0
Moringa water extract (mL)	400	300	250	200
Garlic extract (mL)	0	50	100	150

Information:
F0 = without garlic extract (0%)
F1 = garlic extract 5%
F2 = garlic extract 10%
F3 = garlic extract 15%

Hedonic Test of Garlic-Flavored Dried Moringa Noodles

The hedonic test used untrained panelists to assess simple organoleptic properties, with as many as 30 panelists. The inclusion criteria for the hedonic assessment include panelists being PKK mothers in Jati Padang Village, aged

between 25 and 45 years, being healthy and not allergic to products, not color blind, not losing aroma and taste, not being hungry or full, and not being involved in making noodles directly or indirectly. The hedonic scale used is 1–5 (1 = strongly dislike, 2 = dislike, 3 = neutral, 4 = like, 5 = strongly dislike). First, panelists were instructed to drink mineral water before consuming each garlic-flavored moringa noodle formula.

Based on the hedonic test, the best garlic extract concentration was selected in dried moringa noodles that the panelists preferred to analyze for microbial contamination and nutritional value.

Statistical Analysis

The data from the hedonic test results of dried moringa noodles with the addition of garlic extract were tested for normality with Kolmogorov-Smirnov. If the data is normally distributed, proceed to the ANOVA test, and if there is a noticeable difference (p 0,05), the Duncan test is performed. Statistical analysis was performed using IBM SPSS Statistics 22.

Result and Discussion

Garlic-flavored dried moringa noodles with four tested formulas: organoleptic, microbial contamination, and nutritional value Product formulations are presented in Table 1. The content of garlic extract in dried Moringa noodles is 0% (F0), 5% (F1), 10% (F2), and 15% (F3). The selection of garlic extract concentrations is based on research (Panjaitan et al., 2015) in the manufacture of Spirulina wet noodles with garlic of various concentrations (0, 3, 6, 9%).

Based on the level of consumer acceptance of Spirulina wet noodles with the addition of garlic, it shows that the preferred treatment is a concentration of 6% with a value of 92,75%. In addition, the addition of garlic at 6% concentration exerts a noticeable influence on the organoleptic values of taste and aroma. Research (Sinulingga, 2018) on garlic extract as a natural preservative in white tofu shows that garlic extract concentrations of 0, 2, 4, and 6% have a very real difference at the level of $p < 0,01$ on total microbes and aroma. The higher the concentration of garlic extract, the total microbes decrease, and the higher the concentration of garlic extract, the aroma increases.

Hedonic Test

Hedonic test to determine the level of preference of panelists for dried moringa noodles with various concentrations of garlic extract The hedonic test parameters of moringa noodles added with garlic extract include taste, aroma, color, and texture, conducted by 30 untrained panelists. The results of the statistical analysis of the hedonic test of dried moringa noodles with the addition of garlic extract concentration can be seen in Table 2.

Hedonic tests based on the parameters of taste, aroma, color, and texture of dried garlic-flavored moringa noodles showed the highest average score on the addition of garlic extract concentrations of 5% (F1), followed by 15% (F3), 0% (F0), and 10% (F2), as shown in Figure 2. Garlic-flavored dry moringa noodles with a concentration of 5% (F1) are preferred over other treatments, especially for taste and aroma. This is in accordance with the fact that garlic extract added to moringa noodles can improve the taste and aroma.

Figure 2. Dried moringa noodles addition of garlic extract concentration of 0, 5, 10, 15%.

Table 2. Hedonic test results of garlic-flavored dried moringa noodles

Parameters	Formula				
	F0	F1	F2	F3	p
Taste	3,47[a]	4,03[b]	3,27[a]	3,10[a]	0,000
Aroma	3,17	3,57	3,30	3,47	0,113
Color	3,90	3,30	3,63	3,57	0,104
Texture	3,53	3,70	3,33	3,87	0,081
Total	14,07	14,6	13,53	14,01	
Averange	3,52	3,65	3,38	3,5	

Information: a,b = different letter notation means there is a noticeable difference in Duncan's test with a CL of 95%.

Hedonic test results of dried moringa noodles with the addition of garlic extract

concentrations of 0, 5, 10, and 15% with 30 untrained panelists in the normality test with Kolmogorov-Smirnov The results of the normality test showed that the four treatments were more than α (0,05), then H0 was accepted, and it was stated that the addition of various concentrations of garlic extract was normally distributed.

The results of statistical analysis using an ANOVA test on the taste of dried moringa noodles showed that the addition of various concentrations of garlic extract had a significant effect (p 0,05) on the taste of the dried moringa noodles produced. Based on the results of Duncan's further test in Table 2, the taste of dried moringa noodles with the addition of garlic extract between F1 (5%) treatments was significantly different from F3 (15%), F2 (10%), and F0 (control) treatments. This is because the addition of 5% garlic extract to dry Moringa noodle dough can mask the distinctive taste of Moringa leaves (chelate) in dried Moringa noodles. It is known that garlic contains allicin, and ajoene has a distinctive and strong flavor component (Moulia et al., 2018). However, if the concentration of garlic extract increased by 10% or 15%, the panelists' level of liking for the taste of neutral dry moringa noodles would increase.

An ANOVA test on the aroma of dried moringa noodles showed that the addition of various concentrations of garlic extract did not have a noticeable effect (p > 0,05) on the aroma of dried moringa noodles. Hedonic tests with aroma parameters showed that the panelists' most preferred aroma was dried moringa noodles with the addition of 5% garlic extract (F1). This can be seen from the highest average score, namely F1. The addition of garlic extract to the dough for making dried moringa noodles can remove the distinctive aroma and smell of strong moringa leaves in dried moringa noodles. Garlic contains spicy and fragrant methyl allyl disulfide, so garlic bulbs have a spicy and fragrant aroma (Sari et al., 2016). The higher the addition of garlic extract concentration (10% and 15%), the higher the panelists' preference level for the aroma of neutral dry moringa noodles due to the overpowering aroma from the addition of garlic extract. According to Syah et al. (2018), the strong or distinctive aroma of garlic is caused by the presence of organosulfur compounds such as allicin. The aroma of allicin is a compound formed by the reaction between allicin and the enzyme allinase present in garlic. Garlic sores will activate the enzyme alliinase to react with allicin to form a strong allicin aroma. While dried Moringa noodles without the addition of 0% garlic extract (F0) were also disliked because of the dominant smell typical of Moringa leaf extract.

Panelists preference levels for the color of dried moringa noodles with an ANOVA test showed that the addition of various concentrations of garlic extract did not have a noticeable effect (p > 0,05) on the color of the dried moringa noodles produced. The hedonic test with color parameters showed that the panelists' most preferred color was dried moringa noodles with the addition of 0% garlic extract (F0), which is a green color caused by the presence of moringa leaf extract, which gives the dried moringa noodles their dominant color. The panelists preference level for the color of garlic moringa noodles (5% (F1)) was neutral. The addition of garlic extract to the dried moringa noodle dough gives a light green color to the resulting dried moringa noodles. The higher the garlic extract, between 10% and 15%, the greener the color, so it is less preferred by panelists.

The results of the statistical analysis of Anova's test on the texture of dried moringa noodles showed that the addition of various concentrations of garlic extract did not have a noticeable effect (p > 0,05) on the texture of the dried moringa noodles produced. The hedonic test with texture parameters showed that the panelists' most preferred texture was dried moringa noodles adding 10% garlic extract (F3); this can be seen from the highest average score of F3, while the panelists' level of preference for the texture of dried moringa noodles adding 5% garlic extract (F1) was similar. Garlic extract added to dry moringa noodle dough gives dried moringa noodles a chewy or soft texture because garlic contains essential oils (Sari et al., 2016). The greater the concentration of garlic added to the dough, the more it will make the texture of dry Moringa noodles chewy.

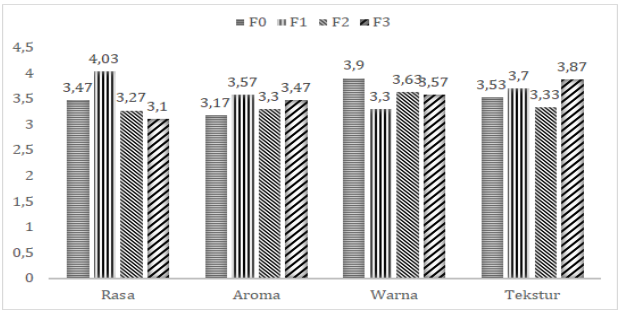

Figure 2. Hedonic test graph of dried moringa noodles addition of garlic extract

Figure 2 shows a hedonic test graph of moringa noodles with the addition of several concentrations of garlic. The best dried moringa noodles with the addition of garlic were based on the hedonic test, namely the F1 formula with a taste scale of 4,03 and an aroma scale of 3,57 that the panelists liked. The results of the analysis for microbial contamination and nutritional value of the F1 formula can be seen in Table 3.

Table 3. Microbial contamination and nutritional value of Moringa noodles formula F1

Parameters	Result
Microbial contamination:	
ALT (CFU/g)	$<1 \times 10^1$
AKK (CFU/g)	$<1 \times 10^1$
Proximate and minerals:	
Water content (%)	7,265
Ash content (%)	2,050
Fat content (%)	0,595
Protein content (%)	13,535
Carbohydrate content (%)	76,600
Vitamin A (Retinol) (mg/100 g)	Tidak terdeteksi
Vitamin B1 (Tiamin) (mg/100 g)	Tidak terdeteksi
Vitamin B6 (Piridoksin) (mg/100 g)	0,090
Vitamin C (Askorbat) (mg/100 g)	1,515
Iron/Fe (mg/100 g)	6,375
Calsium/Ca (mg/100 g)	41,175

Quality noodles are those that are free from microbes, contain good nutritional components, and are in accordance with the Indonesian National Standard (SNI). Table 3 shows dry Moringa noodles formula F1 tested for microbial contamination against bacteria and yeast mold using total plate number (TPN/ALT) and yeast mold number (Angka Kapang/Khamir/AKK) tests. The purpose of this microbial contamination test is to determine whether the dried garlic moringa noodles produced are free of pathogenic and non-pathogenic microbes (Suriawati & Rachmawati, 2022). Microbial contamination in dried garlic moringa noodles can have adverse effects on health. The test results of dried moringa noodles, garlic, and microbial contamination in both ALT and AKK tests are < 1 x 101 CFU/g. The results of the contamination test are <1 x 101 CFU/g because the initial dilution starts at 10-1 and at that dilution no colonies grow, so it cannot be determined how many colonies are less than < 1 x 101 CFU/g. These results are qualified based on SNI 8217:2015 concerning the quality of dry noodles for ALT ≤ 1 x 106 colonies/g and AKK ≤ 1 x 104 colonies/g.

The nutritional content of dry noodles depends on the basic ingredients used in the manufacturing process and can be seen from the results of proximate analysis. The water, ash, fat, protein, and carbohydrate content of dry Moringa noodles F1 (Table 3) meet the requirements for dry noodles in SNI. Water content is very influential on the durability of processed foodstuffs. Dry noodles have low macromolecular components, including fats, proteins, and carbohydrates, which are needed by the body as energy. Fat in dry noodles can improve the taste of a food ingredient because it contains fatty acid esters with glycerol water activity, which will minimize microbial growth activity and maintain the taste of the noodles. The low ash content in dried moringa noodles reflects the brightness level of processed products made from wheat flour (Maryam, 2022). Macromolecular components, including fats, proteins, and carbohydrates, are needed by the body as energy. Fat in dry noodles can improve the taste of a food ingredient because it contains fatty acid esters with glycerol (Khasanah & Astuti, 2019; Zakaria & Rauf, 2017). High protein content in dry noodles because it is substituted for Moringa leaf extract, which contains high protein (Rachmawati & Suriawati, 2019).

Carbohydrates in noodles made from wheat flour come from wheat starch. Amylose and amylopectin, which make up starch, affect the texture of the noodles produced, which can absorb water during the gelatinization process (Maryam, 2022). In addition, based on the test results, dry Moringa noodles F1 contain vitamin B6 (pyridoxine), vitamin C (ascorbate), iron (Fe), and calcium (Ca). This is reinforced by research (Angelina et al., 2021; Maulida & Ismawati, 2016) showing that the addition of Moringa leaf powder to food products can improve nutrition, vitamins, and minerals.

Moringa noodle dough with the addition of as much as 50 g of garlic extract is put into a heat-resistant container measuring 20 x 15 cm and dried in an 80 °C oven for 2 hours, resulting

in Moringa noodles with incomplete drying. The noodles, when stored for 2 days, already had mold. Therefore, moringa noodle dough with the addition of garlic extract should be made as much as 25 g per container so that perfect dry noodles are obtained.

Conclusion

Dried Moringa noodles with the addition of garlic extract concentration of 5% (F1) can improve the taste and are liked by the panelists.

Suggestion, dried moringa noodles the addition of garlic extract needs to be tested for stability and analyzed for microbial contamination, nutritional value, and antioxidant activity to determine product quality during storage.

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References

Angelina, C., Swasti, Y. R., & Pranata, F. S. (2021). Peningkatan nilai gizi produk pangan dengan penambahan bubuk daun kelor (Moringa oleifera): Review. *Jurnal Agroteknologi*, *15*(01), 79. https://doi.org/10.19184/j-agt.v15i01.22089

Borlinghaus, J., Albrecht, F., Gruhlke, M. C. H., Nwachukwu, I. D., & Slusarenko, A. J. (2014). Allicin: Chemistry and biological properties. *Molecules*, *19*(8), 12591–12618. https://doi.org/10.3390/molecules190812591

BSN, B. S. N. (2015). *Mi kering* (SNI 8217:2).

Dhakad, A. K., Ikram, M., Sharma, S., Khan, S., Pandey, V. V., & Singh, A. (2019). Biological, Nutritional, and Therapeutic Significance of Moringa oleifera Lam. *Phytotherapy Research*, *33*(11), 2870–2903. https://pubmed.ncbi.nlm.nih.gov/31453658/

Fachriyah, E., Kusrini, D., Haryanto, I. B., Wulandari, S. M. B., Lestari, W. I., & Sumariyah, S. (2020). Phytochemical Test, Determination of Total Phenol, Total Flavonoids and Antioxidant Activity of Ethanol Extract of Moringa Leaves (Moringa oleifera Lam). *Jurnal Kimia Sains Dan Aplikasi*, *23*(8), 290–294. https://doi.org/https://doi.org/10.14710/jksa.23.8.290-294

Jang, H. J., Lee, H. J., Yoon, D. K., Ji, D. S., Kim, J. H., & Lee, C. H. (2018). Antioxidant and antimicrobial activities of fresh garlic and aged garlic by-products extracted with different solvents. *Food Science and Biotechnology*, *27*(1), 219–225. https://doi.org/10.1007/s10068-017-0246-4

Khasanah, V., & Astuti, P. (2019). Pengaruh Penambahan Ekstrak Dau Kelor (Moringa Oleifera) Terhadap Kualitas Inderawi Dan Kandungan Protein Mie Basah Substitusi Tepung Mocaf. *Jurnal Kompetensi Teknik*, *11*(2), 15–21. https://doi.org/10.15294/jkomtek.v11i2.22499

Lawson, L. D., & Hunsaker, S. M. (2018). Allicin Bioavailability and Bioequivalence from Garlic Supplements and Garlic Foods. In *Nutrients* (Vol. 10, Issue 7). https://doi.org/10.3390/nu10070812

Ma, Z. F., Ahmad, J., Zhang, H., Khan, I., & Muhammad, S. (2020). Evaluation of Phytochemical and Medicinal Properties of Moringa (Moringa oleifera) as a Potential Functional Food. *South African Journal of Botany*, *129*, 40–46. https://doi.org/https://doi.org/10.1016/j.sajb.2018.12.002

Manggara, A. B., & Shofi, M. (2018). Analisis Kandungan Mineral Daun Kelor (Moringa oleifera Lamk.) Menggunakan Spektrometer XRF (X-Ray Fluorescence). *Akta Kimia Indonesia*, *3*(1), 104–111. https://doi.org/DOI: http://dx.doi.org/10.12962/j25493736.v3i1.3095

Marcus, & Nwineewii, J. D. (2015). Studies on the Crude Extract of Moringa oleifera Leaf for Preliminary Identification of Some Phytochemicals and Organic Functions. *IOSR Journal of Applied Chemistry*, *8*(12), 1–5. https://doi.org/DOI: 10.9790/5736-081220105

Mardiah. (2017). Analisa Kadar Kalsium (Ca) Pada Daun Kelor (Moringa oleifera). *Jurnal Ilmu Alam Dan Lingkungan*, *8*(15), 49–52. https://journal.unhas.ac.id/index.php/jai2/article/view/3930/2281

Maryam, S. (2022). Penambahan Tepung Tempe Dan Ekstrak Wortel Proses Pembuatan Mie Berkualitas. *JST (Jurnal Sains Dan Teknologi)*, *11*(2), 238–248. https://doi.org/10.23887/jstundiksha.v11i2.50759

Maulida, H. M., & Ismawati, R. (2016). Pengaruh Penambahan Puree Daun Kelor Dan Bubuk Daun Kelor Terhadap Hasil Jadi Mie Kering Mocaf. *E-Journal Boga*, *5*(2), 17–26. https://ejournal.unesa.ac.id/index.php/jurnal-tata-boga/article/view/15201

Moulia, M. N., Syarief, R., Iriani, E. S., Kusumaningrum, H. D., & Suyatma, N. E. (2018). Antimikroba Ekstrak Bawang Putih. *Jurnal Pangan*, *27*(1), 55–66.

Panjaitan, R., Sari, I., & Dewita. (2015). *Pengaruh Konsentrasi Bawang Putih (Allium sativum) Berbeda Pada Mie Basah Spirulina Terhadap Penerimaan Konsumen* (Vol. 0, Issue 1).

Puspitasari, E. T. (2017). *Pengaruh Level Daun Terhadap Komposisi Fitokimia Dan Aktivitas Antioksidan Air Seduhan Daun Kelor (Moringa oleifera Lam)*. Widya Mandala Catholic University.

Rachmawati, S. R., & Suriawati, J. (2019). Characterization Of Moringa (Moringa oleifera Lam.) Leaf Water Extracts By Chemical And Microbiology. *SANITAS: Jurnal Teknologi Dan Seni Kesehatan*, *10*(2), 102–116. https://sanitas.e-journal.id/index.php/SANITAS/article/view/20191201-rachmawati/20191201-102-116

Rizkayanti, R., Diah, A. W. M., & Jura, M. R. (2017). Uji Aktivitas Antioksidan Ekstrak Air dan Ekstrak Etanol Daun Kelor (Moringa oleifera LAM). *Jurnal Akademika Kimia*, *6*(2), 125–131. https://doi.org/DOI: 10.22487/j24775185.2017.v6.i2.9244

Rugha, M. D. (2021). *Uji Aktivitas Antioksidan Ekstrak Etanol dan Dekokta Daun Kelor (Moringa oleifera Lam) dengan Metode Ferric Reducing Antioxidant Power*. Universitas Sanaa Dharma.

Salim, R., & Eliyarti, E. (2019). Aktivitas Antioksidan Infusa Daun Kelor (Moringa oleifera Lam.) Terhadap Warna Daun. *Jurnal Katalisator*, *4*(2), 91–102. https://ejournal.lldikti10.id/index.php/katalisator/article/view/4210

Salimi, Y., Bialangi, N., Abdulkadir, W., & Parulian, B. R. (2019). Senyawa Triterpenoid dari Ekstrak N-heksana Daun Kelor (Moringa oleifera Lamk.) dan Uji Aktivitas Antibakteri Terhadap Staphylococcus aureus dan Escherichia coli. *Indo. J. Chem. Res.*, *7*(1), 32–40. https://doi.org/https://doi.org/10.30598//ijcr.2019.7-par

Sari, M. O. S. K., Suharno, B., & Rahayu, P. (2016). Kandungan protein dan sifat organoleptik pempek ikan rucah dengan berbagai konsentrasi bawang putih (Allium sativum). *Prosiding Seminar Nasional Sains Dan Entrepreneurship III Tahun 2016*, *January*, 424–431. https://doi.org/10.13140/RG.2.2.12953.67689

Sinulingga, N. A. (2018). *Pengaruh Ekstrak Bawang Putih (Allium Sativum L.) dan Lengkuas (Alpinia galanga) Sebagai Pengawet Tahu*.

Suriawati, J., & Rachmawati, S. R. (2021). *Pengaruh umur simpan mie kelor ering (Moringa oleifera Lam) terhadap aktivitas antioksidan*.

Suriawati, J., & Rachmawati, S. R. (2022). *Uji Cemaran Mikroba dan Aktivitas Antibakteri Ekstrak Bawang Putih Tunggal Terhadap Bakteri Gram Negatif*. *7*(3), 543–550. https://doi.org/https://doi.org/10.37874/ms.v7i3.392

Suriawati, J., & Rachmawati, S. R. (2023). *Antioxidant Activities Of Morage Leaf Extract DPPH And FRAP Methods As Drug And Food*. *8*(1), 253–262.

Syah, A., Sukohar, A., Farmakologi, B., Kedokteran, F., & Lampung, U. (2018). Pengaruh Allicin pada Bawang Putih (Allium sativum L .) terhadap Aktivitas Candida albicans sebagai Terapi Candidiasis. *J Agromedicine Unila | Volume 5 | Nomor 2 | Desember 2018*, *5*, 601–605.

Yong-Bing, X., Gui-Lin, C., & Ming-Quan, G. (2019). Antioxidant and Anti-Inflammatory Activities of the Crude Extracts of Moringa oleifera from Kenya and their Correlations with Flavonoids. *Antioxidants*, *8*(8). https://doi.org/DOI:

10.3390/antiox8080296

Yuliani, N. N., & Dienina, D. P. (2015). Uji Aktivitas Antioksidan Infusa Daun Kelor dengan Metode 1,1- diphenyl-2-picrylhydrazyl (DPPH). *Jurnal Info Kesehatan*, *14*(2), 1060–1082. https://jurnal.poltekeskupang.ac.id/index.php/infokes/article/view/98

Zakaria, & Rauf, S. (2017). Optimalisasi Pembuatan Mie Basah dengan Penambahan Tepung Daun Kelor (Moringa oleifara). *Media Gizi Pangan*, *XXIV*(2), 28–33. https://journal.poltekkes-mks.ac.id/ojs2/index.php/mediagizi/article/view/283