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Antibacterial Activity of Plant Family *Lamiaceae*: A Review

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Abstract:
Background*: Lamiaceae family is a plant from the mint tribe so that it has a distinctive odor for each species and is widely used as a source of perfumes, essential oils, spices, and cooking spices. Plants from the Lamiaceae family contain flavonoids, triterpenoids, essential oils, alkaloids, tannins, and saponins that act as antibacterial. This review article was written to study the antibacterial activity of plants from the Lamiaceae family.*
Materials and Methods*: Generally, the extract that is most widely used in plants is the leaf part, although a small portion uses stems and roots.*
Results*: Several tests of extracts and essential oils from these plants have been carried out against gram-positive and gram-negative bacteria*
Conclusion:*The results of the analysis showed that 13 types of plants from the family Lamiaceae has antibacterial activity, namely Anisomeles malabarica, Coleus aromaticus, Coleus blumei, Coleus atropurpureus Benth, Hyptis suaveolens, Leucas aspera, Mentha arvensis Linn, Ocimum bascilicum, Ocimum gratissimum, Ocimum sanctum, Ocimum obovaflorum, Ocimum tenuiflorum, and Pogostemon cablin. The strength of the antibacterial activity of each plant part depends on the solvent used, concentration, and levels of secondary metabolites contained therein*
Key Word*:Antibacterial,Extract,Lamiaceae,Essential oil.*

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I. Introduction

Biodiversity in Indonesia is used as an alternative medicine from various plants that spread throughout Indonesia. Various floras in Indonesia are used as a source of food, building materials, medicines, and so on. Quite a lot of flora in Indonesia is used as medicine because of the compounds contained in the tissue.[1]

One of the plants that are efficacious as a medicinal plant is the *Lamiaceae* family. Various chemical compounds contained in species in the *Lamiaceae* family are flavonoids, triterpenoids, essential oils, alkaloids, tannins, and saponins which are useful for treating various diseases so that they can be used as medicinal ingredients. Generally, the Lamiaceae contains pain-relieving, diuretic, tonic, anti-fungal, anti-microbial, anti-inflammatory, and anti-infection properties. Extracts from plants have the potential to be further analyzed so as to produce products that have the potential to be used as drugs. Based on the results of the review, the compounds contained in plant extracts have the potential as antioxidants, antimicrobials, anti-inflammatory, and others.[2]

Plant species of the *Lamiaceae* family are plants that are found in the surrounding environment. These plants are generally herbs and shrubs, most of which are ground cover. The stems and branches are rectangular, and the leaves are opposite or crossed opposite each other, with no supporting leaves. Compound flowers and petals do not fall, numbered 4-5, and the flower crown is attached in the shape of a lip. The *Lamiaceae* family is a plant from the mint tribe that has a distinctive odor for each species. This plant is also used as a source of fragrances, essential oils, spices, and cooking spices.[1 3 4]

These types of plants from the *Lamiaceae* are rich in phytochemical compounds and secondary metabolites. Besides being used as a medicinal plant, this plant of the *Lamiaceae* also has various kinds of biological activity plants[5 6]

The Lamiaceae plant is one of the families of the class Magnoliopsida. The *Lamiaceae* family consists of 600 species of plants with 240 genera. The following is the scientific classification of *Lamiaceae:*[7]

Kingdom	:	*Plantae*
Super division	:	*Spermatophyta*
Division	:	*Magnoliophyta*
Class	:	*Magnoliopsida*
Sub class	:	*Asteridae*
Order	:	*Lamiales*
Familys	:	*Lamiaceae*

Based on this, the authors are interested in conducting a review study of antibacterial activity studies on plant extracts and fractions of the Lamiaceae family. The method used in this review is a literature study. It is hoped that in the future this review can be used as a reference for further researchers for the development of the Lamiaceae family plant by conducting an analysis of the content and risk factors as well as its prospects in the pharmaceutical world.

II. Methods

The method that the authors used in this review is a literature study both domestically and internationally. The literature search was carried out in a structured manner to obtain the most current and relevant discussion for the purpose of the review. The literature is taken from various online journal search sites such as digital libraries, Science Direct, NCBI, Researchgate, and Google Scholar for research that have been published from 2011 – 2021. The keywords used in the search were as follows: Lamiaceae, antibacterial. The selection of a number of articles includes the results of the review (title, abstract, and full text) according to the inclusion criteria covering the antibacterial activity of plants of the *Lamiaceae* family. Then the journals obtained were processed and discussed using the narrative method.

III. Resultand Discution

Table 3.1. Antibacterial Activity of Plants of the Laminaceae Family

No	Plant	Part Plant	Ingredient test	Method	Test Bacteria	Concentration	Obstacles zone (mm)	reference
1	*Anisomelesmalabarica*	Leaf	Methanol Extract	*Agar DiscDiffusion*	*Salmonella typhi*	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	10 ± 0,3 10 ± 0,3 7 ± 0,1 - -	
					Salmonella paratyphi	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	8 ± 0,9 8 ± 0,9 7 ± 0,1 - -	[8]
					Pseudomonas vulgaris	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	9 ± 0,7 9 ± 0,7 7 ± 0,1 7 ± 0,1 -	
					Streptococcusaureus.	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	8 ± 0,9 7 ± 0,1 7 ± 0,1 7 ± 0,1 7 ± 0,1	
					Staphylococcus aureus	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	8 ± 0,7 7 ± 0,1 7 ± 0,1 7 ± 0,1 7 ± 0,1	
					Klebsiella vulgaris	50 mg/ml	8 ± 0,5	

						25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	7 ± 0,1 7 ± 0,1 7 ± 0,1 7 ± 0,1	
2	*Coleus aromaticus*	Leaf	Methanol Extract	*Agar DiscDiffusion*	*Salmonella typhi*	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	7 ± 0,1 - - - -	[8]
					Streptococcusaureus.	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	10 ± 0,3 9 ± 0,7 8 ± 0,9 7 ± 0,1 7 ± 0,1	
					Staphylococcus Aureus	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	15 ± 0,4 12 ± 0,1 11 ± 0,1 8 ± 0,7 7 ± 0,1	
					Klebsiella vulgaris	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	7 ± 0,1 7 ± 0,1 7 ± 0,1 7 ± 0,1 -	
3	*Coleus blumei*	Leaf	Methanol Extract	*Disc DiffusionMethod*	*Staphylococcus aureus*	100 mg/ml	14,56 ± 0,444	[9]
					Streptococcus mitis	100mg/ml	13 ± 0,726	
4	*Coleus atropurpureusBenth*	Leaf	Ethanol Extract	*Well method*	*Streptococcus* Sp	20% 40% 60% 80% 100%	2 3,17 8,67 11,17 12,8	[10]
					Pseudomonas Sp.	20% 40% 60% 80% 100%	5,17 7,17 9,5 10,67 12,17	
		Leaf	Ethanol Extract	*agar difussion with modification*	*Staphylococcus aureus*	5% 10% 20% 40% 80%	8,17 9,83 10,67 11,17 12,33	[11]
					Escherichia coli	5% 10% 20% 40% 80%	9,17 10,33 11,17 12,50 14,17	
					Pseudomonas aeruginosa	5% 10% 20% 40% 80%	6,00 8,00 9,33 11,00 11,83	

5	*Hyptissuaveolens*	Leaf	Methanol Extract	*Agar DiscDiffusion*	*Salmonella typhi*	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	8 ± 0,1 7 ± 0,1 7 ± 0,1 7 ± 0,1 7 ± 0,1	
					Salmonella paratyphi	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	11 ± 0,6 9 ± 0,7 8 ± 0,9 7 ± 0,1 7 ± 0,1	[8]
					Streptococcusaureus.	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	9 ± 0,7 8 ± 0,9 - - -	
					Staphylococcusaureus	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml	7 ± 0,1 7 ± 0,1 7 ± 0,1 7 ± 0,1	
					Klebsiella vulgaris	3,125 mg/ml 50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	- 7 ± 0,1 7 ± 0,1 7 ± 0,1 - -	
6	*Leucas aspera*	Root	Methanol Extract	*DiskDiffusion Technique*	*Escherichia coli*	100 mg/ml	9,0 ± 0,5	
					Streptococcusaureus.	100 mg/ml	10,0 ± 0,6	[12]
					Salmonella Choleraesuis	100 mg/ml	11,0 ± 0,5	
					Salmonella typhimurium	100mg/ml	11,0 ± 0,6	
					ShigellaFlexneri	100mg/ml		
					Pseudomonas aeruginosa	100 mg/ml	11,0 ± 0,5	
		Stem	Methanol Extract	*disk diffusion technique*	*Streptococcusaureus.*	100 mg/ml	11,0 ± 0,6 7,0 ± 0,4	
					Salmonella Choleraesuis	100 mg/ml	7,0 ± 0,6	[12]
					Shigella*Flexneri*	100 mg/ml	7,0 ± 0,7	
					Pseudomonas.*Aeruginosa*	100 mg/ml	7,0 ± 0,6	

		Flower	Methanol Extract	*disk diffusion technique*	*Escherichia coli*	100 mg/ml	7,0 ± 0,7	
					Streptococcusaureus.	100 mg/ml	7,0 ± 0,6	[12]
					Salmonella Choleraesuis	100 mg/ml	8,0 ± 0,5	
					Salmonella typhimurium	100 mg/ml	9,0 ± 0,6	
					Pseudomonas.*Aeruginosa*	100 mg/ml	7,0 ± 0,6	
		Leaf	Methanol Extract	*disk diffusion technique*	*Streptococcusaureus.*	100 mg/ml	7,0 ± 0,5	
					Salmonella Choleraesuis	100 mg/ml	8,0 ± 0,5	[12]
					Salmonella typhimurium	100 mg/ml	7,0 ± 0,6	
					ShigellaFlexneri	100 mg/ml	7,0 ± 0,5	
		Leaf	Methanol Extract	*Agar diffusion*	*Salmonella typhi*	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	7 ± 0,1 7 ± 0,1 7 ± 0,1 - -	
					Salmonella paratyphi	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	8 ± 0,9 7 ± 0,1 - - -	[8]
					Staphylococcus aureus	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	7 ± 0,1 - - - -	
					Klebsiella vulgaris	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	8 ± 0,7 7 ± 0,1 - - -	
7	*Menthaarvensis* Linn	Leaf	Methanol Extract	*agar disc diffusion*	*Salmonella typhi*	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	8 ± 0,9 7 ± 0,1 - - -	
					Pseudomonas vulgaris	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	7 ± 1,0 - - - -	[8]
					Streptococcusaureus.	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml	7 ± 0,1 7 ± 0,1 - -	

						3,125 mg/ml	-	
					Staphylococcus aureus	50 mg/ml	7 ± 0,1	
						25 mg/ml	7 ± 0,1	
						12,5 mg/ml	7 ± 0,1	
						6,25 mg/ml	7 ± 0,1	
						3,125 mg/ml	-	
					Klebsiella vulgaris	50 mg/ml	7 ± 0,1	
						25 mg/ml	7 ± 0,1	
						12,5 mg/ml	-	
						6,25 mg/ml	-	
						3,125 mg/ml	-	
8	*Ocimum bascilicum*	Leaf	Methanol Extract	*agar disc diffusion*	*Salmonella paratyphi*	50 mg/ml	9 ± 0,1	[8]
						25 mg/ml	-	
						12,5 mg/ml	-	
						6,25 mg/ml	-	
						3,125 mg/ml	-	
					Pseudomonas vulgaris	50 mg/ml	7 ± 0,1	
						25 mg/ml	7 ± 0,1	
						12,5 mg/ml	-	
						6,25 mg/ml	-	
						3,125 mg/ml	-	
					Staphylococcus aureus	50 mg/ml	8 ± 0,1	
						25 mg/ml	7 ± 0,1	
						12,5 mg/ml	-	
						6,25 mg/ml	-	
						3,125 mg/ml	-	
		Leaf	Methanol Extract	Hole- Plate Diffusion Method	*Escherichia colifrom KFUPM Clinik*	200 mg/ml	21	[13]
						150mg/ml	14	
						100mg/ml	10	
						50mg/ml	4	
					Staphylococcus aureus from KFUPM Klinik	200 mg/ml	16	
						150mg/ml	13	
						100mg/ml	9	
						50mg/ml	4	
					Escherichia coli-ATCC 25922	200 mg/ml	20	
						150mg/ml	13	
						100mg/ml	9	
						50mg/ml	3	
					Staphylococcus aureus –ATCC 33591	200 mg/ml	16	
						150mg/ml	12	
						100mg/ml	9	
						50mg/ml	3	
9	*Ocimum gratissimum*	Leaf	Methanol Extract	*agar disc diffusion*	*Salmonella typhi*	50 mg/ml	7 ± 0,1	[8]
						25 mg/ml	7 ± 0,1	
						12,5 mg/ml	7 ± 0,1	
						6,25 mg/ml	-	
						3,125 mg/ml	-	
					Pseudomonas vulgaris	50 mg/ml	-	
						25 mg/ml	-	
						12,5 mg/ml	-	
						6,25 mg/ml	7 ± 0,1	
						3,125 mg/ml	7 ± 0,1	
					Klebsiella vulgaris	50 mg/ml	7 ± 0,1	
						25 mg/ml	7 ± 0,1	
						12,5 mg/ml	7 ± 0,1	
						6,25 mg/ml	7 ± 0,1	

						3,125 mg/ml	-	
10	*Ocimum Sanctum*	Leaf	Methanol Extract	*agar disc diffusion*	*Salmonella typhi*	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	7 ± 0,1 7 ± 0,1 7 ± 0,1 - -	[8]
					Salmonella paratyphi	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	- 8 ± 0,9 - - -	
					Pseudomonas vulgaris	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	11 ± 0,5 9 ± 0,7 7 ± 0,1 7 ± 0,1 7 ± 0,1	
					Streptococcus aureus	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	- 7 ± 0,1 7 ± 0,1 - -	
					Staphylococcus aureus	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	7 ± 0,1 7 ± 0,1 7 ± 0,1 - -	
					Klebsiella vulgaris	50 mg/ml 25 mg/ml 12,5 mg/ml 6,25 mg/ml 3,125 mg/ml	7 ± 0,1 7 ± 0,1 7 ± 0,1 - -	
		Leaf	Ethanol Extract	*agar well-diffusion*	Actinobacillusactinomycetemcomitans	1% 2% 3% 4% 5% 6% 7% 8% 9% 10%	9 10 10 12 16 22 20 20 21 21	[14]
11	*Ocimumobovatum*	Leaf	Ethanol Extract	*The disk diffusion Method*	*Escherichia coli*	1 mg/ml 2 mg/ml	8 14	[15]
					Staphylococcusaureus.	1 mg/ml 2 mg/ml	12 18	
					Pseudomonas sp	1 mg/ml 2 mg/ml	9 16	
					Proteus sp	1 mg/ml 2 mg/ml	7 13	
12	*OcimumTenuiflorum L*	Leaf	Ethanol Extract	*disc diffusion method*	*Escherichia coli*	10% 20% 40% 70%	- - 17 19	[16]
13	*Pogostemoncablin*	Leaf	Ethanol	*disk diffusion*	*Staphylococcus aureus.*	5 mg/ml	10,33 ± 2,52	

			Extract		*MRSA*	5mg/ml	11,67 ± 1,53	[17]
					Streptococcus pyogenes	5 mg/ml	10,33 ± 1.15	
			Ekstrak Water		*Staphylococcus aureus.*	1 mg/ml	0	
					MRSA	1 mg/ml	8,33 ± 1,53	
					Streptococcus pyogenes	1 mg/ml	0	

The following are the results of a review of the antibacterial activity of the *Lamiaceae* family including plant species, plant parts used, methods used, test bacteria used, concentrations used, the resulting inhibition zones and references from reviewed journals.

IV. Discussion

1. Anisomelesmalabarica

The methanol leaf extract of *Anisomeles malabarica* has antibacterial activity against *Salmonella typhi, Salmonella paratyphi, Pseudomonas vulgaris, Streptococcus aureus, Staphylococcus aureus,* and *Klebsiella vulgaris*. The test was done using agar disc diffusion. The contents tested in *Anisomeles malabarica* in this study were Steroids, Alkaloids, Phenolics, Flavonoids, and Tannins. The crude methanol extract was dissolved in dimethyl sulfoxide (DMSO) and its antibacterial effect was tested using different concentrations of 3.125 mg/ml - 50 mg/ml.[8]

2. *Coleusaromaticus*

Methanol leaf extract of *Coleus aromaticus* has antibacterial activity against *Salmonella typhi, Salmonella paratyphi, Pseudomonas vulgaris, Streptococcus aureus, Staphylococcus aureus*, and *Klebsiella vulgaris*. The test was done using agar disc diffusion. The content tested *Coleus aromaticus* in this study were steroids, alkaloids, phenolics, flavonoids, and tannins. The crude methanol extract was dissolved in dimethyl sulfoxide (DMSO) and its antibacterial effect was tested using different concentrations of 3.125 mg/ml - 50 mg/ml. The results showed that the highest inhibition zone was produced in *Salmonella typhi*, namely at a concentration of 50 mg/ml with an inhibition zone of 7 ± 0.1 mm. *Salmonella paratyphi* bacteria at a concentration of 50 mg/ml with an inhibition zone of 10 ± 0.3 mm. *Staphylococcus aureus* bacteria at a concentration of 50 mg/ml with an inhibition zone of 15 ± 0.4 mm. *Klebsiella vulgaris* bacteria at a concentration of 3.125 mg/ml - 50 mg/ml with an inhibition zone of 7 ± 0.1 each. mm.[8]

3. Coleus blumei

The methanol leaf extract of *Coleus blumei* has antibacterial activity against *Staphylococcus aureus* and *Streptococcus mitis*. Extraction was carried out by filtering to obtain the particle-free extract. The antibacterial screening was done by the disc diffusion method. The contents tested in *Coleus blumei* in this study were flavonoids, terpenoids, tannins, and saponins. The blank discs were impregnated with *Coleus blumei* extract at a concentration of 100 mg/ml. The results showed that the zones produced, the highest, by S*taphylococcus aureus* of 14.56 ± 0.444 mm, and the bacteria *Streptococcus mitis* of 13 ± 0.726.[9]

4. Coleus antropurpureus

Ethanol leaf extract of male mayana leaves (*Coleus atropurpureus* benth) is able to work as an antibacterial for *Streptococcus* Sp and *Pseudomonas* Sp.mayanaleaves that have been dried and then macerated using polar solvent ethanol. The extracts tested by the well method were 100%, 80%, 60%, 40%, and 20%. The contents tested in male mayana leaves (*Coleus atropurpureus* benth) in this study were essential oils, tannins, flavonoids, and eugenol. The test was carried out to observe the presence or absence of the inhibition zone of the ethanol extract of male mayana leaves (*Coleus atropurpureus benth*) against *Streptococcus* sp. and *Pseudomonas* sp. after 24 hours of incubation. The results showed that the polar extract of male mayana leaves (*Coleus*

atropurpureus benth) with concentrations of 100%, 80%, 60%, 40%, and 20% could inhibit the growth of *Streptococcus* sp. with the respective averages of 12.8mm, 11.17mm, 8.67mm, 3.17mm and 2mm while *Pseudomonas* sp with each of the mean inhibition zone diameters of 12.17mm, 10.67mm, 9.5mm, 7.17 and 5.17mm.[10]

The ethanol leaf extract of the leaves of *Coleus atropurpureus* Benth also has antibacterial activity against *Staphylococcus aureus, Escherichia coli, and Pseudomonas aeruginosa*. Extraction was carried out by maceration using 96% ethanol as solvent. Antibacterial activity testing using agar diffusion method (modified Kirby and Bauer diffusion) by means of wells. The contents tested in the leaves of *Coleus atropurpureus* Benth in this study were flavonoids, polyphenols, saponins, alkaloids, and essential oils. The results of the antibacterial activity were analyzed using the One way ANOVA, followed by Duncan's test. ANOVA data showed that the extract concentrations of 5%, 10%, 20%, 40%, and 80% had the activity of inhibiting the growth of the test bacteria. Effective concentrations to inhibit *S. aureus* were at extract concentrations of 20%, 40%, and 80%, for E. coli bacteria at extract concentrations of 10%, 20%, 40%, and 80%, while for *P. aeruginosa* at extract concentrations of 40 % and 80%. The increase in the concentration of the mayana leaf extract showed the larger the diameter of the inhibition zone for bacterial growth [11]

5. Hyptis suaveolens

Methanol leaf extract of *Hyptis suaveolens* has antibacterial activity against *Salmonella typhi, Salmonella paratyphi, Streptococcus aureus, Staphylococcus aureus,* and *Klebsiella vulgaris* bacteria. The test was done using agar disc diffusion. The contents tested in Hyptis suaveolens in this study were steroids, alkaloids, phenolics, flavonoids, and tannins. The crude methanol extract was dissolved in dimethyl sulfoxide (DMSO) and its antibacterial effect was tested using different concentrations of 3.125 mg/ml - 50 mg/ml. The results showed that the highest inhibition zone was produced in *Salmonella typhi*, namely at a concentration of 50 mg/ml with an inhibition zone of 8 ± 0.1 mm. *Salmonella paratyphi* bacteria at a concentration of 50 mg/ml with an inhibition zone of 11.0 ± 0.6 mm. *Streptococcus aureus* bacteria at a concentration of 50 mg/ml with an inhibition zone of 9.0 ± 0.7 mm, *Staphylococcus aureus* bacteria at a concentration of 6.25 mg/ml - 50 mg/ml with an inhibition zone of 7 ± 0.1 mm and Klebsiella vulgaris bacteria at a concentration of 12.5 mg/ml - 50 mg/ml with an inhibition zone of 7 ± 0.1 mm. [8]

6. Leucasaspera

Methanol extract of roots, flowers, stems, and leaves of *Leucas aspera* has antibacterial activity against *Escherichia coli, Streptococcus aureus, Salmonella Choleraesuis, Salmonella typhimurium, Shigella Flexneri, Pseudomonas aeruginosa*. Extracts were made by grinding all parts of the plant (roots, flowers, leaves, and stems) into a powder using a grinder, and then filtered. The dried plant extracts were then redissolved in 80% (v/v) methanol to obtain a solution containing 2 mg/ml of extract each, which was then used for testing. The test was carried out using the Disk Diffusion Technique with a concentration used of 100 mg/ml. The contents tested in roots, flowers, stems, and leaves of Leucas asp*era in this study were triterpenes, sterols, and phenolics.[12]*

Methanol leaf extract *Leucas aspera* also has antibacterial activity against *Salmonella typhi, Salmonella paratyphi, Streptococcus aureus, Staphylococcus aureus, and Klebsiella vulgaris*. The test was done using agar disc diffusion. The contents tested in *Leucas aspera* in this study were steroids, alkaloids, phenolics, flavonoids, and tannins. The crude methanol extract was dissolved in dimethyl sulfoxide (DMSO) and its antibacterial effect was tested using different concentrations of 3.125 mg/ml - 50 mg/ml. The results showed that the highest inhibition zone was produced in Salmonella typhi with concentrations of 50 mg/ml, 25 mg/ml, and 12.5 mg/ml, which was 7 ± 0.1. *Salmonella paratyphi* bacteria with a concentration of 50 mg/ml is 8 ± 0.9. *Staphylococcus aureus* bacteria with a concentration of 50 mg/ml is 7 ± 0.1 and *Klebsiella vulgaris bacteria* with a concentration of 50 mg/ml is 8 ± 0.7.[8]

7. Mentha arvensis linn

Methanol leaf extract of Mentha arvensis has antibacterial activity against *Salmonella typhi, Salmonella paratyphi, Streptococcus aureus, Staphylococcus aureus*, and *Klebsiella vulgaris* bacteria. The test was done using agar disc diffusion. The contents tested in Mentha arvensis Linn in this study were Steroids, Alkaloids, Phenolics, Flavonoids, and Tannins. The crude methanol extract was dissolved in dimethyl sulfoxide (DMSO) and its antibacterial effect was tested using different concentrations of 3.125 mg/ml - 50 mg/ml. The results showed that the highest inhibition zone was produced in *Salmonella typhi*, with a concentration of 50 mg/ml of 8 ± 0.9 mm. *Pseudomonas vulgaris* bacteria at a concentration of 50 mg/ml with an inhibition zone of 7 ± 1.0

mm. Streptococcus aureus bacteria at concentrations of 50 mg/ml and 25 mg/ml with an inhibition zone of 7 ± 1.0 mm. *Klebsiella vulgaris* bacteria at concentrations of 50 mg/ml and 25 mg/ml with an inhibition zone of 7 ± 1.0 mm.[8]

8. Ocimum bascilicum

Methanol leaf extract of *Ocimum bacilicum* has antibacterial activity *against Salmonella typhi, Salmonella paratyphi, Streptococcus aureus, Staphylococcus aureus*, and *Klebsiella vulgaris* bacteria. The test was done using agar disc diffusion. The contents tested in Ocimum bascilicum in this study were Steroids, Alkaloids, Phenolics, Flavonoids, and Tannins. The crude methanol extract was dissolved in dimethyl sulfoxide (DMSO) and its antibacterial effect was tested using different concentrations of 3.125 mg/ml - 50 mg/ml. The results showed that the highest inhibition zone was produced by *Salmonella paratyphi* at a concentration of 50 mg/ml with an inhibition zone of 9 ± 1.0 mm. Pseudomonas vulgaris bacteria at concentrations of 50 mg/ml and 25 mg/ml with an inhibition zone of 7 ± 0.1 mm. Staphylococcus aureus bacteria at a concentration of 50 mg/ml with an inhibition zone of 8 ± 0.1 mm.[8]

Methanol leaf extract of *Ocimum bacilicum* (Linn) also has antibacterial activity against *Escherichia coli* bacteria from KFUPM Clinic, *Staphylococcus aureus* from KFUPM Clinic, *Escherichia coli*-ATCC 25922 and *Staphylococcus aureus*-ATCC 33591. with the hole-plate diffusion method. Extracts were made by drying and grinding then soaked in 1.25 - 1.5 liters of 95% ethanol for 5 days at room temperature. Then filtered and dried. The dry extract was stored in a sterile glass vial at 20oC until being used. Antibacterial activity testing was carried out using the Hole-Plate Diffusion Method. The concentration used was 50 mg/ml - 200 mg/ml. The results showed the highest zone of inhibition in Escherichia coli bacteria from KFUPM Clinic at a concentration of 150 mg/ml of 21 mm. *Staphylococcus aureu*s bacteria from KFUPM Clinic at a concentration of 200 mg/ml of 16 mm. *Escherichia coli*-ATCC 25922 bacteria at a concentration of 200 mg/ml of 20 mm. *Staphylococcus aureus*-ATCC 33591 bacteria at a concentration of 200 mg/ml of 16 mm.[13]

9. Ocimum gratissimum

Methanol leaf extract of *Ocimum gratissimum* has antibacterial activity *against Salmonella typhi, Salmonella paratyphi, Streptococcus aureus, Staphylococcus aureus*, and *Klebsiella vulgaris* bacteria. The test was done using agar disc diffusion. The contents tested were steroids, alkaloids, phenolics, flavonoids, and tannins. The crude methanol extract was dissolved in dimethyl sulfoxide (DMSO) and its antibacterial effect was tested using different concentrations of 3.125 mg/ml - 50 mg/ml. The results showed that the highest inhibition zone was produced by *Salmonella typhi* with concentrations of 50 mg/ml, 25 mg/ml, and 12.5 mg/ml of 7 ± 0.1 mm. *Pseudomonas vulgaris* bacteria at concentrations of 6.25 mg/ml and 3.125 mg/ml of 7 ± 0.1 mm *and Klebsiella vulgaris* bacteria on *Salmonella typhi.*[8]

10. Ocimum sanctum

Methanol leaf extract of *Ocimum Sanctusm* has antibacterial activity against *Salmonella typhi, Salmonella paratyphi, Streptococcus aureus, Staphylococcus aureus*, and *Klebsiella vulgaris*. The test was done using agar disc diffusion. The contents tested in Ocimum Sanctum in this study were Steroids, Alkaloids, Phenolics, Flavonoids, and Tannins. The crude methanol extract was dissolved in dimethyl sulfoxide (DMSO) and its antibacterial effect was tested using different concentrations of 3.125 mg/ml - 50 mg/ml. The results showed that the highest inhibition zone was produced by *Salmonella typhi* at concentrations of 50 mg/ml, 25 mg/ml, and 12.5 mg/ml of 7 ± 0.1 mm.[8]

Methanol leaf extract of *Ocimum sanctum* also has antibacterial activity against the *Actinobacillus actinomycetemcomitans* bacteria. Extracts were made by drying and milling and then macerating with 100% ethanol. Then filtered to get a clear filtrate. The obtained filtrate was reduced at a low temperature of less than 60oCto obtain a solid residue of Ocimum sanctum (Linn.) extract. From 300 grams of *Ocimum sanctum* (Linn.) powder dissolved in 1 liter of ethanol, 18 grams of extract (residue) were obtained so that the yield was 6% w/v. Antibacterial activity was tested by agar well-diffusion method at a concentration of 1% - 10%. The contents tested in *Ocimum sanctum* in this study were ursolic acid, rosmarinic acid, and oleanolic acid. The results showed that the highest inhibition zone was found at a concentration of 6%, which was 22 mm.[14]

11. Ocimum obovatum

Methanol leaf extract of *Ocimum obovatum* has antibacterial activity against *Escherichia coli, Staphylococcus aureus, Klebsiella* sp, *Pseudomonas* sp, *Prote*us sp. The process of making extracts is done by drying, and milling. Leaf powder (250 gm) was extracted using a Soxhlet apparatus with ethanol as a solvent. The resulting

extract was filtered, concentrated to dryness under reduced pressure in a rotary evaporator, and stored at 4°C for further use. The contents tested in Ocimum obovatum in this study were carbohydrates, phenols, flavonoids, tannins, saponins, fixed oil and fats, glycosides, and terpenoids. O. *obovatum* extract was tested against *Escherichia coli* (MTCC40), *Staphylococcus aureus* (MTCC 3160), and *Klebsiella pneumonia*e bacteria. The test method used was the disk diffusion method. The concentration used is 2 mg/ml. The inhibition zone produced was the highest in *Staphylococcus aureus* with an inhibition zone of 18 mm.[15]

12. Ocimumtenuiflorum L

The ethanol leaf extract of *Ocimum tenuiflorum* L has antibacterial activity against *Escherichia coli*. This research was conducted experimentally in a laboratory with the disk diffusion method (disc method). The contents tested in the leaves of *Ocimum tenuiflorum* L in this study were flavonoids, triterpenoids, essential oils, alkaloids, tannins, and saponins. The results showed that the ethanolic extract of the leaves of ruku-ruku (*Ocimum tenuiflorum* L) could inhibit the growth of *Escherichia coli* at a concentration of 40% and 70% with inhibition zones of 17 mm and 19 mm, respectively, while at concentrations of 10% and 20% there was no inhibition zone (0 mm). From the amount of inhibition zone obtained at concentrations of 40% and 70%, it can be stated that the ethanol extract of ruku-ruku (Ocimum tenuiflorum L.) leaves effectively inhibits the growth of *Escherichia coli* bacteria with a strong category.[16]

13. Pogostemoncablin

Water and ethanol leaf extract of *Pogostemon cablin* has antibacterial activity against *Staphylococcus aureus*, MRSA, *and Streptococcus pyogenes*. The test was done with the disk diffusion method at a concentration of 5 mg/ml. The content tested in the leaves of *Pogostemon cablin* in this study was phenolic. The inhibition zone was calculated by measuring the diameter of the inhibition area. Three different fixed directions were taken in triplicate, and their average value was calculated. The concentration used was 5 mg/ml. The inhibition zone in the ethanol extract against *Staphylococcus aureus* bacteria at 10.33 ± 2.52 mm, MRSA at 11.67 ± 1.53, *Streptococcus pyogenes* bacteria at 10.33 ± 1.15. The inhibition zone on the water was only found on MRSA at 8.33 11.67 ± 1.53.[17]

V.Conclusion

Based on the results of the analyzed literature data, it can be concluded that plants from the *Lamiaceae* family can be used as antibacterial agents. The results of the analysis showed that 13 types of plants from the Lamiaceae have antibacterial activity, namely *Anisomeles malabarica, Coleus aromaticus, Coleus blumei, Coleus atropurpureus Benth, Hyptis suaveolens, Leucas aspera, Mentha arvensis Linn, Ocimum bascilicum, Ocimum gratissimum, Ocimum sanctum, Ocimum obovatum, Ocimum tenuiflorum L, and Pogostemon cablin.* The most widely used part of the plant is the leaf.

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