OPEN ACCESS

*Research Article*

# Effectiveness of Antibacterial Leaf Extract *Jatropha curcas* Linn with *Klebsiella pneumoniae* Bacteria

**Qori Fadillah[1], Meldawati[2]**

1. Department of Microbiology, Faculty of Medicine, Universitas Prima Indonesia, Medan
2. Department of Fisiology, Faculty of Medicine, Universitas Prima Indonesia, Medan

* Correspondence: e-mail: drso.melda@gmail.com

**Abstract**

**Background**: This study aims to determine the effectiveness of jatropha leaf extract (*Jatropha curcas* L) with a concentration of 30%, 50%, 70%, 90%, and 100% against bacteria *Klebsiella pneumoniae* with amoxicillin-clavulanic acid as a comparison.

**Method**: The type of research used is true experiment with design posttest only. Antibacterial effectiveness test of leaf extract (Jatropha curcas L) against *Klebsiella pneumoniae* by agar diffusion/Kirby-Bauer using disc paper in which there is jatropha leaf extract then put into culture media (MHA) this method is useful for observing the diameter of the inhibition zone extract then the results are batch-to-batch good.

**Results**: The data processing method used in the research trial was Shapiro-Wilk, namely one-way ANOVA to determine the antibacterial effect of jatropha leaf extract and the Least Significant Difference (LSD) test to determine the difference in antibacterial effects between the 2 treatment groups.

**Conclusion**: From this test, it shows that the research data is normally distributed because p> 0.05 in the statistical test oneway ANOVAshows a value of p= 0.000 (p <0.05), that is, there is a significant difference in the antibacterial effect of jatropha leaf extract (Jatropha curcas L) on bacteria. *Klebsiella pneumoniae* in the analysis results posthoc LSD showed that there was a significant difference between the extract group and the other extract treatment groups.

**Keywords**: *Klebsiella pneumoniae*; *Jatropha curcas* L; Jatropha leaf extract

## INTRODUCTION

Lung disease is a very dangerous disease because the rate of transmission occurs very quickly. Indonesian people have very little knowledge about the dangers of lung disease and the symptoms they experience so that if left without proper treatment there is a risk of disease transmission and even death ), Chronic Obstructive Pulmonary Disease (COPD), Bronchial Asthma, Lung Cancer, and Pneumonia. [1]

Non-smoking tobacco products can increase the risk factors for disease transmission. From research conducted in Saudi Arabia, there are 55 types of bacteria in non-smoking tobacco products, consisting of 28 types of gram-positive bacteria and 27 types of gram-negative bacteria. There was found *Klebsiella pneumoniae* bacteria were the bacteria are bacteria that are resistant to antibiotics. [2]

Infections caused by pathogenic bacteria that are resistant to antibiotics have increased health care and community-acquired infections. Antibiotic resistance is a serious and growing threat to public health and health care providers worldwide. Factors for the emergence of the spread of antibiotic resistance worldwide include inappropriate use of antibiotics, health care settings in prescribing, and widespread community use resulting in an increasing number of immunocompromised individuals, increased global travel, and migration from countries with high levels of the pathogen. Antibiotic resistance is higher with an insufficient number of new antibiotics in development. Based on the table Antibiotic-resistant bacteria in the United States of America, Europe, and the world in 2015 in Europe the bacteria *Klebsiella pneumoniae* (17%) experienced resistance to antibiotic drugs. [3]

In Indonesia, from the table of microbial surveillance data on type A/intensive care type hospital with laboratory testing of blood specimens of gram-negative bacteria *Klebsiella pneumoniae* resistance to antibiotics amoxicillin-clavulanic acid (55.5%), ampicillin-sulbactam (2.1%), azithromycin (55.5%), cefepime (8.5%), cefoxitin (50%), ceftazidime (10.6%), ceftriaxone (6.4%), ciprofloxacin (51.1%), ertapenem (87.2%), gentamicin (33.9%), imipenem (50%). [4]

*Klebsiella pneumoniae* is a gram-negative bacterium that is commonly found in the human digestive tract, a type of bacteria that is an opportunistic pathogen that usually infects the urinary tract, pneumonia, cystitis, surgical wound infections, and

life-threatening infections such as endocarditis and sepsis. The number of side effects caused by antibiotics makes many people use traditional medicinal plants as an alternative to treat infectious diseases.

Indonesian people have always used the surrounding plants to meet their needs such as food, beauty, and various health problems. This is easy to do, considering that plants can be planted in various places and do not require a large area of land. Natural ingredients have to be trusted by the community for a long time because they can treat diseases without side effects compared to drugs that use synthetic materials.

Jatropha (*Jatropha curcas* L) can become an antimicrobial plant because it has latex metabolite compounds as its main component. In addition, there are metabolites, tannins, polyphenols, and polysaccharides as enzyme inhibitors. It is known that jatropha leaves are antiparasitic, while jatropha leaf extract and seeds are reported as antibacterial. In the jatropha leaves and bark, it is known that the most abundant elements are tannins, flavonoids, cardiac glycosides, phlorotannins, terpenoids, and alkaloids. However, it depends on the concentration of jatropha leaves, microbes, and parts used. Tannins with proline-rich proteins form an irreversible complex that inhibits protein synthesis [5].

Jatropha leaves, leaves, fruit, and stems can inhibit *Klebsiella pneumoniae* bacteria because they contain flavonoid compounds as inhibitors of protein synthesis which are anti-microbial, anti-allergic, anti-inflammatory, anti-oxidant, and analgesic. the research was developed on the effectiveness of jatropha leaf extract (*Jatropha curcas* L) as an antibacterial against *Klebsiella pneumoniae* bacteria.

## METHODS

### 1. Study Design

The type of research used was a true experiment with a post-test-only design that aims to determine the antibacterial effectiveness of Jatropha leaf extract (*Jatropha curcas* L) at concentrations of 30%, 50%, 70%, 90%, and 100% against *Klebsiella pneumoniae* bacteria.

### 2. Population and Sample

The sample used in this study was jatropha leaves (*Jatropha curcas* L) derived from jatropha leaf trees obtained in Sidodadi Village, Aceh Tamiang Regency. *Klebsiella pneumoniae* bacteria were purchased from the USU FMIPA Microbiology Laboratory.

The research location for the manufacture of extracts was carried

out at the Traditional Medicine Laboratory, Faculty of Pharmacy, the University of North Sumatra in June. Meanwhile, to see the effectiveness of the extract as an antibacterial on *Klebsiella pneumoniae* bacteria, it was carried out at the Prima Indonesia University Laboratory in March.

**3. Study Instruments**

The tools used in this research are rotary evaporator, beaker glass, petri dish, incubator, water bath, laminar airflow, vortex mixer, paper disc.

The research materials that will be used are jatropha leaves (Jatropha curcas L), Staphylococcus aureus bacteria, amoxicillin-clavulanic acid antibiotics, DMSO (dimethyl sulfoxide), MHA media (Muller Hinton Agar).

The method of making jatropha leaf extract using the maceration method. Weigh 500 grams of Simplicia powder then put it in a container.

**4. Data Analysis**

Data was analyzed by using one-way ANOVA and posthoc LSD parametric statistical tests.

## RESULT

In Jatropha leaf extract (Jatropha curcas L) a phytochemical screening test was carried out so that the results were obtained as shown in the table.1 below:

**Table 1**. Resultsof Phytochemical Screening of Jatropha Leaf Extract (Jatropha curcas L)

| No | Parameter | Result | Sign |
|---|---|---|---|
| 1 | Alkaloid | Positive | + |
| 2 | Steroid | Positive | + |
| 3 | Triterpenoid | Positive | + |
| 4 | Saponin | Negatif | - |
| 5 | Flavonoids | Positive | + |
| 6 | Tanin | Positive | + |

The antibacterial effectiveness of jatropha leaf extract (Jatropha curcas L) at concentrations of 30%, 50%, 70%, 90%, 100% against *Klebsiella pneumoniae* bacteria using the diffusion method. The results showed that all concentrations produced an inhibition zone.

**Table 2**. Results of Inhibition Zone Measurement of Jatropha Leaf Extract (Jatropha curcas L) against *Klebsiella pneumoniae* bacteria

| Repetition | Inhibitory Zone Diameter (mm) at a concentration of Jatropha (Jatropha curcas L) Leaf Extract | | | | | Negative Control | Positive Control |
|---|---|---|---|---|---|---|---|
| | 30% | 50% | 70% | 90% | 100% | | |
| 1 | 12,6 | 14,0 | 15,3 | 17,7 | 20,9 | 0 | 0 |
| 2 | 11,5 | 15,0 | 15,5 | 16,2 | 19,4 | 0 | 0 |
| 3 | 13,2 | 12,6 | 13,2 | 12,5 | 19,8 | 0 | 0 |
| 4 | 12,5 | 12,5 | 13,8 | 13,8 | 16,5 | 0 | 0 |
| Median (mm) | 12,450 | 13,525 | 14,450 | 15,050 | 19,150 | 0 | 0 |
| Deviasi Standart | 0,7047 | 1,1983 | 1,1269 | 2,3388 | 1,8771 | 0 | 0 |

Description: Positive Control (*Amoxicillin-clavulanic acid*), Negative Control (DMSO)

Data from the antibacterial effectiveness test of Jatropha leaf extract (Jatropha curcas L) against *Klebsiella pneumoniae* bacteria, then tested for normality with Shapiro-Wilk. The results of the normality test can be seen in Table 3 below.

**Table 3**. Normality Test Data for Antibacterial Effects of Jatropha Leaf Extract (Jatropha Curcas L) Concentration of 30%, 50%, 70%, 90%, 100%, Positive Control (Amoxcicilin-Clavunalic Acid) and Negative Control (DMSO) against Klebsiella Bacteria Pneumoniae

| Concentration | *p value* | Description |
|---|---|---|
| 30% | 0,669 | Normal |
| 50% | 0,355 | Normal |
| 70% | 0,335 | Normal |
| 90% | 0,791 | Normal |
| 100% | 0,449 | Normal |
| Positive control | 0 | - |
| Negative control | 0 | - |

The results of the one-way ANOVA test were used to see the antibacterial effect of jatropha leaf extract (Jatropha curcas L) at concentrations of 30%, 50%, 70%, 90%, 100%, positive control (Amoxicillin-clavulanic acid), and negative control (DMSO) against bacteria. *Klebsiella pneumoniae* can be seen in Table 4 below.

**Table 4**. Oneway ANOVA Test Results Antibacterial Effect of Jatropha Leaf Extract (Jatropha Curcas L) Concentration of 30%, 50%, 70%, 90%, 100%, Positive Control (Amoxcicilin-Clavunalic Acid) and Negative Control (DMSO) against Bacteria Klebsiella pneumonia

| Group | $\bar{x} \pm SD$ | *p-value* | Description |
|---|---|---|---|
| 30% | 12,450±0,7047 mm | 0,000* | There is a significant difference |
| 50% | 13,525±1,1983 mm | | |
| 70% | 14,450±1,1269 mm | | |

| Group | $\bar{x} \pm SD$ | *p-value* | Description |
|---|---|---|---|
| 90% | 15,050±2,3388 mm | | |
| 100% | 19,150±1,8771 mm | | |
| Positive control | 0 | | |
| Negative control | 0 | | |

Description: there is a significant difference (p<0.05)

The posthoc LSD test was used to determine the difference in antibacterial effects between the 2 treatment groups, more details are seen in table 5 below

**Table 5**. Posthoc LSD Test Results Antibacterial Effects of Jatropha Curcas L Leaf Extract Concentrations of 30%, 50%, 70%, 90%, 100%, Positive Control (Amoxcicilin-Clavunalic Acid) and Negative Control (DMSO) against Bacteria *Klebsiella pneumoniae*

| Kelompok | *p value* | Keterangan |
|---|---|---|
| Extract 30% - extract 50% | 0,262 | No difference |
| Extract 30% - extract 70% | 0,044 | There is a difference |
| Extract 30% - extract 90% | 0,011 | There is a difference |
| Extract 30% - extract 100% | 0,000 | There is a difference |
| Extract 30% - positive control | 0,000 | There is a difference |
| Extract 30% - negative control | 0,000 | There is a difference |
| Extract 50% - extract 70% | 0,333 | No difference |
| Extract 50% - extract 90% | 0,117 | No difference |
| Extract 50% - extract 100% | 0,000 | There is a difference |
| Extract 50% - positive control | 0,000 | There is a difference |
| Extract 50% - negative control | 0,000 | There is a difference |
| Extract 70% - extract 90% | 0,527 | No difference |
| Extract 70% - extract 100% | 0,000 | There is a difference |
| Extract 70% - positive control | 0,000 | There is a difference |
| Extract 70% - negative control | 0,000 | There is a difference |
| Extract 90% - extract 100% | 0,000 | There is a difference |
| Extract 90% - positive control | 0,000 | There is a difference |
| Extract 90% negative control | 0,000 | There is a difference |
| Extract 100% - positive control | 0,000 | There is a difference |
| Extract 100% - negative control | 0,000 | There is a difference |
| Positive control – negative control | 1,000 | No difference |

## DISCUSSION

Based on table 1 above, the results of research on phytochemical screening tests indicate that Jatropha leaf extract (*Jatropha curcas* L) contains secondary metabolites in the form of alkaloids, steroids, triterpenoids, flavonoids, tannins. The method of testing the compound content of Jatropha leaf extract (*Jatropha curcas* L) is qualitative which is only to detect the presence or absence of metabolites in this study. The test was carried out on jatropha

leaf extract (*Jatropha curcas* L) at concentrations of 30%, 50%, 70%, 90%, 100%. The formation of an inhibition zone or clear zone around the paper disc on MHA media indicated an inhibition zone for the growth of *Klebsiella pneumoniae* bacteria. Whereas in the positive control (Amoxicillin-clavulanic acid) and the negative control (DMSO) no inhibition zone or clear zone was found. Based on table 2 above, the results showed that the average inhibitory diameter of Jatropha leaf extract (*Jatropha curcas* L) at concentrations of 30%, 50%, 70%, 90%, 100% in inhibiting *Klebsiella pneumoniae* was 12.450±0.7047. mm; 13.525±1.1983 mm; 14,450±1.1269 mm; 15.050±2.3388 mm; 19,150±1.8771 mm. while the positive control (Amoxicillin-clavulanic acid) and the negative control (DMSO) had no inhibition.

Based on table 3 above, the results of the Shapiro-Wilk normality test on the antibacterial effectiveness of Jatropha leaf extract (*Jatropha curcas* L) against *Klebsiella pneumoniae* bacteria indicate that the data in this study were normally distributed because the p value> 0.05. Thus, data analysis can be continued with one-way ANOVA and posthoc LSD parametric statistical tests. The test was carried out on jatropha leaf extract (*Jatropha curcas* L) at concentrations of 30%, 50%, 70%, 90%, 100%. The formation of an inhibition zone or clear zone around the paper disc on MHA media indicated an inhibition zone for the growth of *Klebsiella pneumoniae* bacteria. Whereas in the positive control (Amoxicillin-clavulanic acid) and the negative control (DMSO) no inhibition zone or clear zone was found. Based on table 2 above, the results showed that the average inhibitory diameter of Jatropha leaf extract (*Jatropha curcas* L) at concentrations of 30%, 50%, 70%, 90%, 100% in inhibiting *Klebsiella pneumoniae* was 12.450±0.7047. mm; 13.525±1.1983 mm; 14,450±1.1269 mm; 15.050±2.3388 mm; 19,150±1.8771 mm. while the positive control (Amoxicillin-clavulanic acid) and the negative control (DMSO) had no inhibition.

Based on table 4 above, the results of the Oneway ANOVA statistical test indicate that the value of p = 0.000 (p <0.05), the research hypothesis is accepted, namely that there is a difference in the antibacterial effect of *Jatropha curcas* Linn (*Jatropha curcas* Linn) leaf extract against *Klebsiella pneumoniae* bacteria.

Based on table 5 above, the results of the Posthoc LSD test showed that there was a significant difference between the 30% extract group and the 70% extract group (p=0.044), the 30% extract group and the 90% extract group (p=0.011), the 30% extract group and the 30% extract group. 100% (p=0.000), extract group 30% - positive control (p=0.000), extract group 30% with negative control (p=0.000), extract group 50% and extract 100% (p=0.000), extract group 50% with positive control (p=0.000), 50% extract group with negative control (p=0.000), 70% extract group with 100% extract (p=0.000), 70% extract group with positive control (p=0.000) , 70% extract group with negative control (p=0.000), 90% extract group with 100% extract (p=0.000), 90% extract

group - positive control (p=0.000), 90% extract group with negative control (p = 0.000), 100% group with positive control (p = 0.000), and 100% extract group with negative control (p = 0.000).

The group that showed the results of the Posthoc LSD test that there was no significant difference was obtained in the 30% extract group with 50% extract (0.262), 50% extract group and 70% extract (0.333), 50% extract group and 90% extract (0.117) , 70% extract group with 90% extract (0.527), and positive control with negative control (p=1,000).

The antibacterial effectiveness of jatropha leaf extract (*Jatropha curcas* L) at concentrations of 30%, 50%, 70%, 90%, and 100% against *Klebsiella pneumoniae* bacteria in this study was due to the presence of active compounds that have antibacterial properties. One of the active compounds contained in Jatropha leaf extract (*Jatropha curcas* L) is an alkaloid. According to Tiwa et al 9, alkaloids can act as an antibacterial by disrupting the composition of the peptidoglycan component of bacterial cells so that the bacterial cell wall is not fully formed and results in lysis.

The mechanism of action of tannin compounds in Jatropha leaf extract (*Jatropha curcas* L) as an antibacterial by inactivating adhesin and enzymes in microbial cells. In addition, tannins also interfere with the protein transport process in the inner layer cells. Imperfect cell wall formation is a target for tannins in polypeptides that result in cell lysis in bacteria by osmotic and physical pressure so that bacterial cells die.

Then, there are flavonoid compounds in jatropha leaf extract (*Jatropha curcas* L). The mechanism of action of flavonoid compounds in the form of extracellular protein complex compounds is polar so that it can damage bacterial cell membranes and release intracellular compounds. Flavonoid compounds can also inhibit DNA-RNA synthesis by an accumulation of nucleic bases so that energy metabolism is disrupted. [6]. Inhibition of membrane binding enzymes such as ATPase and Phospholipase 2 is what inhibits bacterial growth. In addition, Jatropha leaf extract (*Jatropha curcas* L) also contains steroid/triterpenoid components, its mechanism of action is to interfere with the transport of important ions into bacterial cells

## CONCLUSION

There is an antibacterial effect of Jatropha leaf extract (*Jatropha curcas* L) against *Klebsiella pneumoniae* bacteria. There was an increase in the average diameter of the inhibition zone in each treatment with each increase in the concentration of jatropha leaf extract (*Jatropha curcas* Linn) tested. The mean diameter of *Klebsiella pneumoniae* bacteria with concentrations of 30%, 50%, 70%, 90% and 100% were 12.450±0.7047 mm; 13.525±1.1983 mm; 14,450±1.1269 mm; 15.050±2.3388 mm; 19,150±1.8771 mm.

## CONFLICT OF INTEREST

The author declares that there is no conflict of interest in this study.

## FUNDING AND SPONSORSHIP

This study is self-funded.

## ACKNOWLEDGEMENT

Researchers thank and give appreciation to electronic databases: PubMed and Google Scholar

## REFERENCES

[1] Hamzah, M. A. and Darmawansyah (2012) 'Analisis Motivasi Kerja Pegawai Di Kantor Dinas Kesehatan Kabupaten Sidrap 2012', FKM-Unhas Makassar, pp. 1–11. Available at: http://repository.unhas.ac.id/bitstream/handle/123456789/3331/ANALISIS MOTIVASI KERJA PEGAWAI DI KANTOR DINAS KESEHATAN KABUPATEN SIDRAP 2012.pdf.

[2] KEMKES RI (2017) Farmakope Herbal Indonesia Edisi II.

[3] Apriliana, E. et al. (2018) 'Perbandingan Daya Hambat Ekstrak Daun Jarak Pagar ( *Jatropha curcas* Linn ) terhadap Pertumbuhan Bakteri Staphylococcus aureus dan Escherichia coli secara In Vitro', Jurnal Artikel Penelitian, 5, pp. 556–561.

[4] Guranda, I. and Maulanza, H. (2016) 'UJI EFFEKTFITAS TANAMAN JARAK PAGAR (*Jatropha curcas* L.) SEBAGAI ANTI MIKROORGANISME PADA BAKTERI Escherechia coli', Jurnal Serambi Saintia, IV(2), pp. 42–49.

[5] Setiawan Iwan, Erlin Euis, Warsono (2016) 'UJI EKSTRAK ETANOL DAUN JARAK PAGAR (*Jatropha curcas* L.) TERHADAP ZONA HAMBAT BAKTERI Staphylococcus aureus SECARA IN VITRO', Jurnal Pendidikan Biologi (Bioed), 4, pp. 75–80.

[6] Susilo Yulianto, S. K. (2018) 'AKTIVITAS ANTIBAKTERI EKSTRAK DAUN JARAK PAGAR (*JATROPHA CURCAS* L) TERHADAP S TAPHYLOCOCCUS EPIDERMIDIS DAN STAPHYLOCOCCUS AUREUS SECARA IN VITRO', Jurnal Terpadu Ilmu Kesehatan, pp. 60–66.