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In Vivo Study of Nephroprotective Effect of Ethanol Extract of Yellow Rope (*Anamirta cocculus* (L.) Wight & Arn.) on Serum Creatinine Profile of Mice

Studi In Vivo Efek Nefroprotektif Ekstrak Etanol Batang Tali Kuning (*Anamirta cocculus* (L.) Wight & Arn.) terhadap Profil Kreatinin Serum Mencit

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Abstract

Background: Nephrotoxicity due to the use of drugs such as gentamicin can cause kidney damage characterized by increased creatinine levels. The use of medicinal plants as nephroprotective agents is a potential alternative; one such plant is yellow rope stem *(Anamirta cocculus (L.) Wight & Arn.*), known to contain antioxidant compounds. **Objective**: This study aims to assess the nephroprotective activity of yellow rope stem ethanol extract and determine the optimal dose for reducing gentamicin-induced increases in creatinine levels in mice. **Method**: The study was conducted experimentally with a pre-test and post-test design using the maceration method with 70% ethanol solvent. Mice were divided into six groups, namely negative control, positive control (vitamin E), healthy control, and three treatment groups with varying extract doses. Creatinine levels were measured using the Jaffe method with a UV-Vis spectrophotometer. **Results**: The results showed that the yellow rope stem ethanol extract at a dose of 77 mg/kgBW was able to reduce creatinine levels significantly ($p<0.05$), while lower doses did not show a significant difference. **Conclusion**: Ethanol extract of yellow rope stems has nephroprotective activity at an optimal dose of 77 mg/kgBW, thus having the potential to be developed as a herbal agent to protect kidney function.

Keywords: Yellow Rope, Nephroprotector, Creatinine, Gentamicin, Mice.

Abstrak

Latar Belakang: Nefrotoksisitas akibat penggunaan obat seperti gentamisin dapat menyebabkan kerusakan ginjal yang ditandai dengan peningkatan kadar kreatinin. Pemanfaatan tanaman obat sebagai agen nefroprotektor menjadi alternatif yang potensial, salah satunya adalah batang tali kuning (*Anamirta cocculus* (L.) Wight & Arn.) yang diketahui mengandung senyawa antioksidan. **Tujuan:** Penelitian ini bertujuan untuk mengetahui aktivitas ekstrak etanol batang tali kuning sebagai nefroprotektor serta menentukan dosis optimal dalam menurunkan kadar kreatinin pada mencit yang diinduksi gentamisin. **Metode:** Penelitian dilakukan secara eksperimental dengan desain *pre-test* dan *post-test* menggunakan metode maserasi dengan pelarut etanol 70%. Mencit dibagi menjadi enam kelompok, yaitu kontrol negatif, kontrol positif (vitamin E), kontrol sehat, serta tiga kelompok perlakuan dengan variasi dosis ekstrak. Kadar kreatinin diukur menggunakan metode *Jaffe* dengan spektrofotometer UV-Vis. **Hasil:** Hasil penelitian menunjukkan bahwa ekstrak etanol batang tali kuning pada dosis 77 mg/kgBB mampu menurunkan kadar kreatinin secara signifikan ($p<0,05$), sedangkan dosis yang lebih rendah tidak menunjukkan perbedaan yang signifikan. **Kesimpulan:** Ekstrak etanol batang tali kuning memiliki aktivitas nefroprotektif dengan dosis optimal 77 mg/kgBB sehingga berpotensi dikembangkan sebagai agen herbal untuk melindungi fungsi ginjal.

Kata Kunci: Tali Kuning, Nefroprotektor, Kreatinin, Gentamisin, Mencit.

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Introduction

Indonesia is one of the countries with the highest level of biodiversity in the world, so it has a strategic role in the development of global medicinal plants. With a wealth of around 40,000 plant species spread across a wide range of ecosystems, ranging from lowlands to mountainous and coastal regions, the country has massive biodiversity potential. Indonesia's 120.35 million hectares of tropical forests are home to 80% of nutritious plant species. Among the 30,000 species that have been identified, there are 9,600 species that have the potential to be medicinal plants, with about 300 varieties that have been commercially downstreamed by the traditional medicine industry [1].

Kidney failure is one of the crucial public health problems in Indonesia. Based on data from the 2023 Indonesian Health Survey (SKI), the prevalence of chronic kidney failure (CKD) in the population aged 15 years and above was recorded at 0.18% of a total of 638,178 respondents [2]. Kidney failure is defined as a sudden decline in renal function that results in the inability of the organ to excrete metabolic residues or carry out its physiological functions. This condition triggers the accumulation of residual substances in the body, which has an impact on fluid imbalances, electrolytes, as well as disorders in the metabolic and endocrine systems [3]. The accumulation of toxic compounds in the body risks triggering kidney damage known as nephrotoxicity [4]. This condition has a bad impact on the excretory system and has the potential to progress to kidney failure. Definitely, nephrotoxicity is a kidney disorder caused by exposure to chemicals, drugs, and harmful environmental pollutants [5]. In addition, nephrotoxicity can be triggered by oxidative stress that manifests in the degradation of renal tissue as well as a moderate increase in serum creatinine and urea levels. The condition is generally accompanied by necrosis of the epithelial cells of the renal tubules, which is the main etiological factor in the decline in the function of the organ [6].

Gentamycin is an antibiotic of the aminoglycoside group that has a significant toxicity profile. One of the adverse clinical side effects of the use of this drug is its ability to induce damage to the renal tubules [7]. The mechanism of kidney damage due to gentamycin begins with the retention of the drug in proximal tubule cells through *the megalin-cubilin complex*, which leads to impaired membrane function due to phospholipidosis. Mitochondrial dysfunction also occurs through activation of apoptosis pathways and increased oxidative stress due to ROS accumulation and decreased ATP production. In addition to affecting the tubules, gentamycin distorts the glomerular unit by triggering mesangial cell contraction, a condition that decreases filtration capacity and causes excess protein excretion in the urine (proteinuria) [8].

Efforts to prevent and treat nephrotoxicity (kidney damage due to toxic substances) can be done by utilizing antioxidants. This substance has the potential to protect the kidneys due to the ability of the substance to neutralize free radicals that damage kidney tissue. The yellow rope stem (*Anamirta cocculus* (L.) Wight & Arn.) is one of the native flora of Papua that has great potential in the development of phytopharmaceuticals. Empirically, local people in Papua have used this vine as an antimalarial agent because of the characteristics of its stems, which have a bitter taste similar to quinine and chloroquine. Based on this traditional use, this plant continues to be developed as an alternative treatment to overcome malaria [9]. Given the lack of previous studies examining the kidney-protective effects of yellow rope stems, the authors are interested in investigating the nephroprotective activity of *A. cocculus* (L.) Wight & Arn *extracts.* The focus of this study is on the effect on serum creatinine levels in mice with nephrotoxicity.

Experimental Section

Plant Sample Collection

The yellow rope stem (*Anamirta cocculus* (L.) Wight & Arn.) was collected from the East Misol area, Raja Ampat Regency, Southwest Papua Province.

Materials and Apparatus

The tools used in this study include Mouse cage, Analytical scale, Test tube (Pyrex), Measuring cup (Pyrex), Drip pipette, Micro pipette, Beaker glass (Pyrex), Glass funnel (Pyrex), Oven (Kenton), Blender, Sieve, Porcelain cup, Oral sonde, Syringe (Onemed), Test tube rack, Centrifuge, Uv-Vis Spectrophotometry (*Thermo Scientific*), *Waterbath* (*Memmert*), Cuvette, *Handscoon*, Glass Jars, Erlenmeyer (Pyrex), Conical Tubes, and EDTA Conical Tubes.

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This study used materials consisting of samples of yellow rope rods (*A. cocculus* (L.) Wight & Arn.), mice (*Mus musculus*), gentamicine, vitamin E (Ever E 250), 70% ethanol, pickric acid, NaOH, Na CMC, filter paper, aquades, aluminum foil, plastic wrap, tissues, and mouse feed.

Sample processing of yellow rope rod (*Anamirta cocculus* (L.) Wight & Arn.)

Samples of yellow rope rods (*A. cocculus*) were obtained from East Misool, Raja Ampat. A total of 3 kg of samples were cleaned, washed with running water, and then dried in the oven at 50°C. After drying, the sample is mashed and weighed [10].

Manufacture of yellow rope stem extract (*Anamirta cocculus* (L.) Wight & Arn.)

Extraction of 500 grams of yellow rope stem powder (*A. cocculus*) was carried out by the maceration method using 70% ethanol solvent (ratio 1:4) for 3 × 24 hours. Maceration was chosen because the maceration method is highly effective for extracting compounds that are sensitive to high temperatures, such as alkaloids and flavonoids. Since it does not involve heat, the chemical structure integrity of the active compounds in the sample can be better preserved. Alkaloids and flavonoids are known to be heat-sensitive and can oxidize at high temperatures [11]. This process involves periodic remaceration and stirring every 24 hours in a glass container. The resulting filtrate is then filtered and concentrated using a water bath at a temperature of 50°C until a thick extract is obtained for the calculation of the yield, which is calculated using the following formula:

$$\%\ Rendement = \frac{Thick\ extract\ weight}{Weight\ of\ extracted\ simplex}\ x\ 100\%$$

Preparation of test animals

This study used 30 mice that were evenly divided into six experimental groups, with a treatment duration of 10 days. These groups included healthy controls (no treatment), negative controls (intraperitoneal induction of gentamycin 200 mg/kgBB), and positive controls (gentamycin combined with vitamin E 400 mg/kgBB orally) [11]. In addition, there were three test groups, each administered an induction of gentamycin and a dose of yellow rope stem extract (*A. cocculus* (L.) Wight & Arn.) orally with concentration variations of 19.25 mg/kgBB (Dose I), 38.5 mg/kgBB (Dose II), and 77 mg/kgBB (Dose III).

The use of a gentamicin dose of 200 mg/kg BW intraperitoneally was based on previous research. According to that study, nephrotoxicity induction in mice was performed by administering gentamicin at doses ranging from 100–200 mg/kg BW intraperitoneally for 10 days. Even in more specific experimental designs, the nephrotoxic group was given a dose of 200 mg/kg BW for 10 consecutive days. This indicates that the 200 mg/kg BW dose has indeed been used in experimental research. Administration of gentamicin at 200 mg/kg BW for 10 days was able to produce measurable nephrotoxicity (moderate nephrotoxicity), characterized by increased creatinine and urea levels, as well as histopathological changes in the kidneys. In contrast, lower doses such as 50–100 mg/kg BW or shorter durations were reported to not produce significant biochemical and histological changes, making them less optimal for establishing a consistent nephrotoxic model [12].

Experimental animals were categorized as suitable for use if they met the inclusion criteria, such as being in good health, active, free from physical defects, and having appropriate body weight. Animals showing signs of illness or death during the adaptation or treatment period were excluded from the study according to the exclusion criteria.

Creatinine levels were measured in two stages, namely on day 0 (*pre-test*) and day 11 (*post-test*). Blood specimens were collected through the tail veins of mice that had previously been disinfected using *alcohol swabs*. The procedure is followed by cutting the tail tip using sterile scissors that have been cleaned with 70% alcohol, then pressure is placed on the base of the tail until the required volume of blood comes out of the wound tip [12].

This research has obtained ethical approval from the Health Research Ethics Committee of the Makassar College of Pharmacy with number: 1.007/KOMETIK/STIFA/I/2026 dated January 18, 2026. The care and treatment of experimental animals followed the ARRIVE (Animal Research: Reporting of In Vivo Experiments) guidelines and the 3R principles (Replacement, Reduction, Refinement).

Measurement of creatinine levels

A total of 1 mL of blood samples was stored in an Eppendorf tube. The sample was then centrifuged at 10,000 rpm for 10 minutes to separate the serum. The separated serum is then used to measure creatinine

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levels [7]. Creatinine analysis was carried out using *the Jaffe method* through a kinetic test without deproteination. The principle of this method is based on the formation of a reddish-orange complex when creatinine reacts with an alkaline picrate solution. The working reagent is prepared by mixing sodium hydroxide (reagent 1) and picric acid (reagent 2) at a ratio of 4:1. A total of 50 µL of serum is added to 1000 µL of the working reagent in a test tube, then homogenized with a vortex mixer. The absorbance of the mixture was measured using a spectrophotometer at a wavelength of 492 nm after incubation for 2 minutes. This study uses the maceration extraction method.

Results and Discussion

The process of obtaining secondary metabolites from natural substances begins with extraction. Extraction methods are usually divided into two categories: conventional (maceration, percolation, infusion, reflux, and Soxhlet extraction) and modern (UAE and wave-assisted extraction) microorganisms (MAE) [13]. This study uses the maceration extraction method. A simple extraction method known as maceration uses the principle of diffusion at room temperature. Driven by the difference in concentration, the filter fluid will penetrate the plant cell wall and gradually dissolve the active substances inside. Until equilibrium, the active substance will continue to move from within the cell into the filter fluid [14].

Extraction of 500 grams of yellow rope stem simplicia (*Anamirta cocculus* (L.) Wight % Arn.) using 70% ethanol solvent through the maceration method yielded 33 grams of thick extract. Based on the calculation results, the yield obtained is 6.6%. This percentage is categorized as not meeting the criteria for good yield, considering that the optimal yield value standard is above 10% [15]. Yield is the percentage of comparison between the mass of the extract produced and the mass of the initial raw material. This value represents the effectiveness of the solvent in attracting the active compound during the extraction process. The percentage of yield value obtained in this study has not met the standard of a good yield value. This low yield value may be due to the comparison of the volume of solvent to the sample. The increase in solvent volume contributes to an increase in the percentage of extract yield. This is possible because the larger volume of the solvent can optimize penetration into the sample tissue, thereby increasing the amount of bioactive compounds dissolved [16]. These findings are by previous research showing that the addition of solvent volume contributes synergistically to the increase in extract yield [17]. The ethanol extract yield from the yellow rope stem was 6.6%, indicating that the amount of extract obtained from the extraction process was relatively low. Nevertheless, a low yield value does not always correlate directly with weak biological activity, as several studies on extracts from other plant stems have shown that even with small yields, the extracts still exhibited significant pharmacological activity [18]. For future research, it is recommended to conduct a comparative study between the maceration method and other techniques such as reflux or Soxhlet extraction. This aims to evaluate extraction effectiveness and yield in greater depth.

Table 1. Percentage Yield Value of Yellow rope stem extract (*Anamirta cocculus* (L.) Wight % Arn.)

Sample	Sample Weight	Extract Weight	Rendemen
Yellow Rope Stem (*Anamirta cocculus* (L.) Wight & Arn.)	500 gram	33 gram	6,6%

Next, the serum creatinine level of mice was measured. Creatinine is a product of endogenous skeletal muscle metabolism that is excreted through urine without being reabsorbed by the renal tubules. Therefore, fluctuations in creatinine levels in the blood are a crucial indicator to evaluate the condition of a person's kidney function [18]. In this study, vitamin E was used as a positive control. Vitamin E (*alpha-tocopherol*) is a potent fat-soluble antioxidant that protects cells from oxidative stress, regulates immune system function, maintains endothelial cell integrity, and balances normal coagulation [19].

Induction of gentamycin has been shown to increase creatinine and urea levels, as well as trigger oxidative stress characterized by increased levels of *Reactive Oxygen Species* (ROS), *malondialdehyde* (MDA), and 8-OHdG. Gentamicin-induced nephrotoxicity begins with drug accumulation in the renal tubules, triggering oxidative stress such as nitrotyrosine formation and lipid peroxidation. This pathological process involves various signaling pathways (including p38 MAPK and TGF-β) that amplify the inflammatory response through macrophage infiltration. The consequences include tubular necrosis and glomerular dysfunction, which significantly impair the kidney's filtration capacity, leading to a sharp rise in blood creatinine levels [21]. However, the administration of vitamin E is able to improve these biochemical

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parameters to close to normal conditions. In addition to restoring the decreased activity of antioxidant enzymes such as *Superoxide Dismutase* (SOD) and *Glutathione Peroxidase* (GPx), vitamin E is also effective in reducing histopathological damage to kidney tissue. The nephroprotective mechanism of vitamin E comes from its capacity as a powerful antioxidant that inhibits the formation of free radicals, suppresses lipid peroxidation, and maintains the balance of the endogenous antioxidant system. Furthermore, vitamin E plays a role in inhibiting the ferroptosis process through increased GPX4 activity, which functions to prevent kidney cell death due to exposure to oxidative stress [11].

Table 2. Effect of Giving Yellow String Stem Extract (*Anamirta cocculus* (L.) Wight & Arn.) On serum creatinine levels of mice between *pre-test* and *post-test*.

Groups	*Pre-Test* (mg/dl)	*Pos-Test* (mg/dl)	P Value	95% *Confidence Interval of the Difference*	
				Lower	Upper
K+	1.88 ± 0.35	1.05 ± 0.16	0.017	0.24	1.43
K-	1.71 ± 0.33	1.76 ± 0.39	0.827	-0.55	0.47
KS	2.46 ± 0.83	1.83 ± 0.27	0.076	-0.10	1.37
Dosage I	2.44 ± 1.67	2.09 ± 0.70	0.582	-1.26	1.95
Dosage II	1.71 ± 0.49	1.33 ± 0.15	0.181	-0.27	1.02
Dosage III	2.03 ± 0.16	1.14 ± 0.23	0.001	0.57	1.21

Remarks: Statistical test using *paired-sample t-test* with significance value <0.05

Based on the paired t-test in **Table 2,** a significant decrease in creatinine levels ($p < 0.05$) was found only in the positive control group (K+) and the group receiving dose III (77 mg/kg BW). The negative control group (K-), healthy control group (KS), dose I group, and dose II group showed changes that were not statistically significant ($p > 0.05$). The decrease in levels indicates the nephroprotective effect of the administration of the extract against induced kidney damage. Specifically, statistical analysis showed that the positive control group and dose III (77 mg/kgBB) experienced significant changes with a p< value of 0.05. This is reinforced by the value of 95% *Confidence Interval,* which does not exceed zero, so it can be concluded that the treatment in both groups has a real effect on serum creatinine levels. In contrast, in the negative control groups, standard control, dose I, and dose II, no significant difference was found ($p > 0.05$). Although there was a tendency to decrease creatinine levels after treatment in these groups, statistically, the changes that occurred were not strong enough to prove the effect of treatment on improving kidney function. Differences in basal creatinine levels between groups, including relatively higher values in the healthy control group, may be influenced by individual biological variation, hydration status, activity levels, handling stress, and variability in the Jaffe method measurement. Therefore, these baseline data should be interpreted cautiously as a study limitation.

Table 3. Comparison of Serum Creatinine Levels in Mice Between the Control Group and the Yellow Rope Stem Extract (*Anamirta cocculus* (L.) Wight & Arn.)

Variabel	Group I (Positive)	Group II (Negatif)	Group III (Sehat)	Group IV (AC 19,25 mg/kgBB)	Group V (AC 38,5 mg/kgBB)	Group VI (AC 77 mg/kgBB)
Pre-Treatment (mg/dl)	1.88 ± 0.35	1.71 ± 0.33	2.46 ± 0.83	2.44 ± 1.76	1.71 ± 0.49	2.03 ± 0.16
Post- Treatment (mg/dl)	1.04 ± 1.16	1.75 ± 0.39	1.83 ± 0.27	2.09 ± 0.70	1.33 ± 0.34	1.14 ± 0.23
Δ (mg/dl)	0.83 ± 0.34[b]**	-0.04 ± 0.41[a]**	0.63 ± 0.59	0.34 ± 1.28	0.37 ± 0.52	0.89 ± 0.25[b]**

Remarks: Values are expressed as Mean ± SD, n=5, Δ = Difference between pre-treatment and post-treatment, **p< 0.05 independent t-test (independent-samples t-test). [a] compared to positive control, [b] compared to negative control. AC = *Anamirta cocculus* (L.) Wight & Arn.

Statistical analysis in **Table 3.** showed significant differences between the negative control group (K-) and the positive control group (K+) ($p = 0.01$), as well as between the K- group and the dose group III ($p = 0.003$). These results indicate that treatment in positive control and dose III had a noticeable effect compared to negative controls. In contrast, the comparison between the positive control (K+) and the healthy group (KS), dose I, dose II, and dose III showed no significant difference ($p > 0.05$). Although there is a variation in the average score descriptively, the difference is not statistically significant. A similar condition was found in the comparison between the negative control (K-) and the KS, dose I, and dose II groups ($p > 0.05$), suggesting that the three groups were not able to produce a significant difference to the K- group. In addition, comparisons between dose variations (doses I, II, and III) also showed no significant difference ($p > 0.05$). Furthermore, the comparison between the healthy group (KS) and the entire dose group resulted in a p-value of > 0.05. This indicates that the effects of each dose level are still within the same range as normal conditions. Overall, significant differences were only found in the comparison of negative controls to positive controls and dose

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III. This suggests that the effectiveness of the treatment is starting to be seen at the highest dose, but it has not shown consistency in all other dose groups.

Based on research conducted by [20], yellow rope plants (*Anamirta cocculus* (L.) Wight & Arn.) contain alkaloid compounds, flavonoids, tannins, and terpenoids. These compounds are known to have activity as antioxidants. Antioxidants are compounds that inhibit or slow down the oxidation process of molecules due to exposure to oxidants in the body. Through this mechanism, these compounds are able to protect tissues and organs from damage triggered by oxidative stress [7]. Alkaloids and tannins work as antioxidants by donating hydrogen atoms to free radicals. Flavonoids play a nephroprotective role by inhibiting oxidative stress in the kidneys through increased activity and synthesis of antioxidant enzymes, such as *glutathione S-transferase* (GST). In addition, flavonoids can neutralize *Reactive Oxygen Species* (ROS) directly by donating hydrogen atoms from the hydroxyl group to free radicals. In the process, flavonoids transform into flavonoid radicals that then bind to each other to form stable, non-reactive compounds [6]. In line with this, the antioxidant activity of phenolic compounds depends on their ability to form phenoxide ions. These ions function as electron donors for free radicals, resulting in stable non-radical compounds [21]. Meanwhile, terpenoid compounds act as primary antioxidants by breaking the free radical reaction chain. This mechanism effectively prevents the formation of new radicals and produces more stable products, including superoxide radicals [22].

Based on research conducted by [22], the yellow rope plant (*Anamirta cocculus* (L.) Wight & Arn.) contains alkaloid, flavonoid, tannin, and terpenoid compounds. These compounds are known to have antioxidant activity. The phytochemical compounds in A. cocculus, particularly alkaloids and flavonoids, are thought to suppress gentamicin nephrotoxicity through antioxidant and anti-inflammatory activities. In this context, flavonoids from A. cocculus have the potential to scavenge free radicals, inhibit lipid peroxidation, and maintain renal cell membrane integrity, while alkaloids theoretically support nephroprotective effects by suppressing oxidative stress and inflammatory responses. Thus, the decrease in creatinine levels in the treatment group can be explained as the result of protection by these bioactive compounds against gentamicin-induced kidney damage pathways. In line with this, the antioxidant activity of phenolic compounds depends on their ability to form phenoxide ions. These ions act as electron donors to free radicals, thereby producing stable non-radical compounds [20]. Meanwhile, terpenoid compounds serve as primary antioxidants by breaking the free radical reaction chain. This mechanism effectively prevents the formation of new radicals and produces more stable products, including against superoxide radicals [21].

Conclusions

The results showed that ethanol extract of yellow rope rod (*Anamirta cocculus* (L.) Wight & Arn.) had effective nephroprotective activity against gentamicin-induced mice, evidenced by a significant post-treatment reduction in serum creatinine levels. This protective effect against kidney damage due to nephrotoxicity achieved the most optimal results at a dose of 77 mg/kgBB, which statistically showed the most significant reduction in creatinine levels ($p < 0.05$) compared to other dose variations.

Conflict of Interest

The author states that he has no competing financial interests or known personal relationships that could be considered to influence the work reported in this review article.

References

[1] Pradikta HY, Sopiyah S, Dayani TR. Pemberdayaan Masyarakat dalam Pemanfaatan dan Pembuatan Kebun Tanaman Obat Keluarga pada Komunitas Ibu PKK di Pekon Banjar Agung Udik, Kecamatan Pugung, Kabupaten Tanggamus. Wisanggeni J Pengabdi Masy 2021;1:1–10. https://doi.org/10.25217/wisanggeni.v1i2.1897.

[2] Inayati A, Jumaiyah W, Latipah S. Intradialytic flexybility exercise terhadap fatigue pada pasien penyakit ginjal kronis. [Mahesa Malahayati Heal Student J 2025;5:5712–24.

[3] Mait G, Nurmansyah M, Bidjuni H. Gambaran Adaptasi Fisiologis Dan Psikologis Pada Pasien Gagal Ginjal Kronis Yang Menjalani Hemodialisis Di Kota Manado. J Keperawatan 2021;9:1.

Electronic ISSN : 2656-3088
Homepage: https://www.journal-jps.com

https://doi.org/10.35790/jkp.v9i2.36775.

[4] Nasution RA, Lubis AA, Sembiring NB. Uji Efek Nefroprotektif Ekstrak Daun Kemangi (Ocimum Bacilicum L.) Terhadap Tikus Wistar Jantan Yang Diinduksi Aspirin. An-Najat 2025;3:341–51. https://doi.org/10.59841/an-najat.v3i2.2537.

[5] Pusmarani J, Ashar LON, Ifaya M, Khalid NHA. Efek Nefroprotektif Kulit Pisang Raja (Musa paradisiaca var. Sapientum) terhadap Kadar Kreatinin Tikus yang Diinduksi Parasetamol. J Mandala Pharmacon Indones 2023;9:119–24. https://doi.org/10.35311/jmpi.v9i1.320.

[6] Ifmaily I, Irwandi I, Warni EF. Uji Efek Nefroprotektif Ekstrak Kulit Buah Mangga Arumanis (Mangifera indica L) Secara In Vivo Diinduksi Gentamisin. J Pharm Heal Res 2023;4:1–8. https://doi.org/10.47065/jharma.v4i1.3075.

[7] Santi I, Wati A, Sjamsuddin MD. Uji Efek Nefroprotektif Ekstrak Etanol Daun Binahong (Anredera cordifolia (Ten.) Steenis) Pada Tikus Jantan Yang Diinduksi Gentamisin. As-Syifaa J Farm 2022;14:24–30. https://doi.org/10.56711/jifa.v14i1.788.

[8] Akbar DR, Yonata A, Ratna MG, Darwis I. Literature Review : Gagal Ginjal Akut Akibat Nefrotoksisitas Gentamisin Literature Review : Acute Kidney Injury by Gentamicin-Induce Nephrotoxicity 2024;14:1721–7.

[9] Hardiansyah LO, Muslihin AM, Astuti RA. Studi In Vitro Ekstrak Kulit Batang Tali Kuning (A. cocculus) Sebagai Antioksidan. J Kesehat Tambusai 2024;5:12785–92. https://doi.org/10.31004/jkt.v5i4.37849.

[10] Erawati R, Muslihin A, Hardia L. Uji Aktivitas Antioksidan Fraksi Ekstrak Etanol Tali Kuning (Anamirta cocculus) Dengan Metode DPPH. 2024.

[11] Khasanah N, Muslihin AM. Perbandingan Metode Ekstraksi Terhadap Kadar Total Flavonoid Dan Alkaloid Daun Batik Papua (Graptophyllum pictum L . griff). J Etnofarmasi 2025;3:10–25.

[12] Georgiev T, Nikolova G, Dyakova V, Karamalakova Y, Georgieva E, Ananiev J, et al. Vitamin E and Silymarin Reduce Oxidative Tissue Damage during Gentamycin-Induced Nephrotoxicity. Pharmaceuticals 2023;4:1–18.

[13] Rahayu D, Hardia L, Irwandi I. Uji efek hipoglikemik ekstrak buah merah (*Pandanus conoideus* l.) Terhadap mencit (Mus musculus). J Etnofarmasi 2023;1:38–45. https://doi.org/10.36232/jurnalfarmasiunimuda.v1i01.1719.

[14] Rossardy MD, Muslihin AM, Watora W, Budiyanto AB, Hardia L, Irwandi I, et al. Phytochemical Study of Active Compounds in the Stem Extract of Nelambo suon (Rubiaceae) Studi Fitokimia Senyawa Aktif Ekstrak Batang Nelambo suon (Rubiaceae). J Pharm Sci 2026;9:598–606.

[15] Fahiroh J, Arifin N, Devitri RW, Septiarini RT, Silvany E, Maulidya V, et al. Tinjauan Literatur : Efektivitas Maserasi sebagai Metode Ekstraksi Fitokimia. Obat J Ris Ilmu Farm Dan Kesehat 2025;3:228–42.

[16] Rahadyana RZ, Artini KS, Wardani TS. Uji Aktivitas Antioksidan Ekstrak Biji Bunga Matahari (*Helianthus annuus* L) Dengan Menggunakan Metode 2024;5:8049–56.

[17] Selviana AP, Khoirotunnisa U, Ulandari AS, Rahayu ID, Andrifianie F. Pengaruh Konsentrasi dan Volume Etanol Terhadap Rendemen Ekstrak Bunga Telang (Clitoria ternatea L.) Pada Metode Ekstraksi Maserasi. J Kesehat Dan Agromedicine 2024;11:94–100.

[18] Kusuma AE, Aprileili DA. Pengaruh Jumlah Pelarut Terhadap Rendemen Ekstrak Daun Katuk (*Sauropus androgynus* L. Merr). J Farm Sains Dan Obat Tradis 2022;1:125–35.

[19] Jumadewi A, Fajarna F, Emmi W. Kadar kreatinin serum pasien diabetes mellitus tipe 2 pada kelompok usia 40 tahun keatas 2022;4:52–7.

[20] Goudarzi MM. Efficacy of Vitamin E on Renal Function and Preventing Proximal Tubulopathy Caused by Iron Chelation Therapy in Thalassemia Major Patients : A Randomized Controlled Clinical Trial 2023;15:1–9.

[21] Heeba G, Botros S, Anter A. Gentamicin Nephrotoxicity: Mechanisms and Renoprotective Strategies 2022.

[22] Masitoh R. Studi Fitokimia dan Analisis Aktivitas Antioksidan Ekstrak Etanol Batang Tali Kuning (Anamirta cocculus) Dengan Metode DPPH 2024.

[23] Sari WD, Santika IWM. Potensi Tanaman Pepaya (*Carica papaya* L.) sebagai Nefroprotektor. Pros Work Dan Semin Nas Farm 2023;2:700–15. https://doi.org/10.24843/wsnf.2022.v02.p56.

[24] Kartika L, Mirhansyahardana, Rusli R. Aktivitas Antioksidan Tanaman Genus Artocarpus. Mulawarman Pharm Conf 2020:237–44.

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