RINI PRASTIWI-THE ACUTE TOXICITY of KI HAMPELAS LEAVES (STERCULIA RUBIGIMOSA ZOLL. Ex MIQ)

by Rini Prastiwi Uploded By Mas'ud Syaiful

Submission date: 29-Jul-2021 06:02PM (UTC+0700)
Submission ID: 1625405463
File name: PharmacognJ-13-2-570.pdf_-_Prastiwi_Rini.pdf (2.23M)
Word count: 3137
Character count: 16707

rmacogn J. 2021; 13(2): 570-576
A Multifaceted Journal in the field of Natural Products and Pharmacognosy
www.phcogj.com

Research Article

The Acute Toxicity of Ki Hampelas Leaves (*Sterculia rubiginosa* Zoll. Ex Miq)

Rini Prastiwi*, Ema Dewanti, Cut Mauliza, Ester Hidayati, Ita Anggraini, Riska Anggraini, Vera Ladeska

Rini Prastiwi*, Ema Dewanti, Cut Mauliza, Ester Hidayati, Ita Anggraini, Riska Anggraini, Vera Ladeska

University of Mu- hammadiyah Prof. Dr. Hamka, Klender, Jakarta 13460, INDONESIA.

Correspondence
Rini Prastiwi
University of Muhammadiyah Prof. HAMKA, Klender, Jakarta 13460, INDONESIA.
E-mail: khanzapras@gmail.com

History
- Submission Date: 20-10-2020;
- Review completed: 27-11-2020;
- Accepted Date: 08-12-2020.

DOI : 10.5530/pj.2021.13.71

Article Available online
http://www.phcogj.com/v13/i2

ABSTRACT

Background: Ki Hampelas (*Sterculia rubiginosa* Zoll. Ex Miq) is a medicinal plant with antioxidant and nephroprotective activity. **Objective:** This research aims to prove that Ki Hampelas leaves extract through an acute toxicity test. **Materials and Methods:** This study used white male rats of the *Sprague-Dawley* strain divided into four groups, the normal group and the 50 mg/kg, 1000 mg/kg, 2000 mg/kg dose groups. For the acute toxicity test, a single dose with an observation of 14 days. After that, the surgery was done to see changes in the histopathology of the liver and kidneys. **Results:** The administration of Ki Hampelas leaf extract in the acute toxicity test did not cause death in the tested animals. There were no significant liver and kidney changes seen from the SGOT, SGPT, creatinine, urea, and histopathology. **Conclusion:** Ki Hampelas leaves extract did not cause death and toxic effects in the acute toxicity test.
Key words: Ki Hampelas (*Sterculia rubiginosa* Zoll. Ex Miq), Acute Toxicity, Liver, Kidney.

INTRODUCTION

Sterculia is a genus with many pharmacological activities and is also use as a material in pharmaceutical preparations. Among the genus, *Sterculia*, *Sterculia villosa* Roxb, has antileishmanial activity and a safety level at giving a non-toxic dose of 100 mg/kg body[1]. *Sterculia setigera* Del. has the activity of the ethanol extract of *Sterculia setigera* Del. has antioxidant activity with the DPPH method on the fruit of 91.81%. In contrast, ethanol extract on stem bark is 86%[2]. Seeds of *Sterculia foetida* seed have antioxidant and antimicrobial activity[3]. *Sterculia setigera* Del., has activity as a tyrosinase inhibitory activity. It also has antiproliferative activity against human colon adenocarcinoma HT29[4]. *Sterulia quinqueloba* (Garcke) K. Schum has acti as an antimycobacterial activity[5]. *Sterculia quadrifida* R.br Stem bark also has activity as an anti-hepatitis C[6]. Plants of the genus *Sterculia* are also using in n drug delivery applications[7]. Ag nanoparticles using seeds from *Sterculia foetida* L. have activity on mosquito vectors and HeLa cancer cells[8]. Some *Sterculia* genus plants have activities. *Sterculia foetida* for antibacterial and hemolytic[10], apoptosis[11], *Sterculia diversifolia* for immunomodulatory and anti-cancer[12], *Sterculia villosa* as fibrinolytic[5], sedative[6], *Sterculia tragacantha* as anti-inflammatory and analgesic[15],

One of the plants used as an ingredient in traditional medicine is Ki Hampelas leaves (*Sterculia rubiginosa* Zoll. Ex Miq). These plants are scattered in tropical and subtropical areas, especially in Sumatra. Based previous research, Ki Hampelas leaves contain tannins, flavonoids, alkaloids, steroids-terpenoids, glycosides, and phenols. The antioxidant activity and total flavonoids equivalent to quercetine[17]. So it is interesting to study whether *Sterculia rubiginosa* has antioxidant and nephroprotective activity[16].

To ensure the safety, effectiveness, and quality of a drug must undergo a series of tests. Starting from screening to look for active compounds, then continued with testing the effectiveness or selectivity and its mechanism of action in experimental animals or microbes, after being declared to have certain pharmacological activities by a series of safety tests on experimental animals, the toxicity test[17]. In previous studies, Ki Hampelas leaves have activity as a nephroprotective and antioxidant with a minimum dose of 50 mg/kg[16]. So it is necessary to do a toxicity test to ensure the safety of Ki Hampelas leaves extract.

The acute toxicity test aims to detect toxic effects that appear quickly and determine the LD_{50} e in a compound or substance after being given a single dose or repeated doses within 24 hours.

MATERIALS AND METHODS

Material

The leaves of Ki Hampelas obtained from the Bogor Botanical Gardens, Indonesia. Determination at the Botanical Garden Plant Conservation Center, Botany Division, Biology Research Center-LIPI, Indonesia. Ethanol obtained from local suppliers. Urea reagent kit, Creatinine kit, SGOT kit, SGPT kit from PT. Human, Indonesia. Na CMC (PT. Brataco), aqua destillata, obtained from local suppliers.

Extraction

Ki Hampelas leaves powder was extracted by maceration method with 70% ethanol. Two hundred (200) grams of Simplicia powder by immersing 70% ethanol. Then concentrated using a vacuum rotary evaporator at a temperature of 50°C to obtain a thick extract, evaporated on a water bath with a temperature of 50°C until a viscous extract[18].

Cite this article: Prastiwi R, Dewanti E, Mauliza C, Hidayati E, Anggraini I, Anggraini R, *et al.* The Acute Toxicity of KI Hampelas Leaves (*Sterculia rubiginosa* Zoll. Ex Miq). Pharmacog J. 2021;13(2): 570-6.

Extract characteristics

The extract was indentified with organoleptic, the yield, moisture content, ash content and phytochemical screening.

Acute toxicity test

Acute toxicity test used white male rats *Sprague Dawley* strain. The tested animals used in this study were 24 animals divided into four groups consisting of 6 animals for each group. The normal control group was given standard feed and 0.5% Na CMC, extract dose of 50 mg/kg, 1000 mg/kg, 2000 mg/kg. The test animals acclimatized for seven days. During acclimatization, the rats were fed and drunk and controlled the health and weight. Before taking blood, the animal test has fasted for ± 12 hours. The animals anesthetized using ketamine intramuscularly, then blood serum samples taken from white rats. The liver's acute toxicity parameters determined by SGOT, SGPT, and histopathology of the central vein and pyknotic nucleus size. The kidneys' observation done by determining creatinine, urea, and histopathology by looking at the cast on the tubules and the percentage of tubules with close and glomerular swelling. Glomerular calculated by measuring the distance from the Bowman's capsule's edge to the glomerular rim[19] . Tubular damage calculated using the formula = (n / m × 100%), where n= is the number of proximal tubules covered in one field of view and m= is the number of all proximal tubules in one field of view. Then the results were averaged to get the percentage of kidney damage in each mouse[20]. This research was permitted by the Ethics Committee KEPK-UHAMKA No. 02 / 20.03 / 0358.

Data analysis

The Kolmogorov-Smirnov and Levene's test determined the homogeneity and normal distribution of the data. The analytical continuous with the Tukey Test.

RESULTS AND DISCUSSION

Phytochemical screening

Flavonoids, glycosides, alkaloids, tannins, saponins, triterpenoids and steroids, are present in the extract. The test results show in Table 2.

Table 1: Quality Characteristics of extract *S. rubiginosa*.

No.	Characteristics	Result
1.	Organoleptic a.) Form b .) Color c.) Smell d.) Taste	 Thick extract Brownish green Typical A bit bitter
2.	Rendement	13.19 %
3.	Water content	7.95%
4.	Ash content	8.54%

Table 2: Phytochemical Screening of extract *S. rubiginosa*.

Chemical Ingredients	Result
Alkaloids	+
Flavonoids	+
Tannins	+
Phenol	+
Saponins	-
Triterpenoi d & Steroids	+

Description : (+) = Presence; (-) = Absence

Acute toxicity of Ki hampelas leaf extract

The results Ki Hampelas leaf extract with the highest dose of 2000 mg/kg did not cause death in the test animals, the value of LD_{50} extract of Ki Hampelas leaves for test animals male white rats Sprague-Dawley is more than 2000 mg/kg.

Heart

At SGOT levels, SGPT showed an increase between the normal group and the extract group. However, this increase is still in the normal range, so it concluded that Ki Hampelas leaves extract's giving does not influence it. From the results of examining SGOT and SGPT levels, the value obtained ($p > 0.05$) indicated no significant difference in each treatment group. The results show in Figures 1 and 2.

Liver histopathology

Histopathological observations of the liver include measuring the central vein's diameter and the number of pyknotic nuclei. The central vein's diameter is used in the measurement because the central venous area is the center of the hepatic lobule and part of the reservoir of blood originating from the hepatic artery and portal vein[21]. The results of liver histopathological preparations show in Figure 5.

The parameter of liver organ, the central vein's diameter, between normal and the test group, shows no difference between groups. This result show in figure 6. The pyknotic nuclei show the differences between the normal and the test groups. Besides, the number of pyknotic nuclei which a sign of the occurrence of cell necrosis. This result show in Figure 7.

Kidney

The creatinine and urea levels of rats given the extract showed that treatment with different doses had increased creatinine and urea levels in rats. However, the increase in levels was still within normal limits. The results showed that creatinine and urea levels found that acute toxicity Ki Hampelas ki leaf extract had no significant effect on creatinine and urea levels $p > 0.05$. The results show in figures 3 and 4.

Kidney histopathology

Observations on the structure of the kidney structure include the distance between the glomerulus and Bowman's capsule, the percentage of tubules that close in one view and the cast on the tubules, can be seen in Figure 8. Casts are a collection of proteins that result in channeling through the tubular renal hampered, also stimulate the occurrence of necrosis

of the tubules. While necrosis is death Jarin gan due to the absence of metabolites[22].

The result of the study showed no presence of cast in control normal and the test group. The percentage of tubules that closed in one field of view showed that there was no significant difference between the normal group and the 50 mg/kg dose group $p > 0.05$, and the results between the 1000 mg/kg dose group and the 2000 mg/kg dose test group not seen. The significant difference with $p > 0.05$ shown in Figure 9. Meanwhile, the bowman room distance shows a significant difference between the normal control and test groups. The result show in Figure 10.

CONCLUSION

The ethanol extract of 70% Ki Hampelas leaves in the acute toxicity test did not cause death and toxic effects. The examination of SGOT and SGPT levels showed no significant difference between the dose treatment group and the normal group ($p > 0.05$).

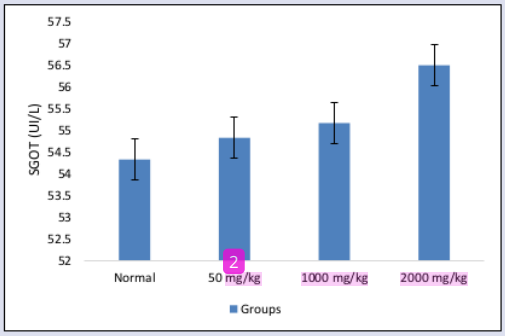


Figure 1: The SGOT Serum.

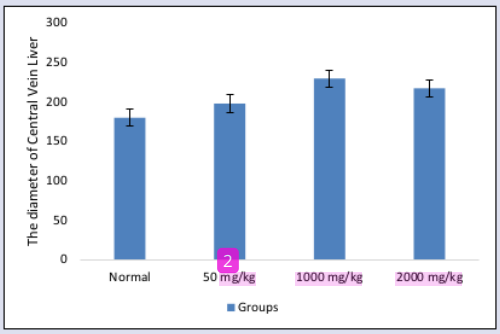


Figure 4: The diameter of Central Vein Liver.

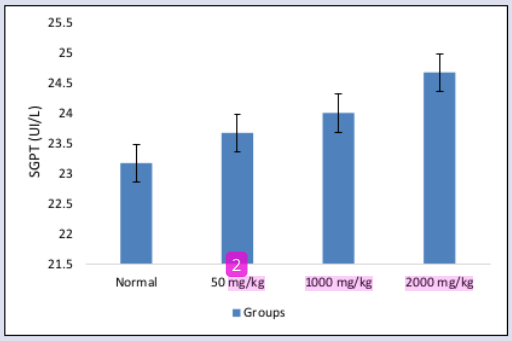


Figure 2: The SGPT Serum.

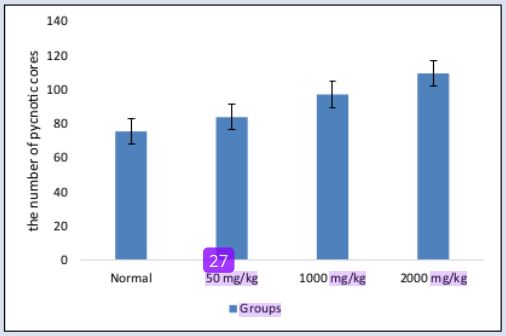


Figure 5: The Number of Pycnotic Cores.

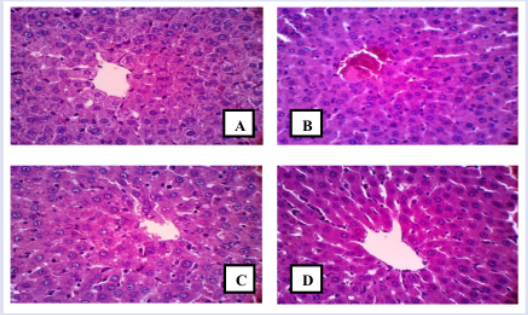


Figure 3: The histopathology of liver. (A) Normal control 0.5% CMC, (B) 50 mg/kg, (C) 1000 mg/kg, and (D) 2000 mg/kg.

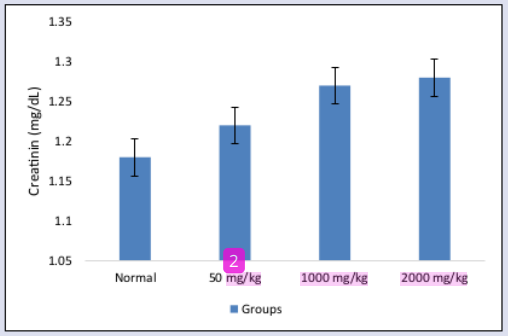


Figure 6: The Creatinine Serum.

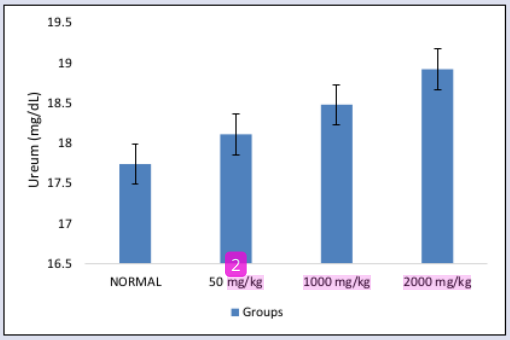


Figure 7: Ureum levels.

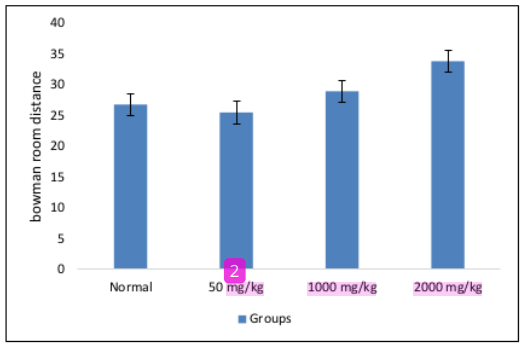


Figure 10: Kidney Bowman's Space Distance.

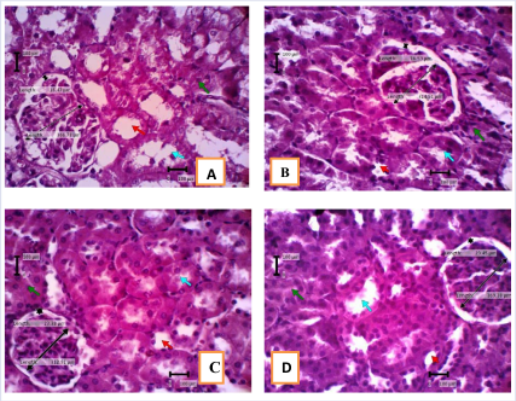


Figure 8: The Histopatology of Kidney. (A) Normal CMC 0,5%, (B) 50 mg/kg, (C) 1000 mg/kg, dan (D) 2000 mg/kg.

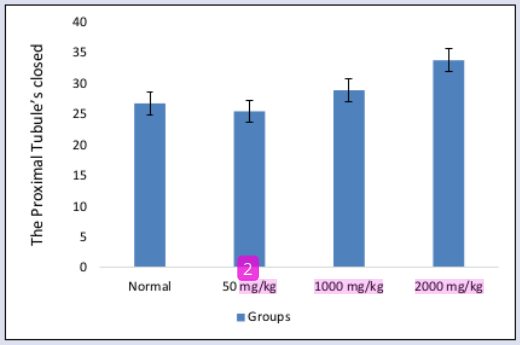


Figure 9: The Proximal Tubule's closed.

ETHICAL ISSUES

The Ethics Committee permitted this research with the number KEPK-UHAMKA No. 02 / 20.03 / 0358.

CONFLICTS OF INTEREST

All authors state there is no conflicts of interest.

ACKNOWLEDGMENT

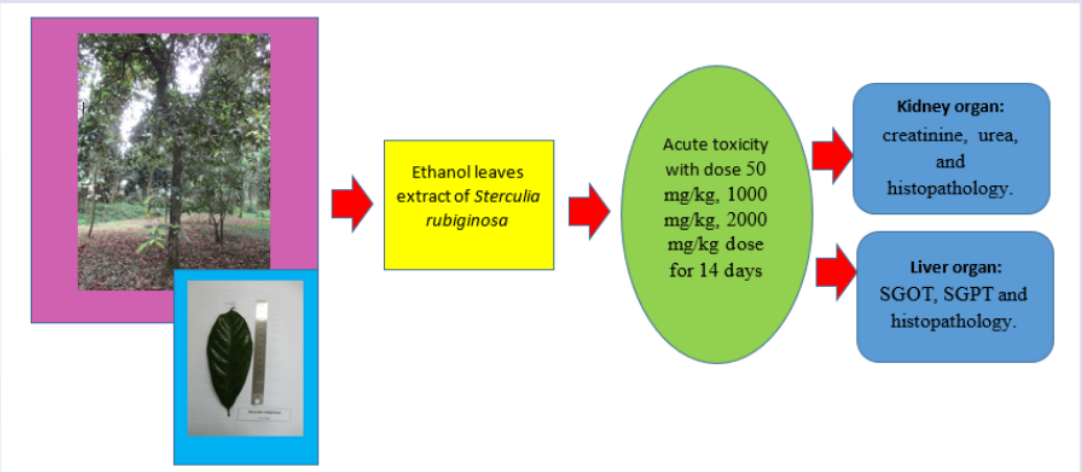
The author would like to thank the Ministry of Research, Technology, and Higher Education, The Republic of Indonesia, for the Research Foundation through the PDUPT Grant.

REFERENCES

1. A. Das, M. C. Das, N. Das, and S. Bhattacharjee, Evaluation of the antileishmanial potency, toxicity and phytochemical constituents of methanol bark extract of Sterculia villosa. Pharm Biol. 2017:55(1):998-100
2. N. M. M. Taha and B. M. Mudawi, Antioxidant and Cytotoxic Activities of Sterculia setigera Del American journal of Research mmunication. 2018;6(5):41-9.
3. A. Jafri, S. Bano, J. Rais, F. Khan, N. Shivnath. Phytochemical screening of Sterculia foetida seed extract for anti-oxidant , anti-microbial activity , and detection of apoptosis through reactive oxygen species (ROS) generation , mitochondrial membrane potential (MMP) decrease , and nuclear fragmentation in human osteosarcoma cells. Histotechnol. 209:42(2):1-12.
4. E. S. M. Bahnson, N. Koo, N. Cantu-medellin, A. Y. Tsui, G. E. Havelka, J. M. Vercammen, Q. Jiang, E. E. Kelley, *et al.* Nitric Oxide Nitric oxide inhibits neointimal hyperplasia following vascular injury via differential, cell-specific modulation of SOD-1 in the arterial wall. Nitric Oxide. 2015:44;8-17.
5. E. Wilson, M. Chacha, and J. Omolo. *In vitro* Antimycobacterial Activity of Sterculia quinqueloba (Garcke) K . Schumand Canthium crassum Hiern. European Journal of Medicinal Plants. 2015:6(2);103-9.
6. M. Ayu, W. Moi, A. A. Permanasari, M. Adianti, and L. Tumewu. The Activity of Sterculia quadrifida R . br Stembark against Hepatitis C Virus. In Proceedings of BROMO Conference (BROMO 2018). 2018:106-10.

7. H. Bera, Y. F. Abbasi, S. Hasnain, and A. K. Nayak, Chapter 9 - Sterculia gum in drug delivery applications. Elsevier Inc., 2019:227-45.
8. P. Rajasekharreddy and P. U. Rani. Biofabrication of Ag nanoparticles using *Sterculia foetida* L . seed extract and their toxic potential against mosquito vectors and HeLa cancer cells. Mater. Sci. Eng. C. 204:39:203-12.
9. R. Prastiwi, B. Elya, R. Sauriasari, M. Hanafi, and E. Dewanti. Pharmacognosy, Phytochemical Study and Antioxidant Activity of Sterculia rubiginosa Zoll. Ex Miq. Leaves. Pharmacognosy Journal. 2018;10:571-5.
10. A. Braga and R. Rodrigues, Gracy, Gregorio, Hilzet, et al. Antibacterial and Hemolytic Activity of a new Lectin Purified from the Seeds of Sterculia Foetida L . Appl Biochem Biotechnol. 2015;17[illegible]1689-99.
11. Jafri, S. Bano, J. Rais, F. Khan, and N. Shivnath. Phytochemical screening of Sterculia foetida seed extract for antioxidant, anti-microbial activity , and detection of apoptosis through reactive oxygen species (ROS) generation , mitochondrial membrane potential (MMP) decrease , and nuclear fragmentation in human osteosarcoma cells. J. Histotech[illegible]2019:1-12.
12. [illegible] and I. U. Fazle Rabbi, Amir Zada, Achyut Adhikari, Almas Jabeen. Sterculia diversifolia bears anti-cancer and immunomodulatory activities. Bangladesh J. Pharmacol. 2017;12:52-5.
13. Z. Uddin, T. Bin Emran, A. K. Nath, I. Hossain, M. Alamgir, and S. Rana. In vitro Antioxidative , Fibrinolytic and Phytochemical Effects of Different Extracts of Sterculia villosa Barks. Int. J. Res. Pharm. Biosci. 2015;2:1-9.
14. F. Hossain, B. Talukder, M. N. Rana, R. Tasnim, T. S. Nipun, S. M. N. Uddin, and S. M. M. Hossen. In vivo sedative activity of methanolic extract of Sterculia villosa Roxb . leaves. BMC Complement. Altern. [illegible]d. 2016;16:10-3.
15. O. M. Mogbojuri, A. A. Adedapo, and M. O. Abatan. Phytochemical screening , safety evaluation , anti-inflammatory and analgesic studies of the leaf extracts of Sterculia tragacantha. J Complement Integr Med. 2016:2-7.
16. R. Prastiwi, E. Dewanti, Nurul, N. Aqilla, S. Salsabila, and V. Ladeska. The Nephroprotective And Antioxidant Activity of Sterculia rubiginosa Zoll. Ex Miq. Leaves . Pharmacognosy Journal. 2020;12:843-9.
17. Priyanto. Toxicology, Mechanism, Antidote Therapy, and Risk Assessment. Lenskofi. Indonesia. 2009.
18. Depkes RI. Indonesian Herbal Pharmacopoeia Edition 1. Ministry of Health RI. Indonesia. 2008.
19. Cahyaningsih. Nephroprotective Effect of Breadfruit Leaf Infusion Artocarpusaltilis Park. Fsb. On Carbon Tetrachloride Induced Male Rats. Pharmaceutical Science Magazine. 2011:15-73.
20. Sihardo. The Effect of Pandanus conoideus Oil on Kidney Histology in Swiss Mice Infection with Plasmodium bergehei Anka. Scientific Writing. 2006.
21. Mescher. Basic Histology of the Junqueira Text and Atlas. EGC. Jakarta. 2011.
22. I. Fajriaty, I. Hariyanto, I. Saputra, and M. Silitonga. Phytochemical Screening and Thin Layer Chromatography Analysis of Ethanol Extract of Lerak Fruit (Sapindus rarak) . Journal of Informatics and Science Education. 2017;6:243-56.

GRAPHICAL ABSTRACT



ABOUT AUTHORS

Cut Mauliza: Student at Faculty of Pharmacy and Sciences, University of Muhammadiyah Prof. Dr. HAMKA, Klender, Jakarta 13460, Indonesia.

Ita Anggraini: Student at Faculty of Pharmacy and Sciences, University of Muhammadiyah Prof. Dr. HAMKA, Klender, Jakarta 13460, Indonesia.

Riska Anggraini: Student at Faculty of Pharmacy and Sciences, University of Muhammadiyah Prof. Dr. HAMKA, Klender, Jakarta 13460, Indonesia.

Ester Hidayati: Student at Faculty of Pharmacy and Sciences, University of Muhammadiyah Prof. Dr. HAMKA, Klender, Jakarta 13460, Indonesia.

Ema Dewanti: Lecturer and researcher at Faculty of Pharmacy and Sciences, University of Muhammadiyah Prof. Dr. HAMKA, Klender, Jakarta 13460, Indonesia.

Vera Ladeska: Lecturer and researcher at Faculty of Pharmacy and Sciences, University of Muhammadiyah Prof. Dr. HAMKA, Klender, Jakarta 13460, Indonesia.

Rini Prastiwi: Lecturer and researcher at Faculty of Pharmacy and Sciences, University of Muhammadiyah Prof. Dr. HAMKA, Klender, Jakarta 13460, Indonesia.

Cite this article: Prastiwi R, Dewanti E, Mauliza C, Hidayati E, Anggraini I, Anggraini R, *et al.* The Acute Toxicity of KI Hampelas Leaves (*Sterculia rubiginosa* Zoll. Ex Miq). Pharmacog J. 2021;13(2): 570-6.

RINI PRASTIWI-THE ACUTE TOXICITY of KI HAMPELAS LEAVES (STERCULIA RUBIGIMOSA ZOLL. Ex MIQ)

ORIGINALITY REPORT

29%	24%	21%	7%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.fulltxt.org Internet Source	4%
2	repository-tnmgrmu.ac.in Internet Source	3%
3	Rollando Rollando, Warsito Warsito, Masruri Masruri, Widodo Widodo. "Potential Therapeutic Use of Sterculia quadrifida R.Br and Sterculia foetida Linn.: Review", Asian Journal of Plant Sciences, 2020 Publication	2%
4	repository.ubaya.ac.id Internet Source	2%
5	Rommel C. Morales, Edward S.M. Bahnson, George E. Havelka, Nadiezhda Cantu-Medellin, Eric E. Kelley, Melina R. Kibbe. "Sex-based differential regulation of oxidative stress in the vasculature by nitric oxide", Redox Biology, 2015 Publication	1%

6	K. R. Solomon, J. P. Giesy, R. J. Kendall, L. B. Best, J. R. Coats, K. R. Dixon, M. J. Hooper, E. E. Kenaga, S. T. McMurry. "Chlorpyrifos: Ecotoxicological Risk Assessment for Birds and Mammals in Corn Agroecosystems", Human and Ecological Risk Assessment: An International Journal, 2001 Publication	1 %
7	repository.uin-malang.ac.id Internet Source	1 %
8	Camilla Xavier, Jeanmaire Molina. "Phylogeny of medicinal plants depicts cultural convergence among immigrant groups in New York City", Journal of Herbal Medicine, 2016 Publication	1 %
9	B. Sundararajan, Anil Kumar Moola, K. Vivek, B.D.Ranjitha Kumari. "Formulation of nanoemulsion from leaves essential oil of Ocimum basilicum L. and its antibacterial, antioxidant and larvicidal activities (Culex quinquefasciatus)", Microbial Pathogenesis, 2018 Publication	1 %
10	Said Hassan, Bashir Ahmad, Shahid Ullah Khan, Huang Linfang et al. "In vivo pharmacological investigation of Monotheca buxifolia and Bosea amherstiana using animal	1 %

models", Saudi Journal of Biological Sciences, 2019
Publication

11	Nabeelah Bibi Sadeer, Eulogio José Llorent-Martínez, Kouadio Bene, Mohamad Fawzi Mahomoodally et al. "Chemical profiling, antioxidant, enzyme inhibitory and molecular modelling studies on the leaves and stem bark extracts of three African medicinal plants", Journal of Pharmaceutical and Biomedical Analysis, 2019 Publication	1 %
12	Antu Das, Junaid Jibran Jawed, Manash C. Das, Padmani Sandhu, Utpal C. De, Biswanath Dinda, Yusuf Akhter, Surajit Bhattacharjee. "Antileishmanial and immunomodulatory activities of lupeol, a triterpene compound isolated from Sterculia villosa", International Journal of Antimicrobial Agents, 2017 Publication	1 %
13	f1000research.com Internet Source	1 %
14	ojs.uho.ac.id Internet Source	1 %
15	Khansa Alshambaty, Sakina Yagi, Abdalla A. Elbashir, Hervé Schohn et al. "Chemical constituents and biological activities of African medicinal tree Sterculia setigera Delile stem	1 %

bark", South African Journal of Botany, 2020
Publication

16	univ-bejaia.dz Internet Source	1 %
17	www.mdpi.com Internet Source	1 %
18	Submitted to School of Business and Management ITB Student Paper	1 %
19	Yipu Xu, Baoxing Pang, Liang Hu, Xiaoyu Feng, Lei Hu, Jingsong Wang, Chunmei Zhang, Songlin Wang. "Dietary nitrate protects submandibular gland from hyposalivation in ovariectomized rats via suppressing cell apoptosis", Biochemical and Biophysical Research Communications, 2018 Publication	1 %
20	www.imedpub.com Internet Source	1 %
21	Amit Kumar Nayak, Md Saquib Hasnain, Mohammad Tabish, Tejraj M Aminabhavi. "Uses of tailored polysaccharides in dentistry", Elsevier BV, 2020 Publication	<1 %
22	Osamudiamen Ebohon, Francis Irabor, Ehimwenma Sheena Omoregie. "Sub-acute toxicity study of methanol extract of	<1 %

	Tetrorchidium didymostemon leaves using biochemical analyses and gene expression in Wistar rats", Heliyon, 2020 Publication	
23	Sri Tjahajawati, Arif Zulhazmi, Arief Cahyanto, Marry Siti Mariam et al. "Matrix levels of metalloproteinase-2 (MMP-2) and toxicity evaluation of carbonate apatite-based endodontic sealer in rat subcutaneous implantation", Heliyon, 2020 Publication	<1 %
24	academicjournals.org Internet Source	<1 %
25	X. Xu, H. M. Taylor. "Increase in Drought Resistance of Cotton Seedlings Treated with Mepiquat Chloride", Agronomy Journal, 1992 Publication	<1 %
26	journals.sagepub.com Internet Source	<1 %
27	Arevalo, R.. "Fetal brain serotonin synthesis and catabolism is under control by mother intake of tryptophan", Life Sciences, 1991 Publication	<1 %
28	psr.ui.ac.id Internet Source	<1 %
29	www.degruyter.com Internet Source	<1 %

30	www.thieme-connect.com Internet Source	<1%
31	scitepress.org Internet Source	<1%
32	www.hindawi.com Internet Source	<1%
33	journal.unair.ac.id Internet Source	<1%
34	www.banglajol.info Internet Source	<1%
35	Afef Troudi, Nejla Soudani, Amira Mahjoubi Samet, Ibtissem Ben Amara, Najiba Zeghal. "2,4-Dichlorophenoxyacetic acid effects on nephrotoxicity in rats during late pregnancy and early postnatal periods", Ecotoxicology and Environmental Safety, 2011 Publication	<1%
36	Dostal, L.A.. "Testicular toxicity and reduced sertoli cell numbers in neonatal rats by di(2-ethylhexyl) phthalate and the recovery of fertility as adults", Toxicology and Applied Pharmacology, 198808 Publication	<1%

Exclude quotes Off

Exclude matches Off

Exclude bibliography Off