

Free Full Text from Publisher [Look Up Full Text](#) [Find PDF](#) [Full Text Options](#) [Export...](#) [Add to Marked List](#)

## Ameliorative Effects of *Aquilaria malaccensis* Leaves Aqueous Extract on Reproductive Toxicity Induced by Cyclophosphamide in Male Rats

By: [Razak, RNHA](#) (Razak, Redzuan Nul Hakim Abdul)<sup>[1]</sup>; [Ismail, F](#) (Ismail, Faridah)<sup>[2]</sup>; [Isa, MLM](#) (Isa, Muhammad Lokman Md)<sup>[3]</sup>; [Wahab, AYA](#) (Wahab, Azantee Yazmie Abdul)<sup>[4]</sup>; [Muhammad, H](#) (Muhammad, Hussin)<sup>[5]</sup>; [Ramli, R](#) (Ramli, Roszaman)<sup>[4]</sup>; [Ismail, RASR](#) (Ismail, Raja Arif Shah Raja)<sup>[4]</sup>

[Ismail, F](#) ORCID

MALAYSIAN JOURNAL OF MEDICAL SCIENCES

Volume: 26 Issue: 1 Pages: 44-57

DOI: 10.21315/mjms2019.26.1.4

Published: JAN-FEB 2019

Document Type: Article

### Abstract

Background: Cyclophosphamide (CP) is a widely used anti-neoplastic and immunosuppressive agent that is associated with adverse side effects including reproductive toxicity. *Aquilaria malaccensis* (AM) is a traditional medicinal plant which was reported to exhibit high anti-oxidant and free radical scavenging properties. The present study was aimed to evaluate the protective effects of AM leaves extract on sperm quality following toxic exposure to CP.

Methods: Forty-eight male Sprague Dawley rats were allocated into eight groups of six rats (n = 6): control, CP only (200 mg kg<sup>-1</sup>), AM only (100 mg kg<sup>-1</sup>), 300 mg kg<sup>-1</sup> and 500 mg kg<sup>-1</sup>) and CP + AM (100 mg kg<sup>-1</sup>, 300 mg kg<sup>-1</sup> and 500 mg kg<sup>-1</sup>). Animals were sacrificed after 63 days of treatment and the sperm from the caudal epididymis was taken for sperm analysis.

Results: The body and the reproductive organs weight, sperm count and motility did not differ between CP and other groups (P > 0.05). A significant increase (P < 0.05) in percentage of the dead and abnormal sperm were seen in the CP alone treated group compared to the control group. Co-administration of AM to the CP exposed rats significantly reduced the (P < 0.05) percentage of abnormal sperm as compared to the CP only group.

Conclusion: Overall, the present results represent the potential of AM to protect against CP induced reproductive toxicity.

### Keywords

**Author Keywords:** antioxidants; *Aquilaria malaccensis*; cyclophosphamide; oxidative stress; reproductive toxicity

**KeyWords Plus:** ALPHA-LIPOIC ACID; OXIDATIVE STRESS; SPERM MORPHOLOGY; TESTICULAR TOXICITY; DAMAGE; CHEMOTHERAPY; MECHANISMS; THYMELAEACEAE; HISTOLOGY; ACROLEIN

### Author Information

**Reprint Address:** Ismail, F (reprint author)

+ Int Islamic Univ Malaysia, Dept Basic Med Sci, Kulliyyah Med, Jalan Sultan Ahmad Shah, Kuantan 25200, Pahang, Malaysia.

### Addresses:

- + [ 1 ] Int Islamic Univ Malaysia, Dept Basic Med Sci, Kulliyyah Allied Hlth Sci, Jalan Sultan Ahmad Shah, Kuantan 25200, Pahang, Malaysia
- + [ 2 ] Int Islamic Univ Malaysia, Dept Basic Med Sci, Kulliyyah Med, Jalan Sultan Ahmad Shah, Kuantan 25200, Pahang, Malaysia
- + [ 3 ] Int Islamic Univ Malaysia, Dept Basic Med Sci, Kulliyyah Nursing, Jalan Sultan Ahmad Shah, Kuantan 25200, Pahang, Malaysia
- + [ 4 ] Int Islamic Univ Malaysia, Dept Obstet & Gynaecol, Jalan Sultan Ahmad Shah, Kuantan 25200, Pahang, Malaysia
- + [ 5 ] Herbal Med Res Ctr, Inst Med Res, Jalan Pahang, Kuala Lumpur 50588, Malaysia

**E-mail Addresses:** [faridahismail@iium.edu.my](mailto:faridahismail@iium.edu.my)

### Funding

Funding Agency	Grant Number
Innovative Research Grant Scheme	IRGS 16-296-0460

[View funding text](#)

### Publisher

UNIV SAINS MALAYSIA, SCH MEDICAL SCIENCES, HEALTH CAMPUS, 16150 KUBANG KERIAN, KELANTAN, 00000, MALAYSIA

### Categories / Classification

**Research Areas:** Research & Experimental Medicine

**Web of Science Categories:** Medicine, Research & Experimental

[See more data fields](#)

### Citation Network

In Web of Science Core Collection

2

Times Cited

[Create Citation Alert](#)

All Times Cited Counts

2 in All Databases

[See more counts](#)

62

Cited References

[View Related Records](#)

### Most recently cited by:

Ibrahim, Hany M.; Mohammed-Geba, Khaled; Tawfic, Amr A.; et al. Camel milk exosomes modulate cyclophosphamide-induced oxidative stress and immuno-toxicity in rats. FOOD & FUNCTION (2019)

Samadi, M.; Abidin, Z. Zainal; Yoshida, H.; et al. Subcritical water extraction of essential oil from *Aquilaria malaccensis* leaves. SEPARATION SCIENCE AND TECHNOLOGY (2019)

[View All](#)

### Use in Web of Science

Web of Science Usage Count

0

0

Last 180 Days

Since 2013

[Learn more](#)

### This record is from:

Web of Science Core Collection  
- Emerging Sources Citation Index

### Suggest a correction

If you would like to improve the quality of the data in this record, please [suggest a correction](#).

## Cited References: 62

Showing 30 of 62 [View All in Cited References page](#)

(from Web of Science Core Collection)

1. **Rutin Ameliorates Cyclophosphamide-induced Reproductive Toxicity in Male Rats.** Times Cited: 39  
By: Abarikwu, S O; Otuechere, C A; Ekor, M; et al.  
Toxicology international Volume: 19 Issue: 2 Pages: 207-14 Published: 2012-May
2. **CHEMICAL CONSTITUENTS AND TOXICITY EFFECTS OF LEAVES FROM SEVERAL AGARWOOD TREE SPECIES (AQUILARIA)** Times Cited: 3  
By: Adam, A. Z.; Tajuddin, S. N.; Sudmoon, R.; et al.  
JOURNAL OF TROPICAL FOREST SCIENCE Volume: 30 Issue: 3 Pages: 342-353 Published: 2018
3. **The role of antioxidant therapy in the treatment of male infertility** Times Cited: 100  
By: Agarwal, Ashok; Sekhon, Lucky H.  
HUMAN FERTILITY Volume: 13 Issue: 4 Pages: 217-225 Published: 2010
4. **Pharmacology of free radicals and the impact of reactive oxygen species on the testis.** Times Cited: 85  
By: Aprioku, Jonah Sydney  
Journal of reproduction & infertility Volume: 14 Issue: 4 Pages: 158-72 Published: 2013-Oct
5. **Cyclophosphamide in multiple sclerosis: scientific rationale, history and novel treatment paradigms.** Times Cited: 25  
By: Awad, Amer; Stuve, Olaf  
Therapeutic advances in neurological disorders Volume: 2 Issue: 6 Pages: 50-61 Published: 2009-Nov
6. Title: [not available] Times Cited: 64  
By: Barden, A.; Awang, A.; Mulliken, T.; et al.  
Heart of the Matter Agarwood Use and Trade and CITES Implementation for AquilariaMalaccensis Published: 2000  
Publisher: Traffic International, Cambridge  
[\[Show additional data\]](#)
7. **Keamanan teh gaharu (Aquilaria malaccensis) dari pohon induksi melalui uji toksisitas subkronik oral 90 hari** Times Cited: 2  
By: Batubara, R; Sihombing, TM; Ginting, H; et al.  
Biofarmasi Volume: 14 Pages: 69-76 Published: 2016  
[\[Show additional data\]](#)
8. **Study on agarwood (Aquilaria malaccensis) to evaluate antibacterial and antioxidant activities of n-hexane, chloroform and ethyl acetate extracts** Times Cited: 3  
By: Begum, Y.  
Pharma Tutor. Volume: 4 Issue: 2 Pages: 47-50 Published: 2016
9. **Mechanisms of toxic damage to spermatogenesis.** Times Cited: 65  
By: Boekelheide, Kim  
Journal of the National Cancer Institute. Monographs Issue: 34 Pages: 6-8 Published: 2005
10. **Toxic Effect of Cyclophosphamide on Sperm Morphology, Testicular Histology and Blood Oxidant-Antioxidant Balance, and Protective Roles of Lycopene and Ellagic Acid** Times Cited: 53  
By: Ceribasi, Ali Osman; Turk, Gaffari; Sonmez, Mustafa; et al.  
BASIC & CLINICAL PHARMACOLOGY & TOXICOLOGY Volume: 107 Issue: 3 Pages: 730-736 Published: SEP 2010
11. **Melatonin ameliorates oxidative stress and reproductive toxicity induced by cyclophosphamide in male mice** Times Cited: 38  
By: Chabra, A.; Shokrzadeh, M.; Naghshvar, F.; et al.  
HUMAN & EXPERIMENTAL TOXICOLOGY Volume: 33 Issue: 2 Pages: 185-195 Published: FEB 2014
12. **Toxicological effects of cyclophosphamide and ameliorative role of ascorbic acid on the reproductive parameters of male Rattus norvegicus** Times Cited: 1  
By: Chouhan, S; Ahmad, B; Chauhan, R; et al.  
Asian Journal of Pharmacy and Life Science. Volume: 4 Issue: 3 Pages: 34-45 Published: 2014  
[\[Show additional data\]](#)
13. **Cyclophosphamide treatment causes impairment of sperm and its fertilizing ability in mice** Times Cited: 69  
By: Elangovan, Namasivayam; Chiou, Tzeon-Jye; Tzeng, Woan-Fang; et al.  
TOXICOLOGY Volume: 222 Issue: 1-2 Pages: 60-70 Published: MAY 1 2006
14. **Anti-cancer activity of Aquilaria malaccensis leaves on human cervical cancer cells** Times Cited: 1  
By: Fatmawati, Hidayat R.  
Eur J Pharm Med Res. Volume: 3 Issue: 1 Pages: 46-49 Published: 2015
15. **Signaling mechanisms in mammalian sperm motility** Times Cited: 25  
By: Freitas, Maria Joao; Vijayaraghavan, Srinivasan; Fardilha, Margarida  
BIOLOGY OF REPRODUCTION Volume: 96 Issue: 1 Pages: 2-12 Published: JAN 2017

16. **Effects of male reproductive toxicants on gene expression in rat testes** Times Cited: 32  
 By: Fukushima, Tamio; Yamamoto, Toshinori; Kikkawa, Rie; et al.  
 Journal of Toxicological Sciences Volume: 30 Issue: 3 Pages: 195-206 Published: AUG 2005
17. **The role of sperm oxidative stress in male infertility and the significance of oral antioxidant therapy** Times Cited: 212  
 By: Gharagozloo, Parviz; Aitken, R. John  
 HUMAN REPRODUCTION Volume: 26 Issue: 7 Pages: 1628-1640 Published: JUL 2011
18. **The mechanisms of cyclophosphamide-induced testicular toxicity and the protective agents** Times Cited: 21  
 By: Ghobadi, Emad; Moloudizargari, Milad; Asghari, Mohammad Hossein; et al.  
 EXPERT OPINION ON DRUG METABOLISM & TOXICOLOGY Volume: 13 Issue: 5 Pages: 525-536 Published: MAY 2017
19. **Testicular gametogenic and steroidogenic activities in cyclophosphamide treated rat: A correlative study with testicular oxidative stress** Times Cited: 81  
 By: Ghosh, D; Das, UB; Ghosh, S; et al.  
 DRUG AND CHEMICAL TOXICOLOGY Volume: 25 Issue: 3 Pages: 281-292 Published: 2002
20. **Impact of paternal exposure to chemotherapy on offspring in the rat.** Times Cited: 29  
 By: Hales, Barbara F; Barton, Tara S; Robaire, Bernard  
 Journal of the National Cancer Institute. Monographs Issue: 34 Pages: 28-31 Published: 2005
21. **Aquilaria spp. (agarwood) as source of health beneficial compounds: A review of traditional use, phytochemistry and pharmacology** Times Cited: 45  
 By: Hashim, Yumi Zuhani Has-Yun; Kerr, Philip G.; Abbas, Phirdaous; et al.  
 JOURNAL OF ETHNOPHARMACOLOGY Volume: 189 Pages: 331-360 Published: AUG 2 2016
22. **Screening of anticancer activity from agarwood essential oil** Times Cited: 10  
 By: Hashim, Yumi Zuhani Has-Yun; Phirdaous, Abbas; Azura, Amid  
 PHARMACOGNOSY RESEARCH Volume: 6 Issue: 3 Pages: 191-194 Published: JUL-SEP 2014
23. **Antioxidant and Antibacterial Activities of Agarwood (Aquilaria malaccensis Lamk.) Leaves** Times Cited: 6  
 By: Hendra, Hadi; Moeljopawiro, Sukarti; Nuringtyas, Tri Rini  
 ADVANCES OF SCIENCE AND TECHNOLOGY FOR SOCIETY Book Series: AIP Conference Proceedings Volume: 1755 Article Number: UNSP 140004 Published: 2016
24. **Evaluation of recovery from cyclophosphamide testicular toxicity in rats** Times Cited: 3  
 By: Higuchi, H; Nakaoka, M; Ozaki, K; et al.  
 J Toxicol Pathol. Volume: 10 Issue: 3 Pages: 165-173 Published: 1997  
 URL: <https://doi-org.ezproxy.um.edu.my/>  
 [Show additional data]
25. **Gonadal damage from chemotherapy and radiotherapy** Times Cited: 233  
 By: Howell, S; Shalet, S  
 ENDOCRINOLOGY AND METABOLISM CLINICS OF NORTH AMERICA Volume: 27 Issue: 4 Pages: 927-+ Published: DEC 1998
26. **Antioxidant activity of aquilaria malaccensis (thymelaeaceae) leaves** Times Cited: 18  
 By: Huda, A. W. N.; Munira, M. A. S.; Fitrya, S. D.; et al.  
 PHARMACOGNOSY RESEARCH Volume: 1 Issue: 5 Pages: 270-273 Published: SEP-OCT 2009
27. **Separation and fractionation of Aquilaria Malaccensis oil using supercritical fluid extraction and the cytotoxic properties of the extracted oil** Times Cited: 14  
 By: Ibrahim, A. H.; Al-Rawi, S. S.; Majid, A. M. S. Abdul; et al.  
 11TH INTERNATIONAL CONGRESS ON ENGINEERING AND FOOD (ICEF11) Book Series: Procedia Food Science Volume: 1 Pages: 1953-1959 Published: 2011
28. **Potential chemoprotective effect of melatonin in cyclophosphamide- and cisplatin-induced testicular damage in rats** Times Cited: 72  
 By: Ibey, Yusuf Ozlem; Ozbek, Emin; Simsek, Abdulmuttalip; et al.  
 FERTILITY AND STERILITY Volume: 92 Issue: 3 Pages: 1124-1132 Published: SEP 2009
29. **Crataegus monogyna aqueous extract ameliorates cyclophosphamide-induced toxicity in rat testis: stereological evidences.** Times Cited: 16  
 By: Jalali, Ali Shalizer; Hasanzadeh, Shapour; Malekinejad, Hassan  
 Acta medica Iranica Volume: 50 Issue: 1 Pages: 1-8 Published: 2012
30. **Laxative effects of agarwood on low-fiber diet-induced constipation in rats** Times Cited: 41  
 By: Kakino, Mamoru; Tazawa, Shigemitsu; Maruyama, Hiroe; et al.  
 BMC COMPLEMENTARY AND ALTERNATIVE MEDICINE Volume: 10 Article Number: 68 Published: NOV 15 2010

