Safety Evaluation of Alcoholic Extract of *Boswellia ovalifoliolata* Stem-bark in Rats

P. R. Sakuntala Devi, K. Adilaxmamma, G. Srinivasa Rao¹, Ch. Srilatha², M. Alpha Raj

Departments of Pharmacology and Toxicology, ²Pathology, College of Veterinary Science, Tirupati, ¹N.T.R, College of Veterinary Science, Gannavaram, Andhra Pradesh, India

ABSTRACT

The safety profile of alcoholic extract of stem-bark of *B. ovalifoliolata* was investigated in male Wistar albino rats as per OECD guidelines 407. A total of 24 male Wistar rats were divided into four groups of six rats each. Group 1 served as control and was given 0.3% carboxymethylcellulose, groups 2, 3 and 4 were given alcoholic extract of *B. ovalifoliolata* @ 100, 500 and 1000 mg/kg respectively in 0.3% carboxymethylcellulose orally for 28 days. The animals were observed daily for clinical signs, mortality, physiological and behavioral changes. Body weights were measured at weekly intervals and various hematological parameters like Hb, PCV, TEC, TLC and serum biochemical profile which included AST, ALT, creatine phosphokinase, creatinine, total protein and antioxidant parameters like TBARS and GSH in liver were estimated at the end of experimental period. There were no clinical signs of abnormality. The weekly body weights, organ weights and hematological parameters did not vary significantly amongst the groups. The mean activity of AST, ALT and CPK, and the concentration of serum creatinine, total protein, TBARS and GSH did not differ significantly among the groups. Histological abnormalities of toxicological significance were not detected in groups 2 and 3. However, mild histopathological alterations were observed in higher dose group 4. In conclusion, the present study revealed that the alcoholic extract of stem-bark of *B. ovalifoliolata* is safe at lower doses of 100 and 500 mg/kg. Hence, alcoholic extract of stem bark of *B. ovalifoliolata* is safe and no observed adverse effect level (NOAEL) is found to be 500 mg/kg following repeated oral administration for 28 days in rats.

Key words: *B. ovalifoliolata*, hematology, oxidative stress, safety evaluation, serum biochemistry

INTRODUCTION

Herbal remedies have been used in the management of various diseases from ages and herbs are considered to be safe (Oduola *et al.*).¹ These remedies are commonly self-medicating, more often with no proper dose regimen. Such indiscriminate use without recourse to safety and adverse effects on biological system is considered as dangerous (Aboyade *et al.*).² Although, the literature has documented several toxicities resulting from the use of herbs on many occasions, still the potential toxicity of herbs has not been recognized by the general public or by professional groups of traditional medicine (Jou-fang).³ The use of medicinal plants as raw materials in the production of drugs is gaining popularity (Olaleye)⁴ and hence, it has become imperative to assess the safety or toxicity of plants used in folklore medicine.

*Boswellia ovalifoliolata* (Family: Burseraceae), an endangered plant vernacularly known as Konda guggilam, is a deciduous
tree endemic to Seshachalam hills of Chittoor and Kadapa districts of A.P. In folklore, the stem and bark are used to cure hydrocoel, inflammation and swellings and stomach ulcers (Pullaiah). Two macrocyclic diaryl ether heptanoids were identified from the stems of *B. ovalifoliolata* viz., ovalifoliolatin A and B together with three compounds acerogenin c, 3 α-hydroxyurs-12-ene and sitost-4-ene-3-one. This class of diaryl heptanoids exhibit a broad range of potent biological activities that include anti-inflammatory, anti-hepatotoxic, antifungal, antibacterial and related effects (Niranjan Reddy et al.). The alcoholic extract of *B. ovalifoliolata* stem bark extract is reported to exhibit anti-inflammatory activity in rats (Sakunthala Devi et al.). The present effort is, therefore, aimed to investigate the safety profile of the stem bark alcoholic extract of the plant following oral administration for 28 days in adult male Wistar rats as per OECD guidelines 407 (OECD).

**MATERIALS AND METHODS**

**Plant extract**

The stem-bark of *B. ovalifoliolata* was collected, cleaned, shade dried and ground into a coarse powder. About 100 g of stem-bark powder was macerated in 500 ml of 95% ethanol v/v with intermittent mixing using a glass rod for 72 h and filtered. The filtrate was evaporated at 55°C on a hot plate to one fourth of the volume. The yield obtained was 10% w/w.

**Animals**

Male Wistar albino rats weighing 270-320 g were used in the present study. The animals were housed in a well cross ventilated room at 27±2°C, relative humidity 44-56%, light and dark cycles of 12 h and 12 h, respectively throughout the experiment. The animals were provided with standard pellet diet supplied by Hindustan Lever Ltd., Bangalore and water ad libitum. The study was conducted with prior permission of Institutional animal ethics committee and in accordance to OECD guidelines 407 (OECD).

**Experimental design**

A total of 24 rats were randomly allotted to control and three treatment groups consisting of six rats each. The control group received 0.3% carboxymethylcellulose. The extract was made into suspension with 0.3% carboxymethylcellulose and administered orally in three doses of 100, 500, 1000 mg/kg to groups 2, 3 and 4 respectively on a daily basis for a period of 28 days.

**Clinical signs**

During the period of administration of the extract, the rats were observed daily for signs of toxicity, physiological and behavioral changes, if any.

**Body weight changes**

The body weights of all the animals were monitored at the onset of the study and at weekly intervals till the end of the experimental period.

**Blood collection**

On day 29, rats were anesthetized with ether and blood was collected by orbital puncture. Whole blood collected in EDTA was utilized for hematological studies and serum obtained after clotting and centrifugation of blood was utilized for biochemical analysis.

**Serum biochemical parameters**

Serum was separated from clotted blood samples by centrifugation at 3000 rpm for 10 min and was utilized for biochemical analysis. The activities of aspartate transaminase (AST), alanine transaminase (ALT), creatinine phosphokinase (CPK), creatinine, and total protein were estimated using standard kits supplied by Qualigens, Pvt. Ltd, Mumbai.

**Hematology**

Hematological parameters viz., hemoglobin, packed cell volume (PCV), total erythrocyte count (TEC), total leukocyte count (TLC) were estimated using standard kits supplied by Qualigens, Pvt. Ltd, Mumbai.

**Antioxidant profile**

Liver samples were collected and homogenized in ice-cold phosphate buffer (pH 7.4) for the estimation of lipid peroxidation (TBARS) (Subramanian et al.) and reduced glutathione (GSH) content (Moron et al.).

**Gross and histopathology**

A detailed post-mortem examination was conducted on the rats sacrificed from each group. Vital organs such as liver, heart, kidney, spleen and testes were weighed immediately after dissection to avoid drying and examined macroscopically for gross lesions, if any. Tissue portions were then fixed in 10% neutral buffered formalin and were processed for routine histopathological processing. Sections of 5-6 μm thickness were prepared and stained by hematoxylin and eosin (Singh and Sulochana). The stomachs were cut open along the greater curvature and gently washed with normal saline and gastric mucosa was examined for the presence of erosions, hemorrhagic spots, ulcers and perforations, if any, with the help of magnifying lens.

**Statistical analysis**

The data was expressed as mean±S.E. Statistical differences between groups were tested using one way ANOVA followed by Duncan’s multiple comparison test using SPSS 15.0 V software and the level of significance was set at *P*<0.05.
RESULTS

The results of weekly body weights, organ weights, hematology, sero-biochemical profile, and oxidative profile are presented in Tables 1-5 respectively.

Clinical signs

The clinical signs in the treatment groups showed no abnormalities in terms of changes in skin, fur, eyes, mucous membranes, occurrence of secretions and excretions and autonomic activity (e.g. lacrimation, piloerception, pupil size, unusual respiratory pattern) gait, posture and response to handling as well as the presence of clonic or tonic movements, stereotypes (e.g. excessive grooming, repetitive circling) or bizarre behavior (e.g. self-mutilation, walking backwards). Further, there were no signs of toxicity in all the groups.

Body weights and organ weights

The body weights [Table 1] and organ weights [Table 2] of liver, kidney, heart, spleen, lungs and testes showed no significant difference between the treated groups and control group and further, at the doses studied, there was no swelling, atrophy or hypertrophy of various organs.

Biochemical parameters

The biochemical parameters like AST, ALT, CPK, creatinine, total protein showed no significant difference between treatment groups and control group indicating that the extract is not toxic to vital organs like liver, kidney and heart [Table 3].

Hematological parameters

The hematological parameters like PCV, Hb, TEC and TLC showed no significant difference between treatment groups and control group, which shows that the extract is not toxic to the hematopoietic system [Table 4].

Antioxidant parameters

The antioxidant status of liver assessed in terms of TBARS and GSH levels was not altered indicating that there are no potential toxic compounds in the extract that can cause oxidative damage [Table 5].

---

**Table 1: Effect of alcoholic extract of *B. ovalifoliolata* on weekly body weights (g)**

| Group                                      | Day 0   | Day 7   | Day 14  | Day 21  | Day 28  |
|--------------------------------------------|---------|---------|---------|---------|---------|
| CMC (0.3%) p.o                             | 318.66 ± 0.02 | 320.23 ± 0.02 | 320.11 ± 0.02 | 312.23 ± 0.03 | 318.44 ± 0.02 |
| *B. ovalifoliolata* alcoholic extract, 100 mg/kg p.o | 283.13 ± 0.01 | 282.56 ± 0.02 | 289.45 ± 0.01 | 281.11 ± 0.01 | 282.16 ± 0.01 |
| *B. ovalifoliolata* alcoholic extract, 500 mg/kg p.o | 293.11 ± 0.01 | 286.22 ± 0.01 | 285.34 ± 0.01 | 283.13 ± 0.01 | 279.22 ± 0.01 |
| *B. ovalifoliolata* alcoholic extract, 1000 mg/kg p.o | 295.67 ± 0.02 | 291.24 ± 0.02 | 301.55 ± 0.01 | 283.24 ± 0.01 | 305.11 ± 0.01 |
| Sig                                        | NS      | NS      | NS      | NS      | NS      |

Values are (mean±S.E); n=6; One-way ANOVA followed by Duncans multiple comparison test using SPSS software 15.0 V (P<0.05)

**Table 2: Effect of alcoholic extract of *B. ovalifoliolata* on organ weights (g)**

| Group                                      | Heart   | Lungs   | Liver    | Spleen   | Kidneys  | Testes  |
|--------------------------------------------|---------|---------|----------|----------|----------|---------|
| Normal saline p.o                          | 0.93 ± 0.02 | 1.65 ± 0.07 | 7.41 ± 0.89 | 0.78 ± 0.08 | 1.96 ± 0.06 | 5.08 ± 0.30 |
| *B. ovalifoliolata* alcoholic extract, 100 mg/kg p.o | 1.04 ± 0.09 | 1.44 ± 0.13 | 7.99 ± 0.33 | 0.86 ± 0.05 | 1.91 ± 0.06 | 4.96 ± 0.28 |
| *B. ovalifoliolata* alcoholic extract, 500 mg/kg p.o | 1.09 ± 0.07 | 1.66 ± 0.08 | 8.27 ± 0.24 | 0.91 ± 0.08 | 1.71 ± 0.17 | 5.24 ± 0.12 |
| *B. ovalifoliolata* alcoholic extract, 1000 mg/kg p.o | 1.03 ± 0.05 | 1.68 ± 0.07 | 8.69 ± 0.22 | 0.85 ± 0.05 | 1.85 ± 0.08 | 5.56 ± 0.18 |
| Sig                                        | NS      | NS      | NS       | NS       | NS       | NS      |

Values are (mean±S.E); n=6; One-way ANOVA followed by Duncans multiple comparison test using SPSS software 15.0 V (P<0.05)

**Table 3: Effect of alcoholic extract of *B. ovalifoliolata* on serum biochemical parameters**

| Group                                      | AST (IU/L) | ALT (IU/L) | Creatinine (mg/dl) | CPK (IU/L) | Total protein (g/dl) |
|--------------------------------------------|------------|------------|--------------------|------------|-----------------------|
| Normal saline p.o                          | 90.36 ± 10.48 | 22.13 ± 3.21 | 1.50 ± 0.11 | 573.93 ± 29.90 | 7.29 ± 0.47 |
| *B. ovalifoliolata* alcoholic extract, 100 mg/kg p.o | 72.12 ± 18.19 | 25.11 ± 0.92 | 1.62 ± 0.18 | 589.26 ± 40.80 | 6.84 ± 1.28 |
| *B. ovalifoliolata* alcoholic extract, 500 mg/kg p.o | 98.22 ± 9.82 | 27.55 ± 1.90 | 1.70 ± 0.04 | 589.58 ± 38.40 | 6.83 ± 0.76 |
| *B. ovalifoliolata* alcoholic extract, 1000 mg/kg p.o | 83.49 ± 5.83 | 24.46 ± 0.62 | 1.84 ± 0.04 | 595.65 ± 38.55 | 6.84 ± 0.56 |
| Sig                                        | NS         | NS         | NS                 | NS         | NS                   |

Values are (mean ± S.E); n=6; One-way ANOVA followed by Duncans multiple comparison test using SPSS software 15.0 V (P<0.05)
Table 4: Effect of alcoholic extract of *B. ovalifoliolata* on hematological profile

| Group                                      | PCV (%) | Hb (g%) | TEC (millions/μl) | TLC (thousands/μl) |
|--------------------------------------------|---------|---------|-------------------|-------------------|
| Normal saline p.o                          | 37.41 ± 1.11 | 12.53 ± 0.39 | 6.25 ± 0.18       | 6.48 ± 0.66       |
| *B. ovalifoliolata* alcoholic extract, 100 mg/kg p.o | 37.57 ± 1.59 | 12.53 ± 0.53 | 6.26 ± 0.26       | 6.52 ± 0.72       |
| *B. ovalifoliolata* alcoholic extract, 500 mg/kg p.o | 40.50 ± 1.52 | 13.52 ± 0.50 | 6.75 ± 0.25       | 6.58 ± 0.67       |
| *B. ovalifoliolata* alcoholic extract, 1000 mg/kg p.o | 40.51 ± 1.45 | 13.61 ± 0.44 | 6.83 ± 0.23       | 6.62 ± 0.72       |

Sig NS NS NS NS

Values are (mean±S.E); n=6; One-way ANOVA followed by Duncans multiple comparison test using SPSS software 15.0 V (P<0.05)

Table 5: Effect of alcoholic extract of *B. ovalifoliolata* on oxidative stress in liver

| Group                                      | MDA (TBARS) (nM MDA/g of tissue) | GSH (mg/g of tissue) |
|--------------------------------------------|----------------------------------|----------------------|
| Normal saline p.o                          | 225.33 ± 52.30                   | 1.34 ± 0.16          |
| *B. ovalifoliolata* alcoholic extract, 100 mg/kg p.o | 242.71 ± 33.34                   | 1.33 ± 0.06          |
| *B. ovalifoliolata* alcoholic extract, 500 mg/kg p.o | 268.70 ± 32.66                   | 1.32 ± 0.07          |
| *B. ovalifoliolata* alcoholic extract, 1000 mg/kg p.o | 273.66 ± 26.32                   | 1.32 ± 0.07          |

Sig NS NS NS

Values are (mean±S.E); n=6; One-way ANOVA followed by Duncans multiple comparison test using SPSS software 15.0 V (P<0.05)

Gross and histopathology

Histopathological examination of liver, kidney, heart and testes did not reveal any lesions of toxicological significance in lower dose groups 2 and 3; however, in higher dose group 4 (1000 mg/kg) mild proliferation of bile ducts in liver [Figure 1], mild necrotic changes in tubular epithelial cells of kidney [Figure 2], mild congestion in heart [Figure 3] and inter tubular edema and severe necrotic degeneration of seminiferous tubules in testes were observed [Figure 4]. Further, at higher doses (1000 mg/kg), rats showed desquamation of epithelium lining of gastric mucosa [Figure 5].

DISCUSSION

The use of herbal remedies is widespread with about 80% of the population in developing countries depending on them. Despite this widespread use, few scientific studies are available that ascertained the safety of traditional remedies (Saggu *et al*.). Therefore, the need to provide information on the toxic implications of these remedies cannot be over emphasized. In this scenario, in the present study, the repeated 28 day oral toxicity of alcoholic extract of stem bark of *B. ovalifoliolata* was investigated for its safety in male rats by assessing clinical signs, hematological parameters, biochemical parameters, antioxidant parameters and histopathological studies of liver, kidney, heart, testes and gastric mucosa.

The clinical signs were normal in all the treatment groups and there was no significant difference in terms of body weight and organ weights in the treatment groups indicating the absence of potential toxic principles in the extract. In general, reduction in body weights and internal organ weights are a simple and sensitive index of toxicity after exposure to potentially toxic substances (Shrinath *et al*.).

Liver is the major organ responsible for metabolism of toxic substances that enter the body (Alisi *et al*.) and
Sakuntala Devi, et al.: Safety evaluation of *Boswellia ovalifoliolata*

Toxicology International
May-Aug 2012 / Vol-19 / Issue-2

119

the functions of the liver can be detrimentally altered by liver injury resulting from acute or chronic exposure to toxicants or by situations affecting both β-oxidation and the respiratory chain enzymes (Alisi *et al.*). Further, hepatotoxicity has been viewed as liver injury associated with impaired liver function caused by exposure to drug or other noninfectious agents or herbs (Navarro; Oduola *et al.*). Serum enzyme activities are used as indicators of chemical-induced liver damage (Drotman and Lawhorn). The study on the activities of different biomarker enzymes such as AST and ALT, and the concentration of total protein have been found to be of great value in the assessment of clinical and experimental liver damage. Membrane damage releases the enzyme into circulation and therefore they can be measured in serum (Teo *et al.*). In the present study, the plant extract did not alter the activities of AST, ALT and total protein levels indicating no potential liver damage [Table 3].

Non-protein nitrogenous (NPN) substances such as urea and serum creatinine are increased only when renal function is below 30% of its original capacity in animals (Kaneko *et al.*). In the present study, there was no significant difference in the creatinine levels in all of the alcoholic extract treated groups.

The activity of creatine phosphokinase (CPK) has been used to assess cardiac damage as it is a biomarker enzyme (Adeneye *et al.*). The CPK levels were not altered in the present study using alcoholic extract of the herb indicating non-toxic implications to the heart.

The hematopoietic system is very sensitive to the toxic effects of chemicals and serves as an important indicator of the physiological and pathophysiological status of both animals and humans (Hashemi *et al.*). After 28 days of treatment using the alcoholic extract of *B. ovalifoliolata*, there were no treatment-related changes in hematological parameters. The study revealed that the orally administered doses are non-toxic and did not interfere with erythropoiesis and leucopoiesis in rats. This shows that the plant is safe for use because some plants are known to cause destruction of red blood cells leading to anemia (Blood and Radostits; Adedapo).

Increased levels of lipid peroxides and reduced glutathione activity reflect the hepatic toxicity of the compound (Adeneye *et al.*). In the present study, the levels were not altered indicating that there are no potential toxic compounds in the extract that can cause oxidative damage.

The gross and histopathological changes in liver, kidney, heart and gastric mucosa revealed no abnormalities in the groups 2 and 3 which were administered 100 mg and 500 mg/kg of the extract. However, in group 4 which was given higher dose of the extract (1000 mg/kg) showed bile duct proliferation, degeneration of tubular epithelial cells in kidney, congestion of heart and desquamation of gastric epithelial lining indicating that the extract is not safe beyond 500 mg/kg upon repeated oral administration for 28 days.

Figure 3: Group 4 heart section showing mild congestion (H and E, x70)

Figure 4: Group 4 testis showing interlobular edema and severe necrotic changes in seminiferous tubular epithelial cells (H and E, x70)

Figure 5: Group 4 stomach showing the desquamation of lining epithelial cells

Figure 6: Group 4 liver section showing bile duct proliferation and desquamation of epithelial lining (H and E, x70)
In conclusion, the safety study on stem-bark extract of *B. ovalifoliolata* revealed no adverse effects of toxicological importance at doses of 100 and 500 mg/kg b.wt whereas at the dose level of 1000 mg/kg revealed mild histopathological changes on repeated 28 day oral toxicity study in rats. Hence, it is concluded that the drug is safe for use with a no observed adverse effect level (NOAEL) of 500 mg/kg/day when administered orally for 28 consecutive days. However, as the higher dose (1000 mg/kg) of the extract revealed mild histopathological changes, it is recommended that chronic toxicity, mutagenicity and carcinogenicity studies are further warranted to support the safe and sound use of the herb.

REFERENCES

1. Odoula T, Popoola GB, Arwioo OJG, Oduola TA, Ademosun AA, Lawal MO. Use of *Jatropha gossypifolia* stem latex as a haemostatic agent: How safe is it? J Med Plants Res 2007;1:104-17.

2. Aboaye O, Yakubu M, Grierson D, Afayian A. Studies on the toxicological effect of the aqueous extract of the fresh, dried and boiled berries of *Solomon aceuleastrum* Dunal in male Wistar rats. Hum Exp Toxicol 2009;28:765-75.

3. Jou-fang D. Clinical toxicity of Herbal medicine in Taiwan. 7th International Conference on Health problems related to the Chinese, 1994.

4. Olaleye MT. Cytotoxicity and antibacterial activity of methanolic extract of *Hibiscus sabdariffa*. J Med Plants Res 2007;1:9-13.

5. Pulliaht A. Medicinal plants in A.P (India). New Delhi: Regency publications; 2002. p. 51.

6. Lakshmi Niranjan Reddy V, Ravinder K, Srinivasulu M, Venkateshwar Goud T, Malla Reddy S, Srujankumar D, *et al*. Two new macrocyclic diaryl ether heptanoids from *Boswellia ovalifoliolata*. Chem Pharm Bull (Tokyo) 2003;51:1081-4.

7. Sakunthala Devi PR, Adilaxamma K, Srinivasa Rao G, Srilatha Ch, Alpha Raj M. Evaluation of anti-inflammatory activity of stem-bark of *Boswellia ovalifoliolata* in rats. Inventi Rapid: Ethnopharmacology 2010;1: ep159. Available from: http://www.inventi.in. Last accessed on 2010 Sept 28.

8. O E C D (The Organization of Economic Co-operation Development). The OECD guideline for testing of chemical: 407 repeated dose oral toxicity-Rodent:28-day or 14-day study. Paris: OECD; 2001. p. 1-7.

9. Balasubramanian KA, Manohar M, Mathan VI. An unidentified inhibitor of lipid peroxidation in intestinal mucosa. Biochim Biophys Acta 1988;962:51-8.

10. Moron MS, Depierre JW, Mannervik B. Levels of glutathione, glutathione reductase and glutathione S-transferase activities in rat lung and liver. Biochim Biophys Acta 1979;582:67-8.

11. Singh UB, Sulochana S. Handbook of Histological and Histochemical Techniques. 2nd ed. Hyderabad: Premier Publishing House; 2007.

12. Sagg S, Divekar HM, Gupta V, Sawhney RC, Bannerjee PK, Kumar R. Adaptogenic and safety evaluation of seabuckthorn (*Hippophae rhamnoides*) leaf extract: A dose dependent study. Food Chem Toxicol 2007;45:609-17.

13. Baliga MS, Jagetia GC, Ulfloor JN, Baliga MP, Venkatesh P, Reddy R, *et al*. The evaluation of the acute toxicity and long term safety of hydroalcoholic extract of Sapthaparna (*Alstonia scholaris*) in mice and rats. Toxicol Lett 2004;151:317-26.

14. Alisi CS, Onyeze GO. Nitric oxide scavenging ability of ethyl acetate fraction of methanolic leaf extracts of *Chromolaena odorata*. Afr J Biochem Res 2008;2:145-50.

15. Navarro VJ, Senior JR. Drug-related hepatotoxicity. N Engl J Med 2006;354:7-31.9.

16. Drottman RB, Lawhorn GT. Serum enzymes as indicators of chemical induced liver damage. Drug Chem Toxicol 1978;1:163-71.

17. Teo S, Stirling D, Thomas S, Hoberman A, Kiorpes A, Khetani V. A 90-day oral gavage toxicity study of D-methylphenidate and D,L-methylphenidate in Sprague-Dawley rats. Toxicology 2002;179:183-96.

18. Kaneko JJ, Harvey JW, Michael LB. Clinical biochemistry of Domestic animals. 5th ed. New York: Academic Press; 1997. p. 857-79.

19. Adeneye AA, Ajagbonna OP, Adeleke TI, Bello SO. Preliminary toxicity and phytochemical studies of the stem bark aqueous extract of *Musanga cecropioides* in rats. J Ethnopharmacol 2006;105:374-9.

20. Blood DC, Radosits OM. Veterinary Medicine. London: Balliere Tindall; 1989. p. 46.

21. Adedapo AA, Abatan MO, Olorunsogo OO. Effects of some plants in the genus *Euphorbia* on haematological and biochemical parameters of rats. Vet Archiv 2007;77:29-38.

22. Adedapo AA, Abatan MO, Olorunsogo OO. Toxic effects of some plants in the genus *Euphorbia* on haematological and biochemical parameters of rats. Vet Archiv 2004;74:53-62.

How to cite this article: Sakuntala Devi PR, Adilaxamma K, Rao GS, C, Raj MA. Safety evaluation of alcoholic extract of *Boswellia ovalifoliolata* stem-bark in rats. Toxicol Int 2012;19:115-20.

Source of Support: Nil. Conflict of Interest: None declared.

Staying in touch with the journal

1) Table of Contents (TOC) email alert
Receive an email alert containing the TOC when a new complete issue of the journal is made available online. To register for TOC alerts go to www.toxicologyinternational.com/signup.asp.

2) RSS feeds
Really Simple Syndication (RSS) helps you to get alerts on new publication right on your desktop without going to the journal’s website. You need a software (e.g. RSSReader, Feed Demon, FeedReader, My Yahoo!, NewsGator and NewsCrawler) to get advantage of this tool. RSS feeds can also be read through FireFox or Microsoft Outlook 2007. Once any of these small (and mostly free) software is installed, add www.toxicologyinternational.com/rssfeed.asp as one of the feeds.