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Toxicity studies on *Harpagophytum procumbens* (Devil's claw) capsules in mice

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Acute (24 h) and chronic (90 days) oral toxicity studies on *Harpagohytum procumbens* (Devil's claw) capsules manufactured by Boiron (France), were carried out. Male and female mice were used as experimental model. Acute dosages were: 0.5, 1.0 and 3 g/kg while chronic dosage was 100 mg/kg per day of the capsule contents. All morphological, biochemical, haematological and spermatogenic changes, in addition to mortality, body weight changes and any change in vital organs were recorded. Histopathological investigations were done on vital organs. During acute toxicity experiment, mice treated with higher dose were found to have reduced locomotor activity as compared to the control animals. Biochemical studies showed reduction in blood glucose level of mice in the treatment groups as compared to the control. During chronic toxicity studies, both male and female mice in the treatment groups gained statistically significant weight which was similar and comparable to respective control groups. The water intake increased in the treatment as well as the control groups. One male animal was found to develop forelimb inflammation and snout alopecia during chronic toxicity studies. All other animals were normal and comparable to the control animals. There was no mortality of statistical significance observed in any group. Biochemical studies revealed a significant decrease in blood sugar levels and uric acid level of Devil's claw treatment groups. A slight increase in the aspartate aminotransferase (AST) levels was noticed in the treatment groups as compared to the control groups. However, hematological parameters remained comparable to the control. At the end of the treatment, the visceral condition and the vital organs of animals were found to be normal and comparable to the control. The results were substantiated by histopathological studies. The male treatment group was subjected to sperm abnormality test to assess any mutagenic potential of Devil's claw prolonged treatment. Devil's claw capsules treatment group, after chronic treatment, showed no spermatotoxic effect. All the observations recorded revealed that Devil's claw treatment in the given dose levels, poses low toxicity. The findings of present study might be used in designing future preliminary and preclinical studies on Devil claws capsules.

Key words: *Harpagophytum procumbens* (Pealiaceae), devil's claw capsules; acute toxicity, chronic toxicity studies, spermatotoxic effect.

INTRODUCTION

Harpogophytum procumbens DeCandolle (Pealiaceae) is a plant with bright pinkish red flowers covered with numerous small hooks, native to south and southwest Africa, Angola, Kalahari desert, Island of Madagascar, Batswana, Zimbabwe, and Namibia (McGregor et al., 2005; van 2008; Romiti et al., 2009). It is locally known

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Table 1. The common medicinal uses of Devil's claw.

Part used and dose	Suggested dosage	Medicinal uses and properties	References
The secondary storage roots, or tuber.	1.5 to 3 g in decoction 3 times a day	Anti-inflammatory, antioxidant, pain killer; used in low back pain, osteoarthritis, rheumatoid arthritis, memory loss; lumbago; Syphilis, arteriosclerosis, anti-cholesterolimic; used in diabetes; indigestion and heartburn; for gall, liver, kidney and bladder problems; as body tonic, detoxifying agent; externally used to treat skin ulcers, boils, sores, and allergies. Its use is contra-indicated in pregnancy, for patients with gastric ulcers. If used in high doses it might cause kidney damage and Cancer.	Argus (2000), Chrubasik (1996), Chrubasik (1997), DerMarderosian and Beutler (2002), Gagnier et al. (2004), Gagnier et al. (2007), Georgiey et al. (2011), Huang et al. (2006), Huang et al. (2006), Inaba et al. (2010), Mabey (1988), Mahomed and Ojewole (2004), Ody (1993), Qi et al. (2010), Smithies (2006), von Koenen (2001) and Weiss 1988.

with its popular names 'Devil's claw', 'Windhoek's root', 'wood spider', 'hook plant', and 'grapple plant' (DerMarderosian and Beutler, 2002; Barnes, 2009). It is harvested in different areas for commercial reasons mainly as a source of income (Kathe et al., 2003; Stewart and Cole, 2005). The secondary storage roots or tubers of the plant are used in herbal supplements for osteoarthritis (Gregory et al., 2008). In the folklore, it is an established remedy for the treatment of a wide range of diseases including diabetes. In Europe and elsewhere it is considered to be an effective anti-inflammatory and analgesic drug which is used to treat low back pain (Chrubasik, 2004; Gagnier, et al., 2007). There are several industrial preparations of "Devil's claw" in different dosage forms, available in the local markets worldwide (Quitas and Heard, 2009; Quitas and Heard, 2010). In Europe, doctors treat some conditions like joint pain, arthritis, low back pain, and knee pain with an injection of Devil's claw extract (Wagener and Lupke, 2003; Gagnier et al., 2007). For a quick look, the major folklore uses and related references on the medicinal properties of Devil's claw are summarized in a tabular form (Table 1).

Several biologically active compounds have been isolated from Devil's claw including: iridoid glycosides, harpagide, pagide, harpagoside, and procumbide; flavornoids; different types of terpenoids, phenolic acids; cinnamic acid; harpagoquinone; acteoside; and other miscellaneous compounds including triterpenes, triterpenoid glycoside, sterols, oleanolic and ursolic acid derivatives, gum resin, esters bitter principles and sugars. However, Iridoid glycosides were recorded to be the main active compounds of Devil's claw (Qi et al., 2006, 2010; Tada et al., 2008; Inaba et al., 2010). Harpagoside is used in quality control studies of Devil's claw pharmaceutical preparations and the presence of 1.2% harpagoside is the required limit (Lueng and Foster, 1986; Pahlow and Das, 1993; Chrubasik, 1997; Boje et al., 2003; Betancor-Femandez et al., 2003; Clarkson et al., 2003, 2006; Qi et al., 2010). Furthermore, the root extracts of *H. procumbens* were referred to be useful in the treatment of glomeular inflammatory diseases (Kaszkin et al., 2004; Huang et al., 2006). Recent reports based on *in vitro* systems also suggested that Devil's claw treatment showed inhibitory effect on cholinesterases and antioxidant activities. Such properties were earlier displayed by some natural products isolated from *Huperzia serrata*, dietary essential fatty acids, and compounds like fordine and huperzine used in Alzheimer disease and vascular dementia (Li and Yan, 1991; Calon et al., 2005; Wang et al., 2006; Georgiey et al., 2011). Devil's claw is an approved status herbal drug product under German Commission E protocol and British Herbal Pharmacopoeia also recognized Devil's claw as herbal drug for the treatment of various ailments (BHP, 1983; Blumenthal, 1998).

Several of the folklore uses of Devil's claw were justified in different scientific experiments (Mahomed and Ojewole, 2004; Gagnier et al., 2007). It is broadly believed that modern medicine has so far notproduced any better anti-inflammatory medicine to Devil's claw (Ody, 1993; Duke et al., 2002). Each allopathic non-steroidal anti-inflammatory drugs (NSAIDS) is indicated with its own unfavorable effect profile varying from stomach disorders to blood anomalies. The anti-inflammatory properties of Devil's claw capsules were attributed mainly to harpagoside and β-sitosterol. Harpagoside in doses as high as 13 g/kg showed low toxicity in treated mice. Although no detailed toxicity evaluation of Devil's claw capsules or tablets has so far been conducted, however, during human trials headache, tinnitus or anorexia were reported (DerMarderosian and Beutler, 2002).

The recommended dosage of the whole herb is 1.5 to 3 g in decoction 3 times a day (Chrubasik, 1997). In the treatment of diabetes, low back pain, and inflammatory diseases, the prolonged use of Devil's claw preparations showed adverse effects in some patients. So far 28

clinical studies have been reported in the literature, where in 20 clinical trials, some adverse effect were observed. There were no alarming toxic effects seen during double-blind studies and the adverse activities were comparable to the placebo, however, in 3% patients gastrointestinal disturbances were observed. Devil's claw was considered to increase the risk of bleeding and potentiate the effects of warfarin therapy (Heck et al., 2000).

Therefore, Devil's formulations were not allowed to be used by the patients on oral anticoagulant and anti-platelet therapy (Argento et al., 2000; Saw et al., 2006). There were no comprehensive toxicology reports in the literature on Devil's claw capsules. In addition, the effect of chronic treatment with Devil's claw capsules was not addressed. Hence, the effects of prolonged treatment with this officially approved herbal drug were considered advisable for safety evaluation of this popular remedy (Vlachojannis et al., 2008). In continuation of our work on the toxicity evaluation of drug products (Al-Omar et al., 2009; Al-Ashban et al., 2010), the present study was designed to investigate the toxic potential of Devils claw capsules in mice after acute and chronic treatment, and the results are presented in the current communication.

MATERIALS AND METHODS

Plant material

Devil's claw capsules (Boiron, France) were purchased from a local Pharmacy in Riyadh (Saudi Arabia). Therapeutic dose specified on the packing was 1 to 2 capsules, 2 to 3 times daily. The capsules were opened as per need and the capsule contents were taken out for the conduct of current toxicity studies in mice. The dose selected was in the range of dose used earlier or as labeled on Devil's claw capsules container (Shah et al., 1991). The capsule contents were suspended in water and given orally following ethical guidelines (Al-Ashban et al., 2010).

Animal Stock

Swiss albino mice (home bred) aged 6 to 7 weeks, weighing about 22 to 26 g, fed on Purina Chow diet and water *ad libitum* were used in the present study. The animals were maintained under controlled temperature, humidity, and automated 12-h light/dark cycle (Shah et al., 1991).

Acute toxicity

A total of 20 mice were randomly allotted to one control and 3 treatment groups. The drug in each case was suspended in water and given orally. The preparation was administered orally in three doses, namely 0.5, 1.0, and 3 g/kg body weight. The toxic symptoms observed were autonomic responses, motor activity and CNS excitation, etc. The animals were observed for 24 h for all signs of toxicity and mortality (Shah et al., 1998; Rao et al., 2001). Acute treatment with 0.5 g/kg Devil's claw was found to cause significant lowering in blood glucose levels of mice in the treatment groups as compared to the control; hence, this dose was selected as the pharmacologically active dose (Mahomed and Ojewole, 2004).

Chronic toxicity

A total of 20 male and 20 female mice were randomly allotted to the control and the extract-treated groups, separately (10 male and 10 female animals separately in each group). Devil's claw was given in drinking water (Shah et al., 1989). The dose selected was 100 mg/kg/day, which is 1/5 of the pharmacologically active dose (Tanira et al., 1988; Al-Ashban et al., 2005). The treatment was continued for a period of 3 months following official protocol (W.H.O, 1967; Shah et al., 1989). The animals were observed for all external general symptoms of toxicity, body weight changes, and mortality daily up to the end of the experiment to analyze the impact of treatment.

The average pre- and post-treatment body weights, vital organ weights, and viscera of the chronically treated animals were compared with the control group. The blood was analyzed for white blood cells (WBC), red blood cells (RBC), and haemoglobin using Contraves Digicell 3100H (Zurich). The blood biochemistry was performed by using Bohringer kits (Al-Ashban et al., 2005). Furthermore, the chronically treated male animals were also analyzed for spermatogenic dysfunction using sperm abnormality test, which is considered a reliable parameter for assessing germ cell mutagenicity and carcinogenicity (Wyrobek and Bruce, 1975; Wyrobek et al., 1983). The caudae epididymides and the vas deferens from the same animals were dissected out and transferred to a centrifuge tube containing 3 ml Krebs Ringer bicarbonate buffer as described earlier (Shah et al., 1989). The sperm suspension was filtered through an 80 µm silk mesh to remove tissue fragments and 0.5 ml of 1% eosin Y was added to each tube.

The contents were thoroughly mixed and the slides were made by placing one drop of the solution on a slide and spread by three passes of another slide. Coded slides were examined for the following abnormalities of the sperm head: amorphous, flat head, microcephali, megacephali and swollen achrosome (Wyrobek and Bruce, 1975; Shah et al., 1998).

Histopathological procedures

Tissue samples of liver, heart, testis, spleen, lungs, and kidney were preserved in 10% buffered formalin and processed for routine paraffin block preparation. Using an American optical rotary microtome, sections of thickness about 5 µm were cut and stained with haematoxylin and eosin. These were examined under the microscope for histopathological changes (Al-Ashban et al., 2010).

Statistical analysis

The different parameters studied were subjected to statistical analyses by the Chi-square test or Student's *t*-test.

RESULTS

The results of the present study are presented in Tables 2 to 8.

Effect of acute treatment

During acute toxicity test, no alarming signs of toxicity except mild decrease in locomotive activity were observed in mice treated with 1 and 3g/kg dose of Devil's claw. All vital signs were normal and at the end of the study. Visceral condition of mice in the treatment groups

was normal and comparable to the control. The results were substantiated by histopathological investigations. Devil's claw treatment was found to decrease blood glucose levels in mice as compared to the control animals. There was no mortality throughout the acute toxicity experiment on all dose levels used, indicating Devil's claw to be less toxic in the given dose levels (Al-Ashban et al., 2005).

Effects of chronic treatment

During chronic toxicity studies, one male mice developed forelimb inflammation at the end of the 30-days of treatment with Devil's claw. The same male mice also developed snout alopecia at the end of 40 days. The other animals were found normal throughout the study. In the survival studies (Table 2), there was no significant lethality in the treatment groups as compared to the respective control groups.

Effects on body weight

During the chronic treatment with Devil's claw capsule contents, the body weight gain was statistically significant $P<0.001$ in both male and female treatment groups as compared to the respective control mice (Table 3).

Effect on water intake

There was a significant increase ($P <0.05$) in water intake of animals in the Devil's claw treatment groups as well as in the male and female mice in the control groups as expected for growing animals (Table 4).

Effects on vital organ weights

In the present study, prolonged treatment for 90 days had minimal effect on organ indices and visceral condition of animals. The slight increase observed in the weight of testes in the male treatment group as compared to the control was statistically not significant (Table 5).

Effects on hematological parameters

All the hematological parameters of mice in the treatment groups remained within normal range and were comparable to the control mice (Table 6).

Biochemical parameters

As regards biochemical parameter studied, in the end of the treatment, a significant decrease ($P<0.05$) was observed in sugar levels of mice in the treatment group as compared to the control. There was also a statistically significant increase in AST levels of animals in the treatment groups. Furthermore, a significant decrease ($P<0.05$) in uric acid levels was observed in animals treated with Devil's claw as compared to the control (Table 7).

Effects on sperm morphology

Treatment of male mice with Devil's claw capsule contents during the current study for 90 days clearly did not induce any sperm morphological abnormalities as compared to the control group. The indices screened for the morphological abnormalities, namely, swollen achrosomes, amorphous, microcephali, megacephali, and flat head showed no significant changes in all these indices as compared to the control. Thus indicating Devil's claw treatment to be devoid of spermatotoxic properties in the given dose and duration. However, the number of abnormal rotated head sperm increased in male mice without altering the overall percent sperm abnormalities (Table 8).

DISCUSSION

During acute toxicity studies, there was no external alarming toxicity symptoms in animals except slight decrease in locomotor activity in the animals treated with higher dose of the *H. procumbens* (Devil's claw) capsule contents. Devil's claw is known to contain several biologically active compounds such as different types of terpenes, flavonoids, iridoid glycosides, β-sitosterol, and fatty acids, etc. which might have contributed to the observed activity (DerMarderosian and Beutler, 2002; Duke et al., 2002). In addition, Devil's claw was reported to induce additive analgesic activity when combined with other analgesics and anesthetics and might cause some central nervous system (CNS) depressant effect. Hence, Devil's claw was suggested not to be used in combination with CNS drugs (Blumenthal, 1998). There was a significant decrease ($P<0.05$) in blood glucose levels of the animals in the treatment groups. Our findings are in full agreement with the earlier claims and reports where Devil's claw was found to induce as dose dependent hypoglycemic effect in both fasted normal as well as diabetic rats. The dose range tested of Devil's claw extract was between 50 to 800 mg/kg (Mahomed and Ojewole, 2004). The results of the present study well supported the folklore use of this potent drug by diabetic patients. It is worth mentioning that at the end of the treatment histopathological studies revealed the visceral condition and all vital organs to be normal and comparable to the control animals. The results of present acute toxicity test revealed Devil's claw treatment to be

Table 2. Quantitative data on the mortality induced in mice on chronic treatment with Devil's claw capsule contents (Mean ± SEM).

Treatment and dose 100 mg/kg (3 months)	N		Mortality						Total dead animals		Lethality (%)	
	M	F	0-30 days		31-60 days		61-90 days					
			M	F	M	F	M	F	M	F	M	F
Control (water)	10	10	1	0	0	0	0	0	1	0	10	0
Devil's claw (100)	10	10	0	0	0	1	1	0	1	1	10	10

P > 0.05 (Chi-square test). M = Male, F = Female.

Table 3. Effect of chronic treatment with Devil's claw capsule contents on the body weight of mice. (Mean ± SEM).

Treatment group	Dose and duration (3 months)	Pre-treatment average body weight		Post-treatment average body weight	
		Male	Female	Male	Female
Control	water	22.4 ± 1.4	21.8 ± 0.8	38.3 ± 1.5*	37.6 ± 1.3*
Devil's claw	100 mg/kg	22.6 ± 1.3	22.2 ± 1.5	37.5 ± 1.7*	36.7 ± 1.5*

*P<0.001 (Student's *t*-test). - Ten male and ten female mice were used in each group. - The average weight was calculated on the number of surviving animals.

Table 4. Effect of chronic treatment with Devil's claw capsule contents on water intake in mice. (Mean ± SEM).

Treatment group	Treatment/duration (3 months)	Initial water intake (ml)		Final water intake (ml)	
		Male	Female	Male	Female
Control	water	3.9 ± 0.1	3.8 ± 0.2	5.6 ± 0.2*	5.4 ± 0.1*
Devil's claw	100 mg/kg/day	3.8 ± 0.1	3.7 ± 0.1	4.9 ± 0.1*	4.7 ± 0.2*

*P<0.01 (Student's *t*-test).

Table 5. Effect of chronic oral treatment with Devil's claw capsule contents on organ weights (per 100 g body weight) of mice.

Treatment & dose 100 mg/kg (3 months)	Average organs weight (per 100 g body weight).						
	Heart	Lungs	Liver	Kidney	Spleen	Testis	Seminal vesicles
Control	0.44 ± 0.01	0.68 ± 0.02	5.43 ± 0.20	1.45 ± 0.04	0.52 ± 0.05	0.64 ± 0.02	0.85 ± 0.11
Devil's claw	0.43 ± 0.03	0.70 ± 0.08	5.46 ± 0.15	1.40 ± 0.03	0.55 ± 0.11	0.68 ± 0.07	0.88 ± 0.14

P > 0.05 (Student's t-test). - The tabular values represent the mean ± S.E.M. of five randomly selected animals.

Table 6. Effect of Devil's claw capsule contents on biochemical parameters of mice after chronic treatment.

Variables (units)	Treatment and Dose: mg/kg body weight duration: 3 months mean ± S.E.	
	Control (water)	Treatment group (100 mg/kg)
Glucose (Mmole/l)	5.50 ± 0.20	4.20 ± 0.10*
Creatinine (µmole/l)	28.75 ± 1.20	29.14 ± 1.40
Uric acid (µmole/l)	62.0 ± 1.30	50.0 ± 1.40*
AST (U/L)	112 ± 14.0	139 ± 15.0*
ALT (U/L)	61 ± 12.0	56 ± 3.0
ALP (U/L)	94 ± 9.0	101 ± 11.0
Calcium (Mmole/L)	1.79 ± 1.0	1.85 ± 1.8

*P<0.05 (Student's *t*-test). - 5 animals were used in each group. - Treatment groups were compared to control.

Table 7. Effect of chronic treatment with Devil's claw capsule contents on hematological variables in mice.

Variables (units)	Treatment and Dose: mg/kg body weight Duration: 3 months	
	Control (water)	Treatment group (100 mg/kg)
WBC x 10^3 (N/ml)	5.26 ± 0.65	6.54 ± 0.76
RBC x 10^6 (N/ml)	7.85 ± 0.22	8.19 ± 0.25
Haemoglobin (%)	12.42 ± 0.46	13.25 ± 0.62
Platelets x 10^9 (N/l)	503 ± 17.0	548 ± 58.0
MCV (fl)	51.7 ± 2.1	53.0 ± 3.3
HCT (%)	38.7 ± 0.7	38.5 ± 0.6

P > 0.05 (Student's *t*-test). The tabular values represent the mean ± S.E. of five randomly selected animals.

Table 8. Effect of chronic treatment (3 months) with Devil's claw capsule contents on the epididymal spermatozoa in mice. (Mean ± S.E.).

Treatment and dose (mg/kg)	Total sperms screened	Sperm head abnormalities (%)						Abnormal sperm (%)
		Swollen achro-some	Amor-phous	Micro-cephali	Mega-cephali	Rotated head	Flat head	
Control (Water)	5644	0.45 ± 0.08	0.50± 0.09	0.05± 0.04	0.06± 0.03	0.25± 0.06	0.04± 0.02	1.29±0.25
Devil's claw (100)	5589	0.65 ±0.12	0.45±0.08	0.06±0.02	0.09±0.05	0.46±0.06*	0.05±0.03	1.40 ±0.27

*P<0.05 (Student's *t*-test).- In both groups 10 male mice were used.- The sperm count was done of surviving animals.

relatively less toxic.

Earlier, harpagoside, the active anti-inflammatory compound isolated from Devil's claw was also found to possess low toxicity with an LD50 greater than 13.5 g/kg in mice. During human trials, headache, tinnitus or anorexia was observed (DerMarderosian and Beutler, 2002). All these reports further supported Devil's claw not to be a poisonous plant, however, verification by chronic toxicity studies is essential. During chronic toxicity studies there were no visual signs of toxicity in the Devil's claw treatment groups as compared to the control groups. However, in the treatment group one male mouse developed fore-limb inflammation on 30^{th} day of treatment. The same male mice also developed snout alopecia at the end of 40^{th} day of treatment. All other animals in the treatment groups remained normal throughout the study and comparable to the respective control groups. There was a significant weight gain in both male and female treatment groups which was similar as in the control animals. There was a significant increase in the water intake of the animals in the treatment groups as well as in the control groups; which might be attributed to the weight gain of mice in different groups during the prolonged period of time in chronic treatment. Both male as well as female animals in the treatment groups were looking healthy and there was no significant mortality in the treatment groups as compared to the control. Devil's claw is known to be a lymphatic system stimulant which helps to detoxify the entire body (Argus, 2000). In addition, Devil's claw is used as tonic and cure for indigestion and heartburn (Weiss, 1988). The slight bitter taste of Devil's claw is considered to improve liver function to help better absorption of nutrients and detoxifying the body. All such properties might be held responsible for good nourishment and better healthy look of animals in the treatment groups.

At the end of chronic treatment, visceral condition and vital organs of animals were found normal and comparable to the respective control groups. The effect of Devil's claw treatment on the average organs weights (per 100 g body weight) in male and female treatment groups showed no significant effects as compared to the control groups. During gross examination, all vital organs and visceral condition was found normal and there were no abnormal signs of toxicity. The observations were confirmed by histopathological results which were similar and normal as compared to the animals in the respective control groups.

At the end of the present chronic treatment experiment, the hematological parameters showed no significant changes in WBC, RBC, and Hb. levels in the treatment groups as compared to the control. However, biochemical variables reflected a significant ($P< 0.05$) increase in AST levels without any effect on the other liver enzyme. The compounds of Devil's claw having anti-inflammatory effect might be held responsible for such an activity. After chronic treatment a decrease in blood glucose levels and uric acid levels of the animals in the treatment groups was observed as compared to the control. Our results of present chronic treatment also added support to the hypoglycemic potential of Devil's claw noticed during acute treatment (Mahomed and Ojewole, 2004). The reduction in uric acid levels observed in treatment groups as compared to the control might be correlated to the analgesic, anti-inflammatory, anti-arthritis and antioxidant effects of Devil's claw. The results of the present study supported the earlier findings which showed Devil's claw harpagosides and other iridoide glycosides to be responsible for the herb's anti-inflammatory, anti-arthritis and analgesic actions (Mabey, 1988; Ody, 1993; Pahlow and Das, 1993; Chrubasik, 1997; Qi et al., 2010).

Based on such properties, herbalists use Devils claw for the treatment of rheumatic pain and joint problems, mainly arthritis and lumbago. On the other hand, one study described no evidence for anti-inflammatory activity of Devil's claw in the treatment of arthritic disease (Whitehouse et al., 1983). All allopathic anti-inflammatory drug products are known to possess side effects ranging from stomach disorders to serious blood abnormalities, however, none of such side effects were observed in the current toxicity studies (Moussard et al., 1992). There were no toxicity signs in the female treatment group as compared to the control.

Chronic treatment with Devil's claw (capsule contents) in male mice revealed no adverse effects on sperm count, sperm motility and sperm viability. All these parameters were found to be normal ($\geq 14x10^6$/ml, $\geq$ 50%, and $\geq$50%, respectively) and comparable with the control male mice. Furthermore, Devil's claw treatment could not induce any increase in sperm abnormalities after chronic treatment as compared to the control. It is well documented that any increase in sperm abnormalities indicates mutagenic nature of the drug product (Wyrobek and Bruce, 1975). In the present chronic toxicity studies, it was demonstrated that Devil's claw treatment to be devoid of spermatotoxic potential (Wyrobek et al., 1983). Thus confirming that treatment with Devil's claw capsule contents in the given dose for prolonged period of time, to be safe. The toxicity results of current study add important points to the accumulating data about Devil's claw toxicity. In addition, our findings might be used in designing future preliminary and preclinical studies on Devil claws capsules.

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