

## Induction of Hypocholesterolemia Associated with Testicular Dysfunction by *Aloe barbedensis* in Albino Rats

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### Summary

Many plants or plant products are known to exert hypocholesterolaemic effects. Addition to these *Aloe barbedensis* is a potent plant for its hypocholesterolaemic activity. On the other side hypolipidaemia could be correlated to testicular dysfunction because of low availability of steroidogenic precursor. Therefore the present study is an attempt to investigate the hypocholesterolemic activity of *Aloe barbedensis* associated with their effect on male reproduction. *Aloe barbedensis* Fr. I was administrated to male rats, serum lipid profile for hypocholesterolemia as well as various biochemical parameters related to reproduction were performed. Results suggest that *Aloe barbedensis* Fr. I induced testicular dysfunction, which could be due to its hypolipidaemic activity.

**Key-words:** Aloe barbedensis, hypolipidaemia, testicular dysfunctions, Leydig cell

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## Introduction

Several epidemiological studies have demonstrated that diet enriched in cholesterol and saturated fat elevates plasma cholesterol levels that lead to the development of atherosclerosis and hyperlipidaemia. Researchers interest has been focused on various herbs that possess hypolipidaemic activity that may be useful adjuncts in help in reducing the risk of cardiovascular disease. Various plants have been effectively used as hypolipidaemic/ antiatherosclerotic agents worldwide. Some of the plants being used are *Allium sativum* (1), *Zingiber officinale* (2), *Emblica officinalis* (3) and *Withania somnifera* (4).

Studies by Hill *et al.* (5) and Nordy *et al.* (6) suggested that endogenous plasma testosterone levels are closely related to lipids and lipoproteins. Mendoza *et al.* (7) reported that endogenous physiologic testosterone levels play a role in regulation of triglyceride and HDL-Cholesterol levels in men and may also affect the hydrolytic susceptibility of very low-density lipo-protein molecules.

Lipid lowering activity of *Aloe barbedensis* (Mill), have been shown in Rhesus (8) and *Presbytis* monkeys (9). Hypolipidaemic effect of *Allium sativum* (Linn.) and testicular lesions were also reported (10). Schneider and Kaffrnick (11) claimed that atomid, a well-reputed agent induces impotency in men when administrated for a period on one year.

Little information is available on possible mechanism of hypolipidaemia induced testicular dysfunction. Present investigation is on similar lines.

## Material and Method

### Plant material

Fresh leaves of *A. barbedensis* were collected from Sanganer near Jaipur (Rajasthan). The leaves were ground and mucoid fluid was allowed to stand over night in cylindrical glass jars and a yellow transparent liquid was decanted and dried at 40°C. The brown solid thus obtained was successively washed with petroleum ether, benzene and chloroform. The yellow powder thus obtained was termed *Aloe barbedensis* Fr. I.

### **Experimental model and design**

Twenty adult healthy male Wistar albino rats weighing 200-230 g of the inbred colony were used. They were maintained in an air-conditioned room ( $26\pm 2^{\circ}\text{C}$ ) and given rat feed (Hindustan Lever Ltd.) and water *ad libitum*. The animals were divided into two groups of 10 rats each.

Group-I served as vehicle treated control and animals of Group II received 200 mg/rat/day *Aloe barbedensis* Fr. I in 2ml of distilled water for a period of 100 days.

All animals were sacrificed 24 hr after the administration of last dose of *Aloe* Fr. I. The testes, epididymis, seminal vesicle and ventral prostate were dissected free of fat and weighed on a torsion balance. The right testes were fixed in Bouin's fixative. Paraffin sections (6  $\mu\text{m}$ ) were prepared and stained with hematoxylin and eosin. Beside this halves of the tissues were frozen for biochemical estimation of protein (12), sialic acid (13) and glycogen (14). Total cholesterol was estimated quantitatively according to Liberman and Burchard (15) method.

The blood was collected through cardiac puncture and the serum analyzed for lipid metabolism i.e. cholesterol (16), phospholipid (17), free fatty acids (18), triglycerides (19) and HDL-Cholesterol (20).

One hundred circular seminiferous tubules were traced with camera lucida at X80. Two perpendicular diameters of each tracing were measured, averaged and expressed in terms of mean tubular diameter. One hundred Leydig cells nuclei were carried out on four sections from each testis with camera lucida drawing at X800.

## Results

### Reproductive organs weight

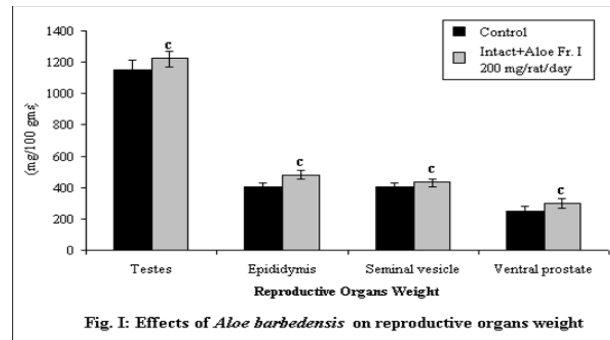


Fig. I: Effects of *Aloe barbedensis* on reproductive organs weight

Values are in mean  $\pm$  SEM (n=10)

Levels of significance - c = non significant when compared with controls

No significant changes in the weights of testes, epididymis, seminal vesicle and ventral prostate were noticed after *Aloe Fr. I* (Fig-I)

### Histological findings

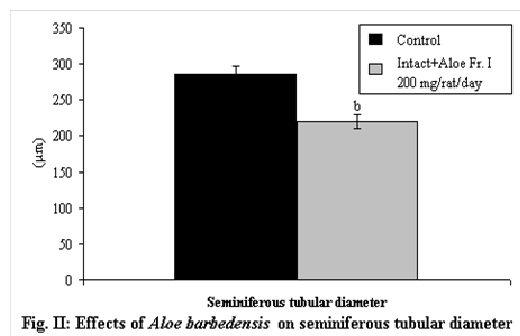


Fig. II: Effects of *Aloe barbedensis* on seminiferous tubular diameter

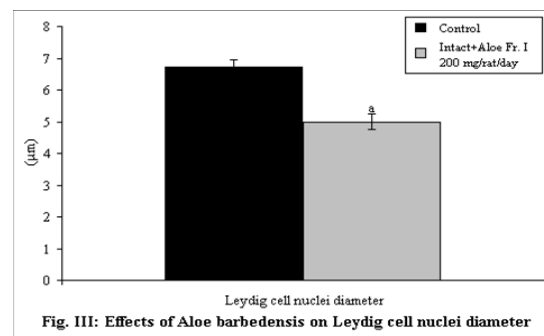


Fig. III: Effects of *Aloe barbedensis* on Leydig cell nuclei diameter

Values are in mean  $\pm$  SEM (n=10)

Levels of significance - a =  $P < 0.001$ ; b =  $P < 0.01$  when compared with controls

In group-I microscopic examination of testes shows normal architecture with all successive stages i.e. spermatogonia, spermatocytes, spermatids and spermatozoa. However, *Aloe Fr. I* treated rats seminiferous tubular diameter (Fig-II) and Leydig cell nuclei diameter (Fig-III) were significantly ( $P < 0.01$ ) reduced.

## Biochemical changes

### Serum biochemistry

**Table- I: Effects of *Aloe barbedensis* Fr. I treatment on serum lipids**

Treatment	Cholesterol	Triglyceride	Phospholipid	Free Fatty Acids	HDL-Cholesterol
	(mg/dl)				
<b>Control</b>	92.8 ±5.51	105.92 ±4.43	143.75 ±7.12	0.230 ±0.003	59.04 ±0.70
<b>Intact+Aloe Fr. I 200 mg/rat/day</b>	60.0 ±2.83 <sup>b</sup>	71.44 ±3.71 <sup>a</sup>	104.16 ±3.40 <sup>b</sup>	0.184 ±0.004 <sup>a</sup>	63.30 ±0.90 <sup>a</sup>

Values are in mean ± SEM (n=10)

Levels of significance - a = P<0.001; b = P<0.01 when compared with controls

A significant (P<0.01) reduction in serum total cholesterol and phospholipid levels were observed. Serum free fatty acids and triglycerides were also reduced significantly (P<0.001) after *Aloe* Fr. I treatment. A significant (P<0.001) increase in HDL-Cholesterol levels were noticed after *Aloe* Fr. I treatment (Table-I).

### Tissue biochemistry

**Table- II: Effects of *Aloe barbedensis* Fr.I treatment on tissue biochemical changes**

Treatment	Protein										
	Cholesterol	Glycogen		Protein				Sialic acid			
	(mg/gm)										
	Testes	Testes	Testes	Epididymis	Seminal vesicle	Ventral prostate	Testes	Epididymis	Seminal vesicle	Ventral prostate	
<b>Control</b>	8.21 ±0.42	1.48 ±0.04	208.43 ±4.0	199.35 ±7.74	242.20 ±6.48	227.43 ±7.76	5.40 ±0.15	5.67 ±0.24	6.20 ±0.24	6.15 ±0.21	
<b>Intact+Aloe Fr. I 200 mg/rat/day</b>	7.20 ±0.42 <sup>c</sup>	1.00 0.04 <sup>c</sup>	156.92 ±3.79 <sup>a</sup>	147.63 ±3.06 <sup>a</sup>	197.20 ±5.28 <sup>a</sup>	166.15 ±3.00 <sup>a</sup>	3.20 ±0.90 <sup>b</sup>	4.35 ±0.08 <sup>a</sup>	4.22 ±0.08 <sup>a</sup>	4.91 ±0.13 <sup>a</sup>	

Values are in mean ± SEM (n=10)

Levels of significance - a = P<0.001; b = P<0.01 and c = non-significant when compared with controls

Testicular cholesterol content does not change significantly after *Aloe* Fr. I treatment. The glycogen amount of testes was reduced significantly (P<0.001) in *Aloe* Fr. I treated rats. A significant reduction (P<0.001) in the protein and sialic acid contents of testes, epididymis, seminal vesicle and ventral prostate was observed in all *Aloe* Fr. I treated rats (Table-II).

## **Discussion**

*Aloe Fr. I* administration decreased the serum total cholesterol, triglyceride, phospholipid and free fatty acids in comparison to normal. It also increases the serum HDL-Cholesterol (9), which has been shown to an important independent “anti-atherosclerotic factor”. Oram and Lawn (21) proposed that HDL-serves a carrier function for transporting cholesterol from peripheral tissues to liver where it is catabolised and exerted. Evidences supporting this hypothesis and other possible mechanism for the protective effect of HDL were reported by various workers (22, 23).

The important finding in the present study is the high selectivity of lesions inflicted by *Aloe Fr. I* on the testes of rats. Reduced glycogen contents of the testes after *Aloe Fr. I* treatment is possibly due to inhibition of phosphorylase inaction. Marked decrease in glycogen content may affect protein synthesis and directly proportional to the steroid hormones and thus subsequently inhibit spermatogenesis (24).

The levels of sialic acid in the testes, epididymis, seminal vesicle and ventral prostate were significantly lower in *Aloe Fr. I* treated rats. This was again probably due to inhibition of spermatogenesis in the testes and to the absence of spermatozoa in epididymis. Impairment of Leydig cell function was evinced in nuclear diameter, shrinkage (25), which may lead to deficient androgen production.

**In conclusion:** *Aloe barbedensis* possess hypocholesterolemic effects, which leads the testicular dysfunction because of low availability of steroidogenic precursor.

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