



## RESTORATIVE ASPECT OF CASTOR PLANT ON MAMMALIAN PHYSIOLOGY: A REVIEW

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### ABSTRACT

The castor plant (*Ricinus communis* L.) is a robust perennial shrub of Euphorbiaceae family and different parts of the plant are widely used by various communities and forest dwellers in many regions of the world for treating a variety of ailments. About 80% of world population is still dependent on traditional herbal medicines. The plant is documented to possess beneficial effects as anti-oxidant, antifertility, anti inflammatory, antimicrobial, central nervous system stimulant, anti diabetic, insecticidal and larvicidal and many other medicinal properties. The extracts or the isolated compounds of this plant have been found to have potent activity against various ailments. The aim of this paper is to scrutinize the available literature related to the restorative activity of the castor plant as a herbal medicine on mammalian physiology and to accumulate those scientifically valid data in a nut shell in the form of a mini review.

**Keywords:** *Ricinus communis* L., herbal medicine, anti-inflammatory, antifertility, anti-oxidant, anti-diabetic, central nervous system stimulant.

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## INTRODUCTION

Starting from pre-historic era to till date plants are being used as prosperous source of effectual and safe remedy against many diseases. Plant-derived extracts have been immensely used as crude drugs in traditional medication and this has resulted in an inherited knowledge about the curing prospective of plant species. About 80% of the world population is still dependent on traditional herbal medicines and these medicines may contain excipients in addition to the active ingredients (Tiwari, 2008). With the development of pharmaceutical industries much more avenues have been created on plant products. The active constituents can be isolated from different plant parts and used directly as drug or designed as pharmacologically active compounds with or without addition of synthetic components.

The *Ricinus communis* L. which is ordinarily acknowledged as Castor plant is a robust perennial shrub of Euphorbiaceae family. The different parts of the plant are widely used by various communities and forest dwellers in many regions of the world for treating a variety of ailments. The plant is documented to possess beneficial effects as anthelmintic, antifertile, diuretic and many other medicinal properties. The primordial and contemporary therapeutic uses of this plant in about fifty countries worldwide, has already been surveyed and reported (Scarpa et al., 1982).

A scrutiny of literature revealed some notable pharmacological activities of the plant and efforts been made by researchers to verify the efficacy of the plant through scientific biological screenings. This paper briefly reviews the restorative aspect of castor plant against different mammalian ailments.

## APPLICATION OF PLANT'S COMPOUNDS

The herbal drug industry is considered to be a high growth industry and popularity of medicinal herbs is increasing day by day. A huge number of medicinal properties of this plant have been described by different workers from time to time; among them some are briefly discussed here.

### **Antidiabetic and Hepatoprotective activity**

Root extract of *Ricinus communis* (RCRE) was investigated along with its bioassay-guided purification. Administration of the effective dose of RCRE to the diabetic rats for 20 days showed favorable effects not only on fasting blood glucose, but also on total lipid profile and liver and kidney functions. Fraction R-18 showed significant antihyperglycemic activity. Thus *R. communis* seems to have a promising value for the development of a potent phytomedicine for diabetes (**Shokeen et al., 2008**).

The plant's leaf extract was evaluated for hepatoprotective. In a preliminary test with albino rats, extract showed significant protection against galactosamine-induced hepatic damage and hepatoprotective activity as judged by hepatocytes isolated from paracetamol-treated rats (**Visen et al., 1992**).

Fresh leaves of *Ricinus communis* offered protection against experimentally induced liver injury by Ccl<sub>4</sub> in albino rats, while cold extract and the glycoside only provided partial protection (**Natu et al., 1977**).

### **Antioxidant effects**

The seed extract has strong antioxidant activity. It produces an inhibition of aryl hydrocarbon hydroxylase (AHH) activity and H<sub>2</sub>O<sub>2</sub> production by lindane-induced mouse hepatic microsomes, indicating the antioxidant activity of the plant (**Williamson, 2002**).

The fat-storing endosperm of *Ricinus communis* was found to contain an ascorbate peroxidase (EC 1.11.1.11), which is nearly as active as catalase (EC 1.11.1.6) in degradation of hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) at its physiological concentrations. This ascorbate peroxidase probably functions together with monodehydroascorbate reductase (EC 1.6.5.4) or dehydroascorbate reductase (EC 1.8.5.1) and glutathione reductase (EC 1.6.4.2) to remove the H<sub>2</sub>O<sub>2</sub> produced during the transformation of fat to carbohydrate in the glyoxysomes (**Klapheck et al., 1990**).

## Activity on reproductive system

### *Female reproductive system*

The influence of natural substances on porcine ovarian cells was described in a previous study (Kolesarova *et al.*, 2011). Seed extract has been reported to possess high antifertility activity in female reproductive system. This is due to progestational activity and alternation in oestrogen/progesterone balance as well as a direct effect on the uterus and fallopian tube. These results indicate a novel contraceptive effect of seed extract of castor plant due to both hormonal and direct effects on the reproductive system (Okwuasaba *et al.*, 1997).

Salhab *et al.* (1997) reported that when female rabbits were treated with castor beans of 7.5 mg.kg<sup>-1</sup> body weight, it resulted in a 4.3 fold decrease in pregnancy of treated female rabbits compared to the control animals.

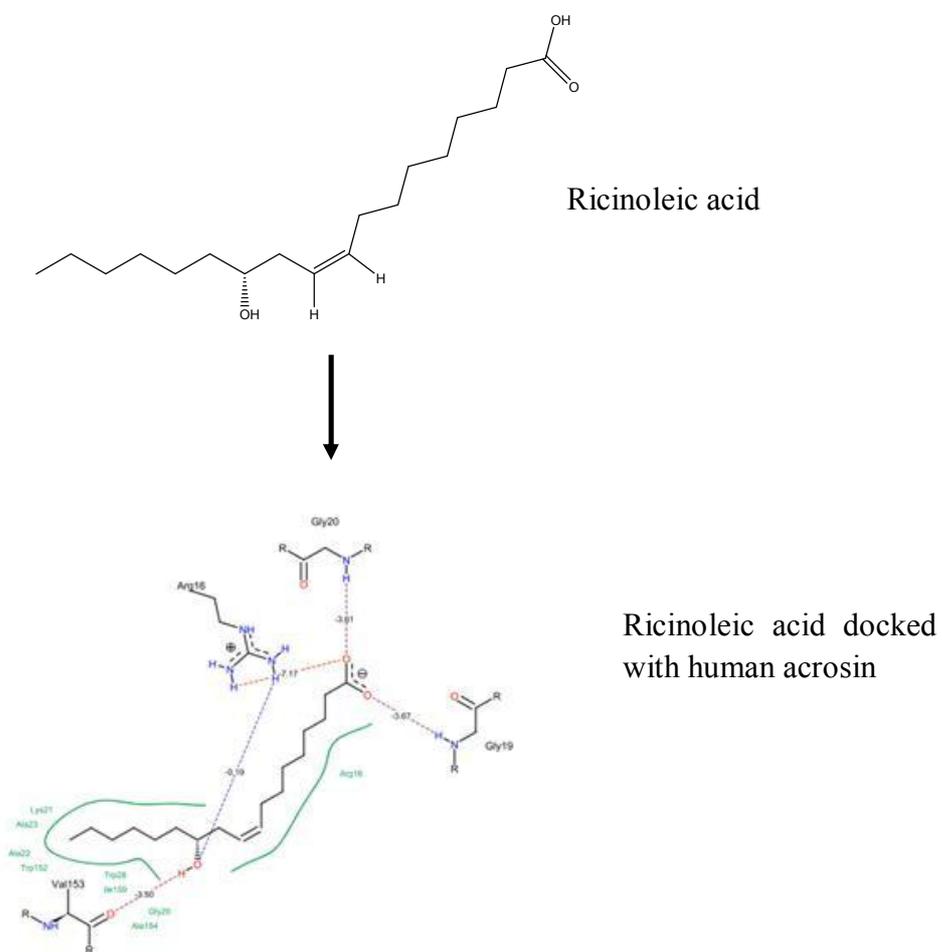
Castor bean extract and Ricin-A chain has known to have abortifacient effect in rabbits. Rabbits, when treated with both castor bean extract and ricin-A chain (intraperitoneally) for three consecutive days resulted in terminated pregnancy. A significant reduction in progesterone, but not estrogen from plasma level was detected in all treated rabbits compared to control rabbits (Salhab *et al.*, 1998).

Furthermore, a significant reduction in the protein contents of the placenta occurred in rabbits treated with ricin-A chain. Laparotomized rabbits exhibited dead foetuses, separation of placenta and blood clots (Salhab *et al.*, 1998). The anti-implantation and anti-ovulation effects of castor bean extract (CBE) and ricin A-chain (RAC) were evaluated in rabbits and this exhibited a pronounced decrease in maternal body weight gain and in death of all foetuses (Salhab *et al.*, 1999).

### *Male reproductive system*

The effect of natural substances on spermatozoa motility in rabbits was described in a previous study (Roychoudhury *et al.*, 2011). A significant decrease ( $P < 0.01$ ) in the weight of the reproductive organs, sperm functions and serum levels of testosterone was observed in rats when they were treated with *Rcinus communis* seed extract (RCE). It had been found that there was disorganization in the cytoarchitecture of the testes, disruption of the seminiferous tubules and erosion of the germinal epithelium. RCE has a reversible negative impact on male reproductive functions, which appears to be mediated via gonadal disruption in testosterone secretion (Raji *et al.*, 2006).

In an *in silico* study conducted with ricinoleic acid showed that, this acid acts as an inhibitor of human acrosin and thus it is acting as a contraceptive which has spermicidal property (Nath et al., 2010)



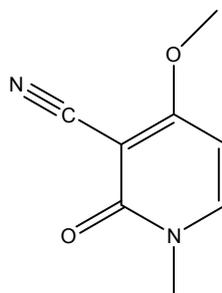
**Fig 1** *In silico* binding mechanism of Ricinoleic acid and human acrosin (Nath et al., 2010)

### Ricinine the Central nervous system (CNS) stimulant

Ricinine, a neutral alkaloid isolated from the extract of pericarp of castor bean shows typical central nervous system stimulant effect when administered to mice and the results shows an improved memory consolidation, decrease in exploratory behaviour and catalepsy similar properties (Williamson, 2002).

The therapeutic index of ricinine is of the order of 200, therefore the compound may be considered as a promising cognition-enhancing drug that may be used for the treatment of human amnesias. This alkaloid also induces seizures when administered to mice at doses

higher than  $20 \text{ mg.kg}^{-1}$ . Animals presenting seizures showed a marked preconvulsive phase followed by short duration hind limb myoclonus, respiratory spasms, and death. The lethal nature of ricinine seizures is also pointed out as a good model to study the events causing death in clonic seizures, particularly those related to respiratory spasms, which are also observed in some types of human epilepsy. The behavioral signs of ricinine-elicited seizures are accompanied by electrographic alterations more evident during the preconvulsive phase in the cerebral cortex and more intense during the ictal phase both in the cortex and in the hippocampus. Results suggest that the mechanism of action of ricinine probably involves the benzodiazepine site in the  $\text{GABA}_A$  receptor. This may represent a new mechanism of drug-elicited seizures that may contribute to a better understanding of epilepsy and to new therapeutic approaches to this disease (Ferraz *et al.*, 1999).



**Fig 2 Ricinine**

### **Anti-inflammatory activity**

Anti-inflammatory and free radical scavenging activities of the root extract was studied in Wistar albino rats. The extract enhanced free radical scavenging activity of stable radical 2,2-diphenyl-1-picryl-hydrazyl (DPPH•), nitric oxide and hydroxyl radical in *in vitro* assay methods. The results of the study indicate that extract of *Ricinus communis* root possess significant anti-inflammatory activity in acute and chronic inflammatory models in rats. The observed pharmacological activity may be due to the presence of phytochemicals like flavonoids, alkaloids and tannins present in the plant extract with various biological activities (Ilavarasan *et al.*, 2005).

### Activity of RCA-1

*Ricinus communis* L. agglutinin 1 (RCA-1) can be used as a specific marker to study the development and differentiation of microglial cells in human embryogenesis (**Bobryshev et al., 1994**).

RCA-1 also blocks the binding of human anti-renal basement membrane antibodies to the kidney. Whether or not glycosyl moieties of glycoproteins present in human renal basement membranes are related to the sites where anti-basement membrane antibodies bind was examined by blocking experiments using several kinds of lectin. RCA I, specific for galactose, blocked the binding of human anti-glomerular basement membrane (GBM) and anti-tubular basement membrane (TBM) antibodies to renal basement membranes. This lectin also diminished the binding of rabbit anti-laminin antibody, but did not inhibit the binding of mouse anti-fibronectin or rabbit anti-human TBM antibodies. These findings suggest that the binding sites of human anti-GBM and anti-TBM antibodies and heteroantibodies to laminin are closely related to the galactose moieties in glycoproteins of human renal basement membranes (**Yoshioka et al., 1989**).

Albumin and *Ricinus communis* L. agglutinin can interfere with transendothelial albumin permeability (**Siflinger-Birnboim et al., 1991**).

### Antimicrobial activity

The plant has antibacterial activity against *Escherichia coli*, *Salmonella newport*, *Serratia marcescens*, *Streptococcus progens* and *Shigella flexneri* (**Ross, 2001 and Islam et al., 2010**), *Bacillus subtilis* and *Staphylococcus aureus* (**Ross, 2001**), *Klebsiella pneumoniae*, *Escherichia coli*, *Proteus vulgaris*, and *Pseudomonas aeruginosa* (**Jombo et al., 2008**).

### Insecticidal and Larvicidal activity

Seeds have insecticidal activity (**Sharma et al., 2009**) against *Spodoptera frugiperda* (**Ramos-López et al., 2010**) where as leaf extracts are active against against *Callosobruchus chinensis* L (**Upasani et al., 2003**).

Crude extracts have larvicidal activity against *Anopheles arabiensis* and *Culex quinquefasciatus* (**Elimam et al., 2009**).

## CONCLUSION

Thousands of plants are there which have restorative/medicinal properties and this *Ricinus communis* L. or castor plant is one of them. Recent efforts are aim at exploring the hidden wealth of this medicinal plant for various use and in near future traditional uses of this plant which do not have any established report till will get proper scientific attention for establishing these age-old facts and its compounds will eventually come out as a potent herbal drugs. A huge number of traditional data are available on medicinal aspect of this plant but most of them are not scientifically validate, so if we can take an attempt to validate those traditional knowledge from scientific point of view then this plant's product may become an asset for the world of medicine.

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