

## Review Article : Open Access

Anti-inflammatory activity of *Ricinus communis* L.: A systematic reviewRahul R. Zade and Anita Wanjari\*<sup>◆</sup>

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## Abstract

*Ricinus communis* L. commonly known as Eranda in Sanskrit and widely distributed throughout India. *R. communis* is well known from ancient times for its medicinal properties and use in various diseases. This plant belongs to Euphorbiaceae family which plays an important role in disease free community. Anti-inflammatory property of *R. communis* is very well known. Hence, a systematic review was carried out using published literature obtained through "Pubmed, Scopus, Cochrane database, Google Scholar" until 2022. Total 121 articles were searched in computer based search engine. In that Pubmed, Scopus, Chocrane and the rest were used to search the anti-inflammatory activity of *R. communis*. After screening, 16 articles were selected which match the criteria. *R. communis* plant leaves, fruits, roots and polymer were used to detect the different activity. This systematic review aimed to collect and assess data from clinical trial, *in vivo* study and *in vitro* study on the effectiveness of *R. communis* as a treatment for inflammation. Study design and outcomes varied widely among the sixteen selected studies. The study concludes that the disease prevention and anti-inflammatory activity of *R. communis* is proved to provide alternatives to various medical areas.

## 1. Introduction

Whenever hazardous compounds, allergens damage to cells occurs the defence response get stimulated in the body called as inflammation (Chen *et al.*, 2017). Allergies, metabolic disorders, arthritis, cardiovascular dysfunctions, cancer and autoimmune diseases causes inflammatory responses in body (Manjuparkavi *et al.*, 2022). Such diseases causes huge impact on our society and individual in the form of economic burden with sorrowful environment in family. To suppress or fight against such inflammation, various medicines are available in market such as immunosuppressant and nonsteroidal anti-inflammatory drugs. These drugs are associated with adverse effects in long term use which causes to apply minimum effective dose. Various diseases such as rheumatoid arthritis or allergic disorders needs long term use of medication with less side effects and more efficacy. In ayurveda, *R. communis* is one of an essential indigenous traditional medicinal plant for the treatment of various disorders like rheumatoid arthritis, bronchitis, diseases of abdomen which shows anti-inflammatory activity.

It is very common herb available all over India mostly in tropical regions. *R. communis* comes under Euphorbiaceae family (Latif *et al.*, 2015). In India, it is commercially cultivated in various states of India. It is also called as castor tree in English. *R. communis* is a perennial, dense plant up to 5 m (Singh *et al.*, 2022). The leaves are commonly 15 to 45 cm long, stalked, alternate palmate with 5 to 12

deep lobes with coarsely toothed segments. Stem is soft wooded (Doshi *et al.*, 2013) available in two varieties white and red colour stems. All parts of plant such as bark, leaves, flowers, seed, roots and oil are important. Mostly, the flowers are monoecious with terminal inflorescences of green or red varieties. The fruit is spiny, greenish capsule containing oval shiny bean seeds. The roots are light weighted with dull outer surface, nearly smooth yellowish in colour with longitudinal wrinkles. In India, it is also known by various vernacular names like as aranda (hindi), aavanakk (malayalam), erendi (marathi), harlu (kannada), amanakku (tamil), amudapu veru (telugu), bedanjiir and arand (urdu), jada and gaba (oriya), aran, banangir (kashmiri), erandio and erando (gujrathi), bherenda (bengali), eda and era (assamese), arind (punjabi), eranda, gandharvahasta, vatari, panchagula, citra, urubu and rubu (sanskrit) (Rana *et al.*, 2012), kheriwa (sudanese) (Mazen *et al.*, 2019).

## 2. Phytochemical constituents

*R. communis* harbors many phytochemicals in root, stem bark, leaves, fruits and seeds. Leaves exhibits presence of alkaloids, glycosides and phenolic compounds. Leaves contain alkaloids as ricinine (0.55 per cent) and N-demethylricinine (0.016 per cent), glycosides as kaempferol-3-O- $\beta$ -D-xylopyranoside, quercetin-3-O- $\beta$ -D-glucopyranoside, quercetin -3-O- $\beta$ -D-xylopyranoside, kaempferol-3-O- $\beta$ -D-glucopyranoside, kaempferol-3-O- $\beta$ -rutinoside and quercetin-3-O- $\beta$ -rutinoside. Phenolic compounds as gallic acid, quercetin, mono-terpenoids, sesquiterpenoid, gentisic acid, rutin, ellagic acid epicatechin in leaves and indole-3-acetic acid in roots. Ricinoleic acid, isoricinoleic acid, crystalline alkaloid ricinine, stearic acids, dihydroxystearic acids and lipases are glycosides present in seeds. The castor oils mostly contains esters as ricinoleic acid (89.4 per cent), linoleic acid (3.4 per cent), oleic (3.2 per cent), linolenic

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(0.2 per cent), palmitic acid (1.2 per cent), stearic acid (0.7 per cent), arachidic acid (0.3 per cent), hexadecenoic acid (0.2 per cent) and dihydroxy stearic acids. (Jena *et al.*, 2012).

### 3. Materials and Methods

A systematic review was carried out using published literature obtained through “Pubmed, Scopus, Cochrane database, Embase, Google Scholar” until 2022. Studies on *R. communis* were searched through computerised database. 121 articles were searched by engine and yielded 99 citations. These included studies on various activity such as hepatoprotective (Visen *et al.*, 2008), laxative and purgative

(Azadmard and Damirchi *et al.*, 2011), ricin toxicity (Moshiri *et al.*, 2016), antioxidant (Iqbal *et al.*, 2012), antinociceptive (Taur *et al.*, 2011), antiasthmatic (Dnyaneshwar *et al.*, 2011), antifertility (Sandhyakumary *et al.*, 2003), antihistaminic (Taur *et al.*, 2011), protective effect in liver injury (Natu *et al.*, 1977), anti-inflammatory (A Doshi *et al.*, 2015), antimicrobial (Naz *et al.*, 2012), antidiabetic (Shokeen *et al.*, 2008), antiulcer (Ashwathy *et al.*, 2016), lipolytic (Lombard *et al.*, 2001), molluscicidal (Sharma *et al.*, 2009), insecticidal and larvicidal (Elimam *et al.*, 2009), antianalgesic (Almeida *et al.*, 2001), anticonvulsant (Tripathi *et al.*, 2010), wound healing (Beloti *et al.*, 2007), antibacterial (Abew *et al.*, 2014) and antihelmintic (Rana *et al.*, 2013).

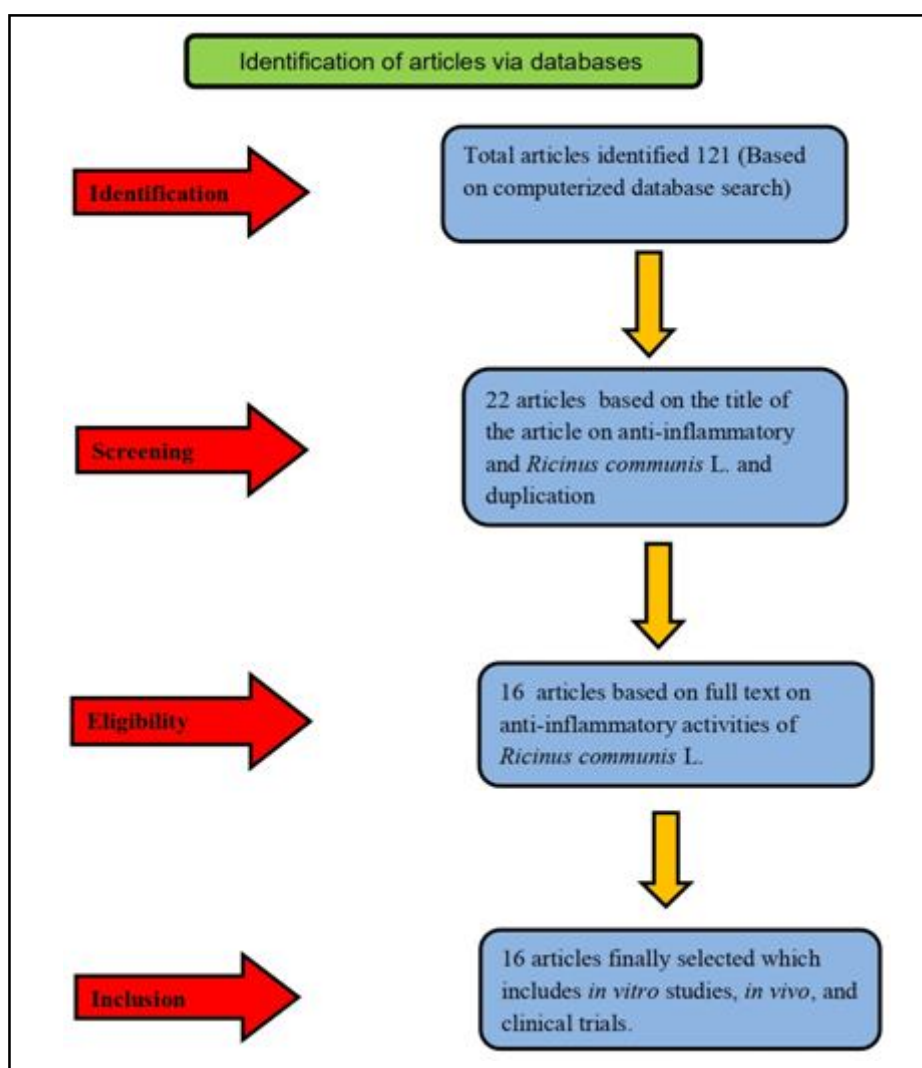


Figure 1: Flow chart (As per PRISMA guidelines)

### 3. Results

The articles meeting the eligibility criteria were selected and reviewed. Duplicate and not matching the inclusion criteria articles were removed. The abstracts were screened individually and full text articles were tried to obtain for studies. Articles fulfilling the eligibility criteria were selected for the study.

From 121 searched articles on the basis of reading titles and abstracts of publications 99 were discarded because they failed to reach the eligibility criteria. 6 duplicate articles were removed from 22 articles and 16 articles were included due to matching with eligible criteria. Out of 16 selected articles 1 was clinical trial, 11 were *in vivo* study and 3 were *in vitro* study and 1 study was performed both on *in vitro* and *in vivo* study.

Table 1: Overview of articles selected in systematic review

S.No.	Author and reference	Journal and year of publication	Study type/place of study	Therapeutic regimen/drugs	Sample size and inclusion criteria	Major outcomes
1	Nemudzivhadi and Masoko, 2014	Evidence based complementary and alternative medicine/2014	<i>In vitro</i> study/ biochemistry, microbiology and biotechnology department, university of limpopo, South Africa	Anti-inflammatory activity using phago burst assay/ <i>R. communis</i> leaves extraction	Two hundred microliters of cells (Raw 264.7 macrophages)	<i>R. communis</i> methanolic extracts contain flavonoid that shows anti-inflammatory agent of medicinal plants
2	Lomash <i>et al.</i> , 2010	Cellular and molecular biology (noisy-le-grand, France)/2010	<i>In vivo</i> study/ College of Veterinary Science and Animal Husbandry, Jabalpur, Madhya Pradesh, India	Carrageenan-induced inflammation in the chicken skin/ ethanolic extract <i>R. communis</i> root bark	Total of 36 broiler chickens, 12 groups of 3 chickens each/8 to 12 weeks healthy male broiler chickens weighing nearly up to 2 kg	The herbal extract of <i>Solanum nigrum</i> and <i>R. communis</i> proves the antihistamic and anti-inflammatory properties.
3	Uscategui <i>et al.</i> , 2019	Molecules/2019	<i>In vitro</i> study/ universidad de La sabana, Chia, Colombia.	Polyurethanes and isophorone diisocyanate from castor oil	Mouse fibroblasts (L929), adult human dermal fibroblast (HDFa) and Human fibroblasts (MRC-5)	Polyurethanes do not have anti-inflammatory activity but is assessed biomaterials for wound dressings due to biocompatibility and mechanical nature.
4	Ziaei <i>et al.</i> , 2016	DARU Journal of Pharmaceutical Sciences/2016	<i>In vivo</i> study/Shahid beheshti University of Medical Sciences, Tehran, Iran.	To evaluate the analgesic and anti-inflammatory effects /leaves extract of <i>Lawsonia inermis</i> L. (henna) and <i>R. communis</i> .	36 adult male wistar rats divided in to 6 groups.	The knee joint inflammation was reduced by applying topical application test group. Thus shows positive result
5	Ilavarasan <i>et al.</i> , 2006	Journal of Ethno pharmacology/ 2006	<i>In vivo</i> study/ Department of pharmacology, C.L. Baid Metha College of Pharmacy, Thorapakkam, Chennai, India	To study the anti-inflammatory, free radical scavenging activity/methanolic extract from the roots of <i>R. communis</i>	Adult wistar albino rats, four groups with six animals in each group.	Methanolic extract of the <i>R. communis</i> root possess anti-inflammatory activity in acute and sub-acute condition. Flavonoids present in the extract shows positive free radical scavenge
6	Srivastava <i>et al.</i> , 2013	Natural product research/2013	<i>In vivo</i> study / Central Institute of Medicinal and Aromatic plants, Lucknow, India	Anti-inflammatory study using hind paw oedema method/ triterpene from the root of <i>R. communis</i>	Carrageenan-induced the left hind paw of each rat in plantar tissues.	The presence of erandone and lupeol compounds supports the anti-inflammatory action of <i>R. communis</i>
7	Nirmal <i>et al.</i> , 2013	The American Journal of Chinese Medicine/2013	<i>In vivo</i> study/ Bharati Vidyapeeth Deemed University, Pune, India	Influence of six medicinal herbs oncollagenase-induced osteoarthritis/ <i>Sida cordifolia</i> roots, inflorescence of <i>Piper longum</i> , <i>Zingiber officinale</i> rhizomes, leaves of <i>Vitex negundo</i> and <i>R. communis</i> and fruits of <i>Tribulus terrestris</i> .	54 female wistarrats.	In comparison to other herbs <i>R. communis</i> also shows anti-inflammatory and anti-arthritic action by reducing knee swelling and paw oedema. It also decreases the degradation chondrocytes and cartilage surface

8	Vieira <i>et al.</i> , 2001	Naunyn Schmiedebergs arch Pharmacol/2001	<i>In vivo</i> study/ Faculdade de Medicina de Riberão preto, Brazil	Various inflammatory actions of ricinoleic acid with comparison group/ ricinoleic acid extracted from castor oil	Male albino dunghartley guinea-pigs (250-350 g) and female albino wistar rats (60-160 g) were used	The results provide pharmacological evidence indicating that ricinoleic acid possesses both pro-inflammatory and anti-inflammatory activity
9	Medhi <i>et al.</i> , 2009	Phytotherapy research/2009	Randomized, double-blind, comparative clinical study/ Department of Pharmacology and Physical Medicine and Rehabilitation, PIMER Chandigarh and AIIMS, New Delhi, India	Comparative clinical study on knee osteoarthritis patients showing safety and efficacy of castor oil	50 knee osteoarthritis patients were selected	In knee osteoarthritis it decreases the inflammation and thus it proves its action
10	Hussain <i>et al.</i> , 2021	Brazilian Archives of Biology and Technology (BAPT) /2021	<i>In vitro</i> and <i>in vivo</i> study/University of Agriculture, Faisalabad, Institute of Physiology and Pharmacology, Faisalabad, Punjab, Pakistan	<i>In vitro</i> antioxidant activity and <i>in vivo</i> anti-inflammatory action/hydroalcoholic extract of <i>R. communis</i> leaves and <i>Withania somnifera</i> roots	144 female wistar rats weighing 160 to 200 g, 6 rats were allocated to each eight groups in 3 different experiments	Leaves of <i>R. communis</i> and roots of <i>W. somnifera</i> contain bioactive various flavonoids present in leaves of <i>R. communis</i> and roots of <i>W. somnifera</i> are responsible for significant free radicals scavenging activities in the <i>in vitro</i> assays and carries potent anti-inflammatory experimental model
11	Mohammed and Albozachri, 2020	Medicolegal update /2020	<i>In vivo</i> study/ College of Veterinary Medicine, University of Karbala, Iraq	Anti-inflammatory effect of skin wounds in rabbits/ methanolic extract of dried leaves of <i>R. communis</i>	16 adult healthy rabbits from either sexes	Castor leaf extract shows increase in wound healing capacity
12	Saiyed <i>et al.</i> , 2017	International Journal of Green Pharmacy/2017	<i>In vivo</i> study/A. R. Pharmacy College and G.H.P Institute of Pharmacy, Gujarat, India	Effectiveness of <i>R. communis</i> root extract in ulcerative colitis	30 male sprague-dawley rats weighing averagely 200 gm. Six animals were included in five groups for study	The root extract shows positive effect in ulcerative colitis showing its anti-inflammatory and antioxidant effect
13	Singh <i>et al.</i> , 2013	International Journal of Pharmtech Research/2013	<i>In vivo</i> study/ISF College of Pharmacy, moga, Punjab, India	Anti-inflammatory ability study by carrageenan induced oedema method/ compound fraction from methanolic extract of <i>R. communis</i>	72 wistar rats weighing 180-220 g of either sex 12 groups with 6 animals in each group	The study shows that tested fractions and compounds fractions <i>R. communis</i> root possesses anti-inflammatory activity

14	Gacche <i>et al.</i> , 2010	Journal of Natural Remedies/2010	<i>In vitro</i> study / School of Life Sciences, Swami Ramanand Teerth Marathwada University, Nanded Maharashtra, India	To study radical scavenging activity, anti-inflammatory abilities and anti-oxidative ingredients / extract of various traditional medicinal plants including <i>R. communis</i>	Reagents and solvents required for scavengers of 2, 2-diphenylpicryl-hydrazyl radicals, hydroxyl radicals, reducing ability Vit. C and polyphenol oxidase inhibitory activity, inhibition of dien conjugates, trypsin and $\beta$ -glucuronidase, trypsin induced hydrolysis of bovine serum albumin	The study shows that the traditional plant used in study possesses anti-oxidative free radical scavenging and anti-inflammatory abilities
15	Valderramas <i>et al.</i> , 2008	Brazilian Journal of Oral Sciences/ 2008	<i>In vivo</i> study and <i>in vitro</i> study/ University of Sagrado coracao, Bauru, SP, Brazil.	Anti-inflammatory activity/ <i>R. communis</i> derived polymer	Wistar male rats weighing (200-250 g) and swiss male mice weighing (20-25 g)	Inhibition of phospholipase A2 enzyme by polymer derived <i>R. communis</i> proves anti-inflammatory activity
16	Bhitre <i>et al.</i> , 2008	Asian Journal of Chemistry/2008	<i>In vivo</i> study/ C.U.S College of Pharmacy, SNDT Women's university, Mumbai, India	To study the anti-inflammatory activity/ various extracts from the fruits of <i>R. communis</i> such as ethanolic, methanolic, chloroform, ethyl acetate and petroleum ether	102 either sex wistar albino rats ranging body weight between 150 g to 250	The study revealed that the fruits of <i>R. communis</i> also carries anti-inflammatory property. Some extract shows nearly same result as that of standard group

#### 4. Discussion

Total 121 articles were searched in computer based search engine. In that Pubmed, Scopus, Chocrane and the rest were used to search the anti-inflammatory activity of *R. communis*.

After screening 16 articles were selected which match the criteria. The different articles showed anti-inflammatory activity of *R. communis* and plant leaves, fruits, roots and polymer was used to detect the different activity.

Nemudzivhadi *et al.* (2014): *In vitro* study shows the presence of various flavonoids present in the roots of *R. communis*, shows anti-inflammatory activity. The cellular production of reactive oxygen species (ROS) was detected by using fluorogenic probe 2,7-dichlorodihydrofluorescein di-acetate. The high level of ROS and cytokines initiate the anti-inflammatory process shows that the roots of above plant have anti-inflammatory activity.

Lomash *et al.* (2010): In this *in vivo* study extracts of *Solanum nigrum* and *R. communis* were used to study the histamic and inflammatory study in chicken skin. The decreased in vascular permeability in initial stage, and suppression of heterophils, basophils and monocytoic cells in histopathology and also reduction in the total leukocyte significantly in pre-treated chicken skin lesions proves the anti-inflammatory ability of given plant.

Uscategui *et al.* (2019): The present *in vitro* study was performed on the polyurethanes prepared from castor oil derived polyols and

other chemicals. The aim of study was to determine the mechanical, physiochemical, morphological, biodegradable ability, inflammatory effect and *in vitro* biocompatibility characteristics of polyurethanes. The evaluation of inflammatory effect was carried by using cellular model of anti-inflammatory and proinflammatory cytokines. For evaluation of anti-inflammatory effect, castor oil polyols synthesized 12 materials were used and nine interleukin inflammatory markers were analysed. The study shows that the polyurethanes prepared from castor oil are suitable for use in biomedical in applications as materials for non-absorbable biomedical sutures which helps in wound dressing.

Ziaei *et al.* (2016): The present study assess that the aqueous leaves extract mixture of *Lawsonia inermis* L. herb with *R. communis* carries analgesic as well as anti-inflammatory property. Paw oedema model was used to study anti-inflammatory activity. Monosodium iodoacetate induced inflammation was reduced by topical usage of mixture. The study shows the anti-inflammatory effect as same as the standard drug used in experiment.

Ilavarasan *et al.* (2006): *In vivo* study was carried on adult wistar albino rats to study the effect of extract of *R. communis* root as anti-inflammatory and free radical scavenging. For acute and sub-acute inflammatory study, hind paw oedema model and cotton pellet granuloma model was used, respectively. Four groups of six animals in each group were selected for acute and sub-acute inflammatory study, respectively. Thus, the extract of given herb holds the property of anti-inflammatory in both experimental models.



Srivastava *et al.* (2013): The *in vivo* study was performed on the roots of *R. communis* plant extract. Methanolic and n-hexane extract of roots were used to study the inflammatory effect by using carrageenan induced paw oedema model on rats. The study shows n-hexane has better efficacy as compare to methanolic extract in inflammatory effect. Among n-hexane two triterpenes erandone shows topically better anti-inflammatory effect as compare to lupeol. Thus shows the *R. communis* roots posses anti-inflammatory effect.

Nirmal *et al.* (2013): In this *in vivo* study collagenase type II-induced osteoarthritis experimental model was used to study the effect of six traditional medicinal herbs on osteoarthritis. *Piper longum*, *Sida cordifolia*, *Ricinus communis*, *Zingiber officinale*, *Tribulus terrestris* and *Vitex negundo*. herbs were compared with standard drug Indomethacin. To monitor the effect of treatment different physiological parameters like paw volume, glycosaminoglycan release, body weight, knee diameter, paw retraction, radiography and histopathology of knee joint were used. As compared to other herbs, *R. communis* also shows positive result by reducing the knee swelling as well as paw oedema. It also prevents the degradation of surface cartilage and chondrocytes by preventing glycosaminoglycan loss. This shows anti-inflammatory and anti-arthritis activity of *R. communis* due to the flavonoids present in it.

Vieira *et al.* (2001): The present *in vivo* study was carried on guinea pig to study the effect of ricinoleic acid (RA) obtain from castor oil on blepharitis. Carrageenan intradermal injection was used to induce blepharitis in guinea pig eyelid. The study shows both pro inflammatory and anti-inflammatory properties.

Medhi *et al.* (2009): A randomized, double-blind clinical study was carried out by using capsule of castor oil and diclofenac capsule over fifty knee osteoarthritis patients. After 4 weeks treatment, it was observed that standard drug shows adverse drug reaction in comparison to castor oil capsule received patients. Thus, due to anti-inflammatory effect, castor oil is effective in primary treatment of knee osteoarthritis.

Hussain *et al.* (2021): *In vitro* and *in vivo* studies were performed to study the antioxidant as well as anti-inflammatory activity of *R. communis* and *W. somnifera*, respectively. Anti-inflammatory activity was studied by using various inflammatory experimental model. This study demonstrated that hydroalcoholic extracts of *W. somnifera* roots and *R. communis* leaves possesses phytochemical compounds showing anti-inflammatory properties. *R. communis* shows better result as comparison to *W. somnifera* in both studies.

Mohammed *et al.* (2020): In present *in vivo* study, 16 adult rabbits weighing in range from 1.25 kg to 2 kg were selected and equally divided into two groups. The study shows decrease in wound healing time and also acceleration of epithelial migration at the site of wound. Thus, decreasing the inflammation, increasing the angiogenic response and fill of tissue proves that less time required for healing of wound due to castor leaf extract in group.

Saiyed *et al.* (2017): The study was carried on 30 sprague dawley rats. *R. communis* roots extract was compared with standard drug in different doses by dividing 5 groups with 6 animals in each group. Ulcerative colitis was induced in rats by replacing instead of drinking water, 4% dextran sodium sulphate solution were given for 7 days to

induced ulcerative colitis in rats. Thus, the *in vivo* study shows positive effectiveness of *R. communis* roots extract on ulcerative colitis by its anti-inflammatory and antioxidant property.

Singh *et al.* (2013): The study was carried out from the methanolic extract on the roots of *R. communis*. The n-butanol fraction of methanolic extract gave three compounds. Two were active pure compounds ricinine, quercetin and one active impure compound SbFr-5. These three compounds showed anti-inflammatory property when perform on carrageenan induced hind paw oedema model. The active impure compound shows more potent effect than other fraction compounds. Thus, the *in vivo* study proves the anti-inflammatory effect of *R. communis*.

Gacche *et al.* (2010): The present *in vitro* study was performed on selected traditional plants to prove free radical scavenging activity, anti-inflammatory activity and antioxidative ingredients. All plants were carrying effective scavengers of 2, 2-diphenylpicrylhydrazyl radicals. All plants also show active towards scavenging of hydroxyl radical. Plants also have antioxidative substances and protoporphyrinogen oxidase inhibitory activity. All plants under study show anti-inflammatory activity and poor to moderate anti-proteolytic activity.

Valderramas *et al.* (2008): In present study, anti-inflammatory activity of polymer derived from *R. communis* was studied in both *in vivo* and *in vitro* model. *In vivo* study was carried out on both chronic and acute inflammatory experimental models. The *in vitro* study was carried on phospholipase A2 (PLA2) enzyme assay. A study on *R. communis* polymer shows a significant anti-inflammatory activity.

Bhitre *et al.* (2008): Various phytochemical extracts were studied on animals to investigate that the fruits of *R. communis* possess anti-inflammatory property. In this *in vivo* study, wistar albino rats were used to study the efficacy of fruits extract by carrageenan induced hind paw oedema method. The study gives positive result at different level dose and petroleum ether extract shows nearly equal anti-inflammatory result as that of standard group. Thus, proves the anti-inflammatory property present in fruits of *R. communis*.

## 5 Conclusion

The *R. communis* is traditional plant having miraculous medicinal property mentioned in classical texts. As plant each and every part (panchang in ayurveda) posses medicinal property. It can be compared with sunlight spreading rays of hope and removing the darkness of various diseases. All articles studied above showed that the plant has anti-inflammatory property. The uses of nonsteroidal anti-inflammatory drugs are increased and for long term use it is not possible as it affects the other systems of body. So, plant like *R. communis* can solve the problem in such condition and can look as alternative solutions for various health related problem. This plant also covers the field of pharmacy, agriculture, economic and social by providing benefits. But still many human trials are needed to use this plant quality in worldwide. The present systematic review proves that the plant has anti-inflammatory property.

## Conflict of interest

The authors declare no conflicts of interest relevant to this article.

## References

- Abew, B.; Sahile, S. and Moges, F. (2014). In vitro antibacterial activity of leaf extracts of *Zehneria scabra* and *Ricinus communis* against *Escherichia coli* and methicillin resistance *Staphylococcus aureus*, Asian Pacific Journal of Tropical Biomedicine, **4**(10):816-820.
- Almeida, R.N.; Navarro, D.S. and Barbosa-Filho, J.M. (2001). Plants with central analgesic activity, Phytomedicine, **8**(4):310-322.
- Ashwathy, G. and Sheela, D. (2016). Evaluation of the antiulcer properties of castor plants indigenous to Kerala, International Journal of Advances in Pharmacy, Biology and Chemistry, **5**(4):423-426.
- Azadmard-Damirchi, Sodeif; Fathi-Achachlouei, Bahram; Alirezalu, Kazem; Alirezalu, Abolfazl; Hesari, Javad. and Emami, S. (2011). Physiological and medicinal properties of castor oil. In book: Recent Progress in Medicinal Plants, **11**:323-337.
- Beloti, M.M.; Oliveira, P.T.; Tagliani, M.M. and Rosa, A.L. (2007). Bone cell responses to the composite of *Ricinus communis* polyurethane and alkaline phosphatase. Journal of Biomedical Materials Research, **84**(2):435-441.
- Bhitre, M.J.; Fulmali, S.; Anwikar, S. and Patil, S. (2008). Anti-inflammatory activity of the fruits of *Ricinus communis* Linn, Asian Journal of Chemistry, **20**(8):6603-6605.
- Chen, L.; Deng, H.; Cui, H.; Fang, J.; Zuo, Z.; Deng, J.; Li, Y.; Wang, X. and Zhao, L. (2017). Inflammatory responses and inflammation associated diseases in organs. Oncotarget, **9**(6):7204-7218.
- Dnyaneshwar, J.T. and Patil, R.Y. (2011). Anti-asthmatic activity of *Ricinus communis* L. roots. Asian Pacific Journal of Tropical Biomedicine, **1**:S13-S16.
- Doshi Krunal, A.; Rabinarayan, A.; Ravishankar, B. and Nariya, M. (2015). Anti-inflammatory activity of wild and cultivated varieties of eranda (*Ricinus communis* Linn.) root, International Journal of Ayurveda and Pharma Research, **2**(4): 231.
- Doshi, K.A.; Acharya, R.; Shukla, V.J.; Kalyani, R. and Khanpara, K. (2013). Phytochemical evaluation of the wild and cultivated varieties of eranda mula (roots of *R. communis* L.). AYU Journal, **34**(2):200-203.
- Elimam, A.M.; Elmalik, K.H. and Ali, F.S. (2009). Larvicidal, adult emergence inhibition and oviposition deterrent effects of foliage extract from *Ricinus communis* L. against *Anopheles arabiensis* and *Culex quinquefasciatus* in sudan. Tropical Biomedicine, **26**:130-139.
- Gacche, R.N.; Dhole, N.A. and Jadhav, A.D. (2010). Free radical scavenging activity, antioxidative ingredients, and possible anti-inflammatory abilities of selected traditional medicinal plants from Ayurveda; Journal of Natural Remedies, **10**(1):64-73.
- Hussain, A.; Aslam, B.; Muhammad, F. and Faisal, M.N. (2021). In vitro antioxidant activity and in vivo anti-inflammatory effect of *Ricinus communis* L. and *Withania somnifera* L. hydroalcoholic extracts in rats; Brazilian Archives of Biology and Technology, **64**(2): e21200783.
- Ilavarasan, R.; Mallika, M. and Venkataraman, S. (2006). Anti-inflammatory and free radical scavenging activity of *Ricinus communis* root extract. J. Ethnopharmacol, **103**(3):478-480.
- Iqbal, J.; Zaib, S.; Farooq, U.; Khan, A.; Bibi, I. and Suleman, S. (2012). Antioxidant, antimicrobial and free radical scavenging potential of aerial parts of *Periploca aphylla* and *Ricinus communis*. ISRN Pharmacology, pp:563267.
- Jena, J. and Gupta, A. (2012). *Ricinus communis* Linn: A phytopharmacological review. International Journal of Pharmacy and Pharmaceutical Sciences; **4**(4):25-29.
- Latif, M.; Krishnasamy, G. and Ilham, A. (2015). Malaysian plants with potential in vitro trypanocidal activity. Ann. Phytomed., **4**(1): 6-16
- Lomash, V.; Parihar, S. K.; Jain, N. K. and Katiyar, A.K. (2010). Effect of *Solanum nigrum* and *Ricinus communis* extracts on histamine and carrageenan-induced inflammation in the chicken skin. Cellular and Molecular Biology, **56**:1239-1251.
- Lombard, S.; Helmy, M.E. and Pieroni, G. (2001). Lipolytic activity of ricin from *Ricinus sanguineus* and *Ricinus communis* on neutral lipids. Biochemical Journal, **358**(3):773-81.
- Manjuparkavi, K.; Sethumathi, P.P.; Lalitha, V.; Senguttuvelu, S.; Prabha, T.; Menaka, M.; Moushmi, A. and Anitha, D. (2022). Assessment of thaalaga parpam: a herbomineral formulation through systematic spectroscopic analysis, acute toxicity testing and in vivo anti-inflammatory activity. Ann. Phytomed., **11**(2):290-295.
- Mazen, T.; Bushra, P.; Bashier, O.; Iman, H.A.; Mona, S.; Wadah, O. and Sayeed, A. (2019). In vitro profiling of plants used in sudanese traditional medicine for antioxidant and anti-breast cancer activities. Ann. Phytomed.; **8**(1):119-126.
- Medhi, B.; Kishore, K.; Singh, U. and Seth, S. D. (2009). Comparative clinical trial of castor oil and diclofenac sodium in patients with osteoarthritis. Phytotherapy Research; **23**(10): 1469–1473.
- Mohammed, N. I. and Albozachri, J. M. K. (2020). Use of iraqi castor (*Ricinus communis*) leaf extract as anti-inflammatory in treatment of skin wounds in rabbits, Medico-Legal Update; **20**(3):642-646.
- Moshiri, M.; Hamid, F. and Etemad, L. (2016). Ricin toxicity: Clinical and molecular aspects. Reports of Biochemistry and Molecular Biology; **4**(2):60-65.
- Natu, M. V.; Agarwal, S.; Agarwal, S. L. and Agarwal, S. (1977). Protective effect of *Ricinus communis* leaves in experimental liver injury. Indian Journal of Pharmacology, **9**(4):265-268.
- Naz, R. and Bano, A. (2012). Antimicrobial potential of *Ricinus communis* leaf extracts in different solvents against pathogenic bacterial and fungal strains. Asian Pac. J. Trop. Biomed., **2**(12):944-947.
- Nemudzivhadi, V. and Masoko, P. (2014). In vitro assessment of cytotoxicity, antioxidant and anti-inflammatory activities of *Ricinus communis* (Euphorbiaceae) leaf extracts. Evidence Based Complementary and Alternative Medicine; pp:625961.
- Nirmal, P.; Koppikar, S.; Bhondave, P.; Narkhede, A.; Nagarkar, B.; Kulkarni, V.; Wagh, N.; Kulkarni, O.; Harsulkar, A. and Jagtap, S. (2013). Influence of six medicinal herbs on collagenase-induced osteoarthritis in rats. American Journal of Chinese Medicine; **41**(6):1407-1425.
- Rana, M.; Dhamija, Hitesh; Prashar, B. and Sharma, S. (2012). *Ricinus communis* L. : A review. International Journal of Pharm Tech Research; **4**: 1706-1711.
- Rana, M.; Kumar, H. and Parashar, B. (2013). In vitro antihelminthic activity of bark of *Ricinus communis* Linn. Journal of Chemical and Pharmaceutical Research, **5**(6):40-42
- Saiyed, M.; Sachdeva, P. and Kukkar, M. (2017). Effectiveness of *Ricinus communis* root extract against dextran sodium sulphate induced ulcerative colitis in rats, International Journal of Green Pharmacy, **11**(2): 84-91.
- Sandhyakumary, K.; Bobby, R.G. and Indira, M. (2003). Antifertility effects of *Ricinus communis* L. on rats. Phytotherapy Research, **17**(5):508-511.

- Sharma, S.; Singh, T. and Vijayvergia, R. (2009). Molluscicidal activity of some medicinal plants. *Journal of Herbal Medicine and Toxicology*, **3**: 155-157.
- Shokeen, P.; Anand, P.; Murali, Y.K. and Tandon, V. (2008). Antidiabetic activity of 50% ethanolic extract of *Ricinus communis* and its purified fractions. *Food and Chemical Toxicology an International Journal Published for the British Industrial Biological Research Association*; **46**(11):3458-3466.
- Singh, P.; Muhammad, A.; Shafi, S.; Marysheela, D.; Kumari, S.; Thirunavukkarasu, V.; Punitha, S. and Mohammad, Khalid. (2022). *In vitro* and *ex vivo* studies to assess the antiurolithiasis activity of phenolic components of *Ricinus communis* L. and *Euphorbia hirta* L. with simultaneous HPTLC analysis. *Ann. Phytomed.*; **11**(1):485-492.
- Singh, V.; Sharma, S.; Dhar, K.L. and Kalia, A.N. (2013). Activity guided isolation of anti-inflammatory compound fraction from root of *Ricinus communis* Linn. *International Journal of Pharm. Tech. Research*, **5**(3):1142-1149.
- Srivastava, P.; Jyotshna; Gupta, N.; Maurya, A.K. and Shanker, K. (2013). New anti-inflammatory triterpene from the root of *Ricinus communis*. *Natural Product Research*, **28**(5):306-311.
- Taur, D.J.; Waghmare, M.G.; Bandal, R.S. and Patil, R.Y. (2011). Antinociceptive activity of *Ricinus communis* L. leaves. *Asian Pacific Journal of Tropical Biomedicine*; **1**(2):139-141.
- Taur, D.J. and Patil, R. (2011). Antihistaminic activity of *Ricinus communis* roots using clonidine induced catalepsy in mice. *Latin American Journal of Pharmacy*, **30**:1226-1228.
- Tripathi, A.C.; Gupta, R. and Saraf, S.K. Phytochemical investigation, characterisation and anticonvulsant activity of *Ricinus communis* seeds in mice. *Natural Product Research*; **25**(19):1881-1884.
- Uscategui, Y.L.; Diaz, L.E.; Gomez-Tejedor, J.A.; Valles-Lluch, A.; Vilarino-Feltrer, G.; Serrano, M.A. and Valero, M.F. (2019). Candidate polyurethanes based on castor oil (*Ricinus communis*), with polycaprolactone diol and chitosan additions, for use in biomedical applications. *Molecules* (Basel, Switzerland); **24**(2):237.
- Valderramas, A.C.; Moura, S.H.P.; Couto, M.; Pasetto, S.; Chierice, G.O.; Guimaraes, S.A.C. and Zurrón, A.C.B. de P. (2008). Anti-inflammatory activity of *Ricinus communis* derived polymer, *Brazilian Journal of Oral Sciences*, **7**(27):1666-1672.
- Vieira, C.; Fetzer, S.; Sauer, S. K.; Evangelista, S.; Averbeck, B.; Kress, M.; Reeh P.W.; Cirillo, R.; Lippi, A.; Maggi, C. A. and Manzini, S. (2001). Pro and anti-inflammatory actions of ricinoleic acid similarities and differences with capsaicin. *Naunyn-Schmiedeberg's Archives of Pharmacology*; **364**(2):87-95.
- Visen, Pradeep; Shukla, B.; Patnaik, G.; Tripathi, S.; Kulshreshtha, D.; Srimal, R. and Dhawan B. Nath. (2008). Hepatoprotective activity of *Ricinus communis* leaves. *International Journal of Pharmacognosy*, **30**: 241-250.
- Ziaei, A.; Sahranavard, S.; Gharagozlou, M.J. and Faizi, M. (2016). Preliminary investigation of the effects of topical mixture of *Lawsonia inermis* L. and *Ricinus communis* L. leaves extract in treatment of osteoarthritis using MIA model in rats. *Daru: Journal of Faculty of Pharmacy, Tehran University of Medical Sciences*, **24**(1):12.

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