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(REVIEW ARTICLE)

A comprehensive review on *Ricinus communis* and its therapeutic utilization as medicinal herb

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Abstract

Medicinal herbs possess a significant function in promoting human wellness, with herbal drugs flourishing tremendously over the past several centuries due to their continuous growth in developed as well as developing nations owing to its natural source and reduced consequences. *Ricinus communis*, often referred to as the castor oil plant or castor bean, is an herbaceous plant in the Euphorbiaceae family, possessing medicinal properties to address a wide range of health issues. This wide family comprises about 7,500 species and 300 genera, most of which are lowering plants. The castor plant offers traditional and therapeutic health benefits and its parts such as leaves, bark, seeds, flowers, and oil are valued for medicinal purposes. Castor oil, derived from the plant's seeds, finds application in Ayurvedic, homeopathic, unani, and allopathic medicine systems primarily as a laxative. Moreover, it exhibits a diverse range of medicinal properties including antimicrobial, pain-relieving, antioxidant, antihistamine, anti-inflammatory, and many others. These effects are attributed to its rich phytoconstituents such as alkaloids, flavonoids, saponins, steroids and glycosides. The current research seeks to assess the distinctive pharmacological properties of *Ricinus communis*, its possible applications in herbal medicine, and its assessment for safety and efficacy.

Keywords: Herbal drugs; Unani; *Ricinus communis*; Pharmacological; Phytoconstituents

1. Introduction

Without nature, civilization is futile, as plant species provide basic indispensable factors such as, food, clothing and shelter among human survival. Since ages, plant-based medicines have served as a sole source for therapeutics. Plant molecules are being employed as preventative and curative medicinal remedies from prehistoric period, as evidenced by practices like Ayurveda, Homoeopathy, Siddha, Unani and various other reforms emphasizing their affordability and accessibility (Chouhan et al., 2021). Globally, approximately 88% of individuals rely on herbal remedies as their first line of treatment to maintain good health and combat certain illnesses. The global herbal market has experienced significant growth, with estimates ranging from 63.05 billion US dollars in 2014 to 71.9 billion US dollars in 2016 (Choudhury et al., 2020). Additionally, herbal components are often considered safer and more efficient in comparison to conventional synthetic analogs. However, it might not always be able to entirely eradicate all detrimental impacts (Kim et al., 2021). The hunt for novel and potent antimicrobial agents based on natural compounds is becoming increasingly crucial owing to the growing inefficiency of chemotherapeutic drugs along with the emergence of microbial resistance. Plant-derived medications have become increasingly significant due to their potential effectiveness and minimal adverse effects. A wide range of beneficial plant secondary metabolites, notably polysaccharides, glycosides, alkaloids, tannins, terpenoids, terpenes, flavonoids, coumarins, gum, and phenols, remain abundant in plants, serving as biological defenses towards diverse microorganisms, herbivores and insect species (Devi et al., 2020).

Plant medications possess characteristics making them more biocompatible to human beings over current pharmaceutical remedies. Therefore, there exists a crucial necessity to fully utilize the benefits of botanical medicines

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into the conventional healthcare system especially for ensuring an adequate healthcare assistance to residents to rural areas. *Ricinus communis*, often called the "castor plant" belongs to Euphorbiaceae, family also referred to as the "palm of Christ," jada in Oriya, verenda in Bengali, endi in Hindi, errandi in Marathi, and diveli in Guajarati, is one of several natural crude drugs traditionally utilized for the management of a wide range of illnesses and disorders. In tropical climes, the plant is often cultivated as an ornamental species (Jena et al., 2012). This review article primarily focuses on exploring the pharmacological activity in plant due to its bioactive chemicals, along with its potential in targeting different microorganisms, infectious illnesses, and disorders.

2. Morphology

Ricinus communis, a perennial herb, featuring soft wood achieving an average height of 1- 5m. The species is recognized for developing lateral roots along with robust tap roots. Chouhan et al. (2021) reported that, the leaves of the shrub appear spirally organized greenish colored turning dark green with age (Chouhanet al., 2021). In deciduous plants, leaf blades are typically 1-3cm in length connecting at their tips onto an enveloping bud. Regardless of its soft woods and explosive growth, the perennial ricinus plant may exceed six feet in height resembling a little tree. The species is cultivated not only for oil production, but also for the vibrant colors of its leaves and blooms. The plant leaves possess shades of green or brown and ranging from 30 to 60 centimeters in diameter, producing a spiky three-celled capsule as its fruit. Fruit capsules develop soft spins resembling processes prior to differentiating into three cocci with two openings. The seeds themselves vary greatly in size and color, possessing an oval structure, measuring 8–18 mm in length and 4–12mm in breadth, appearing somewhat compressed. Their testa appears to be quite smooth, yet thin and fragile. The seeds also exhibit a warty extension termed as caruncle, which typically extends from one corner to the other (Trease and Evans, 2002).

3. Habitat

The plant is extensively distributed across Asia, the tropical and subtropical regions of the Americas, and temperate Europe, although it is believed to originate from northeast Africa. Ricinus is cultivated extensively for castor oil production throughout Indian forests, where it is more prevalent. There are two primary varieties of Ricinus: one is a bushy perennial shrub featuring enormous red seeds and large sized fruits yielding nearly 40% oil from the seeds; the other is a shorter annual shrub with grey-white seeds marked by brown traces, which yields approximately 37% of castor oil. In India, this plant is widely grown, especially in the states of Bengal, Bombay and Madras. In the forests of this country, it grows quite organically (Rana et al., 2012).

4. Phytochemical constituents

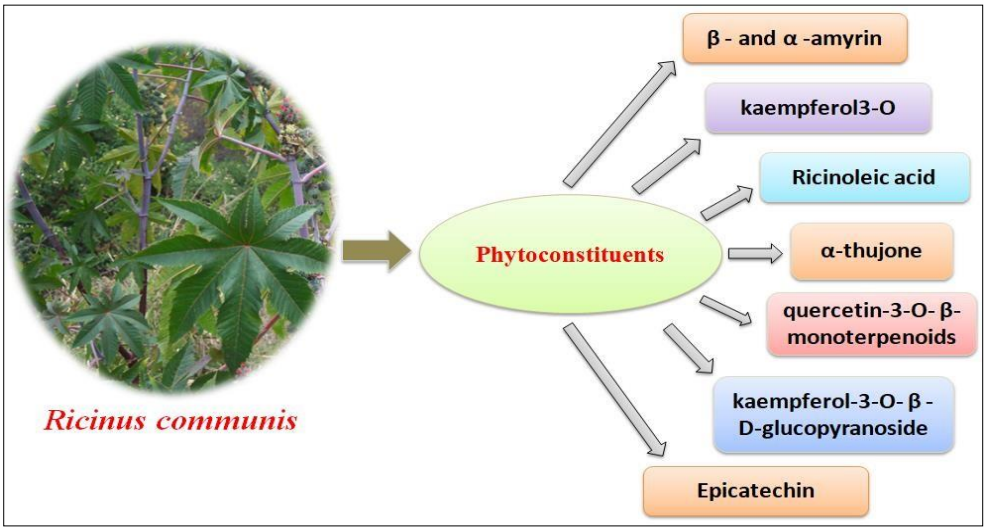

Figure 1 Phytoconstituents present in *Ricinus communis*

The curative property of plant is attributed to its phytochemical components, including saponins, alkaloids, flavonoids, steroids glycosides etc. Laureano Filho et al. (2009) utilized dried castor leaves to conduct capillary electrophoresis with amperometric detection to quantify disaccharide glycoside compounds such as rutin, quercetin, gentistic acid and

gallic acid (Laureano Filho et al., 2009). Also, castor leaves exhibits significant amounts of different phenolic chemicals, including monoterpenoids (1, 8-cineole), camphor, α-sesquiterpenoid (β-caryophyllene), gentilic acid, epicatechin, and ellagic acid (Jena and Gupta, 2012; Thompson and Bowers, 1968). Extracts from ricinus roots confirmed the existence of Indole-3-acetic, along with several esters including stearic, ricinoleic, palmitic, arachidic-hexadecenoic, oleic, linoleic, and dihydroxy stearic acids. Moreover, α-thujone has been preliminarily identified within the plant's beans along with three toxic proteins, *i.e.,* (ricin A, B, and C) and one ricinus agglutinin. The pericarp of castor fruits has the alkaloid compound ricine. A cell-free extract from castor seedlings yields a mixture of diterpene hydrocarbon molecules: ent-trachylobane, ent-kaurene, ent-beyerene, ent-sandaracopimaradiene, and casbene (Rana et al., 2012). Various other phytochemicals responsible for palnt's bioactive potential are kaempferol3-O and kaempferol-3-O- β -D-glucopyranoside, triterpenoids (lupeol, β - and α -amyrin), ingenol, α-thujone and β-thujone, epicatechin, linoleic and ricinoleic acid, kaempferol-3-O- β -D- glucopyranoside and quercetin-3-O- β-monoterpenoids (Jeyam et al., 2014; Abdul et al., 2018).

5. Ethanobotanical uses

R. communis exhibits a wide range of utilizes, encompassing the stem, flowers, fruit, bark, roots, and seeds, amongst other elements of the plant (Scarpa and Guerci, 1982). The leaves comprise five to twelve palmate, heavily lobed segmental overlaping with sharp edges. Numerous findings demonstrated successful repelling action of powdered leaves against various species of mosquitoes, whiteflies aphids, and rust mites (Abdul et al., 2018). Lubrication, catharsis and illumination constitute typical uses for castor oil. Castor oil has wide applications in industries of all kinds, either in unchanged or modified. Generally commercial oil endures numerous processing steps prior to being put to use for different purposes. The synthetically altered oil has been employed in a broad range of products, involving cosmetics and insecticidal Formulations, various paints, greases, enamels, oiled fabrics, special lubricants, polishes and waxes, cutting, dielectric, and condenser oils, linoleum, nitrocellulose-baking coatings, varnishes, patent leather, fly paper, typewriting and printing inks, and urethane foams and rubber substitutes. Perennial oil can be utilized to provide illumination and lubrication, whereas annual oil is beneficial in therapeutic purposes. Whenever a pregnant woman reaches full term, castor oil is typically administered orally, both individually or coupled via quinine sulfate.

The intravenous administration of pharmacological hormonal pharmaceuticals, such steroids, often involves utilization of oil. The oil from castor beans serves a role in the manufacture of liquid disinfectants such as phenyls. Since ancient times, castor oil has been a fundamental component of Indian lamps owing to its potent illuminant properties. It can be utilized during the soap-making process. The oil of castor is a potent and efficient purgative offering numerous benefits, especially for infants, babies and young toddlers, including the ability to cure puerperal ailments, infections harming the gastrointestinal system or genito-urinary functioning, and more. It is recognized as one of the safest, least hazardous and most efficient cleansers in getting rid from congestion or persistent constipation. Traditionally, women were advised for direct application of castor leaves onto their breasts as a poultice or decoction in order to increase milk production. Furthermore, there have been observations regarding lactagogue and emmenagogue effects associated with the Ricinus extract administered internally.

Castor cake is another form of plant-based fertilizer widely utilized in India. Due to its significant mineral and nitrogen contents, it is believed to be effective manure for tobacco, sugarcane, paddy, and various other crops. In various parts of India livestock are typically fed with plant leaves (Abdul et al., 2018). Powdered leaves have a repellant effect on rust mites, mosquitoes, aphids, and white flies, most primarily a consequence of the alkaloid component ricinine. In the United States, the brand "Spra Kast" is utilized for promoting herbal infusions derived from leaves and other plant parts.

According to Vandita (2013), alkaline and aqueous leaves extracts possess antibacterial and antifungal efficiency (Vandita, 2013). For treating wounds, boils, swellings, etc., leaves are believed to be employed as a poultice or fomentation agent. A warm, oil-coated leaf application on to the abdomen could benefit youngsters suffering from flatulent. Plant Leaf infusions have applications as stomachache and eye lotions medications. In order to minimize tooth decay and eradicate guinea worms, crushed leaves have been applied to the lesions. Fresh and young leaf juice is supposedly recommended as an emetic for overdoses of opium and as a remedy for jaundice. Root bark is believed to possess powerful, remarkable detoxifying properties. According to certain clinical experiments and initial plant examination studies performed at the Forest Research Institute, Dehradun, unbarked stems of annual and perennial castor varieties are employed in generating easily bleached chemically processed pulp with suitable characteristics for making writing paper, wrapping, printing and newsprint paper. On treatment with lime, castor stems can also be converted to make straw boards. Plant's dried branches and stems have applications as wattle in mud house walls along with itching treatments. Combination of seed hulls and dried stems can result in the development of an extremely flammable fuel (Rana and Dhamija, 2012).

6. Medicinal properties

R. communis provides conventional and therapeutic benefits for upholding a healthy and perfect lifestyle. It appears that every component of castor, including the leaves, bark, seeds, flowers and oil, plays a vital role in plant's effectiveness. Together with these characteristics, it additionally possesses immune-modulatory, antidiabetic properties, liver protective, antifertility, antibacterial, anti-inflammatory, lipolytic, wound-healing, insect repellent, and larvicidal activities as depicted in (Figure 2) (Table 1).

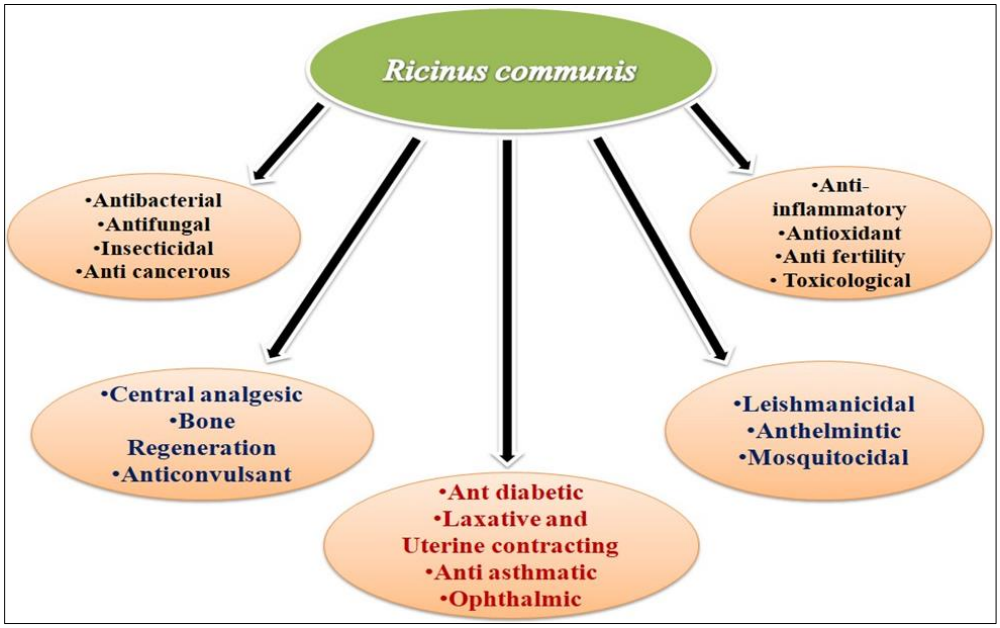

Figure2 Medicinal potential associated with *Ricinus communis* plant

R. communis is employed in managing various illnesses such as, diarrhea, burning, cattle mastitis, blackleg, itching, skin rashes, wounds, dermatitis, and actinomycosis, rashes, swelling etc.

Table 1 Overview of therapeutic efficacy associated to Castor plant

S. No.	Plant part	Name of extract/ Phytocompound	Pharmaceutical efficacy	Reference
1.	Castor bean	Essential oil/castor oil (Ricinoleic acid)	Uterine contractions and laxation by activating prostaglandin receptors 2.	Tunaru *et al.*, 2012
2.	Leaves	Methanolic and Hydroalcoholic extract	Antibacterial efficacy against pathogenic microorganisms	Neha *et al.*, 2024
3.	Roots, leaves and stems	Aqueous and methanolic	Antifungal activity against *Aspergillus fumigates, Aspergillus niger*, *Aspergillus flavus.*	Abdul *et al.*, 2018
4.	Roots	Methanol (Flavonoid)	Minimizes burning, rashes, swelling and itching associated to inflammation.	Chouhan *et al.*, 2021
6.	Stems	Flavanoids (catechin and ellagic acid)	Antioxidant efficacy in preventing tumour proliferation by promoting oxidative stress resulting in ROS.	Vasco-Leal *et al.*, 2021
7.	Whole plant	Ricinlectins	Anticancerous activity against three cancerous cell lines: Sarcoma180, HeLa cells, and human erythrocytes.	Dwivedi and Sharma, 2022

6.1. Antibacterial and Antifungal efficacy

Antibiotic resistance is increasingly prevalent, leading to a surge in illnesses frequency among individuals suffering due to clinical bacterial isolates along with an increasing demand for efficient therapeutic alternative medications in combination to threshold lethal phenomenon. Antibiotic action against a wide range of microbial isolates is believed to be displayed by *R. communis* along with its potent phytocompounds. According to Abew et al. (2014), the basic extract possesses the ability to suppress a broad range of microbes, particularly methicillin- resistant *Enterococcus faecalis*, *Escherichia coli*, *Staphylococcus aureus*, and *Streptococcus mutans* (Abew et al., 2014).

According to Abd-Ulgadir et al. (2015), methanolic extract demonstrated highest efficacy against *Escherichia coli* along with least effectiveness against *Bacillus subtilis* in one investigation. A study conducted by Naz and Bano, (2012) investigated the antibacterial potential of castor's aqueous extract demonstrating highest potential against *Staphylococcus aureus* and least activity against *Klebsiella pneumoniae* (Naz and Bano, 2012). Castor plant demonstrated highest effectiveness against infectious microorganisms in a standardized clinical experiment serving as a full cleaner. Sodium ricinoleate, a component of *R. communis* oil, breaks down microbial cell membranes leading to cell death via apoptosis resulting in cytoplasmic component loss, thereby preventing biofilm formation. *R. communis* could function potentially as a source of antibiotics that could fight several kinds of bacterial illnesses, in accordance with previous research investigations.

Several parts, particularly its roots, leaves and stems, of *R. communis* displays significant antifungal characteristics. Both aqueous and methanolic extracts exhibits substantial efficacy towards a broad spectrum of fungal species. In order to assess the antifungal efficacy of castor bean plant against different fungal pathogens, most significant responses were discovered against *Candida albicans*, exhibiting least activity towards *Alternaria solani* (Abdul et al., 2018). According to an exclusive research, methanolic extract substantially inhibits the growth of both *Aspergillus fumigatus* and *Aspergillus niger*, appearing more ineffective against *Aspergillus flavus* (Abd-Ulgadir et al., 2015; Abdul et al., 2018).

6.2. Antioxidant efficacy

Antioxidant effectiveness in ricinus greatly depends on both extraction procedure and botanical component. In comparison to other plant parts, leaves and seeds possess higher antioxidant levels. Among acetone, n-hexane, methanol, and dichloromethane extracts, methanolic extract exhibited strongest free radical scavenging capabilities of around 95%, following that, the acetone extract showed 91%, dichloromethane exhibited 62%, and n-hexane demonstrated 50% effectiveness (Abbas et al., 2018). Flavonoids are one of the common phytoconstituents possessed by stems of castor bean plant. Flavanoids contribute in preventing tumor proliferation by promoting oxidative stress resulting in ROS (Reactive oxygen species) production. According to an untargeted metabolomic profile, high levels of plant compounds such as catechin and ellagic acid, are associated with antioxidant mechanism. This is also evidenced by the profile of polyphenols (Singh et al., 2010; Vasco-Leal et al., 2021).

6.3. Anti-inflammatory efficacy

Inflammation triggered by pharmaceutical response or damage has to be carefully controlled with the goal of preventing the proliferation of infectious pathogenic infestations. Severe bacterial infection triggered by inflammatory responses at the affected site might end with gangrene. Castor roots primarily demonstrated strong anti-inflammatory capabilities. The efficacy of Ricinus in reducing inflammation has been assessed utilizing a variety of divisions like hexane, acetone, methanol and ethanol based extracts. In recognition of the plant's significant flavonoid content, the methanolic extract demonstrated considerable anti-inflammatory capabilities. Further investigations focusing on the castor bean plant revealed the crucial function of ricinoleinn defining its anti-inflammatory benefits upon an innovative approach. This is frequently employed for managing inflammation compared to different anti-inflammatory medications due to its affordability. Research investigations demonstrate faster therapeutic impact on inflammation over any other medication (Chouhan et al., 2021).

6.4. Leishmanicidial efficacy

Ricinus communis preparations exhibited significant antileishmanial potency in managing leishmaniasis. *Ricinus communis* and *Azadirachta indica* extract combination performs synergistically against *leishmania* parasite. The antiparasitic effectiveness of *Ricinus communis* and *A. indica* is measured at 59.5% and 72%, respectively, with a total efficacy of 88%. A consortium preparation from both extracts holds the potential for being utilized in bioactive component separation, fortification, and bioassay-guided fractionation, possibly resulting in novel pharmacological molecules (Jumba et al., 2015).

6.5. Mosquitocidal efficacy

Several mosquito larvae appeared susceptible towards the larvicidal impacts of *R. communis*. Multiple mosquito species, notably *Anopheles albopictus*, *Anopheles stephens*, *Anopheles gambiae*, and *Culex quinquefasciatus*, were subject of studies with virtually 100% fatality rate.

Ricinus seed extract exhibits different levels of lethal concentration across various larval species *Culex quinquefasciatus* (7.10 µg/mL)>*Anopheles stephensi* (11.64 µg/mL)>*Anopheles albopictus* (16.84 µg/mL) (Wachira, 2014; Mandal, 2010). Deadly protozoan parasite associated with malarial transmission among humans by the bites of particular Anopheles mosquitoes. Over the past 20 years, there has been an enormous increase in research, currently malaria continues a global disease claiming thousands of lives annually. In 2012, according to WHO global estimate data there were around 2.7 million recorded instances of malaria and 627000 projected deaths (WHO, 2012; Abdul et al., 2018).

Plasmodium falciparum is recognized to be resistant to a wide range of antimalarial drugs. The most efficient strain of *R. communis* has been demonstrated to be resistant to the malaria vector *Anopheles gambiae*. *R. communis* preparations can affect Anopheles gambiae larvae in both the male and female stages. The occurrence of two substances, i.e., ricinine and 3-carboxy-4-methoxy-N- methyl-2-pyridone, was believed to be the root cause of this activity (Wachira, 2014). It came to light that once larvae were subjected to more extracts, its larvicidal activity enhanced tremendously. The highest possible mortality was originally seen in preparations derived from *R. communis*, at a lethal concentration 50 (LC50) of 0.18 mg/mL (Abdul et al., 2018). Moreover, it was found that Ricinus extract functioned well on *Culex quinquefasciatus* and *Anopheles arabiensis* (Elimam et al., 2009).

6.6. Anthelmintic efficacy

Helminthiasis, being the most prevalent worm illness globally, is the resultant of poor management strategies. By utilizing plant based extracts, anthelmintic action of *Ricinus communis* leaves were observed. Three different concentrations (50, 75, and 100 mg/ml) of methanol, aqueous, ethanol, ethyl acetate and chloroform extracts from castor leaves were tested on *Pheretima posthuma* in an attempt to generate a cost-effective anthelmintic pharmaceutical medication. Every plant extract demonstrated a notable worm mortality rate. Upon increasing concentration, it became apparent that mortality and paralysis in worms increased dramatically. At higher concentrations (100 mg/ml), methanolic, aqueous, and ethanolic extracts have found to be potent and taking shortest time to kill and paralyze worms (Mahadev and vitthal, 2017).

6.7. Anticancerous efficacy

Studies involving fractions with 100% ethanolic, methanolic and an aqueous phase have demonstrated activity against specific cancerous cell lines, including melanoma, cervical cancer HepG2 (Hepatic cancer), PC3 (Pancreatic cancer), and MCF7 (Breast cancer) (Prakash and Gupta, 2014). Experimental studies conducted both *in vitro* and *in vivo* has validated the anti-cancerous potential of *R. communis* utilizing different plant parts and ricin lectins (Ravishankar et al., 2022; Saha et al., 2016).

Multiple researchers indicated the anti-cancerous properties of *R. communis* were studied and reported by several researchers and initial studies revealed that the cytotoxic effect of lectins on three different cell lines such as, heLa cells, human erythrocytes and sarcoma 180. Lin and Liu, noted the increase in the lifespan of the mice treated with ricin A. In one experiment, the aqueous extract demonstrated cytotoxic effects on A375 human melanoma cancer cell lines with an IC50 value of 48 µg/mL (Shah et al., 2015). Some other, *in vitro* research was carried out to test the cytotoxic impact of *R. communis* on various cell lines, including colon, prostate, cervix, breast, liver, ovarian (OVCAR-5) and skin melanoma (B16F10) cell lines. At lower concentrations around 100 µg/mL, *R. communis* extract showed efficacy against all these cancer cell lines and was shown to be effective (Prakash and Gupta, 2014). The anti-cancer properties of *R. communis*, as revealed by several investigations, clearly suggest that *R. communis* is a potential source of anti-cancerous therapeutic agents.

6.8. Bone regeneration efficacy

Ricinus communis polyurethane (RCP) is currently being investigated for its biological compatibility and ability in boosting bone regeneration. Studies suggests that when Ricinus extract in combination with calcium phosphate or calcium carbonate, triggers matrix mineralization and biological compatibility. Incorporating alkaline phosphatase into RCP and further culturing it in synthetic bodily fluids could increase its biological characteristics (Darmanin et al., 2009). The key benefit of RCP over demineralized bones depicts that, it has a slower reabsorption rate (Beloti et al., 2008).

6.9. Toxicological efficacy

Research is being conducted to investigate the pharmacological and toxicological aspects of *Ricinus communis* plant extracts. Castor leaves possess a broad spectrum of biologically active compounds known to be efficient in any therapeutic plant, like tannins, steroids, flavonoids, saponins, terpenoids, cardiac glycosides, and phlorotannis. When castor leaves were evaluated in rodent models with doses between 100 to 200 mg/kg body weight, revealed that the methanol extract proved safer substitutes causing no harm to the vital organs. In conclusion, the plant leaves proved safer alternative for consumption, when consumed in moderation, likewise possessed antibacterial characteristics. Unlike leaves or other plant material, seeds are extremely poisonous whenever swallowed or ingested. Alkaloid phytotoxin such as Ricin, a Type-II ribosome-inactivating substance, has been reported in *Ricinus communis* seeds (Bhaskaran et al., 2014; Lopez Nunez et al., 2017; Chouhan et al., 2021).

6.10. Anti-diabetic efficacy

Diabetes refers to be a long term chronic condition occuring when the pancreas fails to produce enough insulin for the body or when there is a development of insulin resistance. The number of individuals with diabetes has risen significantly from 108 million to 422 million cases in 2014. In 2012, WHO reported that diabetes was the sole cause for 1.5 million deaths. A study examined the antidiabetic activity of ethanolic castor root extract and found it very effective against hypoglycemic rats. After treating alloxan diabetic rats with a single dose of 500 mg/kg body weight for 20 days, lipid profile was observed by collecting blood on day 0, 10 and day 20 of the experiment. This study demonstrated a significant reduction in fasting blood sugar levels, approaching normal levels, and an increase in insulin levels, thereby causing improvement in lipid profile and body weight as well. The blood glucose levels decreased from (379±72) mg/dL in Diabetic rats to (149±11) mg/dL in control group. Another in vivo study, involving alloxan-induced diabetic rats also found a 61.97% reduction in blood glucose levels over seven days of Ricinus extract treatment, dropping from 390.0 to 148.5 mg/dL (Matthew et al., 2012). These studies indicate the potential of *R. communis* as a therapeutic agent for diabetic control.

7. Discussion

The castor bean, or *Ricinus communis* is renowned for its highly efficient therapeutic properties and its utilization in curing a huge range of ailments. A diverse array of compounds including flavonoids, Saponins, alkaloids, steroids, and glucosides constitute major botanical compounds contributing to its therapeutic potential (Neha et al., 2024). Pharmacological capabilities of herbal plants comprises its anti-inflammatory, antioxidant, antimicrobial, analgesic, anticancerous, anti-diabetic, anti-asthmatic, antipyretic, and antibacterial properties (Sotelo- Leyva et al., 2020; Bhaskaran et al., 2014). A promising approach in curing breast carcinoma involves utilizing extracts from castor fruits. Castor leaves contain flavonoids, cardiac glycosides, tannins, saponins, steroids, phlorotannis, and terpenoids, and all constitute a rich assortment of bioactive elements (Vasco-Leal et al., 2021; Sogan et al., 2018). Many scientists have examined *Ricinus communis* leaves potential for antihelmintic, anticonvulsant, and analgesic effects. Castor's stem, leaf, and seed extracts demonstrated significant lethality against larvicidal and mosquitocidal activities. Moreover, solutions obtained from castor roots demonstrated antiasthamatic, anti-inflammatory, and free radical scavenging activities (Taur and Patil, 2011; Srivastava et al., 2014).

8. Conclusion

R. communis is a native plant of India with notable therapeutic efficacy. The curative potential of castor plant has been highlighted in the current review, showcasing its pharmacological significance and its significant potential impact on different cancerous cells, inhibiting growth of various pathogens, and offering other medicinal benefits. In regards to this, the medicinal efficacy of *Ricinus communis* supports its traditional utilization as as a potent medicinal herb and contributing to the development of sustainable synthetic drugs. Based on the above literature, chemical compounds such as Ricin A, B and C have antitumorous effects, while alkaloids like ricinine and glycoside may have utilization in various herbal formulation as anti-inflammatory, analgesic, antipyretic, cardiac tonic and antiasthamatic agents. It can be concluded that, the disease prevention and recurring characteristic of the *Ricinus communis* made it highly noticeable providing many alternative solutions in medical fields. It also extends its impact to various sectors such as agriculture, pharmacy, and economics, by addressing several health issues that can be treated with the plant. Its promising capabilities pave the way for a positive future in the medical world and provide opportunities for further research to discover novel compounds effective against life-threatening diseases. However, castor plant seeds pose significant risks to humans and animals due to their toxic nature, causing symptoms such as fever and central nervous system depression. Despite this, the rest of the plant and its elements offer many benefits. Therefore, *R. communis*, or the castor

bean plant, is an essential indigenous medicinal herb that warrants further investigation to maximize its medicinal potential.

Compliance with ethical standards

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No conflict of interest to be disclosed.

References

[1] Abbas, M., Ali, A., Arshad, M., Atta, A., Mehmood, Z., Tahir, I.M. and Iqbal, M. (2018). Mutagenicity, cytotoxic and antioxidant activities of *Ricinus communis* different parts. *Chemistry Central Journal*, 12(1): 1-9.

[2] Abdul, W.M., Hajrah, N.H., Sabir, J.S., Al-Garni, S.M., Sabir, M.J., Kabli, S.A., Saini, K.S. and Bora, R.S. (2018). Therapeutic role of *Ricinus communis* L. and its bioactive compounds in disease prevention and treatment. *Asian Pacific Journal of Tropical Medicine*, 11(3): 177-185.

[3] Abd-Ulgadir, K.S., Suliman, S.I., Zakria, I.A. and Hassan, N.E.A. (2015). Antimicrobial potential of methanolic extracts *Hibiscus sabdariffa* and *Ricinus communis*. *Advancement in Medicinal Plant Research*, 3: 18-22.

[4] Abew, B., Sahile, S. and Moges, F. (2014). *In vitro* antibacterial activity of leaf extracts of *Zehneriascabra* and *Ricinus communis* against *Escherichia coli* and methicillin resistance *Staphylococcus aureus*. *Asian pacific journal of tropical biomedicine*, 4(10): 816-820.

[5] Beloti, M.M., de Oliveira, P.T., Tagliani, M.M. and Rosa, A.L. (2008). Bone cell responses to the composite of *Ricinus communis* polyurethane and alkaline phosphatase. *Journal of Biomedical Materials Research Part A*, 84(2): 435-441.

[6] Bhaskaran, M., Didier, P.J., Sivasubramani, S.K., Doyle, L.A., Holley, J. and Roy, C.J. (2014). Pathology of lethal and sublethal doses of aerosolized ricin in *Rhesus macaques*. *Toxicologic Pathology*, 42(3): 573-81

[7] Choudhury, P.R., Talukdar, A.D., Nath, D., Saha, P. and Nath, R. (2020). Traditional folk medicine and drug discovery: prospects and outcome. *Advances in Pharmaceutical Biotechnology: Recent Progress and Future Applications*,3-13.

[8] Chouhan, H.S., Swarnakar, G. and Jogpal, B. (2021). Medicinal properties of *Ricinus communis*: A review. *International Journal of Pharmaceutical Sciences and Research*, 12(7): 3632-3642.

[9] Darmanin, S., Wismayer, P.S., CamilleriPodesta, M.T., Micallef, M.J. and Buhagiar, J.A. (2009). An extract from *Ricinus communis* L. leaves possesses cytotoxic properties and induces apoptosis in SK-MEL-28 human melanoma cells. *Natural product research*, 23(6): 561-71.

[10] Devi, M., Devi, S., Sharma, V., Rana, N., Bhatia, R.K. and Bhatt, A.K. (2020). Green synthesisof silver nanoparticles using methanolic fruit extract of *Aeglemarmelos* and their antimicrobialpotentialagainsthumanbacterialpathogens. *Journaloftraditionalandcomplementarymedicine*,10(2):158-165.

[11] Dnyaneshwar, J. and Patil, R.Y. (2011). Antihistaminic Activity of *Ricinus communis* Roots Using Clonidine Induced Catalepsy in Mice. *Latin American Journal of Pharmacy*, 30(6): 1226-1228.

[12] Dwivedi, N.N. and Sharma, R.A. (2022).Beneficial Action of *Ricinus communis*. *International Journal of Research and Review*, 9(9): 159-168.

[13] 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 *Culexquinquefasciatus* in Sudan. *Tropical Biomedicine*, 26(2): 130-139.

[14] Evans, W.C. (2002). Trease and Evans Pharmacognosy. Saunders Publishers, an imprint of Elsevier Science Ltd; 15th (ed.) 42-44.

[15] Jena, J. and Gupta, A. (2012). *Ricinus communis* Linn: A phytopharmacological review. *International Journal of Pharmacy and Pharmaceutical Sciences*, 4(4): 25-29.

[16] Jeyam, M., Arangaraj, M., Ravikumar, P. and Shalini, G. (2014). Computational analysis of phytocompounds with 1,3-β -D-glucan synthase for antidermatophytic activity. *Journal of Applied Pharmaceutical Science*, 4(2): 064-069.

[17] Jumba, B.N., Anjili, C.O., Makwali, J., Ingonga, J., Nyamao, R., Marango, S., Choge, J.K. and Khayeka-Wandabwa, C. (2015). Evaluation of leishmanicidal activity and cytotoxicity of *Ricinuscommunis* and *Azadirachtaindica*extracts from western Kenya: *in-vitro* and *in-vivo* assays. *BMC Research Notes*, 8(1): 1-11.

[18] Kim, M., Woo, Y. and Han, C. (2021). Current status of the spontaneous reporting and classification/coding system for herbal and traditional medicine in pharmacovigilance. *Integrative Medicine Research*, 10(1): 1-6.

[19] Laureano Filho, J.R., Andrade, E.S., Alberqaria- Barbosa, J.R., Camargo, I.B. and Garcia, R.R. (2009). Effects of demineralized bone matrix and a *'Ricinus communis'* polymer on bone regeneration: a histological study in rabbit calvaria. *Journal of Oral Science*, 51(3): 451-456.

[20] Lopez Nunez, O.F., Pizon, A.F. and Tamama, K. (2017). Ricin poisoning after oral ingestion of castor beans: a case report and review of the literature and laboratory testing. *The Journal of Emergency Medicine*, 53(5): 67-71.

[21] Mahadev, N.D. and Vitthal, B.P. (2017). An evaluation of anthelmintic activity of *Ricinus communis* Linn. leaves by using different type of solvent. *Journal of Pharmacognosy and Phytochemistry*, 6(4): 1845-47.

[22] Mandal, S. (2010). Exploration of larvicidal and adult emergence inhibition activities of *Ricinus communis* seed extract against three potential mosquito vectors in Kolkata, India. *Asian Pacific Journal of Tropical Medicine*, 3(8): 605-609

[23] Matthew, O.O., Olusola, L. and Matthew, O.A. (2012). Preliminary study of hypoglycaemic and hypolipidemic activity of aqueous root extract of *Ricinus communis* in alloxan-induced diabetic rats. *Journal of Physiology and Pharmacology Advances*, 2(10): 354-359.

[24] Naz, R. and Bano, A. (2012). Antimicrobial potential of *Ricinus communis* leaf extracts in different solvents against pathogenic bacterial and fungal strains. *Asian Pacific Journal of Tropical Biomedicine*, 2(12): 944-947.

[25] Neha, Chauhan, S. and Devi, S. (2024). Qualitative Phytochemicals Analysis and *In vitro* Antibacterial Efficacy of Methanolic and Hydroalcoholic *Ricinus communis* L. Leaves Extracts. *Acta Scientific Microbiology*, 7(3): 101-106.

[26] Prakash, E. and Gupta, D.K. (2014). *In vitro* study of extracts of *Ricinus communis* Linn on human cancer cell lines. *Journal of Medical Sciences and Public Health*; 2(1), 15- 20.

[27] Ramanjaneyulu, A.V., Anudradha, G., Raman, M.V., Vishnu, A., Reddy, V. and Gopal, N.M. (2017). Multifarious uses of castor (*Ricinus communis* L.) International Journal of Economic Plants, 4(4): 170-76.

[28] Rana, M. and Dhamija, M. (2012). *Ricinus communis* L. – A Review. *International Journal of PharmTech Research*, 4(4): 1706-1711.

[29] Rana, M., Dhamija, H., Prashar, B. and Sharma, S. (2012). *Ricinus communis* L.—a review. *International Journal of PharmTech Research*, 4(4): 1706-1711.

[30] Saha, S., Ghosh, M. and Dutta, S.K. (2016). Role of metabolic modulator Bet-CA in altering mitochondrial hyperpolarization to suppress cancer associated angiogenesis and metastasis.*Scientific reports*, 6 (1): e23552.

[31] Sandford, E.C., Muntz, A. and Craig, J.P. (2021). Therapeutic potential of castor oil in managing blepharitis, meibomian gland dysfunction and dry eye. *Clinical and Experimental Optometry*, 104(3): 315-22.

[32] Scarpa, A. and Guerci, A. (1982). Various uses of the castor oil plant (*Ricinus communis* L.) a review. *Journal of ethnopharmacology*, 5(2): 117-137.

[33] Shah, T.I., Sharma, E. and Shah, G.A. (2015). Inhibitory property of aqueous extract of *Ricinus communis* leaves on proliferation of melanoma treated against A375 cell lines. *World Journal of Pharmaceutical Sciences*, 3(4): 758-761.

[34] Singh, R.K., Gupta, M.K., Katiyar, D., Srivastava, A. and Singh, P. (2010). *In-vitro* antioxidant activity of the successive extracts of *Ricinus communis* stems. *International Journal of Pharmaceutical Sciences and Research*, 1(8): 100-03.

[35] Sogan, N., Kapoor, N., Singh, H., Kala, S., Nayak, A. and Nagpal, B.N. (2018). Larvicidal activity of *Ricinus communis* extract against mosquitoes. Journal of vector borne diseases, 55(4): 282-290.

[36] Sotelo-Leyva, C., Salinas-Sánchez, D.O., Peña-Chora, G., Trejo-Loyo, A.G., González-Cortázar, M. and Zamilpa, A. (2020). Insecticidal compounds in *Ricinus communis* L. (euphorbiaceae) to control MelanaphissacchariZehntner (Hemiptera: Aphididae). *Florida Entomologist*, 103(1): 91-95.

[37] Srivastava, P., Jyotshna, Gupta, N., Maurya, A. K., and Shanker, K. (2014). New anti-inflammatory triterpene from the root of *Ricinus communis*. *Natural product research*, 28(5): 306-311.

[38] Taur, D.J. and Patil, R.Y. (2011). Antiasthmatic activity of *Ricinus communis* L. roots. *Asian Pacific Journal of Tropical Biomedicine*, 1: S13-S16.

[39] Thompson, M.J. and Bowers, W.S. (1968). Lupeol and 30-norlupan3β-ol-20-one from the coating of the castor bean (*Ricinus communis* L.). *Phytochemistry*, 7(5): 845-47.

[40] Tripathi, A.C., Gupta, R. and Saraf, S.K. (2011). Phytochemical investigation, characterisation and anticonvulsant activity of *Ricinus communis* seeds in mice. *Natural Product Research*; 25(19), 1881-1884.

[41] Tunaru, S., Althoff, T.F., Nusing, R.M., Diener, M. and Offermanns, S. (2012). Castor oil induces laxation and uterus contraction via ricinoleic acid activating prostaglandin EP3 receptors. *Proceedings of the National Academy of Sciences*, 109(23): 9179-9184.

[42] Vandita, P., Amin, N., Khyati, P. and Monisha, K. (2013). Effect of phytochemical constituents of *Ricinuscommunis*, *Pterocarpussantalinus*, *Terminaliabelerica* on antibacterial, antifungal and cytotoxic activity. *International Journal of Toxicology and Pharmacology Research*, 5(2): 47-54.

[43] Vasco-Leal, J.F., Cuellar-Nuñez, M.L., Luzardo-Ocampo, I., Ventura-Ramos, E., Loarca-Piña, G. and Rodriguez-García, M.E. (2021). Valorization of mexican*Ricinuscommunis* L. Leaves as a source of minerals and antioxidant compounds. *Waste and Biomass Valorization*, 12(4): 2071-88.

[44] Wachira, S.W., Omar, S., Jacob, J.W., Wahome, M., Alborn, H.T., Spring, D.R., Masiga, D.K. and Torto, B. (2014). Toxicity of six plant extracts and two pyridone alkaloids from *Ricinus communis* against the malaria vector *Anopheles gambiae*. *Parasites and vectors*, 7(1): 1-8.