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VALIDATION OF THERAPEUTIC EFFICACY OF CASTOR OIL (*ERANDA TAILA*) THROUGH REVERSE PHARMACOLOGY

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ABSTRACT

Castor oil *(Eranda taila)* is extracted from castor seeds and has a variety of health benefits. *Ricinus communis* Linn. (castor) belongs to a family Euphorbiaceae and usually has been cultivated for its medicinal uses as well as for household uses. All parts of plant i.e., root, bark, leaves, flower, fruit, seeds, oil possess high therapeutic value and has been used conventionally for the treatment of various diseases in human beings. The oil is pale yellowish or almost colourless, it is thick, volatile and sticky in consistency. It has a variety of uses in folk and traditional system of medicine but is currently approved for the use as a stimulant laxative by the FDA. It can be used against eye infections, liver disorders and in sexually transmitted diseases. Moreover Castor *(Eranda)* seed oil has an important role in preparation of pharma products and pesticides preparations. Castor *(Eranda)* oil plays an important role inthe preparation of soaps, coating and lubricating agents. The aim of this study is to document and explore various literatures of *Ayurveda* and contemporary modern sciences for its therapeutic aspects and highlights its importance as a medicine. This review covers classical texts of Ayurveda viz. *brihattrayee*, *nighantus* and various other texts of Ayurveda along with contemporary publications. This review conceptually and comprehensively includes the therapeutic and neutraceutical uses of castor oil as per *Ayurveda* as well as modern sciences.

KEYWORDS: *Ricinus communis* Linn., ricin, Castor oil, *Eranda taila*, ricinoleic acid.

INTRODUCTION

Castor oil is one of the most beneficial purgatives, fixed oil obtained from the seeds of the

castor plant. Besides being used as a medicine for various diseases due to its pharmacological properties, the oil is employed for lubricating purposes, burning and for leather dressing. The castor oil plant is a native of India where it is known by several regional names. In ancient Sanskrit text, the most ancient and most common name is *Eranda*, which has passed into several other Indian languages.[1] Castor is very old crop plant and has been cultivated over 6000 years and a rich source of oil for lamps and cosmetics in ancient Egypt. In *Ayurveda*, oil is mentioned among *chatusnehas* (four oils), in which *taila* is the best for themanagement of *vatavyadhi* (diseases caused by deranged *vata dosha*) as its properties (*guna*) are opposite to *vata*.[2] In *vataj vyadhi*, *Sneha virecana* is advised as it clears obstructions in *srotas* (body channels) and relieves *vata* vitiation subsequently.[3] *Eranda taila* (castor oil) is one of the most widely used oil in disease management both internally and externally. It is used as adjuvant for various formulation and ease the mode of administration. *Eranda* increases the *pitta*, hence it is not recommended in *pitta* dominant conditions. Indigestion is the root cause of many diseases because it produces *Ama*, that act as endotoxin in the body and it is the main culprit in the pathogenesis of many diseases. Use of ricinous oil can prevent these conditions. Castor oil mainly consists of Ricinoleic acid. Even though it has various medicinal properties,inappropriate usage causes adverse effects such as dizziness, abdominal cramps, diarrhoea, nausea, electrolytic imbalance.[4] So, Castor oil is used under medical supervision, if it is used without proper guidance and knowledge, it may show some adverse effect to the body.

Habitat – *Ricinus communis* Linn. (Fam. Euphorbiaceae), a tall glabrous shrub or almost a small tree 2-4 m high, found throughout India, mostly growing wild on waste land and also cultivated for its oilseeds. This plant is common and quite wild in the jungles in India and is by far the largest producer. It is cultivated throughout India, chiefly in the Madras, Bengal and Bombay presidencies. Two varieties of this plant are known.

(1) A perennial bushy plant with large fruits and large red seeds which yield about 40 percentof oil.

(2) A much smaller annual shrub with small grey (white) seeds having brown spots and yielding 37 percent of oil.[5]

ERANDA (CASTOR) IN CLASSICAL TEXT

Synonyms (*Ayurveda*)

Sanskrit: *Gandharvahasta, Vatari, Pancangula, Citra, Urundu, Rubu*.

English: Castor oil plant.

Hindi: *Arand, Eranda, Andi, Rend.*[6]

Varieties of *eranda (Ricinus communis* Linn.*)*

Dhanvantari Nighantu, Sodhala Nighantu, Kaiyadeva Nighantu, Bhava Prakass Nighantu and *Raj Nighantu* described two varieties of *Eranda* -

1. *Shweta Eranda* (White Castor)
2. *Rakta Eranda* (Red Castor)

Raja Narahari mentioned another variety in the name of *Sthula Eranda*.

Both red and white varieties are identified as *Ricinus communis*.

1. *Shweta Eranda* (White Castor) - Its roots, leaves and seed oil are used for therapeutic purpose.
2. *Rakta Eranda* (Red Castor)- Seed oil is used as a medicine which is more *ushna* and *teekshna* in action than *Shweta Eranda.*[7]

Parts used – Oil, Leaves, roots and seeds.[8]

Therapeutic potential

1. **Charaka samhita:** It is sweet, heavy, and *kapha*-aggravating. It is highly effective in treating *vatarakta* (Gout), *gulma* (abdominal lump), *hridroga* (heart-diseases) and *jeerna jwara* (chronic fever).[9]

2. **Sushruta samhita:** *Eranda taila* (castor oil) is sweet, hot in potency, penetrating, kindles digestive fire, bitter and astringent in secondary taste, enters into minute pores, cleanses the channels (ducts in the tissue) good for the skin, aphrodisiac, sweet after digestion, withholds ageing, purifies vagina (menstrual fluid) and semen, bestows health, intelligence, brilliancy, complexion, memory and strength, mitigates *vata* and *kapha* and removes the *doshas* (impurities) from lower body part (produces purgation).[10]

3. **Astang hridayam:** The castor oil is little bitter, little pungent, sweet and purgative. It alleviates warts, abdominal lump (*gulma*), *vāta*, *kapha*, abdominal disorders and intermittent fever. It cures pain of waist, anal region, alimentary canal, backache and inflammation.[11]

4. **Yogratnakar:** *Eranda taila* (castor oil) strenghthen body, heavy, hot in potency, sweet and

purgative. It is anthelminthic and relieves pain in whole body, useful in treating disorders of *vata* dosha imbalance, beneficial for skin diseases, rejuvenates body, *pittakopaka* (increases the pitta dosha), *vatashodhaka* (removes excess *vata*), *Vardhma* (warts), *gulma* (abdominal lump), *vatakaphahar* (pacify vata and kapha dosha), *udararoga* (diseases of abdomen) and *visham-jwaranashak* (cures intermittent fever).[12]

Classical Pharmacological Attributes of Castor oil *(Eranda taila)*[13]

Rasa	*Madhura, Katu*
Anurasa	*Kashaya*
Virya	*Ushna*
Vipaka	*Madhura*
Guna	*Sookshma, Teekshna, Sara, Snigdha*
Doshaghnata	*Vata- Kaphahara*

Classical pharmacological properties according to different texts

PROPERTIES	**D. Ni[14]**	**Dra.gu. Sam[15]**	**Ma.Dra. gu[16]**	**MP. Ni[17]**	**K. Ni[18]**	**BP. Ni[19]**	**R. Ni[20]**	**RV. Ni[21]**	**Sh. Ni[22]**	**Ni. Ad[23]**	**Pr. Ni[24]**
Ushna (hot)	+	-	+	+	+	+	-	-	+	+	+
Teekshna (sharpness)	-	-	-	-	+	+	-	-	+	-	+
Sukshma (fineness)	-	-	-	-	+	+	-	-	+	-	-
Guru (heaviness)	+	+	+	-	+	+	-	-	-	-	-
Visra (Foul smell)	-	-	-	-	+	+	-	-	-	-	-
Madhura ras (sweet)	+	+	+	+	+	+	+	+	+	+	+
Kashaya ras (astringent)	-	-	-	+	+	+	-	-	-	-	-
Picchila (sliminess)	-	-	-	-	+	+	-	-	-	-	-
Deepana (appetizers)	+	-	-	+	+	+	+	-	+	-	+
Rechana (cathartic)	-	-	-	-	-	-	-	-	-	-	+
Lekhana(Scrapes *meda*)	+	-	-	-	-	-	-	-	-	-	-
Sara (moving)	+	-	+	-	+	+	-	-	-	-	-
Vatakapha-nashak	+	-	-	-	+	-	-	-	+	-	-
(pacify *vata* and *kapha*)											

Kaphavardhak (increasekapha)	-	-	-	-	+	-	-	+	-	-	-
Pittavardhak (increasespitta dosha)	-	-	-	-	-	-	+	-	+	-	-
Abbreviations- D.Ni- *Dhanvantari Nighantu*, Dra.gu.Sam- *Dravyaguna samgraha*, Ma.Dra.gu- *Madhavadravyaguna*, MP.Ni- *Madan Pal Nighantu*, K.Ni- *Kaiyadev Nighantu*, BP.Ni- *Bhava Prakash Nighantu*, R.Ni- *Raja Nighantu*, RV.Ni- *Raja Vallabha Nighantu*, Sh.Ni- *ShaligramNighantu*, Ni.Ad- *Nighantu Adarsha*, Pr.Ni- *Priya Nighantu*											

Classical therapeutic indication

Indications	**D. Ni**	**Dra.gu. sam**	**Ma. Dg**	**MP. Ni**	**K. Ni**	**BP. Ni**	**R. Ni**	**RV. Ni**	**Sh. Ni**	**Ni. Ad**	**Pr. Ni**
Tvachya (Tonic for skin)	-	-	-	+	+	+	-	-	-	-	+
Vrisya (aphrodisiac)	-	-	-	+	-	+	-	-	+	-	-
Rasayana (rejuvinator)	-	-	-	-	-	-	+	-	+	-	-
Vayasthapana (antiageing)	-	-	-	+	+	+	-	-	+	-	-
Medhya (intelle -ct promoting)	-	-	-	+	+	+	-	-	+	-	-
Kanti (lusture)	-	-	-	+	+	+	-	-	+	-	-
Balya (strength)	-	-	+	+	+	+	-	-	+	-	-
Yonishukravisho dhana (Purifies vagina & semen)	-	-	-	+	+	+	-	-	-	-	-
Vishamjwara- nashak (inter - mittent fever)	-	+	-	-	+	+	-	-	-	-	-
Srotoshodhak (purifies channels)	-	-	-	+	+	-	-	-	+	-	-
Aarogya(health)	-	-	-	-	+	-	-	-	+	-	-
Smriti (memory)	-	-	-	-	+	-	-	-	+	-	-
Shukravivardha na (Improves sperms)	-	-	-	-	+	-	-	+	-	-	-
Shotha (inflammation)	+	+	-	+	+	+	-	-	-	-	-
Shoola (pain)	+	+	-	+	+	+	+	+	+	-	-
Vatavyadhi (diseases due to vata dosa)	+	+	-	+	+	-	+	-	+	-	-

Aamajvyadhi (diseases due to indigestion)	+	-	-	+	+	+	+	+	-	-	+
Vatarakta (gout)	-	-	-	+	+	+	-	+	-	-	-
Krimi (helminthiasis)	-	-	-	-	-	-	+	-	+	-	-
Kustha (Skin diseases)	-	-	-	-	-	-	+	-	+	-	-
Abbreviations- D.Ni- *Dhanvantari Nighantu*, Dra.gu.Sam- *Dravyaguna Samgraha*, Ma.Dra.gu-*Madhava Dravyaguna*, MP.Ni- *Madan Pal Nighantu*, K.Ni- *Kaiyadev Nighantu*, BP.Ni- *Bhava Prakash Nighantu*, R.Ni- *Raja Nighantu*, RV.Ni- *Raja Vallabha Nighantu*, Sh.Ni- *ShaligramNighantu*, Ni.Ad- *Nighantu Adarsha*, Pr.Ni- *Priya Nighantu*											

***Eranda taila* (Castor oil): Contemporary view**

R. communis is a multipurpose folkloric medicinal plant with some medicinal properties associated with either direct application of crude plant extract as a therapeutic agent in various disease or by inhibition of harmful pathogens, which are known to cause various infections and diseases. Numerous studies have been carried out and published on the biological activities of *R. communis*. These activities are both due to the crude extract and its phytochemical compounds which can be of great interest in future for the development of plant based complementary medicine.[25]

Chemistry and Constituents of castor oil - Seeds contain fixed oil 45 percent to 52 percent (yielding 40 to 42 percent of oil in the country *Ghani*), soluble in alcohol, protiens 20 percent, starch, mucilage, sugar and ash 10 percent "the oil chiefly consists of ricinoleate of glycerol, or tri- ricinolein (i.e., a mixture of glycerides of ricinoleic and isoricinoleic acids) with a small quantity of palmitin and stearin. Apart from the oil which is contained in the kernels, a very toxic substance "Ricin", an albuminoid poisonous body is present in the seeds, but not present in the oil to any extent; Viscid oil, the purgative principle; Tristearin; glyceride of dihydroxy stearic acid. Unlike most fixed oils, Castor oil possesses the remarkable property of mixing with absolute alcohol and glacial acetic acid in all proportions. The glycerides of ricinoleic acid $C_{17}H_{34}$ (OH) COOH (which is a hydroxy acid) are mainly responsible for the purgative effect.[26]

Preparation of castor oil

The fixed oil of the commerce is obtained from the seeds by two processes: -

1. **Cold drawn method:** When extracted without the aid of heat, oil is colourless or faintly yellow or straw – coloured, practically odourless, with a bland and slightly acrid taste.

2. **Hot drawn method:** This is done by boiling the seeds with water and skimming off the oil. The hot-pressing process commonly in use in India consists of burning a slow fire under the mill; this liquifies the oil and increases the yield. The oil is bleached by exposure to the sun and is clarified by boiling with water which coagulates the proteins and dissolves out the mucilaginous matrix.

There are several qualities of this oil in the market. For medicinal purposes, the seeds are hand – cleaned and husked, the kernels dried in the sun and afterwards broken in a crushing machine. It is understood that at present most of the oil is extracted by hydraulic presses.[27]

Pharmacodynamics of castor oil

Oil is non-irritant purgative; when it reaches the duodenum it is decomposed by the pancreatic juice into ricinoleic acid which irritates the bowels, stimulates the intestinal glands and the muscular coat and causes purgation, i.e., when given by the mouth the oil is saponified and free acid is liberated which produces the effect. It acts in 4 to 5 hours causing liquid stools without pain or gripping and has a sedative effect on intestine. With glycerine the effects of the oil are increased. Ricinoleic acid is absorbed into the blood and tissues and is excreted with the human milk, which when sucked imparts to the child its purgative action. Ricinine is a violentirritant of the intestines, kidneys and bladder. It gives rise to inflammation of the bile duct and very often to jaundice and to dysuria.[28]

PHARMACOLOGICAL ACTIVITIES

Some of the important pharmacological properties of *R. communis* oil are being listed here.

Drug delivery vehicle - In modern-day medicine, castor oil is used as a drug delivery vehicle. An example is Kolliphor EL or formerly known as Cremophor EL, which is a registered product of BASF Corp. The product is a polyethoxylated Castor oil, a mixture that is prepared when 35 moles ethylene oxide react with 1 mole of castor oil. It is used as a drug delivery vehicle for nonpolar drugs such as the anticancer drugs paclitaxel and docetaxel.[29]

Preclinical studies

Antioxidant and Anti-inflammatory - The fatty acid profile and triglycerides demonstrate that ricinoleic acid and triricinolein are the predominant components in the oil. Bioactive compounds including polyphenols, phytosterols, and tocopherols present in castor oil seed pose its anti-inflammatory and antioxidant properties against oxidation and these may prolong the oil shelf life.[30]

Antibacterial activity - Antibacterial activity of castor oil has been studied against Staphylococcus aureus, Streptococcus viridans, and Shigella dysenteriae using direct inoculation, paper disc method. The result obtained implies that castor oil can be used in the control of wounds, skin infections, throat infections and in the treatment of stomach unrest caused by these bacteria species.[31]

Laxative - The present study was undertaken to elucidate the molecular mechanism underlying biological effect of castor oil-derived ricinoleic acid. Based on in vitro studies, using cells endogenously or heterologously expressing prostanoid receptors, as well as on the use of inducible and tissue-specific EP3 receptor-deficient mice. Data clearly indicates that the EP3 receptor on intestinal smooth-muscle cells mediates the laxative effect of ricinoleic acid and, therefore, is a major prostanoid receptor in the intestine mediating propulsive effects on gut motility.[32]

Wound healing - Ricinoleic acid (RA) has potential to promote wound healing because of its analgesic and anti-inflammatory properties. This study investigates the synthesis and characterization of RA liposomes infused in a hydrogel for topical application. Histopathological analysis of the RA -liposomal chitosan hydrogel group showed that the epidermis, dermis and subcutaneous skin layers displayed an accelerated yet normal healing compared to control group.[33]

Topical application - Observational study indicates that topical application of ricinoliec acid (RA), the main component of castor oil exerts remarkable analgesic and anti-inflammatory effects. The aim of this study was to assess RA anti-inflammatory activities in comparison with capsaicin in several models of acute and sub-chronic inflammation. The result of this study concluded that RA may be seen as a new capsaicin-like, non-pungent anti-inflammatory agent suitable for peripheral application.[34]

Anticancer - A dose dependent treatment plan for 48 h incubation to evaluate the RCEO-NE (*Ricinus communis* L. essential oil nano-emulsion) anticancer impacts on HepG2 compared with normal L929 cell line was designed. Results demonstrated that the 81.4 nm droplets of RCEO-NE with polydispersity index 0.41 revealed appreciable antioxidant activities and can significantly reduce the HepG2 cells' viability ($p < 0.001$). RCEO-NE due to its cell-specific high antioxidant, cytotoxic and individual apoptotic activities for HepG2 cancer cells has the potential to be used as bio-preservative in food industries and applied as an efficient cancer

therapy strategy.[35]

Antimalarial - Castor oil being plant-based ecofriendly and has natural pesticidal action. Castor oil nano-emulsion was formulated in different ratios comprising of castor oil, surfactants and water by high pressure homogenizer mixer. The ratio of castor oil (10%) and surfactants (18%) was found to be stable. The nano-emulsion of castor oil ensures higher efficacy as a larvicidal agent against *Anopheles culicifacies* when compared to ordinary emulsion. From this study, it can be concluded that castor oil can be used as a safe and effective method for controlling vector borne diseases caused by mosquito larvae.[36]

Anthelminthic - Castor oil and mustard oil were tested at different concentrations for the determination of paralysis time and death time of the earthworm *Pheritima posthuma*. Albendazole is used as standard and it was found that castor oil and mustard oil showed a better anthelminthic activity in comparison with the standard.[37]

Insecticidal - The insecticidal value of castor oil in controlling the termites which damage wood of *Mangifera indica* and *Pinus longifolia* was examined. In this comparative trial, the order of insecticidal activity was DDT=BHC> castor oil+ castor cake (1:1) castor oil > castor leaves > castor cake > neem oil > neem leaves.[38]

Antiulcer - Antiulcer activity of castor oil was studied in rats by administration of ethanol or aspirin or by pyloric ligation. Castor oil was administered in the dose of 500 mg/kg and 1000 mg/kg orally 30 min prior to ulcer induction. The antiulcer activity was assessed by determining and comparing the ulcer index in the test drug group with that of ulcerated control group. The finding of the present study demonstrated that castor oil possesses antiulcer activity against ulceration caused by pylorus ligation, aspirin and ethanol.[39]

Clinical studies

Labor induction - A retrospective observational case control study was conducted over five years. Two groups of pregnant women were chosen, one with castor oil group (COG) and other traditional doctor led unit (control group-CG). Castor oil was administered in a 60 ml single dose in 200 ml warm water. The mode of delivery differed significantly between groups: women assuming castor showed a higher incidence of vaginal delivery, whereas the incidenceof c-section was lower in the COG. Hence, the use of castor oil is related to a higher probability of labour initiation within 24 hours. Castor oil can be considered a safe non-

pharmacological method for labour induction.[40]

Arthritis - A randomized, double-blind, comparative clinical study was conducted to compare the safety and efficacy of castor oil with diclofenac sodium in patients with knee osteoarthritis. On completion of 4 weeks treatment, it was observed that both drugs were significantly effective in the treatment of knee osteoarthritis ($p < 0.001$) and adverse drug reactions were high with diclofenac sodium, whereas with castor oil there were no adverse effects reported. The present study indicates that castor oil can be used as an effective therapy in primary knee osteoarthritis.[41] In another study on management of osteoarthritis (*sandhigata vata*) using *Eranda taila,* results of the study showed that *(Savan et al.)* a significant improvement in pain, inflammation and stiffness was observed. The same medication was used for continuous 2 years, results showed that significant improvement for first year and no signs & symptoms of *sandhivata* were noticed after use of castor for consecutive years.[42]

Artificial tears - Clinical trial was conducted between two groups by single blind method. Group A was treated with *Eranda taila* (castor oil) eye drops and group B was treated with Hydroxypropyl Methyl Cellulose (HPMC) eye drops (artificial tear drop) for duration of one month. The outcome of this trial is that the *Eranda taila* eye drops were more effective than artificial tear, well accepted by patients and did not show any adverse effects.[43]

***Amavata* (Rheumatoid arthritis) -** A Clinical study of some *vishaghna dravya* and *eranda taila* in the management of *Amavata* was undertaken. *(Bhupinder et al.)* Outcome of this trial was that the *vishaghna dravya* were effective for symptomatic relief. *Eranda taila* was more efficient and potent than *vishaghna dravyas* in controlling the symptom of *Amavata*. They also concluded that the patients of *vata-pitta prakriti* suffer more aggressively in response to RA, So the patients should avoid pitta vitiated food and habits along with strict dietary regimen and to follow exercises as advised by physician.[44]

Contraindications – Castor oil is contraindicated in Gastrointestinal obstruction,[45] Appendicitis,[45] Perforation,[45] Inflammatory bowel disease[45] Pregnancy,[46] Hypersensitivity[46], Severe impaction,[46] Rectal fissures.[46]

Adverse effect of castor oil (*Ayurveda* and Modern) - In a study comparing castor oil to sennasoides, castor oil tended to cause abdominal cramping, vomiting, bloating and

dizziness.Far fewer adverse effects were occurring with the use of other laxatives.[47]

Toxicology - *R. communis* has shown some toxic effects accidentally due to presence of toxic compounds such as ricin and ricinine. Some of the in-vivo mouse model studies have shown the ricin toxicity may vary from hyperactivity to seizure formation and may even lead to death at a dose of more than 340 mg/kg intraperitoneally and 3 g/kg orally. However, independent of its uptake, ricin is found to be almost toxic, and there is an increase in the severity of symptoms with an increase in the dose.[48]

CONCLUSION

Castor oil *(Eranda taila)* is a vegetable oil that is derived from the seeds of castor plant (*Ricinus communis* L.). It is used as a medicine since ancient ages. *Eranda taila* is briefly described in our Ayurvedic manuscripts and have high therapeutic value. It is efficiently used for a wide range of ailments mainly for *vata* diseases and have effective role in Rheumatoid arthritis (*Amavata*). In Ayurveda, Castor *(Eranda)* oil is commonly used for *virecana* and for the treatment of *vatika shoola* and *shotha*. Its wide range of action and benefits taken into consideration, it can be used wisely in various conditions and cure of severe chronic ailments.

REFERENCES

1. Das Arup J, Goswami Kanika., A conceptual study on castor oil (Eranda oil) with special references to modern & Ayurvedic classics, *J of Eme Tech and Inn Res*, 2020; 7(8).
2. Singh R., Kakade R., Gulhane J., Therapeutic aspects of Eranda Tail (Oil of Ricinus Communis). *J Ayu Int Med Sci*, 2023; 8(4): 158-165.
3. Shastri K.N., Charak Samhita, Vidhyotini Hindi Commentry, Vatavyadhichikitisa Adhyaya, part-2, *Chaukhamba Bharati Sansthan*, Varanasi, 2000; 705: 83-84.
4. Medscape, Drugs and diseases, Castor oil. Retrieved from https://reference.medscape.com/drug/fleet-castor-oil-castor-oil-342010.
5. Nadkarni's K.M., Indian materia medica, revised by Nadkarni A.K., Ricinus communis, *Bombay popular prakashan*, Mumbai, 2002; 1: 1065-66.
6. Nadkarni's K.M., Indian materia medica, revised by Nadkarni A.K., Ricinus communis, *Bombay popular prakashan*, Mumbai, 2002; 1: 1065.
7. Gupta S., Ricinus Communis Linn., IAFA Ayurveda, Ins of App Food Allergy., http://Www.Iafafotallergy.Com.
8. Nadkarni's K.M., Indian materia medica, revised by Nadkarni A.K., Ricinus communis, *Bombay popular prakashan*, Mumbai, 2002; 1: 1066.

9. Shastri K.N. and Chaturvedi G.N., Charak Samhita, Vidhyotini Hindi Commentry, Annapana Vidhi Adhyaya, part-1, *Chaukhambha Bharati Sansthan*, Varanasi, 2014; 1: 560, 289.
10. Murthy K.R. Srikantha Sushruta Samhita, Dravadravya Vidhi Adhyaya, *Chaukhambha Sanskrit Sansthan*, Varanasi, 2017; 348: 114.
11. Gaur Banwari Lal, Gaur Vishwavasu Astangahrdayam by vagbhata, Dravadravya vijnaniya Adhyaya, *Chaukhambha orientalia*, Varanasi, 2017; 78: 57-58.
12. Shastri Laxmipati., Yogratnakar, Vidyotini Hindi Teeka, *Chaukhamba Sanskrit Sansthan*, Varanasi, 1999; 107.
13. Gogate V.M., Ayurvedic pharmacology and therapeutics uses of medicinal plants, Dravyagunavigyana, *Chaukhamba Publications* New Delhi, 1: 321.
14. Dhanwantri Nighantu; e-Nighantu, NIIHM, Hyderabad (Erada tailam, verse), 2012; 119–21.
15. Dravyguna samgrah; e-Nighantu, NIIHM, Hyderabad (taila varga, verse), 2012; 4 – 5.
16. Madhava-Dravyaguna; e-Nighantu, NIIHM, Hyderabad (taila varga, verse), 2012; 8 – 9.
17. Vaidya R.P.; Madanpal Nighantu, *Khemraj Shri Krishna Das Prakashan*, Bombay (paniyadi varga verse), 1990; 141 – 142.
18. Sharma P.V. & Sharma Guru Prasad; Kaiyadeva Nighantu *Chaukhambha Orientalia* Varanasi (taila varga, verse), 2006; 312 – 316.
19. Chunekar K.C. & Pandey Ganga S., Bhavaprakasha Nighantu, *Chaukhambha Bharati Academy* Varanasi. (taila varga, verse), 2010; 22 - 25.
20. Tripathi I.D. Rajnighantu, Dravyagunaprakashika Hindi Commentary *Chaukhambha Krishnadas Academy* (kshiradi varga, verse), 2010; 114.
21. Rajavallabha Nighantu; e-Nighantu, NIIHM, Hyderabad (Paurvahikpariccheda, verse), 2012; 49 – 51.
22. Vaishya S., Shaligram Nighantu, *Khemraja Prakashan, Shri Krishna Das Laxmi Steem Press* Mumbai. (Guducyadi varga,), 1983; 1: 221-222.
23. Bapalal. G. Vaidya; Nighantu Adarsh, *Chaukhambha Vidya Bhawan*, Varanasi (amlakadi varga, p.), 1961; 454.
24. Sharma PV, Priya Nighantu, *Chaukhambha Sanskrit Sansthan* Varanasi (shatpushpadi varga, verse), 1995; 72.
25. Das Arup J, Goswami Kanika., A conceptual study on castor oil (Eranda oil) with special references to modern & Ayurvedic classics, *J of Eme Tech and Inn Res*, 2020; 7(8).
26. Nadkarni's K.M., Indian materia medica, revised by Nadkarni A.K., Ricinus communis,

vol-1, *Bombay popular prakashan*, Mumbai, 2002; 1: 1066.

27. Nadkarni's K.M., Indian materia medica, revised by Nadkarni A.K., Ricinus communis, *Bombay popular prakashan*, Mumbai, 2002; 1: 1066.
28. Nadkarni's K.M., Reprinted Indian materia medica, revised by Nadkarni A.K., Ricinus communis, *Bombay popular prakashan*, Mumbai, 2002; 1: 1067.
29. Patel V, R., Dumancas G, G., et al Castor oil: properties, uses and optimization of processing parameters in commercial production, *lipid insights, 2016.* PMID:27656091.
30. Yeboah A, Ying S, LU J., et al Castor oil (Ricinus communis): a review on the chemical composition and physicochemical properties, *food science and technology*, 2020 doi:10.1590/fst.19620.
31. Ayuba L., Agboire S., Gana A.K., Ishaq M., Aliyu U., Affiniki G. and Manjang J.I., Efficacy of Castor oil in the control of throat, skin and enteric bacteria. *Advances in Food Science and Engineering*, 2017; 1: 3.
32. Tunaru S., Althoff T F., et al Castor oil induces laxation and uterus contraction via ricinoleic acid activating prostaglandin EP3 receptors, *Proc Natl Acad Sci USA*, 2012; 109(23): 9179-9184.
33. Nada A A., Arul M R., Ramos D M., et al Bioactive polymeric formulations for wound healing, 2018. *polym adv tech* doi:10.1002/pat.4288.
34. C. Vieira, S. Evangelista, et al. Effect of ricinoleic acid in acute and subchronic experimental models of inflammation, *mediators of inflamm*, 2000; 9(5): 223-228.
35. Javanshir, A., Karimi, E., Maragheh, A.D. et al. The antioxidant and anticancer potential of *Ricinus communis* L. essential oil nanoemulsions, *food measure*, 2020; 1356–1365.
36. Sogan, N., Kapoor, N., Kala, S., Patanjali Pk et al. Larvicidal activity of castor oil nanoemulsion against malaria vector Anopheles Culicifacies, *International journal of mosquito research*, 2018; 5(3): 01-06.
37. Manthri S., Sravanthi K.C., et al. Anthelminthic activity of Castor oil and Mustardoil, *J. of Phytology*, 2011; 3(3): 12-14.
38. Sharma, S., Vasudevan, P., Madan, M Insecticidal value of Castor *(Ricinus communis)* against termites, *International biodeterioration*, 1991; 27(3): 249-254.
39. Rachhadiya R.M., Kabra M.P et al Evaluation of antiulcer activity of Castor oil in rats, *Int Jour of Res in Ayu & Pharma*, 2011; 2(4): 1349-1353.
40. Neri, I., Dante G et al Castor oil for induction of labour: a retrospective study, *J Matern Fetal Neonatal Med*, 2018; 31(16): 2105-2108.
41. Medhi B., Kishore K., Singh U., Seth S, D., Comparative clinical trial of castor oil and

diclofenac sodium in patients with osteoarthritis. *Phytotherapy research*, 2009. doi:10.1002/ptr.2804.

42. Kumar Savan, Dipti et al., Management of Sandhigata Vata by Eranda Taila: A CaseSeries, *Int Jour of Res-Granth*, 2022; 10(1).
43. Chandan A. Virkar study of efficacy of Eranda taila (Castor oil) aschotana (eye drops) in dry eye syndrome, *world jour. of pharma res, 2015;* 4(4): 660-669.
44. Singh Bhupinder and Singh Bhavna, A Clinical Comparative Study of Some Vishaghna Dravya and Eranda Taila in The Management of Amavata. *world jour. of pharmares*, 2017; 6(9): 855-869.
45. Xing JH, Soffer EE, Adverse effects of laxatives, *Dis Colon Rectum*, 2001; 44(8): 1201-9.
46. Medscape, Drugs and diseases, Castor oil. Retrieved from https://reference. medscape. com/drug/fleet-castor-oil-castor-oil-342010.
47. Ghazikhanlou Sani K, Jafari MR, Shams S. A, Comparison of the efficacy, adverseeffects, and patient compliance of the sena-graph syrup and castor oil regimens for bowel preparation, *Iran J Pharm Res*, 2010; 9(2): 193-8.
48. Das Arup J, Goswami Kanika., A conceptual study on castor oil (Eranda oil) with special references to modern & Ayurvedic classics, *J of Eme Tech and Inn Res*, 2020; 7(8).