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Carissa Carandas Linn A Magical Herb

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Abstract: -

The Apocynaceae family includes the tough, evergreen, spiky, indigenous flowering shrub known as Karonda (*Carissa carandas* L.). It is widely spread throughout South Asia, with areas of India, Pakistan, Myanmar, Afghanistan, Nepal, Sri Lanka, and Malaysia being its most common locations. South Africa and Australia also have it. that 80% of people on the planet still use traditional medicine to treat a variety of illnesses. While the ripening season lasts from August to September, unripe fruits are harvested from mid-May to mid-July and are ready for planting after 6–7 months. Fruits, leaves, roots, stems, and bark are among the parts of these plants that are also used medicinally. Another use for this plant is as a nutraceutical product. Antioxidants, anti-inflammatory, anti-cancer, cardioprotective, hepatoprotective, antimalarial, antibacterial, anti-ulcer, and other chemical compounds found in these plants exhibit phytochemical actions. The most widely used technique is maceration with solvents like ethanol or ethyl acetate.

Keywords: -

Maceration, Nutraceutical, Traditional use, *Carissa Carandas* Linn, and phytochemical effects.

Introduction:

According to a WHO poll, over 80% of people worldwide still use traditional medicines to treat a variety of illnesses.

Native to most of India, Sri Lanka, Java, Malaysia, Myanmar, and Pakistan, the plant is widely distributed. Its leaves are globous, thin, oblong-oval or oblong-lanceolate, simple, opposite, subacute at the base, and obtuse at the apex. The bisexual flowers are regular. The bark is scaly and light grey. At the base of the typically alternating branches are thin, robust, pointed, horizontal, globous spines that range in length from 2.5 to 3.8 cm.

The fruit is round, oblong, or broad-ovoid, and it is found in clusters of three to ten. Purplish-red when unripe, the skin is rather thin yet tough; when ripe, it turns dark purple or almost black and lustrous. Karonda needs constant sunlight and can grow up to 6,000 feet above sea level. All year long, the plant may blossom and produce fruit. Unripe fruits are harvested between mid-May and mid-July for use, and they are ready for planting after 6–7 months of this procedure. The ripening season lasts from August to September [1].

The leaves are conical and oblong, measuring 4-6 inches in length and 2-3 inches in width. They are brown underneath and green above. This group of plants is known for their white, milky sap, which is visible if the leaves or stems are damaged.

Ripe Karonda Due to their high pectin content, fruits can be used to make chutney, jam, squash, syrup, tarts, and jelly—all of which are highly sought-after on the global market.

Karonda bushes are also useful for hedging in home gardens, and because of their lovely cherry-like fruits, they are occasionally planted as decorative plants. The plant may thrive in a variety of soil types since it is resilient and drought tolerant.

For thousands of years, this species has been utilized in homoeopathic, Ayurvedic, and Unani medicine as a traditional medicinal herb. Different portions of the plant were traditionally used to treat different illnesses. While the roots are used to treat illnesses, the fruits are eaten to treat liver dysfunction, lower fever, and prevent blood putrefaction. digestion. Due to their high iron, vitamin C, and pectin content, fruits are employed in ethnomedicine as an astringent, an antiscorbutic, and a treatment for biliousness (gastric distress) [2].

Five species of the genus *Carissa* are indigenous to India, out of the approximately 25 species that are known to exist.

known, five of which are indigenous to India. Because the plant has antiscorbutic qualities and has been shown to be highly effective in treating anaemia, its demand has skyrocketed on the market. In numerous Ayurvedic medicines, it has been used. Chest discomfort is treated with root extract. Fever is treated with the use of leaf extracts. Thiamine, riboflavin, pantothenic acid, pyridoxine, biotin, and folic acid are all most abundant in the fruits [3].

Taxonomy of *Carissa Carandas* Linn: -

- 1) Kingdom- Plant
- 2) Class- Angiosperms
- 3) Sub-class- Eudicots
- 4) Order- Gentianellas
- 5) Superorder- Asteroids
- 6) Family- Apocynaceae
- 7) Genus- *Carissa*
- 8) Species- *carandas*
- 9) Scientific Name- *Carissa carandas*.

Origine and Distribution: -

The Apocynaceae family includes the tough, evergreen, spiky, indigenous flowering shrub known as Karonda (*Carissa carandas* L.). India, Pakistan, Myanmar, Afghanistan, Nepal, Sri Lanka, and Malaysia are the main locations for this widely dispersed species in South Asia. South Africa and Australia also have it. The plant thrives in hot climates and is widely distributed in India's coastal districts of Karavali in Karnataka state Goa and the Western Ghats of Konkan in Maharashtra's western coastline states. It is also grown at heights of 30 to 1,800 meters (98 to 5,906 feet) in the temperate Himalayan Siwalik Hills of India and Nepal. It is grown on a small scale in Rajasthan, Gujarat, Bihar, West Bengal, and Uttar Pradesh, among other regions of India. It can also be found in other South Asian nations, such as Bangladesh, Pakistan, Nepal, and the lowland rain forests of Sri Lanka. In the Americas and various regions of Asia, it is an imported species.[4]

English	Bengal currant, Natal plum, Carandas plum, Christ's thorn, Black currant
<i>Sanskrit</i>	Karmardaka, Avighna
<i>Hindi</i>	Karaunda, Garinga, Gotho
<i>Kannada</i>	Ka ulihannu, karanda kai, Doddakaala, Garchinikai
<i>Assamese</i>	Karja tenga
<i>Bengali</i>	Koromcha
<i>Maithali</i>	Karauna
<i>Marathi</i>	Kali maina, Boranda

<i>Tamil</i>	Kalakka, Aintirikam, Cenkala, Karavinta, Kilamaram, Kilatti, Perumkla, Perungilamaram, Killeekkaai
<i>Telugu</i>	Vakkai, Peddakalavi
<i>Malayalam</i>	Kalachedi, Karakka, Karanta, Karekkai, Panimarda, Susena.

Table 1. Vernacular names of karonda fruit in India.[5]

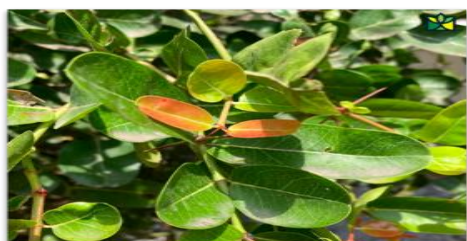
FRUITS



STEM AND BARK



LEAVES



ROOTS



Img- Parts of carrisa *Carindas linn*

Uses: -

- 1) **Fruit:** Polydipsia, anorexia, diarrhoea, brain disorders, intermittent fevers, haemorrhage, and diarrhoea can all be treated with this unripe fruit, which is also thermogenic, astringent, sour, and bitter. Ripe fruit is cold, sweet, tasty, and antiscorbutic. It helps with bilious complaints, expectorant anorexia, burning, scabies, itching, and other skin conditions. It also helps treat anaemia and functions as a poison counter. It's considered carminative. The fruit is used in traditional medicine to treat intestinal worms and increase female libido. The fruit juice is used to treat old, infected wounds since it has antimicrobial and antifungal qualities. Any skin issues can be resolved by using the juice topically. Karamarda has long been used to treat mental illness.
- 2) **Stem bark:** Stem bark is utilized to treat stubborn skin conditions in Ayurveda.
- 3) **Leaves:** Karamarda leaf decoction is used to treat syphilitic discomfort, fever, diarrhoea, earaches, and sore mouth and throat. When recurrent fever first appears, a leaf decoction is administered.
- 4) **Root:** The roots help with stomach issues including acidity and flatulence because they are anthelmintic, stomachic, and antiscorbutic. In addition to being an insect repellent, it helps with intestinal worms, scabies, diabetic ulcers, pruritus, gonorrhoea, pyrexia, indigestion, chronic ulcers, biliousness, and urinary diseases. In the Konkan, traditional practitioners use the root as a plaster to ward off flies.
- 5) Numerous plant parts have been utilized to treat a variety of conditions, including dropsy, anasarca, insanity, rheumatism, hemiplegia, epilepsy, convulsions, postpartum nausea, ulcers, and dog or rabid jackal bites. Itching is treated with a mixture made with horse wine, lime juice, and camphor. Tribal healers in Karnataka's Western Ghat region utilize it as an antihyperglycemic and hepatoprotective. Plant parts are utilized in Bangladesh to treat diabetes, diarrhoea, and malaria. Fresh plant juice is applied to wounds that are resistant to healing. The fruits have anti-inflammatory and analgesic properties [6].

Material And Methods: -

Sr. No	Chemical constituent	Parts	Effect/ Use
01	Lupeol	Root, Fruit	Antioxidant, Anti-inflammatory
02	16b-Hydroxybetulinic acid	Root	Anti-cancer
03	Lupa-12,20(29)-dien-3b,28-diol	Root	Anti-inflammatory
04	Ursolic acid	Root	Anti-cancer, Anti-inflammatory
05	Urs-12-ene-3b,22b-diol	Root	Anti-inflammatory, Antibacterial
06	Meursolate	Root	Anti-inflammatory
07	α -Amyrin	Root	Anti-inflammatory, Hepatoprotective
08	Carissic acid	Leaf	Anti-cancer
09	Carissic acid methyl ester	Leaf	Anti-inflammatory, Antimicrobial
10	Carissic acid monoacetate	Leaf	Anticonvulsant, Antipyretic
11	Carissol	Fruit	Anthelmintics
12	Oleanolic acid	Root	Antioxidant, Anti-inflammatory
13	Carandinol	Leaf	Anti-cancer
14	Betulinic acid	Leaf	Anti-malarial, Antitumor
15	Carindone	Root	Anti-inflammatory
16	(+)-Carissone	Root	Anti-bacterial
17	Nerolidol	Flower	Anti-inflammatory, Anti-malarial
18	Farnesol	Flower	Anti-microbial, Antioxidant
19	Camphene	Flower	Anti-inflammatory, Antimalarial
20	Menthol	Flower	Antiulcerogenic, Antimicrobial
21	p-Cymene	Flower	Antinociceptive, Immunomodulatory
22	α -Terpineol	Flower	Antioxidant, Antiulcer, Antihypertensive
23	Piperitone	Flower	Treatment of fever, chest pain, headache
24	Citronellal	Flower	Control muscle spasms, Diuretic

25	(+)-Linalool	Flower	To treat depression, anxiety, stress
26	Neryl acetate	Flower	Treatment of digestive and dermatological
27	Geranyl acetate	Flower	Anti-inflammatory
28	β -Ionone	Flower	Anti-cancer
29	Rutin	Fruit	Anti-bacterial
30	Epicatechin	Fruit	Anti-inflammatory, Anti-cancer, Anti-viral
31	Epicatechin gallate	Fruit	Anti-diabetes, Antioxidant, Anti-inflammatory
32	Quercetin	Fruit	Anti-inflammatory, Antioxidant, Antiviral
33	Kaempferol	Fruit	Anti-cancer, Anti-inflammatory
34	1,2,4-Butanetriol,2,3-bis[[4 dimethoxy phenyl)methyl]-,1,4-diacetate	Root	Treatment of sickle cell anemia, Antiulcer
35	Carinol	Root	Anti-cancer
36	4,40-Dimethylcarinol	Root	Antimicrobial, Antihistamine
37	1,2,4-Butanetriol,2,3-bis[[4-(acetyloxy)-3-methoxyphenyl)methyl]-,1,4-diacetate	Root	Antiulcer
38	β -Sitosterol	Root	Treatment of heart diseases
39	Sitosterol glucoside	Root	Anti-inflammatory, Immune function
40	Cholest-5-en-3b-ol	Root	Managing the cholesterol level
41	Piceatannol	Fruit	Anti-inflammatory, Anti-cancer, Antioxidant
42	Resveratrol	Fruit	Anti-inflammatory, Antimicrobial, Anti-cancer
43	Syringic acid	Fruit	Anti-diabetic, Antioxidant, Anti-cancer
44	Vanillic acid	Fruit	Antioxidant, Anti-inflammatory, Neuroprotective agent
45	p-Coumaric acid	Fruit	Anti-inflammatory, Anti-cancer, Antioxidant
46	Caffeic acid	Fruit	Anti-cancer, Anti-inflammatory, Antioxidant
47	Ellagic acid	Fruit	Antioxidant, Anti-cancer
48	Chlorogenic acid	Fruit	Treatment of diabetes, obesity, Anti-inflammatory
49	Scopoletin	Fruit, Root	Anti-cancer, Anti-inflammatory, Anti-diabetic, Hepatoprotective

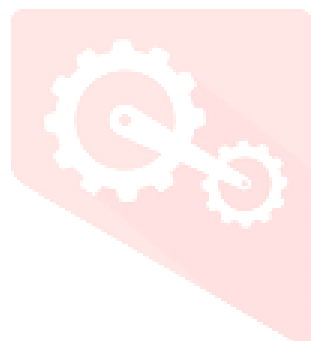
50	Eicosanoic acid	Seed	Anti-inflammatory
51	Hexadecanoic acid	Seed	Antibacterial, Anti-inflammatory
52	Octadecanoic acid	Seed	Skin protectant
53	9Z,12Z-Octadecadienoic acid	Seed	Anti-inflammatory, Antioxidant
54	9Z-Octadecenoic acid	Seed	Anti-inflammatory
55	L-Ascorbic acid	Fruit	Antioxidant, Anti-cancer
56	Dihydrojasnone	Flower	Antitumor, Antibacterial, Antiviral
57	4-Amino-1-(4-amino-2-oxo-1(2H)pyrimidinyl)-1,4-dideoxy-b-D glucopyranuronic acid	Root	Anti-cancer

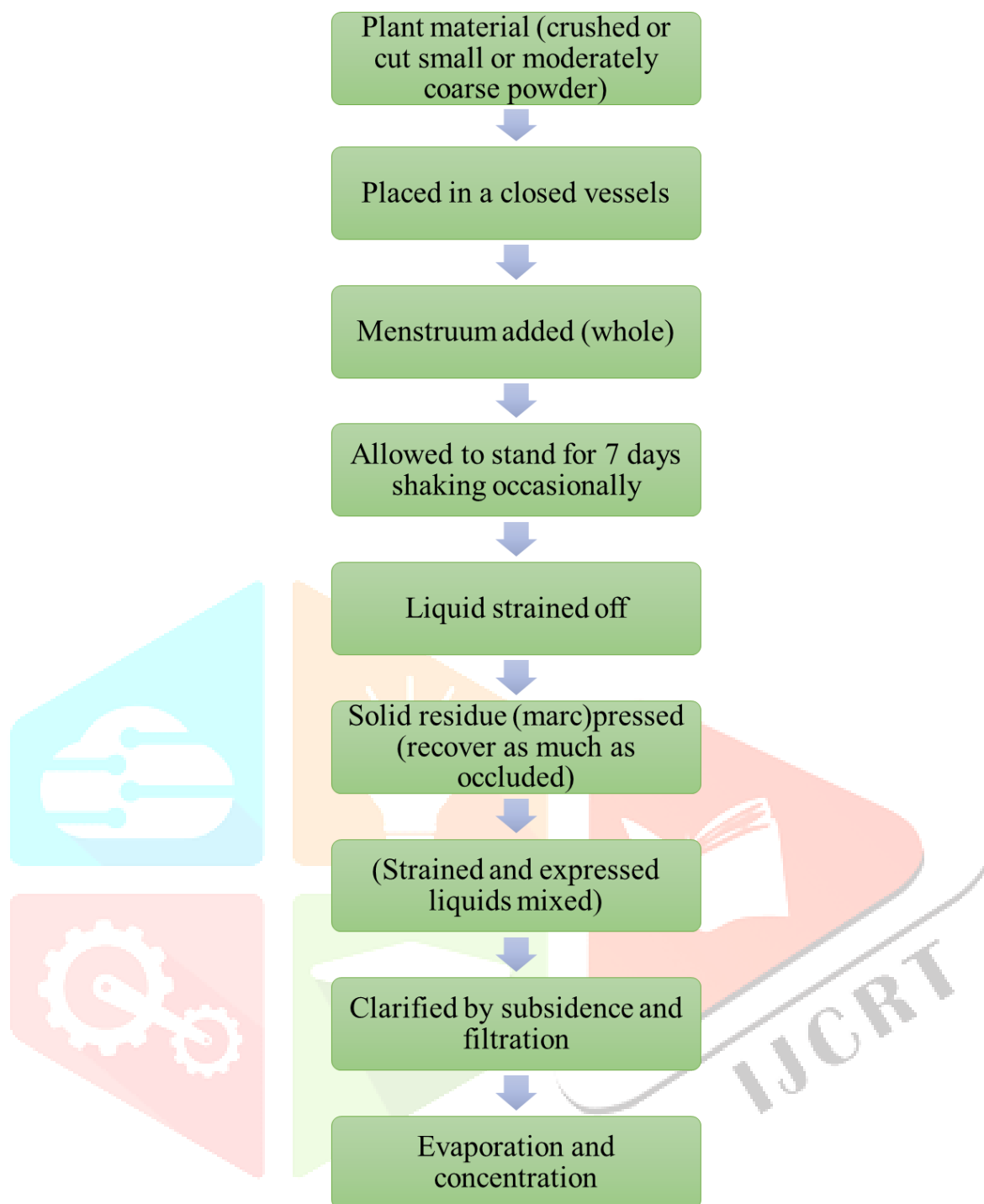
Table 2. **Chemical Constituent:** - [Phytochemical compounds present in *Carissa carandas* Linn]

Extraction: -

Fresh fruit in the unripe stage, fresh fruit in the ripe stage, fresh fruit in the fully ripe stage, dried fruit in the unripe stage, dried fruit in the ripe stage, and dried fruit in the fully ripe stage were the phases for which the percentage yield of six extracts from *C. carandas* fruits was measured. [7]

The corresponding yields were 5.33, 4.70, 5.28, 32.40, 38.59, and 38.30. The yields of the dried fruit extracts were noticeably higher. The drying process, which eliminates extra water and enzyme activity from the cells, could be the cause of this. The dried fruit is therefore more suitable for the extraction process since it provides free bonding and reduced viscosity. Maceration, which employs solvents like ethanol or ethyl acetate, is the most widely used technique [8].





Pharmacological activity: -

1. Anti-inflammatory activity: -

Methanol extract from dried fruits was tested for its anti-inflammatory properties in rats with carrageenan-induced hind paw oedema. Methanolic fruit extract demonstrated a dose-dependent pattern of substantial paw volume reduction (76.12%) at 400 mg/kg. Through the use of gas chromatography and mass spectrometry (GC-MS) analysis, about eleven bioactive components were eliminated from the methanol extract of dried *C. carandas* fruits.

2. Antinociceptive and anthelmintic activity (To relieve the pain and to kill the pain): -

The crude drug's methanol leaf extract was examined for cytotoxic, anthelmintic, and antinociceptive properties. An acetic acid-induced writhing assay in Swiss albino mice was used to assess the antinociceptive effect of *C. carandas*, while the fresh plant leaf juice's anthelmintic activity was assessed by timing the paralysis and death of *Phreesia post-Huma* earthworms.

3. Antineoplastic properties: -

The methanolic leaf extract of *C. carandas* (MLCC) was evaluated for its in-vitro cytotoxic effect as well as its in-vivo antineoplastic and antioxidant qualities. While MLCC reduced the growth of adenocarcinoma cells in a dose-dependent manner in the in-vitro cytotoxic study, the plant extract significantly reduced the viability of the EAC cell count at a dose of 25 mg/kg in the in-vivo experiments. This, in turn, increased the lifespan of EAC cells (Ehrlich Ascites Carcinoma) in the mouse model. Furthermore, the treated mice were able to return the haematological parameters—specifically, white blood cells and red blood cells—to their baseline levels.

4. Antioxidant activity: -

A higher proportion of the naturally occurring active element, anthocyanin, was found in plants like karonda, mulberry, and blackberry. The purpose of the study was to find out how much anthocyanin, an antioxidant, is present in Thai traditional fermented pork sausage (Nham) and lactic acid bacteria (LAB). The collection of anthocyanin and phenolic compounds in the extracts is greatly influenced by the type of solvent used, which also has an impact on the antioxidant qualities. The antioxidant-enriched extracts with the highest anthocyanin content were obtained from *C. carandas* extract in 95% ethanol with 1% hydrochloric acid. After that, the extract was combined in equal parts with the Nham batter and let to ferment at 30 degrees Celsius. The pH of Nham was lowered during the fermentation process due to an increase in lactic acid bacteria and lactic acid concentration. When Nham's pH reached 4.5 after 36 hours of fermentation, the reaction was halted. It was discovered that the anthocyanin had no effect on the fermentation process, and a noteworthy outcome was obtained.

5. Anti-diarrheal properties:-

Steroid-containing plants were able to improve intestinal absorption of water and sodium ions (Na⁺). When compared to the conventional medication, loperamide (5 mg/kg), the total number of moist faeces was significantly decreased by *C. carandas* ethanolic fruit (EFC) and root extracts (ERC) at doses of 200 and 400 mg/kg. When compared to the usual medication atropine sulfate, even the ethanol component of both plant parts reduced the propulsion of charcoal meal through the gastrointestinal tract (GIT). The greatest dosages of both plant part extracts had effects comparable to those of the usual medication, according to the results. The plant was found to have an anti-diarrheal effect.

6. Anticonvulsant activity:-

Both chemically and electrically induced seizures were significantly reduced by the ethanolic root extract of *C. carandas* (ERCC). In a mouse model, ERCC's anticonvulsant effect against seizures caused by maximum electroshock, pentylenetetrazole, picrotoxin, bicuculline, and N-methyl-dl-aspartic acid was assessed at doses of 100, 200, and 400 mg/kg, i.p. According to the findings, ERCC at doses between 100 and 400 mg/kg significantly shortened the interval between seizures brought on by maximal electroshock. The rats were completely protected against tonic-clonic seizures caused by pentylenetetrazole at doses of 200 and 400 mg/kg. Additionally, the start of tonic-clonic seizures caused by picrotoxin and N-methyl dl-aspartic acid was significantly delayed. On the other hand, the root extract had no discernible impact on seizures brought on by the use of bicuculline.

7. Hyper-lipidemic activity: -

In rats with egg yolk-induced hyperlipidemia, the lipid-lowering potential of an aqueous extract of *C. carandas* has been studied. In model-induced rats, the extract significantly decreased body weight, cholesterol, triglycerides, high-density lipoprotein (HDL), and low-density lipoprotein (LDL), according to the researchers' findings. Every outcome was contrasted with atorvastatin, the common medication. The extract has even considerably decreased the histopathological alterations in a diet high in cholesterol.

8. Hepatoprotective activity: -

Using carbon tetrachloride-induced hepatotoxicity in albino rats, a methanolic extract of *C. carandas* leaves demonstrated a hepatoprotective effect. In addition to histological investigations, biochemical markers such as total bilirubin, direct bilirubin, SGPT, and SGOT were examined. All the outcomes were contrasted with those of animals who received silymarin treatment.

9. Haemolytic activity: -

The researcher analysed the antioxidant and hemolytic qualities of n-hexane root extract using GC-MS. Several assays, including reducing power, DPPH, total phenol content (TPC), total flavonoid content (TFC), and antioxidant activity in the linoleic acid system, were used to measure antioxidant activity. The results showed that the herb extract had an IC₅₀ of 12.53 to 84.82% for DPPH, 1.79 to 4.35 GAE mg/g dry extract of TPC value, 1.91 to 3.76 CE mg/g dry extract of TFC value, and 41.0 to 89.21% of % peroxidation inhibition in the linoleic acid system. Additionally, corn oil, which is thought of as the oxidation substrate, was used to assess the extract's antioxidant activity. By measuring the conjugated diene, conjugated triene, and free fatty acid, changes in the oxidation reaction were identified. The percentage of lysis and the cytotoxicity parameters measured against human red blood cells were examined within the 1.01–6.01% range. The plant may be used as one of the possible sources in the form of antioxidant agents in several food sectors, according to the analysis above [9].

10. Antimalarial activity: -

Malaria is a serious parasite disease that has an impact on people's health all over the world. It is necessary to look for new antimalarial medications derived from plants because of the rise in treatment resistance to malarial parasites. Thus, Bapna et al. examined the in-vitro antimalarial activity of three distinct plant parts (leaf, stem bark, and fruit) of the *C. carandas* plant against the *Plasmodium falciparum* 3D7 strain to achieve the aforementioned goal.

11. Heart-related activity: -

Cardiovascular disease includes a wide range of conditions that impact both the heart and the blood arteries, including coronary artery disease, heart attacks, heart failure, excessive blood pressure, and stroke. According to estimates from the World Health Organization, the disease kills almost 30,000 people per day. In 2012, Shamim and Ahmad investigated the potential of plants as a safe and efficient treatment for cardiovascular illnesses. They assessed the impact of *C. carandas* extract on the cardiovascular function of normal rats. When this extract was administered intravenously as a bolus at doses ranging from 5 to 45 mg/kg, arterial blood pressure decreased in a dose-dependent manner ($p < 0.001$). The mean arterial blood pressure was significantly reduced (50.75%) by the 45 mg/kg dosage. Following CC injection at a dose of 45 mg/kg, a substantial decrease in heart rate frequency was noted ($p < 0.001$). The outcomes were like those of acetylcholine 10–4 M. The researchers concluded that the ethanol extract from *C. carandas* had a strong acute hypotensive impact on healthy rats. It activates the muscarinic receptors on the vasculature's endothelial cells. Nitric oxide or endothelial-derived relaxing factors are released because of this stimulation, and these substances diffuse to the smooth muscles of the vasculature, causing them to relax.

12. Anti-ulcer activity: -

Meraï and Jadhav tested various *C. carandas* extracts, given orally at a dose of 500 mg/kg, on various stomach ulcer models, including ethanol-induced acute gastric ulcer, pylorus ligation, and acetic acid-induced chronic gastric ulcer. Every extract accelerated the healing of chronic stomach ulcers caused by acetic acid ($p < 0.05$). The researchers concluded that *C. carandas*' alcoholic extract has very strong anti-ulcer properties.

13. Anti-diabetic activity: -

Gaurav et al. assessed the impact of *C. carandas* aqueous extract on Wistar rats that were normoglycemic and alloxan-induced. They discovered that the extract at doses of 500 and 1000 mg/kg significantly ($p < 0.05$) reduced the blood glucose levels of alloxan-diabetic Wistar rats at 4, 8, and 24 hours. The researchers concluded that the doses of plant extract had both substantial ($p < 0.05$) antihyperglycemic and hypoglycaemic effects. Additionally, by screening methanol extract and its fractions in rats with diabetes induced by alloxan, Itankar et al. showed the plant's anti-diabetic potential. When compared to diabetic control, the investigators found that the methanol extract and its ethyl acetate soluble fraction considerably reduced raised blood glucose levels at a dose level of 400 mg/kg per month after 24 hours. While the flavonoid content of both extracts was 2.92 ± 0.03 mg and 1.534 ± 0.30 mg (rutin equivalent/g extract), respectively, the polyphenol content of the methanol extract and its ethyl acetate soluble fraction was 15.8 ± 1.2 mg and 18.55 ± 0.34 mg (gallic acid equivalent/g extract). The researchers concluded that the ethyl acetate fraction's partial purification through fractionation, which raised the degree of polymerization and segregated secondary metabolites, is what gives it the ability to prevent diabetes more effectively than methanol extract [10].

14. Activity against Microbes: -

It has long been known that a variety of crude extracts and isolated chemicals from various natural resources—particularly plants—are a rich supply of chemical compounds that can be used to prevent fungal and bacterial diseases. The Agar disk diffusion assay, Agar dilution assay, broth microdilution assay, and minimum inhibitory concentration (MIC) assay are among the various assays that have been employed in the literature to screen plant extracts for antimicrobial activity. The most popular and reliable technique for determining a microbe's (bacteria's or fungi's) resistance to an antimicrobial medication or agent is MIC. The table provides a summary of documented antimicrobial tests conducted on extracts from the leaves, stem, and roots of various *Carissa* species against strains of both Gram-positive and Gram-negative bacteria as well as some fungi that cause human infections.

<i>Carissa</i> Species	Plant Part Used	Extract/Compound	Microorganisms	MIC (mg/mL)
<i>C. spinarum</i> (syn. <i>C. opaca</i>)	Roots	Ethyl acetate	<i>Pseudomonas aeruginosa</i> , <i>Bacillus subtilis</i>	0.007–0.008
<i>C. spinarum</i>	Leaves and roots	Methanol and ethanol	<i>Escherichia coli</i> , <i>Staphylococcus aureus</i>	0.312–2.5
<i>C. spinarum</i> (syn. <i>C. lanceolata</i>)	Roots	Root bark methanol, root bark dichloromethane, root wood methanol, root wood, dichloromethane	<i>Bacillus subtilis</i> , <i>Escherichia coli</i>	2.5–20
<i>C. carandas</i>	Fruits	Dichloromethane	<i>Staphylococcus aureus</i> , <i>Escherichia coli</i> , <i>Klebsiella pneumonia</i> , <i>Enterococcus faecalis</i>	0.31–5
	Leaves, stems, and roots	Petroleum ether, water, and methanol	<i>Bacillus subtilis</i> , <i>Agrobacterium tumefaciens</i> , <i>Pseudomonas aeruginosa</i>	0.078–1.25
<i>C. macrocarpa</i>	Fruits	Hydroethanolic	<i>Escherichia coli</i> , <i>Pseudomonas aeruginosa</i> , <i>Enterococcus faecalis</i>	10–20
	Leaves, stems, and flower	Hydroethanolic	<i>Escherichia coli</i> , <i>Enterococcus faecalis</i> , <i>Listeria monocytogenes</i>	0.62–20
	Fruits, stems, and flowers	Essential oil	<i>Salmonella enterica</i> , <i>Staphylococcus aureus</i> , <i>Bacillus subtilis</i>	0.46 -7.5

C. macrocarpa (Syn. <i>C. grandiflora</i>)	Stems, roots, and leaves	Methanol, <i>n</i> -butanol, ethyl acetate, chloroform, <i>n</i> -hexane	<i>Staphylococcus aureus</i> , <i>Escherichia coli</i> , <i>Staphylococcus epidermidis</i>	0.24–2.69
C. spinarum (syn. <i>C. opaca</i>)	Roots	Ethyl acetate, acetone	<i>Candida albicans</i> , <i>Alternaria solani</i> , <i>Aspergillus flavus</i>	0.05–0.1
	Roots	Ethyl acetate	<i>Candida albicans</i>	0.007
C. macrocarpa	Fruits	Essential oil	<i>Candida albicans</i>	0.46
C. spinarum (syn. <i>C. lanceolata</i>)	Wood	Dehydrocarissone (15)	<i>Staphylococcus aureus</i> , <i>Escherichia coli</i> , <i>Pseudomonas aeruginosa</i>	0.5–2
		Carindone (16)		0.5–1
		Carissone (3)		0.1–2
C. spinarum (syn. <i>C. lanceolata</i>)	Roots	2-Hydroxyacetophenone (13)	<i>Bacillus subtilis</i> , <i>Staphylococcus aureus</i> , <i>Escherichia coli</i> , <i>Pseudomonas aeruginosa</i>	1.25
		Carinol (6)		1.25
		Carissone (3)		5–10
C. macrocarpa	Fruits	3 β -Hydroxyolean-11-en-28,13 β -olide (14)	<i>Escherichia coli</i> , <i>Enterococcus faecium</i> , <i>Staphylococcus saprophyticus</i> , <i>Klebsiella pneumonia</i> , <i>Pseudomonas aeruginosa</i> , <i>Staphylococcus aureus</i>	0.06–0.12

Table 3. Antimicrobial potential of *Carissa* species.

15. Antipyretic Activity: -

Several investigations confirmed the traditional usage of *Carissa* leaves and roots to cure fever and pain by observing their antipyretic properties. The considerable action ($p < 0.05$) of the ethanolic extract was reported by Hegde and Joshi after they found that the ethanolic root extract from *C. spinarum* (100, 200, and 400 mg/kg) decreased the body temperature in Wistar rats (Brewer's yeast-induced pyrexia). Additionally, Garg et al. demonstrated that the aqueous extract of *C. carandas* leaves at all dose levels (100, 200, and 400 mg/kg) had considerable antipyretic action ($p < 0.01$) in comparison to 200 mg/kg of paracetamol. Methanolic extracts of *C. carandas* leaves and roots at 100 and 200 mg/kg also decreased ($p < 0.01$) pyrexia in the albino rats in a dose-dependent manner, according to Hati et al. and Bhaskar and Balakrishnan. Gitahi claims that in comparison to the medication (100 mg/kg, aspirin), the leaves and root bark extract (dichloromethane: methanol) of *C. spinarum* (syn. *C. edulis*) exhibit strong antipyretic properties at 50, 100, and 150 mg/kg concentrations. However, in a yeast-induced hyperpyrexia paradigm in male albino rats, Allam et al. likewise demonstrated the strongest antipyretic potential of the crude methanolic extract and butanol fraction of the aerial portions (leaves and stem) of *C. macrocarpa* at 100 mg/kg. The typical medication was 100 mg/kg of acetylsalicylic acid.

Additional in vivo research is required to confirm the traditional use of various portions of the genus *Carissa*, as the antipyretic data indicate that the authors utilized a high concentration of extracts for the experiments.

16. Antiarthritic Activity: -

In Freund's adjuvant-induced polyarthritis model in rats, Hegde et al. found that ethanolic root extracts of *C. spinarum* (100, 200, and 400 mg/kg, p.o.) and phenylbutazone (100 mg/kg, i.m.) had significant ($p < 0.05$) and dose-dependent anti-arthritic activity. In addition, Dar et al. investigated the antiarthritic effects of ethanolic leaf extract from *C. carandas* (200 and 400 mg/kg) in rats with adjuvant-induced arthritis. They found that the ethanol extract reduced ($p < 0.01$) the volume of the paws in comparison to aspirin (50 mg/kg). The authors attribute this characteristic to the phytoconstituents' capacity for synergy. Lanost-5-en-3 β -ol-21-oic acid may be the cause of the noteworthy antiarthritic potential of *C. spinarum* and *C. carandas* leaf and root extracts, according to the results presented above. It is necessary to investigate the function of other phytocompounds in the genus.

17. Adaptogenic Activity: -

Using models of anoxia stress tolerance, swimming endurance, and immunosuppression brought on by cyclophosphamide (experimental mice), Arif et al. screened the crude ethanolic extract and a lanostane triterpenoid, lanost-5-en-3 β -ol-21-oic acid, from the *C. carandas* fruit ethanolic extract (of 200, 100, and 10 mg/kg/day). The typical medication used was aspirin (25 mg/kg). When cyclophosphamide-treated mice showed improved swimming endurance, anoxia stress tolerance, and normalcy of parameters including Hb, afflicted organ, RBC, WBC, and body weight ($p < 0.05$ and $p < 0.01$, respectively), the authors noted the significant significance of crude extract and lanostane triterpenoid. As a result, the scientists demonstrated that lanostane triterpenoid and its crude extract had notable adaptogenic activity [11].

Ayurvedic Properties: -

1. Rasa (Taste) - Amla (Sour), Tikta (Bitter)
2. Guna (Quality) – Guru (heavy)
3. Veerya (Potency) – Ushna (Hot)
4. Vipaka (Post digestive effect) - Amla (Sour)
5. Doshaghnata (Disease pacifying effect) - Vatashamaka (Pacifies vata)
6. Rogaghnata – Trishna (Thirst), Aruchi (Tastelessness), Agnimandya, (Indigestion) Prashitada IJPBA, Jul - Aug 2013, Vol. 4, Issue, 4 (Dental diseases), Vatavikara (Diseases of vata), Yakridvikara (Diseases of the liver), Visphota (Boils), Vishavikara (Diseases due to poisoning)
7. Karma - Ruchya (Enhances taste), Deepana (Improves digestion), Sara (laxative), Bhedana (purgative), Vamaka (Emetic), Mootrajanana (diuretic), Vishaghna (Combats poisoning). Doses – Juice – 10-20 ml. It enhances taste, increases pitta, kapha, and rakta, and mitigates thirst, vata, ripe fruit is light sweet and mitigates kapha and rakta. It is said to be of 2 types. Big and small ones, Bigger ones are the routine ones which are very sour whereas the smaller ones are the wild varieties which are sweet. The properties of ripened and unripe fruits differ. Unripe fruits are appetizers and cause a burning sensation, whereas ripened ones pacify the 3 doshas and combat tastelessness and poisoning [12].

Toxicity: -

When Swiss albino rats of either sex weighing from 150 to 180 g were orally administered with karonda fruit powder extract did not show either sign of toxicity or mortality up to the dose of 2000 mg/kg body weight. The extract was prepared using Soxhlet extraction with ethanol followed by evaporation and then dissolved in 2 % tween 80. Administration and observation were reported based on OECD guideline no.424. A similar study was reported in male Wistar rats weighing 150–250 g divided into 5 groups with 6 rats in each group. It reported that oral administration of 500–5000 mg/kg body weight of acetone extract of karonda fruit (immature, mature, and ripe fruits respectively) showed no sign of lethality up to a dosage level of 2000 mg/kg for an observation period of 24 h. This indicates that karonda fruit extract is a safe drug with potent application in pharmacology [13].

Conclusion: -

C. carandas, an evergreen, deciduous shrub with immense medicinal value has been reviewed to provide a reference source for biology, taxonomy, phytochemistry, pharmacology, and conservation strategy for further research on the plant. pharmacological studies strengthen the concept of utilizing the *C. carandas* plant as a source to facilitate safe and effective herbal treatments for biological problems. Furthermore, the review aims to provide a direction for further clinical research.

Future Scope: -

Some Future aspects of *Carissa carandas*: -

1. Nutraceutical potential: -

Research indicates that Karonda fruit extracts possess significant antioxidant and anti-inflammatory properties, making them suitable for development into functional foods and nutraceuticals aimed at promoting health benefits like improved immunity and anti-ageing effects.

2. Cosmeceutical applications: -

Extracts from Karonda are being explored for their potential in skincare products due to their anti-tyrosinase activity, which could contribute to skin brightening and anti-wrinkle effects.

3. Pharmaceutical potential: -

Studies are investigating the antimicrobial and anti-bacterial properties of Karonda extracts, potentially leading to the development of natural antimicrobial agents.

4. Sustainable agriculture: -

As a hardy plant that can thrive in diverse climates, Karonda has the potential to be cultivated sustainably, offering a valuable source of nutrients in regions with limited agricultural options.

5. Product diversification: -

Beyond fresh consumption, Karonda fruit can be processed into various products like jams, jellies, juices, beverages, pickles, and even alcoholic drinks [14].

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