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A REVIEW ON ANACARDIUM OCCIDENTALE

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Abstract:
Plants are the basis of traditional medicines throughout this world for many thousands of years. In many countries population relies on the remedies of medicinal plants for health care. One of such plant is Anacardium occidentale which is Generally known as cashew tree. It is a member of Anacardiaceae family . Anacardium is one of the most important genera of the family Anacardiaceae . This is most important due to cashew nut. this cashew nut has many medicinal properties and is used for industrial purposes. Anacardiaceae is a family of 74 genera and 400-600 Species . Nearly all the Anacardium species are present in Brazil. A occidentale's nutshell ,leaves, bark and fruits possess many therapeutics properties. cashew is rich in various chemical constituents in various parts of the plants that possess potential health benefits. cashew nut shell liquid, which is a by-product of cashew nut processing rich in phenolic lipids. this review accumulates all the existing literature of A. occidentale highlighting it's details which is helpful for research.

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INTRODUCTION:

Anacardium occidentale contain many pharmacologically active plant constituents .Main constituents that are responsible for pharmacological benefits are β- phellandrene, linalool, methyl chavicol, germacrene B, germacrene D etc. The aim of this review is to highlight its nutritional health benefits, pharmacological activities. A occidental L. is a part of Anacardiaceae family. The word "ana" meaning "Upwards" and "Cardium" meaning "heart". Anacardium occidentale is an evergreen ,medium - sized tree that can grow upto a height of 12m. It consists of a prominent taproot & it is much branched. the generic name of Anacardium occidentale L. was given by Linnaeus, means the heart shaped look of the false fruit [1].

TAXONOMICAL CHARECTERISTICS:

Kingdom	Plantae
Subkingdom	Tracheobionta (vascular plant)
Super division	Spermatophyta (Seed plants)
Division	Magnoliophyta
Class	Magnoliopsida(dicotyledons)
Subclass	Rosidae
Order	Sapindales
Family	Anacardiaceae
Genus	Anacardium L.
Species	Occidentale

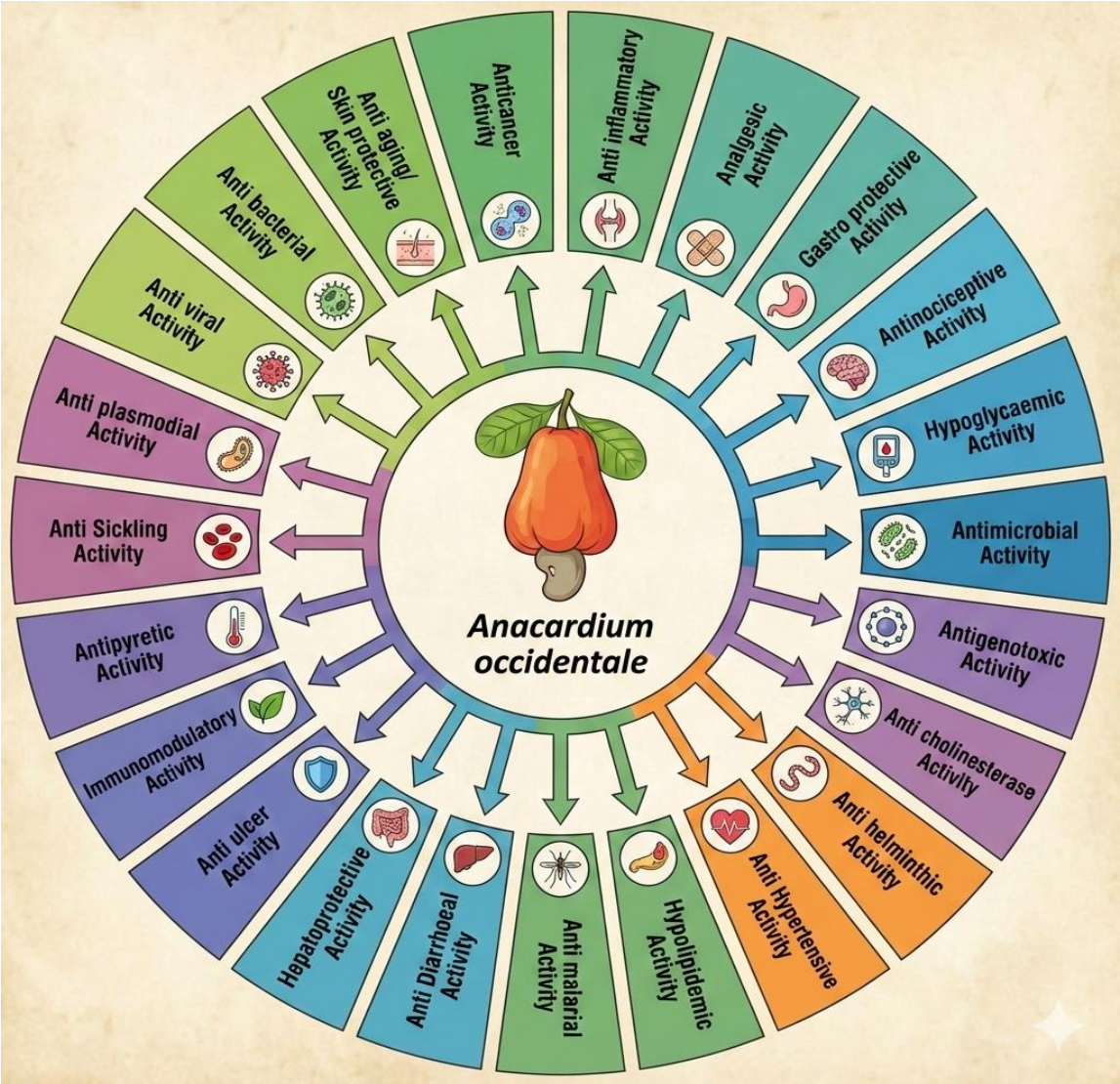
PLANT PARTS	CHEMICAL COMPOSITION
LEAVES	2-hydroxy-6-pentacylbenzoic acid Hyperoside (quercetin 3-galactoside) Amentoflavone derivative Kaempferol- 3-o-arabinofuranoside Kaempferol-3-o-arabinopyranoside Kaempferol-3-o-xyloside Quercetin-3-o-xyloside Agathisflavone Quercetin-3-o-rutionside.
CASHEW APPLE	2,6-dihyroxybenzoic acid Gallic acid 5-hydroxy methyl furfural cinnamic acid Protocatechuic acid Myricetin-o-glycoside Myricetim 3-o-hexoside of methyl cyanidin Rhamnetino-glycoside 5-methyl cyanidin chloride.
CASHEW NUT	Cyanidin Peonidin Anacardic acid Cardanol (decarboxylated anacardic acid) Cardol Salicylic acid Delphinidin 2- methyl cardol Trans-linoleic acid Diethyl phthalate Dimethyl anacardate
FLOWER	Ethylgallate Hyperoside Quercetin Benzyl tiglate Methyl salicylate
STEMBARK	Gallic acid (+)-catechin Stigmast-4- en-3one, Stigmast -4-en-3-0I (-) epicatechin (-) -epigallocatechin Octodecanoic acid 2,3-dihydroxypropyl ester.

GEOGRAPHICAL DISTRIBUTION:

Anacardium occidentale (cashew tree) is native to Brazil, from there it gradually spread across to many tropical and some subtropical regions .This species is cultivated widely across the countries that offer warm temperatures , moderate rainfall, and a short dry season . These conditions are essential for optimal growth[2].

The Portuguese introduced the cashew tree to India from Brazil in the sixteenth century ,and from the south-western coast it expanded across the entire Indian subcontinent . through ports such as cochin ,cashew later reached southeast Asian countries as well . over the years , cashew cultivation has expanded rapidly ,and global production has undergone major geographic shifts.

Currently the major cashew – production countries are Brazil , India, Vietnam, Nigeria ,and Tanzania, which together for nearly three-quarters of the world's output . Vietnam has shown the most dramatic growth , becoming the world's leading



producer by 2002 due to significant expansion in cultivation and processing.
Present, India cultivates cashew across approximately 730,000 hectares, but its production is still insufficient for domestic processing industries , resulting in imports from several African and Asian countries.
Africa has tradition been an important cashew - growing region . In the early 1970s, a global production of cashew was led by Mozambique but due to it's political disruptions it caused a major decline[3].

Few countries like Tanzania , Nigeria , and Guinea - Bissau continue to be significant contributors of Anacardium.Since the 1980s, Indonesia also expanded its cashew cultivation area substantially ,it became one of the notable Asian producers.Overall cashew cultivation spreads widely across tropical regions , including much of south America ,Africa ,south Asia, southeast Asia, and several tropical pacific regions . It's wide distribution and presence reflects both the plant's adaptability across many regions and It's increasing economic importance[4].

PHARMACOLOGICAL ACTIVITIES OF ANACARDIUM OCCIDENTALE :
Anacardium occidentale exhibit various pharmacological activities including Antioxidant,Anti Hypertensive, Anti inflammatory, Wound healing, Anti microbial Activity etc. Anacardium occidentale plant extract contains bioactive chemical constituents which are responsible for various pharmacological activities.
It's bark and leaves possess strong astringent and antidiarrheal activity[5].
Overall it's a medicinal plant with broad therapeutic potential.

ANTICANCER ACTIVITY:

- Oral cancer is the serious health problem in India. It ranks as fifth most predominant type of cancer worldwide [6].
- However, Anacardium occidentale L. contains significant concentration of bioactive constituents which helps to fight oral cancer Cashew nut shell contains a chemical compound called cardanol.
- Cardanol is a bioactive phenolic compound that possess significant medicinal uses
- An Insilico analysis was made to find its potential to fight oral cancer
- Cardanol might work at the gene and cell signalling levels to treat this .
- Researchers identified few oral cancer related genes from the database &compared with those gene targeted by cardanol
- As a result 23 genes were found to be influenced by cardanol that the linked to important cancer processes (cell migration , cell proliferation cell Apoptosis, PBK-AKT signalling etc.
- The main genes affected (eg:- PIK3CA,CCND1,MMP1,MTOR) are found to be involved in the P13K signalling pathway.
- This suggests the cardanol's anti- cancer effect might work through this pathway cardanol shows strong anti-proliferative effects
- So, cardanol could be developed in to a targeted oral cancer therapy

ANTI-INFLAMMATORY ACTIVITY:

- Ethanolic extract of Anacardium occidentale seed contains polyphenols , tannins and flavonoids (gallic acid ,protocatechuic acid etc).
- These bioactive chemical compounds are responsible for the anti-inflammatory activity of cashew plant [7].
- Researchers conducted two experimental methods for demonstrating its activity. They are HRBC membrane stabilization method and protein denaturation assay.
- HRBC membrane stabilization method: They tested the extract's ability to prevent lysis of human Red blood cells
- Tannins and some polyphenols bind to membrane proteins and lipids , There by increasing the structural stability of cell and lysosomal membranes. It prevents red blood cell lysis and reduces the release of intracellular inflammatory mediators
- As a result of this membrane stabilization method, At 150-200µg/ml, this extract showed the strong membrane stabilization.
- Protein denaturation assay: they tested the extract ability to prevent protein denaturation using egg albumin.
- Polyphenols interact with proteins and preventing the protein denaturation. They also inhibit cyclooxygenase (cox) and lipoxygenase (LOX) activity ,thereby reducing the synthesis of prostaglandins and leukotrienes which are the major mediators of the inflammation .
- At 200µg/ml, Ethanolic extract of Anacardium occidentale seed almost completely prevented protein denaturation, showing similar action to the standard drug Diclofenac.

ANTI OXIDANT ACTIVITY:

Research findings show that Anacardium occidentale contains antioxidant rich

compounds They are phenols and flavonoids in cashew nut shell. By using the phosphomolybdenum assay, one can understand the ability of these compounds to neutralize free radicles. This method compares the activity of extract to a standard antioxidant which is ascorbic acid. By measuring the absorbance and interpreting it against a standard curve, the antioxidant strength of CNSE can be expressed accurately [8].

Experimental stage of study	Objective	Observation	Outcome/ Interpretation
Sample selection	To select the test material for Antioxidant activity	Cashew nut shell extract is selected as plant based test extract	It is chosen for further phytochemical screening
Phytochemical screening	To identify chemical constituents related to Antioxidant activity	Presence of polyphenols and flavonoids	Indicates the cashew nut shell extract possess potential Antioxidant activity
Assay selection	To evaluate the total Antioxidant capacity	Invitro assay method suitable for Antioxidant estimation	Phosphomolybdenum assay selected
Selection of standard	To select the reference for standard antioxidant activity	Observed the concentration dependent absorbance	Ascorbic acid used as reference standard
Standard curve preparation	To quantity the antioxidant activity of sample	Obtained the linear standard curve	Calculation of ascorbic acid equivalents
Test sample evaluation	To determine the antioxidant capacity of cashew nut shell extract	Antioxidant response measured for test sample	Cashew nut shell extract showed significant Antioxidant activity
Reference sample evaluation	To determine the antioxidant capacity of standard drug	Antioxidant capacity of standard drug is compared with test sample	Enrofloxacin showed lower Antioxidant activity compared to test sample
Quantitative result of cashew nut shell extract	To quantify the antioxidant capacity of cashew nut shell extract	63.6 ± 0.31 µg/ml Ascorbic Acid Equivalent	It exhibits high antioxidant capacity
Quantitative result of enrofloxacin	To quantify the standard drug activity	33.605 ± 0.31 µg/ml Ascorbic Acid Equivalent	Lower antioxidant activity compared to cashew nut shell extract
Final interpretation	To correlate the results with phytochemicals	Activity contributed to flavonoids and phenols	Phytochemicals flavonoids and polyphenols exhibit strong Antioxidant activity

ANTI MICROBICAL ACTIVITY

Recent research has highlighted a global concern, bacteria is increasing it's resistance against commonly used antibiotics nowadays. This is why scientists are more concerned towards medicinal plant to discover new compound that is used as traditional medicine for years.

In this study , the acetone extract of cashew nut shell was studied to understand the phytochemicals present in it , antibacterial activity staphylococcus aureus and Escherichia coli and whether it can enhance the effect of existing antibiotics such as amoxicillin and enrofloxacin.Cashew nut shell extract shows significant antimicrobial activity especially against S. aureus, and enhances the effect of antibiotics [9].

HYPOGLYCEMIC ACTIVITY

Research findings demonstrate that the methanol leaf extract of Anacardium occidentale possesses hypoglycaemic activity in streptozotocin -induced diabetic rats.

Streptozotocin is a chemical which is commonly used in research to induce diabetes in laboratory animals. So researchers can study about antidiabetic drugs.

Scientists inject streptozotocin into rats to makes them diabetic on purpose to test whether the given drug is anti diabetic or not.

Streptozotocin-induced diabetes is commonly used experimental model to test antidiabetic drugs because it destroys the insulin -producing β-cells in the pancreas, which further leads to reduced insulin levels causing hyperglycaemia[10].
Several bioactive compounds present in Anacardium occidentale like (-) epicatechin ,kaempferol, quercetin derivatives and β- sitosterol glucoside are linked to insulin releasing effect. These bioactive molecules protects pancreas and enhance insulin secretion. other than stimulating insulin release, the extract also improves glucose control by extra pancreatic actions like reducing glucose production in the liver or increasing glucose uptake by tissues.
In the present study, methanolic extract is given in repeated doses produce a stronger Hypoglycaemic effect compared to single-dose treatment. Among all different fractions tested, the ethyl acetate fractions and n-hexane fractions showed the highest activity it indicates that both polar and non- polar compounds contribute to the glucose- lowering activities and restorative action on pancreas.
There may be other possibility that this extract may act by slowing carbohydrate digestion and absorption. This may be due to α-glucosidase inhibitors present in the plant. By inhibiting the α-glucosidase enzyme, extract may reduce sudden spikes in blood sugar.

WOUND HEALING ACTIVITY:

- Delayed wound repair results from some factors like oxidative stress , recurrent injury , insufficient oxygenation , persistent inflammation etc these condition increase the risk of complication
- Although synthetic medications are available for wound healing but thy are often associated with adverse effects , high cost and reduced patient compliance.
- The leaves of A occidentale (cashew) are rich in diverse phytoconstituents , including tannins ,flavonoids ,triterpenoids, alkaloids ,phenolic acids (gallic acid ,ellagic acid) and flavonoids such a quercetin.
- These chemical compounds are known for their anti microbial ,wound healing, antioxidant properties[11].

ANTI NOCICEPTIVE ACTIVITY:

Studies shows that Anacardium occidentale exhibits strong antinociceptive properties .it effectively reduces heat induced pain ,chemical -induced pain and inflammation -associated pain. This antinociceptive activity of activity of cashew involve both peripheral mechanisms and central mechanisms[12].

Several experimental models have shown that active compounds of Anacardium occidentale possess a significant antinociceptive (pain -relieving) effect . Animals which are pre-treated with the cashew extract showed a significant reduction in licking time in both phases.To investigate the further mechanism ,naloxone which is an opioid receptor blocker was used. It showed reduction in analgesic effect after naloxone administration . This indicates that the cashew extract may act through opioid -mediated pathways.These results indicates the tradition use of cashew plant extract in the management of both pain and inflammatory conditions.

CONCLUSION:

Anacardium occidentale is a highly valuable therapeutic and nutritional plant composed of various chemical constituents that are responsible for many pharmacological activities. These bioactive molecules are responsible for wide range of therapeutic potential. It is a multipurpose plant with more economic value and remarkable benefits. Every part of this plant – leaves, flower, bark, roots, nuts, cashew Apple and Cashew nut shell liquid contains diverse range of bioactive molecules including flavonoids, tannins, anacardic acid, phenolic acids, vitamins and minerals etc. These constituents contribute to various activities such as Antioxidant activity, Anti-inflammatory activity, Antinociceptive activity, Antimicrobial activity, Antiviral activity, Antibacterial activity, Hepatoprotective activity, Hypoglycaemic activity, Immunomodulatory activity, Wound healing activity, Anti Hypertensive Activity etc.
From nutritional perspective, cashew nut shell liquid and cashew apple offers benefits as nutritional foods by providing proteins, fatty acids, vitamins, minerals, fibres and micronutrients. Extracts of this plant offers overall cell protection by supporting their role against oxidative-stress related diseases.

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