GARCINIA GUMMI GUTTA; A PHARMACOLOGICAL UPDATE

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KEYWORDS:
Garcinia gummi gutta (L.) N. Robson, phytoconstituents, pharmacological activity, anti fungal, antibacterial, larvicidal activity, anti oxidant activity, anti inflammatory, anti cholinesterase activity.

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ABSTRACT

Garcinia gummi gutta (L.) N. Robson is one of the most diverse species among its family. It belongs to the family Clusiaeae (Guttiferae). Alkaloids, phenolic compounds, carbohydrates, steroids, proteins, terpenoids, tannins constitute the phytoconstituents of Garcinia gummi gutta. Pharmacological studies revealed Garcinia gummi gutta possess anti oxidant, antibacterial, larvicidal, antimalarial, anti obesity, anti ulcer, anti cancer and anti cholinesterase activity. Garcinia gummi gutta possess a great number of traditional uses.
INTRODUCTION:
This review emphasizes on traditionally used clinically potential plant *Garcinia gummi gutta*. It belongs to the family *clusiaceae*. It is a wild subtropical and tropical plant. The plants are shrubs or trees with yellow or greenish juices. The fruits of plant are commercially important for its valuable chemical components. Mostly these species are found in forest. Most of plants are less cultivated in homes and extensively endemic to Western ghuts. *Garcinia gummi gutta* L. commonly known as kodampuli or malabar tamarind. *Clusiaceae* family are a rich source of secondary metabolites.

DESCRIPTION

*Garcinia gummi-gutta* is an evergreen, small to medium-sized tree about with dark smooth, lactiferous bark and horizontal or drooping branches. Leaves are simple, entire, opposite, petiolate, coriaceous, glossy dark green, elliptic-ovate to obovate. Flowers are either androecious or bisexual, thus it is an andromonoecious species. The fruit is a fleshy, globose, sub-globose to ovoid berry, green turning yellow, orangey or reddish when ripe, fluted with longitudinal grooves. The Seeds are 6-8-(13) numbers, smooth, pale brown, oval, surrounded by a succulent reddish or whitish succulent aril.

TAXONOMY

<table>
<thead>
<tr>
<th>KINGDOM</th>
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<tr>
<td>PHYLUM</td>
<td>Magnoliophyta</td>
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<tr>
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<tr>
<td>FAMILY</td>
<td>Clusiaceae(Guttiferae)</td>
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<td>Garcinia</td>
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<td>SPECIES</td>
<td>Garciniagummigutta</td>
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Synonym


Full Text Available On www.ijupbs.com
**Common names**
Bitter kola, Brindali Berries, Brindal berry, Garcinia kola, Malabar tamarind, *Garcinia gummi gutta*

**Vernacular names;**
Chinese; Guan Mu
French; Gamboge tree, Gomme- Gutte
German; Gummigutt, Gummigutbaum, Gummitaz

**India:**
Kannada-Aradala, Aradal, Karkapuli, Manthulli
Hindi – Bilatti-Amli, Goraka, Velaitiimli
Malayalam- Kodampulli, Kodakkapuli, Kotappuli,
Kutappuli
Marati– Darambo, Daraambaa, Dharamba

**FLOWER**

**BARK**
FRUITS

ETHANOPHARMACOLGY

Fruit extract is used for various treatments such as astringent, rheumatism, bowel complaints and purgative. Bark and leaf extract contain alkaloid used to bowel complaints. The Kudampuli is known for its medicinal values in Ayurveda. It helps to promote digestion, and a decoction (kashayam) made out of it is used against Arthritis and some uterine diseases. It is also known to cure ulcers. The root of plant used swelling whole body due to wiper bite. *Malabar tamarind* is shown to possess antioxidant, anthelmintic, anticattarhal, anti-cancer and antimicrobial activities.

PHYTOCONSTITUENTS

Phytoconstituent from the leaves of *Garcinia gummi gutta* in methanol, ethanol and acetone extracts showed the presence of alkaloids. Tannins is present in high quantities in methanol, and ethanol extracts of leaves of *G. gummi gutta*. Phenolic compounds are one of the largest and ubiquitous of plant metabolite. Phenolic flavanoid are present in water and methanolic extract of leaves. Protein is present in all extract of leaf. Steroids present in acetone extract. Terpenoid is present in water, ethanol and chloroform extract. Cardiac glycosides were found positive in only acetone and petroleum ether extract. Phlobatannin have diuretic property. Only ethanol extract showed presence of phlobatannin.

Main component of the fruit of *G. gummi gutta* is hydroxyl citric acid (HCA) and used in anti-obesity drugs. Chemical components of fruit extract include tartaric acid, camogin, glucinol, euxanthone, reducing sugar and fats.

Flower extract of *Garcinia gummi gutta* contains the phytoconstituents such as alkaloid, carbohydrate, coumarins, proteins, phytosteroids, flavonoids, phenol, steroids and terpenoids.

The root contains the xanthone called garbogiol.

TRADITIONAL USES

*Garcinia gummi gutta* has been used traditionally for the treatment of edema, delayed menstruation, constipation, ulcers, hemorrhoids, diarrhoea, dysentery, fever, open sores, intestinal...
parasites, anti-microbial agent, anti-fungal, and as an anti-cancerous agent. *Garcinia gummi gutta* which used traditionally is also a well-established plant for reducing weight.

**PHYTOCHEMICAL STUDIES**

**Johnsy Rani et al.** conducted preliminary phytochemical analysis of *Garcinia gummi gutta* (L.) Robson western Ghats region of Kanyakumari district. In this work alkaloid could be detected in hexane, ethyl acetate and methanolic extract of leaves and while only in the ethyl acetate and methanolic extract of *Garcinia gummi gutta*. In the present study, the phenolic content was detected in the hexane, ethyl acetate, and methanolic extract of fruit. Phenolic compound should not be detected in the leaves extracts. Flavonoid content detected in hexane ethyl acetate methanolic extract of leaves and in ethyl acetate and methanolic extract of fruit. Bioactive tannins are present in the hexane, ethyl acetate and methanolic extract of fruits and methanolic and ethanolic extracts of leaves.

**Madappa et al.** conducted preliminary phytochemical analysis of leaf of *Garcinia gummi gutta* from Western Ghats. In the study shows alkaloid was present in the water, ethanolic, methanolic and acetic extracts. Tannin was present in all extracts of leaves. Saponins, Anthraquinones, Anthocyanoids are absent in all extracts of leaves. Phenolic flavonoid, flavonoid, carbohydrate and proteins were showed in water, ethanol, methanol and acetic extracts. Steroid was detected in methanolic, ethanol and acetic extracts. Terpanoid is present in water extract and crude methanolic extract. Cardiac glycoside present in acetone and petroleum ether extract. Phlobatannin only detected in crude ethanolic extract of leaves.

**PHARMACOLOGICAL ACTIVITY**

The literature reveals that *Garcinia gummi gutta* has been exhaustively explored for its pharmacological activities.

- **ANTI BACTERIAL ACTIVITY**

**M. Maridass etal.**, conducted studies on alcoholic and aqueous extract of *Garcinia gummi gutta* leaves showed significant antibacterial effect against *Aeromonas hydrophilla*, *Bacillus subtilis*, *Staphylococcus aureus*, *Salmonella typhi*, *Pseudomonas aurogenasa* and *Klebsiella pneumonia*. The positive results were seen for all extracts.

**Sivapriya Shivakumar et al.**, conducted studies on antimicrobial activity of hexane, ethyl acetate, ethanol and hydro alcoholic extract of fruit rind of *G. cambogia* in the concentration of 25μg/ml. Test organisms are *E. coli*, *B. Subtilis*, *S. aureus*, *K. pneumonia*, *P. aeruginosa*. Antibacterial activity was tested by agar well diffusion method. Study was seen that the hexane
extract showed no activity against all organisms. The positive result was seen in other all extracts. The ethyl acetate extract of *G. cambogia* exhibited better antibacterial activity against *E. coli*, *B. Subtilis*, *S. aureus*, *K. pneumonia*, *P. aeruginosa*.

J.K. Vidanarachchiet al., conducted studies on antimicrobial effect of *Garcinia cambogia* and *Tamarindus indica* on minced nematalo sagalatheae fish under refrigerated storage.

Johnsy Rani et al., conducted a studies on invitro antibacterial activity of *Garcinia gummi gutta*(L) Robson against pathogenic microorganism. In the present study the methanolic extract of leaves of *Garcinia gummi gutta* was most effective the inhibiting bacterial growth which is followed by hexane and ethyl acetate extract respectively in combacting the growth of bacterial culture.

**ANTHELMENTIC ACTIVITY**

Veeradass Rajendran et al., conducted studies on the invitro anthelmintic activity of fresh juice and crude ethanolic extract and fruits of *Garcinia cambogia*, were evaluated for their anthelmintic activity using adult earth worms. The result are summarized that fresh juice of *Garcinia cambogia* is more potent than the standard drug piperazine citrate. fresh juice showed significant anthelmintic activity at concentration of 10μg/ml, 40μg/ml and 50μg/ml. The ethanolic extract of *G. cambogia* showed anthelmintic activity in dose dependent manner. *Garcinia cambogia* showed presence of Hydroxy citric acid (HCA), dimericflavonoide, xanthones, Benozophenones, organic acid. Some of these phyto constituents may be responsible to show a potent anthelmintic activity. Both the ethanolic extract and fresh juice exhibited a dose dependent inhibition of spontaneous mobility (paralysis) and evoked response to pin-prick and death with higher doses.

**ANTI FUNGAL ACTIVITY**

DhanyaPet al., conducted studies on methanolic extract of *Garcinia gummi gutta* leaf shows antifungal activity due to the presence of flavanoids present in it. In this study, the crude extract is subjected to purification by means of normal phase column chromatography using silica gel as stationary phase and chloroform–methanol was used as mobile phase. Bioactive fraction were found to possess allelopathic effect found to contain flavonoids. Isolated flavonoid fraction was used to test antifungal activity in various fungal culture. The study showed that the *G. gummigutta* leaf extract possess fungicidal activity against Phytophtora species, Curvularia species, Cornespora species. Most fungicidal activity shows against in Phytophtora species. In phytophtora culture have maximum zone of inhibition.
LARVICIDAL ACTION
Dhanya P et al., conducted a study on the crude methanolic extract of G. gummigutta leaves were tested on Aedes aegypti. In this study, the crude extract is subjected to purification by means of normal phase column chromatography using silica gel as stationary phase and chloroform – methanol was used as mobile phase. Biofraction obtained purification was subjected to test the larvicidal activity in instar mosquito larvae. The result of the study states that the extract possesses more cytotoxic effect on third or fourth instar larva at high concentration. In low concentration they show negative effect. 95.6% larvicidal activity observed in the concentration of 3 mg/ml. LD50 was exhibited by a concentration of 2.5 mg/ml. The activity is increased by increasing concentration of the compound. So study suggested that flavonoid compound isolated from Garcinia gummi gutta leaves possessing the ability to kill the mosquito larvae at higher concentration.

ANTI MALARIAL ACTIVITY
Valsaraj et al., evaluated Garcinia gummigutta (Guttiferae) and Mammea longifolia (Guttiferae) against malarial parasite at a concentration of 100 mg/ml. The percentage of growth inhibition induced by Garicinia and Mammea was found to be 99.5 and 86%, respectively.

ANTI OXIDANT ACTIVITY
T.U. Jayaratne et al., purposed a study to investigate the antioxidant of Garcinia cambogia and Tamarindus indica on minced Nematalosagalatheae fish during storage at 4°C. Antioxidant activity was measured by DPPH method. Polyphenolic content was quantified by Folin-Ciocalteau’s reagent assay and expressed as gallic acid equivalents. Ethanolic extract of fruits of Garcinia and Tamarind extracts have a potential to retard the lipid oxidation and microbial load in minced fish, there is a potential to be used these extracts as natural antioxidants in fish products. Result of the study shows the Tamarindus indica was more potent antioxidant than Garcinia cambogia extract.

Thamizh Selvam et al., conducted Antioxidant activity of methanolic extracts of G. gummigutta leaf studied in the paracetamol intoxicated wistar albino rats. In this study animals devided into three groups one considered as healthy control, one group considered as paracetamol-treated disease control group and third group of animals was treated with paracetamol with Garcinia gummi gutta extract. SGPT, ALKP and total protein level was measured in each group of animals and compare the results obtained. SGPT, ALKP and total protein level significantly increased in the disease control. Where as extract treated group showed SGPT, ALKP and total protein level significantly
decreased. Result of this work shows *G. cambogia* possess both anti oxidant and anti hepatotoxicity activity.

**Ranjani R et al.,**\(^{15}\) conducted studies on Antioxidant profile of fruit rind of *Garcinia cambogia* and leaves of *Bauhinia variegate* – An *in vitro* investigation. Antioxidant activity was measured by DPPH free radical scavenging activity, nitric oxide radical scavenging activity, hydrogen peroxide radical scavenging activity, super oxide anion radical scavenging activity, hydroxyl radical scavenging activity and estimation of reducing power activity. Study shows *G. cambogia* ethyl acetate extract is less efficient in scavenging NO, DPPH, SO and H2O2 whereas it is more efficient in scavenging hydroxyl radical and has high reducing activity.

**Shivapriya Shivakumar et al**,\(^{16}\), conducted *in vitro* assessment of antibacterial and antioxidant activities of fruit rind extracts of *Garcinia cambogia* L. The antioxidant activity was measured by DPPH assay, hydroxyl radical scavenging activity and ferric thiocyanate assay methods. The result of the study shows hexane, ethyl acetate, ethanol and hydroalcoholic extracts of *G. cambogia* are able to reduce the free radical. The percentage of DPPH inhibition was found more in ethanolic extract. The percentage of hydroxyl radical scavenging activity was higher in hydro alcoholic extract followed by ethanol and ethyl acetate extracts.

**N. Subhashinietal.,**\(^{17}\) Proposed works on antioxidant and anticholinesterase activities of *G. cambogia*. Antioxidant activity of aqueous extract of fruit rind of *Garcinia cambogia*. Based on the various *in vitro* assays like FRAP methods, TRAP methods and assay of lipid peroxidation method, it can be concluded that the water extract of *G. cambogia* fruit rinds possessed strong antioxidant activity. Evidenced by the free radical scavenging property, iron chelating, and reducing power property, which may be due to the presence of phenolic components in the extract.

**Sharmila P etal**,\(^{19}\), conducted a studies on Phytochemical profile and *in vitro* antioxidant activity of *Garcinia gummi gutta*(L) peel extract. The study concluded that methanolic peel extract of *Garcinia gummi gutta*.L possess most phytochemical constituents and higher free radical scavenging activity.

**ANTITHROMBOTIC ACTIVITY**

**Asika EC etal**\(^{20}\) conducted studies on preliminary investigation of antithrombotic activity of methanolic seed extract of *Garcinia cambogia* in rats. In the study, the preliminary phytochemical analysis of seed extract of *Garcinia cambogia* showed in abundance the presence of glycosides, flavonoids and resins while reducing sugar and proteins are present significantly. Alkaloids and tannins are present while carbohydrates, saponin and oil were absent. Methanolic extract of *Garcinia cambogia* seed was administerd orally. Collected the datas of hematological indices –
bleeding time, clotting time, as well as platelet counts. When compared with values obtained from rats treated with the controlled drugs-normal saline and aspirin-even though in most instances the extract proved to be a good antithrombotic agent. Where this is true, the antithrombotic effect produced by the extract did not however prove to be superior to the antithrombotic effect produced by aspirin. It should be noted nevertheless that, in the case of clotting time where the extract had superior effect to aspirin, implying that the extract has a significant ability to decrease the thromboplastin level in blood.

**ANTI INFLAMMATORY ACTIVITY**

Trishna Debnath et al., conducted a studies on The anti-inflammatory activity of a *Garcinia gummi-gutta* extract was assessed in TNBS-induced colitis rats. The extracts treatment improved the macroscopic damage and reduced MPO activity, COX-2 and Inoexpression. It was also able to reduce PGE2 and IL-1β colonic levels. It did not show any mortality nor toxicity signals after oral administration.

Karmakar Ruma et al., conducted a studies on anti-inflammatory, antioxidant, antimicrobial and cytotoxic properties of fungal endophytes from garcinia species. Study clearly demonstrated diversity and bioactive properties of endophytes from Garcinia species.

Prasanth NV et al., conducted studies on the evaluation of in vitro and in vivo anti-inflammatory activity of leaves of *Garcinia combogia*. Anti inflammatory activity was determined by HRBC membrane stabilization method and invivo carrageenan induced paw edema methods. Result shows that the leaves of the plant *Garcinia combogia* posses appreciable anti-inflammatory activity especially against carrageenan induced paw edema in rats. It also possessed moderate in vitro anti-inflammatory action in HRBC membrane stabilization method.

**ANTI CHOLINESTERASE ACTIVITY.**

N. Subhashini et al., Proposed works on antioxidant anticholinesterase activities of *G. cambogia*. Water extract of fruit rind of *Garcinia cambogia* fruit rind prepared by simple maceration procedure. Anticholinesterase was biologically important enzyme that hydrolyzes acetyl choline, a neurotransmitter consider to play role in pathological condition like alzhimers disease. Acetyl cholinesterase activity determined by invitro acetylcholinesterase inhibition assay .Based on the study, a dose dependent inhibition of AChE was found. Neostigmine inhibited AChE to an extent of 92% which was significantly higher ($p =0.05$) than *Garcinia combogia* extract was found to inhibit AChE to an extent of 67.3% at 1 mg/ml concentration.
A WEIGHT CONTROLING AGENT

The fruit rind of *G. cambogia* contain hydroxyl citric acid (HCA) abundantly. The biological effect of HCA is mainly in the inhibition of extra mitochondrial cleavage of citrate to oxaloacetate and acetyl-CoA. Once acetyl-CoA formation is inhibited, synthesis of fatty acids is reduced drastically. The mode of action of HCA appears to be competitive inhibitor for enzyme ATP citrate lyase. ATP citrate lyase has been suggested to play an important role in gluconeogenesis and in lipogenesis. So Hydroxycitric acid shows its antiobesity activity.

Ilmakauser *et al.* conducted studies on the effect of *Camellia sinensis* and *Garcinia cambogia* on obesity and co morbidities – safer alternatives than synthetic antiobesity drugs. The main constituent hydroxicitric acid of *Garcinia cambogia* has gathered reputation for using as a weight loss aid through two mechanisms appetite suppression and by increasing the body’s ability to form adipose tissue. It inhibits an enzyme that helps to synthesize body fat body for storage of adipose tissue. Synthetic drugs like orlistat, sibutramine, rimonabantetc causes serious side effects like hypertension, tachycardia, cognitive impairment and many more which disturbs normal physiology. The herbs *Garcinia cambogia* have the potential to treat obesity along with co morbidity.

Vasques CA *et al.* conducted studies to analyse the effect of *G. cambogia* on the lipid profile, endocrine, calorimetric and anthropometric parameters of obese women. Then study tell us the short-term treatment with *G. cambogia* demonstrated a hypotriglyceridemic effect, which does not appear to be related to changes in leptinemia.

Ates A *et al.*, conducted the studies to investigate the preventive effects of dietary *Garcinia cambogia* extract on lipid metabolism and serum activities of alanine aminotransferase (ALT), aspartate aminotransferase (AST) and gamma-glutamyltransferase (GGT) in rats fed high-lipid diet. Fat feeding caused rising lipid indices in serum, while *Garcinia cambogia* supplementation to the fatty diet failed to decrease the rise in serum lipid indices in the present dose.

Oluyemi KA *et al.*, conducted studies on The anti-obesity and erythropoietic effects of crude ethanolic extracts of *Garcinia cambogia* seeds on Wistar rats. The results showed a significant increase in RBC counts in both test groups and a decrease in weight of experimental animals. Ethanolic extracts of *G. cambogia* seeds have both haematologically enhancing and anti-obesity effects. The decrease in the high-density-lipoprotein level and an increase in the LDL level may play an important role in cardiovascular disease.

Ramalinga Sripradha *et al.*, conducted studies on Efficacy of *Garcinia cambogia* on body weight, inflammation and glucose tolerance in high fat fed male Wistar rats. In the study using five month old wistar rats were divided into four groups. two group were fed with standard rodents diet.
and remaining two with high fat diet. One group in each of two sets received *Garcinia cambogia* ethanolic fruit extract. Body weight, intraperitoneal glucose tolerance test, leptin, TNF-α and renal function were studied. As the result of the study supplementation of *Garcinia cambogia* extract along with high fat diet significantly decreased body weight gain, glucose intolerance, plasma leptin and TNF-α level. No significant change in renal parameter in any of the groups. Study concluded that supplementation of *Garcinia cambogia* extract with high fat reduced body weight gain, inflammation and glucose intolerance.

**Patil Manoj et al.,**[^30] conducted works on polyherbal preparation for obesity associated diabetes containing *Gymnema sylvestre* R., *Garcinia cambogia*, *Lagerstromiaspeciosa* L., was investigated in normal and obese streptozotocin induced diabetic rats. A comparison was made between the action of polyherbal formulation, the standard antidiabetic drug and the standard antiobesity drug.

**Mahendran P et al.,**[^31] conducted studies in the modulating effect of *Garcinia cambogia* extract on ethanol induced peroxidative damage in rats. Result of this study shows that the treatment with *Garcinia cambogia* fruit extract resulted in reduction of both serum and liver lipid to near normalcy. This hypolipidemic property of *Garcinia cambogia* in turn reduces the peroxidative damage, enhanced by ethanol.

**ANTI ULCER ACTIVITY**

**Mahendran P et al.,**[^32] conducted studies on the antiulcer activity of *Garcinia cambogia* fruit extract against indomethacin-induced gastric ulcer in rats. In the present study this drug was tested for its antiulcerogenic effect. *Garcinia cambogia* fruit extract was given by orally in the dose of 1g/kg for 5,10,15 days protected the gastric mucosa against damage induced by indomethacin. The volume and acidity of the gastric juice decreased in the pretreated rats. The glycoprotein levels of the gastric contents which were decreased in the untreated rats, maintained near normal levels in the pretreated rats. *Garcinia cambogia* was able to decrease the acidity and to increase the mucosal defence in the gastric areas, thereby justifying its use as an antiulcerogenic agent.

**DIURETIC ACTIVITY**

**Githa E Mathew et al.,**[^33] conducted studies on diuretic activity of leaves of *Garcinia Cambogia* in Rats. Ethanol and aqueous extracts of *Garcinia cambogia* act as diuretic in a dose-dependent manner. In the study demonstrated that ethanol and aqueous extract may produce diuretic effect by increasing the excretion of sodium, potassium and chloride. Treatment with aqueous and ethanolic extract resulted in elevated levels of potassium in urine.
ANTI CANCER
Masullo M et al.,\textsuperscript{34} conducted studies on direct interaction of garcinol and related and polyisoprenylated benzophenone of \textit{Garcinia cambogia} fruit with the transcription factor STAT-1 as likely mechanism of their inhibitory effect on cytokine signaling pathways. Garcinol occurring in \textit{Garcinia} species, has been reported to exert antiinflammatory activity in LPS stimulated microphages.

OTHER PHARMACOLOGICAL ACTION

\begin{itemize}
  \item Effect of Reproductive system
  Oluyemi Kayode A et al.,\textsuperscript{35} conducted studies in The Effects of crude ethanolic extract of seeds of \textit{Garcinia cambogia} on the reproductive system of male wistar rats. The effect of graded dosage of \textit{Garcinia cambogia} extract causes increase in the interstitial spaces, reduction in leidig cells population in the interstitial spaces, slight reduction seminiferous luminal spermatozoa concentration. Contraction of seminiferous tubules and derangement of the cells of spermatogenic of series. Result of the study shows the sperm counts revealed a significant increase in the experimental groups when compared statistically with the control.

  \item Modulating effect
  Mahendran P et al.,\textsuperscript{36} conducted a studies on modulating effect of \textit{Garcinia cambogia} fruit rind extract on ethanol induced peroxidative damage in rat. In the present study the animals is divided into four groups group I - normal control, group II - rat given ethanol, group normal- rat given \textit{Garcinia cambogia} extract and group IV – rat diven ethanol + \textit{Garcinia cambogia} extract. After the experimental period the animal was sacrificed by cervical dislocation. Blood and tissue was used to various estimations. AST, ALT, alkaline phosphatase were estimated in serum. SOD, CAT, GSH, GSH-Px and conjugate dienes were estimated in liver tissue. Total cholesterol, phospholipid, triglyceride and proteins estimated both serum and tissue. The imbalance in lipid metabolism could be the reason for increase in lipid peroxidation. In present study the treatment with \textit{Garcinia cambogia} fruit extract resulted in both serum and lipid to near normality. This hypolipidemic property of \textit{Garcinia cambogia} inturn reduces the peroxidative damage, enhanced by ethanol.

  \item Effect on lipid peroxidation
  Mahendran P et al.,\textsuperscript{37} conducted studies on Effect of \textit{Garcinia cambogia} extract on lipid and lipoprotein composition in dexamethasone administrated rats. Dexamethasone administered rats were treated with or without \textit{Garcinia cambogia} fruit extract. The administration of dexamethasone
resulted in increased level of cholesterol, tryglycerides and free fatty acid in both plasma and liver. The level of phospholipids increased in the plasma but decreased significantly in liver tissue after dexamethasone administration as compared to those in normal rats. The activities of lecithin cholesterol" acyl transferase and hepatic lipoprotein lipase were lowered significantly after dexamethasone administration. The levels of HDL-triglycerides and HDL-cholesterol remained unchanged, while the LDL and VLDL increased significantly in dexamethasone administered rats. The lipid levels were maintained at near normalcy when co-treated with *Garcinia cambogia* extract in dexamethasone administered rats. This study reveals the undesirable changes in lipid profile on dexamethasone administration and the hypolipidemic property of *Garcinia cambogia* extract.

- **Effect on blood viscosity**

  Ali Ismail A. Al-Gareeb et al. conducted study to determine the effects of *Garcinia cambogia* oral tablet on blood viscosity profile. Study was done by using twenty healthy male human volunteers. Those volunteers randomly assigned equally in double blind manner in two groups, duration of the therapy was two weeks. Blood viscosity, packed cell volume ,plasma fibrinogen and serum cholesterol were performed at day one and at the end of first and second week treatment. This study showed that after one week treatment with *Garcinia cambogia* there was significant reduction in blood viscosity and plasma fibrinogen. Moreover two weeks treatment with *Garcinia cambogia* produced significant reduction in blood viscosity, plasma fibrinogen and serum cholesterol (P<0.05). An exception was the packed cell volume which is not altered (P>0.05).

**Effect on haematology and plasma biochemistry**

C.Prasad et al., conducted a studies on effect of fruit rind extract of *Garcinia gummi gutta* on haematology and plasma biochemistry of catfish *Pangasianodon hypophthalmus*. This study was to evaluate the effect of dietary aqueous extract of *Garcinia gummi gutta* in catfish, *Pangasianodon hypophthalmus*on basic performance ,haematological and biochemical parameter. The result of the study proves that *Garcinia gummi gutta* extract feed will enhance growth, elicit immunity and modify lipid profile to a significant level.

**CONCLUSION**

*Garcinia gummi gutta* is an important plant in India for its various pharmacological activity and it would be worthwhile in continuing research to isolate the active compounds. *Garcinia gummi gutta* has been traditionaly used in the tratment of rhumatism ,diuresis and fruit is used to treat obesity. Inspite of the plant contains many of phytoconstituent such as flavanoids, glycoside, tannins, terpanoids and sterols etc ,hence many of pharmacological activity studies can be
performed. The future aspects of the plant can be anti diabetic, anti cancer ,anti inflammatory as it contains many of the phytochemicals and work has not been performed yet.

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