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Original Article

Evaluation of Anti- Arthritis Activity of *Garcinia cambogia* Fruit using Animal Models

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ABSTRACT

Background: *Garcinia cambogia* fruit looks like a pumpkin and the fruit is yellow or reddish purple in color. The fruit is used for anti-inflammatory, antiobesity and anticancer agents **Objectives:** The main aim of the study is to scientifically prove the traditional use *Garcinia cambogia* fruit extracts for the management of arthritis through an *in vivo* Complete Freund's Adjuvant (CFA) model. **Materials and Methods:** *Garcinia cambogia* fruit powder 900 g and 1000 g were taken and extracted using chloroform and methanol (5 L) via Soxhlet extraction method. The heating was continued at 65°C for a period of 6 hr and the extraction was carried out for 6 cycles for about 36 hr. The percentage yield of chloroform and methanol was found to be 10% of the total powder taken. Preliminary phytochemical tests were conducted for both chloroform and methanolic extracts at 200 and 400 mg/kg body weight were used for the CFA model. Arthritis was induced in the left hind paw by subplantar injection. Paw oedema was measured and the percentage of inhibition was calculated. Ankle joints were dissected for histopathology studies. **Results:** Results showed a statistically significant *p-value* ($p<0.001$) for 1.0±0.03 and the percentage of inhibition of paw oedema for the chloroform extract at a dose of 400mg/kg body weight. The percentage of inhibition of paw oedema for the standard diclofenac was 82.73%, while the highest percentage of inhibition was shown by the 400 mg/kg chloroform extract showed 61.82% when compared to the methanolic extract 54.55%. Histopathology reports indicated No damage ankle joints. Synovial cells, and synovial joints were within normal range. **Conclusion:** This study provides evidence that phytochemicals like flavonoids and phenolic flavonoids present in the chloroform. Garcinia *cambogia* fruit chloroform extracts showed highest anti arthritic activity when compared to methanolic extract. Hence, *Garcinia cambogia* fruit will serve as potential herbal drug for the treatment of arthritis.

Keywords: Acute toxicity studies, Complete Freund's Adjuvant, Histopathology, Soxhlet extraction.

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INTRODUCTION

Arthritis is a chronic, inflammatory progressive auto immune disorder (Pandey *et al.*, 2020). Rheumatoid arthritis affects almost 0.5%-1% (Goel *et al.*, 2021). population worldwide and incase of Indian more than 20% of the population suffers from any form arthritis. Rheumatoid arthritis is characterized by the destructive cartilages (Sharma *et al.*, 2018), bone changes and limit joint mobility. Inflammation of the peripheral, joints, morning stiffness, articular tissue (Pavithra *et al.*, 2015), destruction and reduced joint mobility, fatigue, swelling and muscle weakness. The production of proinflammatory mediators such as tumors necrosis factor TNF -α and interleukin IL-6 increases the severity of disease (Singh *et al.*, 2020). Drug regimen includes NSAIDS corticosteroids (Tiwari *et al.*, 2021), and include disease modifying new antirheumatic new drugs also are used in treatment of arthritis. Prolonged use can cause serious side effects. Natural products are safe as alternative herbal medicine. According to WHO, 80% of the total population rely on herbal treatment (Muruganathan *et al.*, 2013). Herbal medicines of natural origin may play a leading role in the treatment of arthritis and other inflammatory condition (Choudhary *et al.*, 2015). Previous literature survey reports states that *In vivo* anti arthritic activity on *Garcinia cambogia* has not yet been scientifically validated. *Garcinia cambogia* (*Gaertn*) *Desr* belongs to the family Clusiaceae (Semwal *et al.*, 2015) fruit looks like pumpkin and the fruit is yellow or reddish purple. The fruit is too acidic or sour to eat fresh. *Garcinia cambogia* is also known as Malabar tamarind

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or Brindle berry (Irulandi *et al.*, 2026). The fruit consists of soft white edible pulp surrounded by the pericarp. *Garcinia cambogia* shows the existence of alkaloids, tannins, flavonoids phenolic flavonoids, carbohydrates and proteins and terpenoids (Selvaraj *et al.*, 2013). *Garcinia cambogia* fruit is native of South east Asia and its fruit rind is useful in the treatment of rheumatism (Parambil *et al.*, 2023).

Evidences suggest that many important phytocompounds in *Garcinia Cambogia* with antioxidant, antidiabetic, antihyperlipidemic, antiallergic and hepatoprotective, anti-inflammatory, neuroprotective as well as anticancer activity (Joseph *et al.*, 2023). The anti-inflammatory activity in *Garcinia cambogia* hydroalcoholic fruit extract was evaluated by Carrageenan induced paw edema model in rats, with dose of 300 mg/kg reducing inflammation by 76.5% (Yadav *et al.*, 2025). The *Garcinia Cambogia* chloroform extract exhibited *in vitro* anti arthritis activity was reported (Priyadharisni *et al.*, 2019). But no specific studies are done *in vivo* of antiarthritic activity. Hence, the present aim to bridge the gap and perform *in vivo* antiarthritic activity on *Garcinia cambogia* fruit extracts.

MATERIALS AND METHODS

Authentication and collection of fruits

Garcinia cambogia fruits were collected from Thrissur, Kerala state, India. The fruit were recognized and certified by GKVK, university of Agricultural sciences, Bangalore. The reference number is UASB-4551 and the herbarium file is retained in the department.

Garcinia cambogia fruits were washed using purified water and were cut into pieces using stainless steel knife. *Garcinia cambogia* pericarp was separated and the seeds was removed. Pericarp was dried for a period of 60 days at a temperature of 35- 40 °C. Pericarp was dried and powdered. *Garcinia cambogia* powder was stored in an airtight container.

Preparation of the crude extract

Garcinia cambogia pericarp was powdered coarsely in a grinder. Pericarp powder was stored in airtight container. Pericarp powdered was extracted with petroleum ether to remove fatty material. About 1000 g and 900 g of the pericarp powder was extracted with 5 L of methanol and chloroform respectively for a period of 6 hr by Soxhlet method extraction for about six cycles for about 36 hr and heating at a temperature of 65°C. The drug solvent ratio was 1:10.

The methanolic and chloroform extract was evaporated to dryness under reduced pressure and semisolid mass was formed. The chloroform and methanol extract were weighed and stored in vacuum desiccator at 4°C for future use. The chloroform extract yield and methanolic extract yield was found to be 10%.

Phyto chemical test

Phytochemical test was carried out to detect the presence of alkaloids, flavonoids, phenolic flavonoids, terpenoids, saponins, xanthones and terpenoids

Acute oral toxicity studies

Albino Wistar healthy adult rats 12 rats of 3 male and 3 female in one group (Total of 6 rats) weighing about 140-150 g were divided into 2 group and was subjected to acute oral toxicity studies as per organization 423 OECD guidelines. All animal studies were performed in according to guidelines of CPCSEA and IAEC of Gautham college of Pharmacy. (491/PO/Re/S/01/CPCSEA). male and female rats were administered with single dose of chloroform and methanolic extract 2000 mg/kg body weight and examined for a period 14 days. Increased body weight in animals during the study was observed in all the animals. Animals did not show and any abnormalities like mortality, coughing, sneezing, diarrhea, hematuria of NAD 2-85. The dose was fixed at 200 mg/kg and 400 mg/kg of body weight for both chloroform and methanolic extract.

Experimental Design

Albino Wistar rats of both female and male, weighing 140-150 g were used for this study. The rats were maintained in plastic racks at 22±2°C and were given free access to food and water. On zero-day arthritis was induced to 8-week-old rats by single sub plantar injection of 100 µl of Complete Freund's Adjuvant (CFA) containing (0.5 mg heat killed *Mycobacterium tuberculosis* emulsified in liquid paraffin) into the left paw hind limb of each limb of each rat. Different concentration of chloroform, methanolic extract and Diclofenac standard drug were mixed in 0.5% sodium Carboxy Methyl Cellulose (CMC) and was orally administered on the CFA injected rats started on the same day and should be continued to observe daily once for 21 days. Paw volume of size of body weight was recorded on day of injection Day 0 and continued daily for 7, 14, 21 days following the CFA injection. The paw volumes were measured by a plethysmometer.

The oedema formation and Percentage of Inhibition were calculated as follows:

$$\text{Percentage of Inhibition} = \frac{Vc - Vt}{Vc} \times 100$$

Where Vc is the oedema volume of the control group, and Vt is the oedema volume of the test group.

Each group consisted of 6 rats were taken for the study (Patel *et al.*, 2021).

1. **Group I:** Served as control P.O.
2. **Group II:** Rats received Diclofenac sodium 10 mg/kg P.O.

3. **Group III:** Rats received Chloroform fruit extract of *Garcinia cambogia* 400 mg/kg P.O.
4. **Group IV:** Rats received Chloroform fruit extract of *Garcinia cambogia* 200 mg/kg P.O.
5. **Group V:** Rats received Methanolic fruit extract of *Garcinia cambogia* 400 m/kg P.O.
6. **Group VI:** Rats received Methanolic fruit extract of *Garcinia cambogia* 200 mg/kg P.O.

Observation Schedule

The observation was carried out from 0-day, 7th day, 14th day, and 21st day after the CFA Injection and the increase in paw volume in mL/cm^3 and change in body weight grams were recorded.

Histopathology studies

Ankle joints were removed by dissection of the ankle area the skin and muscle were removed. In a 10% formalin solution the ankle solution was maintained. Samples were dehydrated rinsed with xylol and washed with alcohol. Paraffin was embedded with samples and then cut into 4-6μm pieces and stained using hematoxylin and eosin. The ankle joint was examined under microscope to assess damage in ankle joint damage and anti-inflammatory efficacy. Pieces of ankle joint with safranin and the morphology of the cartilage tissue was evaluated following treatment to examine the ability to protect cartilage tissue.

RESULTS

The results from Table 1 in the chloroform extract showed the presence of flavonoids phenolic flavonoids, saponins and xanthones and methanolic extract showed the presence of alkaloids, flavonoids, phenolic flavonoids and terpenoids.

Statistical Analysis

The results in terms in Mean ± Standard Error of the Mean (SEM). Difference between the groups was determined by statistical Analysis of Variance (ANOVA) with Dunnett test using GraphPad Prism 5. The level of significance was found to be $p<0.001$ (Tables 1-4).

Anti arthritis activity

The results from Table 2 show that there was a significant increase in body weight after inflammation from day 14. The findings of paw volume in Table 3 indicated showed a highly significant reduction in paw volume for the chloroform extract at a dose of 400 mg/kg body weight with the percentage of inhibition 61.82% and the methanolic extract 400 mg /kg body weight exhibited percentage of inhibition 54.55% comparing with the standard drug diclofenac 82.73% Both chloroform and methanolic extract at concentration of 400 mg/kg body weight shows a dose dependent decrease in paw volume from day 14. The highest percentage of inhibition was exhibited by chloroform *Garcinia cambogia* fruit extract.

Table 1: Phytochemicals Investigation of *Garcinia cambogia fruit extract*.

Sl. No.	Phytochemical constituents	Methanolic extract of *Garcinia cambogia* fruits	Chloroform extract of *Garcinia cambogia* fruits
1.	Alkaloids	+	-
	Mayers test	+	+
	Dragendroff test	+	+
	Wagners test	+	+
2.	Phenolic flavonoids	+	+
3.	Terpenoids	+	+
4.	Flavonoids	+	+
	Ferric chloride test	+	+
	Lead acetate test	+	+
	Alkaline test	+	+
	Magnesium hydrochloride test	+	+
5.	Xanthones		
	Ferric Chloride test	-	+
6.	Saponins	-	+

+ -Presence, - Absence.

Table 2: Changes in body weight of anti arthritis activity.

Sl. No.	Body weight in gms					
Days	Positive control	Standard	Methanol extract 400 mg	Methanol extract 200 mg	Chloroform extract 400 mg	Chloroform extract 200 mg
Day 0	152.5±1.4	153.3±1.6	152.3±1.9	152.3±1.7	152.3±1.4	151.7±0.9
Day 7	147.5±1.4	152.8±1.2	152.8±1.8	152.3±1.5	153.7±1.8	152±1.1
Day14	149.2±1.8	157.3±1.7	157±1.8	155.5±1.5	157.2±1.7	156.5±1.0
Day 21	152.2±1.6	161.7±1.4	161.3±2.0	161.5±1.2	163.2±1.8	162.5±1.5

Table 3: Paw volume of anti-arthritic activity.

Sl. No.	Paw Volume mL/cm^3					
Days	Positive Control	Standard	Methanol Extract 400 mg	Methanol Extract 200 mg	Chloroform Extract 400 mg	Chloroform Extract 200 mg
Day 0	1.3±0.04	1.2±0.03	1.2±0.04	1.2±0.04	1.2±0.02	1.2±0.02
Day 7	1.5±0.05	0.8±0.02***	1.1±0.05***	1.4±0.05	1.2±0.05***	1.3±0.03**
Day 14	1.8±0.07	0.6±0.02***	1.0±0.04***	1.4±0.05***	1.0±0.03***	1.4±0.03***
Day 21	1.8±0.09	0.3±0.03***	0.8±0.04***	1.3±0.05***	0.7±0.05***	1.1±0.06***

n=6, Values expressed as Mean± SEM, one way ANOVA followed by Dunnetttest.*** p<0.001, highly significant, * *p<0.01 moderately significant, *p<0.05significant when compared with the control group.

Table 4: Percentage of inhibition of anti-arthritic activity.

Days	Positive Control	Standard	Methanol Extract 400 mg	Methanol Extract 200 mg	Chloroform Extract 400 mg	Chloroform Extract 200 mg
DAY 0	0	0	0	0	0	0
DAY 7	0	44.09	26.88	8.6	21.50	15.03
DAY 14	0	63.30	44.95	19.26	43.11	20.18
DAY 21	0	82.73	54.55	27.27	61.82	38.18

n=6, Values expressed as Mean± SEM, One-Way ANOVA followed by Dunnetttest.*** p<0.001 when compared with the control group.

Acute toxicity Studies

Chloroform and methanolic *Garcinia cambogia* fruit extract did not exhibit any toxicity symptoms or mortality. When administered orally at the dose of 2000 mg/kg animals. LD_{50} exceeding 2000 mg/kg. The absence of severe toxicity supports the use of 200 mg/kg and 400 mg/kg were selected as therapeutic dose.

Histopathology Studies

The results revealed that after 21 days, the ankle joints of rats injected with CFA were not damaged (Figure 1A). The ankle joint showed that intact hyaline cartilage with standard dose drug (Figure 1B). Methanolic extract at concentration 200 mg/kg and 400 mg/kg body weight shows that synovial joint and synovial cells within normal range. Figure 1C shows the high dose of methanolic extract. Then chloroform extract at a concentration of 200 mg /kg and 400 mg/kg shows synovial moderate proliferation of synovial lining cells. Figure 1D shows the high concentration of chloroform extract. The subintimal tissue shows moderate infiltration of inflammatory cells. The joint surface was injured less percentage in mice treated with *Garcinia cambogia* in chloroform and methanolic dosage.

DISCUSSION

CFA model induced arthritis animal model was used and identified for the investigation autoimmune disorder arthritis. CFA induced model resembles the close similarity like that human rheumatoid arthritis in rats. Thus, in the present scientific phytochemical investigation of *Garcinia cambogia* in the chloroform extract contains flavonoids, phenolic flavonoids, saponins and terpenoids and the methanolic extract revealed the presence of alkaloids, saponins, phenolic flavonoids, flavonoids and terpenoids. Phenolic compounds, flavonoids and alkaloids decrease the activation of Nfκβ and protect cartilage destruction (Wassila *et al.*, 2020). Saponins has the ability to suppress the proinflammatory cytokines such as Ilβ, IL-6, Il-8 and TNα (Nimmy *et al.*, 2018) and produces antiarthritic activity. Hence the secondary metabolites produced by *Garcinia cambogia*

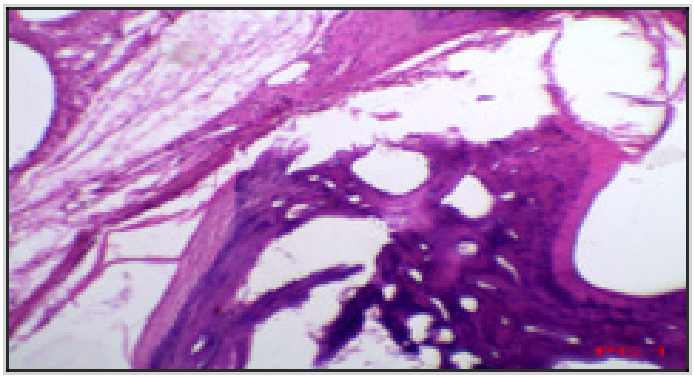


Figure 1A: synovial joint Positive control.

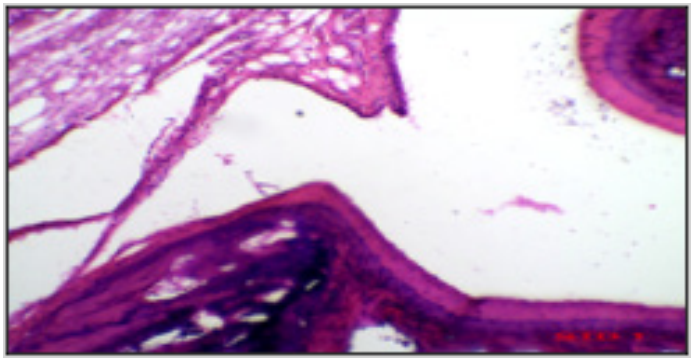


Figure 1B: Standard Diclofenac Synovial Joint Intact Hyaline Cartilage.

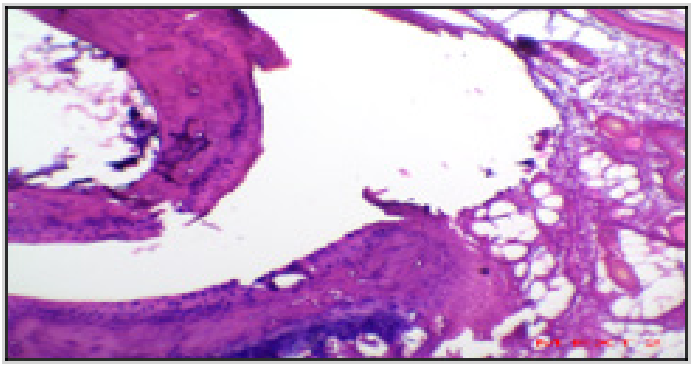


Figure 1C: Synovial joint: methanol 400 mg/kg body weight.

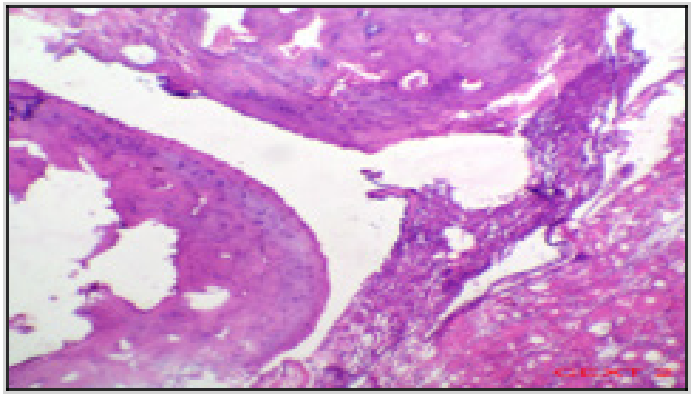


Figure 1D: Synovial joint Choloroform 400 mg/kg body weight.

fruit chloroform extract and methanolic extract reduces the inflammation and arthritis. The results indicated that *Garcinia cambogia* chloroform extract showed highest an inhibitory activity against CFA induced arthritis.

CONCLUSION

This study concluded that presence of secondary metabolites like flavonoids, alkaloids, phenolic flavonoids, tannins, terpenoids, xanthones, and saponins associated with antiarthritic activity. *Garcinia cambogia* chloroform and methanol extract has been successfully assessed for anti-arthritic activity. The dosage of 400 mg /kg and 200 mg/kg of chloroform and methanol extract found to show the anti-arthritic activity by reducing the pain in joints and swelling and also reduce arthritis symptoms when compared to the standard drug Diclofenac. The chloroform *Garcinia cambogia* fruit extract at a dose of 400 mg/kg showed highest inhibition of paw oedema. Histopathology reports revealed that the synovial joint and membrane was normal and hence *Garcinia cambogia* a herbal drug exhibit antiarthritic activity.

Furthermore, research studies and clinical trials are needed for the isolation of secondary metabolites and to find out the biological activity and to validate these findings.

ABBREVIATIONS

CFA: Complete Freund's Adjuvant; **CMC:** Carboxy Methyl Cellulose; **IL:** Interleukin; **NSAIDs:** Non-Steroidal Anti-Inflammatory Drugs; **OECD:** Organization for Economic Co-operation and Development; **SEM:** Standard Error of the Mean; **TNF-α:** Tumor Necrosis Factor-alpha; **WHO:** World Health Organization; **NAD:** No Abnormality Detected.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

SUMMARY

This study evaluated the anti-arthritic potential of *Garcinia cambogia* fruit extracts. Using a Complete Freund's Adjuvant (CFA) induced arthritis model in rats, chloroform and methanolic extracts (200 and 400 mg/kg) were tested. Results indicated significant reduction in paw oedema and joint inflammation in chloroform extract comparable to standard drug Diclofenac. Histopathology studies confirmed joint protection. The study concludes that secondary metabolites present in the chloroform extract of *Garcinia cambogia* possesses significant anti-arthritic activity.

REFERENCES

Anilkumar, A. T. P., Manoharan, S. B. E., Balasubramanian, S., & Perumal, E. (2023). Garcinia gummi-gutta: Phytochemicals and pharmacological applications. BioFactors, 49(3), 584-599. https://doi.org/10.1002/biof.1943

Choudhary, M., Kumar, V., Malhotra, H., & Singh, S. (2015). Medicinal plants with potential anti-arthritic activity. Journal of Intercultural Ethnopharmacology, 4(2), 147-179. https://doi.org/10.5455/jice.20150313021918

Goel, A., & Kulshrestha, S. (2021). Review of anti-Rheumatoid arthritis potential of medicinal plants. International Journal of Current Research and Review, 13(3), 16-32. https://doi.org/10.31782/IJCRR.2021.13303

Joseph, M. K., & Thangavel, I. (2023). GC-MC/HPTLC Analysis, Anti-oxidant, anti-inflammatory and anti-microbial efficacy of *Garcinia cambogia*. Free Radicals and Antioxidants, 13(1), 10-20. https://doi.org/10.5530/fra.2023.1.3

Kokkkaiah Irulandi, S.G., & Mehalingam, P. (2016). Evaluation of Anti-oxidant properties and anti-microbial activity of *Garcinia cambogia* Hort. ex Berl (Cluisaceae) fruit extracts. Journal of Advanced Applied Scientific Research, 74-83. Journal of Advanced Applied Scientific Research - ISSN: 2454-3225.

Muruganathan. (2013) Anti arthritic activity and anti-inflammatory constituents of Medicinal Plants. G, Sudheer G, Satyachetan P and Mohan S. Journal of Applied Sciences, 3(04), 161-164. https://doi.org/10.7324/JAPS.2013.342

Pandey, S. N., Pratap, V., Pratap, S., & Kumar, N. (2020). A comprehensive review of anti-arthritic medicinal plants. International Journal of Pharmacy and Pharmaceutical Sciences, 18(2), 598-603.

Patel, R., Kadri, S., Gohil, P., Deshpande, S., & Shah, G. (2021). Amelioration of Complete Freund's adjuvant-induced arthritis by Calotropis procera latex in rats. Future Journal of Pharmaceutical Sciences, 7(1), 1-11. https://doi.org/10.1186/s43094-021-00361-w

Pavithra, T. K. S., & Kulashekar, K. P. (2015). K.S. and Ashok Kumar. Evaluation of *in vitro* Anti-Arthritic activity of *Vitex negundo* against denaturation of protein.Int.j.cuur. microbio [App].sci,49 (pp. 87-90).

Priyadharisini, J. (2018). Evaluation of *in vitro* Anti Arthritis activity of *Garcinia cambogia* against denaturation of albumin. Journal of Medical Pharmaceutical and Allied Sciences, 8(1), 66. https://doi.org/10.22270/jmpas.v8i1.794

Ranganathan Yadav, H. R., Setty Sridhara, P. B., & Lavanya, D. K. M, Neetha Raj, Deepak Telugu S. Seetharam, and S.M.Gopinath. (2025). Therapeutic potenials of *Garcinia cambogia* (L.) Rox: Phytochemical characterisation and Biological Activities Applied Biological Research, 27(1), 26-37. https://doi.org/10.48165/abr.2025.27.01.3

Selvaraj, T. I., & Mythiliavadhani. (2013) Int.J.Phatm. Medicinal properties of Malabar Tamarind. *Garcinia cambogia* (Gaertn.). Science and Research, 19(2), 101-107.

Semwal, R. B., Semwal, D. K., Vermaak, I., & Viljoen, A. (2015). A comprehensive scientific overview of *Garcinia cambogia*. Fitoterapia, 102, 134-148. https://doi.org/10.1016/j.fitote.2015.02.012

Sharma, H., & Prenachauhan, S. S. (2018). Evaluation of the anti-arthritic activity of *Cinnamonum cassia* bark extract in experimental models. Integrative Medicine, 366-373.10.1016/j.imr.2018.08.002

Shilpa, K., Nimmy Chacko, P., & Sandya, S. (2018). A. Investigation of Anti Arthritic activity of *in vitro* models of Hibiscus hispidissmus Griffith. The Journal of Pharmacology, 7(1), 60-65. https://doi.org/10.31254/phyto.2018.7113

Silmani, W., & Kabouche, S. Z. (2020). Immunomodulatory and anti -arthritic activity of *Satchys circinata*. IJBS, 2, 184-189.

Singh, S., Singh, T. G., Mahajan, K., & Dhiman, S. (2020). Medicinal plants used against various inflammatory biomarkers for the management of rheumatoid arthritis. The Journal of Pharmacy and Pharmacology, 72(10), 1306-1327. https://doi.org/10.1111/jphp.13326

Tiwari, R. K., Chanda, S., Udaybanu, M., Singh, M., & Agarwal, S. (2021). Anti -inflammatory and anti-arthritis potential standardized extract of *Cleondendron serratum* (L.). Moon. Frontiers in Pharmacology, 12, 1-11. https://doi.org/10.3389/fphar.2021.629607

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