International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Extensive Pharmacognostic Standardization, Phytochemical Screening, In-Vitro Anti-Oxidant, and Anthelmintic Activity of Ethanolic Leaf Extract of *Garcinia pedunculata*

Geetartha Saikia[1], Piyush Kr. Krishnatreya[2], Surender Prasad[3]

Pratiksha Institute of Pharmaceutical Sciences, Guwahati-781026

Corresponding Author Email: *geetarthasaikia14[at]gmail.com*
Email: *piyushkumar20001[at]gmail.com*

Abstract: ***Herbal pharmaceuticals and herbal medicine have recently gained a unique position in society, maybe because they have fewer side effects than allopathic drugs. Garcenia penduculata leaf has long been utilized as an anthelmintic in traditional Assamese remedies. So, the current study looks at the antioxidant and anthelmintic capabilities (in-vitro) of the plant Garcenia penduculata's leaves after they have been extracted with ethanol as a solvent. The plant leaves were collected and authenticated followed by drying, grinding, and extraction using various solvents such as petroleum ether, chloroform, and ethanol. All the extract obtained was subjected to various phytochemical screening to detect the different phytoconstituents present in the different extracts. Relevant pharmacognostic evaluations were performed to set the standard parameter for the correct identification of the plant. DPPH, reducing power, H2O2 assay, TPC, and TFC were performed with ethanolic extract to check antioxidant activity. Anthelmintic activity was done with ethanolic extract by using earthworms collected from the Panikhaiti area. Results of the phytochemical investigation revealed the presence of carbohydrates, flavonoids, tannins, alkaloids, amino acids, glycoside, phenols, fats and oils, and steroids in ethanol, chloroform, and petroleum ether extract. This was used as a basis for the in-vitro studies which included an antioxidant study followed by an anthelmintic study. Pharmacognostic standardization parameters such as stomatal index, extractive value, ash value, moisture content, etc. were found to be 18.75±0.091% (upper epidermis stomatal index), 21.73±0.061% (lower epidermis stomatal index,) 2.36% (petroleum ether), 3.14% (chloroform), 6.19% (ethanol), 4.16±0.763 % (Total Ash), 2.9±0.246% (Acid insolubleash), 1.2±0.352% (Water soluble ash) and 7.133±1.474% (Moisture content) respectively. Statistical data which has found Anti-oxidant and anthelmintic activity confirmed that the leaf of Garcenia pedunculata has relevant Anti-oxidant and anthelmintic potential. The results suggest that the plant under research exhibits promising in-vitro Anti-oxidant activity when compared to the standard. The in-vitro anthelmintic experiments also confirmed that the ethanolic leaf extract of Garcenia pedunculata has potent anthelmintic activity. So, further research is required to find out the active phytoconstituent present in the leaf which is responsible for the anthelmintic activity, and also develop a convenient anthelmintic herbal formulation.***

Keywords: *Garcinia pedunculata*, Herbal medicine, Phytoconstituents, Antioxidant, Anthelmintic agent

1. Introduction

Nine species of the genus *Garcinia (*Thekera tenga), which are mostly used as food by various groups, were discovered in North East India in 1934 (Kanjilan et al., 1934) (Baruah et al.2012). Eight of the nine species have been documented from the Assamese Sonitpur area alone (Baruah et al., 2012). The genus is a part of the Clusiaceae family, and its species are primarily evergreen trees or shrubs with greenish gum resins. Different groups utilize them to cure a variety of health issues. For example, Assamese and Bodo people employ the Kau (*G. cowaRoxb*.) and Kuji (*G. morella Desr*.) thekera tenga to treat dysentery (Patir et al., 2007). By the Rabha, Karbi, and Missing populations, Borthekera tenga (*G. pedunculata Roxb*.) has been utilized for Diabetes mellitus (DM) (Sarmah., 2011). According to local traditional healers, if a patient consumes one teaspoon of *Garcinia*. *Pedunculata* juice each morning for a week, their blood sugar levels will be normal. However, using this dried peel frequently for an extended period of time is not advised because it may result in constipation and gastrointestinal issues.

According to scientific research, *Garcinia pedunculata* is the *Garcinia* species with the highest concentration of hydroxy citric acid (HCA). This plant has been linked to one of the isomeric forms of HCA that may help prevent obesity (Kagyung et al., 2010). A hypothesis was developed to examine its in vitro antiamylase and anthelmintic characteristics using the traditional knowledge of its usage in Diabetes Melitus.

Overall, determining the antioxidant activity of plants during research is significant for understanding their potential health benefits, discovering natural antioxidants, assessing nutritional value, ensuring product quality, and supporting the development of antioxidant-based products. It contributes to the broader understanding of plant bioactivity and the utilization of plant-derived compounds for various applications in health, nutrition, and industry.50% of people worldwide suffer from bacterial and Helminthes infection. The key factors that contribute to infection are poor family hygiene, inadequate sanitation, hunger, and cramped living arrangements. A worm infection is known to as helminthiasis. Helminthiasis is a micro-parasitic disease that affects both people and other animals. These parasites come in a variety of forms that fall under the roundworm, fluke, and tapeworm categories. Typically, they reside in their hosts' digestive systems. Helminthiasis is also known as helminthosis,

helminthiases, and helminth infection. These helminth infections are the most typical human infectious illnesses in underdeveloped and developing nations. (Prichard., 1994) (Sondhi et al., 1994).

2. Materials and method

2.1 Preliminary Phytochemical Test

The general procedures were used for identification of phytochemical constituents (Khandelwal., 2008) (Heinrich et al., 2017) (Badal & Delgodar., 2017). Various test for carbohydrates, flavonoids, tannins and phenolic content, fats and oils, alkaloids proteins, steroids and amino acids are performed.

2.2 Pharmacognostic Evaluation

In pharmacognostic evaluation we have performed microscopic and macroscopic evaluation.

2.2.1 Macroscopic evaluation

In macroscopic evaluation we have checked the colour, odour, taste, structure, shape and size, venation, margin and texture of the leaves of *Garcinia pedunculata*

2.2.2 Microscopic evaluation

In microscopic evaluation we have performed the following experiments i. e T. S of midrib portion of leaf, Determination of leaf diagnostic characteristics and Powder microscopy. In determination of leaf diagnostic characteristics, we have calculated the stomatal index and stomatal number. The procedures for microscopic evaluation were taken from (Khandelwal., 2008) (Heinrich et. al 2017) (Badal & Delgada., 2017)

2.3 Physicochemical Evaluation

In physicochemical evaluation we have performed Moisture content, Ash values and Extractives values. In determination of Ash values, we have performed Total Ash, Acid Insoluble Ash and Water-Soluble Ash. The procedures for physicochemical evaluation were taken from (Phillipson., 2007) (Nahar et al., 2010) (Bruce et al., 2019) (Shah., 2009)

2.4 *In-Vitro* Antioxidant Activity

For determining the antioxidant activity of Garcinia pedunculata we have performed several in-vitro experiments. The in vitro experiments are Determination of total phenolic content, Determination of total flavonoid content, Reducing Power Assay and H_2O_2 Scavenging Capacity.

2.4.1 Determination of total phenolic content

FolinCiocalteu Method is followed to determine Total Phenolic Content. Here gallic acid is used as the standard. A stock solution of the standard is prepared (500µg/ml). Two stock solution of the test sample is prepared (500µg/ml) & (1000µg/ml). Dilution of the above stock solutions is done to 20 µg/ml, 40 µ/ml, 60 µg/ml 80, µg/ml & 100 µg/ml.

For Standard: 0.4 ml aqueous solution of gallic acid & 1.6 ml of sodium carbonate (7.5% in distilled water) was added to 2 ml of Folin Reagent.

For Test: 0.4 ml aqueous solution of extract & 1.6 ml of sodium carbonate (7.5% in distilled water) was added to 2 ml of Folin Reagent.

All the determinations were carried out in triplicate. Incubate the above-prepared solutions for 1 hour at room temperature. After incubation, the absorbance was measured at 765nm. Results are expressed as mg gallic acid equivalent (GAE) / g extract. (Blainski et al., 2013) (Sadasivam & Manickam., 1996) (Haq et al., 2011).

2.4.2 Determination of total flavonoid content

Total flavonoid content was determined by the Aluminum chloride colorimetric method. Here Quercetin is used as standard. The stock solution of the standard and test sample is prepared (100µg/ml) for 25 ml with 80% ethanol. Dilution of the above stock solutions is done to 20 µg/ml, 40 µg/ml, 60 µg/ml, 80 µg/ml & 100 µg/ml.

For Standard: 0.5 ml of standard solution is mixed with 1.5 ml of 95% ethanol, 0.1 ml of 10% AlCl3, 0.1 ml of 1M potassium acetate, and 2.8 ml of distilled water.

For Sample: 0.5 ml of test solution is mixed with 1.5 ml of 95% ethanol, 0.1 ml of 10% AlCl3, 0.1 ml of 1M potassium acetate, and 2.8 ml of distilled water.

For Blank: 0.5 ml of 80% ethanol is mixed with 1.5 ml of 95% ethanol, 0.1 ml of 1M potassium acetate, and 2.9 ml of distilled water.

All the determinations were carried out in triplicate. Incubate the above-prepared solutions for 30 minutes at room temperature. After 30 minutes the absorbance of the reaction mixture was measured at 415 nm. (Aiyegroro & Okoh., 2010) (Ghafar et al., 2017)

2.4.3 Reducing Power Assay

In this assay, BHT is used as the standard. The stock solution of the standard and test samples is prepared (100µg/ml) for 25 ml with ethanol. Dilution of the above stock solutions is done to 20 µg/ml, 40 µg/ml, 60 µg/ml, 80 µg/ml & 100 µg/ml.

For Standard: 1.25 ml of various concentrations of the diluted standard solution was mixed with 1.25 ml of 200m mol/l sodium phosphate buffer (Ph-6.6) and 1.25 ml of 1% potassium ferricyanide. The mixture was incubated at 50˚ C for 20 minutes. After incubation 1.25 ml of 10% trichloroacetic acid (w/v) was added to the mixture. The mixture was centrifuged at 3000 rpm for 10 minutes. After the centrifuge, the upper layer (2.5 ml) was mixed with 2.5 ml of distilled water and 0.5 ml of 0.1% of ferric chloride.

For Sample: 1.25 ml of various concentrations of diluted extract solution was mixed with 1.25 ml of 200m mol/l sodium phosphate buffer (Ph-6.6) and 1.25 ml of 1% potassium ferricyanide. The mixture was incubated at 50˚ C for 20 minutes. After incubation 1.25 ml of 10% trichloroacetic acid (w/v) was added to the mixture. The mixture was centrifuged at 3000 rpm for 10 minutes. After the centrifuge, the upper layer (2.5 ml) was mixed with 2.5 ml of

distilled water and 0.5 ml of 0.1% of ferric chloride. Then the absorbance was measured at 700 nm. (Ferreira et al., 2007) (Wong et al., 2006) (Moon & Shibamoto., 2009)

2.4.4 H_2O_2 Scavenging Capacity

In this assay, BHT is used as the standard.0.4ml of plant extract or standard of different concentration solution was taken in a test tube and to this 2.4ml hydrogen peroxide (2mM) and 1.6ml Phosphate buffer (40mM) is added. After that test tubes were incubated for 10 minutes at room temperature. The absorbance of hydrogen peroxide was taken at 230 nm against a blank solution containing the phosphate buffer without hydrogen peroxide. The percentage of hydrogen peroxide scavenging of both an extract and standard compounds was calculated using the formula –

$$\% \text{ Scavenged } (H_2O_2) = [V_c - V_t / V_c] \times 100 \quad (1)$$

Where, V_t = Absorbance of the test sample, V_c= Absorbance of control.
(Keser et al., 2012) (Ruch et al., 1989)

2.5 *In-Vitro* Anthelmintic Activity

Indian earthworm adults were utilized for the experiment because physically, they resemble human intestinal roundworm parasites. From a cow dung dump outside Panikhaiti, Guwahati, Assam, earthworms were collected. An earthworm's typical size was determined to be 6–8 cm. Earthworms were taken out of the wet soil and washed thoroughly with water to eliminate all excrement. After then, the worms were used in an anthelmintic investigation

2.5.1 Anthelmintic assay

First of all, we divided the worms into three groups. Each group will contain three worms that are for triplicate purposes. Albendazole will be used as a standard in this assay.

Control: The group I worms were released onto a Petri dish containing distilled water, normal saline, and tween 80. It will act as the control.

Standard: The worms of group II were released into Petri dishes containing Albendazole (25 mg/ml, 50 mg/ml, and 100 mg/ml) which served as standard. For each concentration three worms are used i. e. it is done in triplicate.

For preparing 25 mg/ml Albendazole solution we added 3 ml distilled water, 9 ml normal saline, 9 drops tween 80 and 75 mg Albendazole.

For preparing 50 mg/ml Albendazole solution we added 3 ml distilled water, 9 ml normal saline, 9 drops tween 80 and 150 mg Albendazole.

For preparing 100 mg/ml Albendazole solution we added 3 ml distilled water, 9 ml normal saline, 9 drops tween 80 and 300 mg Albendazole.

Test: The worms of group III were released into Petri dishes containing ethanolic leaf extract of *Garcinia pedunculata (*25 mg/ml, 50 mg/ml, and 100 mg/ml) which served as the test sample. In this, we need to make sure that there is no trace of ethanol present in the extract as it may alter the death and paralysis of the worms. So, ethanol from the extract should be evaporated nicely. For each concentration three worms are used i.e. it is done in triplicate.

For preparing the 25 mg/ml test solution we added 3 ml distilled water, 9 ml normal saline, 9 drops tween 80 and 75 mg extract.

For preparing the 50 mg/ml test solution we added 3 ml distilled water, 9 ml normal saline, 9 drops tween 80 and 150 mg extract.

For preparing 100 mg/ml test solution we added 3 ml distilled water, 9 ml normal saline, 9 drops tween 80 and 300 mg extract.

In the investigation, observations were conducted on how long it took for individual worms to become paralyzed and die. When there was no movement of any kind even after being switched to regular saline, it was time for paralysis to set in. The worms were declared dead when they fully lost their ability to move and stopped responding to contact from the needle, along with the fading of their body colors. The adult Indian earthworm's respective mean values for paralysis time and death time were determined and tabulated. (Yashaswini at el., 2016) (Sarmah et al., 2017)

3. Results and Discussion

3.1 Phytochemical Screening

Phytochemical screening is done for three types of extracts i. e. ethanolic, chloroform, and petroleum ether extract. After doing the phytochemical screening it is found that the ethanolic extract of *Garcenia pedunculata* has carbohydrates, flavonoids, tannins, phenols, fats and oils, and steroid in it. The chloroform extract of *Garcenia pedunculata* has carbohydrates, flavonoids, tannins, phenols, alkaloids, fats and oils, amino acids, glycosides, and steroid in it. The petroleum ether extract of *Garcenia pedunculata* has carbohydrates, flavonoids, tannins, phenols, alkaloids, fats and oils, steroids, glycosides, and steroid in it.

Figure 1: Phytochemical screening (ethanolic extract)

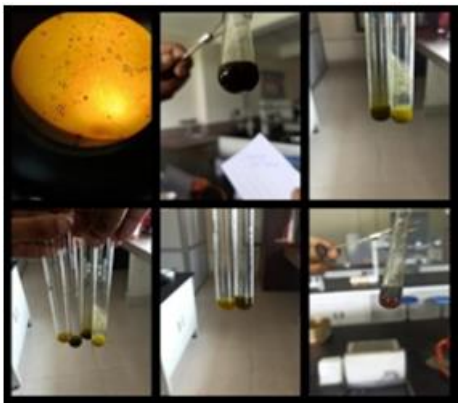

Figure 2: Phytochemical screening (chloroform extract)

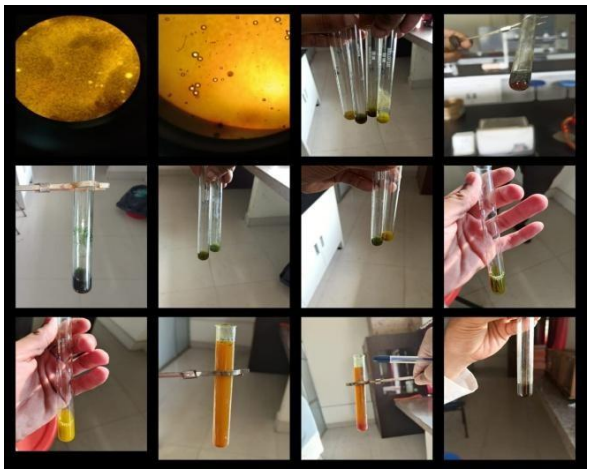

Figure 3: Phytochemical screening (petroleum ether extract)

3.2 Pharmacognostic Evaluation

3.2.1 Macroscopic Evaluation

The color of the leaves can vary depending on the maturity of the plant. Younger leaves tend to be light green, while mature leaves appear dark green. The upper leaf surface is usually darker than the lower surface. Henna-like smell of the leaf powder but no distinct smell of the leaves. The taste of the leaves is sour. The leaves of *Garcinia pedunculata* are typically evergreen, simple, and opposite in arrangement. They exhibit a smooth, glossy texture. The leaves are usually elliptical or lanceolate, with a pointed apex and a tapering base. The size of the leaves can vary, typically measuring between 8-15 centimeters in length and 3-6 centimeters in width. *Garcinia pedunculata* leaves exhibit prominent, pinnate venation. The midrib is well-defined and runs along the length of the leaf, giving rise to lateral veins that branch out in an arcuate pattern. The leaf margin is typically smooth or slightly undulating, without any significant serrations or lobes. The leaf surface is glossy and leathery, with a waxy cuticle. When touched, the leaves may feel smooth and firm.

3.2 Microscopic Evaluation

3.2.1 T. S of Midrib Portion of The Leaf

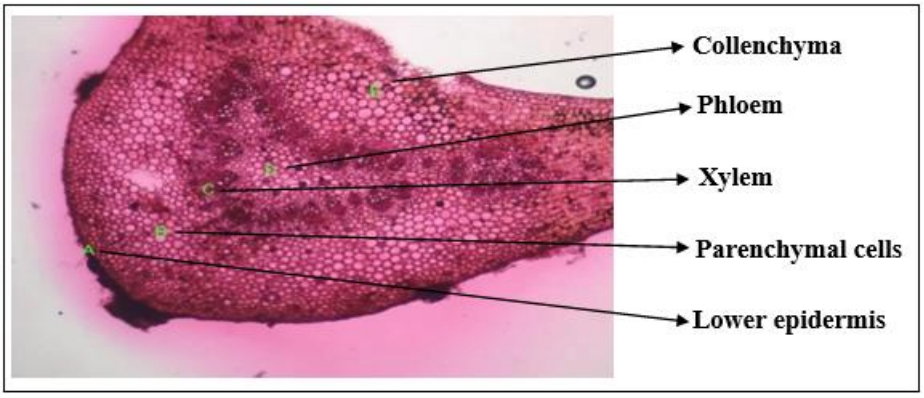

Figure 4: T. S. of the midrib of *Garcinia pedunculata* leaves

3.2.2 Determination of leaf diagnostic characteristics

Indetermination of leaf diagnostic characteristics we have determined the leaf stomatal number and stomatal index of the leaves of *Garcinia pedunculata* leaves. The number of stomata of the upper and lower epidermis of the leave are found to be 60 and 100 respectively. The results for number of stomata are expressed in mean. The stomatal index of the upper and lower epidermis of the leaves are found to be 18.75±0.091 and 21.73±0.061 respectively. The results for number of stomata are expressed in mean ± S. D.

Powder Microscopic Evaluation

In powder microscopic evaluation we have found that it contains Xylem Tissue, Single Phloem Fiber and Fibers.

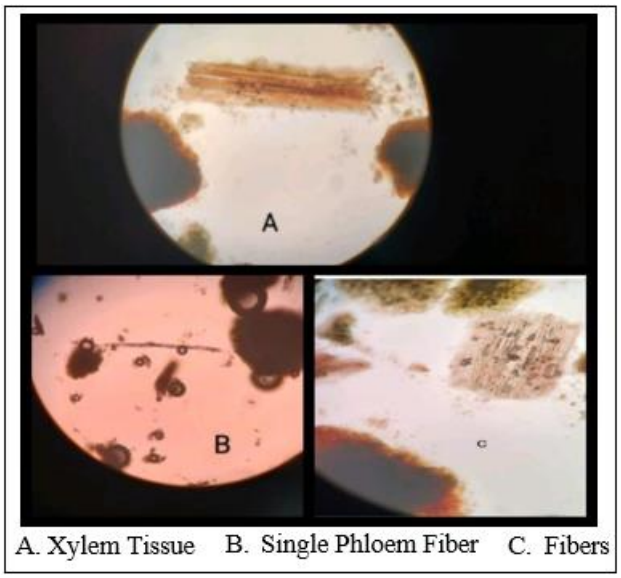

Figure 5: Powder microscopic evaluation

Physicochemical Evaluation

3.2.3 Determination of Moisture Content

The moisture content analysis revealed significant variations across the samples tested. The mean moisture content was found to be 7.133 with a standard deviation of 1.474, indicating a relatively wide range of moisture content among the sample.

3.2.4 Determination of Ash Values

The total ash content of the leaves of *Garcinia pedunculata* was found to be 4.16 ± 0.763 % W/W. These findings indicate the inorganic residue present in the sample after complete incineration. The observed total ash content provides insights into the mineral composition and potential impurities within the leaves of *Garcinia pedunculata*.

The acid-insoluble ash content of the leaves of *Garcinia pedunculata* was found to be 2.9 ± 0.246 % W/W. This value represents the inorganic residue that remains after subjecting the sample to acid digestion, thereby providing insights into the presence of insoluble impurities, such as sand, silica, and other non-combustible substances.

The water-soluble ash content of the leaves of *Garcinia pedunculata* was found to be 1.2 ± 0.352 % W/W. This value represents the inorganic residue that remains after subjecting the sample to water extraction, indicating the presence of water-soluble minerals and salts.

3.2.5 Determination of extractive values

It was seen that Ethanol yielded more % of extract (%) and Petroleum Ether yielded the lowest % of extract (%). The order of % yield i.e. extractive values from increasing to decreasing order is shown below:

Ethanol>Chloroform>Petroleum Ether

3.3 *In-vitro* Antioxidant Activity

3.3.1 Determination of Total Phenolic Content

The strong adsorption and neutralization of free radicals by *Garcinia pedunculata* are explained by its high phenolic component concentration. Phenolic compounds are also helpful in treating a variety of diseases. It was found that the ethanolic extract of leaves of *Garcinia pedunculata* had a total phenolic content of 172.2877 6.510 mg of GAE/g of extract.

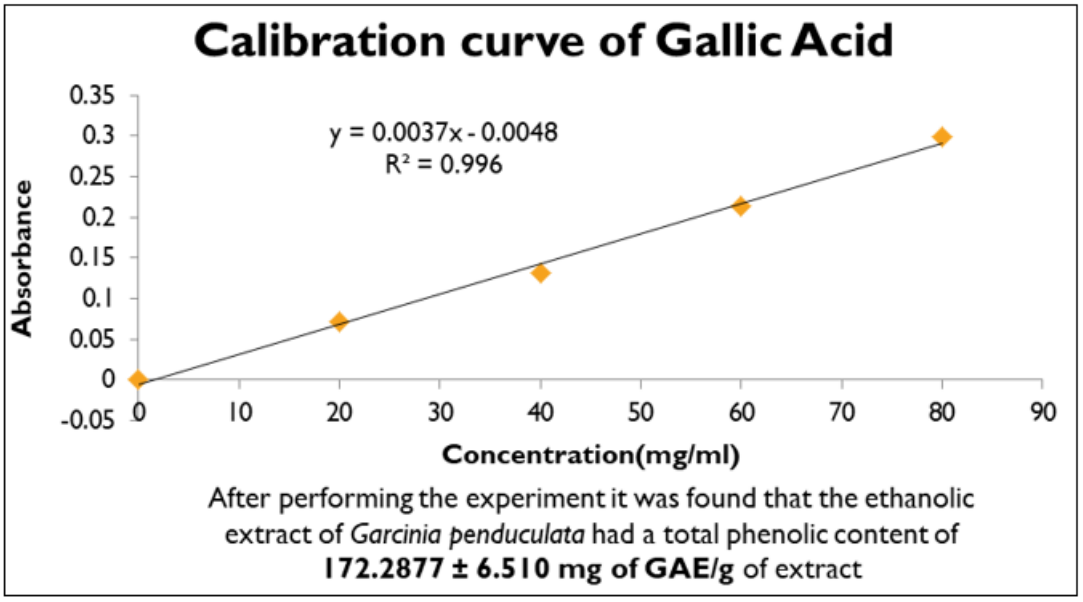

Figure 6: Standard curve of Gallic acid

3.3.2 Determination of Total Flavonoid Content

The total flavonoid content of the ethanolic extract of *Garcinia pedunculata* leaves was determined using the aluminum chloride procedure. The total flavonoid concentration, measured in mg of Quercetin equivalent per gm of extract, was found to be 41.891.0573 mg of QE/gm of the extract. Flavonoids explain why it has antioxidant capabilities via scavenging or chelating.

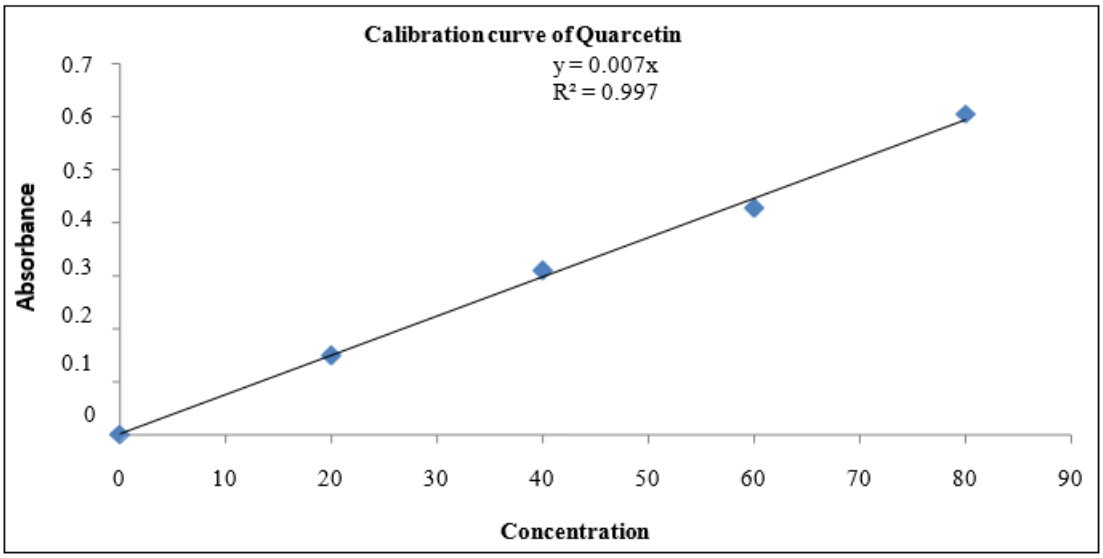

Figure 7: Standard curve of Quercetin

After performing the experiment, it was found that the ethanolic leaf extract of *Garcinia pedunculata* had a total flavonoid content of 41.89±1.0573 mg of Quercetin/g of extract

3.3.3 Reducing Power Assay

The ability of the ethanol extract to reduce was determined. This method is predicated on the ability of the extract to reduce Fe^{3+} to Fe^{2+}, which causes a change in color from yellow to dark green. The capacity of a substance to decline may be a prominent indicator of its potential antioxidant effect. By lowering the oxidized intermediates of lipid peroxidation processes, compounds with substantial reducing power can act as primary and secondary antioxidants. The rise in absorbance with concentration suggested that the sample or extract had a robust reduction potential as well as a significant electron capacity for stabilizing radicals. The results of the reducing power assay are described in Table 1

Table 1: Total antioxidant capacity of ethanol extract of leaves of *Garcinia pedunculta* and standard BHT by Reducing Power Assay

Concentration	Absorbance	
	Extract Mean ± SD	Butylated Hydroxy Toluene Mean ± SD
20	0.333±0.002**	0.410±0.002**
40	0.337±0.002**	0.800±0.004**
60	0.375±0.003**	1.054±0.003**
80	0.448±0.003**	1.366±0.006**

(All values were expressed in Mean ± SD. n=3. One-way Analysis of Variance (ANOVA) followed by Dunnett's test was performed for the significance data. The minimum value of "p<0.05 considered significant, **p<0.01, considered more significant, and ***p group. **p<0.001 considered extremely significant as compared with control group)

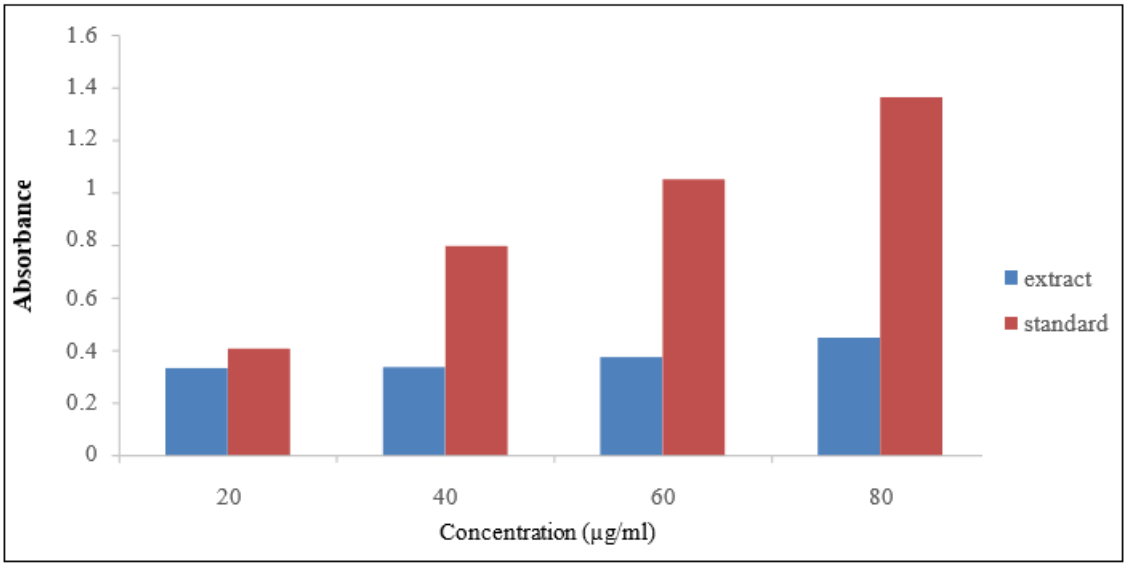

Figure 8: Reducing power activity of leaf extract of *Garcinia pedunculata* and BHT

3.3.4 H2O2 Scavenging Capacity

Here the results of the hydrogen peroxide scavenging capacity assay conducted in this study are presented. The assay was performed to evaluate the antioxidant potential of various plant extracts. The hydrogen peroxide scavenging capacity was determined using the method described by (*Keser et al., 2012*). The IC50 value was determined to assess the efficacy of the plant extracts in inhibiting hydrogen peroxide. The

IC50 value represents the concentration of the extract required to scavenge 50% of the hydrogen peroxide present. The ethanolic extract of leaves of *Garcinia pedunculata* was found to have IC50 value of 52.43 mg/mL, indicating that this concentration of the extract is required to scavenge 50% of the hydrogen peroxide present in the assay. The result of the H2O2 Scavenging Capacity of ethanolic extract of *Garcinia pedunculata* is shown in the table 6.7–

Table 2: Total antioxidant capacity of ethanol extract of leaves of Garcinia pedunculta and standard BHT by H2O2 Scavenging Capacity

Concentration	Percentage Inhibition	
	Extract Mean ± SD	Butylated Hydroxy Toluene Mean ± SD
20	28.13±0.015**	35.29±0.025**
40	33.58±0.026**	46.04±0.035**
60	36.34±0.051**	55.22±0.010**
80	44.02±0.020**	59.47±0.025**

(All values were expressed in Mean ± SD. n=3. One-way Analysis of Variance (ANOVA) followed by Dunnett's test was performed for the significance data. The minimum value of "p<0.05 considered significant, **p<0.01, considered more significant, and ***p group. **p<0.001 considered extremely significant as compared with control group)

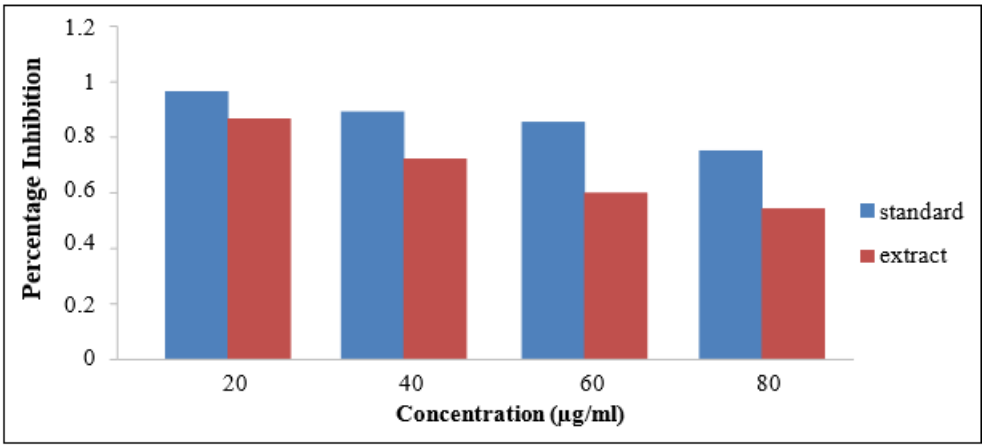

Figure 9: Percentage inhibition of leaf extract of *Garcinia pedunculata* and standard BHT to determine antioxidant activity by H2O2 Scavenging Capacity

3.4 *In-vitro* Anthelmintic Activity

Table 3: Results of in vitro anthelmintic activity of *Garcinia pedunculata*

Test sample	Conc (mg/ml)	Time taken for paralysis (min)	Time taken for death (min)
Control Group	-	-	-
Albendazole	25	38.30±1.27	52.06±1.36
	50	19.29±1.23	28.36±1.46
	100	10.01±0.45	16.39±0.41
Ethanolic Extract	25	48.38±2.01	64.28±1.78
	50	27.07±1.19	36.06±1.95
	100	16.32±0.28	22.24±1.72

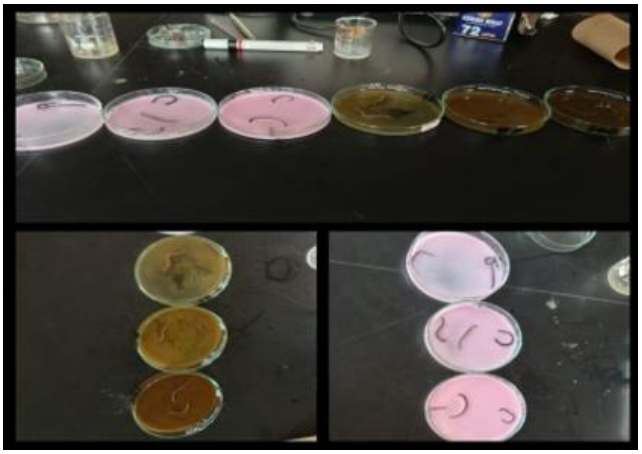

Figure 10: *in-vitro* anthelmintic experiment

The ethanolic extract of the leaves of *Garcinia pedunculata* plant showed strong action against earthworms, delivering the quickest time for paralysis and death, when the anthelmintic activity was compared with the standard Albendazole at concentrations of (25, 50 and 100 mg/ml).

4. Conclusion

The present study aimed to investigate the phytochemical composition and in vitro pharmacological properties, specifically antioxidant and anthelmintic activities, of the medicinal plant *Garcinia pendunculata (*Borthekera). Through comprehensive experimentation and analysis several key findings were observed. Firstly, the phytochemical analysis of *Garcinia pendunculata* revealed the presence of various bioactive compounds, including carbohydrate, flavonoids, tannins, alkaloids, amino acid, glycoside, phenols, fats and oils and steroid. These compounds have been widely recognized for their potential health benefits and medicinal properties. The identification and quantification of these phytochemicals provide valuable insights into the therapeutic potential of *Garcinia pendunculata*. Secondly, the evaluation of antioxidant activity demonstrated that *Garcinia pendunculata* possesses significant free radical scavenging capacity. The high antioxidant potential observed in the plant leaf extract suggests its ability to protect against oxidative stress, a major underlying factor in numerous chronic diseases. This finding highlights the importance of *Garcinia pendunculata* as a potential natural antioxidant source.

Furthermore, the anthelmintic evaluation of leaf extract of *Garcinia pedunculata* revealed notable anthelmintic effect against earthworms. The observed anthelmintic activity suggests the plant's potential application in the development of new anthelmintic agent to combat infectious diseases. Such natural alternatives can help address the growing concern of anthelmintic resistance in both humans and animals. Overall, the findings of this study underscore the pharmacological significance of *Garcinia pedunculata* as a medicinal plant. The phytochemical analysis highlighted the presence of bioactive compounds, while the antioxidant and anthelmintic evaluations provided evidence of its potential therapeutic applications. These results contribute to the expanding knowledge of natural products and their pharmacological activities. It is important to note that this research focused on in-vitro evaluations, and further studies are warranted to investigate the in-vivo effects and potential toxicity profiles of *Garcinia pedunculata*. Additionally, the isolation and characterization of specific bioactive compounds from the plant may provide deeper insights into its mechanisms of action and facilitate the development of novel pharmaceutical formulations. In conclusion, the present study serves as a foundation for future research and encourages further exploration of *Garcinia pedunculata* as a promising medicinal plant. The potential benefits it offers, such as antioxidant and anthelmintic activities, make it a valuable candidate for drug discovery and development. By harnessing the power of natural products like *Garcinia pedunculata*, we can advance the field of pharmacology and contribute to the development of safer and more effective therapeutic interventions.

Acknowledgement
First and foremost, I extend my heartfelt thanks to our Principal, **Dr. Satyendra Deka** for his unwavering support and encouragement throughout the entire duration of my project. His valuable guidance and visionary leadership have been instrumental in shaping the direction and scope of my research. I am immensely grateful to my guide, **Mr. Surender Prasad** for his expertise, patience, and constant guidance. His insightful suggestions and constructive feedback have been invaluable in refining my ideas and enhancing the quality of my work. I am indebted to him for his unwavering dedication and commitment to my academic growth. I would also like to extend my gratitude to the IRC Committee (Institutional Research Committee) for their invaluable feedback and constructive criticism during the evaluation process. Their thorough review and insightful comments have significantly contributed to the overall improvement of my project. Furthermore, I would like to express my appreciation to Guwahati University for providing the necessary resources and infrastructure that enabled me to carry out my research effectively. The academic environment and the opportunities for learning and growth that the university offers have been crucial in shaping my research journey.

References

[1] Kumar, H. K., Raju, M. B. V., Dinda, S. C. and Sahu, S., 2012. Evaluation of anthelmintic activity of Bambusa arundinacea. Asian Journal of Pharmacy and Technology, 2 (2), pp.62-63.
[2] Kanjilal UN, Kanjilal PC, Das A. Flora of Assam V-I. Periodical Expert book Agency, Delhi; 1934. p.103-10.
[3] Baruah S, Borthakur S. Studies on morphology and ethnobotany of six species of Garcinia L. (Clusiaceae) found in the Brahmaputra Valley, Assam, India. J Nat Prod Plant Resour 2012; 2: 389-96
[4] Patir B, Borah A. Wild edible plants of Assam, Director, Forest Communication, Assam; 2007. p.10-1.
[5] Sarmah PC. Ethno antidiabetic plants of Assam. Int J Appl Biol Pharm Technol 2011; 2: 246-51.
[6] Kagyung R, Gajurel PR, Rethy P, Singh B. Ethnomedicinal plants used for gastrointestinal diseases by Adi tribes of Dehang-Debang biosphere reserve in Arunachal Pradesh. Indian J Traditional Knowledge 2010; 9: 496-501.
[7] Prichard, R., 1994. Anthelmintic resistance. Vet Parasitol 54: 259–268.
[8] Sondhi, S. M., Shahu R. Magan, A., 1994. Indian Drugs, 31, pp.317-320.
[9] Guyatt, H. L. and Evans, D., 1992. Economic considerations for helminth control.
[10] Patilaya, P. and Husori, D. I., 2015. Preliminary study on the anthelmintic activity of the leaf ethanolic extract of Indonesian Curanga fel-terrae (Lour.) Merr. Int J Pharmtech Res, 8 (3), pp.347-51.
[11] Basu and Sharma, 2005. Tropical gardening plant in India, pp 17-18.
[12] Tripathi, K. D., 2019. Essential of Medical Pharmacology, 8 th edition, 906-913
[13] Majid N. Nissar S. Raja WY. Nawchoo IA, Bhat ZA. Pharmacognostic standardization of Aralia cachemirica: a comparative study. Future J Pharm Sci.2021 Jan 29, 7 (1): 33.
[14] LEONE, S. PHARMACOGNOSTIC POTENTIALS OF THE GARCINIA KOLA NUT SOLVENT EXTRACT IN HEAVY METAL CHELATION THERAPY IN.
[15] Thakur, R., Singh, R., & Jain, N. (2012). Evaluation of antibacterial activity of Sphaeranthus indicus L. leaves.

J. Pharm. Res, *5* (8), 4382-4388.
[16] Jones, W. P., & Kinghorn, A. D. (2012). Extraction of plant secondary metabolites. *Natural products isolation*, 341-366.
[17] Khandelwal, K. (2008). *Practical pharmacognosy*. Pragati Books Pvt. Ltd. .
[18] Heinrich, M., Barnes, J., Prieto-Garcia, J., Gibbons, S., & Williamson, E. M. (2017). *Fundamentals of pharmacognosy and phytotherapy E-BOOK*. Elsevier Health Sciences.
[19] Badal, S., & Delgoda, R. (2017). *Pharmacognosy (*pp.477-494). Elsevier: Amsterdam, The Netherlands.
[20] Nahar, K., Rahman, M. A., Parvin, M. N. and Sarwar, S., 2010. Evaluation of Anthelmintic Activity of Aqueous Leaf Extract of Clitoria ternatea Linn. Stamford Journal of Pharmaceutical Sciences, 3 (1), pp.46-48
[21] Bruce, S. O., Onyegbule, F. A., & Ezugwu, C. O. (2019). Pharmacognostic, physicochemical and phytochemical evaluation of the leaves of Fadogia cienkowski Schweinf (Rubiaceae). *Journal of Pharmacognosy and Phytotherapy*, *11* (3), 52-60.
[22] Shah, B. N. (2009). *Textbook of pharmacognosy and phytochemistry*. Elsevier India.
[23] Phillipson, J. D. (2007). Phytochemistry and pharmacognosy. *Phytochemistry*, *68* (22-24), 2960-2972.
[24] Blainski, A., Lopes, G. C., & De Mello, J. C. P. (2013). Application and analysis of the folin ciocalteu method for the determination of the total phenolic content from Limonium brasiliense L. *Molecules*, *18* (6), 6852-6865.
[25] Sadasivam S. and Manickam A. (1996) Biochemical methods, 2nd edn, New Age International Publishers, New Delhi, pp.193-194.
[26] Haq, M., Sani, W., Hossain, A. B. M. S., Taha, R. M., & Monneruzzaman, K. M. (2011). Total phenolic contents, antioxidant and antimicrobial activities of Bruguiera gymnorrhiza. *Journal of Medicinal Plants Research*, *5* (17), 4112-4118.
[27] Aiyegroro, O. A., Okoh, A. I.2010. Preliminary phytochemical screening and in vitro antioxidant activities of aqueous extract of Helichrysum longifolium DC. BMC compl. And Alt. Med., 10: 21
[28] Ghafar, F., Nazrin, T. T. N. N., Salleh, M., Hadi, N. N., Ahmad, N., Hamzah, A. A., . . . & Azman, I. N. (2017). Total phenolic content and total flavonoid content in moringa oleifera seed. *GaleriWarisanSains*, *1* (1), 23-25.
[29] Sanna, D., Delogu, G., Mulas, M., Schirra, M., & Fadda, A. (2012). Determination of free radical scavenging activity of plant extracts through DPPH assay: An EPR and UV–Vis study. *Food Analytical Methods*, *5*, 759-766.
[30] Blosi, M. S., 1958. Antioxidant determinations by the use of a stable free radical. Nature 181, 1199 – 1200
[31] Ferreira, I. C., Baptista, P., Vilas-Boas, M., & Barros, L. (2007). Free-radical scavenging capacity and reducing power of wild edible mushrooms from northeast Portugal: Individual cap and stipe activity. *Food chemistry*, *100* (4), 1511-1516.
[32] Wong, C. C., Li, H. B., Cheng, K. W., & Chen, F. (2006). A systematic survey of antioxidant activity of 30 Chinese medicinal plants using the ferric reducing antioxidant power assay. *Food chemistry*, *97* (4), 705-711.
[33] Moon, J. K., & Shibamoto, T. (2009). Antioxidant assays for plant and food components. *Journal of agricultural and food chemistry*, *57* (5), 1655-1666.
[34] Keser, S., Celik, S., Turkoglu, S., Yilmaz, O., & Turkoglu, I. (2012). Hydrogen peroxide radical scavenging and total antioxidant activity of hawthorn. *Chem J*, *2* (1), 9-12.
[35] Ruch, R. J., Cheng, S. J., & Klaunig, J. E. (1989). Prevention of cytotoxicity and inhibition of intercellular communication by antioxidant catechins isolated from Chinese green tea. *Carcinogenesis*, *10* (6), 1003-1008.
[36] Yashaswini, T., Akshara, K. A., Prasad, K., Kumar, M. D., & Akshaykumar, K. (2016). Anthelmintic activity of seed extracts of Artocarpus heterophyllus. *IOSR Journal of Pharmacy and Biological Sciences*, *11* (5), 19-23.
[37] Sarmah, P. I. N. K. Y., Kobing, N. A. K. O., Gogoi, J. Y. O. T. C. H. N. A., & Dutta, M. (2017). In vitro anthelmintic and antiamylase properties of Garcinia pedunculata Roxb. ethanolic extract. *Int J PharmPharmSci*, *9* (1), 189-91.