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Original Research Article

Exploration of Phytochemical and Sun Protection Efficacy of *Anthocephalus chinensis* Leaves Extracts

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ABSTRACT

Overexposure to UV light can cause negative physical conditions for example sear, blot, skin maturing, and cancer of the skin. Using photoprotective or multifunctional products on a daily basis can help to mitigate these harmful health effects. Worries regarding skin protection, communal ramifications, and ethical trading possess increased industry attention in adding natural components into commercial products. Many investigations are presently working on extracts of herbs, however *Anthocephalus chinensis* is still understudied and underutilized. The study attempts to explore *Anthocephalus chinensis* phytochemical composition and sun-protective abilities. The leaves of *Anthocephalus chinensis* were extracted with petroleum ether, water, and ethanol employing the cold-maceration approach. An initial phytochemical search of the leaves extracts of *Anthocephalus chinensis* has been carried out. The UV spectroscopic method has been employed to assess the sun-protective capacity of the various *Anthocephalus chinensis* extracts. The outcomes of the phytochemical search discovered the existence of alkaloids and glycosides in all the *Anthocephalus chinensis* leaves extracts, whereas flavonoids were found only in water and ethanol extract. The sun protective abilities of the various extracts was detected to be 2.27±0.022, 1.57±0.003, and 0.70±0.006 for the ethanol, water, and petroleum ether extracts, respectively. Current work conclusions suggest that extracts of *Anthocephalus chinensis* leaves might be used to produce photoprotective preparations.

***Keywords*:** *Anthocephalus chinensis*, Sun protection factor, Ultraviolet radiation**,** Mansur equation, Plant extracts

Introduction

Humans have employed medicinal plants for their therapeutic value from the beginning of civilization.[1] The relationship between man and his quest for natural remedies dates back thousands of years. It is backed up by a number of sources: documents, unique plant medicines, and even preserved monuments.[2] The Egyptians employed a solar cream made up of inorganic clay and mineral powder in the past. It is especially crucial for those of high social status to have clear skin.[3] Exposure to UV light can cause negative physical conditions for example sear, blot, skin maturing, and cancer of the skin.[4,5,6] According to the wavelength range, ultraviolet rays are categorized as ultraviolet A (315 – 400 nm), ultraviolet B (280 – 315 nm), and ultraviolet C (100 - 280 nm).[7]

Ultraviolet C light is sieved through environmental factors until it arrives at Earth, but ultraviolet B rays can still pierce the ozone layer and burn the skin. Additionally, ultraviolet A radiation can pierce deeper in the skin, harming the skin and speeding up the ageing process.[8] Sunscreens are moisturizers, lotions, and skin treatments that protect against dangerous UV radiation, with regular application reducing UV ray's detrimental effects.[9]

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The effectiveness of a sunscreen is assessed using the sun protection factor (SPF), which is the amount of UV radiation needed to convey a minimal erythemal dose (MED) from protected skin to unprotected skin.[10] To lower the danger of malignancies of the skin and accelerated aging, the Food and Drug Administration of the United States and the European Union (FDA) indicate sun protection factor ratings of SPF-15 or greater. As a result, active agents with high SPF and strong UV radiation filtering efficiency are required.[11]

There are numerous ways to guard against the sun, utilizing compounds obtained from medicinal plants. For instance, few plant secondary metabolites have the capacity to act as ultraviolet filters, although others have anti-inflammatory and antioxidant properties that mitigate the destructive belongings of sun radiation.[12] Herbal sunscreens are reasonably priced and safe.[13] As a result, research into the use of natural substances to reduce skin annoyance and extra negative effects allied with sunscreens continues to grow.[14]

Anthocephalus chinensis Syn. A. indicus, A.rich, A.chiensis (Lam.) Rich. Ex. Walp, (Family-Rubiaceae), also known as kadamba, holds a different place in Ayurveda, an indigenous healthcare system in India. It is also known by the name Kadam.[15,16,17] *Anthocephalus chinensis* is a deciduous woodland species that is frequently farmed in fields. Asia, Australia, and the Pacific are the most prevalent places where they can be found.

Organic substances revealed in *Anthocephalus chinensis* plants can be hired as a natural active component in sunscreen composition.[11] *Anthocephalus chinensis* leaves have been shown to contain various different chemicals. [16, 18] Fever, leprosy, dysentery, and skin conditions were only a few of the ailments that are treated with *Anthocephalus chinensis*. *Anthocephalus chinensis* leaves have anti-oxidant, and wound-healing properties.[17,19,20,21] Considering prior research, this is widely recognized that the leaves of *Anthocephalus chinensis* contain flavonoid compounds.[22] The presence of flavonoid molecules in *Anthocephalus chinensis* plant extracts may support their

photoprotective abilities against UV radiation. Previous studies on the subject, on the other hand, have never gone any further.
This study extracted bioactive compounds from plant materials using ethanol, petroleum ether, and water, but it is necessary to determine the best extraction solvent for each plant material due to the variety of compounds that exist in plants and their varying dissolution properties with various solvents.[23] This study's objectives were to screen for phytochemicals and assess whether the water, petroleum ether, and ethanol extracts of *Anthocephalus chinensis* leaves had any sun-protective properties.

Materials and Methods

Source of Plant material
In order to identify *Anthocephalus chinensis*, whole plant samples were obtained in the month of March 2019 from Dehradun. S. K. Singh of BSI, Dehradun, granted a certificate under reference number BSI/ NRC/ Tech/ Herb (Ident.)/ 2018-19.

Preparation of Anthocephalus chinensis leaves extracts
Anthocephalus chinensis leaves were picked and washed twice using a water supply. To achieve a stable mass, leaves were chopped into small bits. Extraction from *Anthocephalus chinensis* leaves powder (100 g) was performed employing a cold maceration method for 72 hours with 1000 mL of each separate solvent, including ethanol, petroleum ether, and water. The extracts were concentrated in a water bath while being passed through using Whatman filter paper until they were entirely dry. The obtained dark material was kept at 4°C in a closed container in the refrigerator.[24]

Screening of preliminary phytochemicals of Anthocephalus chinensis leaves extracts
Using the Kalaiselvi *et al.* approach, the existence of flavonoids, glycosides, alkaloids, carbohydrates, tannins, and phenolic was examined in extracts of *Anthocephalus chinensis* leaves.[25, 26]
Assessment of the SPF value of Anthocephalus chinensis leaves extracts
Mansur's approach was used for determining sun protection factor.[27] A 100 mL volumetric flask was filled with a measured 0.2 g extract (ethanol, water, and petroleum ether). The extract was then sieved after being diluted with ethanol to volume. A 25 mL sample was moved into a 50 mL volumetric flask then dilute until the appropriate concentration was achieved with ethanol. In the last, once more 25 mL aliquot had been moved to a 50 mL volumetric flask, after which the specimen's final concentration was adjusted with ethanol and quantified using a UV spectrophotometer.[28] At intervals of 5 nm, every extract solution's absorbance has been determined at wavelengths within 290 and 320 nm. With the aid of the Mansur formula, the SPF was established.[29]

$$SPF_{Spectrophotometric} = CF \, X \sum_{290}^{320} EE(\lambda) \, X \, I(\lambda) X Abs(\lambda)$$

Where EE (λ) = erythmogenic effect of radiation with wavelength λ, I(λ) = solar intensity spectrum, CF = correction factor (= 10), and Abs (λ) = absorbance values of the sample.[30]

Statistical analysis
Results of the experiments are reported as means ± SD.

Results and Discussion

Phytochemical screening
In extracts from *Anthocephalus chinensis* leaves, a variety of metabolites were discovered (Table 1).
All of the extracts contained alkaloids, they belong to a class of molecules that have an impact on the nervous system, decrease hunger, and have diuretic properties.[31] Flavonoids are found in all extracts except Petroleum ether extract, and these components will protect you from allergies, carcinogens, and other harmful substances. Glycosides are found in all extracts that were formerly employed in the treatment of cardiac ailments.[32] The extract made from ethanol and water had more bioactive substances, according to preliminary screening, the reason behind this is polar solvents show better isolation for flavonoids.[33]

Determination of sun protection factor of Anthocephalus chinensis leaves extracts
Anthocephalus chinensis leaves extract's SPF was identified using a spectrophotometric technique. Figures 1-3 display the absorption profile.
Since ultraviolet B is most predominant throughout the day and people are subjected to it for an extended amount of duration, it was selected for SPF evaluation. Table 2 displays the findings of the SPF of *Anthocephalus chinensis* leaves extracts.
SPF values were discovered to be 2.27 ± 0.022 (ethanol), 1.57 ± 0.003 (water), and 0.70 ± 0.006 (Petroleum ether) for various extracts. According to findings, *Anthocephalus chinensis* leaves extract may be considered as a sun protector active ingredient because, In SPF position, SPF values 2-12, 12-30, and ≥30 are regarded to have minimum, moderate and high sun protection factor.[14]
Flavonoids from botanical sources are extensively obtained through organic solvents like ethanol.[34] Petroleum ether extract had the lowest SPF value, which was trailed by water extract and ethanol extract.
A lot of studies on the subject suggest that flavonoids play a role in providing UV protection. Flavonoids defend against light in three ways: UV being absorbed, the ability of antioxidants to act in both direct and indirect ways, and the control of various channels of signaling. Plants contain a type of secondary phenolics called flavonoids that act as potent antioxidants. Due to their capacity to absorb UV radiation and function as antioxidants, flavonoids have the potential to deliver direct protection.[35] According to the study's findings (Figure 4), *Anthocephalus chinensis* leaves ethanol extract can be utilized to improve sunscreen performance.

Table 1: Preliminary phytochemical screening of *Anthocephalus chinensis leaves* **extracts.**

Chemical constituents	Petroleum ether extract	Ethanol extract	Water extract
Glycosides	+	+	+
Carbohydrates	-	-	-
Alkaloids	+	+	+
Tannins	-	-	-
Phenolic compounds	-	-	-
Flavonoids	-	+	+

+: Present; -: Absent

Table 2: Sun protection factor values of all extracts of *Anthocephalus chinensis leaves.*

Type of extract	Sun protection factor
Ethanol	2.27 ± 0.022
Water	1.57 ± 0.003
Petroleum ether	0.70 ± 0.006

Conclusion

An analysis of the SPF value of an extract of *Anthocephalus chinensis* leaves was performed using a UV spectrophotometer. The results of this investigation demonstrate that extracts of *Anthocephalus chinensis* have sun-protective properties and may be used to raise the SPF rating of other sunscreen products.

Conflict of Interest

The authors declare no conflict of interest.

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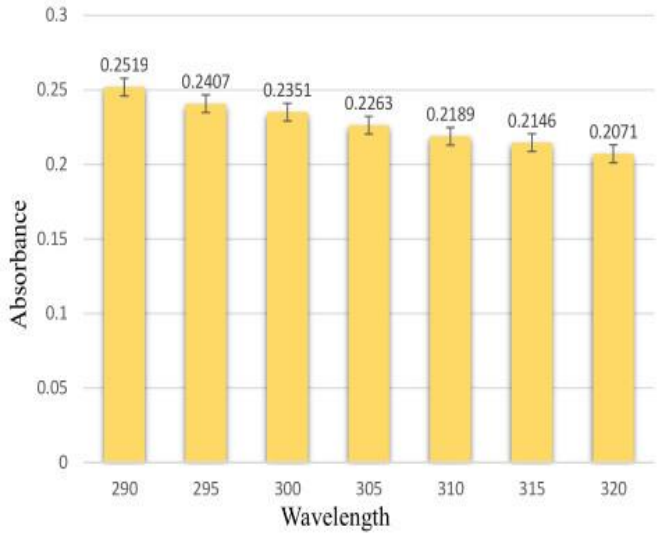

Figure 1: Absorption profile of ethanol extract of *Anthocephalus chinensis* leaves.

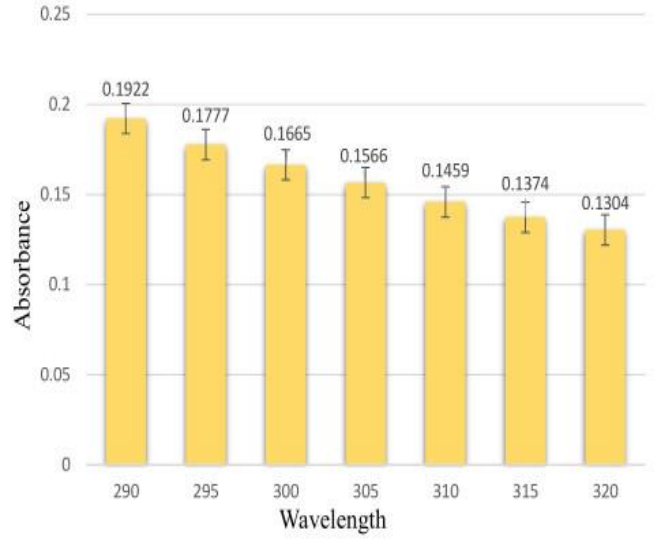

Figure 2: Absorption profile of water extract of *Anthocephalus chinensis* leaves.

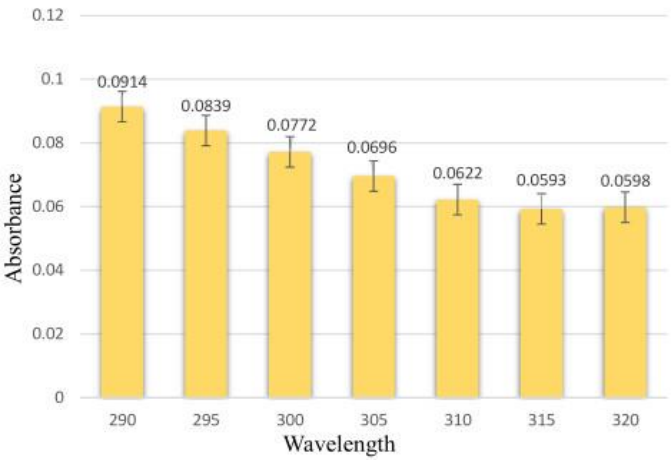

Figure 3: Absorption profile of Petroleum ether extract of *Anthocephalus chinensis* leaves.

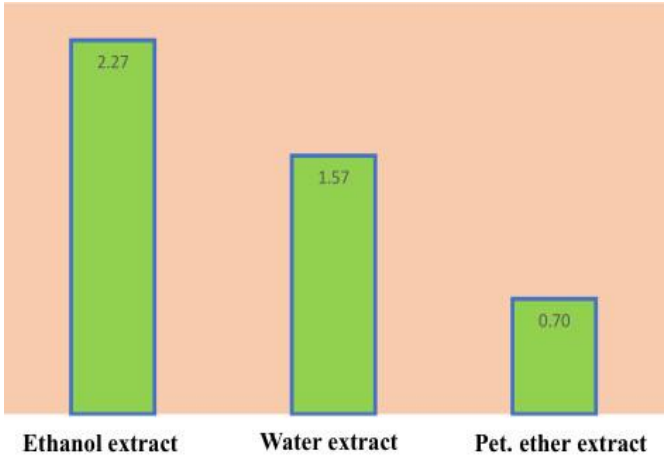

Figure 4: Comparative sun protection factor values of ethanol, water, and petroleum ether *Anthocephalus chinensis* leaves extracts. UV absorbance was measured between 290 and 320 nm with a 5 nm interval according to the Mansur equation.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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