

Biochemical and Functional Characterization of Ethnomedicinal Plants of Manipur for Development of Functional Food Product

**A thesis submitted in partial fulfilment of the requirements for
the degree of**

Doctor of Philosophy

Nemnunhoi Haokip

Registration Number: TZ16711 of 2016



**Department of Food Engineering and Technology
School of Engineering, Tezpur University
Tezpur- 784028, Assam, India**

July, 2024

CHAPTER 8

Summary, conclusions and future scope

8.1. Summary, conclusions

The parts of the plants *Passiflora edulis* Sims., *Plantago major* L., *Clerodendrum glandulosum* Lindl., *Solanum indicum* L., *Centella asiatica* (L.) Urb., and *Phlogocanthus thyriformis* (Roxb. Ex. Hardw.) Mabb., respectively, were explored in the current study, "Biochemical characterization of the hypertensive traditionally used plant of southern Manipur." During the research tenure, methods such as solvent extraction, ultrasonic-assisted extraction and supercritical fluid extraction approaches, extraction methodology optimization, and in vitro tests were conducted to examine the effectiveness of phyto-biomolecule-enriched extracts in the human cell line model and comprehend the inhibition of these molecules in the inflammation pathway and their integration in food product development. Ethnopharmacological field investigations are critical for learning about important indigenous plant species, particularly in the search for new medications and goods. The current study gives detailed information on the traditional applications of ethnomedicinal plants by the Thadou-Kuki tribe of Churachandpur district, Manipur. Our findings revealed that the inhabitants of the investigated area continue to rely on medicinal plants to treat various disorders. Our findings will give baseline data for demonstrating a link between traditional knowledge specialists and scientific researchers. Phytochemical analysis of plant extracts revealed the presence of saponins, tannins, alkaloids, flavonoids, phenolics, and glycosides. Ethanolic extracts from all six plant samples have shown strong antibacterial activity against all tested bacterial strains. Finally, plant extracts are excellent natural antimicrobials that can be used safely as food preservatives. With the present increase in the use and consumption of raw plant materials, it is more important than ever to keep a watch on these plants because they may serve as a source of novel drug and food development. The RP-HPLC analytical results revealed that all the plant samples contained phenolics, with gallic acid being the most prevalent. The study on the leaves extracts of *Clerodendrum glandulosum* Lindl. (optimized samples of UAE and SFE) is an effective choice for treating a variety of inflammatory illnesses. When fed to THP-1 cells, the extracts were found to be non-toxic, and they showed potent anti-inflammatory activity by inhibiting the production of inflammatory mediators such as IL-1 β , TNF- α , and COX-2 in macrophages. With a rising concern among health-conscious people, the hunt

for more nutritious pasta products rich in minerals, phenolic compounds, and dietary low glycemic index has been a focus. In this study, the effect of adding leaf powder and leaf extract powder of *Clerodendrum glandulosum* Lindl. on pasta qualities was investigated. These findings revealed that the fortified pastas had high sensory acceptability. Good marketing expectations are set because it provides sensory acceptability comparable to the standard product. Finally encapsulates of ultrasonicated aqueous leaf extracts of *Clerodendrum glandulosum* Lindl. hydrogel beads with sodium alginate in a calcium chloride solution were prepared and incorporated in a pasta. As a general conclusion, the findings presented in our study show potential prospects for *Clerodendrum glandulosum* Lindl. use as a component in fresh pasta as a healthy dietary option.

Certain points of conclusions from the thesis are summarized below:

1. Investigating the ethnomedicinal applications of traditional medicinal plants by indigenous inhabitants might provide useful insights into traditional usage of plants in addressing various ailments.
2. The identification and quantification analyses can provide insights into the plants' nutritional value, active compounds, and potential therapeutic applications.
3. The analyses of phytochemicals extraction and ACE inhibition analysis helps in understanding how these compounds can regulate blood pressure by inhibiting the conversion of angiotensin I to angiotensin II, which is a key factor in cardiovascular health), and anti-inflammatory properties can provide insights into the compounds' ability to reduce inflammation, which is beneficial for treating various inflammatory diseases.
4. The physico-chemical properties provide insight into the product's quality control and standardization, assuring consistent therapeutic advantages. Understanding these features also aids in product development and marketability.
5. Investigating the encapsulation effectiveness of polyphenol extracts in polysaccharide beads sheds light on their potential as functional food components, improving stability, bioavailability, and consumer appeal through increased sensory qualities.

8.2. Future scope

The future scope for the present research was elaborated. By honoring indigenous knowledge and guaranteeing equal benefits, combining traditional wisdom with contemporary research may protect this heritage while also enhancing global biodiversity and healthcare. In order to preserve tribal knowledge of medicinal plants, it is necessary to uphold cultural legacy, engage people, and incorporate scientific rigor. This will ensure sustainability and equal benefits while promoting biodiversity and global healthcare. Plant species have tremendous potential for scientific validation of their pharmacological actions. This could lead to the creation of new botanical medications or semi-synthetic compounds used in modern medicine.

Identify and analyse phytochemicals found in ethnomedicinal plants, could lead to the discovery of new molecules with medicinal properties. Investigating the long-term viability of ethanol-based ultrasonic and supercritical extraction procedures. This includes determining the environmental impact and feasibility of scaling up these methods for industrial use. Overall, combining ancient knowledge with current extraction techniques and nanotechnology has enormous promise for innovation in the food and pharmaceutical industries, ultimately benefiting health and well-being. It's an intriguing field with many of opportunities for advancement and exploration. Bioactive chemicals have an important role in the food sector, improving product quality and customer health. These chemicals can be obtained from a variety of natural sources and employed as value-added components. The sensory evaluation trial of the final product was conducted in a lab setting with a small panel of participants; however, larger consumer trials are required to validate its viability. Validating a food product necessitates larger customer trials, particularly when using traditional medicinal herbs. These tests ensure not only the product's marketability, safety, and sensory appeal, but also provide critical information for customer acceptance and regulatory approval.