CHAPTER 1

Introduction

In India's healthcare systems, ethnomedical plants are essential, especially in the biodiverse Northeast. Recognized as one of the world's "biodiversity hotspots," this region is home to an enormous variety of indigenous and medicinally valuable plant species. These herbs have long been used by the indigenous populations of North-East India to treat a wide range of illnesses. Their extensive traditional knowledge has been passed down through the years. By employing regional bioresources, this ethnobotanical practice not only supports these communities' basic healthcare needs but also provides a sustainable way of life, knowledge systems, which are essential to the preservation of the region's biodiversity and sense of cultural identity. The conservation and study of these plants is critical for the advancement of translational research, sustainable use, and the preservation of this priceless natural heritage (Lamo et al., 2023). Furthermore, ethnomedicinal practices in North-East India highlight the necessity of safeguarding ancient knowledge systems, which are fundamental to the region's cultural identity and biodiversity conservation (Mipeshwaree et al., 2023).

Ethnomedicine is the study of traditional medical practices as well as cultural attitudes toward health and disease. Its significance arises from its potential to provide insights into indigenous knowledge systems, which can lead to the development of new therapeutic agents and help to conserve medicinal plants. Recent research in ethnomedicine has highlighted its interdisciplinary nature, integrating rigorous scientific approaches with an awareness of cultural backgrounds to improve healthcare results. According to Reyes-García (2023), integrating natural sciences, social sciences, and humanities into ethnobiology and ethnomedicine might lead to policy-relevant research that addresses global health and biodiversity concerns. Another publication from 2024 emphasizes the necessity for ethnobiological and ethnomedical research to become more hypothesis-driven and methodologically sophisticated to successfully influence policies (Carrión-Paladines et al., 2024). These researchs' demonstrates the expanding importance of ethnomedicine in scientific advancement and policy development (Raj et al., 2018).

Plants are vital for phytochemical extraction because they are the major source of these bioactive substances. Phytochemicals are present in different sections of plants, including roots, barks, leaves, flowers, and seeds, and they are responsible for therapeutic effects as well as acting as natural antioxidants. The extraction method is crucial because it extracts active chemicals that may protect against free radical damage and meet human health demands. Optimizing extraction techniques is critical for assuring the isolation of bioactive chemicals and evaluating the performance of future investigations (Mosić et al., 2020; Altemimi et al., 2017; Kumar et al., 2023).

The development of extraction procedures for phytocompounds from ethnomedicinal plants is critical due to the complexity of plant matrices and the fragile nature of these bioactive molecules. Traditional procedures, such as maceration and Soxhlet extraction, frequently result in the incomplete extraction or destruction of these important chemicals. Therefore, novel approaches for extracting bioactive chemicals are needed. New extraction techniques include ultrasound-assisted extraction (UAE), microwave-assisted extraction (MAE), high-pressure (HP), pressurized liquid extraction (PLE), negative pressure cavitations-assisted extraction (NPCE), subcritical water extraction (SWE), supercritical fluid extraction (SFE), enzyme-assisted extraction (EAE), pulsed electric field-assisted extraction (PEF), and accelerated solvent extraction (ASE) (Azmir et al., 2013). Non-thermal, "green" extraction processes meet Environmental Protection Agency standards (Putnik et al., 2018). Green extraction techniques use fewer solvents, require less energy, result in higher yields, and are environmentally benign (Giacomettia et al., 2018).

The inclusion of phytocompounds into food products is gaining popularity due to its health benefits. Antioxidants, flavonoids, and polyphenols are examples of phytochemicals that contribute significantly to the nutritional value of foods. They help prevent oxidative stress-related illnesses by scavenging free radicals (Kawatra et al., 2022). Furthermore, because of their flavouring and stabilizing capabilities, these compounds are used to improve the sensory characteristics and shelf life of food products (Valverde, 2013). Using phytochemicals from food industry by-products promotes sustainability by minimizing waste and environmental effect (Šubarić and Jokić, 2022). Epidemiological studies have connected phytochemical-rich diets to a lower incidence of chronic diseases such as cancer, highlighting the importance of these substances in our diet (Muscolo et al., 2024). Herbal medicine, including phytotherapy, is widely utilized in the treatment of chronic

diseases such as diabetes and high blood pressure, particularly in underdeveloped countries where it is still a popular solution due to affordability (Ben El Mostafa and Maamri, 2020).

Plant extracts are frequently used in the food business for a variety of purposes. The effectiveness of plant extracts is determined by the physicochemical qualities, biological activities, and bioavailability of their active components. However, the limited stability and disagreeable taste of plant extracts limit their use in the food business. Encapsulation is an emerging technology for preserving the biological activity and bioavailability of these bioactive substances while permitting their use in a variety of food products. Encapsulation is the most effective method for not only preserving but also enhancing their physicochemical properties, overcoming the limitations of low water solubility, and improving the sustained release, bioavailability, and application of these functional ingredients in food systems (Reddy et al., 2022).

Ionic gelation is a new process in the world of food product development that promises new advances in texture enhancement and component encapsulation. Ionic gelation is an important technology in food product development because it can improve the texture and rheological qualities of foods. It is responsible for solid-like, viscoelastic characteristics, increased viscosity, adhesiveness, and improved water retention in food products. This is achieved by forming a three-dimensional network of proteins or polysaccharides (Zayas, 1997). Furthermore, ionic gelation is used to encapsulate active substances, extracts, or probiotics for inclusion into foods, which is critical for ensuring the stability and regulated release of these compounds (Gallegos-Tintoré et al., 2024). It also plays a role in generating complicated shapes through 3D printing, replacing lipids, enhancing satiety with minimal food consumption, and sustaining metastable items' structures (Nath et al., 2022).

Objective of the current study

Considering the comprehensive literature review conducted, the present investigation was meticulously designed to harness the potential of India’s underexploited medicinal flora, with a special emphasis on the flora of the North-eastern region. These plants have a longstanding tradition of being utilized in the management of hypertensive ailments. Tribal knowledge of medicinal plants must be preserved and documented using a comprehensive strategy that incorporates sustainability, scientific rigor, community involvement, and

cultural respect. 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. Notwithstanding the paucity of scientific documentation pertaining to their detailed properties and their subsequent application in the development of food products, this study was initiated. The objective was to systematically uncover and document a plethora of intriguing insights associated with the properties of the plants under study, thereby contributing to the existing body of knowledge and facilitating their integration into contemporary therapeutic and nutritional applications.

As a result, the following objectives were established for conducting the research work:

1. To survey on ethnomedicinal uses of traditional medicinal plant used by the indigenous inhabitants of southern Manipur
2. To qualitatively and quantitatively screen six selected ethnomedicinal plants using various extraction techniques and evaluate their antihypertensive potential
3. To optimize the process parameters of phytochemicals extractions using ultrasound assisted and supercritical fluid extraction techniques and study their anti-inflammatory properties
4. To formulate health promoting herbal pasta by incorporating the raw plant powder and extracted plant extracts and study their physico-chemical properties
5. To investigate the encapsulation efficiency of polyphenol extracts within polysaccharide-based beads and evaluate the feasibility of their incorporation in food product