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## List of Publications

### Publications

- **Haokip, N., & Duary, R. K.** (2021). Traditionally used unexplored ethnomedicinal plants by Thadou-Kuki tribe of Churachandpur district, Manipur, India. *Journal of Complementary Medicine Research*, 12(2), 163.
- **Haokip, N., Duary, R. K., & Badwaik, L.** (2023). *Clerodendrum Glandulosum* Lindl. Incorporated functional pasta: Phytochemical, textual, structural and sensory studies. *Journal of Microbiology, Biotechnology and Food Sciences*, 13(1), e9599-e9599.

### Participation in National/International Conference

- **Haokip, N., & Duary, R. K.** “Ethanomedicinal plants used by the Thadou-Kuki tribe of Churachandpur district, Manipur” Future Perspective of Bioresource Utilization” (IJBS 17), February 1-4, 2018, Indian Institute of Technology, Guwahati, Assam
- **Haokip, N., & Duary, R. K.** “Phytochemical screening of Ethnomedicinal plants using Supercritical Fluid Extraction techniques” National Probiotics and Functional Foods on Health Management (PFFHeM), 4<sup>th</sup> - 5<sup>th</sup> March 2019, Department of Food Engineering & Technology, Tezpur University, Napaam, Tezpur - 784 028, Assam

### Awards/achievements

- Received UGC-JRF (UGC-Ref. No.: 1374/(ST) (NET)-JUNE 2015)

The following Questionnaires will be gathered:

AN ETHNOMEDICINAL PLANTS USED BY THADOU-KUKI TRIBE OF MANIPUR

1. Demographic information:

- i. Age:
- ii. Gender:
- iii. Practice specification:
- iv. Duration of practice:
- v. Educational background:

2. Plants used as Medicines:

Sl.No.	Scientific name	Local Name	Parts used	Mode of preparation and uses

3. Parameters:

- i. Source of knowledge: (a) Parental  
(b) Friend  
(c) Healer  
(d) Traditional Health Practitioner  
(e) Divination  
(f) Other

- ii. At what age did you learn about medicinal plants or herbal products and their use?  
(a) 0 - 20 years old  
(b) 21 - 30 years old  
(c) Not sure

- iii. Did the plants work? (Yes)  
(No)

- iii. Any adverse/side effects? (Yes)  
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RESEARCH ARTICLE

# Traditionally Used Unexplored Ethnomedicinal Plants by Thadou-Kuki Tribe of Churachandpur District, Manipur, India

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## ABSTRACT

**Aim/Background:** The indigenous Kuki people have always have a good knowledge of medicinal plants available in their surroundings which are used in treating various illnesses. The present study aims to identify, collect and document traditional uses of ethnomedicinal plants by Thadou-Kuki tribe of Churachandpur district, Manipur.

**Materials and methods:** A total of 80 informants were interviewed through an open-ended and semi-structured questionnaire. The data obtained were analyzed through the Informant Consensus Factor (ICF) and the Fidelity level (FL).

**Results:** It was reported that 55 medicinal plants belonging to 55 genera and 34 families were documented during the survey. The Asteraceae family was the most dominant among all other families. Herbs constituted the largest proportions indigenous to the community with 38.18%. Leaves were the most frequently used plant parts. Decoction and Oral ingestion was found to be the most common mode of preparation and route of application respectively. The consensus analysis revealed that liver diseases, cardiovascular diseases, and respiratory diseases showed the highest ICF with 0.96, 0.92, and 0.91 respectively. While at least four plant species showed 100% FL value namely *Centella asiatica*, *Clerodendrum glandulosum* Lindl., *Solanum indicum* L. and *Justicia adhatoda* L. used for treating hypertension, and *Centella asiatica* used for treating gastrointestinal problem also reported 100% FL value.

**Conclusions:** Our data showed that the inhabitants of the studied area still rely on medicinal plants for treating different diseases. Our findings will provide baseline data to exhibit a connection between the traditional knowledge experts and scientific researchers.

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## KEYWORDS:

ethnomedicinal plants, survey, tribal, traditional knowledge, plant conservation.

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## INTRODUCTION

Presently, there is an urgent need to investigate the role of ethnobotanical studies about age-old traditional folk proficiency and also in finding new plant resources for the

development of drugs and food [1]. Ethnic communities have always learned and passed on orally about the traditional knowledge for a very long time from generation to generation. This knowledge was based mainly on their lifelong experience with the use of plants in curing illnesses and has been regarded

## CLERODENDRUM GLANDULOSUM L. INCORPORATED FUNCTIONAL PASTA: PHYTOCHEMICAL, TEXTUAL, STRUCTURAL AND SENSORY STUDIES

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### ABSTRACT

With an increasing concern by health conscious people search for more nutritious pasta products rich in minerals, phenolic compounds and dietary low glycemic index and have become the subject of primary significance. In this work effect of the addition of leaf powder as well as leaf extracted powder of *Clerodendrum glandulosum* L. on properties of pasta was studied. Functional pasta was developed by using a blend of durum wheat semolina, leaf powder and extracted leaf powder. The plant powder and extracts powder were added in the formulation with four proportions (2.5%, 5.0%, 7.5% and 10%) respectively. The obtained products were analyzed for their cooking attributes, textural properties, colour, phytochemical properties and sensory characteristics. Incorporation of leaf powder and extracts remarkably elevated the antioxidant activity ( $42.01 \pm 1.40$  to  $74.19 \pm 2.58\%$ ) and total phenolic content ( $13.96 \pm 1.84$  to  $43.55 \pm 2.55$  mg GAE/g). The moisture content decreases ( $55.79 \pm 1.53$  to  $48.58 \pm 1.51\%$ ) with increase in leaf or leaf extract powder. The swelling index and water absorption index of functional pasta were recorded lower values than the control pasta. With the addition of more leaf and extract powder, the product's lightness (L\*) and yellowness (b\*) reduced while its redness (a\*) grew. The hardness, springiness and chewiness were found to be relatively lower than that of the Control. The findings of the current study showed that among the pastas that have been fortified, the pasta with *Clerodendrum glandulosum* L. additions up to E-2.5% had the highest sensory acceptance. Good marketing expectations are given because it supplied sensory acceptance similar to the standard product.

**Keywords:** Functional pasta, Leaf powder and extracts, cooking properties, swelling index

### INTRODUCTION

Pasta is a fundamental meal that is mostly made by combining water and durum wheat semolina, and it is sold in a wide variety of forms around the world. Due to its numerous desirable qualities, including its vast variety of forms, extended shelf life, good nutritional value, hygienic quality, and due to its low cost, pasta is consumed all over the world. Due to its widespread usage around the world, pasta is one of the healthiest foods. The physical, chemical, and textural features of the pasta are directly influenced by the composition of the raw materials used in its creation. It can be challenging to incorporate non-traditional ingredients without having an adverse influence on the pasta's quality qualities or without having those elements have an effect that is inconsistent with the quality of the pasta. Thus, it is necessary to pay more attention to developing nutrient-rich pasta products with higher-quality features and innovating unique nonconventional components to improve the quality of the dough. In order to create unique pasta products, further study is needed to identify and develop nonconventional components with greater utility and reasonable costs (Nilusha and Jayasinghe, 2019).

The manufacture of pasta presents a number of opportunities for product innovation. According to Laus *et al.*, (2017), pasta is an appropriate vehicle for combining dietary supplements such plant extracts, vitamins, minerals, fatty acids, and dietary fibre. Scientists and manufacturers have been working to create new pasta formulas in recent years so that it can not only provide nutrients and energy to the body, but also modulate one or more specific bodily functions by enhancing a specific physiological response and/or lowering the risk of disease. Functional pasta products are what these novel formulations are known as. The process of refining flour and semolina results in the loss of phenolic chemicals, therefore commonly consumed pasta does not contain them. The long-term consumption of diets high in plant polyphenols may provide protection against the development of cancers, cardiovascular diseases, diabetes, osteoporosis, and neurodegenerative diseases, according to epidemiological studies and related meta-analyses. As a result, a number of methods have been devised to create functional pasta that is high in phenolic compounds. Antioxidant consumption has been linked to decreased lymphocyte DNA oxidative damage. Similar findings have been reported for foods and beverages high in polyphenols, demonstrating the antioxidant properties of polyphenols (Vitrac, *et al.*, 2002). One of the methods recently investigated to produce functional pasta is the use of powders and extracts from plant foods and food byproducts.

Some scientists have been looking into the prospect of enhancing pasta with herbal raw materials in recent years. Padalino *et al.*, (2019) added an extract from the *Salicornia europaea* plant to fresh durum wheat pasta. Enhanced anti-inflammatory and anticancer capabilities are present in this annual herb (Kang *et al.*, 2011). Angiolillo *et al.*, (2019) investigated the impacts of microbiological and sensory quality utilising bioactive ingredients added to freshly filled pasta after being isolated from broccoli byproducts. Saffron extract was added to pasta made from durum wheat flour, and it was discovered that this additive reduced the glycaemic index and starch digestibility of the enriched pasta (Armellini *et al.*, 2019). Additionally, the presence of saffron caused the digestive juices to release crocin, a significant component that gives saffron its colour. Different plant species' leaves are an important source of a variety of bioactive substances with beneficial effects on health that can be employed as food additives. Recently, wheat pasta was made with *Moringa oleifera* L. leaf powder, according to Simonato *et al.*, (2020). This plant's leaves added phenolic chemicals, DF, protein, and minerals to pasta. An essential member of this family, *Clerodendrum glandulosum* Lindl. (also known as *C. colebrookianum* Walp.), grows profusely in the wild in India's Northeast (NER) as well as the tropical and subtropical regions of the South Asian subcontinent. The genus contains a number of species that are found throughout India in varied agro-ecological zones, from the Himalayan foothills to the Kanyakumari coast. In the North Eastern region of India, there are 18 species and 2 variants of the genus *Clerodendrum*. Nefafu, Phuinum, and Anphui are some of its common names in Assamese, Mizo, and Thadou-Kuki ethnomedicinal traditions, respectively (Nath and Bordoloi, 1991; Kalita *et al.*, 2012; Duary & Haokip, 2021). This plant maintains a unique place in NER folk medicine and culinary customs due to its several strong medicinal effects, and it is frequently taken. For the treatment of several metabolic syndromes (MetS), such as hypertension, high cholesterol, diabetes, obesity, etc. *Clerodendrum glandulosum* (CG) has been mentioned. Extracts obtained from leaves of CG have been reported as antioxidant, hepatoprotective, anti-inflammatory, cardioprotective, hypolipidemic, antiobesity, anti-hyperglycemic and antidiabetic (Jadeja *et al.*, 2010).

The goal of the current study was to create novel, functional pasta with high antioxidant properties by fortifying it with *Clerodendrum glandulosum* L., and to evaluate how fortification affected the physiochemical, textural, and sensory characteristics of the fortified pasta in order to increase consumer acceptance of the quick-to-prepare food as a means of disease prevention. This study will help to



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### Chapter 1

#### Introduction

In India's healthcare systems, ethnomedicinal 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 (Mipeshwarce 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 ethnomedicinal research to become more hypothesis-driven and methodologically sophisticated to successfully influence policies (Carrion-Paladines et al., 2024). These researches' 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

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