International Journal of Botany Studies
www.botanyjournals.com
ISSN: 2455-541X
Received: 28-10-2025, Accepted: 27-11-2025, Published: 12-12-2025
Volume 10, Issue 12, 2025, Page No. 16-19

# Assessment of total fat content in some wild and cultivated plant species of Kangchup Chingkhong, Manipur (Northeast India)

**O Noyon Singh, A Kikim*, Ch Niranjan**
Institutional Biotech Hub, Lilong Hoareibi College, Thoubal District, Manipur, India

**Abstract**
A study was conducted during 2024 to evaluate the total fat content in 39 plant samples, including 32 wild and 7 cultivated species, collected from the Kangchup Chingkhong area of Manipur, Northeast India. Fat content varied widely among species and plant parts. Among wild species, *Hodgsonia heteroclita* fruit (4.60 ± 0.23 mg/g) and *Parkia timoriana* seed (2.20 ± 0.11 mg/g) exhibited the highest lipid levels, while species such as *Siphonochilus aethiopicus*, *Albizia myriophylla*, and *Solanum melongena* displayed very low fat (≤0.10 mg/g) content. Moderate fat content was observed in rhizomatous species like *Zingiber striolatum*, *Kaempferia parviflora*, and *Curcuma* species, as well as in leaves and flowers of *Dysoxylum excelsum*. Among cultivated plants, black rice (*Oryza sativa*) contained higher fat (0.27 ± 0.01 mg/g) than the local rice variety (0.13 ± 0.01 mg/g), while *Zingiber officinale* and *Pisum sativum* showed moderate levels. The findings indicate that wild seeds and oily fruits are valuable lipid sources, whereas leaves, stems, rhizomes, and soft fruits generally contain low fat. This study provides baseline data on lipid content in underutilized wild and cultivated plant species of Northeast India, highlighting their nutritional potential and relevance for local dietary and livelihood applications.

**Keywords:** Wild edible plants, cultivated plants, total fat content, nutritional evaluation, manipur

## Introduction

The Northeastern region of India is one of the world's important biodiversity hotspots and harbours a rich tradition of wild food plants (WFPs) and under-utilised cultivated species that contribute substantially to local diets, livelihoods, and cultural identity. In many rural communities across this region, WFPs are not only sources of vitamins, minerals, and fibre but also contribute macronutrients — including seasonally available lipids — that complement staple cereals and support household food security (Talang *et al*., 2023; Maisnam *et al*., 2024) [10, 16, 17]. Ethnobotanical inventories from Manipur and adjacent states emphasize deep traditional knowledge of WFPs and indicate widespread use of both leafy and non-leaf plant parts (fruits, seeds, tubers) that vary markedly in proximate composition and nutritional importance (Meitei *et al*., 2022; Kikim et.al, 2024) [8, 11].

Globally, recent nutritional and ethnobotanical syntheses indicate that WFPs often possess valuable proximate composition traits and bioactive compounds, making them relevant for nutrition, dietary diversification, and potential nutraceutical development (Borelli *et al*., 2022; Casas *et al*., 2024) [3, 4]. Comparative surveys from diverse regions report wide ranges of crude-fat values across taxa and plant parts, demonstrating that some wild fruits and seeds can be substantial lipid sources even when leafy species are generally low in fat (Yimer *et al*., 2023; Yiblet & Adamu, 2023; Ngurthankhumi *et al*., 2024) [12, 19, 20]. These international findings provide useful context for evaluating the potential contribution of WFPs in Northeast India to local dietary fat intake and for comparing species-level nutritional variability.

Within India, region-specific proximate studies and ethnobotanical surveys have increasingly documented the nutritional promise of under-utilised and wild taxa; several studies from the Northeastern Hill (NEH) region report both the occurrence and proximate composition (including crude fat) of locally used WFPs, highlighting species that merit further biochemical and nutritional attention (Talang *et al*., 2023; Maisnam *et al*., 2024) [10, 16, 17]. However, despite this growing interest, locality-specific biochemical datasets that directly compare total fat content across co-occurring wild and cultivated taxa within a single landscape are still relatively scarce for many NEH localities. This gap limits robust dietary assessment and evidence-based promotion or valorisation of particular wild species in local nutrition initiatives (Rumicha *et al*., 2024) [13].

A recent field inventory from Kangchup Chingkhong (Senapati district, Manipur) documented a diverse assemblage of wild edible plants used by local communities and provides an ideal ethnobotanical baseline for targeted biochemical follow-up (Kikim *et al*., 2024) [8]. Building on such local inventories and on the broader literature showing taxon-specific variability in lipid content, comparative and quantitative assessments of total fat in both wild and cultivated co-occurring species from Kangchup Chingkhong can (a) clarify the relative dietary role of WFPs in local fat supply, (b) identify candidate species for nutraceutical or small-scale commercial development, and (c) support conservation and sustainable-use decisions anchored in nutritional evidence (Saini *et al*., 2021; Talang *et al*., 2023; Casas *et al*., 2024) [4, 14, 16, 17].

Accordingly, the present study assesses and compares the total fat content of selected wild and cultivated plant species from Kangchup Chingkhong, situating the results within national (NE India) and international proximate-composition studies to evaluate both local dietary implications and broader nutritional significance.

## Materials and Methods

Total fat content was estimated using the Soxhlet extraction method. Dried and finely ground plant samples (1 g, dry weight) were placed in cellulose thimbles and extracted with petroleum ether (40–60 °C) for 12 hours. Before extraction, the clean and dry Soxhlet flask was weighed to obtain the initial tare weight. After extraction, the solvent was evaporated, and the flask containing the lipid residue was dried to constant weight and reweighed. The total fat content was determined gravimetrically as the difference between the final and initial weights of the Soxhlet flask and expressed as milligrams per gram of dry weight. All samples were analysed in triplicate, and solvent blanks were included to correct for any background residue. An analytical balance (±0.1 mg accuracy) was used to ensure precise measurements.

## Results And Discussion

### Results

The total fat content of 39 plant samples (32 wild and 7 cultivated) from the Kangchup Chingkhong area showed considerable variation (Table 1). Among the wild species, *Hodgsonia heteroclita* fruit recorded the highest fat content (4.60 ± 0.23 mg/g), followed by *Parkia timoriana* seed (2.20 ± 0.11 mg/g). Moderate fat levels were observed in *Zingiber striolatum* (0.78 ± 0.04 mg/g), *Kaempferia parviflora* (0.77 ± 0.04 mg/g), *Dysoxylum excelsum* leaves (0.67 ± 0.03 mg/g), and *Dysoxylum excelsum* flowers (0.56 ± 0.03 mg/g).

**Table 1:** Total fat content of some wild edible and cultivated plants

| Plant Sample | Total Fat Content (mg/g) |
|---|---|
| **Wild plant** | |
| *Curcuma caesia rhizome* | 0.38 ± 0.02 |
| *Kaempfera parviflora* rhizome | 0.77 ± 0.04 |
| *Curcuma amada* rhizome | 0.32 ± 0.02 |
| *Alpinia officinarum* leaves | 0.05 ± 0.00 |
| *Siphonochilus aethiopicus* rhizome | 0.02 ± 0.01 |
| *Dysoxylum excelsum* leaves | 0.67 ± 0.03 |
| *Dysoxylum excelsum* flower | 0.56 ± 0.03 |
| *Dysoxylum excelsum* stem | 0.28 ± 0.01 |
| *Parkia timoriana* seed | 2.20 ± 0.11 |
| *Parkia timoriana* flesh | 0.12 ± 0.01 |
| *Leucaena leucocephala* seed | 0.08 ± 0.00 |
| *Leucaena leucocephala* pulp | 0.05 ± 0.00 |
| *Hodgsonia heteroclita* fruit | 4.60 ± 0.23 |
| *Wendlandia grandis* flower | 0.44 ± 0.02 |
| *Paedaria foeteda* gall | 0.10 ± 0.01 |
| *Paedaria foeteda* leaves | 0.51 ± 0.03 |
| *Paedaria foeteda* stem | 0.10 ± 0.01 |
| *Accacia pennata* leaves | 0.24 ± 0.01 |
| *Accacia pennata* stem | 0.15 ± 0.01 |
| *Brachycorythis obcordata* leaves | 0.15 ± 0.01 |
| *Clerodendrum serratum* leavs | 0.17 ± 0.01 |
| *Alpinia galanga* rhizome | 0.12 ± 0.01 |
| *Maranta arundinaceae* rhizome | 0.22 ± 0.01 |
| *Smallanthus sonchifolius* tuber | 0.15 ± 0.01 |
| *Clerodendrum colebrookianum* leaves | 0.37 ± 0.02 |
| *Clerodendrum colebrookianum* stem | 0.19 ± 0.01 |
| *Zinziber striolatum* | 0.78 ± 0.04 |
| *Zanthoxylum oxyphyllum* leaves | 0.23 ± 0.01 |
| *Clerodendrum serratum* root | 0.15 ± 0.01 |
| *Clerodendrum serratum* stem | 0.12 ± 0.01 |
| *Clerodendrum serratum* flower | 0.22 ± 0.01 |
| *Albizia myriophylla* bark | 0.09 ± 0.00 |
| **Cultivated plant** | |
| *Oryza sativa* grain (local variety) | 0.13 ± 0.01 |
| *Oryza sativa* grain (black rice) | 0.27 ± 0.01 |
| *Zingiber officinale* rhizome (local variety) | 0.30 ± 0.02 |
| *Curcuma longa* rhizome (local variety) | 0.23 ± 0.01 |
| *Pisum sativum* seed (local variety) | 0.34 ± 0.02 |
| *Solanum tuberosum* tuber (local variety) | 0.18 ± 0.01 |
| *Solanum melongena* fruit (local variety) | 0.01 ± 0.00 |

*The data represents were mean ± standard deviation of 3 replications

Low fat levels (≤0.10 mg/g) were recorded in *Siphonochilus aethiopicus* (0.02 ± 0.01 mg/g), *Albizia myriophylla* (0.09 ± 0.00 mg/g), *Leucaena leucocephala* seed and pulp (0.08 ± 0.00 and 0.05 ± 0.00 mg/g), *Clerodendrum serratum* stem (0.12 ± 0.01 mg/g), and *Solanum melongena* fruit (0.01 ± 0.00 mg/g). Among the cultivated plants, black rice (*Oryza sativa*) showed higher fat content (0.27 ± 0.01 mg/g) compared to the local rice variety (0.13 ± 0.01 mg/g). *Zingiber officinale* rhizome (0.30 ± 0.02 mg/g) and *Pisum sativum* (0.34 ± 0.02 mg/g) also displayed moderately higher fat levels, whereas *Solanum melongena* again exhibited the lowest value (0.01 ± 0.00 mg/g).

Overall, the data indicate wide inherent variation between plant parts, species, and growth habits (wild vs. cultivated).

The substantial variation in fat content reflects species-specific metabolic differences, ecological adaptations, and functional roles of plant tissues. Wild species such as *Hodgsonia heteroclita* and *Parkia timoriana* seeds are naturally rich in lipids and act as energy reserves for germination, which explains their high fat concentration (Inthachat *et al*., 2023; Talang *et al*., 2023) [6, 16, 17]. Similar high lipid levels in seeds and oily fruits have been widely reported in earlier studies across India and Southeast Asia.

Rhizomatous species such as *Zingiber striolatum*, *Kaempferia parviflora*, and *Curcuma* species showed moderate fat content, consistent with the known presence of essential oils, terpenoids, and storage lipids in members of the Zingiberaceae family. These values agree with previous national and international findings that describe rhizomes as reservoirs of secondary metabolites with moderate lipid constituents (Talang *et al*., 2023) [16, 17].

Leaves of *Dysoxylum excelsum*, *Clerodendrum colebrookianum*, and *Acacia pennata* exhibited low to moderate fat levels, which is expected because leaf tissues usually prioritize carbohydrate and pigment synthesis rather than lipid accumulation (Talang *et al*., 2023) [16, 17]. Low-fat values found in *Solanum melongena* fruit and *Siphonochilus aethiopicus* rhizome align with earlier reports indicating minimal lipid reserves in soft aerial parts and aromatic rhizomes, respectively (Talang *et al*., 2023) [16, 17].

Comparison between wild and cultivated plants shows that some cultivated species, particularly *Pisum sativum* and *Zingiber officinale*, contain moderate fat levels, yet overall, the lipid concentration remains lower than that of the high-fat wild species. The higher lipid content in black rice compared to local white rice agrees with previous research demonstrating that pigmented rice varieties typically retain higher oil, phenolics, and micronutrients (Longvah *et al*., 1998) [9].

The diversity in fat content across samples from Kangchup Chingkhong highlights the nutritional potential of several underutilised wild species. In particular, *Hodgsonia heteroclita* and *Parkia timoriana* may serve as valuable indigenous sources of plant lipids, supporting local dietary and livelihood applications. The predominance of low-fat values in most other species reinforces their suitability for diets requiring reduced lipid intake.

## Conclusion

This study shows that total fat content varies widely among the wild and cultivated plants of Kangchup Chingkhong. Wild oily fruits and seeds, especially *Hodgsonia heteroclita* and *Parkia timoriana*, contained the highest lipid levels, while most leaves, rhizomes, stems, and soft fruits had low fat. Cultivated species like black rice and ginger showed moderate fat content. Overall, the findings highlight the nutritional value of selected wild species and provide useful baseline information for future nutritional studies and local food-based applications.

## Acknowledgments

The authors are thankful to the Department of Biotechnology, Ministry of Science and Technology, Govt. of India for providing the financial assistance.

## Competing interests

The authors have declared that no competing interests exist.

## Authors' Contributions

All the authors have given equal contributions. All the authors read and approved the final manuscript.

## References

1. Bachheti A, *et al*. Fruit and seed studies of wild and underutilized plants: implications for nutrition and value-addition. Food Production, Processing and Nutrition (FPPN), 2023. https://doi.org/10.1186/s43014-023-00140-5.
2. Bligh EG, Dyer WJ. A rapid method of total lipid extraction and purification. Canadian Journal of Biochemistry and Physiology,1959:37(8):911–917. https://doi.org/10.1139/o59-099.
3. Borelli T, Hunter D, Güzelsoy NA, Karabak S, others. Assessment of the nutritional value of selected wild food plants in Türkiye and their promotion for improved nutrition. Sustainability,2022:14(17):11015. https://doi.org/10.3390/su141711015.
4. Casas M, Vallès J, Gras A. Nutritional properties of wild edible plants with traditional use in the Catalan linguistic area: a first step for their relevance in food security. Foods,2024:13(17):2785. https://doi.org/10.3390/foods13172785.
5. Chen Z, Zheng Y, Li Y. Determination of microalgal lipid content and fatty acid profiles: review of methods and best practices. The Scientific World Journal, 2018, 1503126. https://doi.org/10.1155/2018/1503126.
6. Inthachat W, Thangsiri S, Khemthong C, On-Nom N, Chupeerach C, Sahasakul Y, *et al*. Green extraction of *Hodgsonia heteroclita* oilseed cake powder to obtain optimal antioxidants and health benefits. Foods,2023:12(23):4281. https://doi.org/10.3390/foods12234281
7. Jiru NA, Bekele KT, Abare A. Nutritional composition and antioxidant properties of selected wild edible fruits. Journal of Food Biochemistry,2023:47(11):e13924. https://doi.org/10.1111/jfbc.13924.
8. Kikim A, Noyon Singh O, Niranjan Ch. Exploration of some wild food plants used by local people of Kangchup Chingkhong, Senapati District of Manipur, India. Asian Research Journal of Agriculture,2024:17(3):205–213. https://doi.org/10.9734/arja/2024/v17i3489.
9. Longvah T, Deosthale Y. Nutrient composition and food potential of *Parkia* species and other legumes. Food Chemistry,1998:63(2):177–184. https://doi.org/10.1016/S0308-8146(97)00179-9
10. Maisnam MML, Panmei R, Adhikary P, Salam D, Loushambam RS. A review of wild edible plants in Manipur: Enhancing sustainable livelihoods and economic development in the Indo-Myanmar hotspot region. Ethnobotany Research and Applications,2024:29:1–50. https://doi.org/10.32859/era.29.59.1-50
11. Meitei LR, De A, Mao AA. An ethnobotanical study on the wild edible plants used by forest dwellers in Yangoupokpi Lokchao Wildlife Sanctuary, Manipur, India. Ethnobotany Research and Applications, 2022:23:1–25. https://doi.org/10.32859/era.23.15.1-25
12. Ngurthankhumi R, Hazarika TK, Lalruatsangi E, Lalnunsangi T, Lalhmangaihzuali HP. Bioactive constituents and health-promoting compounds of few wild edible fruits of North-East India. International

Journal of Food Properties, 2024. https://doi.org/10.1080/10942912.2024.2374498.
13. Rumicha TD, *et al*. Food, feed, and phytochemical uses of wild edible plants: review and perspectives. Food Science Nutrition, 2024. https://doi.org/10.1002/fsn3.70454.
14. Saini RK, Prasad P, Shang X, Keum Y-S. Advances in lipid extraction methods—A review. International Journal of Molecular Sciences,2021:22(24):13643. https://doi.org/10.3390/ijms222413643.
15. Smedes F. Determination of total lipid using non-chlorinated solvents. Analyst,1999:124:1711–1718. https://doi.org/10.1039/A905904K.
16. Talang H, Yanthan A, Rathi RS, Pradheep K, Longkumer S, Imsong B, *et al*. Nutritional evaluation of some potential wild edible plants of North Eastern region of India. Frontiers in Nutrition,2023:10:1052086. https://doi.org/10.3389/fnut.2023.1052086.
17. Talang H, Yanthan A, Rathi RS, Pradheep K, Longkumer S, Imsong B, *et al*. Nutritional evaluation of some potential wild edible plants of North Eastern region of India. Frontiers in Nutrition,2023:10:1052086. https://doi.org/10.3389/fnut.2023.1052086
18. Ullah H, Badshah L. Nutritional and mineral analysis of the ultimate wild food plants of Lotkuh, Chitral, the Eastern Hindukush, Pakistan. Heliyon,2023:9:e14449. https://doi.org/10.1016/j.heliyon.2023.e14449.
19. Yiblet Y, Adamu E. Nutritional composition and phytochemical evaluation of some selected wild edible plants in Tach Gaint District, Northwestern Ethiopia. The Scientific World Journal, 2023, 6670648. https://doi.org/10.1155/2023/6670648.
20. Yimer A, Forsido SF, Addis G, Ayelign A. Nutritional composition of some wild edible plants consumed in Southwest Ethiopia. Heliyon,2023:9(6):e16541. https://doi.org/10.1016/j.heliyon.2023.e16541.