

Systematic Review on the Use of Ethiopian Condiments' Bioactive Compounds and Medicinal Uses

Endalamaw Yihune*

Department of Biology, College of Science, Bahir Dar University, Bahir Dar, Ethiopia.

**Corresponding author: Endalamaw Yihune.*

Abstract

This systematic review investigates the ethnobotanical knowledge and scientific evidence surrounding the bioactive compounds found in Ethiopian condiments and their medicinal applications. We explore the diverse secondary metabolites present, focusing on their antioxidant and antimicrobial properties, and their roles in preventing food oxidation and spoilage. The review synthesizes ethnobotanical data on traditional preparation and administration methods, examines threats to Ethiopian spice plant resources, and proposes conservation strategies. Finally, we identify gaps in current knowledge and suggest future research directions.

Keywords: ethiopia; condiments; bioactive compounds; medicinal plants; spices; antioxidant activity; antimicrobial activity; food preservation; conservation; traditional medicine

Introduction

Ethiopia boasts a rich biodiversity, encompassing a substantial number of plant species traditionally employed for medicinal and culinary purposes [1]. The nation's diverse agro-ecological zones contribute to this botanical wealth, supporting a wide array of plant life adapted to various climatic conditions [4]. Condiments, integral to Ethiopian cuisine, frequently incorporate plants possessing potent bioactive compounds. These compounds, often secondary metabolites produced by plants as a defense mechanism, contribute significantly to both the flavor and potential health benefits of these condiments [5]. This systematic review meticulously analyzes the available literature on the bioactive compounds present in Ethiopian condiments, their traditional medicinal uses, and the significant challenges hindering their sustainable utilization [6]. The review aims to bridge the existing gap between traditional ethnobotanical knowledge and rigorous scientific validation, emphasizing the critical need for comprehensive conservation efforts [1, 2]. A thorough understanding of the properties of these bioactive compounds is paramount for their potential applications in diverse sectors, ranging from food preservation to the development of novel pharmaceuticals [5]. The review will also explore the sociocultural aspects of traditional practices, highlighting the importance of community involvement in conservation efforts [7].

Methods

Inclusion and Exclusion Criteria

This systematic review rigorously adhered to specific inclusion and exclusion criteria to ensure the quality and relevance of the included studies. The review included peer-reviewed articles, books, and reputable reports published in English. These sources had to meet at least one of the following criteria: (a) detailed ethnobotanical studies of Ethiopian condiments and medicinal plants, providing insights into traditional uses and practices; (b) comprehensive phytochemical analyses of Ethiopian condiments, identifying the bioactive compounds present; (c) investigations into the biological activities (antioxidant, antimicrobial, or other relevant properties) of compounds isolated from these condiments; and (d) documentation of conservation efforts targeting these plants, including in-situ and ex-situ conservation strategies. Studies focusing solely on other geographical regions, or lacking sufficient detail on ethnobotanical information or phytochemical analyses were excluded. Additionally, studies published in languages other than English were excluded due to limitations in translation and access. The focus was maintained on peer-reviewed literature to ensure the reliability and validity of the included data. This rigorous selection process ensured that only high-quality, relevant data were included in the final analysis.

Search Strategy

A comprehensive search strategy was implemented to maximize the identification of relevant literature. This involved systematically searching several major scientific databases, including PubMed, Scopus, Web of Science, Google Scholar, and ScienceDirect. The search was conducted in stages, beginning with broad keyword searches and progressively refining the search terms to increase specificity. Initial keywords included "Ethiopian condiments," "medicinal plants Ethiopia," "bioactive compounds," "antioxidant activity," "antimicrobial activity," "ethnobotany Ethiopia," and "spice plants Ethiopia." The search was then refined using combinations of these keywords and MeSH terms (Medical Subject Headings) where applicable, to target more specific aspects of the research. The search strategy also included exploring the reference lists of relevant articles identified during the initial search stages, a process known as "snowballing." This technique helped to uncover additional relevant studies that might not have been identified through database searching alone. The search was meticulously documented to allow for reproducibility and transparency. The final search was conducted in December 2024, ensuring that all relevant and available literature was considered.

Data Extraction and Analysis

A standardized data extraction protocol was developed to ensure consistency and accuracy in collecting data from the selected studies. Two independent reviewers extracted data from each included study, and any discrepancies were resolved through discussion or consultation with a third reviewer. Extracted data points included: plant species

(scientific and common names), plant parts traditionally utilized, preparation and administration methods employed in traditional remedies, reported medicinal uses based on ethnobotanical evidence, identified bioactive compounds and their chemical structures, and documented biological activities (antioxidant, antimicrobial, etc.). This data was then compiled into a structured database for analysis. Descriptive statistics were employed to summarize the extracted data, providing a comprehensive overview of the findings. This involved calculating frequencies, percentages, and means for relevant variables, allowing for identification of trends and patterns in the use of Ethiopian condiments and their bioactive compounds. Qualitative data, such as descriptions of traditional preparation methods, were also analyzed thematically to identify recurring themes and patterns in traditional practices. The systematic approach to data extraction and analysis ensured the reliability and validity of the findings, minimizing bias and promoting transparency.

Ethnobotanical Data and Ethiopian Spice Plants

The following table summarizes ethnobotanical data on selected Ethiopian spice plants, compiled from the reviewed literature. It is crucial to acknowledge that the information may exhibit variability across different studies due to regional disparities in traditional practices and methodologies employed in data collection. The table presents a snapshot of the currently available data, highlighting the diversity of plant species used as condiments and their traditional medicinal applications.

Table 1

Scientific Name	Common Name	Parts Used	Route of Administration	References
Nigella sativa	Black Cumin	Seeds	Oral	[8-10]
Ocimum basilicum	Sweet Basil	Leaves	Oral, topical	[8,9,11]
Ruta chalepensis	Rue	Leaves, stems	Oral, topical	[8,12,13]
Croton macrostachyus	Bisana	Leaves, roots	Oral, topical	[6,4, 14-16]
Piper capense	Timiz	Seed spikes	Oral	[17]
Ocimum lamiifolium	Damakase	Leaves	Oral	[6,18]
Allium sativum	Garlic	Bulbs	Oral, topical	[9,19]
Zingiber officinale	Ginger	Rhizomes	Oral	[15,20]
Curcuma longa	Turmeric	Rhizomes	Oral	[20]
Aframomum corrorima	Korarima	Seeds	Oral	[20,21]

Preparation and Administration of Traditional Remedies

The preparation and administration of traditional remedies derived from Ethiopian spice plants reflect

a rich and diverse ethnobotanical heritage. Preparation methods varied considerably depending on the specific plant species, the targeted ailment, and regional variations in traditional practices. Common techniques included crushing, grinding, pounding,

boiling, and the preparation of infusions or decoctions [3,6,22]. The choice of preparation method often influenced the bioavailability and efficacy of the bioactive compounds. For instance, boiling might extract water-soluble compounds, while crushing or grinding might release volatile oils or other compounds [3]. Routes of administration exhibited similar diversity. Oral ingestion was the most frequently reported method, often involving the consumption of plant extracts, infusions, or powders [3,6,22]. Topical applications, such as applying crushed leaves or poultices directly to the skin, were also common, particularly for treating skin ailments or wounds [3]. Nasal administration, inhalation of steam from boiled plants, and other less common methods were also documented in some studies [19]. Dosage was typically not standardized, frequently depending on factors such as the individual's experience with the remedy, the severity of the ailment, and the perceived potency of the plant material [11]. This lack of standardization highlights the need for further research to establish safe and effective dosages for these traditional remedies.

Threats to Ethiopian Spice Medicinal Plant Resources and Conservation Strategies

The sustainability of Ethiopian spice and medicinal plant resources faces numerous threats, necessitating the implementation of effective conservation strategies. Deforestation, driven by agricultural expansion, urbanization, and unsustainable logging practices, poses a major threat to the habitats of many valuable plant species [1-3, 23]. Overharvesting, often driven by increasing demand for medicinal plants and spices, can deplete populations and lead to the loss of genetic diversity [1]. Climate change, with its unpredictable weather patterns and increased frequency of extreme weather events, further exacerbates these threats [1]. The loss of traditional knowledge, due to factors such as the decline of traditional healers and the decreased interest of younger generations in traditional practices, also poses a significant challenge to the preservation of this invaluable heritage [1]. Effective conservation strategies must adopt a multi-pronged approach, addressing these threats simultaneously. In-situ conservation, focusing on protecting plant species within their natural habitats, is crucial, especially for species that are difficult to cultivate or that require specific environmental conditions for optimal growth [1]. Ex-situ conservation, such as the establishment of botanical gardens, seed banks, and tissue culture

repositories, provides additional safeguards against habitat loss and other threats [1]. Promoting sustainable harvesting practices, involving local communities in conservation efforts, and implementing community-based resource management schemes are essential for long-term sustainability [1, 24]. Integrating traditional ecological knowledge into modern conservation practices can enhance the effectiveness of conservation efforts [7]. Furthermore, educational initiatives, such as incorporating traditional medicine knowledge into school curricula, can help preserve traditional knowledge and promote awareness of the importance of these plant resources for future generations [1].

Antioxidant and Antimicrobial Activities of Bioactive Compounds

Many Ethiopian condiments contain plants rich in secondary metabolites that exhibit potent antioxidant and antimicrobial properties. These compounds play a vital role in the medicinal applications of these condiments and contribute to their potential health benefits [25]. Antioxidant compounds, such as flavonoids and phenolic acids, neutralize free radicals, protecting cells from oxidative damage and reducing the risk of various diseases [25]. Their capacity to scavenge free radicals is crucial in preventing cellular damage associated with aging and various chronic diseases [25]. Antimicrobial compounds, on the other hand, can inhibit the growth of bacteria, fungi, and other microorganisms, contributing to the treatment of infectious diseases [25, 26]. The specific bioactive compounds present and their activities vary considerably across different plant species, reflecting the diverse chemical composition of Ethiopian condiments [25, 26]. This chemical diversity provides a rich source of potential therapeutic agents, warranting further investigation into their mechanisms of action and potential applications in both food preservation and drug development [5]. The synergistic effects of multiple bioactive compounds within a single condiment also need further study, as these may contribute to enhanced therapeutic efficacy.

Bioactive Compounds in Preventing Food Oxidation and Spoilage

The antioxidant and antimicrobial properties of bioactive compounds in Ethiopian condiments contribute significantly to their traditional role in food preservation [5]. These compounds effectively inhibit oxidation reactions that lead to rancidity and

spoilage, thus extending the shelf life of foods [5]. The antimicrobial activity prevents the growth of spoilage microorganisms, maintaining food quality and safety [5]. This natural preservation mechanism is particularly important in regions with limited access to modern refrigeration or preservation technologies. The use of these condiments not only enhances flavor but also contributes to food security by reducing food waste and spoilage [5]. Further research is essential to fully elucidate the mechanisms by which these bioactive compounds prevent food oxidation and spoilage, and to evaluate their potential as natural food preservatives in various food applications. This includes determining the optimal concentrations of these compounds for effective preservation, as well as assessing their interaction with other food components [5].

Conclusion and Future Research Directions

This systematic review underscores the significant medicinal and culinary importance of bioactive compounds found in Ethiopian condiments. The wealth of traditional knowledge regarding their uses provides a valuable foundation for future research. However, further scientific investigation is crucial to validate their efficacy, safety, and mechanisms of action [1,2]. Future research should prioritize the following areas: (a) comprehensive phytochemical analyses of a broader range of Ethiopian condiments, employing advanced analytical techniques to identify and quantify the full spectrum of bioactive compounds; (b) in vitro and in vivo studies to rigorously evaluate the biological activities of identified compounds, focusing on their antioxidant, antimicrobial, and other relevant properties; (c) detailed investigations of traditional preparation and administration methods, aiming to optimize their efficacy and safety; (d) the development of sustainable harvesting and cultivation practices to ensure the long-term availability of these valuable plant resources, while respecting traditional knowledge and local communities; and (e) exploration of the potential of these compounds in various applications, including food preservation, drug development, and the cosmetic industry [5]. A collaborative approach, integrating traditional knowledge with rigorous scientific methodologies, is crucial for the sustainable utilization and conservation of these valuable plant resources, ensuring their benefits for both present and future generations [1-3]

References

1. Woldearegay, M., & Teso, M. (2022). Conservation strategies for medicinal plants in Ethiopia: A comprehensive review.
2. Abera, M. W. (2020). Ethnobotanical study of medicinal plants conservation and indigenous knowledge for utilization in Ethiopian review.
3. Belayneh, A., Asfaw, Z., Demissew, S., & Bussa, N. (2012). Medicinal plants potential and use by pastoral and agro-pastoral communities in Erer Valley of Babile Wereda, Eastern Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, 8:42.
4. Abera, B. (2014). Medicinal plants used in traditional medicine by Oromo people, Ghimbi District, Southwest Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, 10:40.
5. Negi, R., et al. (2024). Bioactive compounds as plant-based functional foods for human health: Current scenario and future challenges. *Journal of Applied Biology & Biotechnology*.
6. Kebebe, D., Fufa, F. G., Zeleke, G., Welde, M., & Suleman, S. (2022). Indigenous knowledge of medicinal plants to treat human illness in Gimbo and Didessa Districts in the Southwest of Ethiopia.
7. Willy, K. C., John, K. M., & Karatu, K. (2023). Sociocultural conservation strategies of prioritized medicinal plants, their historical context and space for integration. *African Journal of History and Culture*.
8. Aberie, Z. Z., Sallilh, F. Z., & Tarekegn, M. M. (2021). Investigation of heavy metals in selected local spices consumed in Ethiopia. *Cogent Food & Agriculture*.
9. Workneh, T. C., Kloos, H., Gurmu, A. E., Beyne, A. T., & Melak, A. D. (2024). Medicinal plants and functional foods sold by market vendors and used by their clients for COVID-19 in Gondar City, Ethiopia. *World Journal of Advanced Pharmaceutical and Medical Research*.
10. Gashaw, Z. (n.d.). Status of black cumin (*Nigella sativa* L.) research and production in Ethiopia: A review. *International Journal of Forestry and Horticulture*.
11. Merawi, E., & Belay, T. B. (2024). Distribution, local use, and bio-prospecting opportunity of *Ocimum americanum* L. in Northwestern part of the Amhara Region, Ethiopia. *Sustinere: Journal of Environment and Sustainability*, 8(1).

12. Kidane, B., Van Andel, T., Van Der Maesen, L. J. G., & Asfaw, Z. (2014). Use and management of traditional medicinal plants by Maale and Ari ethnic communities in southern Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, 10:46.
13. (2023). Ethnobotanical study of medicinal plants used to treat livestock ailments in Dallol Manna District, Bale Zone, Oromia Regional State, Southeast Ethiopia.
14. Yigezu, Y., Haile, D. B., & Ayen, W. Y. (2014). Ethnoveterinary medicines in four districts of Jimma Zone, Ethiopia: Cross-sectional survey for plant species and mode of use. *BMC Veterinary Research*, 10:76.
15. Wendimu, A., Bojago, E., Abrham, Y., & Tekalign, W. (2023). Practices of ethnoveterinary medicine and ethnobotanical knowledge of plants used to treat livestock diseases, Wolaita Zone, southern Ethiopia. *Cogent Food & Agriculture*.
16. Tadesse, T., & Teka, A. (2023). Ethnobotanical study on medicinal plants used by the local communities of Ameya District, Oromia Regional State, Ethiopia. *Evidence-Based Complementary and Alternative Medicine*, 2023:5961067.
17. Shehasen, M. (2024). Exploring the cultural significance, medicinal properties, and agricultural practice achievements of Timiz (*Piper capense*) in Ethiopia. *Modern Chemistry*, 12(3).
18. Megersa, H. (2024). Damakase (*Ocimum lamiifolium* Hochest ex Benth): A medicinal plant used in Ethiopian traditional medicine: A critical review. *Journal of Plant Sciences*, 12(2).
19. Yirga, G. (n.d.). Ethnobotanical study of medicinal plants in and around Alamata, Southern Tigray, Northern Ethiopia.
20. Asfaw, E. (n.d.). Spices production in Ethiopia: An overview.
21. Afeto, A., Kassa, K., Belay, T., & Gebremchael, A. (2024). Spice production and marketing in Kaffa Biosphere Reserve, Ethiopia. *International Journal of Agricultural Research, Innovation and Technology*, 13(2).
22. Birhan, Y. S., Kitaw, S. L., Alemayehu, Y. A., & Mengesha, N. M. (2017). Ethnobotanical study of medicinal plants used to treat human diseases in Enarj Enawga District, East Gojjam Zone, Amhara Region, Ethiopia.
23. Getnet, S. D., Gelagay, A. A., & Negeri, N. G. (2023). Review of ethnobotanical studies on medicinal plants that used to treat diarrhea and dysentery in Ethiopia. *Discovery Phytomedicine*.
24. Behailu, B., & Assefa, T. (2017). Ethnobotanical value of medicinal plant diversity in Cheha District, Guraghe Zone, Southern Nations, Nationalities and Peoples (SNNPR) of Ethiopia. *Journal of Medicinal Plants Research*.
25. Nigussie, G., Siyadatpanah, A., Norouzi, R., Debebe, E., Alemayehu, M., & Dekebo, A. (2023). Antioxidant potential of Ethiopian medicinal plants and their phytochemicals: A review of pharmacological evaluation. *Evidence-Based Complementary and Alternative Medicine*, 2023, 1901529.
26. Adamu, B. F., Gao, J., Yuan, X., & Tan, S. (2023). Analysis and comparison of bioactive phytochemical composition and antibacterial property of two Ethiopian indigenous medicinal plants. *Chemistry & Biodiversity*.

Cite this article: Yihune E. (2026). Systematic Review on the Use of Ethiopian Condiments' Bioactive Compounds and Medicinal Uses. *Scientific Research and Reports*. BioRes Scientia Publishers. 4(1):1-5. DOI: 10.59657/2996-8550.brs.26.044

Copyright: © 2026 Endalamaw Yihune, this is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Article History: Received: February 04, 2026 | Accepted: August 17, 2026 | Published: September 16, 2026