



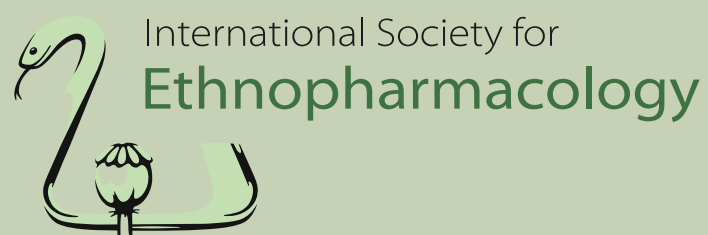
International Society for **Ethnopharmacology**

ABSTRACT BOOK

25th International Congress of the International Society
for Ethnopharmacology (25th ISE)

FOLIGNO, ITALY | 14 - 17 SEPTEMBER 2026





CONTENTS

<i>ITALIAN INTERSOCIETY — II 1–6</i>	4
<i>PLENARY LECTURES — PL 1–6</i>	10
<i>INVITED SPEAKERS — IS 1–17</i>	16
<i>ORAL COMMUNICATIONS — OC 1–34</i>	34
<i>WORKSHOP ON NURSING ETHNOPHARMACOLOGY — WN1...</i>	74
<i>POSTERS — PO 1–68</i>	75

FROM NIGER ETHNOPHARMACOLOGY TO THE INVESTIGATION OF ANTI-GASTRITIS PROPERTIES OF *PROSOPIS AFRICANA* (GUILL. & PERR.) TAUB. IN GASTRIC CELLS

Safwa Moheb El Haddad¹, Souleymane Magagi Damé², Marco Fumagalli¹, Nicole Maranta¹, Giulia Martinelli¹, Carola Pozzoli¹, Enrico Sangiovanni¹, Amadou Tidjani Ilagouma², Stefano Piazza¹, Mario Dell'Agli¹

¹ Department of Pharmacological and Biomolecular Sciences "Rodolfo Paoletti" (DiSFeB), University of Milan, Via Balzaretti 9, 20133, Milan, Italy

² Laboratory of Natural Products and Organic Synthesis, Faculty of Sciences and Techniques, Abdou Moumouni University, Niamey, Niger
safwa.elhaddad@unimi.it

Ethnopharmacological relevance: *Prosopis africana* (Guill. & Perr.) Taub. (*P. africana*) is a tree traditionally used in Niger and in African regions for the treatment of gastric disorders and infectious diseases, according to African traditional medicine practices and ethnobotanical surveys ^[1]. Despite its extensive traditional use, its phytochemical composition and biological activity at gastric level remain poorly characterized.

Aim of the study: The aim of this study was to validate the traditional use of *P. africana* by investigating its anti-inflammatory and antibacterial effects in human gastric epithelial cells infected by *Helicobacter pylori* (*H. pylori*).

Materials and methods: Decoction and methanolic extract were obtained from the bark to compare a traditional preparation to an alcoholic extract, respectively. The potential stability after oral consumption was also investigated by gastric simulated digestion.

GES-1 cells (human gastric epithelial cells) were infected by *H. pylori* CagA⁺ strain (26695, ATCC) ^[2]. Anti-inflammatory activity was evaluated after assessing cell viability, by ELISA assays for inflammatory markers of gastritis (IL-8, IL-6). Polyphenols content, with focus on condensed tannins, was measured by colorimetric assays.

Results: Cytotoxicity was excluded for both *P. africana* extracts (10-100 µg/ml). Treatments with extracts significantly inhibited IL-8 secretion induced by *H. pylori*, with an IC₅₀ about 28.68 µg/mL, at concentrations between 25 and 100 µg/mL. After simulated gastric digestion, the extracts retained the anti-inflammatory effect, suggesting the stability of the bioactive compounds in the gastric environment.

MIC (Minimal Inhibitory Concentration) assay showed antibacterial activity against *H. pylori* up to 200 µg/mL.

Fractionation of the methanolic extract by Sephadex LH-20 chromatography allowed the identification of a polyphenol-enriched fraction, mostly composed by condensed tannins: the fraction showed IL-8 inhibitory activity comparable to the whole extract at 5 µg/mL.

Conclusion: These findings support the traditional use of *P. africana* and suggest its valorization for the management of *H. pylori* infection in geographical areas with high prevalence of the diseases.

References:

- [1] Abdullahi A.A., *African Journal of Traditional, Complementary and Alternative Medicines* **2011**, 8, 115–123.
- [2] Martinelli G., et al., *Food Funct.*, **2025**, 16, 5049

COMMIPHORA MYRRHA AND CANNABIDIOL: A DUAL-TARGETING STRATEGY AGAINST PERSISTENT PAIN

Laura Micheli¹, Samuele Trisolini¹, Ludovica Lollini¹, Lorenzo Di Cesare Mannelli¹, Annarita Bilia², Carla Ghelardini¹

¹ Department of Neuroscience, Psychology, Drug Research and Child Health – NEUROFARBA – Pharmacology and Toxicology Section, University of Florence, Italy

² Department of Chemistry “Ugo Schiff” (DICUS), University of Florence, Italy.
laura.micheli@unifi.it

Ethnopharmacological relevance: *Commiphora myrrha* has been traditionally used to treat pain and inflammatory conditions and exhibits analgesic activity attributed to bioactive compounds with an opioid-like pharmacological profile, supporting its relevance in combination analgesic strategies.

Aim of the study: This study aimed to evaluate the efficacy of a combined treatment based on cannabidiol (CBD), a non-psychoactive analgesic component of *Cannabis sativa*, and a *Commiphora myrrha* extract in a murine model of neuropathic pain induced by the sciatic nerve ligation (Chronic Constriction Injury; CCI). The combination therapy approach was designed to enhance analgesic efficacy while improving the therapeutic profile by reducing side effects, including tolerance, through the association of opioid and non-opioid analgesics with different pharmacodynamic mechanisms.

Materials and methods: Male CD-1 mice subjected to CCI were treated acutely (p.o.) on day 7 post-surgery with CBD (3–30 mg/kg), *C. myrrha* extract (3–100 mg/kg), or CBD + *C. myrrha* combinations (3+3, 10+3, 3+10, and 10+10 mg/kg). Nociceptive threshold was assessed using the paw pressure and von Frey tests. Pharmacodynamic mechanisms were investigated using naloxone (1 mg/kg), the CB2 receptor antagonist MC21 (10 mg/kg), and the CB1 receptor antagonist SR141716A (3 mg/kg). Repeated oral treatment with CBD 10 mg/kg + *C. myrrha* 10 mg/kg was administered daily from day 7 to day 28 post-surgery to evaluate tolerance development.

Results: The 10+10 mg/kg combination elicited a significantly greater anti-hyperalgesic effect compared with individual treatments, resulting in a marked reversal of neuropathy. The effect of *C. myrrha* was antagonized by naloxone, indicating opioid involvement, while CBD effects were blocked by CB2 and partially by CB1 receptor antagonism. Repeated administration of the combination produced sustained analgesia without tolerance, whereas *C. myrrha* alone lost efficacy after nine days.

Conclusion: The combination of CBD and *C. myrrha* represents an effective strategy for neuropathic pain management, enhancing analgesic efficacy while preventing tolerance and potentially reducing opioid-related side effects.

DIETARY TERPENOID LACTONES ARE PROMISCUOUS AGONISTS OF BITTER TASTE RECEPTORS (TAS2RS)

Federica Pollastro¹, Stefano Salamone¹, Sara Montelatici², Maurizio Rinaldi¹, Giovanni Appendino¹, Marcel Winnig², Gabriella Morini³

¹Department of Pharmaceutical Sciences, University of Piemonte, Italy

²Axxam S.p.A., Italy

³University of Gastronomic Sciences, Italy

federica.pollastro@uniupo.it

Ethnopharmacological relevance: The presence of a lactone ring is widespread in bitter secondary metabolites, particularly in dietary terpenoids, and the perception of bitterness by TAS2Rs receptors acts as a defence mechanism against potential toxins. ^[1] Understanding these interactions is crucial for modulation in pharmaceutical and nutritional contexts. ^[2]

Aim of the study: The study aimed to verify whether the lactone pharmacophore, including its lactol/furan version, was specific for TAS2R46 or if it could also activate other bitter taste receptors.

Materials and methods: Twenty-two bitter isoprenoids were assayed on 25 different TAS2R receptors cloned into transiently transfected HEK293 PEAKrapid cells with the specific cDNAs and calcium responses were measured. ^[3]

Results: Considerable heterogeneity in TAS2Rs activation was observed. In addition to the generalist receptor TAS2R46, ten other TAS2Rs were activated. In some cases, the activity on these additional receptors was higher than on TAS2R46. Between all the isoprenoids tested, neoquassin showed nanomolar potency for TAS2R30, while andrographolide showed significant activity on TAS2R50. ^[4]

Conclusion: The results indicate that the lactone ring is not a universal bitter structural element, but a versatile pharmacophore capable of inducing activity across a diversity of bitter taste receptors depending on the molecular scaffold. These observations provide a blueprint for the rational design of specific ligands to clarify the structural basis of TAS2Rs activation. ^[5]

References:

- [1] Behrens, M., Meyerhof, W., *J. Agric. Food Chem.* Vertebrate Bitter Taste Receptors: Keys for Survival in Changing Environments. **2017** 66, 10, 2204-2213.
- [2] Harmon, C., Deng, D., Breslin, P., *Curr. Opin. Physiol.* Bitter Taste Receptors (T2Rs) are Sentinels that Coordinate Metabolic and Immunological Defense Responses **2021**, 20, 70-76.
- [3] Ueda, T., Ugawa, S., Yamamura, H., Imaizumi, Y., Shimada, S., *J. Neurosci.*, Functional Interaction between T2R Taste Receptors and G-Protein α Subunits Expressed in Taste Receptor Cells. **2003**, 23, 7376 - 7380.
- [4] Brockhoff, A., Behrens, M., Massarotti, A., Appendino, G., Meyerhof, W., *J. Agric. Food Chem* Broad tuning of the human bitter taste receptor hTAS2R46 to various sesquiterpene lactones, clerodane and labdane diterpenoids, strychnine, and denatonium. **2007**, 55 15, 6236-43.
- [5] Di Pizio, A. Niv, N. Y., *Bioorg. Med. Chem.* Promiscuity and selectivity of bitter molecules and their receptors. **2015**, 23 14, 4082-4091.

REDISCOVERING MYRRH: SCIENTIFIC EVIDENCE FOR TRADITIONAL USES AND A NEW PERSPECTIVE ON THE MAGI'S GIFT

Roberto Della Loggia

University of Trieste, Italy
rdellaloggia@units.it

The Gospel of Matthew recounts that wise men (later traditionally referred to as the Magi) came from the East to worship the infant Jesus, bringing three gifts: gold, incense, and myrrh. The meaning of the first two gifts is relatively clear: gold, a symbol of power, honours the future King; incense, burned in worship of the gods, acknowledges his divine nature. Myrrh, however, is commonly interpreted as a symbol of resurrection and of life's victory over death, since it was also used in embalming—a rather unconvincing explanation.

Myrrh is a resin exuded from incisions in the trunk of *Commiphora myrrha*, a small tree native to eastern Africa and southern Arabia. A precious substance, it is well known for its use in antiquity as a cosmetic and, indeed, for embalming. In fact, myrrh was also widely employed as a medicinal agent across a variety of pathological conditions, a use now supported by recent phytochemical and pharmacological research. The resin contains hundreds of compounds, among which the most biologically relevant include sesquiterpenes such as furanodiene, associated with analgesic properties ^[1], and steroids such as guggulsterones, which exhibit significant anti-inflammatory effects ^[2], while monoterpenes such as carvacrol are responsible for antibacterial activity ^[3].

The Italian Official Pharmacopoeia includes a specific preparation for inflammatory conditions of the oral cavity consisting of a mixture of rhatany tincture and myrrh tincture. In stomatitis, particularly in the presence of aphthae, bacterial infection, inflammation, and pain coexist. While the astringent effect of rhatany provides protection over lesions, myrrh acts on all three pathological components.

This perspective may suggest a more plausible interpretation of the gift of myrrh: it functioned in antiquity as an analgesic, an anti-inflammatory, and an antimicrobial agent—thus truly symbolising the victory of life over death, but achieved through medicine.

References:

- [1] P. Dolara, C. Luceri, C. Ghelardini, et al. *Nature* **1996**, 379, 29.
- [2] I. Kimura, M. Yoshikawa, S. Kobayashi, Y. Sugihara, M Suzuki, H. Oominami, T. Murakami, H. Matsuda, V.V. Doiphode. *Bio-org Med Chem Lett* **2001**, 11, 985-989.
- [3] P. Dolara, B. Corte, C. Ghelardini, A.M. Pugliese, E. Cerbai, S. Menichetti, A. Lo Nostro. *Planta Med.* **2000**, 66, 356-358.

TRADITIONAL USE OF MEDICINAL PLANTS AND PHYTOVIGILANCE

Annabella Vitalone

Sapienza University of Rome Italy
annabella.vitalone@uniroma1.it

Ethnopharmacological relevance: The traditional use of medicinal plants has led, over the years, to the discovery of modern drugs. At the same time, the Ethnopharmacological importance of medicinal plants in various European Union countries has led to the centralized and simplified registration of traditionally used herbal medicines, under European Medicines Agency (EMA) regulation (Directive 2004/24/EC) ^[1].

Aim of the study: 1. Understand how traditional use can differ from the “frantic” pursuit of efficacy, which instead could expose to safety issues. 2. Enhance Phytovigilance system, with a view to preventing predictable side effects.

Materials and methods: The study consisted of a narrative literature review, carried out by consulting scientific documents and articles, included in academic databases (such as PubMed, Scopus, etc.).

Results: There are many emerging issues, such as identity, standardization, quality (e.g., contamination, adulteration, sophistication, etc.). Evidence shows that, at most, only the 10% of herbal products are standardised ^[2]. Moreover, the use of multi-component products and/or products in which isolated, purified and concentrated phytoconstituents is increasingly frequent on the market, without considering the balance of the phytocomplex. These facts do not reflect the ethnobotanical use of medicinal plants. At the same time, for various reasons, reports of suspected adverse reactions are increasing, even for widely used plants, including *Serenoa repens*, *Citrus aurantium* ^[2,3], etc.

Conclusion: Lack of quality and standardization of herbal products can lead to variability in their safety (and eventually efficacy). Considering that, between 2024 and 2029, the European herbal medicine market will probably improve from USD 65.3 billion in 2024 to USD 89.05 billion in 2029 ^[4], the safety of medicinal plants should be thoroughly evaluated and a Phytovigilance system should be implemented worldwide, as was already evident several years ago ^[5].

References:

- [1] Directive 2004/24/EC of the European Parliament and of the Council of 31 March **2004** amending, as regards traditional herbal medicinal products, Directive 2001/83/EC on the Community code relating to medicinal products for human use. Available at <https://eur-lex.europa.eu/eli/dir/2004/24/oj/eng>.
- [2] F Firenzuoli, B Firenzuoli, V Mascherini, N Firenzuoli, F Menniti-Ippolito, I Ippoliti, V Maggini, E Gallo, A Cuomo, A Fagiolini, GF Gensini, F Firenzuoli. Can we identify a post-*Serenoa syndrome* (PSS)? A case series on sexual and psychiatric side effects of *Serenoa repens*. *Br J Clin Pharmacol*. **2026**, 92(4):1237-1246.
- [3] A Plaitis, E Grigoraki, M Karakosta, V Gardikioti, AE Kalesi, A Kalivi, A Giannakodimos, D Barmpagiannis, A Theodosios-Georgilas, N Patsourakos. Unexplained Supraventricular Tachycardia and Myocardial Injury After Bitter Orange Supplement Use in a Young Woman. *JACC Case Rep*. **2026**, 108361.
- [4] AR Gatt, P Vella Bonanno, R Zammit. Ethical considerations in the regulation and use of herbal medicines in the European Union. *Front Med Technol*. **2024**, 6:1358956.
- [5] F Menniti-Ippolito, E Aiello, E Arzenton, A Assisi, U Blaznik, JJM Castenmiller, M Crevani, D de Clock, S Di Giacomo, S Emendi, LA Gonella, I Ippoliti, M Lindquist, L Magro, G Mazzanti, N Mores, U Moretti, PA Moro, B Novakovic, E Raschi, I Sik-sna, MR Valetto, A Vitalone, G Vo Van Regnault. Erice Manifesto 2022: On the Surveillance of Potential Harms Caused by Food Supplements in Europe. *Drug Saf*. **2023**, 46(5):435-437.

BIOACTIVE RESINS: BRIDGING ETHNOMEDICINE AND MODERN THERAPEUTICS

Maria Carla Marcotullio

*Department of Pharmaceutical Sciences, University of Perugia, Italy
mariacarla.marcotullio@unipg.it*

For centuries, plant resins have been used as therapeutic agents within traditional medical systems across diverse cultures, representing an important yet underexplored field of ethnopharmacology. Resins, obtained from trees and shrubs, are complex mixtures of terpenoids, phenolic compounds, and other bioactive metabolites, and have been historically used for wound healing, infection and inflammation treatment, and ritual purification. Ethnobotanical records from the Mediterranean basin, Sub-Saharan Africa, the Middle East, South Asia, and the Americas consistently document the medicinal use of resins such as frankincense (*Boswellia* spp.), myrrh (*Commiphora* spp.), and copal (*Bursera* spp.).^[1]

The healing properties of plant resins allow the creation of a “bridge” between the traditional knowledge and the contemporary pharmacological evidence. Traditional applications, such as topical administration for wounds, burns, and skin disorders,^[2] as well as oral or inhaled preparations for respiratory and gastrointestinal conditions, are now evaluated alongside modern studies that demonstrate antimicrobial, anti-inflammatory, antioxidant, and tissue-regenerative activities. The complex chemical composition of resins allows a broad spectrum of biological and therapeutic activities. Frequently, modern drug discovery relies on traditional plant remedies, and many lead compounds are identified on the basis of natural product structures. However, the ongoing erosion of traditional knowledge and unsustainable harvesting practices present significant threats to both cultural heritage and biodiversity.

Integrating ethnopharmacology with biomedical research enables the discovery of the therapeutic potential of plant resins and supports their systematic study, conservation, and ethical incorporation into modern healthcare. The recognition and preservation of ethnopharmacological knowledge are essential for advancing sustainable, culturally informed approaches to drug development.

References:

- [1] J.H. Langenheim, *Plant Resins: Chemistry, Evolution, Ecology and Ethnobotany* **2003**, Timber Press, Portland, Cambridge
- [2] Z. Zaheri-Abdevand, P. Badr, *Journal of Herbal Medicine* **2023**, *41*, 100715

PLASTICITY IN THE HUMAN OLFACTORY SYSTEM: CLINICAL ASPECTS**Hummel T**

*Interdisciplinary Center „Smell and Taste“, Dept. of Oto-Rhino-Laryngology, TU Dresden, Fetscherstrasse 74, 01307 Dresden, Germany; Phone: +49-351 458 4189; Fax: +49-351 458 4326;
thomas.hummel@tu-dresden.de*

The sense of smell is important. This became especially clear to patients with infection-related olfactory loss during the SARS-CoV-2 pandemic. We react, for example, to the body odors of other humans. The sense of smell warns us of danger, and it allows us to perceive flavors when eating and drinking. In essence, this means quality of life. Therefore, anosmia must be taken seriously. Importantly, olfactory receptor neurons and the human olfactory bulbs are characterized by regenerative/neuroplastic capacity. This is used to treat olfactory disorders, for example in the form of olfactory training.

FOUR DECADES OF ETHNOPHARMACOLOGY: A BIBLIOMETRIC LENS ON GLOBAL SCHOLARSHIP, AFRICA'S UNTAPPED POTENTIAL, AND SOUTH AFRICA'S EMERGING CONTRIBUTION

Alvaro M. Viljoen^{1,2}

¹Department of Pharmaceutical Sciences and, ²SAMRC Herbal Drugs Research Unit
Tshwane University of Technology, Pretoria, South Africa

1. The Journal of Ethnopharmacology at Forty: A Bibliometric Overview

The Journal of Ethnopharmacology (JEP), founded in 1979, has accumulated over 20,000 publications and charted the trajectory of a discipline: from descriptive ethnobotany and phytochemical characterisation, to integration with computational tools, omics technologies, and clinical validation. Bibliometric analyses, keyword co-occurrence networks, co-authorship maps, and citation bursts reveal a field that has grown in global relevance, with dominant themes spanning antimicrobial resistance, chronic disease, and neuropharmacology. Yet these same analyses expose a striking structural inequity, most apparent when attention turns to Africa.

2. Africa's Paradox: The Richest Pharmacopoeia, the Weakest Scientific Footprint

Africa harbours an estimated 45,000 - 50,000 plant species and traditional medicine remains the primary healthcare recourse for up to 80% of sub-Saharan Africa's population, yet African institutions account for a disproportionately small share of the global ethnopharmacological literature, with much Africa-focused research authored outside the continent. Inadequate infrastructure, limited funding, restricted publication access, and extractive research legacies perpetuate this paradox. The consequences are apparent; indigenous knowledge is documented without community benefit, therapeutic leads go unexplored, and evidence-based regulatory frameworks for traditional medicine remain underdeveloped. Narrowing this gap is a collective continental imperative.

3. South Africa as a Model: Building Excellence from Indigenous Knowledge

South Africa offers a compelling counter-narrative. Over two decades, our research programme has demonstrated that rigorous, globally competitive ethnopharmacology can be conducted in and about Africa, by African scientists, for African populations. Highlights include: validation of traditional antimicrobial uses against drug-resistant pathogens; the characterisation and clinical corroboration of *Mesembryanthemum tortuosum* (kanna) for mood, stress, and, most recently, neuroprotection in models of Parkinson's disease-associated depression; and application of hyphenated analytical technologies (GC-MS, LC-MS, NMR) to authenticate and quality-control commercially traded medicinal plants. This presentation argues that the path forward lies in training the next generation of African researchers, developing equitable partnerships, and ensuring intellectual ownership of Africa's botanical heritage remains on the continent.

Keywords: bibliometrics; ethnopharmacology; African traditional medicine; South Africa; medicinal plants; research equity; Journal of Ethnopharmacology

FROM WITCHCRAFT ACT TO DIALOGUE: DECOLONISING AND TRANSMITTING INDIGENOUS HEALTH KNOWLEDGE IN UGANDA

Caroline S. Weckerle¹, Nelson Abit², Godwin Anywar³, Manuela Dahinden⁴, Jacqueline Grigo¹, Yahaya Sekagya Hill⁵, Maude Kamatenesi⁶, Moses Kasure⁷, Thomas Laely⁸, Amon Mugume²

1 DSEB, University of Zurich, Switzerland;

2 Uganda National Museum, Uganda;

3 Makerere University, Uganda;

4 PSC, University of Zurich, Switzerland;

5 PROMETRA, Uganda;

6 Mamita Foundation and Training Centre, Uganda;

7 Igongo Cultural Center, Uganda;

8 ISEK, University of Zurich, Switzerland

caroline.weckerle@uzh.ch

Ethnopharmacological relevance: Indigenous health knowledge and the medicinal plants underpinning it remain central to health-seeking behaviour across Uganda. Yet the legitimacy of indigenous health knowledge - and particularly of spiritual healers as its custodians - was systematically undermined by colonial-era legislation such as the Witchcraft Act of the 1950s, which criminalised traditional spiritual practice and cast its practitioners as dangerous rather than as healthcare providers. This stigmatisation continues to shape how this knowledge is perceived in policy and public discourse, making critical historical reflection an essential component of any effort to integrate traditional medicine with contemporary health systems.

Aim of the study: This paper presents findings from a three-year Solution-Oriented Research for Development project addressing two interconnected questions: (1) How has indigenous health knowledge been transmitted historically and in the present, and how has colonial stigmatisation shaped these pathways? (2) How can information on the effective, safe and sustainable use of medicinal plants be made broadly accessible through participatory platforms that actively contribute to destigmatisation?

Materials and methods: A transdisciplinary approach combined epidemiology, ethnobotany, ethnopharmacology and social science methods. Qualitative fieldwork was conducted with traditional medicine practitioners across 22 districts in seven regions. Data were coded thematically and complemented by a review of published and grey literature. Participatory platforms - including museum exhibitions, mobile museums, plant gardens and co-produced teaching materials - were developed in dialogue with indigenous health knowledge custodians, public health actors and civil society.

Results: Indigenous health knowledge is embedded in clan structures and ritual practice, transmitted primarily through oral apprenticeship. Contemporary influences are reshaping, but not replacing this knowledge, producing plural health knowledge ecologies. Museums and plant gardens proved effective platforms for reframing traditional medicine as a legitimate knowledge system and for initiating dialogue on historical stigmatisation. Comparative framing with institutionalised complementary medicine systems such as Switzerland's *Erfahrungsmedizinisches Register* further demonstrated that structured integration of traditional knowledge into health systems is feasible and desirable. The current extension phase develops modular teaching curricula for traditional healers and traditional birth attendants, contributing directly to capacity building and professional recognition.

Conclusion: Addressing the colonial legacy of stigmatisation is inseparable from efforts to integrate Indigenous health knowledge into contemporary health systems. This project demonstrates that transdisciplinary, participatory approaches centring indigenous health knowledge custodians as co-producers of knowledge can bridge this historical divide. Museums, mobile exhibitions and structured teaching modules offer scalable, community-embedded mechanisms for destigmatisation, knowledge preservation and equitable science-practice collaboration.

BRIDGING ETHNOPHARMACOLOGY AND DRUG DISCOVERY TO TREAT CHAGAS DISEASE: WHERE TRANSLATION REALLY MATTERS

Jürg Gertsch

*Institute of Biochemistry and Molecular Medicine, University of Bern, Switzerland
juerg.gertsch@unibe.ch*

Ethnopharmacological relevance: Chagas disease, caused by *Trypanosoma cruzi*, remains a major neglected tropical disease in Latin America, with no effective treatment for the chronic stage [1]. Some indigenous communities have traditionally used medicinal plants to manage symptoms associated with chronic Chagas disease, including cardiomyopathy, although the ethnomedical classification of the disease is complex and historically recent [2]. Traditional medicinal knowledge and natural products represent a valuable but underexplored resource for identifying bioactive compounds with antichagasic potential.

Aim of the study: This interdisciplinary project aims to systematically investigate medicinal plants traditionally associated with Chagas disease and evaluate whether ethnopharmacological knowledge correlates with measurable antitrypanosomal activity compared with unrelated medicinal plant libraries. The project further seeks to identify phylogenetic patterns of bioactivity and discover natural product scaffolds suitable for drug development and clinical trials. Using lab *T. cruzi* infection assays together with biochemical and pharmacological approaches, we focus particularly on covalent natural inhibitors targeting parasite redox biology and host–parasite interactions.

Materials and methods: Ethnopharmacological field studies were conducted in Bolivia among Quechua, Izocéño-Guaraní, Chiquitano, and Ayoreo communities, with ongoing work in the Amazon region. Plant extracts and isolated compounds were evaluated using *T. cruzi* infection assays, biochemical profiling, phylogenetic analysis, and molecular networking approaches. Selected compounds are further assessed in animal and human studies to investigate pharmacokinetics and bioavailability.

Results: An international collaborative project was established integrating ethnomedical perspectives, vector biology, and natural product-based drug discovery. Screening revealed that only a subset of extracts showed selective antichagasic activity, highlighting the importance of guided discovery strategies. Distinct phylogenetic hotspots of activity were identified, particularly among anthraquinone-, coumarin-, and chalcone-containing taxa [3]. Several natural product scaffolds with promising antiparasitic properties were identified and their pharmacokinetics was analyzed in humans and or mice. Our data suggest that it could be feasible to engage in clinical fieldstudies using antichagasic natural products.

Conclusion: The study demonstrates that combining ethnopharmacology with phylogenetic and pharmacological analyses is a powerful strategy for natural product-based drug discovery. The findings support the relevance of traditional medicinal knowledge and identify anthraquinones and related scaffolds as promising leads for new treatments against Chagas disease.

Acknowledgements: Swiss National Science Foundation Grant 10006474, Targeting *Trypanosoma cruzi* host cell interactions by small molecules to treat Chagas disease: The role of redox metabolism and the endocannabinoid system

References:

- [1] J.A. Pérez-Molina, I. Molina, *Lancet*. **2018**, 391, 82-9.
- [2] A. Salm, J. Gertsch. *Parasit Vectors*. **2019**, 12(1):291.
- [3] A. Salm, S.R. Krishnan, M. Collu, O. Danton, M. Hamburger, M. Leonti, G. Almanza. J. Gertsch. *iScience*. **2021**, 24(4):102310.

ENHANCING THE SCIENTIFIC INTEGRITY AND PRECISION OF RESEARCH AND REGULATION OF NATURAL PRODUCTS

Bob Allkin, Caroline Wilkinson, Francesco Civita, Ellie Graves, Freya Read, Kristina Patmore

*Plants for Health, Royal Botanic Gardens, Kew, London TW9 4AB, UK
b.allkin@kew.org*

Ethnopharmacological relevance: The integrity of ethnopharmacological research and the regulation of natural products rely on the precision with which plants, fungi and derived substances are named. Finding publications or regulations relies on effective indexing of all names used in the past, in different countries or different disciplines. Despite editorial guidelines, published research and pharmacopoeia use ambiguous, misleading or imprecise terms^{[1][2]}. Finding all information about a species with potential health benefits can be challenging given the fragmentation of the literature across continents and disciplines. Simply counting the numbers of species involved is complicated by the multiplicity, ambiguity and inconsistency of names in use^[3].

Aim: We seek to offer a reference resource and information services to enable researchers and regulators to employ nomenclature meaningfully and to communicate their work effectively.

Materials and methods: Over 12 years *Medicinal Plant Names Services (MPNS)*^[4] accumulated evidence of medicinal plants from 422 sources employing 700,000 different names.

Results: By mapping these names to Kew's global taxonomic references we can count 41,787 medicinal plants in use. As data sources are added so the species count grows: there are more to find. Kew, meanwhile, tracks c.10,000 changes to scientific nomenclature and taxonomy published annually which MPNS automatically incorporates. Use of our portal and data services grow significantly in regulation, industry and research across an increasing range of disciplines.

Conclusion: We concluded there is a demand for tools to index and disambiguate published information about natural products. *Plants for Health*^[5] builds on MPNS. It covers supplements, nutraceuticals, cosmetics and fungi; includes bioactive molecules, toxicity, substitutes and conservation status; and differentiates "products" defined by different sources. We are now testing a portal for searching and exploring this enriched content and to reach other data sources regardless of what name they use. We seek feedback and input as to how to best make information available to researchers, regulators and practitioners and especially those managing their own data systems.

References:

- [1] Allkin, B. & Patmore, K. Botanical Nomenclature for Herbal Medicines and Natural Products: Its Significance for Pharmacovigilance. In *Pharmacovigilance for Herbal and Traditional Medicines Advances, Challenges and International Perspectives* (2022) Ed. Jo Barnes. pp 141-175. https://doi.org/10.1007/978-3-031-07275-8_8
- [2] Rivera D, Allkin R, Obón C, Alcaraz F, Verpoorte R, Heinrich M. What is in a name? The need for accurate scientific nomenclature for plants. *J Ethnopharmacol* (2014) 152(3):393-402. <https://doi.org/10.1016/j.jep.2013.12.022>
- [3] Allkin and Patmore Why Names Matter: Demystifying the Nomenclature of Plants and Herbal Substances. *Herbal-Gram* (2025) 142: 44-69. American Botanical Council. <https://www.herbalgram.org/resources/herbalgram/issues/142/table-of-contents/hg142-feat-nomenclature/>
- [4] Royal Botanic Gardens, Kew. Medicinal Plant Names Services V15. (2026) www.kew.org/mpns
- [5] Royal Botanic Gardens, Kew. Plants for Health (2026) www.kew.org/plants-for-health



Figure 1: How many medicinal plants are there?

ON THE TRAIL OF SILPHION: MODERN SCIENCE SHEDS LIGHT ON AN ANCIENT MYSTERY

Giovanni Appendino

Università del Piemonte Orientale, Larago Donegani 2, 28100 Novara, Italy giovanni.appendino@uniupo.it

Ethnopharmacological relevance: Worth its weight in gold, *Silphion* was the most valuable spice of the Greek-Roman world, and is the first documented case of man-related plant extinction.^[1] Based on iconographic documentation, and its endemic distribution on the Lybian coast, *Silphion* has been identified as an umbelliferous plant from the genus *Ferula* or *Margotia*. After its extinction, *Silphion* was replaced by assafetida, a vile-smelling gum-resin from various Iranian *Ferula* specie. More recently, *Silphion* has been at the centre of a heated debate on its alleged use as a contraceptive and aphrodisiac,^[2] and to its apparent rediscovery in a remote Anatolian region.^[3]

Aim of the study: to critically review the identification of *Silphion* by complementing the iconographic documentation with phytochemical and bioactivity studies on plants from the genus *Ferula* and *Margotia*.
Materials and methods: The possible presence of hormonally active compounds and of foul-smelling sulfides as well as a culinary use as a spice were considered critical.

Results: Some plants from the genus *Ferula* contain large amounts of ferutinin, the most potent phytoestrogen known. Unlike all other potent estrogenic compounds, ferutinin can be easily deactivated by hydrolysis, avoiding the complications associated to the slow functional deactivation of natural hormones.^[4] No example of co-occurrence of significant amounts of ferutinin and foul-smelling polysulfides in *Ferula* species was found.

Conclusion: The phytochemistry of plants from the genus *Margotia* provides no evidence for the presence of foul-smelling compounds, hormonally-active principles, or culinary use, all associated instead to plants the genus *Ferula*, albeit not in the same species. Remarkably, these compounds do not occur in *F. drudeana* Korovin, recently claimed as the original silphion.
^[3] While failing to identifying *Silphion* with a specific plant, modern studies suggest that the ancient literature hints associating *Silphion* to sexuality^[2] could have a foundation.

Acknowledgements: I am very grateful to Prof. Mauro Ballero (Univeristy of Cagliari) for all his suggestions and help in our decades-long studies on *Ferula* and related Mediterranean species.

References:

- [1] C. L. Gemmill, *Bull. Hist. Med.* **1966**, 40, 295–313. [2] J. M. Riddle, J. Worth Estes, *Am. Sci.* **1992**, 80, 226–233.
- [3] M. Miski, *Plants* **2021**, 10, 102
- [4] G. Appendino, P. Spagliardi, O. Sterner, S. Milligan, *S. J. Nat. Prod.* **2004**, 67, 1557-1564.

SOME REFLECTIONS ON THE MOLECULAR MODE OF ACTION OF PLANT MATERIAL IN ETHNOPHARMACOLOGICAL RESEARCH

Günter Vollmer

*Technische Universität Dresden, Germany
Guenther.Vollmer@tu-dresden.de*

Ethnopharmacological relevance: Promising medicinal plant extracts are often tested in cell based *in vitro* assays, *in vivo* experimental animal models or used for clinical trials. From the results obtained it is often hard to disclose the molecular mode of action of the investigated product.

Aim of the study: This paper aims to provide tools to identify molecular principles underlying biological of clinical effects of medicinal plants.

Material and methods: In the first part of the paper the combination of state-of-the-art phytochemical approaches with genome wide sequencing and bioinformatic evaluation was comparatively applied two different hops (*humulus lupulus*) extracts. For the second part of the presentation on Ashwagandha (Winter Cherry; *Withania somnifera*) extensive literature review^[1] was used to obtain information on its potential mode of action.

Results: After depleting a defined subfraction from an entire hops extract, the applied extensive molecular analysis revealed, that the not only some parts of the gene expression profile of the entire extract were deleted, but also altered gene expression profiles became apparent. These altered gene expression profiles gave clues to potential novel molecular actors involved in the action of hops extracts, among them clock genes. By literature review, the molecular mode of action of Ashwagandha could not be resolved entirely. However, the extensive literature review identified strong candidate targets for the experimental elucidation of the molecular mode of action of Ashwagandha.

Conclusion: The knowledge of the molecular mechanism of action of a medicinal plant product is a crucial element in efficacy and safety evaluation of the respective product. Here it is shown that not only complex molecular approaches, but also intensive literature research in the field of interest may deliver the required information.

Reference:

[1] G. Vollmer, T. Brendler *Phytotherapy Research* **2025**, doi: 10.1002/ptr.70155. Online ahead of print.

PLANT-BASED DRUG DEVELOPMENT: A SCIENTIFIC AND ETHICAL PERSPECTIVE**Namrita Lall^{a,b,c}**^a *Department of Plant and Soil Sciences, University of Pretoria, Pretoria 0002, South Africa*^b *School of Natural Resources, University of Missouri, Columbia, MO, United States*^c *College of Pharmacy, JSS Academy of Higher Education and Research, Mauritius*
Namrita.lall@up.ac.za

Ethnopharmacological relevance: Medicinal plants represent a vast and largely untapped source of bioactive compounds with potential for the development of novel therapeutic agents and natural products. However, transforming plant-based knowledge into safe, effective, and commercially viable products involves a complex and highly regulated process, underpinned by strong ethical considerations. South Africa is blessed, as the biodiversity is the third largest here globally. The untapped potential of plants has been investigated and many valuable products resulting from the research will be emphasized in the talk.

Aim of the study: The talk explores the stages of natural product development, outlining the scientific workflow from initial problem identification to the optimisation of plant-derived therapeutics. Key steps discussed include plant selection—often guided by traditional knowledge—followed by preclinical evaluation of efficacy and safety, formulation development, compound characterisation, and stability assessment.

The role of collaboration with traditional healers in identifying medicinal plants is highlighted, alongside the practical and legal challenges associated with sourcing biological materials. Particular attention is given to the acquisition of bioprospecting permits and the negotiation of licensing agreements.

Results: Many popular examples of plant-based pharmaceuticals and cosmeceuticals, such as for pigmentation, cancer, acne, wrinkles etc, will be documented which have gone from the lab to the shelves and being commercialised. Importantly, the presentation will also emphasise the ethical frameworks required to protect Indigenous Knowledge Systems (IKS), including the implementation of Benefit Sharing Agreements and Material Transfer Agreements. These mechanisms are essential to ensure equitable recognition, fair compensation, and the preservation of cultural heritage.

Further discussion addresses the challenges involved in patenting plant-based innovations, identifying suitable manufacturing partners, and establishing licensing pathways for product commercialisation.

Conclusion: Finally, the talk reviews the classification and regulation of complementary medicines, cosmeceuticals, and pharmaceuticals derived from plants, with a comparative perspective on regulatory systems in Southern.

ETHNOBOTANY OF WELL-KNOWN MEDICINAL PLANT: TRADITIONAL FOOD AND MEDICINAL USES OF PANAX NOTOGINSENG IN SOUTHWESTERN CHINA

Ruyu Yao^{1,2}, Guomao Wu^{1,2}, Yuhua Wang^{1,2}

¹ Yunnan International Joint Laboratory of Health Plant Resources

Development & Yunnan Key Laboratory for Wild Plant Resources, Department of Economic Plants and Biotechnology, Kunming Institute of Botany, Chinese Academy of Sciences, Kunming 650201, China.

² University of Chinese Academy of Sciences, Beijing 101408, China.

yaoruyu@mail.kib.ac.cn

Ethnopharmacological relevance: *Panax notoginseng* (Burkill) F.H.Chen ex C.H.Chow is a well-known medicinal plant from southwestern China where it is commonly used in traditional diets for its health-promoting properties. However, the traditional food-medicinal knowledge of this species is scattered among the local population, and it is at risk of being lost.

Aim of the study: Here we document the local knowledge about the traditional medicine and food uses of *P. notoginseng* in its traditional cultivation areas.

Materials and methods: We used classical ethnobotanical methodology with a quantitative approach. Field surveys were conducted from April 2024 to January 2025 in 15 villages within the traditional cultivation areas of *P. notoginseng*. Semi-structured interviews and key informant interviews were conducted to document the traditional knowledge of *P. notoginseng*. Quantitative ethnobotanical analyses were performed to determine its food and medicinal use values.

Results: A total of 294 informants were interviewed, resulting in 1004 use reports (URs) on medicine and food. The use reports belonged to thirteen ICPC-3 disease categories. Blood diseases (69 URs, 23%) and general diseases (66 URs, 22%) ranked as the most common categories, followed by health care (39 URs, 43%). The most common preparation method was powdering the plant (175 URs, 58%). The most common way of preparing *P. notoginseng* was stewing (270 URs, 43%). Consumption of *P. notoginseng* was done in the following categories: health care (39 URs), general (38 URs), circulatory system (12 URs), and blood (11 URs).

Conclusion: This is the first systematic documentation of the traditional knowledge relating to food and medicinal uses of *P. notoginseng* in its traditional cultivation areas, contributing fundamental data for the conservation of traditional knowledge on *P. notoginseng*, and providing important clues for its application in the health industry based on its food-medicinal values.

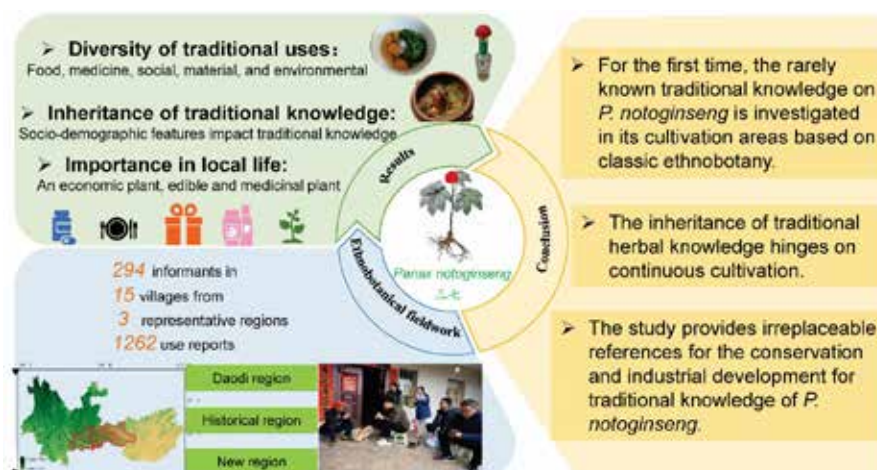


Figure 1: Graphic Abstract



Figure 2 Relative importance of traditional uses of *P. notoginseng* as food: (A) Proportion of used parts; (B) Proportion of different preparation methods.

Acknowledgements: This work is supported by Special Project for the Construction of Science and Technology Innovation Centers Facing South Asia and Southeast Asia - Yunnan International Joint Innovation Platform (202503AP140001), Caiyun Postdoc Fellowship, and Introducing Talents Start-up Fund of Kunming Institute of Botany, Chinese Academy of Sciences.

COULD THE CONCEPT OF “HOT” AND “COLD” DIABETES IN TRADITIONAL PERSIAN MEDICINE CORRESPOND TO MODERN CLASSIFICATIONS OF THE DISEASE?

Adolfo Andrade-Cetto, Fereshteh Safavi

Laboratorio de Etnofarmacología Facultad de Ciencias, Universidad Nacional Autónoma de México, México
aac@ciencias.unam.mx

Ethnopharmacological relevance: Diabetes is a metabolic syndrome characterized by glucose dysregulation, and Traditional Persian Medicine (TPM) has long contributed to its diagnosis, prevention, and treatment.

Aim of the study: This work aims to explore whether the traditional TPM concepts of “hot” and “cold” diabetes can be meaningfully compared with contemporary biomedical classifications of diabetes. It also seeks to examine the principal remedies employed in TPM for the management of the disease and to elucidate their potential therapeutic targets and mechanisms of action within both traditional and modern frameworks.

Materials and methods: In this work, seminal TPM texts were systematically analyzed using targeted keywords to extract key information regarding definitions, etiologies, symptoms, diagnostic approaches, and therapeutic strategies associated with diabetes. The main symptoms reported in TPM were compared to modern symptoms related to type 1 or type 2 diabetes and their complications.

Results: TPM interprets diabetes as *dulāb* (“water wheel”) to reflect the hallmark symptoms of excessive thirst and polyuria. While the kidneys are considered the primary organ involved, liver function is also recognized as playing a significant role in the condition. In “hot” diabetes, an overheated renal temperament is thought to increase the absorption of fluids from the liver and stomach into the kidneys, leading to excessive fluid loss. Consequently, treatment focuses on herbs that cool, hydrate, and support liver function. In contrast, “cold” diabetes is associated with the dominance of *Sáudā* (black bile) and is more commonly observed in women and individuals with obesity, often emerging under stress. TPM management of cold diabetes emphasizes strengthening vital organs such as the heart, brain, and liver, alongside eliminating the effects of *Sáudā*.

Conclusion: TPM classifies diabetes based on temperament, distinguishing between “hot” and “cold” dysregulation. However, this framework may not align with distinct modern categories such as Type 1 and Type 2 diabetes; rather, it may represent different stages along a continuum of disease progression. Within this perspective, we document 208 plant species, providing a rich, evidence-based foundation for exploring their potential as hypoglycemic agents.

Acknowledgements: The authors acknowledge; UNAM, DGAPA-PAPIIT In214225.

References:

1. American Diabetes Association Professional Practice Committee for Diabetes. 2. Diagnosis and classification of diabetes: Standards of Care in Diabetes—2026. *Diabetes Care* 2026;49(Suppl. 1): S27–S49.
2. Safavi F, Andrade-Cetto A and Escandón-Rivera SM (2025) Diabetes and traditional remedies in Medieval Persia: a historical perspective. *Front. Pharmacol.* 16:1673440. doi: 10.3389/fphar.2025.1673440.

AYAHUASCA AND SACRED MEDICINES, PSYCHEDELIC-ASSISTED THERAPY, AND REGULATORY FRAMEWORKS: A REFLECTION ON DIVERGENT PARADIGMS

Matteo Politi^{1,2}, Fabio Friso¹, Jacques Mabit¹

¹ Takiwasi, Center for the Rehabilitation of Drug Addicts and Research on Traditional Medicines – Tarapoto, Peru

² Naturale, Scientific Consultancy and Naturopathy – Bigorio, Switzerland
matteo.politi@takiwasi.com

Ethnopharmacological relevance: In recent years, there has been a marked increase in scientific publications and pharmaceutical investments focused on the use of psychedelic substances for the treatment of various mental health conditions^[1]. Many of these compounds originate from natural remedies long used within indigenous and traditional medical systems^[2]. In this context, an ethnopharmacological approach is essential to guide the development, evaluation, and clinical application of these substances in modern healthcare settings^[3].

Aim of the study: This study takes as example the therapeutic model for substance use disorder treatment implemented at the Centro Takiwasi (Peru); this includes the use of Ayahuasca, one of the most prominent traditional medicines in the Amazonian context, containing DMT as its main psychedelic compound^[4]. The aim is to highlight key similarities and differences between the traditional use of Ayahuasca and other sacred medicines like San Pedro (containing mescaline as its main psychoactive compound), and the current research and development of psychedelic-based pharmaceuticals.

Materials and methods: The study draws on two complementary sources. On the one hand, it is grounded in ethnobotanical interviews conducted in Peru, primarily with local experts in the traditional use of Ayahuasca and San Pedro. On the other hand, it incorporates interviews with specialists in psychedelic-assisted psychotherapy based mainly in Switzerland, one of the few countries where this clinical approach is currently permitted.

Results: In comparing the use of traditional remedies with that of modern preparations^[5], significant differences emerge in the processes of preparation and administration of psychedelics, which can affect the quality, safety, and efficacy of the treatment. These divergences are also reflected in national regulatory frameworks, as illustrated by the analysis of the cases of Peru, Switzerland, and Italy.

Conclusion: In the current development of psychedelic-based medicines, ethnopharmacology is called upon to play a key role and assume responsibility for supporting the safe, effective, and culturally informed integration of substances rooted in indigenous traditions into modern clinical practice, as well as for informing policy and regulatory decisions.

References:

- 1 Silczuk A, Madejek RJ, Koweszko T, Mularczyk-Tomczewska P, Adamska E, Gujski M, Szulc A. *Med Sci Monit. Psychedelic-Assisted Therapy: Potential Benefits and Challenges in Mental Health Treatment*. **2025**, 31, e948302.
- 2 Loizaga-Velder, A, & Loizaga Pazzi A. *Journal of Studies on Alcohol and Drugs. Traditional medicine, culture, and psychedelic science: New pathways for recovery from substance use disorders*. **2024**, 85(5), 595-606.
- 3 Gearin AK, Luna LE, Mendive F, Leonti M, Ferrante C, Menghini L, Politi, M. *Frontiers in Pharmacology. Beyond the pharmacology of psychoactive plant medicines and drugs: Pros and cons of the role of rituals and set and setting*. **2021**, 12, 804254.
- 4 Mabit J, Friso F., Politi M. *Ayahuasca Ritual and Spiritual Practices for Substance Abuse Rehabilitation: the Takiwasi Model and Experience* In: *Handbook of Entheogenic Healing*. **2025**, Michael J. Winkelman (Editor), Publisher: BRILL, Leiden / Boston, pages: 542–572.
- 5 Tresca G, Marcus O, Politi M. *Anthropology & Medicine. Evaluating herbal medicine preparation from a traditional perspective: Insights from an ethnopharmaceutical survey in the Peruvian Amazon*. **2020**, 27(3), 268-284.

ETHNOPHARMACOLOGICAL PERSPECTIVES ON HERB–DRUG INTERACTIONS: AÇAÍ ASSOCIATED CARDIOVASCULAR RISK AND KRATOM MEDIATED MODULATION OF ANTIRETROVIRAL THERAPY

Angela I. Calderón

Department of Drug Discovery and Development, Harrison College of Pharmacy, Auburn University, Auburn, AL 36849, USA
aic0001@auburn.edu

Ethnopharmacological relevance: Botanical dietary supplements (BDS) derived from traditional medicinal plants are increasingly used alongside prescription medicines, often without clinical oversight. Açaí (*Euterpe oleracea* Mart.) and kratom (*Mitragyna speciosa* Korth.) are widely consumed for perceived cardiovascular, anti-inflammatory, or psychoactive benefits. However, their ethnomedical use has outpaced systematic evaluation of associated herb–drug interaction risks, particularly in patients receiving narrow therapeutic index therapies.

Aim of the study: This work aims to examine ethnopharmacological and mechanistic evidence underlying clinically relevant herb–drug interactions involving açaí and kratom, with emphasis on açaí-associated cardiovascular risk and kratom-mediated modulation of antiretroviral therapy (ART) metabolism.

Materials and methods: An integrated experimental approach was employed using standardized botanical extracts and commercially available BDS. Açaí-associated vascular risk was evaluated using human endothelial cell models to assess cell viability, nitric oxide signaling, and angiogenic capacity following co-treatment with conventional drugs. Kratom-mediated drug interaction potential was investigated in human hepatocyte models by quantifying cytochrome P450 (CYP) enzyme expression following exposure to kratom alkaloids and representative ART agents using quantitative PCR. Interaction outcomes were analyzed using statistical modeling and interaction synergy frameworks.

Results: Açaí-containing preparations demonstrated enhanced cellular toxicity and markers of endothelial dysfunction when combined with select therapeutics, supporting vascular injury as a plausible mechanism underlying reported cardiovascular adverse events. Kratom and its primary alkaloid, mitragynine, significantly induced CYP3A4 expression at elevated concentrations, indicating potential for reduced ART exposure and therapeutic efficacy through metabolic modulation.

Conclusion: These findings highlight significant ethnopharmacologically rooted herb–drug interaction risks associated with açaí and kratom use. Mechanism-based evidence underscores the need for improved clinical guidance and regulatory consideration to ensure safe concomitant use of botanical supplements with cardiovascular and antiretroviral therapies.

Acknowledgements: NIH R15-AT011079, NIH-R03DA057851 grants

ETHNOPHARMACOLOGY AT [NEARLY] 60: OVERCOMING CHALLENGES IN A TRANSDISCIPLINARY FIELD OF RESEARCH

Michael Heinrich^{1,2}

¹ - Pharmacognosy and Phytotherapy Group, UCL School of Pharmacy WC 1N 1AX, United Kingdom
E-mail: m.heinrich@ucl.ac.uk

² - Chinese Medicine Research Centre, College of Chinese Medicine, China Medical University, Taichung, Taiwan

In 2027, it will be 60 years since the formal introduction of the term ‘ethnopharmacology’ (Holmsted 1967) at the time focusing on psychoactive substances from plants and fungi. The initial focus was very much about making local knowledge and practice being understood and about developing globally useful interventions. Today numerous new challenges point to a need for global perspectives incl. on biocultural diversity. Climate change and human activities severely impact plants and ecosystems, threatening biodiversity, local communities, healthcare resources, and sustainable development of plant-based products. All challenges our thinking about reality at all levels.

From local to global is well established in case of many medicinal plants like *cempasúchil* (*Tagetes erecta* L.; Lopez-Estrada et al. 2024). Today this Mexican plant is a widely grown and traded ornamental and important resource for a bioactive metabolite – lutein. However, all local resources today also face increasing risks to their long-term viability. Therefore, **focusing on the local impact of global developments** is getting even more paramount.

Recently, we have argued that in order to mitigate the impact of climate change (Mykhailenko et al 2025), we need expand and refocus our approach in the research on herbal medical products/herbal medicines/medicinal natural products. In a scoping review we assessed the state of research on how climate change affects medicinal plants, focusing on ecological shifts, traditional uses, changes in secondary metabolites, and adaptation strategies (Takubessi et al., 2025). Research output has rapidly expanded, dominated by studies on Asian resources, especially China, with limited coverage of Africa, Europe, and the Americas. As of late 2025, 357 species have been assessed, including climate-sensitive high-altitude taxa. Shifts in secondary metabolite production, linked to stress factors such as drought, indicate a need for new analytical methods.

In the chemical space this will require to focus on, for example, the changing composition of medicinal plants under changing ecological conditions and a focus on improved quality assurance of products on the many markets globally. Such high value resources can provide important local economic opportunities, as an element of climate change mitigation. These changes are reshaping both the ecology and pharmacological value of medicinal plants. Research on sustainable sourcing, and better regulation of which products can be commercialised and used safely.

References:

1. Holmstedt, B. 1967. An overview of ethnopharmacology. Historical survey. *Psychopharmacology Bulletin* 4 (3) , pp. 2-3
2. Lopez Estrada D., Chang W-T, Heinrich M. 2024. From “traditional” to modern medicine: A medical and historical analysis of *Tagetes erecta* L. (*Cempasúchil*). *Journal of Traditional and Complementary Medicine*. 15: 6-14. <https://doi.org/10.1016/j.jtcme.2024.08.001>
3. Mykhailenko O, Jalil B, McGaw LJ, Echeverría J, Takubessi M, Heinrich M. (2025) Climate change and the sustainable use of medicinal plants: a call for “new” research strategies. *Front Pharmacol*. 15:1496792. doi: 10.3389/fphar.2024.1496792.
4. Takubessi M, Jalil, B. and Heinrich M (2025) “Climate Change” Impact on Medicinal Plants and Bioactive Natural Products as an emerging challenge in Ethnopharmacology: A Scoping Review. *Front Pharmacol* 16:1697581. doi: 10.3389/fphar.2025.1697581

UNCOVERING THE POTENTIAL ANTICANCER ACTIVITIES OF SEVERAL COMPOUNDS FROM VIETNAM MEDICINAL PLANTS AGAINST CANCER STEM CELLS

Thi Thao Do, Ha Phuong Trieu, Thi Nga Nguyen, Le Nam Khanh Tran, Hoang Ngan Ha Le, Thi Phuong Do, Thi Cuc Nguyen

Institute of Biology, Vietnam Academy of Science and Technology, Vietnam
thaodo@ib.ac.vn

Recent studies have suggested that cancer stem cells (CSCs) may represent novel targets for cancer therapies [1],[2]. Meanwhile, flavonoids and alkaloids derived from medicinal plants have attracted considerable attention due to their promising bioactivities and therapeutic potential [3],[4]. This research aimed to evaluate the biological activities of two natural compounds of distinct chemical classes: (i) Nitidine (NIT), a benzophenanthridine alkaloid isolated from *Zanthoxylum myriacanthum*; (ii) Glyasperin A (GlyA) is a flavonoid isolated from the leaves of *Macaranga indica* Wight against NTERA-2 (NT2/D1) or NCIT cancer stem cells, a representative CSC model. The potential anti-proliferative and anti-stemness effects of both compounds were investigated using MTT assay, spheroid assay, DNA and lysosome staining, flow cytometry, caspase assay, immunoblotting, and molecular docking studies. Both compounds exhibited selective cytotoxicity toward CSCs, with less effect on HEK-293A human embryonic kidney cells. They suppressed stemness properties like *in vitro*-tumorsphere forming, c-myc, Oct4, Nanog transcription factors after 48-hour-treatment. Nitidine induced selectively anti-survival activities by triggering the intrinsic apoptotic process through p53 signaling and lysosome-dependent cell death (LDCD). The mechanism of action of Nitidine on cancer stem cells was also investigated using molecular docking studies to provide physical insights. Molecular docking studies revealed that Nitidine induce LDCD by effectively inhibiting the MHR1/2 domain of TRPM2 protein on liposome membrane. Besides, GlyA induced apoptosis by upregulating Bax and phosphorylated ERK1/2 protein levels. Moreover, the levels of some proteins involved in the Akt/mTOR/IKK signaling pathways, which play critical roles in maintaining the self-renewal and proliferative features of CSCs, were also decreased. These results show that the compounds affect multiple targets that sustain the stemness features and proliferation or cell death of CSCs.

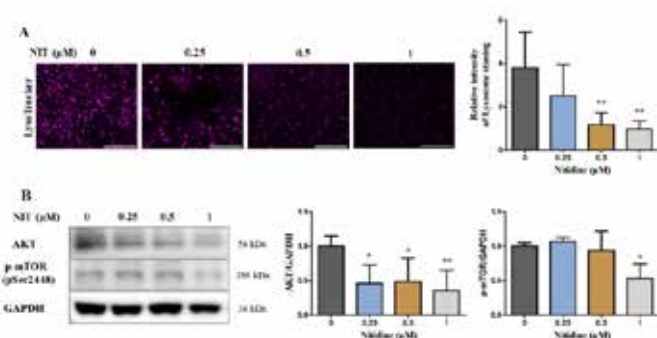


Figure 1. (A) Relative fluorescent intensity of lysosome in NTERA-2 cells and (B) Western blot analysis for the expression of Akt and p-mTOR. Such expression significantly decreased after stimulation with NIT at several concentrations after 48 h, compared with the control group. The error bars represent the standard deviation from three independent experiments (* $p < 0.05$ vs. control group; ** $p < 0.01$ vs. control group). Scale bar, 200 μ m

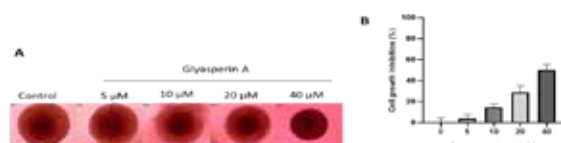


Figure 2. Effect of GlyA on NCCIT tumorsphere. (A) NCCIT tumorsphere (10X) was grown in low-attachment 96 wells-plate and incubated with GlyA for 72 hours; the scale bar was 200 μ m. (B) NCCIT cell growth inhibition in spheroid was performed using an MTT assay and compared with the control. All the measures were present as mean $\pm$ SD of at least three replicates

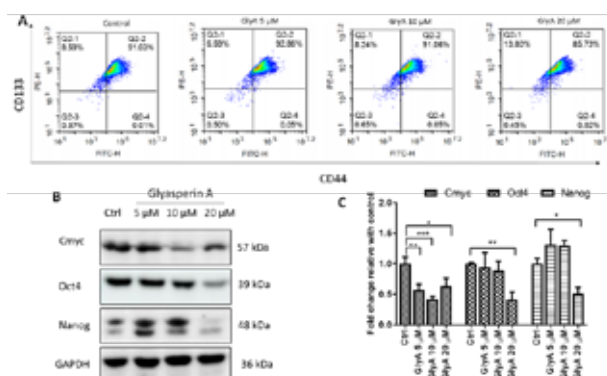


Fig. 3 Effects of GlyA on the expression of stemness markers for 24 h. (A) GlyA-treated cells were double incubated with CD133-

INVITED SPEAKER **IS 8**

PE/CD44-FITC antibodies for flow analysis. **(B)** The image presents the downregulation of Oct4, Nanog, and cMyc protein when NCCIT cells were incubated with GlyA for a period of 24 hours and then analyzed by the western blotting method. GAPDH was a loading control. **(C)** The fold change of Oct4, Nanog, and Cmyc relative to un-treatment under exposure with different concentrations of GlyA. The intensity of these proteins was normalized to GAPDH. Compared with untreated control, * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

References:

- [1] Moharil RB, Dive A, Khandekar S, Bodhade A. *Journal of Oral and Maxillofacial Pathology* **2017**; 21(3): 463
- [2] Chu X, Tian W, Ning J, Xiao G, Zhou Y, Wang Z, Zhai Z, Tanzhu G, Yang J, Zhou R. *Sig Transduct Target Ther*, **2024**. 9: 170
- [3] Lo Iacono M, Gaggianesi M, Bianca P, Brancato OR, Muratore G, Modica C, Roozafzay N, Shams K, Colarossi L, Colarossi C. *J Clin Med*, **2022**, 11: 6996.
- [4] Okagu IU, Ndefo JC, Aham EC, Udenigwe CC. *Frontiers in Pharmacology* **2021**; 12: 713090

APPLICATION OF AI-DRIVEN AYURINFORMATICS FOR DEVELOPMENT OF AYUSH MEDICINES

Sanjay M. Jachak, PhD

Department of Natural Products, National Institute of Pharmaceutical Education and Research (NIPER),
Sector-67, Mohali 160062, Punjab
Email: sanjayjachak@niper.ac.in

The integration of artificial intelligence (AI) into traditional systems of medicine has given rise to a novel interdisciplinary field known as Ayurinformatics, which combines the wisdom of Ayurveda with modern computational and analytical tools. It makes large-scale, effective reverse pharmacological validation of Ayurvedic practices possible [1]. To address the growing interest in in silico evaluation of phytoconstituents present in medicinal plants and polyherbal formulations, our group recently proposed Systematic Assessment and Pre-step Protocol for Herbal In Silico Research and Evaluation (SAPPHIRE), a guideline for pre-step analysis of medicinal plants for computational research [2]. At NIPER-SAS Nagar, we have applied this Ayurinformatics-driven framework to study Ayurvedic formulations and medicinal plants for mechanism-based validation. A case study of Arogyamrita Kwath, developed in collaboration with Dhanwantry Ayurvedic College and Hospital, Chandigarh, will be presented [3]. LC-HRMS metabolomics, in vitro, and in silico studies demonstrated its promising translational potential toward antiviral therapy. Further, our recent studies highlight the broader applicability of this approach. *Schleichera oleosa* bark *n*-hexane fraction, enriched with triterpenoids such as lupeol, lupeol acetate, betulinic acid, and β -sitosterol, significantly reduced paw edema, arthritic score, pro-inflammatory mediators (TNF- α , IL-1 β , IL-6), improved antioxidant markers, and restored joint architecture in CFA-induced arthritic rats. Additionally, network pharmacology study revealed possible interactions between these compounds and other protein targets and signaling pathways linked to rheumatoid arthritis, offering mechanistic insights [4]. Similarly, *Boerhavia diffusa* roots rotenoid-enriched fraction significantly reduced ROS generation, nitric oxide production, and lipid accumulation, while enhancing ADH and ALDH activity in ethanol-induced HepG2 cells, with molecular docking revealing strong interactions with CYP2E1, NRF2, SIRT1, SREBP1, TNF- α , and TLR4 targets [5]. These findings demonstrate how AI-enabled Ayurinformatics, combined with metabolomics and experimental validation, can accelerate phytopharmaceutical development and promote global acceptance of evidence-based Ayurvedic therapeutics.

References:

1. Gupta P, Nesari TM. Ayurinformatics Laboratory- A synergy platform for Ayurveda and technology. J. Ayur. Integr. Med. 2024, 15, 101019.
2. Gupta P, Jachak SM, Dey A, Sahu R, Anajana CS, Galib R. SAPPHIRE: Gupta and Jachak guideline for a Pre-Step analysis of medicinal plants for In Silico research (SAPPHIRE: Systematic assessment and Pre step protocol for herbal in silico research and evaluation). Phytomed. Plus 2025, 5 (3), 100820
3. Dey A and Jachak SM et al. In vitro anti-inflammatory and in silico anti-viral assessment of phytoconstituents in polyherbal Ayurvedic formulation 'Arogyamrita Kwath'. J. Ayur. Integr. Med. 2025, 16(2), 101076.
4. Tandalekar YB, Kulshreshtha S, Jangra B, Goyal A, Jachak SM. *Schleichera oleosa* Bark Extract Shows Potent Anti-Arthritic Activity in Complete Freund's Adjuvant (CFA) Induced Arthritis in Rats and Network Pharmacology. Chem. Biodivers. 2026, 23(4), e02071.
5. Deshmukh KN, Kendre AG, Srivastava A, Goyal A, Bharatam PV, Jachak SM. Hepatoprotective Potential of *Boerhavia diffusa* L. Against Alcohol Induced Toxicity in HepG2 Cells: An *In Vitro* and *In Silico* Study. ChemistrySelect. 2026, 11(9), e03437.

METABOLOMICS-BASED SCIENTIFIC VALIDATION OF UNANI MEDICINE FOR CHRONIC KIDNEY DISEASES

Prof. (Dr.) Sayeed Ahmad

*School of Pharmaceutical Education & Research,
Jamia Hamdard, New Delhi, 110062, India
Email: sahmad_jh@yahoo.co.in*

Traditional Indian systems of medicine (AYUSH), including Ayurveda, Unani, and Siddha, constitute a vast repository of botanicals with longstanding therapeutic applications. Translating this traditional knowledge into evidence-based phytopharmaceutical development necessitates rigorous chemical and biological validation. Advanced metabolomics platforms such as LC-MS, LC-MS/MS, GCMS, and NMR combined with chromatographic techniques (HPLC/UPLC and HPTLC), enable comprehensive metabolite profiling, dereplication, and high-resolution fingerprinting. These approaches are critical for authentication, standardization, and ensuring batch-to-batch quality consistency.

Furthermore, hyphenated techniques such as TLC-MS and LC-MS-guided bioassays, integrated with network pharmacology, facilitate the correlation of phytochemical data with multi-target biological mechanisms. These strategies also support pharmacokinetic and toxicity evaluations.

Our research focuses on the scientific validation of traditional Unani formulations used in the management of chronic kidney diseases (CKD). By employing both targeted and untargeted metabolomics, alongside network pharmacology and in vitro and in vivo studies, we aim to substantiate therapeutic claims, identify bioactive markers, and elucidate underlying molecular pathways.

Unani medicine, rooted in Greco-Arabic traditions established by Hippocrates, Galen, and later Avicenna, emphasizes the maintenance of physiological balance through humoral theory, temperament (mizaj), and vital forces. In this study, classical formulations such as *Sharbat-e-Bazoori Motadil* and their individual constituents have been systematically investigated.

Metabolomics-driven approaches thus provide a robust, evidence-based framework for the discovery, validation, and standardization of plant-derived therapeutics, effectively bridging traditional medical knowledge with modern drug discovery and regulatory requirements.

Keywords: Medicinal plants, Metabolomics, Network pharmacology, Ethnopharmacology, Quality control, Chronic kidney disease, Unani medicine

ETHNOPHARMACOLOGY FOR TRANSLATING INDIAN SYSTEMS OF MEDICINE: EXPLORE, EDUCATE AND EMPOWER

Pulok Kumar Mukherjee

*Department of Pharmaceutical Technology, Jadavpur University, Kolkata – 700032, India 1
www.pulokmukherjee.com*

Ethnopharmacology provides an interdisciplinary framework for bridging traditional wisdom with modern biomedical science and translating local healthcare knowledge into globally relevant evidence-based therapeutics. Indian Systems of Medicine (ISM), especially Ayurveda, represent one of the world's oldest codified traditional healthcare systems, encompassing extensive ethnopharmacological knowledge developed through centuries of community practice and cultural adaptation. However, the successful translation of traditional therapies into globally accepted evidence-based healthcare requires scientific rigour, technological integration, sustainable resource management, and ethical governance. The concept of “Explore, Educate and Empower” provides a comprehensive translational framework for transforming indigenous therapeutic knowledge into scientifically validated, accessible, and sustainable healthcare solutions. This lecture will highlight the exploration of traditional therapies today that extends far beyond ethnobotanical documentation and includes ethnopharmacology-guided bioprospecting, phytochemical profiling, dereplication strategies, metabolomics, proteomics, cheminformatics, and bioassay-guided fractionation. Emerging approaches integrating network pharmacology, systems biology, and ADME/Tox evaluation are enabling mechanistic understanding of multi-component traditional formulations and facilitating translational pipelines from molecular discovery to preclinical and clinical validation. Simultaneously, artificial intelligence, machine learning, predictive modelling, knowledge graphs, and digital documentation are reshaping computational ethnopharmacology by improving target prediction, mechanism elucidation, and safety assessment, while blockchain-enabled traceability supports the authentication and transparency of medicinal resources.

The translational future of traditional medicine also depends on sustainable bioresource management and One Health approaches that integrate human, animal, and environmental health. Conservation biology, regenerative cultivation systems, climate-resilient medicinal plant production, and circular bioeconomy models are essential for the long-term sustainability of medicinal bioresources. Advances in biotechnology, synthetic biology, green chemistry, microbial platforms, and waste valorisation further support scalable and environmentally responsible production of phytopharmaceuticals, botanical drugs, and nutraceuticals. Education and empowerment through interdisciplinary capacity-building, preservation of indigenous knowledge, and responsible policy integration remain central pillars of this translational journey. Integrating ethnopharmacology with advanced analytical sciences, computational biology, and translational medicine offers a powerful pathway for transforming traditional therapies into scientifically credible, safe, and globally relevant healthcare solutions and globalization of local knowledge.

BIG DATA, BENCH, AND BEDSIDE: TRADITIONAL HERBAL MEDICINE FOR CANCER PATIENTS IN TAIWAN

Hung-Rong Yen^{1,2,3}

¹School of Chinese Medicine, and International Master Program in Acupuncture, College of Chinese Medicine, China Medical University, Taichung 404328, Taiwan

²Chinese Medicine Research Center, China Medical University, Taichung 404328, Taiwan

³Division of Integration of Chinese and Western Medicine, Department of Chinese Medicine, China Medical University Hospital, Taichung 404327, Taiwan
hungrongyen@mail.cmu.edu.tw

Ethnopharmacological relevance: Chinese herbal medicine (CHM) is widely used as complementary therapy among cancer patients in East Asia, particularly in Taiwan. However, the translational linkage between real-world clinical evidence and mechanistic immunopharmacology remains incompletely understood.

Aim of the study: To establish a “Big Data–Bench–Bedside” framework investigating the clinical effectiveness and immunopharmacological mechanisms of CHM in integrative oncology.

Materials and methods: A nationwide cohort study using Taiwan’s National Health Insurance Research Database analyzed 582,799 adult cancer patients. Disease-specific analyses were conducted in pancreatic ductal adenocarcinoma (PDAC) and cervical cancer cohorts. Mechanistic studies evaluated the immunomodulatory effects of *Hedyotis diffusa* Willd and genipin, a bioactive compound from *Gardenia jasminoides* Ellis, using cellular and murine tumor models.

Results: CHM users had significantly lower all-cause mortality than non-users (adjusted HR = 0.69; 95% CI = 0.68–0.70). Adjunctive CHM was also associated with reduced mortality in PDAC (adjusted HR = 0.67; 95% CI = 0.56–0.79) and cervical cancer patients (adjusted HR = 0.29; 95% CI = 0.27–0.31). *Hedyotis diffusa* was among the most frequently prescribed herbs. Experimental studies showed that *H. diffusa* extract activated antigen-presenting cells via the MAPK pathway, enhanced dendritic cell antigen presentation, and promoted effector and memory T-cell responses. Its active constituent rutin functioned as an immune adjuvant in therapeutic cancer vaccines. Furthermore, genipin inhibited uncoupling protein 2 (UCP2), enhanced mitochondrial oxidative phosphorylation, and activated the IL-12R/STAT4/mTOR axis in CD8⁺ T cells, promoting Tc1 differentiation and IFN- γ production. Combined with IL-17 blockade, genipin synergistically enhanced antitumor immunity and prolonged survival in PDAC models.

Conclusion: These findings support a translational continuum from population-based evidence to mechanistic immunopharmacology, validating CHM-derived compounds as evidence-based components of integrative oncology.

Acknowledgements: This research work was partially supported by the Chinese Medicine Research Center of China Medical University, under The Featured Areas Research Center Program within the framework of the Higher Education Sprout Project, the Ministry of Education, Taiwan and the National Science and Technology Council, Taiwan.

FROM GREEK TO EUROPEAN PHARMACOPOEIAS: CONTINUITY OF NATURAL PRODUCTS

Ekaterina-Michaela Tomou, Christina Barda, Sofia Barbayanni, Helen Skaltsa

Section of Pharmacognosy and Chemistry of Natural Products, Department of Pharmacy, School of Health Sciences, National & Kapodistrian University of Athens, Panepistimiopolis, Zografou, 15771 Athens, Greece
ktomou@pharm.uoa.gr

Ethnopharmacological relevance: Historical texts have long served ethnopharmacology by linking historical *materia medica* with contemporary traditional practices and by guiding the discovery of bioactive natural products^[1]. Within this context, the official Greek Pharmacopoeias represent an important source of medicinal and ethnopharmacological knowledge.

Aim of the study: This study aimed to investigate the occurrence and evolution of natural products in the five official Greek Pharmacopoeias and to evaluate their continuity and representation in the European Pharmacopoeia 11 (Ph. Eur. 11).

Materials and Methods: A comparative historical analysis was performed using the five official Greek Pharmacopoeias, including available addenda, and the European Pharmacopoeia 11. Natural products were systematically recorded, classified, and comparatively assessed, focusing on herbal drugs, taxonomic diversity, and continuity across pharmacopoeial editions.

Results: A total of 298 herbal drug aggregates were identified across the Greek Pharmacopoeias^[2]. Herbal monographs predominated in the earliest edition, decreased in later editions, and increased again in the most recent pharmacopoeia. Comparative evaluation demonstrated substantial continuity with the European Pharmacopoeia, as many herbal drugs remained officially recognized over time. Beyond herbal products, Greek Pharmacopoeias documented natural metabolites, animal-derived preparations, antibiotics, enzymes, hormones, and vitamins.

Conclusion: The findings reflect the broader trajectory of modern therapeutics, with many herbal monographs retained in Ph. Eur. 11. This continuity underscores the sustained relevance of natural products in contemporary medicine and highlights the lasting contribution of ethnopharmacological knowledge to modern pharmaceutical development.

References:

- [1] P. de Vos, *J Ethnopharmacol.* **2010**, 132, 28-47.
- [2] E-M. Tomou, C. Barda, S. Barbayanni, H. Skaltsa, *J Ethnopharmacol.* **2026**, 365, 121539.

THE ROLE OF GUT MICROBIOTA AND MICROBIAL METABOLITES FOR THE ACTIVITY OF HERBAL MEDICINE

Rudolf Bauer

Institute of Pharmaceutical Sciences, University of Graz, Austria
rudolf.bauer@uni-graz.at

Despite extensive research, the active principles and mechanisms of action of many herbal drugs remain poorly understood. In addition, the bioavailability of numerous polar plant constituents is quite limited, making systemic effects unlikely and the relevance of results obtained by in-vitro studies questionable. Consequently, alternative approaches should also be considered to explain the biological activity of herbal medicine.

Gut microbiota and the human body exist in a symbiotic relationship that is essential for health and well-being. Dysbiosis can contribute to a wide range of diseases, including inflammation, obesity, asthma, diabetes, and even cancer. For instance, *Faecalibacterium prausnitzii* has been identified as a key contributor to intestinal health; the mucin-degrading bacterium *Akkermansia muciniphila* has been associated with obesity and type 2 diabetes (T2D); and *Fusobacterium* species have been implicated as potential causative agents in colorectal cancer [1]. Therefore, gut microbiota represent a relevant target also for herbal drugs and may help clarify their therapeutic effects.

Conversely, gut microbiota also play a crucial role in the metabolism of plant constituents. Metabolites are produced, which are not contained in the original plant material or extract, and which may play a role as active principles of herbal medicine. To investigate the interactions between medicinal plant extracts and the gut microbiota, we have established a research platform that enables both the analysis of plant-constituent metabolization using LC-HRMS and the assessment of microbiome shifts through 16S rRNA sequencing [2].

We have investigated, STW 5, an herbal medicinal product containing nine herbs with proven clinical efficacy in the treatment of functional gastrointestinal disorders. The effects of STW 5 on fecal microbial communities and metabolite production effects have been studied. A rapid metabolic turnover of STW 5 components into specific degradation products with reported anti-inflammatory, cytoprotective, or spasmolytic activities was observed, which may be relevant for the pharmacological activity of STW 5 [3].

A St. John's wort extract (STW 3-VI), clinically proven to be effective in mild to moderate depression, has also been investigated in our platform. While hyperforins remained stable, flavonoids and hypericins were rapidly biotransformed, suggesting that they may act as prodrugs. Several metabolites were formed, some of them are known to be involved in gut-brain communication. Differential abundance analysis of the gut microbiome composition revealed significant changes particularly for taxa known to be potentially associated with depression. For example, the Firmicutes/Bacteroidetes ratio, known to be lowered in depressive patients, was increased. These interactions suggest pharmacological effects of St. John's wort extracts via the microbiome-gut-brain axis [4].

Another example is valerian extract. Upon fermentation with fecal microbiota, most constituents were extensively metabolized. Several of the formed metabolites are known to be involved in gut-brain communication, such as phenylpropionic acid derivatives and protocatechuic acid. The formed lignan enterolactone is known that it can reach the brain in vivo and it has also been linked with reduced prevalence of depressive symptoms and sleep disorders [5].

Conclusion: All these findings suggest that gut microbiota-mediated biotransformation can play an important role for the activity of herbal medicinal products.

References:

- [1] J.A. Gilbert J.M. Blaser, J.G. Caporaso, J.K. Jansson, S.V. Lynch, R. Knight, *Nat Med.* **2018**, *24*; 392-400.
- [2] E.M. Pferschy-Wenzig, K. Koskinen, C. Moissl-Eichinger, R. Bauer, *Front Pharmacol.* **2017**, *8*; 893.
- [3] T.A.Thumann, E.-M. Pferschy-Wenzig, C. Kumpitsch, S. Duller, C. Högenauer, P. Kump, H. Aziz-Kalbhenn, R.M. Ammar, S. Rabini, C. Moissl-Eichinger, R. Bauer, *Microbiology spectrum*, **2024**, *12*; e0403123.
- [4] M.E. Grafakou, E.-M. Pferschy-Wenzig, H. Aziz-Kalbhenn, O. Kelber, C. Moissl-Eichinger, R. Bauer *Biomed Pharmacother.* **2025**, *187*; 118111.
- [5] M.E. Grafakou, E.-M. Pferschy-Wenzig, O. Kelber, C. Moissl-Eichinger, R. Bauer, **2026**, submitted for publication.

MULTIOMICS PRECISION STRATEGIES FOR NATURAL PRODUCTS DISCOVERY AND REAL-WORLD MEDICINE VALIDATION

Francesco Galli

*Steering committee and scientific board member UNIBIOS
Department of Medicine and Surgery, University of Perugia, Italy
e-mail: progetto.unibios@unipg.it; Tel. +39 075 585 8165*

*Nutrigenomics and Micronutrients Lab (NUTRIMICRO).
Department of Pharmaceutical Sciences, University of Perugia, Italy
e-mail: francesco.galli@unipg.it; Tel. (lab/office) +39 075 58574745/90*

Natural products from medicinal plants remain a major source of pharmacologically active compounds and nutraceutical ingredients. Their development increasingly requires approaches able to move beyond empirical bioactivity screening and to capture the molecular complexity of both botanical preparations and human pathophysiology. Genomic and post-genomic sciences as transcriptomics, proteomics and metabolomics, are reshaping this field by providing mechanism-based tools for natural product drug discovery, target identification, efficacy assessment, safety evaluation and patient stratification. This lecture will discuss how omics technologies can support a future-oriented vision of ethnopharmacology and natural products, in which traditional knowledge, phytochemical complexity and systems biology converge into precision strategies for prevention and therapy.

Multi-omics approaches allow the integrated evaluation of physiological status, an intrinsically individual and biologically dynamic feature, as well as of early disease risk and transitions toward overt pathological alterations. Rather than measuring isolated or partial endpoints, these platforms can comprehensively define molecular signatures of homeostasis, adaptive stress responses and disease progression, thereby supporting predictive diagnostics and the identification of therapeutic targets according with the criteria of precision and personalized medicine.

In real-world medicine, this paradigm shift from traditional to holistic and personalized approaches will open new avenues for the identification/prediction of health risks and the protection of physiological functions through the lifecycle, as well as for the treatment of virtually all human health ailments since their earliest phases of development and with genomic-guided patient-tailored solutions.

The proposed perspective positions omics as a strategic advancement for ethnopharmacology bridging medicinal plant knowledge and precision natural products discovery with patient health care. This is the core philosophy and research mission of UNIBIOS private-public partnership research facility recently established at University of Perugia that will be presented in this lecture.

PHYTOCHEMICAL INVESTIGATIONS FOR THE VALORIZATION OF THE THREATENED GREEK MEDICINAL PLANTS *ORIGANUM DICTAMNUS* AND *PRIMULA VERIS* SUBSP. *VERIS* DURING DOMESTICATION

Anastasia Karioti¹, Charikleia Paloukopolou², Paschalina Chatzopoulou³, Nikos Krigas^{3,4}

¹ Dipartimento di Farmacia, Università di Pisa, Pisa, Italy

² Laboratory of Pharmacognosy, Department of Pharmacy, Aristotle University of Thessaloniki, Thessaloniki, Greece

³ Institute of Plant Breeding and Genetic Resources, Hellenic Agricultural Organization Demeter (ELGO-Dimitra), Thessaloniki, Greece

⁴ Institute of Agri-Food and Life Sciences, Research Centre of the Hellenic Mediterranean University, Heraklion, Greece
anastasia.karioti@unipi.it

Origanum dictamnus L. or Cretan dittany (Lamiaceae) is a rock-dwelling native Greek chamaephyte which is endemic to the island of Crete and has been declared as Near Threatened and protected by the Greek Presidential Decree 67/81.^[1] Although dittany has long been introduced into cultivation, to date there are only scarce data concerning its chemical content and the pharmacological evaluation of its extracts, especially under cultivation.

Primula veris L. (Primulaceae), is an herbaceous perennial plant which is native almost across Europe with edge populations in Greece.^[2] Anthropogenic impact along with drastic warming of arctic or alpine regions have detrimental effects on its survival, especially in Greece where wild populations of subspecies *veris* are also subjected to intense illegal harvesting from the wild. Therefore, there is an urgent need to protect its wild populations from uncontrolled collections and to facilitate its sustainable cultivation in the long-term.

Both species have finalized monographs in the European Medicines Agency. *Origanum dictamnus* is used for cold, as digestive, spasmolytic, against stomach discomforts and externally as cicatrizing and minor skin problems^[3] while *P. veris* roots and flowers are used for the treatment of respiratory tract problems, such as cough, asthma, bronchitis and catarrh.^[4] Extensive chemical investigations assisted by LC-MS have been performed in different parts of cultivated *O. dictamnus* affording new naturally occurring compounds. Infusions demonstrated spasmolytic activity on rabbit intestine, while metabolism/absorption studies provided important insights on how the components interact with the intestinal tissue.

Chemical analyses in all parts of *P. veris* subsp. *veris*, showed a slightly different chemical content than that of other subspecies.^[2,5] To select *P. veris* subsp. *veris* genotypes with optimal phytochemical traits, we investigated phytochemically 13 wild-growing populations sourced from mountain areas along a longitudinal gradient of Northern Greece in the frame of the domestication process of Greek native cowslip genotypes.

References:

- [1] Flora of Greece Web, 2026. Available online: <https://portal.cybertaxonomy.org/flora-greece/intro> (accessed on 30 April 2026).
- [2] I. Stefanis, P. Chatzopoulou, N. Krigas, A. Karioti. *Horticulturae* **2023**, *9*, 1120.
- [3] EMA, 2014. Community herbal monograph on *Origanum dictamnus* L., herba. EMA/HMPC/200429/2012 Corr.
- [4] EMA/HMPC/104095/2012 Committee on Herbal Medicinal Products (HMPC) Community herbal monograph on *Primula veris* L. and/or *Primula elatior* (L.) Hill, radix.
- [5] P.I. Chintiroglou, N. Krigas, P. Chatzopoulou, A. Karioti, A. *Planta Med.* **2021**, *87*, 1219-1230.

CONCLUSIONS FROM THE ANTIMICROBIAL ACTIVITY OF 741 ACETONE LEAF EXTRACTS OF 537 DIFFERENT SOUTH AFRICAN TREE SPECIES

Kobus (JN) Eloff, Lita (E) Pauw

Phytomedicine Programme, Faculty of Veterinary Science, University of Pretoria, South Africa

There are two main ways of investigating the activity of medicinal plants i.e. by following traditional leads or by random screening. In our group we have followed both approaches. With excellent funding support and the help of many students we investigated the antibacterial and antifungal activity of acetone tree leaf extracts against four nosocomial bacteria and two yeasts. Leaves were collected in several well curated national botanical gardens in South Africa. Established methods were used to determine the activity [1]. A chemotaxonomic approach was to investigate whether there was a statistically significant difference in the activity between tree taxa and activity to enable predictions and select taxa for investigation. In comparing tree orders with high activity with orders with low activity there was a higher probability for Gram negative (five-fold), Gram positive (three-fold) and double probability for antifungal activity [2]. There are major differences in what is considered high antimicrobial activity in the literature. Categories were selected from the large database to classify the antimicrobial activity based on the percentage of plants extracts with a specific activity. A rational approach could be to determine the minimum inhibitory concentrations of the most active 1, 3, 9, 25, 50, and >50% of a large number of plant extracts [3].

Activity MIC in mg/ml	Classification	% of total species
equal or <0.02	outstanding activity	1%
0.021–0.04	excellent activity	3%
0.041–0.08	very good activity	9%
0.081–0.16	good activity	25%
0.161–0.32	average activity	50%
>0.32	weak activity	>50

Because the same species were collected from national botanical gardens in different climatic areas of South Africa, it was also possible to investigate how large the variation between the same species in different areas was. Publication of the database would also indicate which species would reward in depth further investigation.

References:

- [1] Eloff, JN 2019 BMC Complementary and Alternative Medicine (2019) 19106
- [2] Pauw E and JN Eloff 2014 BMC Complementary and Alternative Medicine, 14,317
- [3] Eloff JN Planta Medica 2021, 87, 836-840

ETHNOBOTANICAL STUDY ON TAJIK MEDICINAL PLANTS ON THE PAMIR PLATEAU, CHINA

Aybek Rehmatul¹, Yan Li², Jiang He¹, Wei-Jun Yang¹, Chun-Lin Long^{1,2}

¹Xinjing Institute of Meteria Medica, Urumqi, China

²Minzu University of China, Beijing, China
long.chunlin@muc.edu.cn

This study aims to systematically investigate, organize, and document the medicinal plants and associated traditional knowledge of the Tajik ethnic group on the Pamir Plateau, China. It evaluates the diversity of medicinal plants and the degree of consensus regarding their therapeutic uses, providing a scientific basis for the inheritance, protection, and sustainable utilization of Tajik traditional medicine. Ethnobotanical and ethnopharmacological methods, including semi-structured interview, key informant interviews, participatory investigation, and voucher specimen collection, were employed in Taxkorgan Tajik Autonomous County. A total of 117 local folk healers and inheritors were interviewed to gather data on traditional knowledge associated with medicinal plants. Using the ICD-11 disease classification system, the data were quantitatively analyzed by utilizing indicators such as Relative Frequency of Citation (RFC) and Informant Consensus Factor (ICF). The traditional knowledge of 162 species of medicinal plants belonging to 54 families used by the Tajik people was documented in Taxkorgan County. Primary twelve traditional preparing methods were recorded, such as powders, decoctions, pastes, honey pastes, and fumigants. Demographic analysis revealed that the majority of folk healers were male (86.3%) and predominantly engaged in agriculture. In terms of disease treatment, the ICF values for respiratory diseases, musculoskeletal and connective tissue diseases, and digestive system diseases were high (0.76, 0.76, and 0.70, respectively), indicating a high degree of community consensus. Commonly used medicinal materials include licorice, ephedra, *Cynomorium songaricum*, and *Rhodiola rosea*. It is the first research to deal the traditional knowledge associated with medicinal plants among the Tajik people on China's Pamir Plateau. The results revealed there are abundant ethnobotanical treasures of medicinal plants used by the Tajik, particularly regarding their uses of treating common diseases occurring on plateau. This study provided information to preserve endangered traditional knowledge, and essential baseline data and scientific support for the conservation and sustainable utilization of local medicinal plant resources, as well as for the modern research and development of ethnomedicines.

Keywords Pamir Plateau; Tajik ethnomedicine; Ethnopharmacology; Medicinal plants; Traditional therapy

CLINICAL EFFICACY EVALUATION OF PILOT STUDY OF FOUR TIBETAN MEDICINAL COMPOUND IN THE TREATMENT OF PULMONARY ARTERIAL HYPERTENSION

Cuomu Mingji

University of Tibetan Medicine, Lhasa, TAR, PRC

Introduction Based on the five-element and three-factor theory of Tibetan medicine, this study explores the pathological mechanism of pulmonary arterial hypertension, clarifies its clinical diagnosis and localization, and pilot study for four Tibetan medicinal formulas. Clinical preliminary drug screening trials were conducted to observe the clinical efficacy of these medicines against pulmonary arterial hypertension, laying a foundation for subsequent systematic research.

Objective To preliminarily evaluate the clinical efficacy of four Tibetan medicinal formulas in treating pulmonary arterial hypertension.

Methods A clinical evaluation scale for pulmonary arterial hypertension was formulated. Inclusion and exclusion criteria for patients were established, baseline clinical data were collected, a 45-day treatment course was set, follow-up data were gathered, and all data were statistically entered and analyzed.

Results

Compound Tibetan Medicine 001: total improvement rate 100%, clinical cure rate 60%.

Compound Tibetan Medicine 002: total improvement rate 100%, clinical cure rate 65%.

Compound Tibetan Medicine 003: total improvement rate 100%, clinical cure rate 62%.

Compound Tibetan Medicine 004: total improvement rate 100%, clinical cure rate 67%.

All statistical P values ≤ 0.001 .

Conclusion Clear clinical diagnosis and pathological localization of pulmonary arterial hypertension have been established from the perspective of Tibetan medicine. All four screened Tibetan medicinal formulas achieve a 100% clinical effective rate. The findings make breakthrough progress in the clinical diagnosis and treatment of pulmonary arterial hypertension, and provide a solid basis for further in-depth and systematic studies.

SUSTAINABLE SUPPLY CHAIN FOR HERBAL MATERIALS FROM ETHNOPHARMACOLOGY?

Chlodwig FRANZ

*Div. Functional Plant Compounds, University of Veterinary Medicine Vienna, Austria
chlodwig.franz@vetmeduni.ac.at*

Natural products have always been an important source of new drug leads and drug discovery is still successfully fuelled from ethnopharmacological research. In this context, the advantages and disadvantages of wild collection vs. systematic cultivation of medicinal plants as raw material for herbal products have been discussed exhaustively over the last decades ^[1,2]. In addition, within the last years the awareness regarding the following facts has risen:

- the growing world population especially in Middle East, Africa and Latin America vs. the ageing societies in Europe, North America, China and Japan: both having more but different need of plant based health products for primary health care or for the welfare and wellness societies resp.;
- natural habitats of the plants and their protection are reduced due to human activities; climate change brings pressure on the natural distribution as well as the cultivation of medicinal plants
- specific quality requirements are increasing (authenticity, free from contaminations and residues); herbal products intersect with the 'One Health' approach emphasizing the interconnectedness of human, animal and environmental health.

Due to these circumstances a sustainable supply with wild collected plant material and the protection of all natural habitats cannot be guaranteed any longer. Ex-situ conservation and gene banks are necessary to keep biodiversity, and domestication, selection, systematic cultivation and adaptation are unalterable. For this reason the Guidelines for Good Agricultural and Collection Practice (GACP)^[3] as well as the Domestication Strategy for Wild Plants^[4,5], which we have developed some years ago, has to be updated accordingly. Out of the large number of medicinal plants from temperate, Mediterranean and tropical climate zones we domesticated over the last decades, the topic sustainable supply chain will be discussed by means of some selected results with e.g. *Lippia sp.*, *Primula veris*, *Tagetes lucida* and other relevant specie.

References:

- [1] U. Schippmann, D. Leaman, A.B. Cunningham, *Frontis* **2006**, Vol 17, 75-95 (Times New Roman, 10 pts,
- [2] M.I. Takubessi, B. Jalil, M. Heinrich, *Front Pharmacol* **2025**, Vol 16, 1697518
- [3] EUROPAM (European Herb Growers Association) **2022**, *Guidelines for Good Agricultural and Wild Collection Practice for Medicinal and Aromatic Plants (GACP-MAP) Version 8.0*. www.europam.net
- [4] Ch. Franz, *Plant Res Developm* **1993**, Vol 37, 101-111
- [5] I. Goehler, *Domestikation von Medizinalpflanzen und Untersuchungen zur Inkulturnahme von Tagetes lucida* **2006**, PhD Thesis BOKU Vienna, 171 p.

INDIAN CONTRIBUTION TO TRADITIONAL MEDICINE IN RÉUNION ISLAND

Stéphane SAVRIAMA^{1,3}, Gary MARES², Florent CHOPINET^{3,1}¹ UFR Santé, Université de La Réunion, La Réunion (France)² CYROI (Cyclotron Réunion Indian Ocean), La Réunion (France)³ ORLAT (Regional Observatory for Termites Control), La Réunion (France)
stephane.savriama@univ-reunion.fr

Reunionese traditional medicine persists although conventional medicine is present in the Island and we have a «double health system», mixing traditional medicine and modern medicine. In fact, traditional medicine is very present in Reunion Island, and it concerns 9 families on 10^[1].

Moreover, Reunion's traditional medicine result from the sum of knowledge, of the peoples who live in the Island. This mix of traditional knowledge is mainly explained by a specific process of creolization^[2,3].

We can show that there is a great part of Indian contribution in this Reunionese traditional medicine. In fact, we have done some semi-directive interview with 30 families in the 13 cities of the island. We also done some aqueous extract of plants and FTIR spectroscopy in order to obtain their chemical profile.

We will take 3 sacred Indian plants use in Reunion's traditional medicine as examples to illustrate our results:

- nôti (*Vitex negundo*), use in ritual for Lord Mourouga, also use in bath for foot's pain and contain anti-inflammatory's secondary metabolites.
- tolsi (*Ocimum Tenuiflorum*), use in ritual for Lord Vishnou, also use in infusion as an anti-diabetic and contain secondary metabolites that can reduce blood sugar level.
- mango (*Mangifera indica*), use in all Tamil's rituals, also use in bath for eye's pain and contain anti-inflammatory's secondary metabolites.

Finally, this traditional and transcultural knowledge of Reunion popular medicine can be relied to the great principles of Indian medicine. It is also comfort by phytochemistry, and the chemical profiles can indicate some new perspectives. One of this new perspective is the fight against insect that can be vector of pathologies.

Acknowledgements: The authors would like to thanks mister Dimitri KOSHEL from MicroScan Lab society. His help for the FTIR spectroscopy was precious.

References:

- [1] DUTERTRE, J. « *Enquête prospective au sein de la population consultant dans les cabinets de médecine générale sur l'île de la Réunion: à propos des plantes médicinales, utilisation, effets, innocuité et lien avec le médecin généraliste* », thèse de doctorat en médecine, Université de Bordeaux 2 Victor Segalen, 2011, 120 p.
- [2] GHASARIAN, C. « *La Réunion: acculturation, créolisation et réinventions culturelles* », 2002, Ethnologie Française, p. 663-676
- [3] SAVRIAMA S. (2019), « *Survivance de la langue tamoule à travers la médecine traditionnelle réunionnaise* », actes du colloque « *Langues de l'Inde en diaspora* », Sous la direction d'APPASAMY Murugaiyan, SCITEP Editions, pp 237-258

ETHNOPHARMACOLOGY OF PSORIASIS IN WEST SUB-SAHARIAN AFRICA

Albertina Onsea, Giovanni Damiani

*Research center in Precision Medicine and Chronic Inflammation, University of Milan, Milan, Italy
albertinao@gmail.com*

Ethnopharmacological relevance: Ethnopharmacological practices in West Sub-Saharan Africa represent a valuable source of knowledge for managing psoriasis, a chronic inflammatory erythematous-desquamative dermatosis. Traditional healing systems rely on plant-based therapies embedded in holistic frameworks that integrate environmental, spiritual, and physiological interpretations of disease, guiding both plant selection and therapeutic strategies ^[1].

Aim of the study: This study aims to synthesize ethnopharmacological knowledge on medicinal plants used in the management of psoriasis in West Sub-Saharan Africa and to assess their potential contribution to evidence-based medicine and drug discovery.

Materials and methods: Data was collected from ethnobotanical surveys, as well as phytochemical and pharmacological studies focusing on plants traditionally used in the region. Particular attention was given to preparation methods, plant species, and reported biological activities. A comparative approach was adopted to identify commonly used species and shared therapeutic patterns across different ecological and cultural contexts.

Results: Commonly reported species include *Azadirachta indica*, *Vernonia amygdalina*, *Khaya senegalensis*, *Khaya grandifoliola*, *Senna alata*, *Aloe vera*, *Zanthoxylum zanthoxyloides*, *Xylopia aethiopica*, *Securidaca longepedunculata*, and *Combretum micranthum*. These plants are typically prepared as decoctions, infusions, macerates, and topical formulations, often combined in polyherbal mixtures to enhance efficacy. Phytochemical analyses reveal the presence of flavonoids, terpenoids, alkaloids, tannins, saponins, and phenolic compounds, associated with anti-inflammatory, antioxidant, antiproliferative, and immunomodulatory activities relevant to psoriasis symptom control ^[2].

Conclusions: Ethnopharmacological knowledge offers a promising basis for developing novel anti-psoriatic therapies. However, variability in plant use due to environmental, climatic, and cultural factors requires careful standardization. Rigorous experimental validation and clinical studies are essential to ensure safety, efficacy, and reproducibility, facilitating integration into conventional medical practice.

Keywords: ethnodermatology; psoriasis; West Sub-Saharan Africa; West African pharmacopeia; drug discovery

References:

1. Diallo D, et al. J Ethnopharmacol. 2012. Management of diabetes in Guinean traditional medicine: an ethnobotanical investigation in the coastal lowlands
2. Agyare C, et al. J Ethnopharmacol. 2017 Ethnopharmacological survey and in vivo anti-inflammatory activity of medicinal plants used for skin diseases in Ghana

PHARMACOVIGILANCE AND SAFETY SURVEILLANCE OF CHINESE HERBAL MEDICINE IN TAIWAN

Min-Chieh Shih¹, Yu-An Yeh^{1,2}, Hung-Rong Yen^{1,3,4}

¹Department of Chinese Medicine, China Medical University Hospital, Taichung 404327, Taiwan

²School of Post-baccalaureate Chinese Medicine, College of Chinese Medicine, China Medical University, Taichung 404328, Taiwan

³School of Chinese Medicine, and International Master Program in Acupuncture, College of Chinese Medicine, China Medical University, Taichung 404328, Taiwan

⁴Chinese Medicine Research Center, China Medical University, Taichung 404328, Taiwan

³Division of Integration of Chinese and Western Medicine, a0963317859@gmail.com

Ethnopharmacological relevance: In Taiwan, Chinese herbal medicine (CHM) is widely used and incorporated into integrative healthcare systems. Although often perceived as natural and safe, CHM may cause adverse reactions, herb–drug interactions, and toxicity related to inappropriate use, overdose, or misidentification of medicinal materials. Strengthening pharmacovigilance systems is therefore essential for the safe clinical application of CHM.

Aim of the study: To review the development and current status of Taiwan’s Chinese medicine safety surveillance system and summarize representative adverse events associated with CHM reported through the national pharmacovigilance framework.

Materials and methods: Adverse event reports collected from Taiwan’s National Chinese Medicine Safety Monitoring System between 2001 and 2024 were reviewed. Representative clinical cases were analyzed to illustrate major safety concerns associated with CHM use. Causality assessment was performed according to the WHO–UMC system and Naranjo criteria.

Results: Five representative cases were identified: palpitations associated with *Aconitum carmichaeli* Debx. (Fuzi); gastrointestinal toxicity caused by misidentification of *Trichosanthes kirilowii* Maxim. root (Tianhuafen); purpura following combined use of Shen Tong Zhu Yu Tang and aspirin; oral bleeding associated with co-administration of *Salvia miltiorrhiza* Bunge (Danshen) and dabigatran; and excitability with insomnia after overdose of *Ephedra sinica* Stapf (Mahuang). Reported adverse reactions predominantly involved the cardiovascular, gastrointestinal, hematologic, and neurologic systems. Most cases were categorized as having possible to probable causality. Major contributing factors included intrinsic herbal toxicity, herb–drug interactions, dosage-related adverse effects, and errors in botanical identification.

Conclusion: Taiwan’s pharmacovigilance experience highlights the importance of systematic safety surveillance for CHM. Accurate botanical identification, quality control, appropriate dosage regulation, and awareness of herb–drug interactions are critical for minimizing risks. Robust adverse event reporting systems and interdisciplinary collaboration remain essential to support the safe integration of CHM into modern healthcare.

Acknowledgements: This research work was supported by the Department of Chinese Medicine and Pharmacy, Ministry of Health and Welfare, Taiwan.

BRIDGING ETHNOPHARMACOLOGICAL USES AND MOLECULAR PHARMACOLOGY: ORCHIDACEAE AS A MODEL FAMILY

Andrés F. Vásquez¹, Mehdi D. Davari¹, Ludger Wessjohann^{1*}

¹ Department of Bioorganic Chemistry (NWC), Leibniz Institute of Plant Biochemistry (IPB-Halle), Germany
avasquez@ipb-halle.de

Traditional medicinal knowledge remains an important but still underconnected source of insight for natural product (NP) research [1]. However, ethnopharmacological uses are often recorded using symptomatic, functional, or culturally embedded terms that are not easily aligned with modern pharmacological annotation systems [2]. Orchidaceae, one of the largest plant families and a chemically rich yet unevenly documented lineage, provides a particularly informative case study for exploring this challenge [3]. To investigate how Orchidaceae ethnopharmacological reports relate to modern pharmacological annotations, we evaluated the overlap between both domains. This allowed us to identify hidden functional signals, highlight research gaps, and determine where improved data normalization is needed. A genus-level dataset of orchid NPs was compiled from NPASS- and LOTUS-derived records and harmonized against WCVF/POWO [4,5]. Ethnobotanical use terms were retrieved from Dr. Duke's Phytochemical and Ethnobotanical Databases (<https://phytochem.nal.usda.gov/>), while disease/function terms were retrieved from ChEMBL-linked annotations (<https://www.ebi.ac.uk/chembl/>). Structural classes were assigned using NPClassifier (<https://npclassifier.ucsd.edu>), and functional signals were contextualized across GBIF/WWF ecoregions (<https://ecoregions.appspot.com>). Preliminary analyses revealed partial but meaningful convergence between ethnopharmacological and pharmacological annotation spaces. Overlaps were evident for neoplasm/cancer, inflammation, and arthritis, whereas tonic, stomachic, and sedative showed limited correspondence to pharmacological vocabularies, reflecting evidence gaps and normalization challenges. The current overlap is driven by a small set of medicinally prominent orchid taxa, especially *Dendrobium*, *Gastrodia*, *Bletilla*, *Pleione*, and *Vanilla*, and is enriched in phenanthrenoids and stilbenoids. However, it does not yet track major orchid diversity centers, suggesting persistent taxonomic and geographic bias. Orchidaceae emerges as a strong pilot family for linking traditional medicinal knowledge with modern pharmacological annotation. This study is among the first to examine this interface through orchid-derived NPs in a chemical and biogeographic context and suggests that improved normalization and integration may uncover underappreciated functional links and strengthen connections between ethnopharmacology, biodiversity, chemodiversity, and NP discovery.

References:

- [1] D. Domingo-Fernández, Y. Gadiya, S. Mubeen, et al., *iScience* **2023**, 26, 107729.
- [2] V. Sharma, W. Law, M.J. Balick, I.N. Sarkar, *AMIA Annu Symp Proc* **2018**, 2017:1537–1546.
- [3] S. Agustin, A.S. Nugraha, L. Wessjohann, et al., *Phytochem Rev* **2026**, 25, 977–1015.
- [4] H. Zhao, Y. Yang, S. Wang, et al., *Nucleic Acids Res.* **2023**, 51, D621–D628.
- [5] R. Govaerts, E. Nic Lughadha, N. Black, et al., *Sci Data*, **2021**, 8, 215.

ALLIUM URSINUM L. FROM THE APENNINE REGION AS A PHYTOALIMURGIC RESOURCE PROMOTING COLON HEALTH

Claudio Ferrante¹, Mariachiara Gabriele¹, Mattia Spano², Simonetta Cristina Di Simone¹, Luigi Menghini¹

¹ Botanical Garden "Giardino dei Semplici", Department of Pharmacy, "G. d'Annunzio" University Chieti Pescara, Italy¹

² Department for the Promotion of Human Science and Quality of Life, San Raffaele University, Via di Val Cannuta 247, Rome 00166, Italy²
claudio.ferrante@unich.it

Ethnopharmacological relevance: *Allium ursinum* L., commonly known as wild, is a perennial herbaceous plant widely distributed across Europe and Asia. Its leaves are traditionally consumed as food and used in folk medicine, particularly for gastrointestinal wellbeing. Despite its phytochemical and ethnopharmacological similarity to *Allium sativum*, whose gastrointestinal protective effects are well documented, antioxidant and antiinflammatory properties of *A. ursinum* in the intestinal tract remain poorly explored.

Aim of the study: This study investigated antioxidant, enzyme inhibitory, and antiinflammatory effects of leaf polar extracts of *A. ursinum*, providing experimental support for its traditional use in food and pharmaceutical applications.

Materials and methods: Ultrasoundassisted extraction was performed using water and hydroalcoholic solvents to mimic infusion and maceration processes. Extracts were characterized using complementary chromatographic, spectroscopic, and NMR techniques. Antioxidant activity was evaluated through DPPH, ABTS, CUPRAC, and FRAP assays, while enzyme inhibition against aglucosidase, amylase, tyrosinase, and cholinesterases was assessed by colorimetric methods. Biocompatibility was tested in C2C12 myoblasts. Antiinflammatory effects were investigated *ex vivo* using isolated mouse colon tissue exposed to *Escherichia coli* lipopolysaccharide (LPS), evaluating mRNA expression of IL6, COX2, and iNOS.

Results: The extracts displayed a complex metabolite profile dominated by sulfurcontaining compounds, mainly methiin and alliin. The water extract was rich in sugars, amino acids, and organic acids, whereas hydroalcoholic extracts preferentially concentrated polyphenols. The latter showed the strongest antioxidant and enzyme inhibitory activities, correlating with total phenolic and flavonoid content. All extracts were biocompatible (up to 1000 µg/mL) and protected C2C12 cells from H₂O₂ induced oxidative stress. Notably, the 50% hydroalcoholic extract significantly downregulated LPS induced IL6, COX2, and iNOS gene expression in isolated colon tissue *ex vivo*, demonstrating antiinflammatory activity.

Conclusion: Overall, these findings support the ethnopharmacological use of *A. ursinum* for gastrointestinal health. Further *in vivo* studies are warranted to fully define the pharmacological and toxicological profile.

FROM FOREST TO MARKET: CLIMATE RISK AND SUSTAINABILITY IN THE PHARMACEUTICAL VALUE CHAIN – *Eurycoma Longifolia* (Kalimantan, Indonesia)

Marce Inggritha Takubessi¹, Banaz Jalil¹, Mateus C. Silva³, Michael Heinrich^{1,2}

¹ Pharmacognosy and Phytotherapy Group, UCL School of Pharmacy, WC1N 1AX. United Kingdom,

² Chinese Medicine Research Centre, College of Chinese Medicine, China Medical University, Taichung, Taiwan

³ Department of Geography, Faculty of Environment, Science and Economy, University of Exeter, Exeter, UK
marce.bessi.23@ucl.ac.uk

Ethnopharmacological relevance: *Eurycoma longifolia* Jack [Simaroubaceae] is a widely used medicinal plant in Southeast Asian traditional medicine and is increasingly being commercialised globally. However, climate change and land-use change threaten both its distribution and the resilience of the socio-economic systems that sustain it.

Aim of the study: This study examined how climate change affects the ecological distribution and medicinal plant value chain of *Eurycoma longifolia* in Kalimantan, Indonesia, by integrating Species Distribution Modeling (SDM) with qualitative stakeholder analysis to identify vulnerabilities, bottlenecks, and adaptation responses.

Methods: A mixed-methods approach integrated Species Distribution Modeling (SDM) using MaxEnt under the SSP5–8.5 climate scenario with qualitative stakeholder analysis. Bioclimatic variables from WorldClim and occurrence records from GBIF were used to assess habitat suitability, while semi-structured interviews with 45 stakeholders across the value chain were analysed using framework and thematic analysis.

Results: Approximately 80% of suitable habitat is projected to remain stable, although localised habitat losses (84,366 km²) and gains (~20,500 km²) are expected, with Central Kalimantan identified as a potential climate refugium. However, ecological stability does not ensure supply chain resilience. The value chain remains fragmented, with weak governance, limited traceability, and unequal distribution of benefits and market access. Upstream actors, particularly wild harvesters, face the greatest vulnerability due to resource scarcity, income instability, and climate-related exposure. Climate-related stressors, including heat stress, rainfall variability, and inadequate drying conditions, combined with logistical and infrastructure constraints, affect labour conditions, transportation, and product quality. Although adaptation responses are emerging, they remain short-term coping strategies rather than transformative solutions.

Conclusion: Climate vulnerability in medicinal plant systems is inherently socio-ecological and extends beyond species distribution alone. Strengthening governance, traceability, cultivation strategies, and multi-stakeholder coordination is essential to improve the sustainability and resilience of medicinal plant supply chains under climate change.

References:

- [1] Booker A, Johnston D, Heinrich M. Chapter 2 - New perspectives on value chains of herbal medicines— Ethnopharmacological and analytical challenges in a globalizing world. In: Mukherjee PK, editor. Evidence-Based Validation of Herbal Medicine (Second Edition): Elsevier; 2022. p. 43-58.
- [2] Phillips SJ, Anderson RP, Schapire RE. Maximum entropy modeling of species geographic distributions. *Ecological Modelling*. 2006;190(3):231-59
- [3] Takubessi MI, Jalil B, Heinrich M. The impact of climate change on medicinal plants and natural products: A scoping review. *Frontiers in Pharmacology*. 2025; Volume 16 - 2025.

ROSES THROUGH TIME: FROM TRADITION TO INNOVATION

Valentina Parisi¹, Emanuele Rosa¹, Poonam Devi², Norbert Maggi³, Mauro Giacomini³, Laura de Benedetti⁴, Nunziatina De Tommasi¹, Angela Bisio².

¹ Department of Pharmacy, University of Salerno, 84084 Fisciano, Italy;

² Department of Pharmacy, University of Genova, 16148 Genova, Italy;

³ Department of Informatics, Bioengineering, Robotics and System Science, University of Genova, 16145 Genova, Italy;

⁴ CREA, Research Centre for Vegetable and Ornamental Crops, 18038 - Sanremo, Imperia, Italy.
vparisi@unisa.it

Ethnopharmacological relevance: “Valle Scrivia rose syrup” (VSrs) is an ancient Italian recipe, produced by infusing rose petals from ancient plants cultivated in Liguria, and awarded as Slow Food Presidium. According to ethnobotanical knowledge, VSrs is used both as a drink and a remedy for coughs and bronchitis ^[1]. Red rose syrup is also used as a corrective for the odor and taste of other syrups. Three rose ecotypes are mainly used, locally known as “muscosa”, a mutation of *R. centifolia*, a presumed hybrid between a *R. gallica* and *R. damascena*, “rugosa”, attributed to the group derived from *R. rugosa*, and “damask” (*R. x damascena*).

Aim of the study: Aim of project is the valorization of local products through the chemical profiling of three under-explored roses ecotypes, collected from different farms, traditionally used in VSrs preparation.

Materials and methods: Rose petals, were studied by LC-MS and NMR metabolomics-based approach. Data from NMR and LC-MS were subjected to multivariate analysis (PCA, HC, SOM).

Results: The ¹H NMR profiling revealed the presence of amino acids, such as arginine and asparagine, organic acids such as quinic acid. Among sugars, glucose was the most abundant. Several aromatic protons, belonging to phenolic compounds, were also detected. LC-HRESIMS/MS analysis led to the annotation of several flavonoids, especially quercetin and kaempferol derivatives, and anthocyanins, such as cyanidin, pelargonidin, and delphinidin hexosides. Among gallotannins, tri-*O*-galloylhexose, tetra-*O*-galloylhexose and penta-*O*-galloylhexose were identified ^[2]. Results from multivariate analysis showed two clusters, one made up of all “muscosa” and “rugosa” samples, mainly characterized by quercetin-*O*-hexoside-dehydroxyhexoside and delphinidin-*O*-hexoside, and one of all “damask” samples, mainly characterized by cyanidin-*O*-hexoside. The antioxidant activity of roses samples was also evaluated by DPPH, FRAP and TPC assays.

Conclusion: LC-MS and NMR data clearly separated the “damask” ecotype, which exhibits a distinct metabolic signature, from other groups. In progress studies could integrate these metabolomic results with transcriptomic or genomic data to uncover regulatory networks and gene-metabolite associations.

References:

[1] <http://lamialiguria.it/2022/11/sciroppo-di-rose-il-nettare-degli-dei>

[2] Olennikov DN, Chempsov VV, Chirikova, NK. Metabolites of prickly rose: Chemodiversity and digestive-enzyme-inhibiting potential of *Rosa acicularis* and the main ellagitannin rugosin D. *Plants* **2021**, 10(11), 2525.

“This research was financial supported by Interreg VI-A Francia-Italia (ALCOTRA) (2021 - 2027) “AGRISMART” project n. 21350

PROTECTIVE EFFECTS OF ELEUTHEROCOCCUS SENTICOSUS ROOT EXTRACT IN A MURINE MODEL OF ACUTE PANCREATITIS

Danilo D'Avino¹, Sara Perna¹, Michele Spinelli², Martina Simonelli¹, Guerino Sbrogna³, Eduardo Maria Sommella⁴, Maria Daglia¹, Simona Pace⁵, Fiorentina Roviezzo¹, Antonietta Rossi¹

¹ Department of Pharmacy, School of Medicine and Surgery, University of Naples Federico II, Naples, Italy

² Department of Physical and Mental Health and Preventive Medicine, School of Medicine and Surgery, University of Campania L. Vanvitelli, Naples, Italy

³ LunaVetLab - Laboratorio di analisi veterinarie, Salerno, Italy

⁴ Department of Pharmacy, University of Salerno, Fisciano, Italy

⁵ Department for the Promotion of Human Science and Quality of Life, "San Raffaele Open University of Rome", Rome, Italy
danilo.davino@unina.it

Eleutherococcus senticosus (ES) Maxim., commonly known as *Siberian ginseng*, belongs to the *Araliaceae* family and its root is widely used in traditional Chinese medicine for the treatment of impotence, weakness and immune-inflammatory diseases^[1]. These indications have been officially accepted in the Community Herbal Monograph on ES Maxim. Radix (EMA/HMPC/244569/2006), published by the European Medicines Agency. ES contains a variety of bioactive compounds, including flavonoids, triterpenoid saponins, organic acids, lignans, phenols, and polysaccharides^[2], responsible for its antifatigue, antioxidant, anti-inflammatory properties^[3]. The aim of this study was to evaluate the anti-inflammatory activity of a commercial ES root extract, standardized to 2% eleutherosides, in an *in vivo* model of acute pancreatitis (AP), a life-threatening disease with limited pharmacological treatment options^[4]. AP was induced in CD1 mice by intraperitoneal injections of cerulein (CER, 50 µg/Kg) hourly (5 times). Mice received ES extract (400 mg/kg, p.o.) 0.5 and 2.5 h after the first CER injection and were euthanized 6 h after the first CER injection. ES extract showed a protective role against pancreatic injury, as evidenced by lower plasma amylase and lipase levels, which are higher in AP conditions. H&E staining confirmed its beneficial effects, since it showed a reduction of inter- and intra-lobular edema after CER injections, along with lower inflammatory cell infiltration, particularly neutrophils and macrophages. This was associated with a decreased expression of adhesion molecules such as E-selectin and ICAM-1, which are important for the migration of these immune cells to the inflammation site. The extract also showed antioxidant and anti-inflammatory effects, by upregulating pancreatic Nrf2, reducing ferroptosis as well as pro-inflammatory prostaglandin levels, iNOS and p65 expression. In conclusion, our data suggest a potential use of ES root extract as a supplement for AP treatment and new insights of its mechanism of action in reducing inflammation.

References:

- [1] F. Graczyk et al., *International Journal of Molecular Sciences*, **2024**, 25, 9295
- [2] A. Jia et al., *Journal of Ethnopharmacology*, **2021**, 268, 113586
- [3] R.H. Kwon et al., *Scientific Reports*, **2024**, 14, 26330
- [4] P.A. Banks et al., *Gut*, **2013**, 62, 102-111

FROM FOLK REMEDY TO PHARMACOLOGICAL EVIDENCE: THE CASE OF PEUCEDANUM OSTRUTHIUM (L.) W.D.J. KOCH

Antonella Smeriglio

¹ Department of Chemical, Biological, Pharmaceutical and Environmental Sciences, University of Messina, Italy
antonella.smeriglio@unime.it

Ethnopharmacological relevance: *Peucedanum ostruthium* (L.) W.D.J. Koch (Apiaceae), commonly known as masterwort, is a medicinal plant traditionally used in Alpine regions for inflammatory conditions, skin disorders, and wound healing. While the rhizome is the officially recognized medicinal organ, ethnobotanical surveys also report the topical use of leaves, suggesting an underexplored therapeutic potential of aerial parts ^[1].

Aim of the study: This contribution aims to bridge traditional knowledge with pharmacological evidence by comparatively evaluating the bioactive potential of *P. ostruthium* rhizomes and leaves, focusing on both non-volatile (hydroalcoholic extracts) and volatile (essential oils) fractions.

Materials and methods: Rhizomes and leaves collected from the same Alpine population were subjected to micromorphological characterization. Polyphenol-enriched hydroalcoholic extracts were analyzed by LC-DAD-ESI-MS and tested for antioxidant, anti-inflammatory, and wound-healing activities using cell-free and cell-based *in vitro* assays. Essential oils (EOs) were obtained by hydrodistillation, chemically characterized by GC-FID and GC-MS, and evaluated for antioxidant and anti-inflammatory activities ^[2].

Results: Leaf extracts showed a markedly higher flavonoid and proanthocyanidin content, translating into superior antioxidant and anti-inflammatory activities and a stronger wound-healing effect in keratinocyte and fibroblast models compared to rhizome extracts. EOs analysis revealed distinct chemotypes: rhizome EO was monoterpene-rich, while leaf EO was dominated by sesquiterpenes. Consistently, leaf EO exhibited significantly higher antioxidant and anti-inflammatory efficacy across all *in vitro* assays ^[1,2]. Neither EO displayed antimicrobial activity, in line with literature data indicating that antimicrobial effects in *P. ostruthium* are mainly associated with non-volatile constituents.

Conclusion: The results provide robust pharmacological validation of traditional uses of *P. ostruthium* and highlight the leaves as a valuable and sustainable source of bioactive compounds. An integrated exploitation of both volatile and non-volatile fractions emerges as a promising strategy to preserve the full phytocomplex and enhance therapeutic potential, supporting the transition from folk remedy to evidence-based phytotherapy.

References:

- [1] C. Danna, M. Bazzicalupo, M. Ingegneri, A. Smeriglio, D. Trombetta, B. Burlando, L. Cornara, *Molecules* **2022**, 27, 4271.
- [2] C. Danna, A. Mainetti, S. Belaid, E. La Camera, D. Trombetta, L. Cornara, A. Smeriglio, *Plants* **2025**, 14, 2047.

ANTI-METASTATIC POTENTIAL OF SYZYGium CUMINI & SYZYGium JAMBOLANUM: AN INTEGRATIVE NETWORK PHARMACOLOGY, MOLECULAR DOCKING, MD SIMULATION, AND EXPERIMENTAL APPROACHES

Muhammad Suhail Sheikh¹, Mruthunjaya Kenganora² Manjula Santhepete Nanjundaiah¹, Shailendra S Gurav³

¹ Department of Pharmacology JSS College of Pharmacy, JSS Academy of Higher Education and Research, Mysuru, India

² Department of Pharmacognosy, JSS College of Pharmacy, JSS Academy of Higher Education and Research, Mysuru, India

³ Department of Pharmacognosy, Goa College of Pharmacy, Panaji, Goa University, Goa, India

kmruthunjaya@jssuni.edu.in

Ethnopharmacological Relevance: *Syzygium cumini* (SC) and *Syzygium jambolanum* (SJ) (close variants) are used in Ayurveda and Unani systems of medicine. Traditionally, different parts of these plants, mainly the seeds and fruits, have been used for the treatment of diabetes inflammatory diseases, and gastrointestinal ailments. However, current pharmacological research is now focusing more on their bioactive compounds, with notable potential as adjuvants in cancer therapy^[1-5].

Aim of the study: This research seeks to identify the phytochemicals present in various parts of fruits of SC and SJ and assess their medicinal value in preventing breast cancer metastasis using a multidisciplinary approach.

Materials and Methods: LC-HRMS was used to identify bioactive phytochemicals in different fruit parts of SC and SJ. Network pharmacology identified target proteins, while molecular docking and MD simulations evaluated interactions with MMP-2 and Caspase-3. Anti-cancer activity was assessed using MTT, wound-healing, and Transwell migration assays on MDA-MB-231 breast cancer cells. In vivo antimetastatic activity of seed extracts was studied in a 4T1-induced BALB/c mouse model. IL-6, IL-8, and MMP-2 levels, along with histopathological changes in mammary tissue, lung, liver, and spleen, were analyzed.

Results: LC-HRMS identified gallic acid, asiatic acid, and hamamelitannin. Key targets included IL-6, TNF, and EGFR. Molecular docking confirmed stable binding of asiatic acid and hamamelitannin with MMP-2 and Caspase-3. Seed extracts inhibited proliferation and migration of MDA-MB-231 cells and reduced tumor size in 4T1 mice at 200 mg/kg. Treatment suppressed IL-6 and IL-8 expression, enhanced apoptosis. histopathological studies revealed improvement in the tissues studied.

Conclusion: Seed extracts of both SC and SJ possess significant anti-metastatic effects through inhibition of cell motility, inflammation modulation, and apoptosis induction. These results indicate that the multiple target pathways involved in these extract effects, especially their action on MMP-2, provide a possible approach to breast cancer treatment due to their cytotoxicity.

References:

1. Anticancer of genus *Syzygium*: a systematic review. (2023). *Journal of Clinical Medicine*, 12(10), 10185443. <https://pmc.ncbi.nlm.nih.gov/articles/PMC10185443/> Cited by: 12
2. Ayyanar, M., & Subash-Babu, P. (2012). *Syzygium cumini* (L.) Skeels: A review of its phytochemical constituents and traditional uses. *Asian Pacific Journal of Tropical Biomedicine*, 2(3), 240–246. [https://doi.org/10.1016/S2221-1691\(12\)60050-5](https://doi.org/10.1016/S2221-1691(12)60050-5) Cited by: 450
3. Baliga, M. S., Fernandes, S., Thilakchand, K. R., D'souza, P., & Rao, S. (2013). Scientific validation of the antidiabetic effects of *Syzygium jambolanum* DC (black plum), a traditional medicinal plant of India. *Journal of Alternative and Complementary Medicine*, 19(3), 191–197. <https://doi.org/10.1089/acm.2011.0752> Cited by: 110
4. Chhikara, N., Kaur, R., Jaglan, S., Sharma, P., Gat, Y., & Panghal, A. (2018). Bioactive compounds and pharmacological and food applications of *Syzygium cumini* – a review. *Food & Function*, 9(12), 6096–6115. <https://doi.org/10.1039/C8FO00654G> Cited by: 215
5. Mesquita, L., Neves, B. V., & De Rosso, V. V. (2023). The Active Compound Content of Jamblang (*Syzygium cumini*) as an Anti-Breast Cancer. *Eureka Herba Indonesia*, 5(1), 361–366. <https://www.researchgate.net/publication/376371079>.

VACCINIUM MACROCARPON EXTRACT RESTRAINS SARCOBESITY DRIVEN BY THE ADVANCED GLYCATION END-PRODUCTS (AGES)/RAGE AXIS

Laura Salvadori¹, Martina Paiella¹, Tommaso Raiteri², Tommaso Manenti³, Andrea Astolfi⁴, Maria Letizia Barreca⁴, Sara Chiappalupi¹, Guglielmo Sorci¹, Flavia Prodam⁵, Nicoletta Filigheddu², Francesca Riuzzi¹

¹ Department of Medicine and Surgery, University of Perugia, Perugia, Italy

² Department of Translational Medicine, University of Piemonte Orientale, Novara, Italy

³ Laboratori Biokyma srl, Anghiari, Arezzo, Italy;

⁴ Department of Pharmaceutical Sciences, University of Perugia, Perugia 06123, Italy

⁵ Department of Health Science, University of Piemonte Orientale, Novara, Italy
francesca.riuzzi@unipg.it

Ethnopharmacological relevance: Sarcobesity (SO) is a critical, emerging chronic metabolic dysfunction characterized by the coexistence of sarcopenia (loss of muscle mass/strength) and obesity (excessive adiposity). The widespread adoption of a Western-style diet (WD), rich in saturated fats and refined sugars, is considered a major risk factor for SO. WD foods are enriched in dietary advanced glycation end-products (dAGEs), a heterogeneous group of harmful glycated proteins. Upon tissue accumulation, dAGEs impair protein function and promote oxidative stress and inflammation through their receptor, RAGE. We demonstrated that dAGEs induce muscle atrophy *in vitro*, and a *Vaccinium macrocarpon* (VM) extract markedly inhibits AGE formation/activity^[2], pointing to its potential use against dAGE effects on SO.

Aim of the study: To investigate the role of dAGEs/RAGE axis in an animal model of SO and to test the potential protective effect of VM.

Materials and methods: Adult WT and RAGE-null (*Ager*^{-/-}) mice were fed with a high-AGE diet (WD) or standard diet for 20 weeks. WD-fed WT mice were administered or not with VM. *In silico* target fishing was used to identify the potential targets of VM's active metabolites.

Results: We found AGE accumulation in muscles and sera of WD-fed WT mice, which showed RAGE upregulation, reduced myofiber area, hyperactivation of proteolytic systems, and degradation of myosin heavy chain (MyHC)-II in muscles, along with reduced muscle performance. WD-fed WT mice also showed hepatomegaly with fat deposition and fibrosis, spleen inflammation, and visceral fat deposition, promoting SO. VM administration restrained dAGE accumulation by inhibiting the aldose reductase enzyme, restored muscle performance, and maintained body composition in WD-fed WT mice. Remarkably, WD failed to induce SO in *Ager*^{-/-} mice.

Conclusion: Our data unravel the AGES/RAGE axis as a mediator of SO and identify a promising natural strategy for inhibiting WD-associated dangerous effects.

Acknowledgements: The present research was funded by MUR, PRIN 2022-PNRR (project #P2022Z4EB5).

References:

- [1] D.C. Gross, C.R. Cheever, J.A. Batsis. *Expert Rev Endocrinol Metab.* **2023**;18(6):469-488.
- [2] M. Paiella, T. Raiteri, S. Reano, D. Manfredelli, T. Manenti, G. Gentili, H. Mesquine, S. Chiappalupi, G. Bellomo, F. Prodam, C. Antognelli, R. Sardella, A. Migni, G. Sorci, L. Salvadori, N. Filigheddu, F. Riuzzi. *Antioxidants (Basel).* **2025**;14(8):900.

EVALUATION OF THE ANTI-INFLAMMATORY ACTIVITIES OF PLANTS TRADITIONALLY USED IN CAMEROON TO TREAT GASTRIC AILMENTS

Jean Faustin Atangana^{1,2}, Stefano Piazza¹, Safwa Moheb El Haddad¹, Giulia Martinelli¹, Lin Marcellin Messi², Marco Fumagalli¹, Carola Pozzoli¹, Enrico Sangiovanni¹, Olivier Placide Noté², Mario Dell'Agli¹

¹ Department of Pharmacological and Biomolecular Sciences, Università degli Studi di Milano, Italy

² Department of Chemistry, Higher Teacher Training College, University of Bertoua, Cameroon

jeanfaustin.atangana@guest.unimi.it

Ethnopharmacological relevance: In Cameroon, the decoction of the stem bark of *Albizia malacophylla* (AM) is used traditionally to treat skin and gastric inflammations while the stem bark of *Pancovia laurentii* (PL) is used to treat stomachache. However, no ethnopharmacology data are available at this regard.

Aim of the study: To evaluate the anti-inflammatory properties of the methanolic extracts from the stem barks of the two selected plants in non-tumoral human gastric epithelial cells (GES-1). The stability after the simulated gastric digestion as well as the antibacterial potential against *H. pylori* have been also investigated.

Materials and methods: The treatment with both samples (AM and PL) was performed after stimulation with TNF- α and IL-1 β . After 6h of incubation, cell viability was measured through the MTT assay while the inhibition of IL-8 release and the NF- κ B driven transcription were measured by ELISA and Luciferase assay methods, respectively. Antibacterial assays were performed by microbroth dilution and the chemical profile of the extracts especially their screening for total polyphenols has been investigated by colorimetric assays.

Results: Both extracts showed no toxicity against GES-1 cells with percentage of viability more than 80%. AM inhibited IL-8 as well as NF- κ B upon stimulation with TNF- α with IC₅₀ values of 1.29 and 7.37 μ g/mL, respectively. Concerning PL, it was obtained IC₅₀ values of 0.69 and 8.04 μ g/mL, respectively. The Folin-Ciocalteu, n-butanol and AlCl₃ assays indicated the presence of high amount of polyphenols and oligomeric proanthocyanidins for both the extracts.

Conclusion: This work highlights for the first time, the in vitro anti-inflammatory properties of two Cameroonian medicinal plants in human gastric epithelial cells. The antibacterial potential against *H. pylori* which is responsible of severe gastric inflammation and gastritis has also been evaluated.

CHRYSOPHYLLUM ALBIDUM IMPROVES INSULIN SENSITIVITY IN HIGH-FAT DIET-INDUCED OBESITY BY REGULATING APPETITE, GLUCOSE AND FATTY ACID METABOLISM IN WISTAR RATS

Tolulope Oke¹, Rasidat Tijani², Ayomide Ajibewa^{1,3}, and Oyindamola Abiodun^{1,3*}

¹ Department of Pharmacology and Therapeutics, College of Medicine, University of Ibadan, Nigeria

² Department of Pharmacology and Toxicology, Faculty of Pharmacy, Olabisi Onabanjo University, Ago-Iwoye, Sagamu Campus, Nigeria

³ Department of Pharmacology and Toxicology, Faculty of Pharmacy, University of Ibadan, Ibadan, Nigeria
oketolulopeaderinola@gmail.com

Ethnopharmacological relevance: *Chrysophyllum albidum* (CA) has traditionally been used to manage obesity^[1]. However, its mechanism of action remains unclear.

Aim of the study: to investigate the anti-obesity effects of CA's Fruit Peel Extract (FPE) and Stem Bark Extract (SBE) in Wistar rats.

Materials and methods: Obesity was induced in Wistar rats by feeding them a High-Fat Diet (HFD) with *ad libitum* water for 7 weeks^[2]. Weekly body weight, food, and water intake were recorded. Blood glucose, serum insulin, and lipid levels were measured via spectrophotometry, while leptin, liver adiponectin, and Proliferator Activated Receptors Alpha (PPAR- α) were quantified using Enzyme-Linked Immunosorbent Assay (ELISA). Insulin resistance was assessed using Homeostasis Model Assessment-Insulin Resistance (HOMA-IR). Data were analysed using descriptive statistics and ANOVA at $\alpha_{0.05}$.

Results: HFD rats treated with extracts (51.6–60.4%), orlistat (55.8%), and a regular diet (49.4%) showed significantly lower overall weight gain compared to the HFD-d.H₂O group. Food intake was notably reduced in SBE-500 and FPE-500-treated rats compared to the HFD-d.H₂O group. Also, FPE-166.7, FPE-500, SBE-500, and orlistat significantly reduced HOMA-IR compared with the HFD group. Treatment with FPE-166.7, FPE-500, SBE-500, and orlistat reduced triglycerides, total cholesterol, and Low-Density Lipoprotein (LDL) cholesterol considerably compared to the HFD-d.H₂O group. Additionally, High Density Lipoprotein (HDL) cholesterol levels increased significantly relative to HFD-d.H₂O. FPE-500, SBE-500, and orlistat reduced serum leptin levels by 22.5, 28.6, and 30.7%, respectively, while all treatment groups showed increased adiponectin and PPAR- α levels.

Conclusion: *Chrysophyllum albidum* improves glucose and fatty acid metabolism, insulin sensitivity, and regulates appetite in Wistar rats, suggesting its potential for obesity management.

Results:

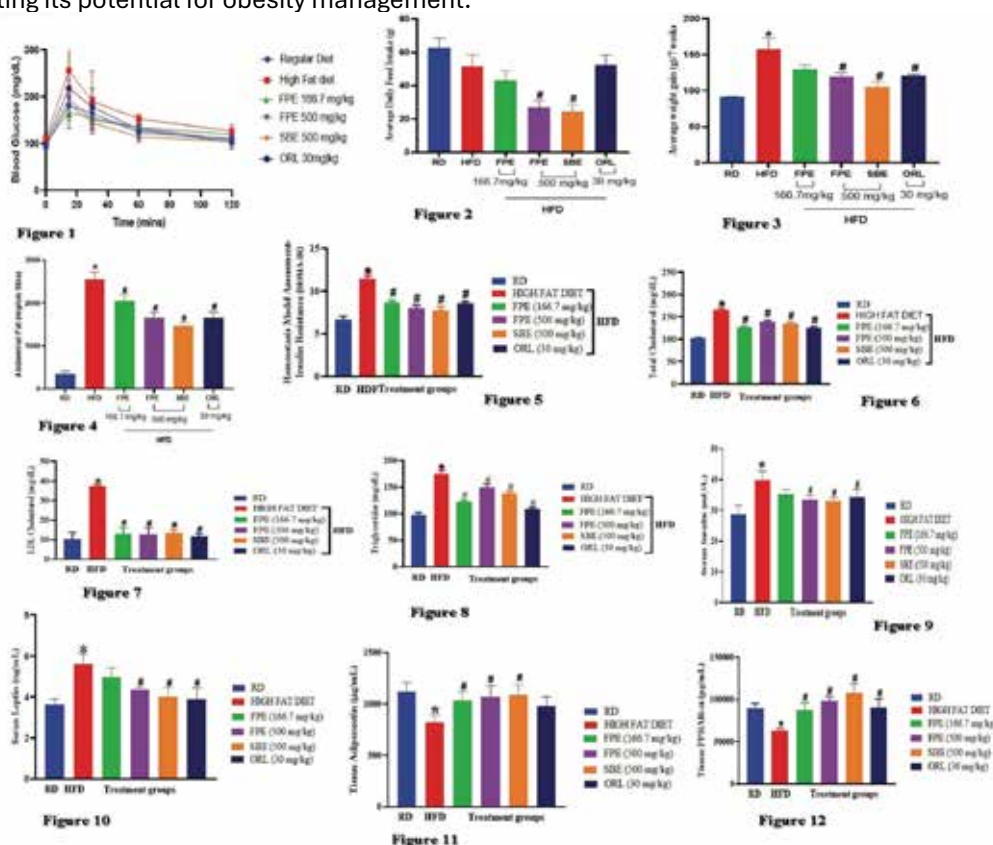


Figure 1-12 shows the effects of ethanol extract of CA on Blood glucose, Average Feed Intake, Average Weight Gained, Abdom-

ORAL COMMUNICATION **OC 16**

inal Fat, HOMA-IR, Total Cholesterol, LDL, Triglyceride, Serum insulin, Serum Leptin, Tissue Adiponectin, and tissue PPAR- α in Obese Rats.

*The data are expressed as mean $\pm$ SEM, n=5. Significant difference between the High Fat Diet and the Normal Diet group: * $p < 0.05$. *High Fat Diet vs. Normal Diet; # High Fat Diet vs. Obese treated group, (One-way ANOVA followed by Dunnett's multiple comparisons test).*

RD: Normal Diet; HFD: High Fat Diet; FPE: Fruit Peel Extract; SBE: Stem Bark Extract; ORL: Orlistat

References:

- [1] Olorunnisola, D.S., Amao, I.S., Ehigie, D.O. and Ajayi, Z.A.F. Antihyperglycemic and hypolipidemic effect of ethanolic extract of *Chrysophyllum albidum* seed cotyledon in alloxan induced diabetic rats. *Res J Appl Sci.* 2008, 3(2), pp.123-127.
- [2] Von Dentz, K.E., Silva, B.S., Queiroz, E.A., Bomfim, G.F., Nascimento, A.F., Sugizaki, M.M. and Luvizotto, R.A. Hibiscus sabdariffa ethanolic extract modulates adipokine levels, decreases visceral fat and improves glycemic profile in high-fat/sugar diet-induced obese rats. *Nutrition & Food Science.* 2021, 51(2), pp.222-233.

MEDICINAL MUSHROOMS IN ETHNOPHARMACOLOGY: BRIDGING TRADITIONAL USE AND CONTEMPORARY RESEARCH

Massimo Tacchini, Alessandra Guerrini, Gianni Sacchetti

*University of Ferrara, Italy
massimo.tacchini@unife.it*

Ethnopharmacological relevance: Medicinal mushrooms represent a long-standing component of traditional medical systems worldwide^[1]. In East Asia, particularly within Traditional Chinese Medicine, fungi have historically been used to promote longevity, immune balance, and disease resistance. Comparable uses are documented in other ethnomedical traditions, in which mushrooms were traditionally applied to infectious, inflammatory, and wound-related conditions^[2]. These practices constitute a rich body of ethnopharmacological knowledge that has stimulated contemporary scientific investigation.

Aim of the study: This contribution critically examines the continuity and discontinuity between traditional uses of medicinal mushrooms and modern biomedical research, with particular emphasis on the transition from ethnopharmacological applications to dietary supplements and pharmaceutical preparations.

Materials and methods: A narrative review approach was adopted, integrating historical ethnopharmacological sources, ethnobotanical surveys, and contemporary peer-reviewed literature. Special attention was given to clinical trials involving mushroom-derived compounds and to studies evaluating commercial mushroom-based supplements. Issues related to species identification, extraction, and standardisation methods were comparatively analysed.

Results: Evidence from preclinical and clinical studies supports the immunomodulatory activity of high-molecular-weight compounds, particularly polysaccharides and protein-bound β -glucans, with applications in oncology and immune-related disorders. In parallel, increasing attention has been directed toward low-molecular-weight mycochemicals, including triterpenoids, phenolics, sterols, and other secondary metabolites. These small molecules have demonstrated antiproliferative, pro-apoptotic, and differentiation-modulating effects, including activity against cancer stem cells^[3], suggesting a complementary role to polysaccharide-mediated mechanisms. Nevertheless, significant variability in chemical composition, extraction methods, and formulations has, in some cases, led to inconsistent bioactivity across studies^[4].

Conclusion: The limited integration of medicinal mushrooms into modern Western therapeutics is largely justified by the absence of standardised preparation and evaluation protocols. Establishing unified standards—potentially aligned with Good Clinical Practice (GCP)—is essential to validate bioactivity, ensure reproducibility, and effectively bridge traditional ethnopharmacological knowledge with contemporary clinical research.

References:

- [1] C. Hobbs, *Medicinal mushrooms: an exploration of tradition, healing, and culture*, **2003**, Botanica Press.
- [2] O. Comandini, *Mushrooms, Humans and Nature in a Changing World*, **2020**, pp. 341–364.
- [3] M. Tacchini, *Toxins*, **2023**, 15, pp. 360.
- [4] S. P. Wasser, *Appl Microbiol Biotechnol*, **2011**, 89, pp. 1323–1332.

METABOLOMICS-GUIDED PROFILING OF ANTICANCER-ASSOCIATED METABOLITES IN *INDIGOFERA OBLONGIFOLIA* AND *INDIGOFERA COLUTEA*: ORGAN-DEPENDENT CYTOTOXIC ACTIVITY

Naglaa Ashmawy^{1,2}, Dina Bahgat², Sarra Shakartalla³, Shahd Elmenshawy⁴, Ghina Baghdadi⁴, Judy Maala⁴, Ali El-Keblawy⁵

¹ College of Pharmacy, Dubai Medical University, United Arab Emirates

² Faculty of Pharmacy, Ain Shams University, Egypt

³ College of Medicine, University of Sharjah, United Arab Emirates

⁴ College of Pharmacy, Gulf Medical University, United Arab Emirates

⁵ Department of Applied Biology, University of Sharjah, United Arab Emirates

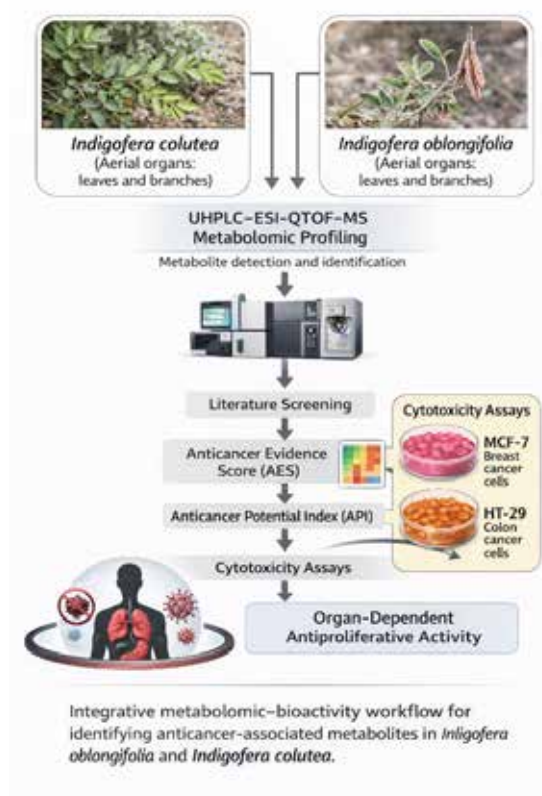
Naglaa.saad@pharma.asu.edu.eg

Ethnopharmacological relevance: *Indigofera* species (Fabaceae) have a long history of use in traditional medicine across tropical and subtropical regions, where various preparations have been employed for the management of inflammatory conditions, infections, and related ailments [1], making them ethnopharmacologically relevant candidates for pharmacological investigation.

Aim of the study: To investigate the anticancer-associated metabolite profiles of *Indigofera oblongifolia* and *Indigofera colutea* using an integrated metabolomic–bioactivity approach, and to evaluate the relationship between organ-specific metabolite enrichment and cytotoxic activity [2].

Materials and methods: Leaf and branch extracts were profiled using UHPLC–ESI–QTOF–MS [3]. Compounds with reported anticancer activity were assigned an Anticancer Evidence Score (AES) based on the level of experimental validation, and an Anticancer Potential Index (API) was calculated per organ. Cytotoxic activity was evaluated in vitro against MCF-7 breast cancer and HT-29 colon cancer cell lines using the MTT assay [4]. IC₅₀ values were estimated using a four-parameter logistic model.

Results: Twenty-seven metabolites were tentatively identified, belonging primarily to flavonoids, phenolic acids, indole derivatives, and related phytochemical classes [5]. Leaf extracts exhibited higher enrichment of anticancer-associated metabolites than branch extracts, as demonstrated by AES-weighted heatmap and principal component analysis (Figure 1). In vitro cytotoxicity assays revealed stronger antiproliferative activity in leaf extracts, with lower IC₅₀ values against both MCF-7 and HT-29 cell lines (Table 1), consistent with the observed metabolomic enrichment patterns.



ORAL COMMUNICATION **OC 18**

Figure 1: AES-weighted heatmap illustrating organ-level distribution of anticancer-associated metabolites in *Indigofera oblongifolia* and *I. colutea*. OL = *I. oblongifolia* leaves; OB = branches; CL = *I. colutea* leaves; CB = branches.

Cell Line	SL (OL leaves)	SB (OL branches)	LL (CL leaves)	LB (CL branches)
MCF-7	0.59	>1.0	0.54	0.58
HT-29	0.36	>1.0	0.31	>1.0

Table 1: IC_{50} values (mg/mL) of *Indigofera* leaf and branch extracts against MCF-7 and HT-29 cancer cell lines.

Conclusion: Integrating metabolomic profiling with evidence-based prioritization and cytotoxic evaluation provides a useful framework for identifying anticancer-relevant metabolites in ethnomedicinally significant plants. The findings highlight *Indigofera* leaves as promising sources of bioactive phytochemicals and support the application of metabolomics-guided strategies in natural product drug discovery.

References:

- [1] Mahajan, S. et al. (2016). *Journal of Pharmacy and Pharmacology*, 68(11), 1419–1428.
- [2] Newman, D.J. & Cragg, G.M. (2020). *Journal of Natural Products*, 83(3), 770–803.
- [3] Wolfender, J.L. et al. (2019). *Natural Product Reports*, 36(6), 855–868.
- [4] Mosmann, T. (1983). *Journal of Immunological Methods*, 65(1–2), 55–63.
- [5] Yang, Z. et al. (2020). *Chinese Medicine*, 15, 127.

PERUVIAN TRADITIONAL MEDICINE IN MILAN (ITALY). THE CASE STUDY OF *MINTHSTACHYS MOLLIS*: FROM ETHNOBOTANY TO PHYTOCHEMISTRY AND BIOLOGICAL ACTIVITY

Martina Bottoni^{1,2}, Carmina Sirignano³, Giulia Abate⁴, Ernesto Gargiulo³, Flavia Scaletta³, Stefania Morandini⁴, Fabrizia Milani^{1,2}, Claudia Giuliani^{1,2}, Andrea Mastinu⁴, Daniela Rigano³, Carmen Formisano³, Orazio Tagliatela Scafati³, Gelsomina Fico^{1,2}

¹ Department of Pharmaceutical Sciences, University of Milan, Italy

² G.E. Ghirardi Botanical Garden, Department of Pharmaceutical Sciences, University of Milan, Italy

³ Department of Pharmacy, University of Naples Federico II, Italy

⁴ Department of Molecular and Translational Medicine, University of Brescia, Italy

martina.bottoni@unimi.it

Ethnopharmacological relevance. *Mintostachys mollis* (Benth.) Griseb. (Lamiaceae) is an endemic Andean plant, commonly known as *muña*, and one of the most relevant in Peruvian traditional medicine^[1,2]. In Peru, leaves-based infusions represent a folk remedy to alleviate high-altitude-related symptoms. *Muña* teas are also consumed in Italy by the Peruvian immigrant community as digestive, carminative, and antispasmodic, often as an alternative to conventional pharmacological treatments.

Aim of the study. Within the project *BE ETHNO*^[3], an urban ethnobotanical survey was conducted in Milan with the Peruvian community to document the traditional knowledge preservation. This study aims to investigate the chemical composition and the potential anti-inflammatory properties of the *muña* popular infusion.

Materials and methods. Semi-structured interviews focused on medicinal plants. Aqueous (folk infusion) and ethanolic extracts were prepared using dried leaves imported from Peru and purchased in ethnic markets. An untargeted LC-MS analysis was performed to obtain a preliminary phytochemical profile of both extracts and to identify the main classes of metabolites. Preliminary anti-inflammatory activity of both extracts was evaluated in RAW264.7 murine macrophages challenged with lipopolysaccharide (LPS). Cells were treated with a range of concentrations and cytocompatibility was assessed by MTT assay.

Results. Thirty-four informants were interviewed. *M. mollis* was the most frequently cited, mainly for gastrointestinal problems. Both extracts showed a rich phytochemical profile, characterized by free phenolic compounds, their glycosylated derivatives, and terpenes. The aqueous extract was cytocompatible up to 100 µg/mL and significantly counteracted LPS-induced cytotoxicity at all dosages tested. The ethanolic extract was cytocompatible up to 12.5 µg/mL, while only specific concentrations (1 µg/mL, 3.12 µg/mL) showed a protective effect.

Conclusion. Overall, these findings depicted *M. mollis* as a relevant species of the Andean-Peruvian biocultural heritage to be considered as a source of new bioactive compounds with promising phytomedicinal applications. However, more research is needed to validate its traditional use.



Figure 1: *M. mollis* sample. A-B) Dried leaves commercially available in ethnic markets in Milan. C) Traditional infusion of the species.

Acknowledgements: We wish to thank Prof. Alberto Spada (Department of Agricultural and Environmental Sciences, UNIMI),

ORAL COMMUNICATION **OC 19**

Prof. Luigi Sironi, Dr. Giovanna Baron, Dr. Laura Castiglioni and Dr. Sofia Messinese (Department of Pharmaceutical Sciences, UNIMI) for freeze-drying of the aqueous extract; Prof. Laura Santagostini (Department of Chemistry, UNIMI) for drying the ethanolic extract.

References:

- [1] R.E. Guzmán-Ardiles, A.C.D. Oliveira, C.M. Castro, *Ciência Rural* **2025**, 55(8), 1-9.
- [2] C.F. Saldaña-Chafloque, M. Acosta-Román, J. Torres-Huamaní, J.L. Castillo-Zavala, *Biologics* **2024**, 4(1), 30-43.
- [3] *BE ETHNO: sharing traditions, sharing plants, sharing place, sharing future*, Fondazione Cariplo - Bando “Giovani Ricercatori 2023. Accompagnare i dottori di ricerca nelle fasi iniziali della loro carriera” (2024-2027, ID:2023-1454).

ISOLATION FROM ETHYL ACETATE FRACTION OF *VENTILAGO DIFFUSA* (G.DON) EXELL AND ITS NEUROPROTECTIVE EFFECTS ON 3-NITROPROPIONIC ACID-INDUCED HUNTINGTON'S DISEASE-LIKE MODEL

Huynh Nhu Mai¹, Lam Truong Tuong², Triet Nguyen Thanh³

¹Department of Pharmacology, School of Pharmacy, University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam

²Department of Pharmaceutical Chemistry, School of Pharmacy, University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam

³ Faculty of Traditional Medicine, University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam
mnhnu@ump.edu.vn

Ethnopharmacological relevance: *Ventilago diffusa* (G. Don) Exell, is primarily distributed in wet tropical regions, typically Cameroon, Uganda, and Ivory Coast. In Vietnam, this plant was first discovered and identified in Quang Binh province in 2022 by our research group and the Institute of Tropical Biology, Ho Chi Minh City. To date, we have isolated various bioactive compounds that were also found in other species of this genus.^[1-3] These compounds, including emodin and chrysophanol, exhibited potent antioxidant activity, thereby suggesting potential neuroprotective effects.

Aim of the study: To isolate and identify compounds in *Ventilago diffusa* extract. To investigate the neuroprotective effects of its ethyl acetate fraction (VDEA) via behavioural, biochemical, and histological assessments in an *in vivo* experiment.

Materials and methods: Compounds from different fractions was isolated by classical chromatography and crystallization, their structures were elucidated using MS, 1D/2D NMR in comparison with literature data. *In vivo*, male Swiss albino mice were orally administered VDEA at 60 mg/kg and 180 mg/kg for 14 consecutive days followed by an administration of. On day 10, mice were administered 3-nitropropionic acid (3-NPA) (50 mg/kg, i.p., bid) to induce Huntington's disease-like symptoms. On day 14, mortality rate, mice's performance in Rotarod Test, Tail Suspension Test (TST), MDA levels, and histological analysis of the striatum were assessed.

Results: Twenty compounds were isolated and identified. Administration of VDEA at 60 mg/kg and 180 mg/kg alleviate mortality rate (25% and 37.5%, respectively) as compared to the untreated (56.25%). VDEA at both doses significantly improved performance in Rotarod Test and TST ($p < 0.05$ vs untreated), and reduced MDA levels. Histological observations revealed that VDEA attenuated neuronal damage by reducing the number of pyknotic and necrotic cells in the striatum.

Conclusion: Twenty compounds were identified from VDEA and it exhibited neuroprotective effects in a 3-NPA-induced Huntington's disease-like mouse model.



Figure 1: Morphological parts of *Ventilago diffusa* (G. Don) Exell. (A) Whole plants. (B) Leaves. (C) Stem. (D) Roots. (E) Chemical structures of compounds isolated from VDEA.

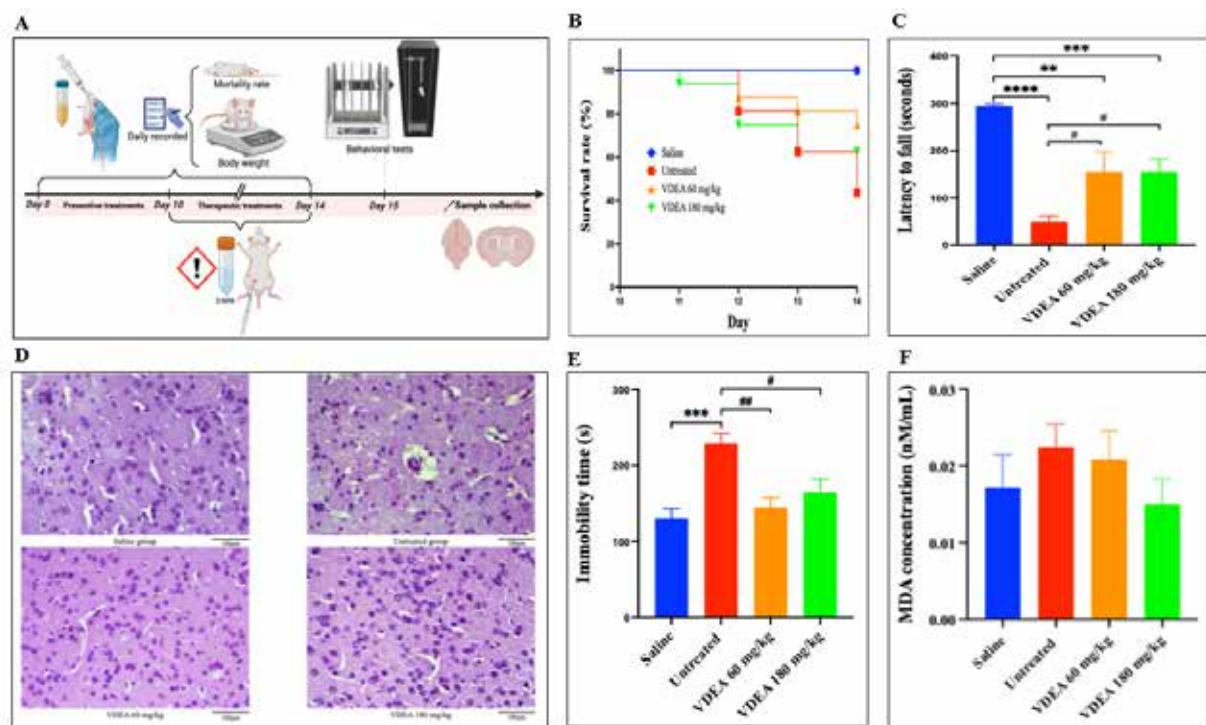


Figure 2: (A) Experimental design for assessment the neuroprotective effects of VDEA. (B) Total mortality rate. (C) Rotarod test. (D) Histological observation. (E) Tail suspension test. (F) MDA concentration.

References:

- [1] K. N. Krishnakumari, B. Bhuvaneswari, I. Raja Swapna, *Fitoterapia* **2001**, 72, 671–675
- [2] C. C. Lin, C. H. Chang, J. J. Yang, T. Namba, M. Hattori, *J. Ethnopharmacol.* **1996**, 52, 107–111.
- [3] K. Panthong, S. Hongthong, C. Kuhakarn, et al., *Phytochemistry* **2019**, 169, 112182.

DRUG-SUPPLEMENT INTERACTIONS AND VIROLOGIC FAILURE IN PEOPLE LIVING WITH HIV RECEIVING HAART

D. Donnarumma^{1,2}, **A. Pagano**², **E. De Bellis**¹, **I. Mazza**², **B. Charlier**^{2,3}, **S. Madonia**⁶, **A. Masullo**⁶, **M. Onofrio**⁶, **V. Fortunato**⁶, **A.M. Spera**⁶, **G. Franci**^{3,7}, **F. Salzano**³, **G. Corbi**⁵, **A. Filippelli**^{3,4}, **P. Pagliano**^{3,6}, **V. Conti**^{3,4}

¹ PhD School "Clinical and Translational Oncology (CTO)", Scuola Superiore Meridionale, University of Naples "Federico II", Naples, Italy

² Postgraduate School of Clinical Pharmacology and Toxicology, University of Salerno, Baronissi, Italy

³ Department of Medicine, Surgery and Dentistry "Scuola Medica Salernitana", University of Salerno, Baronissi, Italy

⁴ Clinical Pharmacology Unit, San Giovanni di Dio e Ruggi d'Aragona University Hospital, Salerno, Italy

⁵ Department of Translational Medical Sciences, University of Naples "Federico II", Naples, Italy

⁶ Infectious Diseases Unit, San Giovanni di Dio e Ruggi d'Aragona University Hospital, Salerno, Italy

⁷ U.O.S. Microbiology and Virology, A.O.U. San Giovanni di Dio e Ruggi d'Aragona University Hospital, Salerno, Italy
ddonnarumma@unisa.it

Ethnopharmacological relevance: Natural Health Products (NHPs), including multivitamins with minerals and antacids, are commonly perceived as safe by People Living with HIV (PLWH). However, polyvalent cations may chelate integrase strand transfer inhibitors, reducing antiretroviral bioavailability and potentially leading to virological failure.

Aim of the study: To describe supplement-related adverse outcomes in PLWH receiving Highly Active Antiretroviral Therapy (HAART) and to evaluate the impact of multidisciplinary medication review and deprescribing.

Materials and methods: In this observational longitudinal study, adult PLWH receiving HAART were consecutively enrolled at the University Hospital of Salerno. Demographic, clinical and pharmacological data, adherence, viremia, HAART resistance and adverse events were collected during scheduled visits. Potential drug-supplement interactions (DSIs) were assessed using Drugs.com, Lexicomp, the Liverpool HIV Interaction Checker, Summaries of Product Characteristics and literature review.

Results: Among 84 PLWH, 446 potential interactions were identified and 22 were DSIs. Eight patients experienced interaction-related adverse outcomes; four were DSIs. All four received bicitgravir/emtricitabine/tenofovir alafenamide and self-administered magnesium-containing supplements; one also used a calcium carbonate/sodium bicarbonate antacid. After excluding poor adherence and drug resistance, supplements were considered a possible cause of virological failure. Patients 1 and 3 showed progressive increases (undetectable/<20 to 25 copies/mL; 59.8 to 72.5 and 136 copies/mL, respectively), whereas patients 2 and 4 fluctuated (47.8, 95.1, undetectable; <20, 77.6, undetectable copies/mL). After supplement discontinuation, patients 2 and 4 remained undetectable at 4 and 8 months; patient 1 became undetectable at 4 months and remained so at 8 months; patient 3 decreased to 49.4 copies/mL at 2 months and to <20 copies/mL at 4 months.

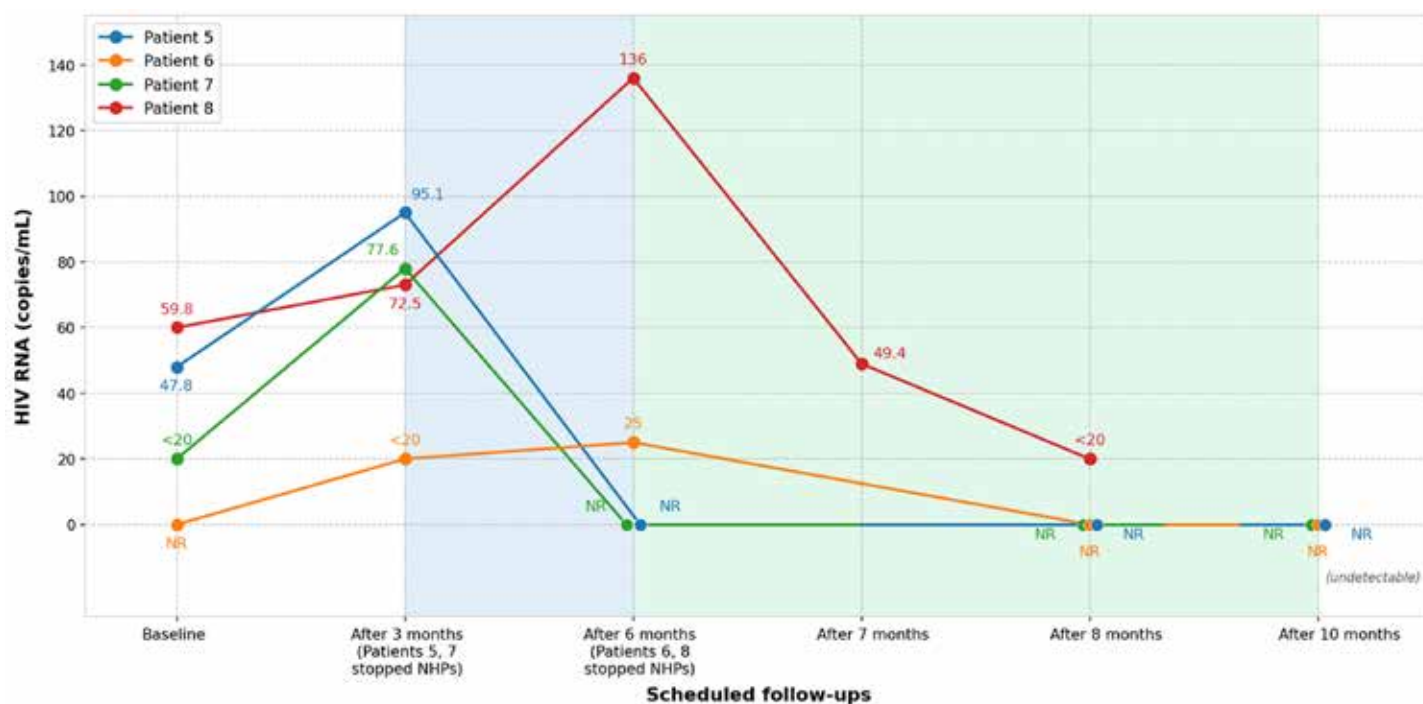


Figure 1: Viremia of patients 1, 2, 3, and 4 measured at baseline and across the two-follow-up compared to the period after the II follow-up

ORAL COMMUNICATION **OC 21**

Conclusion: The unreported use of NHPs may compromise the effectiveness of HAART in PLWH. Medication review and de-prescribing should explicitly consider NHPs and, in particular, dosing schedules. A clinical pharmacology-guided medication review and deprescribing can prevent virologic failure and improve person-centered HIV care.

References:

- [1] E. De Bellis et al., *Pharmaceutics* 2025, 17, 31.
- [2] V. Conti et al., *J. Pers. Med.* 2024, 14, 685.
- [3] I. Song et al., *J. Clin. Pharmacol.* 2015, 55, 490-496.
- [4] European Medicines Agency, Product information: bictegravir/emtricitabine/tenofovir alafenamide, 2018.
- [5] M. Carollo et al., *Aging Clin. Exp. Res.* 2024, 36, 63.

PETROSELINIC ACID FROM APIACEAE PLANTS: A RARE FATTY ACID WITH AN ANTI-INFLAMMATORY AND ANTI-OBESITY POTENTIAL

Eleonora Spinozzi¹, Giada Trebaiocchi¹, Alessia Romondia¹, Sonia Núñez², Carlota Gómez-Rincón², Victor Lopez², Riccardo Petrelli¹, Filippo Maggi¹

¹ ChIP-Chemistry Interdisciplinary Project, School of Pharmacy, University of Camerino, Via Madonna delle Carceri, 62032, Camerino (MC), Italy

² Department of Pharmacy, Faculty of Health Sciences, Universidad San Jorge, 50830 Villanueva de Gállego (Zaragoza), Spain
eleonora.spinozzi@unicam.it

Ethnopharmacological relevance: Plants of the Apiaceae family have a consolidated use in traditional medicine, since they are reported for the treatment of gastrointestinal and neurological disorders, vomiting and diarrhoea and for their antispasmodic, antiseptic, carminative and antiulcer properties, to name a few.^[1] The seeds of these plants are rich sources of a rare fatty acid named petroselinic acid (PA). The latter is a monounsaturated fatty acid which has gained notable interest for its numerous biological properties, especially for its anti-biofilm activity against *Staphylococcus aureus* by inhibition of the bacterial lipase. Nevertheless, the anti-obesity activity of PA has not been deeply investigated yet.^[2]

Aim of the study: The aim of this study was to assess the anti-obesity and anti-inflammatory potential of PA. Moreover, this study aimed at determining PA content in 11 Apiaceae seeds by an alternative HPLC-MS methodology.

Materials and methods: In detail, PA was purified by gravity column chromatography, and its anti-inflammatory and anti-obesity properties were assessed in terms of inhibition of lipoxygenase (LOX) and phospholipase A2 (PLA2), and porcine pancreatic lipase (PPL), respectively. In addition, the prevention of lipid accumulation was evaluated on *Caenorhabditis elegans*, a widely used in vivo model for the screening and identification of anti-obesity compounds.^[3]

Results: Among the Apiaceae seeds, aniseed resulted the richest source of PA (3.97%). The biological assays revealed a strong porcine pancreatic lipase (PPL) inhibition, with a 85-90% activity reduction at 1000 µg/mL, with a comparable efficacy to that of the anti-obesity drug orlistat. The anti-obesity potential was further demonstrated by the prevention of lipid accumulation on *C. elegans*.^[3] The inhibition of lipoxygenase (LOX) demonstrated also a significant anti-inflammatory effect, with a 75-85% activity reduction at 1000 µg/mL.

Conclusion: This study demonstrated the considerable therapeutic potential of PA as anti-obesity and anti-inflammatory agent.

References:

- [1] B. Sayed-Ahmad, T. Talou, Z. Saad, A. Hijazi, O. Merah, *Industrial crops and products* **2017**, *109*, 661-671.
- [2] A. Hajib, S. El Harkaoui, H. Choukri, A. Khouchlaa, S. Aourabi, N. El Menyiy, B. Abdelhakim, B. Matthaeus, *Biomolecules* **2023**, *13*, 1675.
- [3] Y. Yue, S. Li, P. Shen, Y. Park, *Current Research in Food Science* **2021**, *4*, 692-697.

PLUMERICIN, AN IRIDOID DERIVED FROM *HIMATANTHUS SUCUUBA*, MODULATES INDOXYL SULFATE-INDUCED INTESTINAL HOMEOSTASIS IMPAIRMENT VIA NF-KB/AHR/NRF2 SIGNALING

Stefania Marzocco¹, Rosaria Margherita Rispoli^{1,2}, Stefan Schwaiger³, Ada Popolo¹, Giuseppina Autore¹, Marco Gargaro⁴, Hermann Stuppner³

¹ Department of Pharmacy, University of Salerno, Italy

² PhD Program in Drug Discovery and Development, University of Salerno, Italy

³ Institute of Pharmacy/Pharmacognosy and Centre for Molecular Biosciences Innsbruck (CMBI), University of Innsbruck, Austria

⁴ Department of Medicine and Surgery, University of Perugia, Italy
smarzocco@unisa.it

Ethnopharmacological relevance: Plumericin is an iridoid lactone isolated from *Himatanthus sucuuba*, a medicinal tree traditionally used in Amazonian ethnomedicine for inflammatory disorders, gastric ulcers, pain and infections through stem bark and latex preparations [1]. Unlike several iridoids, plumericin contains a highly electrophilic α -methylene- γ -lactone group responsible for its reactivity toward nucleophilic cellular targets. Plumericin has been reported to exert several biological effects, mainly through modulation of NF- κ B and redox-sensitive pathways [2].

Aim of the study: Chronic kidney disease (CKD) is characterized by chronic inflammation, oxidative stress and immune dysfunction [3]. The uremic toxin indoxyl sulfate (IS) accumulates due to impaired renal clearance also contributing to systemic complications [4]. Given the role of the gut in CKD-related inflammation, in this study we investigated the effects of plumericin, to mitigate IS damage in intestinal epithelial cells, IEC-6, also focusing on its immunomodulatory activity in IS-treated murine J774A.1 macrophages.

Materials and methods: IEC-6 and J774A.1 macrophages were treated with plumericin (0.5–2 μ M) and IS (250 μ M), alone or in inflammatory conditions (LPS+IFN - 10 μ g/mL or LPS -10 μ g/mL). After 24 h, cell viability, inflammatory and oxidative stress markers as well as wound healing repair were assessed; Statistical analysis was performed using one-way ANOVA with Bonferroni post hoc test.

Results: In IEC-6, plumericin reduced IS-induced iNOS, COX-2, caspase-1, IL-1 β , ROS and nitrotyrosine, increasing the antioxidants SOD-2, NQO1 and HO-1 ($p < 0.05$ vs IS). These effects were associated with NF- κ B inhibition and AhR activation and enhanced Nrf2 nuclear translocation. In IEC-6 plumericin improved wound healing repair and E-cadherin and ZO-1 expression. In macrophages, plumericin reduced IS- and LPS-induced NO production, iNOS, COX-2, ROS, and nitrotyrosine while enhancing antioxidant defenses ($p < 0.05$ vs IS). Similar effects were observed in epithelial-immune crosstalk experiments using conditioned medium from IS-treated IEC-6 cells.

Conclusion: These findings suggest that plumericin may represent a promising therapeutic candidate for intestinal impairment in CKD acting through coordinated modulation of AhR/NF- κ B/Nrf2 signaling, highlighting the ability to modulate epithelial-immune crosstalk in CKD.

References:

- [1] Amaral, A.C.; Silva, J.R.D.; Ferreira, J.L.; Pinheiro, M.L. Monograph of *Himatanthus sucuuba*. *Pharmacogn. Rev.* **2007**, *1*, 305–313.
- [2] Fakhrudin, N., Waltenberger, B., Cabaravdic, M., Atanasov, A.G., Malainer, C., Schachner, D., Heiss, E.H., Liu, R., Noha, S.M., Grzywacz, A.M., Mihaly-Bison, J., Awad, E.M., Schuster, D., Breuss, J.M., Rollinger, J.M., Bochkov, V., Stuppner, H. and Dirsch, V.M. Plumericin – a novel promising NF- κ B inhibitor. *Br J Pharmacol*, 171: 1676-1686, **2014**. <https://doi.org/10.1111/bph.12558>
- [3] Boima V, Agyekum AB, Ganatra K, Agyekum F, Kwakye E, Inusah J, Ametefe EN, Adu D. Advances in kidney disease: pathogenesis and therapeutic targets. *Front Med (Lausanne)*. **2025** Feb 14;12:1526090. doi: 10.3389/fmed.2025.1526090
- [4] Cheng TH, Ma MC, Liao MT, Zheng CM, Lu KC, Liao CH, Hou YC, Liu WC, Lu CL. Indoxyl Sulfate, a Tubular Toxin, Contributes to the Development of Chronic Kidney Disease. *Toxins (Basel)*. **2020** Oct 29;12(11):684. doi: 10.3390/toxins12110684. PMID: 33138205; PMCID: PMC7693919.

ANTI-OSTEOCLASTOGENIC AND PRO-OSTEOBLASTOGENIC EFFECTS OF STANDARDIZED *VACCINIUM MACROCARPON* EXTRACT IN EXPERIMENTAL MODELS OF BONE LOSS

Maria Laura Belladonna¹, Chiara Suvieri¹, Laura Salvadori^{1,2}, Ciriana Orabona¹, Maria Teresa Pallotta¹, Sofia Rossini¹, Claudia Volpi¹, Guglielmo Sorci^{1,2} and Francesca Riuzzi^{1,2}

¹ Department of Medicine and Surgery, University of Perugia, Italy

² Interuniversity Institute of Myology (IIM), Perugia, Italy

marialaura.belladonna@unipg.it

Ethnopharmacological relevance: *Vaccinium macrocarpon* (American cranberry) is traditionally used in ethnopharmacology and is rich in polyphenols with antioxidant and anti-inflammatory activities. Emerging evidence suggests beneficial effects on bone remodeling through modulation of osteogenesis and osteoclastogenesis^[1]. However, its effects in integrated models of in vitro cell-differentiation and in vivo AGE-rich western diet-induced bone loss remain poorly characterized.

Aim of the study: The present study investigated the antiosteoclastogenic and proosteoblastogenic activities of a standardized *V. macrocarpon* extract through in vitro and in vivo experimental models.

Materials and methods: Antiosteoclastogenic activity was evaluated in RANKL-stimulated RAW 264.7 murine macrophages by TRAP staining, mature osteoclast counting, bone-resorption assays, and gene-expression analysis of osteoclastogenic markers. Proosteoblastogenic activity was investigated in MC3T3 preosteoblastic cells through Alizarin Red S (ARS) staining and osteoblastogenic marker expression. In vivo activity was assessed in mice fed a western diet, followed by histological evaluation of tibial bone tissue and analysis of osteoblast- and osteoclast-related genes.

Results: Bone homeostasis is critically regulated by the balance between osteoclast-mediated bone resorption and osteoblast-mediated bone formation. Dysregulation of this equilibrium contributes to pathological conditions characterized by bone loss and skeletal fragility^[2-3]. Treatment with *V. macrocarpon* inhibited osteoclastogenesis in RAW264.7/RANKL cultures, as demonstrated by reduced TRAP-positive multinucleated osteoclasts, decreased bone-resorption activity, and downregulation of osteoclastogenic genes. In MC3T3 cells, *V. macrocarpon* enhanced osteoblast differentiation, increasing calcium-rich mineralized nodule deposition and the expression of osteoblastogenic markers. In vivo, western diet-fed control mice displayed evident bone matrix degradation, whereas animals treated with *V. macrocarpon* showed markedly preserved bone architecture, supported by modulation of bone-remodeling gene expression in tibial samples.

Conclusion: The findings demonstrate that standardized *V. macrocarpon* extract exerts dual antiosteoclastogenic and proosteoblastogenic activities, supporting its potential use as a nutraceutical strategy to counteract western diet-associated bone loss and preserve skeletal homeostasis under conditions of AGE-rich dietary exposure.

Acknowledgements: We thank Laboratori Biokyma S.r.l. (Arezzo, Italy) for providing the *V. macrocarpon* standardized extract

References:

- [1] A. Ghosh, S.C. Debnath, A.U. Igamberdiev, *Frontiers in Molecular Biosciences* **2024**, *11*, 1520661.
- [2] M. Tsukasaki, H. Takayanagi, *Nature Reviews Immunology* **2019**, *19*, 626–642.
- [3] N. Takegahara, H. Kim, Y. Choi, *Experimental & Molecular Medicine* **2024**, *56*, 1081–1093.

AMELIORATIVE EFFECTS OF SYZYGIUM AROMATICUM FLOWER BUD ETHANOLIC EXTRACT ON AMYLOID- β -INDUCED COGNITIVE DEFICITS IN MICE

Manjula Santhepete Nanjundaiah¹, Mamatha Gavisiddaiah¹, Mruthunjaya Kenganora²

¹ Department of Pharmacology, JSS College of Pharmacy, JSS Academy of Higher Education and Research, Mysuru, India

² Department of Pharmacognosy, JSS College of Pharmacy, JSS Academy of Higher Education and Research, Mysuru, India
snmanjula@jssuni.edu.in

Ethnopharmacological relevance: Flower bud of *Syzygium aromaticum* (clove) is widely used in traditional medicine for the management of neurological and inflammatory disorders due to its antioxidant and anti-inflammatory properties^[1].

Aim of the study: The study aimed to investigate the neuroprotective potential of clove bud ethanolic extract against amyloid- β -induced Alzheimer's disease by targeting soluble epoxide hydrolase (sEH), a key enzyme involved in neuroinflammation and neurodegeneration.

Materials and methods: Phytoconstituents of the extract were characterized by LC-MS analysis followed by *in-vitro* evaluation of sEH inhibitory activity^[2] against murine and human sEH enzymes. *In-vivo* efficacy of extract was assessed against $A\beta_{1-42}$ -induced C57BL/6 mice at a dose of 15 and 30 mg/kg. Cognitive and olfactory functions were evaluated using Morris Water Maze, passive inhibitory avoidance^[3] and buried pellet tests^[4], respectively. BBB integrity and molecular markers were assessed by *in vivo* imaging and western blotting besides histopathological studies. TPPU (1mg/kg, i.p.) was used as the standard sEH inhibitor. Mechanistic pathways were further explored using network pharmacology^[5] and mRNA sequencing. The adopted study design is represented in figure 1.

Results: The extract demonstrated significant *in-vitro* sEH inhibitory activity, while LC-MS analysis identified bioactive phytoconstituents associated with anti-Alzheimer's potential. In $A\beta_{1-42}$ -induced mice, treatment improved locomotor activity, memory, spatial learning and olfactory functions besides restoration of BBB integrity and modulation of inflammatory (NLRP3, sEH) and oxidative marker (NRF2), amyloid- β expression with reduced neuroinflammation, neuronal degeneration as evidenced by *in-vivo* imaging and molecular studies. Network pharmacology and mRNA sequencing further supported modulation of neuroinflammatory and amyloid-related signaling pathways.

Conclusion: The present study demonstrates the ameliorative effects of clove extract in amyloid- β -induced cognitive impairment through antioxidant, anti-inflammatory and sEH inhibitory mechanisms. Integration of network pharmacology with transcriptomic profiling substantiates the therapeutic potential of extract in Alzheimer's disease influencing key molecular pathways associated with oxidative stress, inflammation and apoptosis.

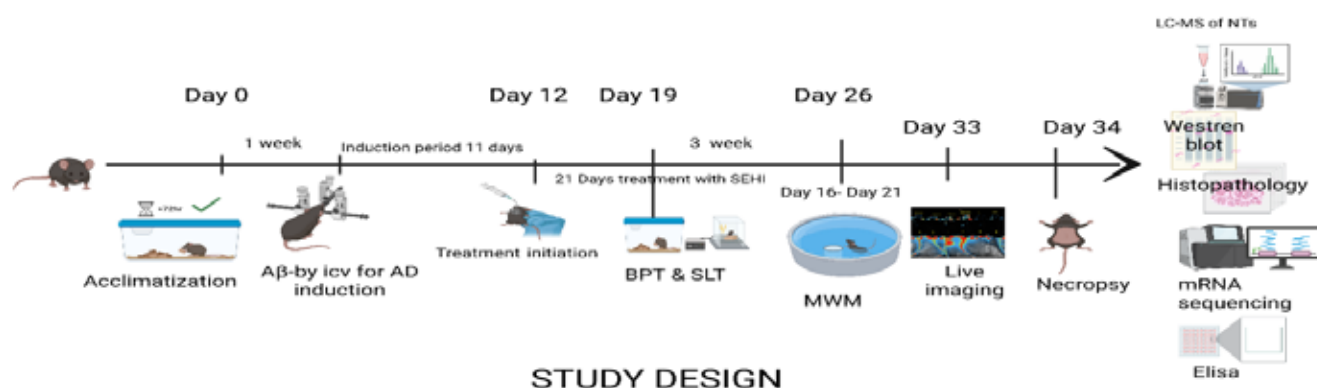


Figure 1: (Study design of the project)

References:

1. Rawa MSA, Mazlan MKN, Ahmad R, Nogawa T, Wahab HA. Plants. 2022;11(11):1476.
2. Liang Z, Zhang B, Xu M, Morisseau C, Hwang SH, Hammock BD, et al. TPPU, a selective and potent dual inhibitor of soluble epoxide hydrolase and p38 kinase intervenes in Alzheimer's signaling in human nerve cells. ACS Chem Neurosci. 2019;10(9):4018.
3. Thippeswamy AH, Rafiq M, Viswantha GLS, Kavaya KJ, Anturlikar SD, Patki PS. Evaluation of Bacopa monnieri for its synergistic activity with rivastigmine in reversing aluminum-induced memory loss and learning deficit in rats. Innov Acupunct Med. 2013;6(4):208-13.
4. Mitrano DA, Houle SE, Pearce P, Quintanilla RM, Lockhart BK, Genovese BC, et al. Olfactory dysfunction in the 3xTg-AD model of Alzheimer's disease. IBRO Neurosci Rep. 2021;10:51-61.
5. Bouter C, Rareş SR, Moldovan P, et al. The abundant phytocannabinoids in rheumatoid arthritis: therapeutic targets and molecular processes identified using integrated bioinformatics and network analysis. Life. 2023.

SELF-NANOEMULSIFYING DELIVERY OF 6-GINGEROL: A QBD-BASED STRATEGY FOR IMPROVED BIOPHARMACEUTICAL PERFORMANCE

Ganesh Kumar¹

School of Pharmaceutical Sciences, Swami Rama Himalayan University, Jollygrant Dehradun, Uttarakhand
drganeshbhatt2@gmail.com

Ethnopharmacological Relevance: Zingiber officinale (ginger) is extensively utilized in traditional medicine for its anti-inflammatory and neuroprotective properties^[1]. Its primary main bioactive compound, 6-gingerol, demonstrates poor aqueous solubility and lower oral bioavailability, constraining therapeutic application^[2].

Aim of the Study: To formulate & optimized a self-nanoemulsifying drug delivery system (SNEDDS)[3] for 6-gingerol using a Quality by Design (QbD) method to make it more soluble, permeable, and available throughout the body.

Materials and Methods: Excipients were selected through solubility screening, identifying Capryol 90, Cremophor RH40, and Transcutol P as optimal choices [4]. Pseudo-ternary phase diagrams determined the nanoemulsion region, while Box–Behnken design optimized formulation variables. The optimized SNEDDS was characterized for droplet size, PDI, drug loading, morphology, and dilution stability. In-vitro dissolution, ex-vivo intestinal permeation, IVIVC, and pharmacokinetic studies were subsequently performed to evaluate formulation performance.

Results: Among the tested lipids, Capryol 90 exhibited the highest solubilization capacity, while Transcutol P showed superior performance among co-surfactants. The optimal nanoemulsion region was achieved at an Smix ratio of 2:1 (surfactant:co-surfactant). The optimized SNEDDS exhibited droplet sizes below 80 nm, low PDI (<0.25), and high drug-loading efficiency. The formulation demonstrated rapid and extensive drug release (>90% within 30 min) compared with the pure drug (<30%) [5]. Ex-vivo studies revealed a 2–3-fold enhancement in intestinal permeability. IVIVC analysis confirmed improved drug absorption. Pharmacokinetic evaluation showed significantly enhanced systemic exposure, with nearly threefold higher C_{max}, four- to fivefold increased AUC, and reduced T_{max}.

Conclusion: The QbD-optimized SNEDDS made 6-gingerol dissolve, pass through membranes, and be available in the mouth much better. This delivery platform is a promising way to make phytoconstituents that don't dissolve well in water work better as medicines.



Graphical Abstract

References:

1. Grzanna R, Lindmark L, Frondoza CG. Ginger—an herbal medicinal product with broad anti-inflammatory actions. *J Med Food*. 2005.
2. Zick SM et al. Pharmacokinetics of 6-gingerol and its metabolites. *Cancer Epidemiol Biomarkers Prev*. 2008.
3. Dhyani, A et al. Self-emulsifying Drug Delivery Systems as a Paradigm for Enhancing Bioavailability of Phytoconstituents. *Journal of Solution Chemistry* (2026).
4. Pouton CW. Formulation of self-emulsifying drug delivery systems. *Adv Drug Deliv Rev*. 2006.
5. Kommuru TR et al. Self-emulsifying drug delivery systems (SEDDS) of poorly soluble drugs: formulation and evaluation. *Int J Pharm*. 2001.

HERBAL CONCOCTIONS USED FOR MATERNAL HEALTHCARE IN QWAQWA, FREE STATE

Mamokete Setshego¹, Motheo Koitsiwe¹, Sechaba Bareetseng¹

¹ Centre of Indigenous Knowledge Systems, North West University, South Africa,
Mamokete.setshego@nwu.ac.za

Ethnopharmacological relevance: The use of medicinal plants has been practiced since time immemorial in rural African communities. Indigenous people have developed traditional methods of combining medicinal plants to prepare herbal concoctions used to manage maternal health challenges. Maternal health refers to the health of women during pregnancy, childbirth, and the postnatal period. In Africa, many women rely on medicinal plants due to their socio-economic status and limited access to healthcare services in their communities.

Aim of the study: This study aimed to explore the herbal concoctions used for maternal healthcare in QwaQwa, Free State Province, South Africa.

Materials and methods: A mixed-methods study was conducted with 29 community members, including traditional health practitioners and wisdom keepers (knowledge holders), through interviews. Thematic analysis was employed to analyse qualitative data, while ethnobotanical indices such as use-value (UV) and frequency index (FI) were calculated. The use-value of natural resources was determined using the formula: $UV = \Sigma U/n$, where ΣU represents the total number of uses mentioned by participants and n is the total number of informants interviewed during the survey.

Results: The study documented five herbal concoctions used for maternal healthcare to manage various maternal health challenges, including constipation, infertility, miscarriage, and difficult labour associated with a narrow birth canal. Plant species identified in the concoctions included *Eriocephalus punctulatus*, *Rheum rhabarbarum* L., and *Hypoxis hemerocallidea* Fisch., C.A.Mey. & Avé-Lall, among others. The findings revealed that *Hypoxis hemerocallidea* had the highest frequency of citation and use-value among the recorded medicinal plants.

Conclusion: The study concludes that indigenous knowledge plays a significant role in maternal healthcare among women in QwaQwa. The documented herbal concoctions and medicinal plants contribute to the preservation of indigenous ethnopharmacological knowledge and may provide a basis for future pharmacological investigations.

STUDY OF THE EFFECT OF COMPOUNDS FROM *PERSEA AMERICANA* SEEDS ON THE ONCOGENIC PROTEINS VACA AND CAGA OF *HELICOBACTER PYLORI*

Rita de Cássia Ribeiro Gonçalves¹, Amanda Cavalcante Gonzaga Nunes¹, Dalila Nickel Loose¹, Lorena Carnielli Queiroz¹, Leonardo Bruno Federico², Ricardo Machado Kuster¹, Rodrigo Rezende Kitagawa¹

¹ Graduate Program in Pharmaceutical Sciences, Federal University of Espírito Santo, Brazil

² Department of Pharmaceutical Sciences, Federal University of Santa Catarina, Brazil
rita.goncalves@ufes.br

Ethnopharmacological relevance: avocado (*Persea americana*) seeds are traditionally used for gastrointestinal disorders in Central and South America^[1]. Pharmacological studies confirm antibacterial and antiulcer effects, supporting their potential as a natural source for protection against anti-*Helicobacter pylori* infection^[2,3]. Gastric cancer is strongly associated with this infection whose virulence factors CagA and VacA play key roles in carcinogenesis^[4].

Aim of the study: this study aimed to evaluate the effects of a hydroalcoholic extract of *P. americana* seeds on the expression of cagA and vacA genes, combining *in vitro* and *in silico* approaches.

Materials and methods: the minimum inhibitory concentration (MIC) was determined using the broth microdilution method. Gene expression levels were analyzed by RT-qPCR. The chemical composition of the extract was characterized by high-resolution mass spectrometry, and molecular docking studies were performed with identified compounds against RNA and protein structures of CagA and VacA.

Results: the extract exhibited bacteriostatic activity starting at 64 µg/mL and bactericidal activity at 128 µg/mL. A marked reduction in cagA and vacA expression was observed, reaching 82.4% and 73.9% after 3 hours, and 76.5% and 67.1% after 6 hours, respectively. Chemical analysis suggested the presence of fatty acid derivatives, such as avocadene and persenones. Molecular docking identified persenones A, B, and C, as well as persin, as the most promising ligands for interaction with RNA structures, particularly the complexes formed between domain 4 of cagA and persenone C, and domain 1 of vacA and persenone A (Figure 1). Docking with the CagA protein indicated persenone A as a potential inhibitor of the CagA-ASPP2 interaction.

Conclusion: these findings, supported by molecular docking, highlight avocado seeds as a promising natural source of bio-active compounds capable of impairing bacterial survival and virulence, reinforcing their potential as an adjuvant strategy for prevention of *H. pylori*-associated gastric carcinogenesis.

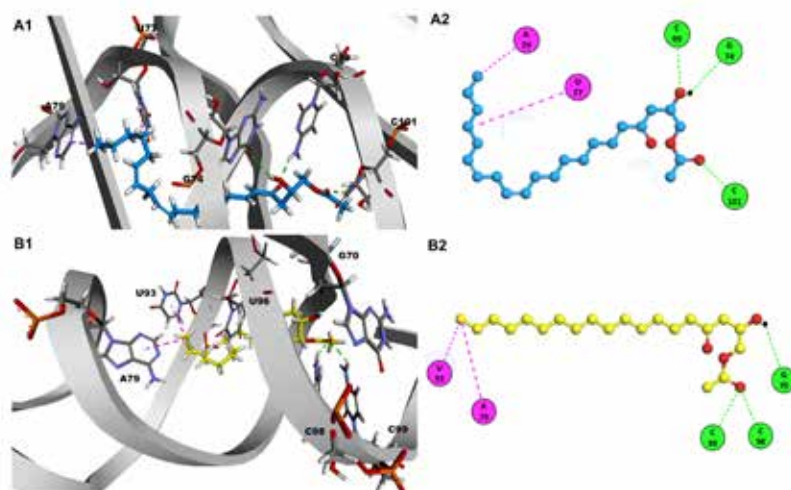


Figure 1: Interaction between Domain 1 of vacA and persenone A (A) and persenone B (B). 1. Tridimensional pose; 2. Main interactions (π -alkyl interactions are highlighted in pink, hydrogen bonds in green).

Acknowledgments: This work was supported by Fundação de Amparo à Pesquisa e Inovação do Espírito Santo – FAPES (Grant Number: 2022-78KWB) and CAPES (Grant Number: 2280/2022), process 88881.749045/2022-01.

References:

- [1] D. Dabas, R.M. Shegog, G.R. Ziegler, J.D. Lambert, *Curr. Pharm. Des.* **2013**, 19, 6133–6140.
- [2] B.R. Athaydes, G.M. Alves, A.L.E.M. de Assis, J.V.D. Gomes, R.P. Rodrigues, B.P. Campagnaro, B.V. Nogueira, D. Silveira, R.M. Kuster, T.M.C. Pereira, R.R. Kitagawa, R. de C.R. Gonçalves, *Food Res. Int.* **2019**, 119, 751–760.
- [3] B.R. Athaydes, C. Tosta, R.Z. Carminati, R.M. Kuster, R.R. Kitagawa, R. de C.R. Gonçalves, *J. Funct. Foods* **2022**, 99, 105352.
- [4] Y. Duan, Y. Xu, Y. Dou, D. Xu, *J. Hematol. Oncol.* **2025**, 18, 10.

HERBAL EXTRACTS AS MODULATORS OF THE IMMUNE RESPONSE: EVALUATION OF SELECTED MEDICINAL PLANTS IN HCT116, HaCaT, BEAS-2B, AND RAW 264.7 CELL LINES

Marta Palacz-Wróbel¹, Joanna Nackiewicz¹, Magdalena Skonieczna², Giorgia Renga³, Domenico Delfino³,
Monika Rykaczewska-Czerwińska¹, Dominika Rykaczewska-Czerwińska¹, Przemysław Nowak¹

¹ Opole University

² Silesian University of Technology

³ Università degli Studi di Perugia

Introduction Medicinal plants represent a valuable source of biologically active compounds with immunomodulatory and anti-inflammatory properties. Particular attention has been given to cocklebur (*Xanthium strumarium*), agrimony (*Agrimonia eupatoria*), ribwort plantain (*Plantago lanceolata*), and clubmoss (*Lycopodium clavatum*). These species contain numerous bioactive constituents — including flavonoids, tannins, phenolic acids, saponins, and alkaloids — which may regulate immune responses through modulation of inflammatory processes and immune cell activity.

Materials and Methods The study was conducted using four cell lines: HCT116 (colorectal carcinoma), HaCaT (human keratinocytes), BEAS-2B (bronchial epithelial cells), and RAW 264.7 (macrophage-like cells). These in vitro models were employed to evaluate the biological activity and immunomodulatory potential of selected herbal extracts. The applied models enabled assessment of the effects of plant-derived compounds on epithelial, cancer, and macrophage-like cells involved in inflammatory and immune responses.

Results Extracts obtained from agrimony and ribwort plantain demonstrated anti-inflammatory, antioxidant, and tissue-regenerating effects, which may contribute to the reduction of chronic inflammatory conditions. Cocklebur, although potentially toxic when improperly used, was found to contain compounds with antimicrobial and immunoregulatory activity. Clubmoss proved to be a source of biologically active alkaloids capable of affecting neuroimmunological processes and protecting cells against oxidative stress.

Conclusion The results indicate that the investigated medicinal plants may represent a valuable component of phytotherapy, with distinct immunomodulatory mechanisms of action supporting the treatment of inflammatory diseases and immune disorders. However, further clinical studies are necessary to confirm their efficacy and safety in human subjects.

GREEN MEDICINE FROM INDONESIA: NEW PERSPECTIVES IN THE THERAPY OF GIARDIASIS

Radka Pecková¹, Karel Doležal^{2,3,4}, Bohumil Sak⁵, Ivan Petřík^{3,4}, Michal Prikryl¹, Wisnu Nurcahyo⁶, Ivona Foitová¹

¹ Department of Botany and Zoology, Faculty of Science, Masaryk University, Czech Republic

² Department of Chemical Biology, Faculty of Science, Palacký University, Czech Republic

³ Laboratory of Growth Regulators, Faculty of Science, Palacký University, Czech Republic

⁴ Laboratory of Growth Regulators, Institute of Experimental Botany, The Czech Academy of Sciences, Czech Republic

⁵ Institute of Parasitology, Biology Centre of the Czech Academy of Sciences of the Czech Republic, v.v.i., Czech Republic

⁶ Department of Parasitology, Faculty of Veterinary Medicine, Gadjah Mada University, Indonesia
r.peckova@mail.muni.cz

Ethnopharmacological relevance: *Giardia intestinalis* is an intestinal protozoan parasite of mammalian species, including humans. It is considered the most prevalent parasitic cause of diarrhoea in the developed world. It has a global distribution, and symptomatic infections occur in both developing and developed countries, although in the latter ones, giardiasis is mostly associated with outbreaks. Because of an increasing resistance to commercial treatments and significant side effects, there is an urgent need to search for new therapeutic alternatives. The development of new therapeutics is increasingly inspired by nature.

Aim of the study: Our research focuses on testing of plant extracts that were selected based on behavioural data from Sumatran orangutans (*Pongo abelii*), in which a reduction in parasite burden was observed after targeted consumption of these plants. These plants are also used by local people to treat gastro-intestinal problems, e.g. diarrhoea.

Materials and methods: Selected plants were extracted in three extraction solvents (MeOH, MeOH:THF, and water) and tested first *in vitro* on axenic trophozoite cultures and subsequently, for active extracts, also on an *in vivo* model (gerbil, *Meriones unguiculatus*).

Results: The results in *Piper betle*, first plant we tested, with $IC_{50} = 1.75 \mu\text{g/ml}$ in the aqueous extract, demonstrated a significant reduction in the number of cysts excreted in the faeces of gerbils, scientifically validating the empirical observations in apes. In addition to these confirmed data, there will be presented for the first time the preliminary results of an ongoing screening of another series of medicinal plants, that are in publication process now.

Conclusion: These new findings further expand the spectrum of potential natural medicines and confirm that studying the self-medication behaviour of primates is a highly effective strategy for identifying new compounds with antiparasitic activity.

THE ANTIFUNGAL ACTIVITY AND MECHANISM OF ACTION OF THE ESSENTIAL OILS OF *HETEROPYXIS* SPP. AGAINST DERMATOPHYTES

Bianca Diedericks¹, Anna-Mari Kok², and Namrita Lall^{1,3,4}

¹ Department of Plant and Soil Sciences, University of Pretoria, Pretoria, South Africa

² Independent Researcher, Pretoria, South Africa

³ School of Natural Resources, University of Missouri, Columbia, MO, United States

⁴ College of Pharmacy, JSS Academy of Higher Education and Research, Mauritius

bianca.diedericks@tuks.co.za

Ethnopharmacological relevance: Species of *Heteropyxis* are traditionally used in southern African ethnomedicine for the treatment of infections, including skin-related conditions. Their essential oils are therefore, of interest as potential sources of novel antifungal agents against dermatophytes such as *Trichophyton rubrum* (*T. rubrum*).

Aim of the study: To evaluate the antifungal activity, cytotoxicity, and potential mechanism of action of essential oils from *Heteropyxis* spp. against dermatophytes.

Materials and methods: Essential oils were extracted using steam distillation, then chemically profiled using gas chromatography-mass spectrometry (GC-MS). Antifungal activity was assessed against a resistant strain of *T. rubrum* and susceptible strains of *Trichophyton mentagrophytes* (*T. mentagrophytes*), and *Microsporum gypseum* using Microtiter PrestoBlue assays. Combination studies with the antifungal drug; 'griseofulvin', were evaluated using the fractional inhibitory concentration index (FICI). Cytotoxicity was determined in HaCaT keratinocytes and chitin-differentiated U937 macrophages. Mechanistic studies included chitinase inhibition assays, with alkaline phosphatase (AKP), and inflammatory response assays in progress.

Results: The essential oils demonstrated antifungal activity, with MIC values of 0.5-1 mg/mL. *Heteropyxis dehniae* (HD) and *Heteropyxis canescens* (HC) oils showed the greatest activity (MIC: 0.5 mg/mL) against *T. rubrum* and *T. mentagrophytes*. Griseofulvin, the reference drug, exhibited higher potency (MIC: 2-4 µg/mL), although the oils maintained consistent activity across dermatophyte species. Combination studies including HD and HC with griseofulvin revealed additive interactions (FICI = 1). Cytotoxicity assays indicated relatively low toxicity, with IC₅₀ values ranging from 346.43 ± 21.46 to 532.03 ± 3.13 µg/mL (HaCaT) and 470.27 ± 13.64 to 623.47 ± 10.92 µg/mL (U937). Chitinase inhibition ranged from 57–66%, suggesting disruption of fungal cell wall processes.

Conclusion: *Heteropyxis* spp. essential oils exhibited antidermatophytic activity, low cytotoxicity, and promising effects on fungal cell wall-associated enzymes. These findings support their potential as possible complementary antifungal agents, with ongoing studies expected to further elucidate their mechanism of action.

ANTIBACTERIAL, ANTIOXIDANT AND TOXICOLOGICAL PROPERTIES OF FUNGAL ENDOPHYTE EXTRACTS FROM *KHAYA SENEGALENSIS* A. JUSS. AND *PTEROCARPUS ERINACEUS* POIR

Sophia Aliou^{1,2}, Eric Agbodjento¹, Aimé Cézaire Ayéna¹, Hornel Koudokpon¹, Brice Fanou¹, Samiratou Ayoka Labakè Sanni¹, Ayétohi Marcel Romaric Akinotcho¹, Alda Yemadje², Guevara Nonviho², Louis Fagbohoun³, Victorien Dognon¹, Jean Robert Klotoé^{*1,2}

¹Research Unit in Applied Microbiology and Pharmacology of natural substances (URMAPha), Polytechnic School of Abomey-Calavi (EPAC), University of Abomey-Calavi (UAC), Abomey-Calavi, Benin

²Multidisciplinary Research Laboratory for Technical Education (LARPET), Department of Applied Biology and Social Sciences (STBASS), National University of Science, Technology, Engineering and Mathematics (UNSTIM), Lokossa, Benin

³Kaba Laboratory for Research in Chemistry and Applications (LaKReCA), Department of Physics and Chemistry (PC), National University of Science, Technology, Engineering and Mathematics (UNSTIM), Natitingou, Benin

(*) Corresponding author: Prof Jean Robert Klotoé, jrklotoe@yahoo.fr

Ethnopharmacological relevance: *Khaya senegalensis* and *Pterocarpus erinaceus* are two major medicinal plants in Benin's traditional pharmacopeia. Despite their extensive use, they face a high risk of extinction. Endophytes from these species offer a sustainable alternative for producing bioactive metabolites while preserving plant biodiversity. ^[1]

Aim of the study : This study aimed to evaluate the antibacterial, antioxidant, and toxicological properties of fungal endophyte extracts (PF2bβ and KF1cβ) isolated from these two medicinal plants.

Materials and methods : Extracts were obtained via controlled culture and ethyl acetate extraction. Chemical composition was analyzed using thin-layer chromatography and spectrophotometry (polyphenols, flavonoids, tannins). Antioxidant activity was assessed by DPPH radical scavenging. Antibacterial potential was tested against *Staphylococcus aureus* and *Escherichia coli*, while toxicity was evaluated using the *C. elegans* model ^[2,3].

Results : The PF2bβ extract (from *P. erinaceus*) showed a higher polyphenol content (8.7 mg/g GAE) compared to KF1cβ (3.03 mg/g GAE). Both extracts contained sterols, terpenes, and saponins. PF2bβ demonstrated superior antioxidant capacity (= 3.01 mg/ml) and moderate antibacterial activity against *S. aureus* (13.25 mm inhibition). Toxicity tests on *C. elegans* revealed that PF2bβ was less toxic (= 137.24 mg/ml) than KF1cβ (= 287.55 mg/ml).

Conclusion : The PF2bβ fungal extract exhibits a promising biological profile, combining low toxicity with significant antioxidant and antimicrobial activities. These findings highlight its potential as a sustainable source of bioactive molecules for future therapeutic applications.

Endophyte extracts studied	IC ₅₀ (mg/ml)	Standard deviation
KF1cβ	11.52	0.47
PF2bβ	3.01*	0.34

*Significantly different at the 5% threshold

Table 1: Antioxidant activity expressed in IC₅₀ of the endophyte extracts studied

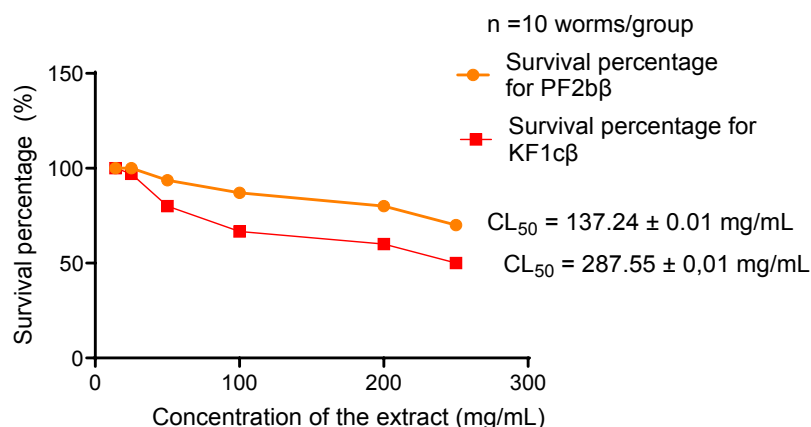


Figure 1: Dose-dependent toxicity of endophyte extracts PF2bβ and KF1cβ on *C. elegans*

References:

- [1] S. Tsipinana, S. Husseiny, K. A. Alayande, M. Raslan, S. Amoo, and R. Adeleke, "Contribution of endophytes towards improving plant bioactive metabolites: a rescue option against red-taping of medicinal plants," *Front. Plant Sci.*, vol. 14, p. 1248319, Sep. 2023, doi: 10.3389/fpls.2023.1248319.
- [2] V. L. Singleton, R. Orthofer, and R. M. Lamuela-Raventós, "Analysis of total phenols and other oxidation substrates and antioxidants by means of folin-ciocalteu reagent," in *Methods in Enzymology*, vol. 299 pp 152–178, in *Oxidants and Antioxidants Part A*, vol. 299 pp 152–178., Academic Press, 1999. doi: 10.1016/S0076-6879(99)99017-1.
- [3] M. Zore *et al.*, "Design and synthesis of etrasimod derivatives as potent antibacterial agents against Gram-positive bacteria," *Eur. J. Med. Chem.*, vol. 263, p. 115921, Jan. 2024, doi: 10.1016/j.ejmech.2023.115921.

EFFICACY OF *MANGIFERA INDICA*, *AZADIRACHTA INDICA*, AND *MORINDA LUCIDA* AGAINST BACTERIA ASSOCIATED WITH DIABETIC FOOT INFECTIONS AND POSTPRANDIAL HYPERGLYCEMIA

Eric Agbodjento¹, Raoul Awassi^{1,2}, Hornel Koudokpon¹, Kevin Sintondji¹, Aimé Cézaire Ayena¹, Fréjus Hans Ohouko¹, Victorien Dougnon¹, Jean Robert Klotoe^{1,2}.

¹ Research Unit in Applied Microbiology and Pharmacology of natural substances (URMAPHA),

Polytechnic School of Abomey-Calavi (EPAC), University of Abomey-Calavi (UAC), Abomey-Calavi, Benin

² Multidisciplinary Research Laboratory for Technical Education (LARPET), Higher Teacher Training College for Technical Education (ENSET), National University of Science, Technology, Engineering and Mathematics (UNSTIM), Abomey, Benin
agbodjento89@gmail.com

Ethnopharmacological relevance: In Benin, medicinal plants play a central role in the management of diabetes and its complications, including diabetic foot infections (DFIs). *Mangifera indica*, *Azadirachta indica*, and *Morinda lucida* are traditionally used by local healers for wound care, infection control, and glycemic regulation.

Aim of the study: This study aimed to assess the traditional uses of *Mangifera indica*, *Azadirachta indica*, and *Morinda lucida* through evaluation of their efficacy against bacteria associated with DFIs and their postprandial antihyperglycemic effects.

Materials and methods: Ten clinical bacterial strains isolated from diabetic foot wounds were characterized. Resistance genes (blaOXA-1, blaCTX-M15, blaSHV, blaTEM, qnrB, qnrS, aac, mecA, blaZ, ermB) were detected using multiplex PCR [1,2]. Antibacterial activity of aqueous and ethanolic extracts was assessed by agar diffusion, and minimum inhibitory concentrations were determined [3]. Antihyperglycemic activity was evaluated in Wistar rats using the oral glucose tolerance test [4].

Results: *Klebsiella pneumoniae* and *Escherichia coli* harbored multiple resistance genes, while no blaCTX-M15 or qnrS genes were detected. *Pseudomonas aeruginosa* isolates did not express the targeted genes. Among Gram-positive bacteria, blaZ was detected only in *Staphylococcus aureus*, whereas ermB and aac were identified in coagulase-negative staphylococci. Ethanolic extracts of *Azadirachta indica* showed the highest antibacterial activity against *S. aureus* (23.67 ± 1.52 mm), comparable to ceftriaxone, with low MIC values (0.39 mg/mL). Aqueous extracts of *Morinda lucida* significantly reduced postprandial glucose levels (0.61 g/L), with effects comparable to glibenclamide

Conclusion: These findings provide scientific evidence supporting the traditional use of *Mangifera indica*, *Azadirachta indica*, and *Morinda lucida* in Benin for managing infections and diabetes. Their dual antibacterial and antihyperglycemic activities highlight their potential as complementary therapeutic agents in the management of diabetic foot infections.

Keywords: Diabetic foot infections, medicinal plants, antibiotic resistance, antihyperglycemic activity, Benin

References:

- [1] C. Dallenne, A. Da Costa, D. Decré, C. Favier, G. Arlet, *Journal of Antimicrobial Chemotherapy* **2010**, 65, 490–495.
- [2] D Khan, M. Zeb, S.K. Khattak, A.A. Shah, M. Abdullah, M. Bilal, *Endocrine and Metabolic Science* **2023**, 12, 100136
- [3] V. Dougnon, E. Hounsa, H. Koudokpon, E. Agbodjento, A. Afaton, K. Sintondji, J.R. Klotoe, J. Segbo, L. Baba-Moussa, *Bulletin of the National Research Centre* **2021**, 45, 107.
- [4] V.H. Sato, S. Chewchinda, A.S. Goli, H. Sato, J. Nontakham, B. Vongsak, *Molecules* **2023**, 28, 6775

A MEDITERRANEAN REMEDY FOR URINARY TRACT INFECTIONS: IN VITRO ANTI-INFLAMMATORY AND ANTI-ADHESIVE PROPERTIES OF *CISTUS* × *INCANUS* L.

Nicole Maranta¹, Giulia Martinelli¹, Giovanna Nicotra², Silvia Francesca Vicentini², Beatrice Bruno², Giovanna Baron³, Chiara Di Lorenzo¹, Safwa Moheb El Haddad¹, Marco Fumagalli¹, Carola Pozzoli¹, Enrico Sangiovanni¹, Giancarlo Aldini³, Mario Dell'Agli¹, Stefano Piazza¹

¹ Department of Pharmacological and Biomolecular Sciences "Rodolfo Paoletti", University of Milan, Milan, Italy

² EPO Srl, Via Stadera 19, 20141, Milan, Italy

³ Department of Pharmaceutical Sciences, University of Milan, Milan, Italy
nicole.maranta@unimi.it

Cistus x incanus L. is a medicinal plant used in the traditional medicine of Mediterranean populations^[1]. Its infusion was used, from Turkey^[2] to Morocco^[3, 4] and Spain, for the treatment of inflammatory and infective disorders, including urinary tract infections (UTIs)^[5]. However, little evidence supports its use against uropathogenic *E. coli* (UPEC).

The aim of this study is therefore to evaluate the anti-inflammatory, antibacterial and antiadhesive effects of an hydroalcoholic extract (CE) from aerial parts of *Cistus x incanus* L., in a model of in vitro urinary inflammation (UTI). In parallel, preliminary efforts were dedicated to the identification of the bioactive fraction and the investigation of the metabolic fate of the extract. T24 bladder epithelial cells were infected with UPEC strain CFT073, and then treated with CE, the digested extract (CEd) or the fraction (IF) obtained by bioguided fractionation. IL6 release was measured by ELISA, the adhesion by flow cytometry, while the bacterial growth by microdilution. The polyphenol composition and the potential gastrointestinal stability were analyzed by LC-MS/MS.

CE inhibited UPEC induced IL6 release in a concentration dependent manner, retaining the effect post digestion (IC₅₀=16.05, and 19.05 µg/mL, respectively). CE reduced UPEC adhesion (79 % at 200 µg/mL) and moderately impaired bacterial growth (47% at 500 µg/mL). The anti-inflammatory activity was also demonstrated for IF (IC₅₀= 16.27 µg/mL), as well as the anti-adhesive effect (-84% at 50 µg/mL). LCMS/MS analysis showed IF was rich in flavonol glycosides, catechins and tannins, with flavonol glycosides being the most stable polyphenols after simulated intestinal passage.

In conclusion, this study supports the traditional use of *Cistus x incanus* L. in UTIs. The extract showed antiinflammatory and antiadhesive effects against UPEC that were preserved after in vitro intestinal digestion. The analysis of the bioactive fraction revealed a complex polyphenolic composition and suggested a major role for flavonols.

References:

- [1] Tomou, *Phytochem* **2022**, Rev. 21, 2049–2087
- [2] Guzel, *Journal of Ethnopharmacology*, **2015**, 174, 118–152.
- [3] Ouhammad, *Journal of Applied Biosciences.*, **2015**, 84(1), 7707–7722
- [4] Idm'hand, *Acta Ecologica Sinica*, **2020**, 40, 134–144.
- [5] Martinelli, *Journal of Ethnopharmacology*, **2026**, 356, 120786

NURSE INTERVENTIONS FOR VAPING CANNABIS AMONG ADOLESCENTS

Susana J. Calderon, Ph.D., RN, FNAP¹, Laura Finan, Ph.D.²

¹ Illinois State University, United States of America

² Illinois State University, United States of America
sjcalde@ilstu.edu

Ethnopharmacological relevance: Cannabis (*Cannabis sativa* L.) vaping products (e.g., high-potency THC cartridges and flavored concentrates) are increasingly accessible to adolescents and are often perceived as a safer, “cleaner” route of administration. However, vaping can deliver rapid THC exposure and introduce additives (e.g., solvents, terpenes, flavorants) that may increase health risks. Nurses in schools and primary care are uniquely positioned to prevent initiation, identify early use, and intervene before escalation.

Aim of the study: To present an evidence-informed, nurse-led prevention and early-identification framework for adolescent cannabis vaping that is practical for nursing students and nurses in school health and primary care settings.

Materials and methods: This workshop integrates adolescent substance-use screening principles and ethnopharmacology considerations (product type, THC/CBD ratio, additives, source, and route) into a stepwise nursing approach aligned with SBIRT. Content includes: (1) developmentally appropriate screening for cannabis and nicotine co-use; (2) brief assessment of motivations (stress, sleep, peer norms), functional impact (school, sports), and safety concerns (driving, mental health); (3) brief intervention using motivational interviewing and harm-reduction counseling; (4) family-centered education and culturally responsive communication; and (5) referral and follow-up pathways to behavioral health and substance-use treatment when indicated.

Results: Participants are provided with a concise, nurse-friendly intervention algorithm and communication tools suitable for routine clinical encounters and school-based settings. Emphasis is placed on addressing common misconceptions (e.g., “vaping is harmless” or “medical cannabis is safe for everyone”), recognizing early warning signs of problematic use, and reinforcing protective behaviors.

Conclusion: A nurse-delivered, adolescent-centered approach that combines ethnopharmacology knowledge with brief behavioral counseling can strengthen prevention, increase early identification of cannabis vaping, and support timely referral. Future evaluation should test feasibility and outcomes across diverse youth in different settings.

References:

1. Centers for Disease Control and Prevention. (2024, February 15). Cannabis and teens. <https://www.cdc.gov/cannabis/health-effects/cannabis-and-teens.html>
2. Miech, R., Patrick, M. E., & Leventhal, A. M. (2025). Trends in US adolescent use of vaping and flavored solutions for marijuana consumption, 2021–2024. *Journal of Adolescent Health*, 77(5), 924–930.
3. Woods, D. L., Mentis, J. C., Cadogan, M., & Phillips, L. R. (2017). Aging, genetic variations, and ethnopharmacology: Building cultural competence through awareness of drug responses in ethnic minority elders. *Journal of Transcultural Nursing*, 28(1), 56–62.

PERIPHERAL ANTINOCICEPTIVE EFFECT OF 8β-TIGLOYLOXYCOSTUNOLIDE FROM *AGERATINA LIGUSTRINA*: BRIDGING MAYAN TRADITIONAL MEDICINE AND COX2-TARGETED PHARMACOLOGY

Adolfo Andrade-Cetto¹, Sonia M. Escandón-Rivera¹

¹ Laboratorio de Etnofarmacología Facultad de Ciencias, Universidad Nacional Autónoma de México, México
aac@ciencias.unam.mx

Ethnopharmacological relevance: *Ageratina ligustrina* (Asteraceae) is widely used in Mayan communities (Q'eqchi', Tzeltal, Tzotzil) as a household remedy for abdominal pain and other gastrointestinal complaints, yet its bioactive principles and mechanisms of action remain poorly defined, despite its high cultural salience for visceral pain relief.

Aim of the study: To isolate and identify major constituents from the aerial parts of *A. ligustrina*, to evaluate the peripheral antinociceptive activity of the organic extract and a selected sesquiterpene lactone *in vivo*, and to explore cyclooxygenase-2 (COX-2) as a plausible molecular target through molecular docking.

Materials and methods: A dichloromethane:methanol (1:1) extract of the aerial parts was fractionated, affording several compounds, which were characterized by MS and 1D/2D NMR. The crude extract and 8-β-tigloyloxykostenolide (**3**) (100 mg/kg, p.o.) were evaluated in male mice using the acetic acid-induced writhing test, with 10% DMSO as vehicle and acetylsalicylic acid (ASA, 100 mg/kg, p.o.) as reference. Molecular docking on COX-2 was performed to analyze binding modes and predicted affinities.

Results: Eight compounds were obtained, including lupeol acetate (**1**), α-amyrin acetate (**2**), 8-β-tigloyloxykostenolide (**3**), 6,4'-dimethoxy quercetagenin (**4**), three dicaffeoylquinic acids (**5-7**), and chlorogenic acid (**8**). At 100 mg/kg, the crude extract produced only modest inhibition of writhing (≈10%), whereas **3** significantly reduced nociceptive behavior (≈45% inhibition), approaching ASA (≈54%; $p \leq 0.05$ vs. control). Docking showed that **3** adopts a stable pose within the COX-2 catalytic pocket, forming hydrogen bonds and hydrophobic contacts, with a predicted binding free energy of -8.79 kcal/mol and a theoretical inhibition constant of 358.41 nM, indicating higher affinity than ASA.

Conclusion: These findings provide the first direct evidence that 8-β-tigloyloxykostenolide contributes to the peripheral antinociceptive properties of *A. ligustrina* and suggest COX-2-mediated prostaglandin inhibition as a plausible mechanism, thereby validating and mechanistically substantiating its traditional Mayan use for visceral pain relief.

Acknowledgements: The authors acknowledge; UNAM, DGAPA-PAPIIT In214225.

Reference:

Vargas-Ponce J., Andrade-Cetto, A*. 2024. Comparative study of abdominal pain in the Mayan cultures Tzeltal, Maya Tzotzil and Maya Q'eqchi' and use of *Ageratina ligustrina* for the treatment. Bol. Latinoam. Caribe Plant. Med. Aromat. 24 (4): 577 - 607. ISSN: 0717-7917.

ENVIRONMENTAL DEGRADATION AS A DETERMINANT OF ETHNOPHARMACOLOGICAL STABILITY IN MADAGASCAR

Nifesimi Joshua

Environmental Studies Department, Amherst College, USA
joshua.nife26@gmail.com

Ethnopharmacological relevance: In Madagascar, traditional medicine remains a primary source of healthcare for much of the population. The medicinal plant systems underpinning this care are increasingly threatened by fire-driven deforestation and landscape degradation, making it critical to understand how environmental change affects the stability and reliability of ethnopharmacological practice.

Aim of the study: This study investigates how recurrent burning and associated environmental changes influence the availability and stability of medicinal plant resources used by traditional healers.

Materials and methods: Semi-structured interviews including 26 traditional healers were conducted in Andasibe, Antananarivo and Marondora. The study focused on widely used medicinal species, including *Adansonia grandidieri*, *Cedrelopsis grevei*, *Cryptocarya agathophylla*, *Prunus africana*, and *Catharanthus roseus*. Data was collected on species availability, harvesting practices, and healer responses to ecological disruption.

Results: Repeated burning and soil degradation have reduced access to mature medicinal plants, compelling healers to modify harvesting locations and timing and to increasingly rely on substitute species. Majority (82%) of healers reported reduced potency and less predictable therapeutic effects in plants collected from degraded landscapes, with these ecological pressures altering treatment strategies overall.

Conclusion: Environmental change appears to undermine the stability of ethnopharmacological systems. Integrating environmental management, ethnopharmacological research, and health policy will be essential to safeguard medicinal plant systems and maintain traditional healthcare in ecologically vulnerable regions.

THE BOTANICAL SAFETY CONSORTIUM: A COLLABORATIVE EFFORT TO ADVANCE THE USE OF NAMS FOR EVALUATING NATURAL PRODUCT TOXICITY

Angela I. Calderón¹, Connie Mitchell²

¹Department of Drug Discovery and Development, Harrison College of Pharmacy, Auburn University, Auburn, AL 36849, USA

²Health and Environmental Sciences Institute (HESI Global), Washington DC 20005, USA
aic0001@auburn.edu

Ethnopharmacological relevance: The use of natural health products, including botanical dietary supplements, is increasing globally, making their safety a critical public health concern.

Aim of the study: The Botanical Safety Consortium (BSC) was established through a Memorandum of Understanding between the US FDA, the National Institute of Environmental Health Sciences, and the Health and Environmental Sciences Institute to improve safety evaluation methods for botanicals. The consortium serves as an international platform for collaboration among experts from government, academia, industry, and non-profits to advance and apply new approach methodologies (NAMs) for botanical safety assessment.

Materials and methods: Multiple toxicity-focused working groups selected relevant assays and data-rich botanicals to evaluate the utility of NAMs for complex mixtures. For genotoxicity, the Ames test and the in vitro micronucleus assay were used to evaluate botanicals, such as *Aristolochia*, which is known to induce DNA damage. For hepatotoxicity, botanicals such as concentrated green tea extract, associated with liver toxicity in animals and humans, were tested in primary human hepatocytes. Endpoints included cytotoxicity and enzyme-based measures to assess potential liver injury and botanical-drug interactions.

Results: These studies demonstrate the applicability of selected NAMs for detecting known toxicological effects in complex botanical mixtures, supporting their use in evaluating genotoxicity and hepatotoxicity. The findings highlight the ability of these assays to capture biologically relevant responses aligned with known in vivo and clinical outcomes.

Conclusion: Future efforts will focus on refining and expanding the BSC toolkit through assay optimization, addressing endpoint gaps, and integrating ADME data and in silico modeling approaches. By leveraging advances in NAMs, chemical analysis, and data interpretation, the consortium is developing robust tools to support botanical safety assessment. These efforts aim to inform regulatory frameworks, enhance consumer safety, and promote innovation in the development of safe botanical products.

PHYTOCONSTITUENTS OF MACROSPHYRA LONGISTYLA ETHANOL LEAF EXTRACT SUPPRESSES ABNORMAL UTERINE BLEEDING INDUCED BY INCOMPLETE ABORTION IN RATS

Mutiat Ibrahim¹, Oluwakemi Oyelowo², Akinniyi Odewo³, Oluwande Apanishile¹

¹Department of Pharmacognosy, Faculty of Pharmacy, University of Lagos,
College of Medicine campus, Idi-Araba, Lagos, Nigeria.

²Department of Physiology, Faculty of Basic Medical Science, University of Lagos,
College of Medicine campus, Idi-Araba, Lagos, Nigeria.

³Department of Forest Conservation and Protection, Taxonomy and Ethnobotany Section,
Forestry Research Institute of Nigeria, Jericho, Ibadan, Oyo State, Nigeria
mibrahim@unilag.edu.ng

Ethnopharmacological Relevance: *Macrosphyra longistyla* (DC.) Hook.f. ex Hiern, (Rubiaceae), commonly known as the long-style gardenia, has traditionally been used as a contraceptive, fertility restoration, and as an anti-hemorrhagic^[1,2].

Aim of the study: The anti-hemorrhagic effect of ethanolic leaf extract of *M. longistyla* (MLE) against abnormal uterine bleeding (AUB) in rats is being investigated

Materials and Methods: Mifepristone and misoprostol were used to induce an incomplete abortion model in early pregnant rats (n= 6/group). This was followed by oral administration of 200 and 400 mg/kg doses of MLE to the rats for one week. The effect of treatment with *M. longistyla* extract was assessed by measurements of volume and duration of uterine bleeding, and determination of plasma metabolic markers and hematological parameters^[3,4].

Results: The plant extract reduced the volume of bleeding with a significant decrease in the duration of bleeding compared with the model group. A significant dose-dependent decrease in TNF- α level and increase in VEGF level was exhibited in rats treated with *M. longistyla* compared with the model group. Rats in the *M. longistyla* treated group showed a significant dose-dependent increase in WBC and MCHC levels with a decrease in HCT and MCV levels compared to the model group.

Conclusion: These results demonstrated that *Macrosphyra longistyla* leaf extract showed an anti-hemorrhagic effect on bleeding caused by incomplete abortion, suppress pro-inflammatory cytokine (TNF- α) and upregulate VEGF. These effects suggest that the plant extract promotes endometrial repair and restores uterine homeostasis.

References:

- [1] E. U. Durugbo, J. O. Ogah, N. Chukwuemeka, P. G. Sename, A. T. Olukanni, K. O. Yusuf, I. C. Awuzie, O. D. Olukanni, S. O. Aboaba, Phytochemical, chemical and biomedical characterization of crude extract of *Macrosphyra longistyla* (DC.) Hiern, Jordan J Biol. Sci. 14 (2021) 453 – 461, <https://www.researchgate.net/publication/354678491>
- [2] M. B. Ibrahim, O. T. Ajayi, Y. H. Wang, H. B. Kothapalli, I. A. Khan, Z. Ali, Phytoconstituents of Extract and Fractions of *Macrosphyra longistyla* Leaves Inhibit Nitric Oxide and Prostaglandins Inflammatory Mediators: In Vitro, In vivo, and Chemical Profiling. Rev. Bras. Farmacogn. (2025) 1-10, <https://doi.org/10.1007/s43450-025-00660-w>
- [3] Nishijima, C.M., Rodrigues, C.M., Silva, M.A., Lopes-Ferreira, M., Vilegas, W., Hiruma- Lima, C.A., 2009. Anti-hemorrhagic activity of four Brazilian vegetable species against *Bothrops jararaca* venom. Molecules 14, 1072–1080. <https://doi.org/10.3390/molecules14031072>
- [4] Mobli, M., Qaraaty, M., Amin, G., Haririan, I., Hajimahmoodi, M., Rahimi, R., 2015. Scientific evaluation of medicinal plants used for the treatment of abnormal uterine bleeding by *Avicenna*. Arch. Gynecol. Obstet. 292 (1), 21–35. <https://doi.org/10.1007/s00404-015-3629-x>.

PROTECTIVE EFFECTS OF *SPONDIAS MOMBIN* METHANOLIC LEAF EXTRACT AND FRACTIONS IN A MOUSE MODEL OF SCOPOLAMINE-INDUCED MEMORY IMPAIRMENT

Ayobami Olusola¹, John Ogbu², Rosário Mário¹, Denise Pinheiro³, Vera Oliveira³, Christianah Elusiyan⁵, Gustavo Pedrino¹, James Fajemiroye^{2,4}

¹ Department of Physiological Sciences, Institute of Biological Sciences, Federal University of Goiás, Goiânia, GO, Brazil

² Department of Pharmacology Sciences, Institute of Biological Sciences, Federal University of Goiás, Goiânia, GO, Brazil

³ Laboratory of Clinical Analysis and Health Education, Institute of Biological Sciences, Federal University of Goiás, Goiânia, GO, Brazil

⁴ Graduate Program in Pharmaceutical Sciences, Campus Arthur Wesley Archibald, Evangelical University of Goiás, Anápolis, 75083-515, Brazil

⁵ Drug Research and Production Unit, Faculty of Pharmacy, Obafemi Awolowo University, Ile-Ife, Osun State, Nigeria
ayobamiolusola@discente.ufg.br

Ethnopharmacological relevance: *Spondias mombin* (SM) is traditionally used in Africa and South America for inflammatory and memory-related disorders [1], [2]. However, extensive preclinical validation and safety studies remain necessary to support its translational potential.

Aim of the study: This study evaluated the effects of the crude methanol extract (CME) and its methanol (MF), ethyl acetate (EF), dichloromethane (DF), and n-hexane (HF) fractions from SM leaves on memory and cytokine levels in scopolamine-treated mice, as well as serum biochemical markers in normal mice.

Materials and methods: After plant extraction and fractionation, Swiss albino mice (25–30 g) were treated orally with saline (SAL, 10 mL/kg), different doses of CME (10, 30, and 100 mg/kg) or MF (33 mg/kg), EF (27 mg/kg), DF (5 mg/kg), and HF (2 mg/kg) fractions before scopolamine (1 mg/kg, i.p.) administration for either 24 h or 7 consecutive days. Memory and exploratory behaviors were assessed using the step-down passive avoidance and open-field paradigms under blinded conditions. All procedures were approved by the Ethics Committee on Animal Use of the Federal University of Goiás, Brazil (Protocol No. 004/23). Blood and whole-brain samples from scopolamine-treated mice were collected for cytokine assays, while serum from normal mice was analyzed for biochemical biomarkers (Table 1).

Results: Acute and subacute treatments with the CME and fractions reversed scopolamine-induced memory deficits, with the 100 mg/kg CME dose and MF showing the greatest effects ($P < 0.05$). Treatments significantly and dose-dependently reduced TNF- α and IL-1 β levels while increasing IL-10 levels in plasma and brain. MF, EF, and HF, but not DF, exhibited significant anti-inflammatory activity ($P < 0.05$). Most serum biochemical parameters were unchanged, although DF and HF increased cholesterol, HF increased HDL, and CME 100 and HF reduced urea ($P < 0.05$) (see Table 1).

Conclusion: These findings support the potential of SM as a neuroprotective candidate for further investigation in memory-related disorders.

Table 1: Effects of CME and fractions of SM leaves on serum metabolic, hepatic, renal, and lipid profile biomarkers in mice (mean $\pm$ SEM, $n = 10$, * $P < 0.05$; ** $P < 0.01$ compared with the saline control group)

	H D L mg/dl	Uric acid mg/dl	Cholesterol mg/dl	T o t a l Protein g/dl	Triglycerides mg/ dl	Albumin	AST	ALP	ALT	Creatinine	Urea
SAL	64 $\pm$ 3.6	2.2 $\pm$ 0.32	86 $\pm$ 3.7	4.7 $\pm$ 0.098	258 $\pm$ 25	2.1 $\pm$ 0.037	321 $\pm$ 54	125 $\pm$ 12	59 $\pm$ 3.6	0.38 $\pm$ 0.043	69 $\pm$ 3.4
C M E 10	70 $\pm$ 4.4	2.2 $\pm$ 0.34	101 $\pm$ 5.2	5.0 $\pm$ 0.062	172 $\pm$ 29	2.1 $\pm$ 0.061	307 $\pm$ 33	92 $\pm$ 5.6	64 $\pm$ 4.1	0.31 $\pm$ 0.015	80 $\pm$ 2.2
C M E 30	74 $\pm$ 4.8	2.0 $\pm$ 0.4	98 $\pm$ 4.0	4.8 $\pm$ 0.10	210 $\pm$ 20	2.0 $\pm$ 0.04	284 $\pm$ 29	120 $\pm$ 8.1	60 $\pm$ 3.4	0.40 $\pm$ 0.022	72 $\pm$ 2.8
C M E 100	60 $\pm$ 5.1	1.8 $\pm$ 0.24	87 $\pm$ 5.9	4.4 $\pm$ 0.083	205 $\pm$ 17	2.0 $\pm$ 0.038	302 $\pm$ 44	130 $\pm$ 13	60 $\pm$ 3.5	0.47 $\pm$ 0.088	57 $\pm$ 3.5*
MF	66 $\pm$ 3.0	1.4 $\pm$ 0.18	94 $\pm$ 4.1	4.6 $\pm$ 0.091	236 $\pm$ 19	2.0 $\pm$ 0.05	323 $\pm$ 46	113 $\pm$ 13	66 $\pm$ 5.5	0.41 $\pm$ 0.057	66 $\pm$ 2.6
EF	78 $\pm$ 1.5	2.4 $\pm$ 0.53	105 $\pm$ 3.7	5.0 $\pm$ 0.11	189 $\pm$ 17	2.2 $\pm$ 0.057	388 $\pm$ 67	160 $\pm$ 9.7	62 $\pm$ 5.7	0.50 $\pm$ 0.038	71 $\pm$ 3.1
DF	79 $\pm$ 3.9	2.0 $\pm$ 0.26	112 $\pm$ 5.6**	4.7 $\pm$ 0.071	209 $\pm$ 21	2.1 $\pm$ 0.038	296 $\pm$ 25	135 $\pm$ 9.4	76 $\pm$ 6.7	0.28 $\pm$ 0.021	60 $\pm$ 1.9
HF	82 $\pm$ 4.2*	1.7 $\pm$ 0.27	107 $\pm$ 6.2*	4.8 $\pm$ 0.13	206 $\pm$ 26	2.0 $\pm$ 0.048	239 $\pm$ 27	132 $\pm$ 5.2	56 $\pm$ 5.1	0.39 $\pm$ 0.097	56 $\pm$ 4.3*

HDL, high-density lipoprotein; AST, aspartate aminotransferase; ALP, alkaline phosphatase; ALT, alanine aminotransferase

References:

- [1] T. I. dos Santos Sampaio *et al.*, “Leaves of *Spondias mombin* L. a traditional anxiolytic and antidepressant: Pharmacological evaluation on zebrafish (*Danio rerio*),” *J. Ethnopharmacol.*, vol. 224, pp. 563–578, doi: 10.1016/j.jep.2018.05.037.
- [2] O. B. Ogunro, B. O. Oyeyinka, G. A. Gyebi, and G. E.-S. Batiha, “Nutritional benefits, ethnomedicinal uses, phytochemistry, pharmacological properties and toxicity of *Spondias mombin* Linn: a comprehensive review,” *J. Pharm. Pharmacol.*, vol. 75, no. 2, pp. 162–226, doi: 10.1093/jpp/rgac086.

ANTI-STRESS ACTIVITY OF POLYHERBAL FORMULA OF SELECTED INDIAN MEDICINAL PLANTS

**Mruthunjaya Kenganora¹, Kiran Mahadeva¹, Chandrashekar Venkaraddi Mangnnavar²,
Manjula Santhepete Nanjundaiah³**

¹Department of Pharmacognosy, JSS College of Pharmacy, Mysuru, JSS Academy of Higher Education and Research, India²

³Department of Pharmacology, JSS College of Pharmacy, Mysuru, JSS Academy of Higher Education and Research, India

²Department of Pharmacology, HSK College of Pharmacy, Bagalakote, India

kmruthunjaya@jssuni.edu.in

Ethnopharmacological relevance: Oxidative stress, neuroinflammation, metabolic dysfunction, and neuronal damage are all linked to stress, which is a major global health concern. Several 'Medhya Rasayana' herbs are recommended by traditional Ayurvedic medicine to enhance stress resilience, mental wellness, and cognitive function^[1]. The adaptogenic, antioxidant, neuroprotective, and anti-inflammatory qualities of *Withania somnifera*, *Tinospora cordifolia*, *Bacopa monnieri*, and *Curcuma longa* have long been utilized^[2]. However, there is still a lack of scientific evidence supporting their synergistic anti-stress potential.

Aim of the study: The current work sought to assess the antioxidant, neuroprotective, and anti-stress properties of a polyherbal formula of extracts of selected plant material.

Materials and methods: Aqueous extracts of said plants were used in the polyherbal mixture, which was screened for physicochemical analysis and *in-vitro* antioxidant tests utilizing the DPPH and FRAP assays^[3,4]. JC-1 staining, apoptosis analysis and MTT assay were used to measure neuroprotective activity in SH-SY5Y neuronal cell lines. The Chronic Unpredictable Mild Stress (CUMS) paradigm was used to assess anti-stress activity in Wistar rats using behavioral tests such as the elevated plus maze and open field test^[5].

Results: Significant antioxidant activity and improved neuronal cell survival with defense against oxidative stress-induced apoptosis were displayed by the polyherbal mixture. Treatment with the polyherbal mixture considerably reduced stress-induced changes while improving behavioral metrics, antioxidant enzyme levels (SOD, GSH, CAT), and biochemical markers in the CUMS model. Protective benefits against stress-induced tissue injury were further validated by histopathological investigations.

Conclusion: Because the phytoconstituents in the chosen medicinal plants work in concert, the results of this study indicate that the created polyherbal mixture has strong antioxidant, neuroprotective, anti-inflammatory, and anti-stress properties. The study confirms these medicinal plants' promise as a promising herbal treatment method for stress-related diseases and provides scientific validation for their ethnopharmacological use in stress management.

References:

1. Singh N, Bhalla M, de Jager P, Gilca M. An overview on Ashwagandha: a Rasayana (rejuvenator) of Ayurveda. *Afr J Tradit Complement Altern Med*. 2011;8(5 Suppl):208-213.
2. Kapoor LD. *Handbook of Ayurvedic Medicinal Plants*. Boca Raton: CRC Press; 2000.
3. Brand-Williams W, Cuvelier ME, Berset C. Use of a free radical method to evaluate antioxidant activity. *LWT Food Sci Technol*. 1995;28(1):25-30.
4. Benzie IF, Strain JJ. The ferric reducing ability of plasma (FRAP) as a measure of antioxidant power. *Anal Biochem*. 1996;239(1):70-76.
5. Willner P. Chronic mild stress (CMS) revisited: consistency and behavioural-neurobiological concordance in the effects of CMS. *Neuropsychobiology*. 2005;52(2):90-110.

HIGH-ALTITUDE HEART DISEASE AND HIGH-ALTITUDE PULMONARY HYPERTENSION: NEGLECTED DISEASES AND A HEALTH ECONOMICS PERSPECTIVE ON TIBETAN MEDICINE

Boshi Peng

*Institute for Tibetan Medicine, China Tibetology Research Center, China
13220103225@163.com*

Ethnopharmacological relevance: Over 80 million people reside permanently at altitudes $\geq 2,500$ meters worldwide^[1], and high-altitude heart disease (HAHD) and high-altitude pulmonary hypertension (HAPH) are prevalent in this population. However, neither of these conditions is included among the 21 neglected tropical diseases (NTDs) identified by the World Health Organization (WHO), resulting in a severe lack of research investment and health economic evaluations. The Tibetan medicine “Seventy Flavors Pearl Pill (Rannasangpei)” is clinically used as an adjunctive treatment for cardiovascular and cerebrovascular diseases, but its value has yet to be systematically evaluated.

Aim of the study: (1) Provide epidemiological evidence on HAHD/HAPH as neglected diseases; (2) Review recent advances in the pharmacology of Seventy Flavors Pearl Pill; (3) Propose a health economic evaluation framework.

Materials and methods: We searched PubMed, CNKI, and WHO reports to collect data on prevalence, pharmacology, and NTDs policies.

Results: A 2024 systematic review and meta-analysis on high-altitude inhabitants in Latin America further highlighted the global scope of this health issue^[2]. In Tibetan areas of Sichuan Province, the crude prevalence of HAPH is 6.2% (8.6% in men vs 4.6% in women)^[3]. Seventy Flavors Pearl Pill has been shown to protect against ischemic/hypoxic injury via regulation of the oxidative phosphorylation pathway and to ameliorate stroke severity in animal models^[4]. The 2025 WHO NTD report does not list HAHD or HAPH^[5].

Conclusion: HAHD and HAPH are common but globally neglected high-altitude conditions. The pharmacological properties of Seventy Flavors Pearl Pill merit further investigation. A health economics evaluation framework for this Tibetan medicine could provide a new research paradigm for these diseases and evidence to support policy for integrating Tibetan medicine.

References:

- [1] Tremblay JC, Ainslie PN. Global and country-level estimates of human population at high altitude. *Proceedings of the National Academy of Sciences - PNAS* 2021;118(18):1-3.
- [2] Zila-Velasque JP, Grados-Espinoza P, Goicochea-Romero PA, Tapia-Sequeiros G, Pascual-Aguilar JE, Ruiz-Yaringaño AJ, et al. (2024) Mountain sickness in altitude inhabitants of Latin America: A systematic review and meta-analysis. *PLoS ONE* 19(9): e0305651.
- [3] Gou QL, Shi RF, Zhang X, et al. The prevalence and risk factors of high-altitude pulmonary hypertension among native Tibetans in Sichuan Province, China. *European heart journal* 2020;41(Supplement_2).
- [4] Ma R, Norbo K, Zhu Y, et al. Chemical proteomics unveils that seventy flavors pearl pill ameliorates ischemic stroke by regulating oxidative phosphorylation. *Bioorganic chemistry* 2024;145:107187.
- [5] World Health Organization. Neglected tropical diseases[EB/OL]. [cited 2026-05-19]. <https://www.who.int/health-topics/neglected-tropical-diseases>.

THE IMPACT OF TIBETAN MADICAL BATH DEVELOPMENT ON THE ADVANCEMENT OF TIBETAN MEDICINE

Rinqing Duojie

University of Tibetan Medicine, Lhasa, China

The evolution of Tibetan madical bath has significantly influenced the comprehensive development of Tibetan Medicine, serving as a pivotal catalyst for its preservation, practical application, industrialization, and cultural propagation.

From a theoretical perspective, Tibetan madical bath is deeply embedded in the foundational principles of Tibetan Medicine, including the “Five Elements” (earth, water, fire, wind, space) and the “Three Humors” (rLung, mKhris pa, Bad kan) theories, with its earliest documentation in the seminal Tibetan medical text, The Four Tantras. Its inclusion in UNESCO’s Representative List of the Intangible Cultural Heritage of Humanity in 2018 has not only elevated global awareness but also spurred extensive research into the theoretical framework of Tibetan Medicine, thereby reinforcing the preservation of traditional knowledge and specialized madical bath techniques.

Clinically, Tibetan madical bath has demonstrated substantial therapeutic efficacy in managing conditions such as rheumatism, stroke sequelae, lumbar disorders, dermatological conditions, and certain gynecological ailments. Beyond its therapeutic applications, most Tibetan medical institutions like have extended its use to health maintenance, wellness, and rehabilitation, exemplified by the introduction of facial bath programs. This expansion has broadened the clinical applications of Tibetan Medicine, addressing the diverse health needs of contemporary society.

Industrially, the increasing demand for Tibetan madical bath has driven the growth of upstream and downstream sectors within the Tibetan Medicine industry. Enterprises such as the Tibet Ganlu Tibetan Medicine Industry Group have established comprehensive industrial chains encompassing the cultivation, research and development, production, and distribution of Tibetan medicinal materials. From January to September 2024, the combined industrial output of 17 Tibetan medicine manufacturers in Tibet surpassed 2.5 billion yuan, reflecting an optimized industrial structure and enhanced economic vitality.

Culturally, as an integral component of Tibetan Medicine, Tibetan madical bath has emerged as a key medium for cultural dissemination. Some regions in Xizang, initiatives such as health lectures, free medical consultations, and the “Tibetan madical bath into Villages” program have effectively disseminated related knowledge to the public. Concurrently, the utilization of new media platforms and international cultural exchanges have amplified the domestic and global influence of Tibetan Medicine, fostering greater recognition of its cultural significance.

POSTER **PO 9**

Keywords: Traditional Medicine, Medicinal Plant, sub-Saharan Africa, Capacity building

References:

- [1] World Health Organization Regional Office for Africa, *Guidelines for Registration of Traditional Medicines in the African Region* **2010**.
- [2] A.C.S. Vissoh, J.R. Klotoé, L. Fah, E. Agbodjento, H. Koudokpon, E. Togbe, S. Saïdou, V. Dougnon, *Journal of Ethnobiology and Ethnomedicine* **2024**, 20, 47

MECHANISTIC AND METABOLOMIC EVALUATION OF ETHNOMEDICINAL AGENTS FOR NEPHROPROTECTION USING INTEGRATED IN VIVO, IN VITRO, AND NETWORK PHARMACOLOGY STRATEGIES

Aftab Alam^{1,2}, Bushra Parveen^{1,2}, Sayeed Ahmad^{3*}

¹Centre of Excellence in Unani Medicine (Pharmacognosy and Pharmacology) Bioactive Natural Product Laboratory, Jamia Hamdard, New Delhi-110062

²Department of Pharmacology, School of Pharmaceutical Education & Research, Jamia Hamdard, New Delhi 110062

³Department of Pharmacognosy, School of Pharmaceutical Education & Research, Jamia Hamdard, New Delhi-110062
aftabalam_sch@jamiahamdard.ac.in

Ethnopharmacological relevance: Traditional Unani drugs are widely reported for nephroprotection, yet systematic validation spanning network pharmacology, metabolomics, and in-vitro remains limited.

Aim of the study: This study aims to validate the nephroprotective claims of Unani medicinal plants by network pharmacology, metabolomics and in vitro study of standardized extracts along with development of synergy-based polyherbal for nephroprotection.

Materials and methods: In silico analysis of CS (*Cucumis sativus*), NS (*Nigella sativa*) and TT (*Tribulus terrestris*) was done to evaluate the nephroprotective potential, KEGG enriched pathways and Gene Ontology. Plant materials were collected, microscopically authenticated, and extracted by reflux. Extracts were evaluated for total phenolics (TPC), total flavonoids (TFC), antioxidant capacity (DPPH, FRAP) and HPTLC analysis produced reproducible fingerprints and specific marker was quantified. In vitro study also done on HEK-293 renal cells for cytoprotection. Synergy among screened extracts was developed via dose-response modeling using isobologram analysis through combination index to select an optimized ratio.

Results: The in-silico analysis revealed that CS, NS and TT have nephroprotective potential. Several compounds were retrieved among which dithymoquinone, apirole, harmine and linoleic acid were important. A PPI network was constructed and TNF, AKT1, IL6 and SRC Hub genes were identified. All the selected plants showed a higher amount of TPC and TFC and robust radical-scavenging. HPTLC fingerprinting showed many separated bands, each band correspond to different metabolites. Cucurbitacin, thymoquinone, and steroidal saponin showed the presence in CS, NS, and TT respectively with a significant amount. The optimized combination showed synergistic cytoprotection through in-vitro study.

Conclusion: This study validates the nephroprotective potential of CS, NS, and TT using network pharmacology, metabolomics, and in-vitro studies. The optimized synergy-based polyherbal combination demonstrated significant cytoprotection, supporting its further development.

Acknowledgements: Authors are thankful for financial support to create the facilities of Centre of Excellence in Unani medicine (Pharmacognosy and Pharmacology), Jamia Hamdard, Ministry of Ayush, Government of India (S-12013/2/2021-SCHEME, 24 March 2022).

References:

- [1] Gaurav, Zahiruddin, S., Parveen, B., Ibrahim, M., Sharma, I., Sharma, S., Sharma, A. K., Parveen, R., & Ahmad, S. TLC-MS bioautography-based identification of free-radical scavenging, α -amylase, and α -glucosidase inhibitor compounds of anti-diabetic tablet BGR-34. *ACS Omega*, **2020**, 5(46), 29688–29697.
- [2] Khan, M. A., Srivastava, V., Kabir, M., Samal, M., Insaf, A., Ibrahim, M., Zahiruddin, S., & Ahmad, S. Development of Synergy-Based Combination for Learning and Memory Using in vitro, in vivo and TLC-MS-Bioautographic Studies. *Frontiers in Pharmacology*, **2021**, 12, 678611. <https://doi.org/10.3389/fphar.2021.678611/full>

MEDICINAL PLANTS IN POLYCYSTIC OVARY SYNDROME (PCOS): A MECHANISM-BASED ETHNOPHARMACOLOGICAL MAPPING OF TRADITIONAL USE

Irmak Alev Çetinkaya^{1,2}, Diren Ergin^{2,3}

¹ Department of Pharmacognosy and Natural Product Chemistry, Institute of Health Sciences, Bezmialem Vakif University, Türkiye

² Department of Pharmacognosy, Altinbas University, Türkiye

³ Natural Product Research and Development Center, Altinbas University, Türkiye
irmak.alev1@altinbas.edu.tr

Ethnopharmacological relevance: Polycystic ovary syndrome (PCOS) is a complex endocrine and reproductive disorder characterized by polycystic ovaries, irregular menstruation, hyperandrogenism and metabolic disturbances. In traditional medicine, medicinal plants are used to manage symptoms of PCOS such as menstrual irregularities, hyperandrogenic symptoms and metabolic complications ^[1].

Aim of the study: The aim of this study is to map medicinal plants traditionally used for PCOS-related symptoms and to classify their reported pharmacological effects according to hormonal, metabolic and anti-inflammatory/antioxidant mechanisms.

Materials and methods: Literature search was conducted using PubMed, Scopus and Google Scholar databases. The ten most frequently reported medicinal plants in the reviewed literature were first recorded separately and then classified according to traditional use and mechanism group. Ethnobotanical and pharmacological studies were included in this study.

Results: Ethnobotanical studies reveal that these plants have traditionally been used to manage reproductive and metabolic symptoms associated with PCOS. Medicinal plants such as *Vitex agnus-castus* L. and *Paeonia lactiflora* Pall. are reported to have effects on hormonal balance, while *Cinnamomum* spp. and *Trigonella foenum-graecum* L. are reported to play a regulatory role in insulin resistance and glucose metabolism. Furthermore, plants such as *Curcuma longa* L. and *Nigella sativa* L. are noted for their anti-inflammatory and antioxidant effects ^[2]. These findings demonstrate that the effects of these plants occur in a multi-targeted way through hormonal, metabolic and anti-inflammatory/antioxidant mechanisms and traditional uses of these plants may be linked to different symptoms and mechanisms involved in PCOS.

Conclusion: The findings suggest a partial overlap between ethnobotanical uses and reported pharmacological effects. The effects of medicinal plants appear to be associated with the simultaneous modulation of hormonal, metabolic and anti-inflammatory/antioxidant processes rather than being explained by a single mechanism. Therefore, further well-designed clinical and pharmacological studies are required to validate their potential role in PCOS management.

References:

- [1] S. Arentz et al., *BMC Complementary and Alternative Medicine* **2014**, 14, 511.
[2] W. Jung et al., *Heliyon* **2023**, 9(10), e20889.

ETHNO-OBSTETRICS AND PERINATAL BOTANY IN THE CENTRAL APENNINES: THE MIDWIFE BETWEEN TRADITION AND EVIDENCE-BASED MEDICINE (EBM)

Barbara Alfieri, Anna Angeloni, Michela Bonifazi

¹ Master's Degree in Nursing and Midwifery Sciences, University of Perugia, Italy
barbaralfieri76@gmail.com

Ethnopharmacological relevance: In post-unification Italy, the municipal midwife served as institutional mediator between emerging biomedical knowledge and traditional remedies of the mammane of the central Apennines. For over a century, she practiced empirical pharmacovigilance in isolated rural settings, selecting herbal remedies (*Silybum marianum*, *Trigonella foenum-graecum*, *Calendula officinalis*, *Capsella bursa-pastoris*, *Galega officinalis*) for puerperal women as tools of cultural negotiation to introduce new hygienic protocols (antisepsis). This study investigates how such practices may find legitimacy within EBM and ethnonursing[1,2].

Aim of the study: To explore the historical-anthropological roots of midwife botanical knowledge; to analyse scientific evidence on the main perinatal botanical taxa, assess methodological quality and identify research gaps for integrating traditional knowledge with evidence-based clinical practice.

Materials and Methods: Narrative review with a historical-anthropological and ethnopharmacological approach. Primary and secondary sources: Umbrian-Marchean municipal archives, oral tradition, documented by the Seppilli school[1], RCTs, systematic reviews and observational studies[2]. Assessment of risk of bias, sample size and outcome standardisation.

Results: A heterogeneous but promising picture emerges. *Silybum marianum* shows the strongest evidence: the micronised formulation demonstrates +85% milk production vs +32% in the placebo group[3]. *Trigonella foenum-graecum* and *Calendula officinalis* show low-to-moderate evidence as galactagogues and for perineal healing post-episiotomy[5]. *Capsella bursa-pastoris* has one promising RCT on postpartum haemorrhage[4]. *Galega officinalis*, despite a solid pharmacological rationale, lacks monotherapy RCTs. Limitations: samples n<100, outcome heterogeneity, inadequate blinding, absence of phase III multicentre trials. These constraints guide future research without invalidating the historical value of these taxa.

Conclusions: The transition from empirical herbal remedies to modern standardised phytotherapeutic formulations marks the evolution of obstetric ethnopharmacology. Limitations in the literature do not invalidate empirical observation, but represent an opportunity to promote rigorous multicentre studies with predefined outcomes. Integrating this heritage into EBP would enable culturally competent care, honoring midwifery roots while building an evidence-based future.

References:

- [1] T. Seppilli (ed.), *Le tradizioni popolari in Umbria* 1989, Electa Editori Umbri, Perugia.
- [2] P.M. Guarrera, *Usi e tradizioni della flora italiana. Medicina popolare ed etnobotanica* 2006, Aracne Editrice, Roma.
- [3] F. Di Pierro, A. Callegari, D. Carotenuto, M.M. Tapia, *Acta Biomedica* 2008, 79(3), 205-210.
- [4] S. Ghalandari, N. Kariman, Z. Sheikhan, F. Mojab, M. Mirzai, *J Altern Complement Med* 2017, 23(10), 798-804.
- [5] F. Eghdampour, F. Jahdie, M. Kheyrkhan, M. Taghizadeh, S. Naghizadeh, H. Haghani, *J Caring Sciences* 2013, 2(4), 279-286.

PHYTOCHEMICAL PROFILING AND *IN SILICO* EVALUATION OF ANTI-ALLERGIC POTENTIAL OF *MENTHA SPICATA* FROM SAUDI ARABIA

Shaza Al-Massarani¹, Ali ElGamal¹, Md Tabish Rehman¹, Rabab El Dib²

¹College of Pharmacy, King Saud University, Saudi Arabia

²Faculty of Pharmacy, Helwan University, Egypt
salmassarani@ksu.edu.sa

Ethnopharmacological relevance: *Mentha spicata* L. (Lamiaceae) is traditionally used in Saudi Arabia and Yemen to manage respiratory and inflammatory conditions, including allergy-related symptoms. Aromatic medicinal plants from these regions are rich in bioactive compounds with notable pharmacological activities [1]. Phenolic constituents, such as rosmarinic acid, are associated with anti-inflammatory and antioxidant effects [2,3].

Aim of the study: To profile the phytochemical constituents of *M. spicata* and evaluate their potential anti-allergic and anti-inflammatory activities using *in silico* molecular docking.

Materials and methods: The aerial parts of *M. spicata*, collected from the Abha region (southwestern Saudi Arabia), were subjected to phytochemical investigation using various chromatographic techniques. The identified compounds were evaluated through molecular docking against the histamine H1 receptor (HRH1) (PDB ID: 3RZE), and cyclooxygenase-2 (COX-2). Binding affinities were compared with standard reference drugs (cetirizine and celecoxib). Structure–activity relationship (SAR) analysis was performed to identify key functional features influencing activity, supported by previously reported *in silico* studies on phenolic acids and flavonoids [4].

Results: Major compounds included flavonoids and phenolic acids such as luteolin, apigenin, vitexin, linarin, luteolin-7-O-glucoside, rosmarinic acid, caffeic acid, naringenin, cosmosiin, and protocatechuic acid [5]. Luteolin and rosmarinic acid showed strong binding to HRH1 (−9.5 and −9.9 kcal/mol), outperforming the reference antihistamine cetirizine (−7.3 kcal/mol), and also demonstrated high affinity for COX-2 (−9.2 and −8.2 kcal/mol), approaching that of celecoxib (−10.2 kcal/mol). SAR analysis indicated that catechol moieties and C2–C3 double bonds enhance receptor binding, while glycosylation reduces activity.

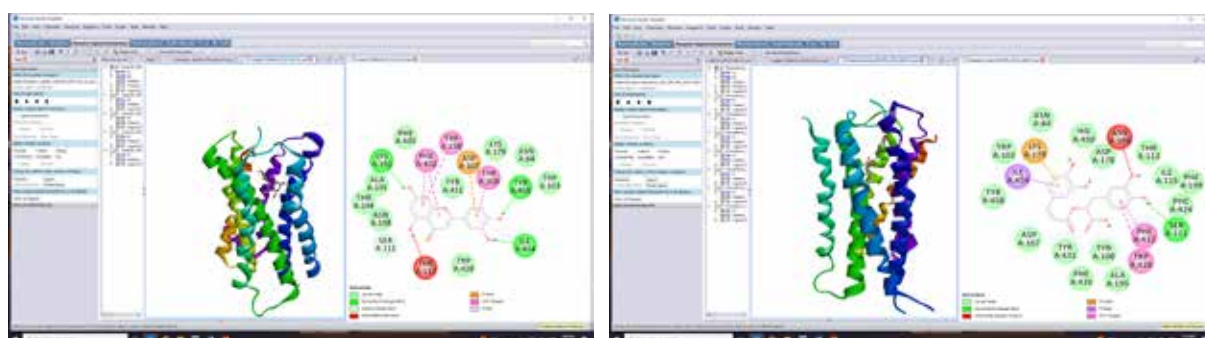


Figure 1. Molecular interaction between Luteolin, Rosmarinic acid and HRH1

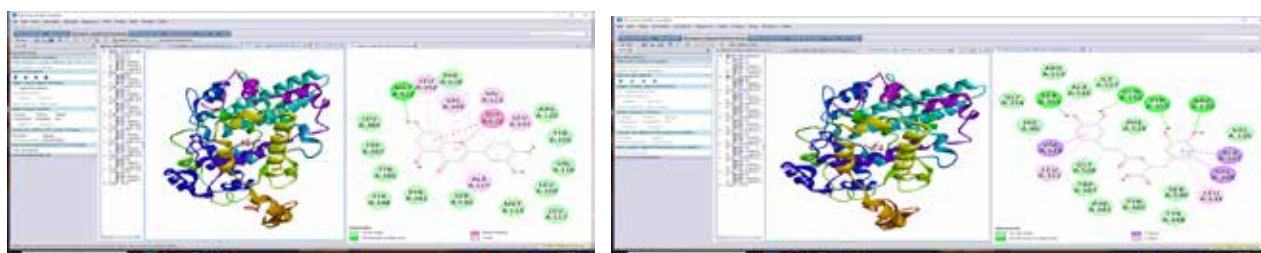


Figure 1: Molecular interaction between Luteolin, Rosmarinic acid and COX-2

Conclusion: *M. spicata* represents a promising source of multi-target bioactive compounds with potential anti-allergic activity. These findings support its traditional use and warrant further experimental validation.

References:

- [1] Chhetri BK, Ali NAA, Setzer WN. *Medicines* (Basel). **2015**, 2(2), 67–92.
- [2] Shekarchi M, et al. *Pharmacogn Mag*. **2012**, 8(29), 37–41.
- [3] Guan H, et al. *Molecules*. **2022**, 27(10), 3292.
- [4] El-Mageed, H.R.A, et al. *Biologics* **2021**, 1, 416-434.
- [5] El Machrafi S, et al. *J Ecol Eng*. **2025**, 26(1), 164–177.

MAPPING TRADITIONAL MEDICINAL PLANT KNOWLEDGE IN PORTUGAL: A SCOPING REVIEW OF ETHNOBOTANICAL AND ETHNOPHARMACOLOGICAL STUDIES

Renata Almeida¹, Olga Silva¹, Luís Carvalho²

¹ iMed.Ulisboa — Research Institute for Medicines, Faculty of Pharmacy, Universidade de Lisboa, Portugal

² Botanical Museum, Beja Polytechnic University, Campus do IPBeja, Portugal

renata.raimundo@edu.ulisboa.pt

Ethnopharmacological relevance: Traditional medicinal plant knowledge in Portugal reflects long-standing interactions between communities, local floras and therapeutic practices. Systematic mapping is needed to safeguard biocultural heritage, identify underrepresented territories and support future ethnopharmacological research.

Aim of the study: To map and critically synthesize ethnobotanical and ethnopharmacological studies conducted in Portugal, assessing medicinal plant uses, geographic coverage, sociocultural contexts, methodological approaches and the temporal evolution of published studies.

Materials and methods: A scoping review was conducted according to PRISMA-ScR principles. Peer-reviewed articles, academic theses, reference works and grey literature were retrieved from PubMed, Web of Science, Scopus and complementary academic sources. Eligible records reported original data on medicinal plant use in Portugal. Extracted variables included publication period, study region, plant taxa, vernacular uses, preparation methods, therapeutic indications, informant-related information and methodological features.

Results: Approximately 140 bibliographic references were identified covering mainland Portugal, Madeira and the Azores. A marked geographic asymmetry was evidenced with a strong concentration of field work in northeastern Portugal, particularly Bragança and Vila Real. The number of studies increased markedly after the 1990s, reflecting growing academic interest in Portuguese ethnobotany and ethnopharmacology, although research intensity remained uneven across regions. The studies document diverse medicinal taxa and uses, with digestive, respiratory, dermatological and inflammatory conditions among the most frequent therapeutic categories. Recurrent families and species occur across regions, whereas some uses show local or cultural specificity. Methodological reporting was heterogeneous, particularly regarding sampling, interview procedures, quantitative indices and taxonomic documentation.

Conclusion: Portuguese ethnobotanical literature constitutes a substantial, but unevenly distributed, evidence base. This review identifies priority regions for new fieldwork and supports traditional medicinal plant knowledge as a basis for pharmacological research, conservation strategies and sustainable valorization of plant resources.

PHYTOCHEMICAL PROFILING AND ACTIVITY OF *SIDA RHOMBIFOLIA* L. (MALVACEAE) EXTRACTS AGAINST *SCHISTOSOMA MANSONI* CERCARIAE

Flávio Luís Beltrame¹, Debora Bueno¹, Anna Claudia Morais de Oliveira Capote¹, Larissa Rodrigues¹, Rosimeire Nunes de Oliveira¹, Airon Kist¹, Jane Manfron¹, Evelin Lemos de Oliveira², Silmara Marques Allegratti³

¹ State University of Ponta Grossa (UEPG), Brazil

² State University of Maringa (UEM), Brazil

³ State University of Campinas (UNICAMP), Brazil.

flaviobeltra@gmail.com

Ethnopharmacological relevance: *Sida rhombifolia* L. (popularly known as guanxuma) is notable for its wide distribution and ethnopharmacological relevance^[1]. In Brazil, it is widely used in the treatment of several diseases, such as malaria, gastrointestinal infections, diarrhea, and mainly for helminthic infections^[2,3]. The prevalence of alkaloids and phenolic compounds (flavonoids, tannins and phenolic acids) in the species may account for its ethnopharmacological properties^[1,4].

Aim of the study: To characterize the chemical profile of *S. rhombifolia* extracts and assess their antiparasitic activity against larval infectious stages of *Schistosoma mansoni*.

Materials and methods: *Sida rhombifolia* leaves, roots and stems were subjected to extraction using water (1:5, w/v; infusion (Leaves AI) and decoction (Roots AD and Stems AD)) and the leaves also were subjected to a hydroalcoholic (80:20, v/v) maceration extraction (1:5, w/v; dynamic maceration (Leaves HM)). Phytochemical screening was performed using pharmacognostic color tests and high-performance liquid chromatography (HPLC) coupled with diode array (DAD) detector and mass spectrometry (ESI-MS). Subsequently, Principal Component Analysis (PCA) was performed using chemical data. At the same time, *S. mansoni* cercariae were obtained from infected *Biomphalaria glabrata* snails and exposed to artificial illumination for 1h, distributed on 24-well culture plates (100 cercariae/well) in a final volume of 2 mL and exposed to different extract concentrations (25, 100, 250, 500 µg/mL). Cercarial mortality was monitored from 30 minutes to 24 hours, with immobility and structural damage used as indicator of death.

Results: The preliminary phytochemical tests of the *S. rhombifolia* extracts identified different classes of secondary metabolites (Table 1). The ESI-MS/MS evaluation tentatively identified mainly the presence of phenolic compounds (Table 2). The PCA data (Figure 1) displayed four different clusters (attributed to variations in composition and quantity of the compounds in the extracts). The different extracts exhibited cercaricidal activity with mortality increasing in a concentration and time-dependent manner, with a complete mortality (100%) achieved with the leaves HM extract in 30 minutes.

Conclusion: The chemical analyses allowed to infer the presence of saponins, alkaloids and phenolic compounds in *S. rhombifolia* extracts; Some compounds extracted using hydroalcoholic mixture (leaves HM extract) are related to cercaricidal activity. Further studies are being done to identify the compounds present in this extract that may contribute to the observed activity.

Phytochemicals	Leaves AI	Leaves HM	Roots AD	Stems AD
Saponins	++	+	+++	+
Alkaloids	-	+	+	+
Tannins	+	+	+	+
Flavonoids	+	+	+	+

(+) presence; (++) moderate presence; (+++) high presence; and (-) absence.

Table 1- Secondary metabolites of *Sida rhombifolia* in different extracts.

Compound	Molecular Formula	Fragments (m/z)	Presence (part of plant)
<i>p</i> -Hydroxybenzoic acid	C ₇ H ₆ O ₃	137 > 93	Leaves HM; Leaves AI; Stems AD and Roots AD
Protocatechuic acid	C ₇ H ₆ O ₄	153 > 109	Leaves HM; Leaves AI; Stems AD and Roots AD
<i>p</i> -Coumaric acid	C ₉ H ₈ O ₃	163 > 119	Leaves HM; Leaves AI and Stems AD
Caffeic acid	C ₉ H ₈ O ₄	179 > 135	Leaves HM; Leaves AI; Stems AD and Roots AD
Ferulic acid	C ₁₀ H ₁₀ O ₄	193 > 134	Leaves HM; Leaves AI and Stems AD
Protocatechuic acid glycoside	C ₁₃ H ₁₆ O ₉	315 > 153	Leaves HM; Leaves AI and Roots AD
Rosmarinic acid	C ₁₈ H ₁₆ O ₈	359 > 161	Leaves HM; Leaves AI; Stems AD and Roots AD
<i>trans</i> -Cinnamic acid	C ₉ H ₈ O ₂	147 > 103	Leaves HM and Stems AD
Isorhamnetin	C ₁₆ H ₁₂ O ₇	315 > 300	Leaves AI
Gallic acid	C ₇ H ₆ O ₅	169 > 125	Stems AD

Table 2- HPLC-MS data of phenolics fraction from *Sida rhombifolia*.

POSTER PO 15

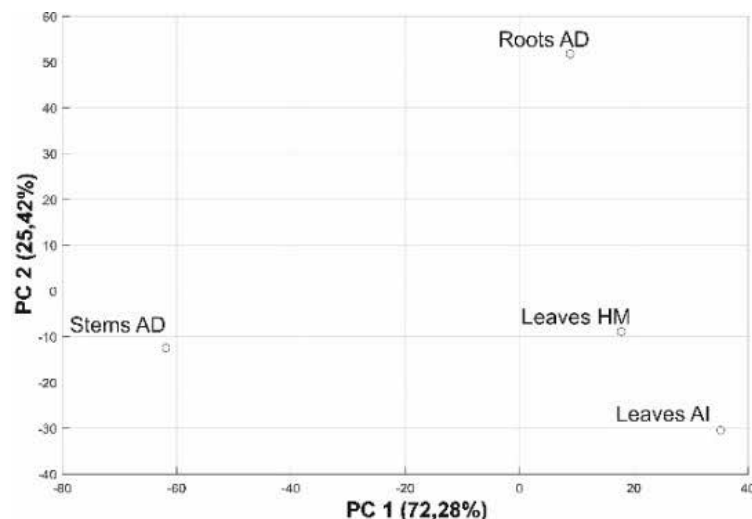


Figure 1 - Score plot of HPLC-PDA data: PC1 (72.28%) vs PC2 (25.42%).

Acknowledgements: This research was funded by Fundação Araucária (Paraná, Brazil) (Research Grant 460/2024) Postgraduate Pharmaceutical Sciences Programme and UEPG. The authors gratefully acknowledge this financial support.

References:

- [1] N.S. AMINAH, et al. Secondary metabolite compounds from *Sida* genus and their bioactivity **2021**, Vol 7, e07855, 2021.
- [2] B. DINDA, et al. The genus *Sida* L. – A traditional medicine: its ethnopharmacological, phytochemical and pharmacological data for commercial exploitation in herbal drugs industry **2015**, Vol 176, 135-176.
- [3] M.U. FEMOE, et al. In Vitro Assessment of the Cercaricidal Activity of *Sida acuta* Burm. F. and *Sida rhombifolia* Linn. (Malvaceae) Hydroethanolic Extracts, Cytotoxicity, and Phytochemical Studies **2022**, Vol 2022, 1-17.
- [4] F.C. RODRIGUES; A.F.M. OLIVEIRA. The genus *Sida* L. (Malvaceae): An update of its ethnomedicinal use, pharmacology and phytochemistry **2020**, Vol 132, 432-462.

NEUROPROTECTIVE POTENTIAL OF AQUEOUS EXTRACT OF BACOPA MONNIERI IN AN ADULT ZEBRAFISH MODEL OF HIGH-FAT DIET-INDUCED TYPE 2 DIABETES-ASSOCIATED COGNITIVE IMPAIRMENT

Md Reyaz Alam^{1,2}, Sanjay Tamoli³, Bushra Parveen^{1,2*}, Sayeed Ahmad^{2,4*}

¹Department of Pharmacology, School of Pharmaceutical Education and Research, Jamia Hamdard, New Delhi, India

²Centre of Excellence in Unani Medicine (Pharmacognosy and Pharmacology), Bioactive Natural Products Laboratory, School of Pharmaceutical Education and Research, Jamia Hamdard, New Delhi, India

³Director, Target Institute of Medical Education and Research, Mumbai, India

⁴Department of Pharmacognosy, School of Pharmaceutical Education and Research, Jamia Hamdard, New Delhi, India

Ethnopharmacological relevance: Traditional *Bacopa monnieri* (Brahmi; Plantaginaceae) is a well-known Ayurvedic *medhya rasayana* traditionally used to enhance memory and manage age-related cognitive decline. With increasing evidence linking high-fat diet (HFD)-induced obesity and type 2 diabetes to cognitive impairment, evaluating its neuroprotective potential in metabolic-associated dementia is ethnopharmacologically significant.

Aim of the study: To investigate the neuroprotective effects and underlying mechanisms of aqueous extract of *Bacopa monnieri* (AEBM) in high-fat diet-induced cognitive impairment using an adult zebrafish model.

Materials and methods: Adult zebrafish were exposed to an oil-enriched HFD for 6 weeks and divided into four groups: CTRL, BM, HFD, and HFD+BM (low/high dose). AEBM (0.25–1.0 g/L) was administered via overnight immersion (5 days/week). Metabolic parameters (body weight, fasting glucose, lipid profile, hepatic steatosis), behavioural assays (novel tank diving, Y-maze, recognition memory), blood–brain barrier (BBB) integrity (Evans Blue), oxidative stress markers (MDA, 4-HNE, SOD, CAT, GPx, GSH), inflammatory markers (nfkb, tnfa, il1 β , il6), neurogenesis markers (PCNA, Ki-67), and signalling pathways (AChE, BDNF, Nrf2/HO-1, SIRT1, IGF-1, GLP-1R) were evaluated.

Results: HFD induced obesity, hyperglycaemia, dyslipidaemia, and hepatic steatosis, along with anxiety-like behaviour, cognitive deficits, BBB disruption, oxidative stress, neuroinflammation, and reduced neurogenesis. AEBM treatment significantly improved metabolic parameters, restored behavioural performance, preserved BBB integrity, reduced oxidative and inflammatory markers, and enhanced neurogenesis and neuroprotective signalling in a dose-dependent manner.

Conclusion: The study demonstrates that *Bacopa monnieri* exerts significant neuroprotective effects against HFD-induced cognitive impairment through multi-target mechanisms, supporting its potential as a therapeutic candidate for diabetes-associated neurodegeneration.

Acknowledgements: Authors are thankful for financial support to create the facilities of Centre of Excellence in Unani medicine (Pharmacognosy and Pharmacology), Jamia Hamdard, Ministry of Ayush, Government of India (S-12013/2/2021-SCHEME, 24 March 2022).

References:

- [1] Ertas, B., Hazar-Yavuz, A. N., Topal, F., Keles-Kaya, R., Karakus, Ö., Ozcan, G. S., Taskin, T., & Cam, M. E. Rosa canina L. improves learning and memory-associated cognitive impairment by regulating glucose levels and reducing hippocampal insulin resistance in high-fat diet/streptozotocin-induced diabetic rats. *Journal of Ethnopharmacology*, 2023, 313, 116541.
- [2] Ghaddar, B., Veeren, B., Rondeau, P., Bringart, M., Lefebvre d'Hellencourt, C., Meilhac, O., Bascands, J. L., & Diotel, N. Impaired brain homeostasis and neurogenesis in diet-induced overweight zebrafish: a preventive role from *A. borbonica* extract. *Scientific Reports*, 2020, 10(1), 14496.

MULTISCALE INTERACTOME-GUIDED PRIORITIZATION OF CANDIDATE HERBS AND ACTIVE COMPOUNDS FOR HEPATIC CIRRHOSIS USING A BIASED RANDOM WALK ALGORITHM

Jun-Ho Lee^{a,†}, Seon-Been Bak^{b,c,†}, Jeong-Su Yang^d, Won-Yung Lee^{d,e}, Yun-Kyung Kim^{a,f}

^a College of Herbal Medicine, Wonkwang University, Iksan 54538, Republic of Korea

^b School of Korean Medicine, Dongguk University, Gyeongju 38066, Republic of Korea

^c Department of Nutritional Science and Food Management, Ewha Womans University, Seoul 03760, Republic of Korea

^d College of Korean Medicine, Wonkwang University, Iksan 54538, Republic of Korea

^e Research Center of Traditional Korean Medicine, Wonkwang University, Iksan 54538, Republic of Korea

^f Wonkwang Oriental Medicines Research Institute, Wonkwang University, Iksan 54538, Republic of Korea

[†] These authors contributed equally to this work.

qwnsgph8268@gmail.com

Ethnopharmacological relevance: Hepatic cirrhosis is the end stage of chronic liver injury, and no disease-modifying anti-fibrotic therapy is approved. Herbal medicines have long been used for liver disorders in East Asian traditional medicine, and trials of Biejia-Ruangan and Fuzheng Huayu^[1,2] report fibrosis regression, motivating systematic prioritisation of individual herbs and constituents.

Aim of the study: To prioritise candidate herbs and active compounds for hepatic cirrhosis on a multiscale interactome using a biased random-walk algorithm, and to generate mechanistic hypotheses for those lacking reported evidence.

Materials and methods: Herb–compound associations for 478 herbal medicines were retrieved from the OASIS database and mapped to experimentally supported compound–target interactions (DrugBank, TTD, STITCH). Cirrhosis-associated proteins were curated from DisGeNET. Diffusion profiles for the disease and for each herb and compound were generated on the multiscale interactome^[3] by biased random walk, and candidates ranked by profile correlation and hypergeometric target overlap. KEGG/GO enrichment and disease-focused subnetworks were analysed.

Results: Ten herbs were prioritised, led by *Cynanchi Atrati Radix et Rhizoma* (*Vincetoxicum atratum* (Bunge) C. Morren & Decne. and *V. versicolor* (Bunge) Decne.), all with significant target overlap (enrichment 3.88–6.79). The herb–target network comprised 261 targets and 500 edges, 74 shared by three or more herbs. Enrichment converged on TNF, Toll-like receptor, NF- κ B signalling and apoptosis, with VEGF, HIF-1, MAPK and PI3K–Akt signals. Herbs with existing hepatoprotective literature were set aside; compound-level analysis focused on those lacking curated evidence: bergapten from *Saposhnikovia Radix* (*Saposhnikovia divaricata* (Turcz. ex Ledeb.) Schischk.), linked to JAK–STAT and TNF nodes, and oleic and octadecanoic acid from *Fritillariae Cirrhosae Bulbus* (*Fritillaria cirrhosa* D. Don and related species) were nominated as underexplored actives.

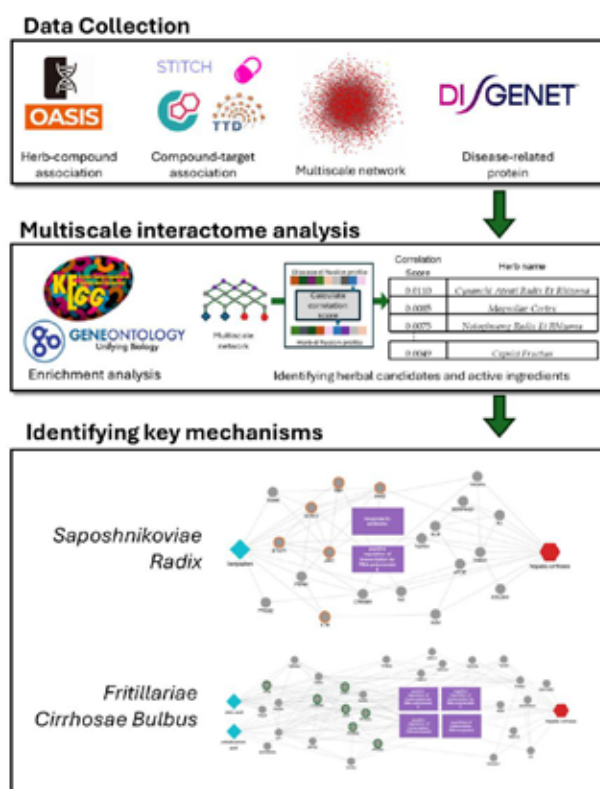


Figure 1: Overall workflow of the multiscale interactome-based prioritisation framework.

POSTER **PO 17**

Conclusion: The framework recovers known hepatoprotective herbs and nominates underexplored herbs and compounds with testable mechanistic hypotheses for hepatic cirrhosis.

Acknowledgements: *This work was supported by Wonkwang University in 2026.*

References:

- [1] G. Rong, Y. Chen, Z. Yu, Q. Li, J. Bi, L. Tan, D. Xiang, Q. Shang, C. Lei, L. Chen, et al., *The Journal of Infectious Diseases* 2022, 225, 1091–1099.
- [2] T. Hassanein, D. Tai, C. Liu, T.D. Box, M.J. Tong, L. Rossaro, R. Pozza, J.S. Glenn, R. Cheung, A. Hemaïdan, et al., *Evidence-Based Complementary and Alternative Medicine* 2022, 2022, 4494099.
- [3] C. Ruiz, M. Zitnik, J. Leskovec, *Nature Communications* 2021, 12, 1796.

FROM FIELD TO DRUG DISCOVERY: TOOLS FOR THE ETHNOPHARMACOLOGICAL COMMUNITY

Antigoni Cheilari^{1,2}, Theodora Manika², Michail Tsenos^{2,3}, Christian Ebeling⁴, Vijay Ingalalli⁵, Dimitrios Gunopoulos^{2,3}, Petros Bouras-Vallianatos^{2,6}, Marc Jacobs⁴, Avni Hajdari⁷, Andrea Pieroni⁸, Nektarios Aligiannis^{1,2}

¹ Laboratory of Pharmacognosy and Natural Products Chemistry, Faculty of Pharmacy, School of Health Sciences, National and Kapodistrian University of Athens, 15771 Athens, Greece

² Institute for Ethnopharmacological Studies and Phytotherapy, National and Kapodistrian University of Athens, 15771 Athens, Greece

³ Dept. of Informatics and Telecommunications, National and Kapodistrian University of Athens

⁴ Department of Bioinformatics, Fraunhofer Institute for Algorithms and Scientific Computing (SCAI), Sankt Augustin, 53757, Germany

⁵ PangeAI, Pangea Botanica GmbH, Bernhardstraße 14, 45239 Essen, Germany

⁶ Department of History and Philosophy of Science, National and Kapodistrian University of Athens, 15771 Athens, Greece

⁷ Department of Biology, Faculty of Mathematical and Natural Science, University of Prishtina, Mother Theresa St, Prishtinë, 10000, Republic of Kosovo

⁸ University of Gastronomic Sciences, Piazza Vittorio Emanuele II 9, I-12042 Pollenzo, Italy
cheilarianti@pharm.uoa.gr

Ethnopharmacological relevance: Ethnopharmacology generates vast and heterogeneous datasets — spanning fieldwork, historical manuscripts, and published literature — that remain largely fragmented and underexploited. Computational tools capable of systematically collecting, mining, and integrating this knowledge are urgently needed to accelerate the transition from traditional medicinal knowledge to evidence-based drug discovery.

Aim of the study: Within ETHCSTWIN project, this work presents novel tools designed to support the workflows of ethnobotanists, pharmacognosists, and ethnopharmacologists, and introduce computational methodologies as standard practice within the community.

Materials and methods: The web applications were developed using modern web architecture (relational databases, API-based cross-database queries). Mining tools were developed using machine learning and natural language processing applied to a curated corpus of ethnobotanical literature and digitised manuscripts. Plant identification is standardised through integration with IPNI and WFO. A custom ontology was built from terminology derived from field studies and historical texts, while traditional usages were mapped to ICD-11, MONDO, MeSH and SYMP ontologies. Ethical compliance (Nagoya Protocol, benefit-sharing principles) was ensured throughout.

Results: Three interconnected tools are presented (**Figure 1**): **EthnoBot**, a web application enabling researchers to collect real-time ethnobotanical data using standardized field questionnaires, with instant statistical summaries (plant families, preparation types, use categories) and taxonomy resolved against WFO; **EthnoDBs**, AI-powered literature and manuscript mining tools that extract a) structured ethnobotanical data from published studies (5.6K taxa and 7.3K traditional uses across 1.5K regions with 10K recipes) and b) ancient texts, supported by custom-built domain ontologies; and **PhytoCode**, a web-based platform for querying, exploring and analysing publicly available biochemical, ethnobotanical and taxonomic databases (COCONUT, BRENDA, ChEBI, TaxTree, IPNI, WFO) to facilitate the discovery of pathways linking plants, compounds, medical uses, and diseases.

Conclusion: ETHCSTWIN aggregator provides a unified computational infrastructure for ethnobotanical and ethnopharmacological research, connecting field documentation, knowledge mining, and drug discovery in a single interoperable environment.

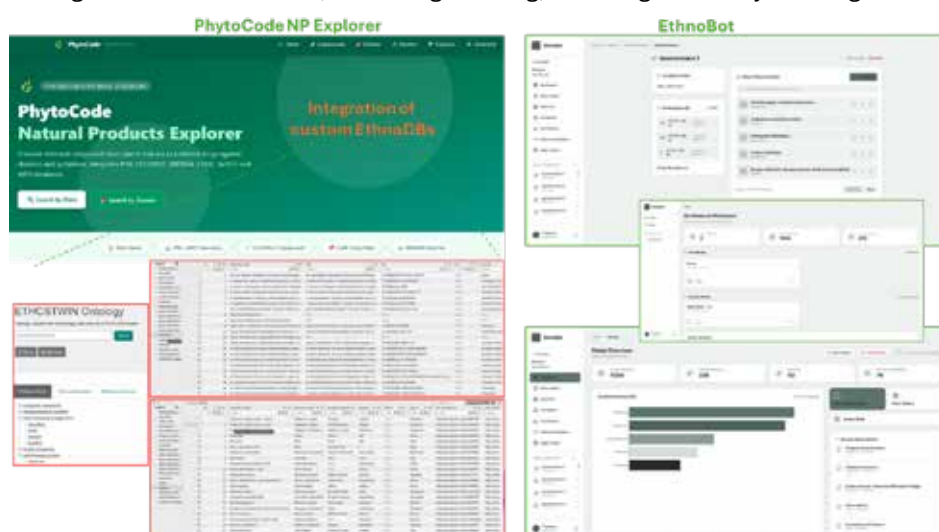


Figure 1: Open digital tools incorporated in ETHCSTWIN aggregator

Acknowledgements: This work was funded under the European HORIZON-WIDERA-2023-Twinning Bottom-Up project “ETHCSTWIN: Reinforcing the Scientific Excellence of the Institute for Ethnopharmacological Studies and Phytotherapy (IESP) through Twinning with Computer Science (CS)”, id: 101159928.

COMPARATIVE ANALYSIS OF ETHNOBOTANICAL KNOWLEDGE ACROSS COMMUNITIES IN THE GJIROKASTËR REGION (SOUTHERN ALBANIA) AND THE TZOUMERKA AREA, EPIRUS (NORTHWESTERN GREECE)

Evanthia Dina^{1,2}, Ioanna Maltezos¹, Ani Bajrami³, Nektarios Aligiannis^{1,2}, Avni Hajdari⁴, Andrea Pieroni⁵

¹ Department of Pharmacognosy and Natural Products Chemistry, Faculty of Pharmacy, NKUA, Panepistimiopolis Zografou, 15771, Athens, Greece

² Institute for Ethnopharmacological Studies and Phytotherapy, NKUA, Panepistimiopolis Zografou, 15771, Athens, Greece

³ Faculty of Natural Sciences, Museum of Natural Sciences "Sabiha Kasimati", University of Tirana, Rruga Petro Nini Luarasi 76, 1010 Tirana, Albania

⁴ Department of Biology, Faculty of Mathematics and Natural Sciences, University of Prishtina "Hasan Prishtina", 10000 Prishtina, Kosovo

⁵ University of Gastronomic Sciences, Piazza Vittorio Emanuele 9, 12060 Bra/Pollenzo, Italy
euantina@phatm.uoa.gr

Ethnopharmacological relevance: Over the centuries, people around the world have utilised a wide range of herbs not only for nutritional purposes but also for the treatment and prevention of numerous diseases. In many countries, traditional medicine remains an important option, as herbal remedies are more readily accessible and often more affordable for local populations.

Aim of the study: This study compares the ethnobotanical knowledge of local communities in the Gjirokastrë area (Southern Albania) and the Tzoumerka area (Epirus, Greece) - neighboring regions that share a rich, diverse flora and a strong tradition of orally transmitted medicinal plant use.

Materials and methods: Conducted as part of the European ETHICSTWIN project, the research involved two parallel surveys: the first among Albanian, Aromanian, and Greek communities in Gjirokastrë (16 villages, 84 participants, 28 per ethnic group), and the second among Aromanian and Greek communities in Tzoumerka (17 villages, 70 participants, 35 per ethnic group). The primary objectives were to assess the consistency of plant uses across areas and communities and to evaluate the scientific validity of local ethnobotanical knowledge.

Results: Analysis of 84 and 70 completed questionnaires identified 120 and 160 plant taxa used for nutrition and treating ailments, respectively, with 87 taxa shared between regions and most used for similar purposes. Main reported species were *Allium cepa* L., *Beta vulgaris* L., *Cornus mas* L., *Crataegus monogyna* Jacq., *Hypericum perforatum* L., *Malva sylvestris* L., *Origanum vulgare* subsp. *hirtum* A. Terracc., *Punica granatum* L., *Rosa × damascena* Herrm., *Salvia officinalis* L., *Sempervivum tectorum* L., *Sonchus oleraceus* L., *Taraxacum officinale* F.H. Wigg., *Urtica dioica* L., and *Vitis vinifera* L.

Conclusion: Comparison with scientific literature confirms that many traditional uses are supported by empirical evidence. These results highlight the enduring reliability of local knowledge and the importance of ethnobotanical research for sustainable resource management and the development of local herbal and food product markets.

PROTECTIVE EFFECTS AND MECHANISMS OF MONGOLIAN MEDICINE ZHACHONG SHISANWEI PILL AGAINST H₂O₂-INDUCED PC12 CELL INJURY

Hanqiong Hu^{12†}, Yifan Sun^{1†}, Zhen Yang¹, Limuge Che³, Mingyang Cai⁴⁵, Xiaoxuan Li¹², Xianju Huang⁶, Hurilebagen⁷, Wulanqigige⁷, Wuyunsiriguleng⁸, Liqun Ma⁶, Haiying Tong^{12*}

¹ College of Traditional Chinese Medicine, Beijing University of Chinese Medicine, China

² Institute of Ethnic Medicine, Beijing University of Chinese Medicine, China

³ Medicine Innovation Center for Nationalities, Inner Mongolia Medical University, China;

⁴ Hospital of Pediatrics, The First Affiliated Hospital of Henan University of Traditional Chinese Medicine, China

⁵ Pediatric Medical College, Henan University of Traditional Chinese Medicine, China;

⁶ College of Pharmaceutical Science, South-Central Minzu University, China

⁷ Mongolian Medical College, Inner Mongolia Medical University, China;

⁸ Psychosomatic Medicine Department, Inner Mongolia International Mongolian Hospital, China

Corresponding author: Haiying Tong; E-mail: Haiying.tong@163.com; † Equal contributors

Ethnopharmacological relevance: Zhachong Shisanwei Pill (ZSP) is a traditional Mongolian formulation composed of thirteen medicinal materials and has long been used clinically for ischemic stroke.^[1] Oxidative stress and apoptosis are key pathological events in ischemic neuronal injury.^[2,3]

Aim of the study: This study investigated the neuroprotective effects of ZSP and its potential mechanisms against H₂O₂-induced oxidative injury in PC12 cells, with emphasis on antioxidant response, mitochondrial function, apoptosis, and MAPK signaling.^[4]

Materials and methods: PC12 cells were exposed to H₂O₂ to establish an oxidative stress injury model associated with ischemic stroke. Cells were treated with ZSP-containing serum at 10–100 µg/mL. Cell viability, antioxidant enzyme activities, mitochondrial function, apoptosis-related proteins, and phosphorylation levels of MAPK pathway proteins were evaluated using biochemical assays and molecular analyses.

Results: ZSP treatment dose-dependently improved cell viability, showing a 35% increase compared with the control condition. It enhanced antioxidant enzyme activities and restored mitochondrial function. ZSP also downregulated the pro-apoptotic proteins Bax and cleaved caspase-3 while upregulating the anti-apoptotic protein Bcl-2. Mechanistically, ZSP suppressed activation of the MAPK pathway by reducing phosphorylation of JNK, ERK, and p38 by 42%, 37%, and 51%, respectively.

Conclusion: ZSP exerts neuroprotective effects against H₂O₂-induced PC12 cell injury by coordinating antioxidant actions, preserving mitochondrial function, and regulating apoptosis through inhibition of MAPK signaling.^[4] These findings support the ethnopharmacological relevance of ZSP in the management of ischemic stroke-related neuronal injury.

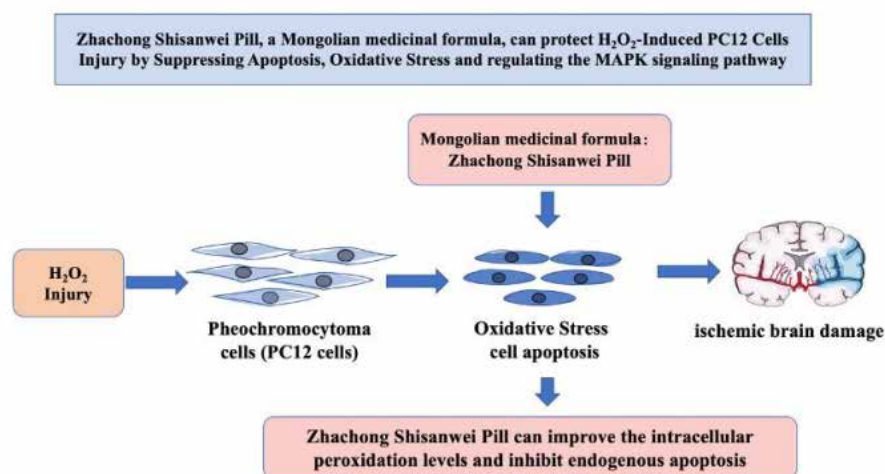


Figure 1: Proposed mechanism by which ZSP protects PC12 cells from H₂O₂-induced oxidative injury through antioxidant, anti-apoptotic, mitochondrial, and MAPK signaling modulation.

Acknowledgements: This work was supported by Major Science and Technology Projects in Inner Mongolia Autonomous Region (2019ZD004).

References:

- [1] Q. Song, L. Bi, J. Jiao, J. Shang, Q. Li, L. Shabuerjiang, et al., J. Ethnopharmacol. 2023, 301, 115766. doi:10.1016/j.jep.2022.115766.
- [2] A. Chamorro, U. Dirnagl, X. Urra, A.M. Planas, Lancet Neurol. 2016, 15, 869-881. doi:10.1016/S1474-4422(16)00114-9.
- [3] H. Sies, Redox Biol. 2015, 4, 180-183. doi:10.1016/j.redox.2015.01.002.
- [4] S. Fakhri, S. Piri, S.Z. Moradi, H. Khan, Curr. Neuropharmacol. 2022, 20, 836-856. doi:10.2174/1570159X19666210809103346.

UNVEILING THE POLYPHENOLIC PROFILE AND HEALTH-PROMOTING POTENTIAL OF FRUITS FROM THE GENUS LUZURIAGA

Carlos Fernández-Galleguillos¹, Luisa Quesada-Romero¹, Ernane Souza²

¹ Departamento de Química, Facultad de Ciencias, Universidad de La Serena, La Serena 1700000, Chile

² Gregory School of Pharmacy, Palm Beach Atlantic University, Palm Beach, USA
carlos.fernandez@userena.cl

Ethnopharmacological relevance: Native fruits from southern Chile, particularly those from the Valdivian Forest, represent an important source of unexplored compounds with pharmacological potential within this biodiversity hotspot [1]. *Luzuriaga radicans* (locally known as “quilineja”) is an endemic climbing species belonging to the Alstroemeriaceae family that produces small fruits traditionally consumed by local communities for the treatment of fever, jaundice, and rheumatism. Although poorly studied, *L. radicans* forms part of traditional Mapuche ethnobotanical knowledge.

Aim of the study: In continuation of our studies on native fruits [2], this study aimed to evaluate, for the first time, the polyphenolic profile, antioxidant capacity, and neuroprotective potential of *L. radicans* fruits.

Materials and methods: The extract was analysed for total phenolic (TPC) and flavonoid content (TFC) and antioxidant capacity using DPPH, ABTS, and ORAC assays. Neuroprotective potential was evaluated in SH-SY5Y neuroblastoma cells, as well as through acetylcholinesterase (AChE) and tyrosinase inhibitory (TYR) assays. Chromatographic analyses were performed using High-Performance Liquid Chromatography coupled with Photodiode Array Detection (HPLC–PDA) for the quantitative analysis of polyphenolic compounds.

Results: TPC, TFC, antioxidant capacity, and the inhibitory activity against AChE and TYR were evaluated in polyphenol-rich extracts of *L. radicans*. TPC was 2.94 ± 0.224 mg GAE/g of dried fruit, while TFC reached 5.86 ± 0.999 mg QE/g of dried fruit. HPLC–PDA analysis revealed the presence of gallic acid, chlorogenic acid, vanillic acid, and flavonoid derivatives, including quercetin 3-glucoside and apigenin 7-glucoside. The extracts exhibited antioxidant activity in DPPH, FRAP, and ORAC assays. Additionally, moderate inhibitory effects against AChE and TYR were observed (IC_{50} : 604.52 ± 0.21 and 528.09 ± 0.31 μ g/mL, respectively), together with a concentration-dependent neuroprotective effect in human SH-SY5Y neuroblastoma cells.

Conclusion: These findings highlight the phenolic richness and health-promoting potential of *L. radicans* fruits, supporting their ethnopharmacological relevance and potential as a source of bioactive compounds.

References:

- [1] Fernández-Galleguillos, C.; Quesada-Romero, L.; Puerta, A.; Padrón, J.M.; Souza, E.; Romero-Parra, J.; Simirgiotis, M.J. UH-PLC-MS Chemical Fingerprinting and Antioxidant, Antiproliferative, and Enzyme Inhibition Potential of *Gaultheria pumila* Berries. *Metabolites* 2021, 11, 523.
- [2] Mardones, D; Scherson, R. Hotspots within a hotspot: evolutionary measures unveil interesting biogeographic patterns in threatened coastal forests in Chile. *Botanical Journal of the Linnean Society* 2023, 202, 433–448.

PRELIMINARY CHEMICAL AND BIOLOGICAL EVALUATION OF THE DIFFERENCES BETWEEN FIVE PROPOLIS SAMPLES

Alessandro Giordano¹, Milena Popova², Boryana Trusheva², Giulia Baini¹, Giorgio Cappellucci¹, Federica Vaccaro¹, Francesca Vidotto¹, Elisabetta Miraldi¹

¹ Department of Physical, Earth, and Environmental Sciences, University of Siena, Italy

² Institute of Organic Chemistry with Centre of Phytochemistry, Bulgarian Academy of Sciences, Bulgaria
alessandr.giordano@student.unisi.it

Ethnopharmacological relevance Propolis is a cornerstone of traditional medicine worldwide. However, its chemical complexity, dictated by geographical and botanical origins, leads to significant variability in therapeutic consistency.

Aim of the study This preliminary study characterized and compared the chemical profiles of five propolis samples from distinct global biomes to investigate how this variability influences immunoregulatory mechanisms.

Materials and methods Raw samples from Bulgaria, Taiwan, Vietnam, and two Brazilian regions were extracted via 70% ethanol maceration (24 h, room temperature). Chemical characterization involved GC-MS for marker identification, alongside spectrophotometric assays for total phenolic (TPC) and flavonoid (TFC) content, and antioxidant and antiradical capacities. Biological assays were performed on human PBMCs treated with 20 µg/mL of each sample, both under basal conditions and LPS-induced (100 ng/mL) inflammation. Cytokine production (IL-1β, IL-6, IL-10) was quantified via ELISA.

Results GC-MS revealed distinct chemical fingerprints: Bulgarian propolis (*Populus nigra*) was rich in flavonoids and caffeic acid derivatives (CAPE); Green Brazilian (*Baccharis dracunculifolia*) featured prenylated cinnamic acids (artepillin C); Red Brazilian (*Dalbergia ecastaphyllum*) contained isoflavones and pterocarpanes; Taiwanese (*Macaranga tanarius*) was characterized by prenylated flavanones (propolins); Vietnamese (*Mangifera indica*) showed mainly alkylphenols and triterpenes. TPC and TFC were highest in the Taiwanese sample (TPC: 29.36 ± 0.48% w/w), followed by Bulgarian, Green Brazilian, Red Brazilian, and Vietnamese samples, and correlated directly with antioxidant and antiradical capacities. Under basal conditions, no sample increased pro-inflammatory IL-1β or IL-6, while all up-regulated regulatory IL-10. In the inflammatory model, the Taiwanese sample, the one with the highest TPC, exhibited the strongest immunomodulatory effect, significantly reducing IL-1β and IL-6 while further increasing IL-10.

Conclusion These findings validate propolis's traditional use in inflammatory conditions. However, the results emphasize that the extent of the biological/immunomodulatory activity of different propolis samples from around the world depends closely on differences in their chemical composition.

DIRECT EFFECTS ON COLON CELLS AFTER HUMAN GUT MICROBIOTA BIOTRANSFORMATION OF *SIDERITIS SCARDICA*, *MENTHA X PIPERITA*, *SALVIA OFFICINALIS* AND *MELISSA OFFICINALIS*

Maria-Eleni Grafakou, Joerg Heilmann

Department of Pharmaceutical Biology, University of Regensburg, Germany
maria-eleni.grafakou@ur.de

Ethnopharmacological relevance: *Sideritis scardica* Griseb., *Mentha x piperita* L., *Salvia officinalis* L., and *Melissa officinalis* L. have a long term traditional use for gastrointestinal complaints according to the EMA^[1].

Aim of the study: The aim of this study is to evaluate the effects of the biotransformed herbal teas after incubation with human gut microbiota in colon cell lines, in order to investigate the role of the intestinal microbiome for the observed effects of these herbal medicinal products in the digestive tract. The role of the microbiome has been largely neglected so far, however the majority of the components have low bioavailability and substantial amounts would reach the colon, where they are exposed to microbial metabolism, attributing to new insights into their mechanism of actions through different microbiome-gut axes^[2] or direct effects on the colon.

Materials and methods: In this study a comparison between native (non biotransformed) and biotransformed (24h anaerobic incubation with gut microbiota derived from three healthy human donors' fecal material) herbal teas extracts (prepared as described in the EMA monographs) is performed, using a cytotoxicity assay (MTT) with cancerous colon epithelial cells (HT-29), and an anti-inflammatory assay using colon epithelial cells (Caco2-NFkB-Luci).

Results: Preliminary results show significant differences between native and biotransformed extracts for all investigated herbal teas, indicating that microbial metabolism substantially influences their biological activity.

Conclusion: These findings contribute to a better understanding of plant-gut microbiome interactions and their relevance for the therapeutic effects of herbal teas used in gastrointestinal complaints, supporting their role in evidence-based healthcare.

References:

- [1] <https://www.ema.europa.eu/en/glossary-terms/european-union-herbal-monograph>
- [2] X. Li, Y. Liu, N. Liu, Wu H, K. Cong, L. Duan, T. Chen, J. Zhang. *Pharmacol Res* **2025**, 15, 107730.

EVALUATION OF BLACK BRYONY BERRY JUICE IN GINGIVITIS

Anastasia-Ioanna Papantonaki¹, Eirini Moustaka¹, Antigoni Petsiou¹, Chara Almpani¹, Eleni Georgakopoulou¹, Panagiota Loumou¹, Christina Barda¹, Maria-Eleni Grafakou², Ioannis Sfiniadakis³, Andreas Vitsos¹, Jane Anastassopoulou¹, Michail Rallis¹

¹ Section of Pharmaceutical Technology, Department of Pharmacy, National and Kapodistrian University of Athens, Greece

² Department of Pharmaceutical Biology, Faculty of Pharmacy and Chemistry, University of Regensburg, Germany ³ Athens Naval Hospital, Pathologoanatomic Laboratory, Deinokratous 70, 11521 Athens, Greece
maria-eleni.grafakou@ur.de

Ethnopharmacological relevance: The berry juice from black bryony (*Dioscorea communis* (L.) Caddick & Wilkin) can be used against oral infections, according to traditional use in Greece^[1]. Periodontal disease is an inflammatory condition characterized by the breakdown of gingival tissues and alveolar bone, primarily caused by a dysbiotic shift in the oral microbiome resulting in the formation of biofilm^[2].

Aim of the study: This study aims to establish a simple robust experimental model for inducing gingivitis in healthy and diabetic mice, enabling the investigation of host responses under pathological oral conditions and investigate the effects of *D. communis* berry juice.

Materials and methods: SKH-hr2 hairless mice are used, and diabetes is induced through intraperitoneal injection of streptozotocin, while gingivitis is achieved through ligation. A range of assessments is performed, including clinical evaluations, photodocumentation, blood glucose levels, gingival pH, transepidermal water loss, FTIR spectroscopic analysis, histopathological examination and 16 sRNA sequencing.

Results: In this experimental context, the proposed model successfully induces gingivitis in both normal and diabetic mice. Preventive treatment with *D. communis* berry juice extract was found to significantly postpone the onset of disease without toxic effects.

Conclusion: The findings suggest a potential protective role of the berry juice of *D. communis* against gingivitis to support its traditional use.

References:

- [1] K. Tsami, C. Barda, G. Ladopoulos, N.A. Didaras, M.E. Grafakou, J. Heilmann, D. Mossialos, M. Rallis, H. Skaltsa, *Sci* **2022**, 4(2), 21.
- [2] D. Kinane, P. Stathopoulou, P. Papapanou, *Nat Rev Dis Primers* **2017**, 3, 17038.

ETHCSTWIN: AN ONTOLOGY-DRIVEN SEMANTIC FRAMEWORK FOR ETHNOPHARMACOLOGICAL KNOWLEDGE INTERGRATION

Konstantia Graikou¹, Marc Jacobs², Evanthia Dina¹, Nektarios Aligiannis¹

¹ Institute for Ethnopharmacological Studies and Phytotherapy (IESP), University Center of Research and Innovation, National & Kapodistrian University of Athens, Greece

² Department of Bioinformatics, Fraunhofer Institute SCAI, Germany
kgraikou@pharm.uoa.gr

Ethnopharmacological relevance: Ethnopharmacological knowledge is highly heterogeneous, culturally embedded, and documented across diverse sources, including ethnobotanical field studies, ethnopharmacological reports, and historical manuscripts. The absence of standardized terminology and formalized conceptual structures hampers interoperability, comparability, and systematic reuse of this knowledge in contemporary pharmacological and biomedical research.

Aim of the study: Within the ETHCSTWIN project¹ framework, this work aims to develop and deploy an ontology-driven semantic model that standardizes core ethnopharmacological concepts and enables machine-readable, interoperable representation and retrieval of traditional knowledge across heterogeneous document types.

Materials and methods: An ontology was designed to represent key domains, including herbal preparations, plant parts, administration routes, therapeutic indications, toxicological properties, and phytochemical composition. These were formalized into a controlled vocabulary with hierarchical and semantic relationships (e.g. part-of, has-preparation-form, has-indication, has-constituent), supporting consistent annotation across ethnobotanical reports, scientific articles, and manuscript transcriptions. Terminology curated in tabular (XLS) format, was transformed into OWL 2-compliant axioms and validated using Description Logic reasoner in Protégé ontology editor to ensure logical consistency and support inference.^[1] The ontology was uploaded to the ETHCSTWIN Ontology Lookup Service (OLS), providing web-based browsing, REST APIs, and text-based search².^[2]

Results: The ETHCSTWIN ontology comprises structured upper-level concepts for materials (e.g. plant, preparation), processes (e.g. preparation method, administration), and roles (e.g. therapeutic indication, adverse effect). Hosted in the ETHCSTWIN OLS, the ontology can be used to tag and retrieve semantic concepts in full-text scientific publications, field study documentation, and digitized historical sources through concept-based search and programmatic queries. Ontology-based tagging enables semantic querying across sources (e.g. linking traditional uses to phytochemical and pharmacological data) and supports downstream computational analysis.

Conclusion: Embedding the ETHCSTWIN ontology within a semantic infrastructure supports standardization, interoperability, and reproducibility, facilitating cross-study comparisons and evidence-based evaluation of traditional remedies, with applications in phytotherapy and plant-based product development and safety assessment.



Figure 1: Screenshot of the ETHCSTWIN ontology within the OLS web application. OLS allows to search and retrieve concepts of ethnopharmacological relevance

Acknowledgements: This work has been funded by the European Union's Horizon Europe Research and Innovation Programme under Grant agreement ID: 101159928 - ETHCSTWIN

References:

- [1] Knublauch H, Fergerson RW, Noy NF, Musen MA. *The Protégé OWL plugin: An open development environment for semantic web applications*. In: McIlraith SA, Plexousakis D, van Harmelen F, editors. *The Semantic Web – ISWC 2004*. Lecture Notes in Computer Science, vol 3298. Springer; **2004**. Protégé project page: <https://protege.stanford.edu/>
- [2] Côté RG, Jones P, Apweiler R, Hermjakob H. *The Ontology Lookup Service, a lightweight cross-platform tool for controlled vocabulary queries*. BMC Bioinformatics. **2006**;7:97. doi:10.1186/1471-2105-7-97. Available at: <https://www.ebi.ac.uk/ols/4/>

COMPARING HERBALS USED TRADITIONALLY FOR SKIN DISORDERS IN GREECE, SINCE 20TH CENTURY, WITH REGULATORY DATA IN EU (EMA & ESCOP)

Konstantia Graikou, Christos Ganos, Evgenia Panou, Nektarios Aligiannis, Ioanna Chinou

*Lab of Pharmacognosy and Chemistry of Natural Products, Dept of Pharmacy,
National and Kapodistrian University of Athens, Greece
kgraikou@pharm.uoa.gr*

Ethnopharmacological relevance: Medicinal and aromatic plants (MAPs) have been employed widely and successfully in traditional medicine for skin disorders in Greece, since Antiquity. The current study is conducted, to provide an overview of folk knowledge of MAPs therefore.

Aim of the study: As herbal medicines no longer reflect the famous past and rich medicinal flora and biodiversity of the country, the present overview focuses on the plants traditionally used for skin care, quoted from literature, which provides extensive insight on herbs used since 20th century in Greece, a country for which modern ethnopharmacological and phytotherapeutical data are lacking in quantity and quality.

Materials and methods: Four well-known Greek scientific books of herbal therapy/phytotherapy, since 60's were searched thoroughly^[1,2,3,4] for herbal substances on different skin issues and the data further compared towards approved plants from EMA's (European Medicines Agency) and ESCOP's monographs (47 and 20 respectively). The results catalogued and further statistically elaborated.

Results: The study resulted to a long list with herbs proposed for skin ailments among which certain botanical families (Lamiaceae, Rosaceae, Asteraceae, Fabaceae and Poaceae) appeared with higher number of representatives. Moreover, during comparison with EMA and ESCOP for the same therapeutic area, it has been revealed that more than half of them are fully approved by both.

Conclusion: The data collection from Greek literature evaluated for the first time, and surprisingly confirmed, that many plants were commonly mentioned in most of the studied books as well as into modern phytotherapy and regulatory system of EU. It is noteworthy that comparing the results demonstrated, linked and discussed with respect to historical data, a high continuation is revealed and phytotherapy proved as great living tradition with strong feasibility for further exploitation towards development of new therapeutics against dermatological diseases.

References:

- [1] E. Anassis "The Medicinal Herbs of Greece" **1969**, Ed M. Makri, Athens, Greece
- [2] I. Zaharopoulos "Modern complete herbal therapy" **1972**, Ed Psihalou, Athens, Greece, 318 pages
- [3] S K. Bazaos "One hundred herbs and thousand therapies" **1982**, Ed Bazaos, Athens, Greece, 397 pages
- [4] L. Spyrou "Pharmaceutical herbs and therapeutic properties" **1984**, Ed S Spyrou, Athens, Greece, 601 pages

MICROBIAL TRANSFORMATION OF MEDICINAL PLANTS: FROM PLANT PHYTOCHEMICALS TO BIOACTIVE METABOLITES IN FERMENTED HERBAL MEDICINES

Syeda Hasan¹, Bushra Shaida²

¹Department of Pharmacology, Clinical Trial Unit, All India Institute of Medical Sciences, Guwahati, India

²Center for Nutrition and Dietetics, Jamia Hamdard, New Delhi, India

syedaminhaz01@gmail.com

Ethnopharmacological relevance: Fermented herbal medicines have been widely utilized in traditional healthcare across cultures, particularly in Ayurveda and Traditional Chinese Medicine. Indian Ayurveda is distinguished among traditional medicines for its polyherbal Fermented Traditional Medicines (FTM), specifically Arishta (fermented decoctions) and Asava (fermented infusions). These are naturally fermented herbal formulations, where microbial activity enhances the bioavailability and therapeutic efficacy of phytoconstituents. The phytochemicals from these herbs are less toxic, more potent, and more rapidly absorbed. These formulations have been used for managing a wide range of conditions, including digestive disorders, metabolic imbalances, and inflammatory diseases. [1,2]

Aim of the study: This study aims to evaluate the pharmacological potential and therapeutic benefits of fermented herbal medicines, with emphasis on their enhanced bioavailability and relevance in traditional systems.

Materials & methods: A comprehensive literature review was conducted using databases including PubMed, Scopus, and Google Scholar. Studies on fermented herbal formulations, particularly Asava and Arishta, were analyzed using keywords such as “fermented herbal medicines,” “ethnopharmacology,” “bioavailability,” and “phytochemicals.” In vitro, in vivo, and clinical studies were included.

Results: Fermentation enhances the therapeutic properties of herbal medicines by improving phytochemical bioavailability, increasing antioxidant activity, and generating beneficial microbial metabolites. These formulations show potential in managing digestive, metabolic, inflammatory, and immune-related disorders. Key challenges include microbial strain selection, process standardization, safety, and regulatory concerns. Emerging approaches such as omics technologies, nanotechnology-based delivery systems, and AI-driven methods may support scalable phytopharmaceutical development. [3]

Conclusion: Fermented herbal medicines bridge traditional knowledge and modern pharmacology, demonstrating improved efficacy and safety. Further standardized clinical studies are needed to validate their mechanisms and ensure quality, safety, and broader acceptance. This approach offers sustainable pathways to enhance the therapeutic value of medicinal plants, promoting precision ethnopharmacology and global health equity.

References:

1. Mishra AK, Gupta A, Gupta V, Sannd R, Bansal P. Asava and arishta: An ayurvedic medicine—An overview. *Int J Pharm Biol Arch*. 2010 Apr;1(1):24-30.
2. Hussain A, Bose S, Wang JH, Yadav MK, Mahajan GB, Kim H. Fermentation, a feasible strategy for enhancing bioactivity of herbal medicines. *Food Research International*. 2016 Mar 1;81:1-6.
3. Lee JH, Lee JH, Jin JS. Fermentation of traditional medicine: present and future. *Oriental Pharmacy and Experimental Medicine*. 2012 Sep;12(3):163-5.

MINING THE MIAO ETHNIC MEDICINAL PLANTS OF CHINA: TAXONOMIC DIVERSITY, CONSERVATION NEEDS, AND POTENTIAL SPECIES HOT-NOTES PREDICTION

Shuyu Hou^{1,2}, Yuhua Wang^{1,2}, Huifu Zhuang^{1,2}, Ruyu Yao^{1,2}

¹ Yunnan International Joint Laboratory of Health Plant Resources Development & Yunnan Key Laboratory for Wild Plant Resources, Department of Economic Plants and Biotechnology, Kunming Institute of Botany, Chinese Academy of Sciences, Kunming 650201, China.

² University of Chinese Academy of Sciences, Beijing 101408, China.
houshuyu@mail.kib.ac.cn; yaoruyu@mail.kib.ac.cn

Ethnopharmacological relevance: In China, large population of Miao ethnic group still rely on ethnic medicinal plants for primary healthcare. The traditional knowledge on such ethnic medicinal plants is crucial for ethnopharmacological studies that are aiming to new drug discovery, however, without scientific classification and standardization, those traditional terminologies are hardly to be understood cross-culturally, restricting its global scientific communication and bioprospecting.

Aim of the study: To standardize traditional knowledge on Miao ethnic medicinal plants, reveal its diversity and its medical use patterns, and detecting the phylogenetic structure of plant species with specific therapeutic efficacies.

Materials and methods: Traditional uses and taxonomic data of Miao ethnic medicinal plants were extracted from monographs and recent publications systematically. Nomenclature of plant species was standardized via World Flora Online. Traditional uses were mapped to 16 medical systems according to categories of ICPC-3. A comprehensive phylogenetic tree was constructed with megatree approach. Phylogenetic structures of plants with specific medical uses were assessed via the Net Relatedness Index (NRI) and Nearest Taxon Index (NTI), and hot node analysis was applied to detect potential therapeutic lineages.

Results: Totally 1316 plant species across 193 families were identified to be used for 15 therapeutic purposes. Miao ethnic medicinal, which are predominated by Asteraceae, Fabaceae, Lamiaceae, and Rosaceae. Of these, 727 species are used for digestive system, whereas 673 species are for musculoskeletal system and 685 species are for general healthcare. Compared with the plant conservation lists, 50 species are in China national conservation list, 43 species are in CITES list, and 134 species are included in regional list, suggesting the serious conservation needs of Miao medicinal plants. Using phylogenetic comparative approach, 441 hot nodes were found to be used for the 15 categories of indications.

Conclusion: This study provides the first comprehensive quantitative ethnobotanical analysis on Miao ethnic medicinal plants of China. While the species diversity is high, the conservation needs is highlighted. This systematic approach provides an efficient solution for cross-cultural understanding of traditional herbal knowledge, supporting a robust scientific basis for targeted pharmacological mining and the sustainable conservation of rare medicinal resources.

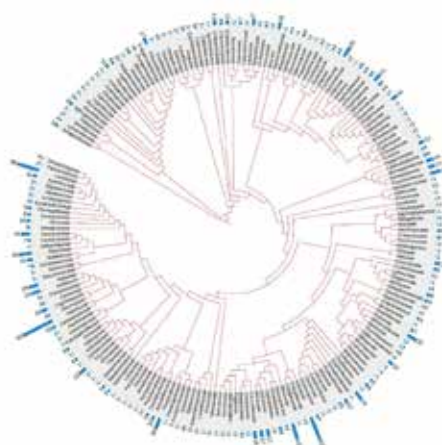


Figure 1: Phylogenetic distribution of Miao ethnic medicinal plants at the family level.

Acknowledgements:

This work is supported by Special Project for the Construction of Science and Technology Innovation Centers Facing South Asia and Southeast Asia - Yunnan International Joint Innovation Platform (202503AP140001).

References:

- [1] Yao, R., Heinrich, M., Zhang, B., Wei, X., Qi, Y., Gao, W., 2023. Single botanical drugs in the Ayurvedic Pharmacopoeia of India-A quantitative ethnobotanical analysis. *Front Pharmacol* 14, 1136446.
- [2] Yao, R., Gao, J., Heinrich, M., Yu, S., Xue, T., Zhang, B., Wei, X., Qi, Y., Gao, W., 2024. Medicinal plants used by minority ethnic groups in China: Taxonomic diversity and conservation needs. *Journal of Ethnopharmacology* 334, 118573

PHYTOCHEMICAL SCREENING AND ANTI-INFLAMMATORY ACTIVITY OF *PHAULOPSIS SILVESTRIS* FROM NIGERIA

Tope Ijaola^{1,2}, David Ajayi³, Olayimika Olumide²

¹ Production Department, Cardinal Drugs Limited, Agege, Lagos

² Department of Pharmaceutical Technology, Moshood Abiola Polytechnic, Abeokuta, Ogun State, Nigeria

³ Department of Pharmaceutical and Medicinal Chemistry, Federal University Lokoja, Kogi State, Nigeria
topeijaola@gmail.com

Ethnopharmacological relevance: This study provides evidence supporting the presence of potential anti-inflammatory compounds that may be useful in the treatment of pain and other inflammatory conditions. The plant was pharmacologically evaluated through phytochemical screening, anti-inflammatory assays, and assessment of inflammatory mediator release in vivo.

Aim of the study: The study aimed to identify the phytochemical constituents of *Phaulopsis silvestris* and evaluate the efficacy of its extract in alleviating pain and inflammation using in vivo models.

Materials and methods: Leaves of *Phaulopsis silvestris* were collected and extracted using methanol with the aid of a rotary evaporator. The extract was screened for the presence of alkaloids, steroids, tannins, cardiac glycosides, terpenoids, anthraquinones, flavonoids, and saponins. Colitis was induced in forty (40) Wistar rats aged 4 - 5 weeks (weighing 88–95 g) via intraperitoneal administration of 0.7% acetic acid at a dose of 0.1 ml per 10 g body weight. Inflammatory marker release was assessed using the Westergren method. The animals were divided into four groups and treated with extract doses of 100 mg/kg and 200 mg/kg, alongside positive (Aspirin 300 mg) and negative control (normal saline) groups. The number of writhing responses was recorded for each group.

Results: Phytochemical screening showed that the leaf extract of *Phaulopsis silvestris* contained alkaloids, cardiac glycosides, tannins, and terpenoids. The group treated with 200 mg/kg of the extract showed the greatest reduction in writhing frequency, indicating the highest anti-inflammatory activity, as illustrated in Figure A.

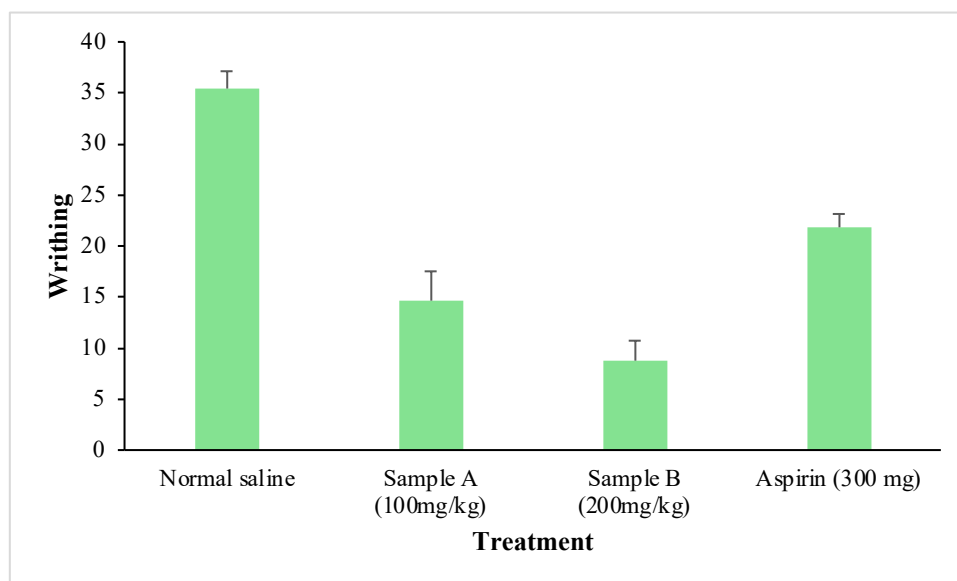


Figure A: Inflammation response following administration of the extract at various concentrations.

Conclusion: The findings suggest that the leaf extract contains bioactive constituents with anti-inflammatory properties.

DEVELOPMENT AND FORMULATION OF COROSOLIC ACID LOADED NANOSTRUCTURED LIPID CARRIER FOR ANTI-OBESITY ACTIVITY

Pallavi Jachak^{*1}, Komal¹, Kirti N. Deshmukh², Akash Dey², Sanjay M. Jachak²

¹ Chandigarh College of Pharmacy, CGC, Landran, Mohali, Punjab 140307, India

² National Institute of Pharmaceutical Education and Research, Sector 67, Mohali 160062, India

Correspondence to: pallavi.ccp@cgc.edu.in

Obesity is a chronic metabolic disorder associated with dyslipidemia, insulin resistance, hepatic steatosis, and cardiovascular complications, thereby demanding safer and more effective therapeutic interventions. Corosolic acid possesses significant anti-obesity potential; however, its therapeutic application is restricted by poor aqueous solubility and low oral bioavailability. Therefore, the present study aimed to develop and evaluate Corosolic Acid-loaded Nanostructured Lipid Carriers (CRA-NLCs) to enhance its bioavailability and therapeutic efficacy. CRA-NLCs were prepared using the hot homogenization-ultrasonication method and optimized through central composite design. The optimized formulation exhibited a particle size of 126.4 nm, PDI of 0.194, zeta potential of -22.5 mV, entrapment efficiency of 86%, and sustained drug release up to 72 h following Korsmeyer-Peppas kinetics. HR-TEM and PXRD studies confirmed spherical morphology and amorphous dispersion of CRA within the lipid matrix. In vitro studies using 3T3-L1 adipocytes demonstrated improved biocompatibility and reduced cytotoxicity of CRA-NLCs compared to free CRA. Furthermore, the anti-obesity efficacy was evaluated in high-fat diet-induced obese C57BL/6J mice, where CRA-NLC treatment significantly reduced body weight gain, BMI, Lee's index, feed efficiency, visceral adiposity, hepatic fat accumulation, and serum lipid abnormalities while improving glucose tolerance and insulin sensitivity. Histopathological examination revealed marked restoration of adipose and hepatic architecture, particularly in the high-dose CRA-NLC-treated group, which exhibited near-normal tissue morphology. Overall, the developed CRA-NLCs demonstrated superior anti-obesity efficacy compared to pure CRA, attributed to enhanced stability, sustained release, and improved bioavailability. These findings suggest that CRA-loaded nanostructured lipid carriers represent a promising nano-phytopharmaceutical strategy for the management of obesity and associated metabolic disorders.

Keywords: Corosolic acid, Nanostructured lipid carriers, Obesity, High-fat diet, Adipogenesis

EXPLORING THE METABOLIC PROFILE OF *PRIMULA VERIS* L. SUBSP. *VERIS* ROOTS: COMPARISON BETWEEN CULTIVATED AND WILD-GROWING POPULATIONS

Maria Vitiello¹, Michela Oliva¹, Marinella De Leo¹, Alessandra Braca¹, Paschalina Chatzopoulou², Nikos Krigas^{2,3}, Anastasia Karioti¹

¹ Dipartimento di Farmacia, Università di Pisa, Pisa, Italy

² Institute of Plant Breeding and Genetic Resources, Hellenic Agricultural Organization Demeter (ELGO-Dimitra), Thermi, Greece

³ Institute of Agri-Food and Life Sciences, Research Centre of the Hellenic Mediterranean University, Heraklion, Greece
anastasia.karioti@unipi.it

Ethnopharmacological relevance: *Primula veris* L. (Primulaceae) has been used traditionally as expectorant for cough, asthma, bronchitis, and catarrh. Roots and flowers of *P. veris* and *P. elatior* are registered by EMA as Traditional Use Herbal Medicinal Products ^[1]. Among the four infraspecific taxa of *P. veris* (subspecies *veris*, *canescens*, *columnae*, and *macrocalyx*), only subsp. *veris* occurs in Greece in the cooler higher-altitude zones; however, illegal harvesting from the wild compromises the long-term survival of its wild-growing populations. In this context, a research project was carried out by the Hellenic Agricultural Organization Dimitra for the development of a sustainable exploitation strategy involving the domestication process of Greek native *P. veris* subsp. *veris* and its phytochemical characterization. ^[2,3]

Aim of the study: The saponin content of *P. veris* subsp. *veris* from wild and cultivated plants was explored and compared qualitatively.

Materials and methods: Native plants were collected from Mt. Smolikas. ^[2] Twenty g of this plant material was extracted consequently with MeOH 100% and aq. MeOH 70% and the combined extracts were subjected to chromatographic isolations by Sephadex LH-20 and preparative HPLC to afford six saponins. Structures were elucidated by 1D- 2D-NMR and HR-MS. Cultivated plant material was collected from an experimental field in Konitsa (Ioannina district, Epirus). Samples were extracted with MeOH 50% ^[3,4] and analysed by LC-MS (Orbitrap).

Results: To date, six saponins have been isolated and characterised by HR-MS/NMR as Primulic acid I, Priverosaponin B, Priverosaponin B-22 acetate and oxygenated derivatives thereof. The structural elucidation by NMR is underway. LC-MS data of cultivated species showed the presence of all isolated saponins.

Conclusion: *Primula veris* subsp. *veris* roots have a slightly different chemical profile compared to those of *P. veris* previously reported. ^[4] Cultivated samples had the same qualitative profile as the wild-growing ones. Quantitative characterization is underway.

Acknowledgements: This study is partly founded by the Region of Epirus.

References:

- [1] EMA/HMPC/113577/2012. Assessment report on *Primula veris* L. and/or *Primula elatior* (L.) Hill, radix. Available online: https://www.ema.europa.eu/en/documents/herbal-report/final-assessment-report-primula-veris-l/primula-elatior-l-hill-radix_en.pdf. (Accessed on April 29, 2026).
- [2] P.I. Chintiroglou, N. Krigas, P. Chatzopoulou, A. Karioti, A. *Planta Med.* **2021**, 87, 1219-1230.
- [3] I. Stefanis, P. Chatzopoulou, N. Krigas, A. Karioti. *Horticulturae* **2023**, 9, 1120.
- [4] A. Müller, M. Ganzera, H. Stuppner. *J Chromatogr A* **2006**, 1112, 218-223.

OLEA EUROPAEA LEAF EXTRACTS: BRIDGING MEDITERRANEAN TRADITIONAL KNOWLEDGE AND MODERN IMMUNOPHARMACOLOGY

Anna La Rosa¹, Maria Carla Marcotullio², Daniela Pezzolla³, Giulia Mencarelli¹, Benedetta Pieroni¹, Alessandro Pinzi¹,
Giorgia Manni¹, Francesca Fallarino¹

¹ Department of Medicine and Surgery - Pharmacology Section - University of Perugia, Italy

² Department of Pharmaceutical Sciences - University of Perugia, Italy

³ Department of Civil and Environmental Engineering - University of Perugia, Italy

anna.larosa@dottorandi.unipg.it

Ethnopharmacological relevance: The olive tree (*Olea europaea* L.) is one of the most ancient cultivated species of the Mediterranean, deeply embedded in the traditional medicine of multiple cultures across millennia. Its leaves have been ethnobotanically documented as remedies for fever, hypertension, and inflammation (Fig. 1), reflecting a long-standing cross-cultural consensus on their therapeutic value. *Olea europaea* leaves obtained as by-products of agricultural pruning constitute an abundant, renewable, and largely underutilized source of bioactive phytochemicals, whose scientific re-valorization transforms agricultural waste into a sustainable resource, connecting ethnopharmacological tradition with modern therapeutic discovery.

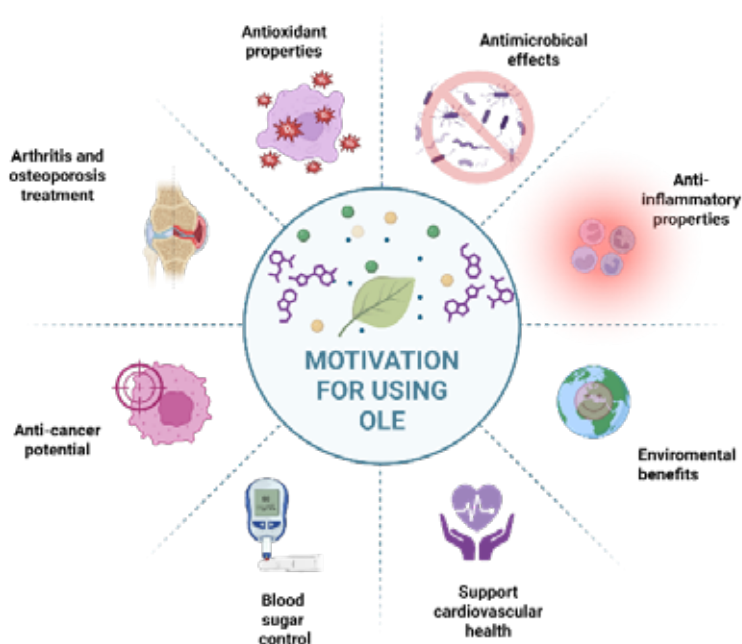


Figure 1: Benefits and Therapeutic Effects of *Olea europaea* Leaves.

Aim of the study: The study aimed to optimize a sustainable platform for the valorization of olive pruning waste through the production of olive leaf extracts and the isolation of bioactive-enriched fractions. It further aimed to identify novel phytochemicals and evaluate their immunomodulatory activity and effects on immune cells.

Materials and methods: The biomass was initially characterized, and bioactive molecules were extracted using optimized protocols. Extract cytotoxicity was evaluated in vitro by MTT assay on HeLa cells. Phytochemical profiling and fractionation were performed by HPLC analysis; also, total polyphenol content and antioxidant activity were assessed through spectrophotometric assays. Functional studies were carried out to evaluate activation of the *Aryl Hydrocarbon Receptor* (AhR) and modulation of epigenetic pathways in dendritic cells.

Results: Among the tested extraction methods, maceration showed the highest extraction yield. The extract obtained did not show any cytotoxic effects in HeLa cells confirming its safety under the tested conditions. Phytochemical analysis by HPLC enabled fractionation of the extract and revealed a composition rich in known bioactive compounds, including *oleuropein* and *hydroxytyrosol*, along with a high polyphenol content (Table 1) and strong antioxidant capacity. Functional assays demonstrated activation of AhR signaling pathways, suggesting anti-inflammatory and immunomodulatory properties. In addition, the extract modulated epigenetic mechanisms in dendritic cells, including regulation of BRD4 expression, supporting its potential involvement in immune regulation.

Conclusion: Olive pruning waste represents a sustainable and scalable source of bioactive compounds with antioxidant, anti-inflammatory, and immunomodulatory activities. These findings support the potential exploitation of olive leaf extracts for nutraceutical and therapeutic applications within a circular economy approach.

GLOBAL PROSPECTING AND BIOACCESSIBILITY OF *PORTULACA OLERACEA* L.: A MULTICENTRIC STUDY ON ITS POTENTIAL FOR PHENYLKETONURIA MANAGEMENT

Labanca, R. A.¹, Eduardo M.², Alminger M.³, Fialová S. B.⁴

¹Food Science Department, Federal University of Minas Gerais (UFMG), Brazil

²Faculty of Engineering, Eduardo Mondlane University, Mozambique

³Food and Nutrition Science, Chalmers University of Technology, Gothenburg, Sweden

⁴Faculty of Pharmacy, Comenius University Bratislava, Slovakia

renatalabanca@ufmg.br

Ethnopharmacological relevance: *Portulaca oleracea* L. (Purslane) is a globally distributed Unconventional Food Plant (UFP) with a rich history in traditional medicine for treating metabolic and inflammatory disorders. Despite its high nutritional value, its potential as a strategic clinical matrix for rare metabolic diseases, such as Phenylketonuria (PKU), remains unexplored in ethnopharmacological literature^{1,5}.

Aim of the study: To evaluate the nutritional potential and phenylalanine (Phe) bioaccessibility of *P. oleracea* as a disruptive dietary alternative for PKU management, while mapping the global technological gap regarding this botanical matrix^{2,3}.

Materials and methods: This study integrates a multicentric perspective, considering the occurrence and traditional use of *P. oleracea* in Brazil, Slovakia, Mozambique, and Sweden. Laboratory procedures conducted in Brazil included mineral profiling Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES), and Phe quantification by Ultra-Performance Liquid Chromatography (UPLC)^{1,4}. Gastrointestinal bioaccessibility was assessed using the INFOGEST static *in vitro* digestion protocol^{2,4}. Simultaneously, a global technological prospection was conducted using the Cortellis database to identify records for “*Portulaca oleracea*” intersected with “Food” and “Phenylketonuria”³.

Results: Prospection in Cortellis revealed an absolute void in clinical and patent records for PKU (zero results), despite over 2,700 general citations for the species. Only 12 records associated the plant specifically with “Food” (Table 1). Laboratory results showed that *P. oleracea* possesses a unique fiber-rich matrix that significantly reduces Phe bioaccessibility during digestion. Moreover, post-digestion analysis confirmed high antioxidant markers, important for neuroprotection in PKU patients.

Conclusion: This study fills a critical clinical and technological gap by being the first to characterize *P. oleracea* as a safe, low-Phe, and bioactive-rich dietary option. Our findings promote food sovereignty and biodiversity-based innovation for neglected metabolic needs.

Search Terms	Total Citations	Molecular Targets	Patents	Clinical Studies	Scientific Publications	Experimental Models	Biomarkers (Used)*
<i>P. oleracea</i> (General)	2770	14	166	98	609	110	230 (254)
<i>P. oleracea</i> + Diabetes	291	14	14	0	10	5	215 (4)
<i>P. oleracea</i> + Food	61	4	8	0	12	6	28 (0)
<i>P. oleracea</i> + PKU	40	0	0	0	0	3	37 (0)
<i>P. oleracea</i> + Phenylketonuria	12	3	0	0	0	0	9 (0)

Table 1. Bibliometric and Technological Prospecting of *Portulaca oleracea* (Cortellis Database)

Note: *Values represent the total number of records retrieved in the Cortellis database; numbers in parentheses indicate unique entries or specific hits validated for clinical/pharmacological relevance within the search intersection.



Figure 1. Habit and flowering of *Portulaca oleracea* L. (Purslane).

POSTER **PO 33**

Acknowledgements: This work was supported by the National Council for Scientific and Technological Development (CNPq) and the Office of the Vice Rector for Research of the Federal University of Minas Gerais (PRPq/UFMG).

References:

1. Minighin, E. C., de Sousa, R. C. S., Ramos, A. L. C. C., Dias, L. T. S., Labanca, R. A., & de Araújo, R. L. B. . Evaluation of the consumption of fruits and vegetables by Phenylketonurics in the metabolic control of phenylalanine: An integrative review. *Journal of Medicinal Food*, **2022**, 25(5), 487-494.
2. Ramos, A. L. C. C., Minighin, E. C., Soares, I. I. C., Ferreira, R. M. D. S. B., de Sousa, I. M. N., Augusti, R., ... & Melo, J. O. F. Evaluation of the total phenolic content, antioxidative capacity, and chemical fingerprint of *Annona crassiflora* Mart. Bioaccessible molecules. *Food Research International*, **2023**, 165, 112514.
3. Clarivate. Cortellis Drug Discovery Intelligence. [S. l.]: Clarivate Analytics, 2026. Disponível em: <https://www.cortellis.com/>. Acesso em: 27 abr. **2026**.
4. Labanca, R. A.; Svelander, C.; Alminger, M. Effect of particle size of chia seeds on bioaccessibility of phenolic compounds during in vitro digestion. *Cogent Food & Agriculture*, **2019** v. 5, n. 1, p. 1694775.
5. Uddin, Md. Kamal; Juraimi, Abdul Shukor; Hossain, Md Sabir; Nahar, Most. Altaf Un; Ali, Md. Eaquib; Rahman, M. M. Purslane Weed (*Portulaca oleracea*): A Prospective Plant Source of Nutrition, Omega-3 Fatty Acid, and Antioxidant Attributes. *The Scientific World Journal*, **2014**, v. 2014, art. 576719, p. 1-17.

QUERCETIN ALLEVIATES CIGARETTE SMOKE EXTRACT AND LIPOPOLYSACCHARIDE-INDUCED PULMONARY INFLAMMATION AND FIBROSIS BY INHIBITING NECROINFLAMMATION AND ASSOCIATED SIGNALING IN MURINE MODEL

Aman Tiwari¹ and Rakesh Kumar Singh¹

¹Department of Pharmacology and Toxicology, National Institute of Pharmaceutical Education and Research (NIPER) – Raebareli, India
amantiwari.966phdpc22@niperrbl.ac.in

Ethnopharmacological relevance: Quercetin, a naturally occurring flavonoid, is found in various plants and dietary sources. It has been recognised for its potential antioxidant, anti-inflammatory, and cytoprotective properties^[1,2]. The traditional system of medicine has been using quercetin-rich extract for the management of respiratory ailments^[3]. However, its mechanistic role in regulating necroinflammation and fibrotic remodeling in chronic pulmonary inflammation remains insufficiently explored.

Aim of the study: The present study aimed to investigate the protective effect of quercetin against cigarette smoke extract (CSE) and lipopolysaccharide (LPS)-induced pulmonary inflammation and fibrosis with a particular focus on the modulation of necroinflammatory signaling pathways in the murine model.

Materials and methods: Mice were exposed to CSE and intermittently administered LPS for 60 days to induce chronic lung inflammation. Quercetin was administered as a therapeutic intervention. Lung tissue was analysed using histopathological techniques to assess tissue injury and fibrosis. Molecular and protein expression analysis were performed using western blotting, immunohistochemistry, and immunofluorescence to evaluate necroptotic markers, inflammatory mediators and fibrotic signalling pathways.

Results: CSE and LPS exposure were associated with significant increases in pulmonary inflammation, structural disruption, and collagen deposition in mouse lung tissue. This was accompanied by activation of necroinflammatory signaling as evidenced by increased expression of RIPK1, RIPK3, and MLKL, along with elevated inflammatory and oxidative stress markers. Quercetin treatment markedly attenuated these pathological alterations by suppressing necroptotic signaling, reducing inflammatory response, and mitigating fibrotic remodeling. Histological analysis confirmed improved tissue architecture and decreased collagen accumulation following quercetin administration.

Conclusion: The findings demonstrated that quercetin effectively alleviates CSE and LPS-induced pulmonary inflammation and fibrosis by inhibiting necroinflammation and associated signaling pathways. These results highlight the therapeutic potential of quercetin as a promising candidate for the management of chronic pulmonary diseases.

Acknowledgements: The authors acknowledge the Department of Pharmaceuticals, Ministry of Chemicals and Fertilizers, Govt. of India, for providing funding, financial support and necessary infrastructures and facilities to conduct this research work.

References:

- [1] Xiao K, Zhou M, Lv Q, He P, Qin X, Wang D, et al. Protocatechuic acid and quercetin attenuate ETEC-caused IPEC-1 cell inflammation and injury associated with inhibition of necroptosis and pyroptosis signaling pathways. *Journal of animal science and biotechnology* 2023; 14:5.
- [2] Yu J, Fu R, Buhe A, Xu B. Quercetin attenuates lipopolysaccharide-induced hepatic inflammation by modulating autophagy and necroptosis. *Poultry Science* 2024; 103:103719.
- [3] Deng S, Li J, Li L, Lin S, Yang Y, Liu T, Zhang T, Xie G, Wu D, Xu Y. Quercetin alleviates lipopolysaccharide-induced acute lung injury by inhibiting ferroptosis via the Sirt1/Nrf2/Gpx4 pathway. *Int J Mol Med*. 2023 Dec;52(6):118.

ACETOGENINS FROM AVOCADO SEED SELECTIVELY INHIBIT ADENOCARCINOMA CELLS AND INTERACT WITH THE MITOCHONDRIAL COMPLEX 1

Rita de Cássia Ribeiro Gonçalves¹, Amanda Gonzaga Nunes¹, Dalila Nickel Loose¹, Lorena Carnielli Queiroz¹,
Leonardo Bruno Federico², Ricardo Machado Kuster¹, Rodrigo Rezende Kitagawa¹
Rita de Cássia Ribeiro Gonçalves

¹ Graduate Program in Pharmaceutical Sciences, Federal University of Espírito Santo, Brazil

² Department of Pharmaceutical Sciences, Federal University of Santa Catarina, Brazil

rita.goncalves@ufes.br

Ethnopharmacological relevance: *Persea americana* (Laureaceae), known as avocado, is an meso-american native vegetal specie mostly destined to alimentary and cosmetic applications of the pulp. The seed is treated as industrial waste, however, they are traditionally used to treat inflammations and gastric disorders^[1,2].

Aim of the study: the work aimed to evaluate antitumoral activity of avocado seed hydroalcoholic extract and its fractions against gastric adenocarcinoma cells, and to suggest *in silico* interactions with the mitochondrial complex 1.

Material and Methods: the crude extract was prepared by maceration and the fractions were obtained by liquid-liquid fractionation followed by column chromatography with hexane/ethyl acetate gradient. Chemical characterization of most active fraction was performed by high resolution mass spectrometry. Cytotoxicity assay against AGS (gastric adenocarcinoma) cells were evaluated according to MTT method^[3]. Results were expressed by median inhibitory concentration (IC₅₀) values using fibroblast cells (L929) to determine safety and to calculate selectivity index. Molecular docking on AutoDock Vina^[4] was used to analyse interactions with the mitochondrial complex I (PDB = 6ZKK)^[5], validated by rotenone redocking.

Results: from the crude extract, seven fractions were obtained. MTT assay showed that all samples exhibited antitumoral effect against AGS in concentrations lower than 30 µg/mL. The best result was found in fraction 3, which achieved IC₅₀ value statistically equal to cisplatin, but had higher selectivity index, indicating its potential safety profile (Table 1).

Sample	AGS	L929	SI
EBSA	12.16 ± 0.62	110.93 ± 7.17	9.1
Fraction 1	7.79 ± 0.06	47.66 ± 5.30	6.1
Fraction 2	7.32 ± 1.37	56.70 ± 1.42	7.7
Fraction 3	5.79 ± 0.26	58.80 ± 7.03	10.2
Fraction 4	16.07 ± 1.49	51.23 ± 1.20	3.2
Fraction 5	27.40 ± 1.37	> 200	>7.3
Fraction 6	21.18 ± 2.52	> 200	>9.4
Fraction 7	16.48 ± 1.92	113.30 ± 1.21	6.9
Cisplatin	11.39 ± 0.33	5.79 ± 0.26	0.5

Table 1: Inhibitory concentration median 50% (IC₅₀) in µg/mL (means ± SD) and selectivity index for avocado seed fractions in fibroblast (L929) and adenocarcinoma (AGS) cell lines.

Mass spectrometry signals of fraction 3 were attributed to avocadene and avocadyne. Molecular docking between these acetogenins and 6ZKK revealed binding energies of -5.7 and -5.8 kcal/mol respectively, including interactions with residues important for rotenone promoted inhibition (Figure 1).

Conclusion: Therefore, acetogenins identified in avocado seeds exhibit *in vitro* anti-gastric cancer activity, while mitochondrial complex I represents a promising molecular target. Nevertheless, further studies are required to establish the structure–activity relationships of these compounds.

Acknowledgements: This work was supported by Fundação de Amparo à Pesquisa e Inovação do Espírito Santo – FAPES (Grant Number: 2022-78KWB) and CAPES (Grant Number: 2280/2022), process 88881.749045/2022-01.

References:

- [1] I. Castillo-Juárez, *J. Ethnopharmacol.* **2009**, 122, 402–405.
- [2] D. Dabas, R.M. Shegog, G.R. Ziegler, J.D. Lambert, *Curr. Pharm. Des.* **2013**, 19, 6133–6140.
- [3] T. Mosman, *J. Immunol Methods*, **1983**, 65, 55–63.
- [4] J. Eberhardt et al, *J. Chem. Inf. Model.*, **2021**, 61, 3891–3898.
- [5] D. Kampjut, L. A. Sazanov, *Science*, **2020**, 370.

RECOVERY AND STRENGTHENING OF FOOD SOVEREIGNTY THROUGH UNCONVENTIONAL FOOD PLANTS: EXTENSION, PARTICIPATORY RESEARCH, AND COMMUNITY QUALIFICATION IN QUILOMBOLA TERRITORIES, BRAZIL

Labanca, R. A.¹, Dala Paula B. M.¹, Melo J. O. F.¹, Minighin, E. C.¹, Martins, M. M.¹, Eduardo M.², Correia V. T. V.³, Barbosa, C. C.⁴, Duarte, L. F. R.⁵, Araújo R. L. B.¹

¹Food Science Department, Federal University of Minas Gerais (UFMG), Brazil;

²Faculty of Engineering, Eduardo Mondlane University, Mozambique;

³Agriculture and Livestock Research Enterprise of Minas Gerais (EPAMIG),
Risoleta Neves Experimental Field, São João del-Rei, MG, Brazil;

⁴Ouro Preto Movement for Childhood (MOPI)Ouro Preto, MG, Brazil, ⁵Federal University of Pará (UFPA), Belém, PA, Brazil
renatalabanca@ufmg.br

Ethnopharmacological relevance: The present study addresses Food and Nutritional Security (FNS) through the promotion of Unconventional Food Plants (UFP), a critical field for preserving traditional diets. This initiative integrates rigorous scientific analysis, specifically utilizing High-Performance Liquid Chromatography (HPLC) to profile phenolic compounds and amino acids, with comprehensive extension programs and social engagement^{1,2,3}. The research focuses on highly vulnerable traditional communities, aiming to bolster food sovereignty by empowering local leaders in the social oversight of federal public policies, such as the National School Feeding Program (PNAE) and the Food Acquisition Program (PAA)⁴. By overcoming systemic bureaucratic barriers, the project facilitates the productive and nutritional inclusion of local UFP production into institutional markets, ensuring sustainable development and the preservation of traditional knowledge⁵.

Aim of the study: The study aims to promote food sovereignty in traditional Quilombola territories in Minas Gerais through the strategic valorization of UFP⁵. By integrating participatory research with advanced laboratory techniques, the project characterizes the nutritional and bioactive potential of local species. Furthermore, it seeks to qualify community leaders for effective social oversight of federal public policies, dismantling obstacles to the productive inclusion of these communities and bridging the gap between traditional knowledge and institutional food systems.

Materials and methods: The project employs Participatory Action Research (PAR) and Popular Education principles, structured in three main axes. The first axis generates scientific evidence via HPLC to analyze the nutritional profile and bioactive compounds of community-cultivated plants^{2,3}. The second axis involves qualifying community leaders through dialogue circles and workshops on legislation and technical argumentation. The third axis focuses on political incidence and the co-authorship of a Productive Inclusion Plan to formalize Quilombola production in institutional markets. The methodology includes agroecological technical assistance and the implementation of educational gardens at the Faculty of Pharmacy⁵.

Results: The project has already achieved significant progress, as the educational gardens at the Faculty of Pharmacy are currently active and operational (Figure: 1). The successful cultivation stages and the active engagement of the community provide tangible evidence of the initiative's real-world application. Expected outcomes also include the qualification of at least thirty social control agents and the formal institutionalization of this participation model within municipal management. By combining cutting-edge science with traditional wisdom, the initiative effectively improves nutritional quality, ensures income generation, and guarantees the fundamental rights of traditional peoples. This multidisciplinary approach generates social technologies that can be replicated in other territories, ultimately strengthening food sovereignty and global sustainable development agendas.



Figure 1. Diversity of Unconventional Food Plants (UFP) cultivated at the UFMG Faculty of Pharmacy garden. (A) Established

POSTER PO 36

rows of *Allium fistulosum* (Green onion) demonstrating soil adaptation. (B) Robust leaf development of *Xanthosoma sagittifolium* (Elephant ear/Taioba), a key tuberous species. (C) Fruit maturation of *Capsicum baccatum* (Lady's finger pepper) showing biological scale for morphological assessment.

Conclusion: The integration of analytical chemistry with participatory extension proves to be an effective strategy for rescuing food sovereignty. The scientific validation of UFP nutritional profiles provides the necessary technical substrate for community leaders to demand and implement public policies. This model not only preserves ancestral knowledge but also inserts traditional production into formal economic circuits, promoting social justice and nutritional health.

Acknowledgements: This work was supported by the National Council for Scientific and Technological Development (CNPq) and the Office of the Vice Rector for Research of the Federal University of Minas Gerais (PRPq/UFGM).

References:

1. LABANCA, R. A.; SVELANDER, C.; ALMINGER, M. Effect of particle size of chia seeds on bioaccessibility of phenolic compounds during in vitro digestion. *Cogent Food & Agriculture*, v. 5, n. 1, art. 1694775, 2019.
2. RAHAYU, Y. Y. S. et al. Exploring unconventional food plants used by local communities in a rural area of West Java, Indonesia: ethnobotanical assessment, use trends, and potential for improved nutrition. *Journal of Ethnobiology and Ethnomedicine*, v. 20, n. 57, 2024.
3. RANIERI, G. R. et al. Mineral nutrients and protein composition of non-conventional food plants (*Pereskia aculeata* Miller, *Sonchus oleraceus* L. and *Xanthosoma sagittifolium* (L.) Schott). *Food Chemistry*, v. 463, 2024.
4. GLIESSMAN, S.; MÉNDEZ, V. E. Coupling Agroecology and PAR to Identify Appropriate Food Security and Sovereignty Strategies in Indigenous Communities. *Agroecology and Sustainable Food Systems*, v. 38, n. 2, p. 165–183, 2014.
5. LOPES, C. V. et al. Nutritional and Bioactive Characterization of Unconventional Food Plants for Sustainable Functional Applications. *Sustainability*, v. 17, n. 15, 6718, 2025.

EROSION OF ANCESTRAL PHYTOCHEMICAL CORRESPONDENCE IN VERNACULAR CANNABIS CATEGORIES 'SATIVA' AND 'INDICA'

George Coleridge Lewis¹, Mike Barnes²

¹ Pharmacognosy & Phytotherapy, UCL School of Pharmacy, University College London, United Kingdom1

² Institute of Neuroscience, Newcastle University, United Kingdom2
george.lewis.25@ucl.ac.uk

Ethnopharmacological relevance: Cannabis is an ancient, highly heterogeneous, culturally embedded drug plant. Its diversity is often compressed into vernacular 'Sativa'/'Indica' labels, which are maintained as proxies for ancestry, chemistry and effect, despite pervasive hybridisation and adaptation to allochthonous production systems. Because the putative ancestral landrace groups are critically endangered reservoirs of germplasm,^[1] testing these labels' phytochemical correspondence is relevant to cannabis standardisation, landrace preservation and ethnopharmacological diversity.

Aim of the study: We tested whether Sativa/Indica-labelled categories retain phytochemical correspondence with their putative ancestral narrow-leaflet drug (NLD) ganja and wide-leaflet drug (WLD) hash-plant pools across breeding eras.

Materials and methods: We conducted a comparative secondary analysis of three published datasets representing landrace, Dutch classic-era and contemporary US cannabis categories. Overlapping cannabinoid and terpenoid markers were harmonised as relative within-panel compositions and compared using resampling-based univariate inference and Hellinger-based multivariate ordination.

Results: The NLD–WLD contrast evident in landrace material was progressively attenuated and reconfigured across later-era categories; modern US Sativa/Indica showed the strongest overlap, with terpinolene the only consistent label-tracking phytochemical analysed. CBC and propyl-chain cannabinoids declined substantially, and the WLD-associated population-level THC:CBD balance was absent from modern Indica-labelled material. Contemporary Type I US samples were dominated by THC, with mean THC + CBG accounting for at least 99% of total cannabinoids. Terpenoid profiles showed a shift toward a small set of high-volatility compounds, particularly myrcene and limonene, while several sesquiterpenoids declined in relative abundance.

Conclusion: These results suggest that modern 'Sativa' and 'Indica' function poorly as phytochemical labels and only weakly support the effect claims often attached to them. More broadly, they point to a THC-centred compression of visible cannabis diversity, risking a narrower pharmacological search space and obscuring the value of traditional cannabis populations. Preserving and characterising cannabis landraces, regional products and cultural contexts should therefore be treated as an ethnopharmacological priority.

Reference:

[1] John M McPartland and Ernest Small. "A classification of endangered high-THC cannabis (*Cannabis sativa* subsp. *indica*) domesticates and their wild relatives". In: *PhytoKeys* 144 (2020), pp. 81–112.

DISTINCT DRUG–METABOLISM PROFILES OF CITRUS PEELS RELATED TO CHENPI IN A MODERN PHARMACOLOGICAL CONTEXT

Wan-Ting Liao^{1,2}, Hsiang-Cheng Chi^{3,4}, Shang-Ming Huang⁵

¹ Chinese Medicine Department, Show Chwan Memorial Hospital, Changhua, Taiwan

² Graduate Institute of Chinese Medicine and Drug Development, National Chung Hsing University, Taichung, Taiwan

³ Institute of Biochemistry and Molecular Biology, China Medical University, Taichung, Taiwan

⁴ Chinese Medicine Research Center, China Medical University, Taichung, Taiwan.

⁵ Department of Nutrition, China Medical University, Taichung, Taiwan

enolainsky@gmail.com

Ethnopharmacological relevance: Chenpi, derived from the dried peel of *Citrus reticulata*, is a traditional medicinal material widely used in East Asian medicine for regulating qi and improving digestive function. In modern clinical settings, Chenpi is frequently co-administered with conventional medications. However, citrus-associated food–drug interactions are often generalized from grapefruit, despite substantial phytochemical differences among citrus species, raising questions regarding the pharmacological distinctiveness and safety relevance of Chenpi.

Aim of the study: This study aimed to comparatively evaluate the effects of multiple citrus peel extracts on drug metabolism-related pathways, with a particular focus on determining whether Chenpi exhibits a distinct interaction profile compared with non-Chenpi citrus species.

Materials and methods: Peel extracts from six commonly consumed citrus species, including *Citrus limon*, *Citrus depressa*, *Citrus maxima*, *Citrus paradisi*, *Citrus sinensis*, and *Citrus reticulata*, were evaluated using an in vivo rat model combined with complementary in vitro assays. Drug metabolism-related endpoints, including cytochrome P450 activity, disposition-associated pathways, and hepatic redox status, were assessed following coadministration with a model drug.

Results: Distinct species-dependent patterns were observed across the tested citrus peels. *Citrus paradisi* exhibited a pronounced interaction profile consistent with strong modulation of drug metabolism pathways. In contrast, *Citrus reticulata* demonstrated comparatively mild effects and did not reproduce the interaction pattern observed with grapefruit. *Citrus depressa* showed an intermediate profile, with moderate metabolic influence accompanied by a more favorable redox-related response. These differences were associated with species-specific phytochemical characteristics.

Conclusion: The present findings suggest that citrus peels should not be regarded as a pharmacologically uniform category and that Chenpi represents a distinct group with a comparatively lower interaction-related impact on drug metabolism. This study highlights the importance of species-level evaluation in ethnopharmacology and supports a more nuanced interpretation of citrus use in the context of modern pharmacotherapy.

ETHNOBOTANICAL RESEARCH AND EDUCATION IN CHINA**Chun-Lin Long¹, Ren-Ai Xu², Wei-Jun Yang³**¹ *Minzu University of China, Beijing, China*² *Wenzhou Medical University, Wenzhou, China*³ *Xinjing Institute of Meteria Medica, Urumqi, China*
long.chunlin@muc.edu.cn

China is one of the countries with the largest number of ethnobotanists in the world. Ethnobotany as an independent discipline has been developed in China for more than 40 years which has made great contributions to ethnopharmacology. The scientific activities carried out by Chinese ethnobotanists are very frequent. However, many international ethnosience communities have very limited knowledge about China's ethnobotanical research and education. The authors reviewed the status of research, organization, education, exchange, and application of ethnobotany in China, based on ethnobotanical and ethnopharmacological approaches. The China Association of Ethnobotany and its sister organizations (for example, ethnomedicine, ethnopharmacology, ethnoecology, and others) hold 2-3 symposia each year, and there are 150-300 participants in every symposium. Young Scientist Awards in these symposia strongly encouraged young ethnobotanists' enthusiasm in ethnobotany, ethnopharmacology and their relative subjects. Ethnobotanical curriculum has been developed in some famous Chinese colleges including the Minzu University of China. Graduation education has been conducted in universities and research organizations. More than 200 people have been awarded master or doctoral degrees in ethnobotany and ethnopharmacology, who are from China and some developing countries such as Pakistan, India, Nepal, Thailand, Kenya, Madagascar and Mongolia. In the past 20 years, Chinese ethnobotanists have completed ethnobotanical inventories of over 30 ethnic groups and local communities. Dozens of ethnobotanical and ethnopharmacological achievements have provided assistances to biodiversity conservation, rural revitalization, and enterprise development based on the ideas and technology of modern ethnobotany. Now ethnobotany has become popular through public education and dissemination in China. The ethnobotanical and ethnopharmacological achievements and products will play significant roles in biodiversity conservation, health promotion and sustainable development. This paper provides an outline of ethnobotanical research and education in China, including the status of ethnopharmacological studies in the country.

Keywords: ethnobotany, ethnopharmacology, research, education, China

CAMELLIA FLAVA (PITARD) SEALY MODULATES OXIDATIVE STRESS-INFLAMMATION-WOUND HEALING RESPONSES VIA MYELOPEROXIDASE SUPPRESSION, AN *IN VITRO* AND *IN VIVO* STUDY

Huynh Nhu Mai¹, Lac Thuy Nguyen Huu¹

¹ School of Pharmacy, University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam
mnhu@ump.edu.vn

Ethnopharmacological relevance: Hemorrhoidal disease (HD) is a gastrointestinal condition that significantly reduces quality of life due to anal bleeding, rectal pain and pressure.^[1] *Camellia flava* (Pitard) Sealy (CF) is a native Vietnamese golden camellia species with broad biological activities, yet remains underexplored. Our research group is the first to investigate its pharmacological properties, demonstrating that CF extract is rich in total flavonoids and exhibits significant antioxidant and anti-inflammatory activities, suggesting its potential for the treatment of inflammation-related diseases.^[2,3]

Aim of the study: To simultaneously quantify two biomarkers in CF extract. To evaluate its therapeutic efficacy via *in vitro* ROS scavenging, MPO suppression, promotion of cell migration and proliferation, and attenuation of tissue injury, and vascular dysfunction in *in vivo* models.

Materials and methods: Simultaneous quantitation of quercetin and rutin was performed using HPLC. Cell viability, intracellular ROS and scratch assays were conducted using HaCaT and HDF cells. A croton oil preparation was used to induce hemorrhoid-like condition in mice for 3 days, followed by a 7-day treatment period. On day 10, rectal tissues were collected for macroscopic examination, H&E staining, anal-rectal coefficient (ARC), MPO activity, and Evans blue assay.

Results: The contents of rutin and quercetin were $1.07 \pm 0.02\%$ and $0.81 \pm 0.01\%$, respectively. CF extract showed no cytotoxicity at concentration up to 5 mg/mL. It reduced ROS levels and significantly accelerated wound closure at 10 $\mu\text{g/mL}$ ($p < 0.05$). It also suppressed MPO activity ($\text{IC}_{50} = 17.04 \mu\text{g/mL}$). Treated groups demonstrated improvements in macroscopic evaluation and ARC. CF extract showed protection effects against inflammatory infiltration, necrosis, and ulceration in H&E stainings and in the vascular extravasation assay.

Conclusion: CF extract demonstrated potentials in *in vitro* and *in vivo* studies via modulation of oxidative stress-inflammation-wound healing responses, providing foundation for further studies on its anti-inflammatory mechanisms.

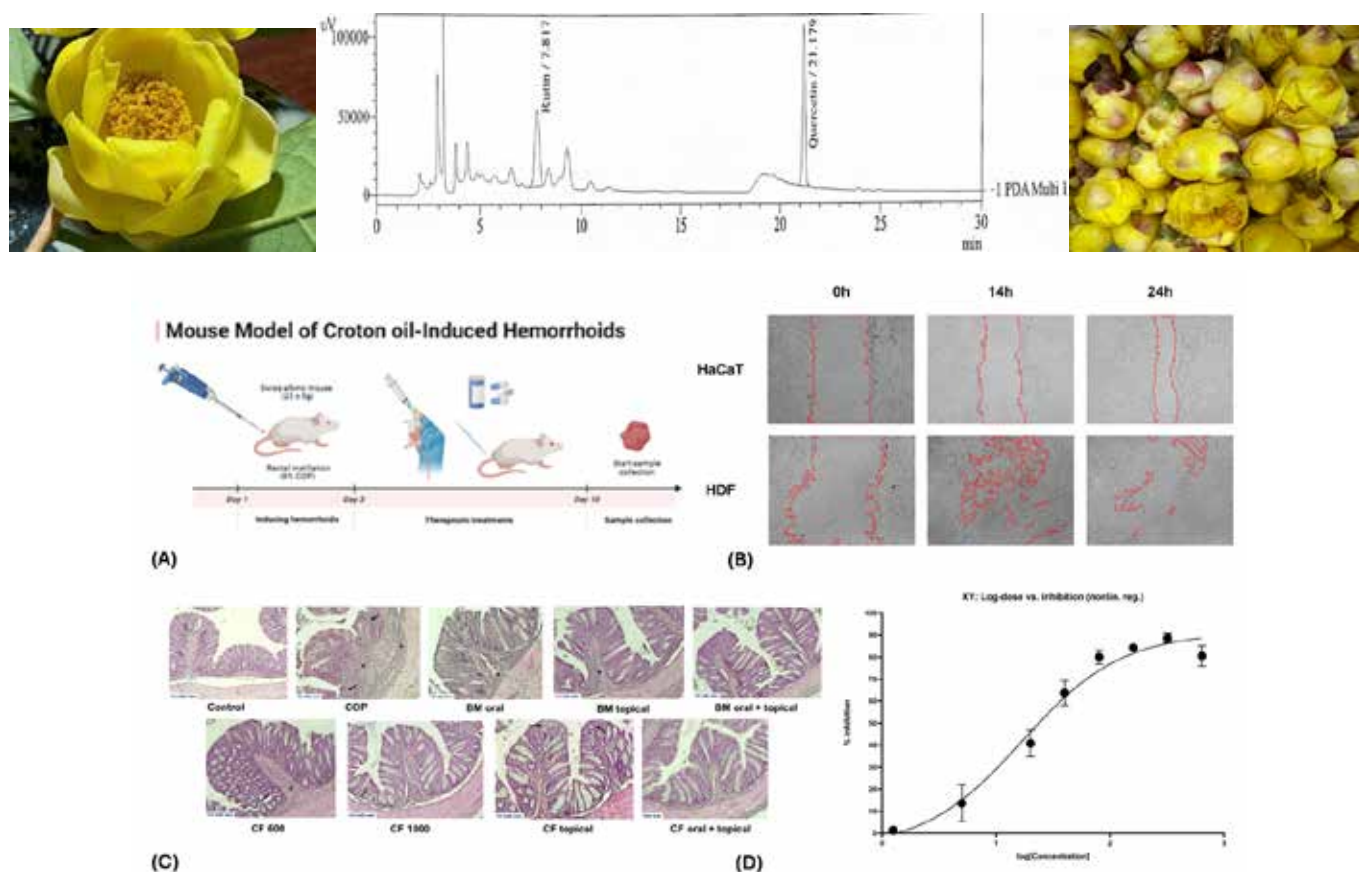


Figure 1. Flowers of *Camellia flava* (Pitard) Sealy and HPLC chromatogram of CF extract showing the separation of bioactive markers. Peaks at 8 and 21 min correspond to rutin and quercetin, respectively, used for simultaneous quantification.

Figure 2. Experimental design and results of *in vitro* and *in vivo* assessments (A) Schematic representation of the *in vivo* ex-

POSTER **PO 40**

perimental design; (B) Wound area in HaCaT and HDF cells treated with CF flower extract at 0, 14, and 24 h post-scratch; (C) Histomicrographs of anorectal tissues of nine groups of mice at 10x magnification; (D) Nonlinear regression for inhibition of myeloperoxidase (MPO) in vitro.

References:

- [1] J.H. Ashburn, *JAMA* **2025**, 334, 1541–1550
- [2] H.L.T. Nguyen, T.T.P. Ha, N.P.N. Nguyen et al., *Pharmacia* **2024**, 71, 1–15
- [3] M.N. Truong, D.T. Nguyen, H.N. Phan-Van, L.T. Nguyen-Huu, *Natural Product Research* **2026**, 1–9.

ETHNOBOTANICAL KNOWLEDGE AND MEDICINAL PLANT USE FOR SKIN DISORDERS IN THE BALKANS AND MEDITERRANEAN - A REVIEW

Ioanna Maltezos¹, Evanthia Dina^{1,2}, Antigoni Cheilari^{1,2}, Ioannis Bazos³, Andreas Zikos³, Nektarios Aligiannis^{1,2}

¹Department of Pharmacognosy and Natural Products Chemistry, Faculty of Pharmacy, NKUA, Panepistimiopolis Zografou, 15771, Athens, Greece

²Institute for Ethnopharmacological Studies and Phytotherapy, NKUA, Panepistimiopolis Zografou, 15771, Athens, Greece

³Department of Ecology and Systematics, Faculty of Biology, NKUA, Panepistimiopolis Zografou, 15771, Athens, Greece

ioanmalt@pharm.uoa.gr

Ethnopharmacological relevance: Ethnobotanical research in the Balkans and the Mediterranean region has expanded significantly in recent years, reflecting both the high biodiversity of these regions and the long-standing use of traditional medicinal knowledge within them. This knowledge remains deeply embedded in local and indigenous cultures and is transmitted from generation to generation, providing fertile ground for scientific research ^[1]. Given that skin conditions affect approximately 1.8 billion people worldwide ^[2] and that many current therapeutic approaches are associated with significant adverse effects, interest in herbal medicine has increased considerably ^[3]. Ethnobotanical studies offer important complementary insights by documenting medicinal plant use, thus supporting pharmaceutical research in the development of safer and more effective treatments.

Aim of the study: The present literature review aimed to systematically investigate, compare, and evaluate ethnobotanical knowledge related to the treatment of dermatological disorders across the Balkans and Mediterranean.

Materials and methods: A literature search was conducted in Scopus, PubMed, Google Scholar, and ScienceDirect, covering studies published up to 2024. Sixteen countries were included: Albania, Kosovo, Italy, Greece, Romania, Bulgaria, Serbia, Turkey, Malta, Moldova, Bosnia and Herzegovina, Cyprus, Montenegro, North Macedonia, Croatia, and Slovenia. The data were organized into a table including scientific name, plant family, country of study, plant part used, preparation methods, and reported therapeutic uses. Documented dermatological conditions were standardized using established terminology and classified into 39 categories.

Results: Overall, 332 ethnobotanical studies were analyzed, from which 1,714 plant taxa used for dermatological treatments were recorded. In addition, useful indices were calculated to enable statistical validation, and comparative analyses of the collected quantitative data. The findings confirm the ongoing ethnobotanical research in the study areas and highlight the timeless importance of the use of traditional medicinal plants.

Conclusion: The systematic review and evaluation of these studies provide a strong dataset that may support future pharmacological research and contribute to the development of new therapeutic applications for dermatological disorders.

ASSESSING THE POTENTIAL INSULIN SENSITIZING EFFECT OF FOUR PLANT EXTRACTS *IN VIVO* AND *IN VITRO*

Samantha Martínez-Medina¹, Adolfo Andrade-Cetto¹

¹ Laboratorio de Etnofarmacología, Departamento de Biología Celular,
Facultad de Ciencias, Universidad Nacional Autónoma de México, México
sam.mtz.md@ciencias.unam.mx

Ethnopharmacological relevance: The plants *Eysenhardtia officinalis* (EO), *Costus pulverulentus* (CP), *Jefea lantanifolia* (JL), and *Eryngium cymosum* (EC) are traditionally used in the communities of Tamala and Huejutla, Hidalgo, Mexico, for the treatment of type 2 diabetes.^[1,2,3]

Aim of the study: The effects of the four species on insulin sensitivity (IS) were assessed both *in vivo*, using healthy rats, and *in vitro*, through inhibition assays targeting protein tyrosine phosphatase 1B (PTP1B) activity an enzyme recognized as a key negative regulator of the insulin signalling pathway.^[2]

Materials and methods: Healthy, fasted Wistar rats were used for acute insulin tolerance tests (ITT). Extracts were administered at traditional doses: ethanol-aqueous extract of EO (8 mg/kg), aqueous extracts of CP (186 mg/kg), JL (365 mg/kg), and EC (47 mg/kg). Pioglitazone (20 mg/kg) was used as a positive control. Forty-five minutes later, baseline glucose was measured, and isophane insulin was injected at a dose of 0.5 U/kg. Blood glucose levels were then monitored at 15, 30, 60, and 120 minutes post-injection. *In vitro* concentration-response inhibition assays of PTP-1B enzyme activity were also performed by adding increasing concentrations of each extract. Na₃VO₄ was used as a control. The inhibitory concentration 50 (IC₅₀) was calculated using nonlinear regressions with the absorbances of three assays in triplicate.

Results: All four extracts showed a higher rate of glucose disposition compared to the negative control. Regarding the PTP-1B assay, the four extracts inhibited enzyme activity between 80% to 100%, with IC₅₀ values ranging from 944 to 3,631 µg/ml.

Conclusion: The *in vivo* results suggest that the extracts' behaviour responds to a mechanism that could promotes IS, as a significant potentiation of the decrease in plasma glucose was observed compared to the negative control, and even greater than that of the positive control in the case of CP.

Acknowledgements:

To the Posgrado en Ciencias Biológicas, UNAM, to SECIHTI for the doctoral scholarship awarded (CVU:1034583), and DGA-PA-PAPIIT project In214225.

References:

- [1] Andrade-Cetto, A., Espinoza-Hernández, F., Escandón-Rivera, S., Mata-Torres, G., Martínez-Medina, S., & Gabriel-Vázquez, J, Contribution to understanding the acute hypoglycemic effect of traditionally used *Eysenhardtia officinalis* R.Cruz & M.Sousa, 2024, *Journal of Ethnopharmacology*, 321, 117534. <https://doi-org/10.1016/j.jep.2023.117534>
- [2] Safavi, F., Escandón-Rivera, S. M., Andrade-Cetto, A., & Rosas-Ramírez, D, Phytochemical Composition and Acute Hypoglycemic Effect of *Jefea lantanifolia* (S. Schauer) Strother in Rats, 2025, *Plants*, 14(19), 3054. <https://doi.org/10.3390/plants14193054>
- [3] Espinoza-Hernández, F., Andrade-Cetto, A., Escandón-Rivera, S., Mata-Torres, G., & Mata, R, Contribution of fasting and postprandial glucose-lowering mechanisms to the acute hypoglycemic effect of traditionally used *Eryngium cymosum* F.Delaroche, 2021, *Journal of Ethnopharmacology*, 279, 114339. <https://doi.org/10.1016/j.jep.2021.114339>
- [4] Liu, Z., Gao, H., Zhao, Z., Huang, M., Wang, S., & Zhan, J, Status of research on natural protein tyrosine phosphatase 1B inhibitors as potential antidiabetic agents: Update, 2023, *Biomedicine & Pharmacotherapy*, 157, 113990. <https://doi.org/10.1016/j.biopha.2022.113990>

MECHANISM PARTICIPATING IN THE HYPOGLYCAEMIC EFFECT OF THE AQUEOUS EXTRACT OF *Jefea Lantanifolia* (S.Schauer) Stroher

Gerardo Mata-Torres Valle¹, Javier López-Mendoza¹, Hanael Cervantes-Hernández¹, Adolfo Andrade-Cetto¹

¹ Laboratorio de Etnofarmacología, Departamento de Biología Celular, Facultad de Ciencias, Universidad Nacional Autónoma de México, México.
gerardom.torres@ciencias.unam.mx

Ethnopharmacological relevance: Type 2 diabetes (T2D) is characterized by increased blood glucose levels due to a high production of this carbohydrate by the liver and decreased utilization by skeletal muscle and adipose tissues [1]. Pharmacological treatment is needed, nevertheless, these drugs are not affordable for native communities in Mexico, therefore local population uses medicinal plants to treat T2D. In Hidalgo, Mexico *Jefea lantanifolia* is traditionally used to manage T2D. Aerial parts are prepared as an infusion and consumed throughout the day. Previous results shown that *J. lantanifolia* reduced blood glucose levels in hyperglycaemic rats [2].

Aim of the study: Elucidate the action mechanism by analysing insulin secretion and inhibition of hepatic glucose production (HGP).

Materials and methods: For insulin secretion testing, two-month-old Wistar rats were used. The aqueous extract was administered orally, and blood samples were collected at 0, 30, 60, 90, and 120 minutes after administration. These samples were analysed to determine insulin and glucose levels. To evaluate the inhibition of HGP, a pyruvate tolerance test (PTT) was performed in hyperglycaemic Wistar rats. *J. lantanifolia* extract (365 mg/kg) was administered orally 30 minutes prior to an intraperitoneal injection of sodium pyruvate (2 g/kg). Blood glucose levels were measured every 30 minutes up to 120 minutes after pyruvate administration. Enzymatic inhibition assays were conducted on glucose-6-phosphatase (G6Pase) and fructose-1,6-bisphosphatase (F1,6BisPase).

Results: *J. lantanifolia* reduced blood glucose levels compared with the control group; however, insulin secretion was not stimulated by the extract. In the PTT, *J. lantanifolia* did not inhibit HGP, although glucose values decreased between 30 and 120 minutes. Additionally, enzymatic inhibition assays demonstrated that *J. lantanifolia* inhibited G6Pase with an IC₅₀ of 793 µg/mL and F1,6BisPase with an IC₅₀ of 625 µg/mL.

Conclusion: The extract reduced blood glucose without modifying insulin secretion and improved glucose utilization after PTT.

Acknowledgements: To UNAM, DGAPA-PAPIIT In214225 for the financial support to this project.

References:

- [1] M. Bajaj et al., "2. Diagnosis and Classification of Diabetes: Standards of Care in Diabetes—2026," *Diabetes Care*, vol. 49, no. Supplement_1, pp. S27–S49, Jan. 2026, doi: 10.2337/dc26-S002.
- [2] F. Safavi, S. M. Escandón-Rivera, A. Andrade-Cetto, and D. Rosas-Ramírez, "Phytochemical Composition and Acute Hypoglycemic Effect of *Jefea lantanifolia* (S. Schauer) Strother in Rats," *Plants*, vol. 14, no. 19, p. 3054, Oct. 2025, doi: 10.3390/plants14193054.

HYPOGLYCEMIC MECHANISM OF *Croton Guatemalensis* LotsyAngelina Daniela Moreno-Vargas¹, Fernanda Artemisa Espinoza-Hernández¹, Adolfo Andrade-Cetto¹

¹ Laboratorio de Etnofarmacología, Departamento de Biología Celular,
Facultad de Ciencias, Universidad Nacional Autónoma de México, México
daniela_21@ciencias.unam.mx

Ethnopharmacological relevance: The bark of *Croton guatemalensis* Lotsy is used by the Cakchiquels of Guatemala to treat type 2 diabetes ^[1]. The ethanol–water extract (EWE) exhibited a hypoglycemic effect in hyperglycemic rats ^[2], and junceic acid (JA) was identified as the major compound ^[3].

Aim of the study: Contribute to elucidate the hypoglycemic mechanism in this species.

Materials and methods: Normoglycemic and hyperglycemic rats were used to evaluate the effects of EWE and JA on fasting and postprandial insulin concentrations, as well as on hepatic gluconeogenesis using pyruvate tolerance tests (PTT). Healthy rats were used to assess the effects of both treatments on insulin sensitivity using insulin tolerance tests (ITT). Insulin resistance was induced in rats to evaluate the effect of EWE on Akt phosphorylation in the gastrocnemius muscle and liver by Western blot analysis. To complement the in vivo experiments, in vitro assays were performed to assess the inhibitory activity against the enzymes PTP-1B, glucose-6-phosphatase (G6Pase), and fructose-1,6-bisphosphatase (FBPase).

Results: Under fasting conditions, EWE decreased glucose levels in both normoglycemic and hyperglycemic rats without increasing insulin concentrations; conversely, JA reduced glucose levels only in hyperglycemic rats and increased insulin secretion in normoglycemic rats. Under postprandial conditions, in both groups, EWE and JA reduced the hyperglycemic peak following a glucose load without increasing insulin secretion. In the PTT, both treatments attenuated the hyperglycemic peak induced by pyruvate administration. During the ITT, neither EWE nor JA improved the insulin response. Regarding Akt phosphorylation in muscle, EWE increased pAkt1 but not pAkt2, which is more directly involved in glucose metabolism in this tissue; in contrast, in the liver, phosphorylation of both Akt isoforms was increased. In in vitro assays, both EWE and JA inhibited all evaluated enzymes: PTP-1B by 93% and 72%, G6Pase by 97% and 93%, and FBPase by 89% and 82%, respectively.

Conclusion: Both EWE and JA improved postprandial hyperglycemia without stimulating glucose-induced insulin secretion. EWE exerted a greater effect at the hepatic level by increasing the phosphorylation of both Akt isoforms.

Acknowledgements: The authors acknowledge SECIHTI for the doctoral scholarship awarded (CVU: 6297863), Posgrado en Ciencias Biológicas, UNAM and DGAPA-PAPIIT In214225 for sponsoring this project.

References:

- [1] E. C. Cruz and A. Andrade-Cetto, "Ethnopharmacological field study of the plants used to treat type 2 diabetes among the Cakchiquels in Guatemala," *J. Ethnopharmacol.*, vol. 159, pp. 238–244, Jan. 2015, doi: 10.1016/j.jep.2014.11.021.
- [2] A. Andrade-Cetto, E. C. Cruz, C. A. Cabello-Hernández, and R. Cárdenas-Vázquez, "Hypoglycemic Activity of Medicinal Plants Used among the Cakchiquels in Guatemala for the Treatment of Type 2 Diabetes," *Evidence-based Complementary and Alternative Medicine*, vol. 2019, 2019, doi: 10.1155/2019/2168603.
- [3] S. M. Escandón-Rivera, A. Andrade-Cetto, D. G. Rosas-Ramírez, and R. Arreguín-Espinosa, "Phytochemical Screening and Isolation of New Ent-Clerodane Diterpenoids from *Croton guatemalensis* Lotsy," *Plants*, vol. 11, no. 22, Nov. 2022, doi: 10.3390/plants11223159.

COMPUTATIONAL, PHARMACOGNOSTICAL AND PHARMACOLOGICAL EVALUATION OF LEAF AND BARK EXTRACTS OF *SARACA ASOCA* (ROXB.) WILLD. AGAINST NEUROPATHIC PAIN

Mandar Mahendra Muley^{1,2}, Prakash Rambhau Itankar¹

¹Department of Pharmaceutical Sciences, R.T.M. Nagpur University Nagpur - 440033, Maharashtra, India.,

² School of Pharmacy, Indira University Pune - 411033, Maharashtra, India.

mandar.niper2019@gmail.com

Ethnopharmacological relevance: *Saraca asoca* (Roxb.) Willd., commonly known as *Sita Ashok*, is revered across South and Southeast Asia for its religious and pharmaceutical value^[1]. The tree is also crucial for biodiversity and ethnopharmacological sustainability. Overexploitation of its bark for therapeutic purposes has led to its classification as Vulnerable by the IUCN. The present study investigates the feasibility of substituting bark with leaves as a sustainable conservation strategy and compares bark and leaves extracts for their efficacy against neuropathic pain^[2].

Aim of the study: To perform comparative evaluation with respect to pharmacognostic profile of the bark of *Saraca asoca* (Roxb.) Willd. with its leaves and to study pharmacological activity of extracts against neuropathic pain

Materials and methods: Pharmacognostic investigations were first conducted as preliminary evaluations. Analytical profiling by TLC and HPLC was performed to identify and quantify selected phytochemicals, including epicatechin, catechin, and procyanidin B2. Network pharmacology identified neuroinflammation-linked targets and pathways. Molecular docking quantified marker compounds binding to TGF- β receptor I and NF- κ B (p50), using gabapentin and pregabalin as reference. Cytotoxicity was assessed on RAW 264.7 cells using MTT assay to obtain IC₅₀. Therapeutic efficacy of both extracts was evaluated in paclitaxel-induced neuropathic pain (PINP) model in adult Wistar rats (2 mg/kg via intraperitoneal route). Behavioral assessments were conducted according to established models (Von Frey filament test, cold allodynia, walking track test), and at study termination histopathological evaluation, biochemical assays (MPO, TBARS), and ELISAs for inflammatory markers (NF- κ B, TGF- β , and TNF- α) were performed^[3,4].

Results: HPLC analysis confirmed the presence of epicatechin, catechin, and procyanidin B2 in both bark and leaves extracts, demonstrating comparative quantification. In-silico studies illustrate promising interactions of selected phytochemicals with neuropathic pain-related targets, supporting their pharmacological relevance. In PINP model, both bark and leaves extracts (200 mg/kg, orally) attenuated key inflammatory mediators NF- κ B, TGF- β , and TNF- α in sciatic nerve tissue and were associated with improved behavioral outcomes on day 14, and 21. The leaves extract produced greater reductions in these mediators and superior recovery in behavioral assays compared with the bark extract. Pregabalin was used as the reference standard (30 mg/kg, orally). The results indicate that the leaves extract exerts stronger anti-inflammatory and neuroprotective effects, supporting its promise as a sustainable alternative for *Sita Ashok* derived anti-inflammation therapies.

Conclusion: These multimodal data suggest that leaves of *Saraca asoca* (Roxb.) Willd. can serve as a viable substitute for bark without compromising therapeutic efficacy. Leaves contain key neuroactive polyphenols comparable to bark, possess plausible molecular interactions with neuropathic-relevant targets, and exhibit comparable neuroprotective potential. The substitution of leaves for bark in *Sita Ashok* represents a promising conservation-oriented strategy that mitigates harvesting pressure on wild populations while enabling sustainable and ethically sourced plant-derived therapeutics.

Acknowledgements: The authors acknowledge the National Medicinal Plants Board (NMPB), Ministry of AYUSH, New Delhi, for financial support under Project No. R&D/MH-01/2021-22

References:

- 1) Government of India, Ministry of Health and Family Welfare, Department of AYUSH. The Ayurvedic Pharmacopoeia of India. New Delhi: Government of India; **1978**.
- 2) Jena, A.K.; Karan, M.; Vasisht, K. Journal of Ayurveda and Integrative Medicine **2017**, 8, 68–72.
- 3) Griffiths, L.A.; Duggett, N.A.; Pitcher, A.L.; Flatters, S.J. Pain Research and Management **2018**, 8217613.
- 4) Jain, V.; Sinha, S.K.; Rustage, K.; Pareek, A.; Srivastava, M.; Meena, M.K.; Shakya, A.; Gupta, M.M.; Rai, N.; Pareek, A.; Ratan, Y. Molecular Neurobiology **2023**, 60, 5378–5394.

INVESTIGATION OF *IN VITRO* AND *IN VIVO* ANTI-INFLAMMATORY ACTIVITY OF THE VIETNAMESE TRADITIONAL POLYHERBAL FORMULA “TOA CAN BAN”

Triet Thanh Nguyen¹, Quynh-Mai Vu Trinh^{1,2}, My-Duyen Thi Chung¹

¹Faculty of Traditional Medicine, University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam

²Faculty of Traditional Medicine, Pham Ngoc Thach University of Medicine, Vietnam

nguyenthanhtriet1702@ump.edu.vn

Ethnopharmacological relevance: Toa Can Ban (literally “basic formula”) is a Vietnamese traditional formula combining ten medicinal herbs, used to “clear the toxic heat” and “detoxify”.^[1] Because the traditional concepts of “heat/fire-toxin” share clinical parallels with inflammation in modern medicine, and there is a link between “clearing heat and detoxifying” and anti-inflammation, this study investigated the anti-inflammatory activity of Toa Can Ban.

Aim of the study: The study aims to evaluate the anti-inflammatory activity of Toa Can Ban extracts and to identify a promising extract for further development.

Materials and methods: Dried crude drugs (10 medicinal herbs) of the formula were extracted using water, 40% ethanol, or 70% ethanol. Anti-inflammatory activity was screened *in vitro* by measuring nitric oxide (NO) production in LPS-stimulated RAW 264.7 macrophages (Griess reaction) with cell viability assessed by MTT assay.^[2,3] The most active extract (70% ethanol) was evaluated for acute oral toxicity in mice and for *in vivo* anti-inflammatory activity in the carrageenan-induced paw edema model (single dose and repeat dosing), with meloxicam (8 mg/kg) used as a positive control.^[4,5]

Results: The 70% ethanol extract showed the strongest inhibition of NO production ($IC_{50} = 25.51 \mu\text{g/mL}$). Phytochemical screening detected essential oils, flavonoids, saponins, anthranoids, alkaloids, tannins, coumarins, and carbohydrates, and TLC fingerprinting indicated major contributions of phytochemicals from *Imperata cylindrica*, *Centella asiatica*, *Eclipta prostrata*, and *Eleusine indica*. No mortality or abnormal behavior was observed after oral administration of the 70% ethanol extract at D_{max} of 26.82 g/kg. In the paw edema model, the extract reduced edema in both single-dose and repeat-dosing regimens, with maximal edema reduction of 65.04% (repeat dosing; 5.4 g/kg).

Conclusion: The 70% ethanol extract of Toa Can Ban demonstrated measurable anti-inflammatory activity *in vitro* and *in vivo*, without acute oral toxicity found at the tested doses, supporting further mechanistic and chemical investigations.

Table 1: Regression equations and IC_{50} values for NO inhibition (unpublished data)

Batch	Regression equation	R ²	IC ₅₀
Cardamonin	$y = 18.055 \cdot \ln(x) + 36.614$	0.9592	2.10 μM
Water extract	$y = 18.461 \cdot \ln(x) - 13.398$	0.9774	31.01 $\mu\text{g/mL}$
40% ethanol extract	$y = 10.128 \cdot \ln(x) + 16.679$	0.9888	26.84 $\mu\text{g/mL}$
70% ethanol extract	$y = 12.53 \cdot \ln(x) + 9.4162$	0.9859	25.51 $\mu\text{g/mL}$

Table 2: Edema inhibition (I, %) versus control in the single-dose regimen (unpublished data)

Group (n=8)	Edema inhibition (I, %)			
	1h	3h	5h	24h
Meloxicam	5.89	45.03	63.67	63.46
TCB1	7.16	34.61	37.94	36.34
TCB2	3.11	24.89	33.20	31.23

Table 3: Edema inhibition (I, %) versus control in the repeat-dose regimen (unpublished data)

Group (n=8)	Edema inhibition (I, %)			
	1h	3h	5h	24h
Meloxicam	30.40	56.38	70.07	77.07
TCB1	26.05	48.31	61.39	65.04
TCB2	17.41	40.69	54.07	59.56

Acknowledgements: The authors thank Faculty of Traditional Medicine, University of Medicine and Pharmacy at Ho Chi Minh City and the Vietnam Academy of Science and Technology for providing facilities and technical support.

References:

- [1] Huong NV, *Traditional Vietnamese Oriental Medicine Prescriptions* **2012**, Thin T, Lien NTA, Nghiep NT, Chan NP, Hai HP, Kiem VG, Ho Chi Minh City, 628.
- [2] Kieu TT, Cao LTT, Nguyen TAN, Nguyen TT, *Vietnam Journal of Science and Technology* **2023**, 65, 16–21.
- [3] Hatzieremia S, Gray AI, Ferro VA, Paul A, Plevin R, *British Journal of Pharmacology* **2006**, 149, 188–198.
- [4] Winter CA, Risley EA, Nuss GW, *Proceedings of the Society for Experimental Biology and Medicine* **1962**, 111, 544–547.
- [5] Kabir I, Ansari I, *Asian Journal of Pharmaceutical and Clinical Research* **2018**, 11, 29.

ETHNOPHARMACOLOGY IN TREATING SKIN DISEASES IN INUIT CULTURE

Albertina Onsea¹, Giovanni Damiani¹, Carsten Sauer Mikkelsen², Szymon Sulima³¹ Italian Center for Precision Medicine and Chronic Inflammation, University of Milan, Milan, Italy² Aalborg University Hospital, Aalborg, Denmark³ Reykjavik University, Reykjavik, Iceland
albertinao@gmail.com

Ethnopharmacological Relevance: In Inuit culture, distributed across Arctic regions including Greenland, Northern Canada, and Alaska, traditional knowledge of medicinal resources plays a central role in the management of skin disorders. Harsh climatic conditions characterized by extreme cold, wind, and low humidity contribute to high prevalence of xerosis, dermatitis, and wound infections, making adapted local therapies essential^[1].

Materials and Methods: This study is based on a narrative ethnopharmacological review of published ethnobotanical and ethnomedical literature regarding Inuit medicinal practices. Data was analyzed focusing on Arctic plants, lichens, mosses, and animal-derived products used in topical dermatological preparations with emphasis on antimicrobial, anti-inflammatory and skin-protective applications^[2].

Results: Inuit treatments integrate marine and botanical resources. Seal and whale oils are commonly applied for hydration and barrier protection. Lichens such as *Cladonia rangiferina* and *Cetraria islandica* are used for their antimicrobial antiseptic and soothing properties in wound management. Mosses serve as natural dressings due to their high water retention and ability to support tissue healing. Vascular plants including *Rhododendron tomentosum*, *Empetrum nigrum* and *Salix* species provide anti-inflammatory antipruritic and analgesic effects. Ice is occasionally used for acute pain relief and inflammation reduction. These remedies are often combined to enhance therapeutic efficacy in topical applications adapted to extreme environmental conditions.

Conclusions: The Inuit ethnomedical system represents a sustainable and ecologically adapted approach to dermatological care based on local biodiversity and empirical knowledge. Ethnopharmacological investigation of Arctic medicinal resources offers valuable perspectives for preservation of indigenous heritage and identification of novel bioactive compounds relevant to dermatology and pharmacognosy particularly in anti-inflammatory and antimicrobial drug discovery.

References:

1. Larsen J et al. 2019 Arctic ethnopharmacology and traditional medicinal systems Journal of Ethnopharmacology 245 112-124 review article Arctic regions
2. Müller H and Jensen K 2021 Inuit medicine and Arctic plant use dermatological care Arctic Pharmacognosy Review 18 55-70 study

IN VITRO EVALUATION OF ANTI-ELASTASE, ANTI-COLLAGENASE, ANTI-HYALURONIDASE, AND ANTI-TYROSINASE ACTIVITIES OF *HELICHRYSUM GRAVEOLENS* (M.BIEB.) SWEET

Ebru Özdemir^{1,2}, Diren Ergin^{1,2}

¹Faculty of Pharmacy, Department of Pharmacognosy, Altınbaş University, İstanbul, Türkiye

² Natural Products Research and Development Center (DÜAGEM), Altınbaş University, İstanbul, Türkiye
pharmebru@gmail.com

Ethnopharmacological relevance: Approximately 656 taxa have been recorded in the genus *Helichrysum* Mill., which belongs to the Asteraceae family. Of these taxa, 34 are naturally growing in Türkiye, and 17 are endemic^[1,2]. *Helichrysum* species are used in ethnobotanical research in Türkiye for problems such as scarring, diabetes, hypercholesterolemia, kidney stones, hepatitis, nephrology, earache, cough, jaundice, hemostatic effects, and wound healing^[3,4].

Aim of the study: Regulating the activity of enzymes such as hyaluronidase, elastase, and collagenase is crucial for maintaining a youthful, healthy skin appearance. The aim of this study is to investigate the anti-tyrosinase, anti-elastase, anti-collagenase, and anti-hyaluronidase activities of *Helichrysum graveolens* (M.Bieb.) Sweet, a species with potential as a natural inhibitor.

Materials and methods: *H. graveolens* was obtained from Datça (Türkiye). It was identified, and voucher specimens were deposited in the Herbarium of Altınbaş University (HERA1012). Ethanolic extracts were prepared. For all in vitro anti-aging enzyme activities, plant extracts and reference substances used as positive controls were prepared at 3 concentrations (0.25 mg/mL, 0.50 mg/mL, 1 mg/mL), and the enzyme inhibition activities at these concentrations were calculated as % inhibition.

Results: Inhibiting extracellular matrix-degrading enzymes (collagenase, elastase, and hyaluronidase) and regulating tyrosinase activity have emerged as key strategies to prevent or mitigate cutaneous aging and hyperpigmentation. Of the four enzyme activities, the collagenase inhibitory activity ($90.45 \pm 1.85\%$) was the highest. This was followed by anti-hyaluronidase activity (85.78 ± 1.42), anti-elastase activity ($79.73 \pm 0.47\%$), and anti-tyrosinase activity ($48.41 \pm 2.19\%$), respectively.

Conclusion: *H. graveolens* exhibited significant inhibitory activity against skin-aging-related enzymes, particularly collagenase, hyaluronidase, and elastase. The strongest effect was observed against collagenase, suggesting a potential role in protecting the extracellular matrix and delaying skin aging processes. Overall, these findings suggest that *H. graveolens* may be a promising natural source for cosmetic applications, particularly in anti-aging formulations.

Acknowledgements: This work was supported by Altınbaş University Scientific Research Projects Unit Project. Project number: PB2025-ECZ-1.

References:

- [1] World Flora Online, <http://www.worldfloraonline.org> (accessed on 29.04.2026).
- [2] Eren, A., İnci, Ş., Saleh, K. Kh., Kırbağ, S., Güven, K. Turkish Journal of Science and Technology **2023**, 18, 345–351.
- [3] Özdemir, E., Alpınar, K. J Ethnopharmacol **2015**, 166, 53–65.
- [4] Tuzlacı E. Türkiye Bitkileri Geleneksel İlaç Rehberi. **2016**, İstanbul.

THE EFFECTS OF A NUTRACEUTICAL COMBINATION ON LIPID PROFILE AND ANTHROPOMETRIC PARAMETERS IN A NORTH-EAST ITALIAN POPULATION: AN OBSERVATIONAL STUDY

Raffaele Pezzani^{1,2}, Sara Vitalini³, Susi Barollo¹, Ruggero Grazioli²

¹ *Phytotherapy Lab (PhT-Lab), Endocrinology Unit, Department of Medicine (DIMED), University of Padova, via Ospedale 105, Padova, 35128, Italy*

² *Accademia Italiana di Fitoterapia, Via Ugo la Malfa, 24, Brescia (BS), 25100, Italy*

³ *Department of Biomedical, Surgical and Dental Sciences, University of Milan, Via della Commenda 10, 20122 Milano, Italy.
raffaele.pezzani@unipd.it*

Ethnopharmacological relevance: Nutraceutical combinations derived from natural sources — including black garlic, berberine, policosanols, *Chrysanthellum americanum*, selenium, and chromium — have gained increasing interest as a complementary approach to managing mild dyslipidemia, one of the most modifiable risk factors for cardiovascular disease (CVD), the leading cause of death in Western countries.

Aim of the study: This observational study investigated the effects of this nutraceutical combination on lipid profile and cardiometabolic parameters in treatment-naïve adults with mild dyslipidemia.

Materials and methods: Forty-one treatment-naïve adults with mild dyslipidemia were enrolled by their general practitioners in the Veneto and Lombardy regions. Participants took the nutraceutical supplement once daily for 12 weeks. Lipid profile, anthropometric parameters, blood pressure, fasting glycemia, and safety-related laboratory markers were assessed at baseline and after 12 weeks. Health-related quality of life was evaluated using the validated Italian version of the SF-12 questionnaire.

Results: Statistically significant reductions were observed in total cholesterol ($p = 0.0452$), triglycerides ($p = 0.0494$), body weight ($p = 0.0436$), and diastolic blood pressure ($p = 0.0426$). LDL cholesterol, BMI, and fasting glycemia showed borderline improvements. HDL cholesterol remained unchanged. No clinically relevant alterations in hepatic, renal, or muscular function markers were detected. A significant improvement in the physical component of health-related quality of life (PCS-12, $p = 0.0178$) was also observed.

Conclusion: This study provides preliminary evidence that this nutraceutical combination may beneficially affect lipid profile and cardiometabolic parameters in patients with mild dyslipidemia, with an acceptable short-term safety profile. Larger randomized controlled trials are warranted to confirm these findings.

ENRICHED ASPARAGUS RACEMOSUS (SHATAVARI) EXTRACT ATTENUATES REPRODUCTIVE AND HORMONAL DISTURBANCES IN EXPERIMENTALLY INDUCED POLYCYSTIC OVARY SYNDROME

Udaykumar Vegad¹, Marui Mehreen², Mayur Gondaliya¹, Devyani Agarwal¹, Devang Sheth², Gaurang Shah²

¹ GTU School of Pharmacy, Gujarat Technological University, Gandhinagar, India

² Department of Pharmacology, L. M. College of Pharmacy, Gujarat Technological University, Ahmedabad, India
 udaygvegad@gmail.com; udaykumar@gtu.edu.in

Ethnopharmacological relevance: *Asparagus racemosus* Willd. (Shatavari), has been traditionally used for centuries as a primary female reproductive tonic. Classical Ayurvedic texts classify it as a Rasayana herb that promotes fertility, regulates the menstrual cycle, and restores hormonal balance. Modern research confirms that its bioactive steroidal saponins (shatavarins I–XII) possess phytoestrogenic, antioxidant, and adaptogenic properties that may underpin its traditional gynaecological uses.

Aim of the study: To evaluate the efficacy of an enriched, standardised *A. racemosus* root extract (prepared through patent filled process, $\geq 10.0\%$ Shatavarin IV by HPTLC) in a combined dehydroepiandrosterone (DHEA) and high-fat diet (HFD)-induced rat model of polycystic ovary syndrome (PCOS), with comparison against reference drugs metformin and clomiphene citrate.

Materials and methods: The enriched extract was prepared by a unique process of hydroalcoholic extraction and fractionation technique. The enriched extract was standardized for Shatavarin IV using HPTLC. Further, the extract was evaluated against experimentally induced PCOS model. For that, female Wistar rats (6–7 weeks; 150–180 g; $n=6/\text{group}$) received DHEA (60 mg/kg s.c.) and 30% HFD for 30 days to induce PCOS. Six groups were assigned: normal control, disease control, metformin (200 mg/kg p.o.), clomiphene citrate (100 mg/kg p.o.), enriched extract low dose (125 mg/kg p.o.) and high dose (250 mg/kg p.o.). Treatments were administered orally for 21 days. Evaluated parameters included: estrous cyclicity (vaginal cytology), body weight, serum hormones (LH, FSH, testosterone) by ELISA, ovarian superoxide dismutase (SOD) activity, and ovarian histopathology (H&E staining).

Results: The unique enrichment process helped to increase the Shatavarin IV content $\geq 10.0\%$ in the final product, measured through HPTLC. In the preclinical study, PCOS induction was confirmed by disrupted estrous cyclicity (elevated diestrus: 54.76%), increased body weight, elevated serum testosterone (4.07 ± 0.22 ng/mL vs. 2.78 ± 0.18 in controls), reduced ovarian SOD (10.90 ± 1.51 vs. 20.73 ± 3.05 mU/mg protein), and polycystic ovarian morphology with absent corpus luteum. Treatment with enriched extract produced dose-dependent improvements: the high dose (250 mg/kg) significantly restored estrous cyclicity (diestrus reduced to 28.57%), decreased testosterone (2.24 ± 0.14 ng/mL; $p < 0.05$ vs. disease control), normalised SOD activity (15.58 ± 2.28 mU/mg protein), and restored ovarian histoarchitecture including corpus luteum reappearance. The low dose (125 mg/kg) matched normal-control SOD levels (20.12 ± 0.97 mU/mg; $p < 0.01$). Both doses demonstrated testosterone reduction superior to clomiphene citrate. Gonadotropin patterns in this model reflected a hyperandrogenic, metabolically driven phenotype rather than classical LH-dominant PCOS, consistent with DHEA+HFD model characteristics. [1,2]

Conclusion: Enriched Shatavari extract demonstrates significant multi-targeted efficacy in a PCOS model. It reduced hyperandrogenism, oxidative stress, and ovarian dysfunction, comparable to or exceeding standard pharmacotherapies. Extract enrichment to defined shatavarin thresholds appear to provide pharmacological advantages over crude extracts previously studied. These findings provide a preclinical basis validating the Ayurvedic ethnopharmacological use of Shatavari in female reproductive disorders. This sets the rationale for further clinical investigation along with molecular mechanism investigations. [3]

Acknowledgements: The authors thank the Institutional Animal Ethics Committee of L. M. College of Pharmacy (Proposal No. LMCP/IAEC/2025/6/162) for ethical approval.

References:

- [1] Ghosh A. et al., *Res. Square* **2024**, Preprint. DOI: 10.21203/rs.3.rs-4472411/v1.
- [2] Kim E.J. et al., *Front. Endocrinol.* **2018**, 9, 735.
- [3] Kumarapeli M. et al., *Int. J. Pharm. Sci. Res.* **2018**, 9(6), 2494–2499.

INTEGRATED EXPERIMENTAL AND COMPUTATIONAL EVALUATION OF *CARYOTA MITIS* L. EXTRACT IN THE REGULATION OF GLUCOSE HOMEOSTASIS

Sandesh Kumar Pattanaik¹, Diptirani Rath¹, Sudipta Jena², Asit Ray², Pratap Kumar Sahu¹, Manoranjan Dash³, Sovan Pattanaik⁴

¹ Department of Pharmacology, School of Pharmaceutical Sciences, Siksha 'O' Anusandhan Deemed to be University, Kalinga Nagar, 751003, Bhubaneswar, Odisha, India

² Centre of Biotechnology, Siksha 'O' Anusandhan Deemed to be University, Kalinga Nagar, 751003, Bhubaneswar, Odisha, India

³ Faculty of Management Science, Institute of Business and Computer Studies, Siksha O Anusandhan Deemed to be University, Kalinga Nagar, 751003, Bhubaneswar, Odisha, India

⁴ Department of Pharmaceutical Chemistry, School of Pharmaceutical Sciences, Siksha 'O' Anusandhan Deemed to be University, Kalinga Nagar, 751003, Bhubaneswar, Odisha, India
sandeshpattanaik210@gmail.com

Ethnopharmacological relevance: *Caryota mitis* L. (*C. mitis*) has long been utilized in traditional medicine across parts of South and Southeast Asia for managing elevated blood glucose levels, yet its pharmacological basis remains insufficiently explored [1-3].

Aim of the study: This study was designed to systematically evaluate the antidiabetic potential of the methanolic stem extract of *C. mitis* and to elucidate its underlying mechanisms focusing on key metabolic regulators such as PPAR- α , PPAR- γ , and GLUT-4.

Materials and methods: Phytochemical constituents were characterized using HR-LCMS analysis. The extract was assessed comprehensively in vitro, including cytotoxicity (MTT), enzyme inhibition (α -amylase and α -glucosidase), glucose uptake, and gene expression studies in HepG2 cells. In vivo efficacy was assessed in "high-fat diet (HFD)" and "streptozotocin" induced diabetic rats using biochemical, physiological, and histopathological analyses. Additionally, "molecular docking" and "molecular dynamics simulations" were performed to investigate interactions between identified compounds and diabetes-related targets.

Results: The extract exhibited no detectable toxicity and demonstrated significant suppression activity with respect to α -amylase and α -glucosidase in a concentration-dependent manner. It enhanced cellular glucose uptake and favourably modulated the GLUT-4, PPAR- α , and PPAR- γ expression. In disease rats, treatment improved glucose tolerance, reduced fasting blood glucose and HbA1c levels, and restored lipid, liver, and kidney parameters. Histological findings supported protective effects on vital organs. Computational studies identified key phytoconstituents with strong binding affinity toward target proteins, supporting their potential role in glycemic regulation.

Conclusion: The findings indicate that *Caryota mitis* exerts significant antidiabetic effects through multi-target mechanisms involving enzyme inhibition and regulation of insulin sensitivity pathways. This plant extract represents a promising candidate for the development of plant-based therapeutic agents for diabetes management.

Acknowledgements: We express our sincere gratitude to the Founder of Siksha 'O' Anusandhan (Deemed to be University), Prof. (Dr.) M. Nayak, for his continuous support and encouragement and Prof. (Dr.) D. Das, Dean, School of Pharmaceutical Sciences, for providing the necessary facilities for carrying out the research work.

References:

- [1] Andrade, C., Gomes, N.G.M., Duangsrisai, S., Andrade, P.B., Pereira, D.M., Valentao, P., 2020. Medicinal plants utilized in Thai Traditional Medicine for diabetes treatment: ethnobotanical surveys, scientific evidence and phytochemicals. *J. Ethnopharmacol.* 263, 113177. <https://doi.org/10.1016/j.jep.2020.113177>.
- [2] ASahriar, S., 2017. *Caryota mitis* Lour.(Arecaceae)-a previously unreported plant for treatment of elevated blood glucose level in diabetic patients. *J. Pharmacogn.* 1 (4), 47.
- [3] Pattanaik, S.K., Jena, S., Rath, D., 2025. Pharmacology and phytochemistry of *caryota mitis*: a brief review. *Int. Res. J. Med. Sci.* 6 (1), 1168–1180. <https://doi.org/10.47857/irjms.2025v06i01.02369>.

ANALYSIS ON THE CHARACTERISTICS AND ADVANTAGES OF TIBETAN MEDICINE: A CASE STUDY OF LUM MEDICINAL BATHING OF SOWA RIGPA

Re Dan

China Tibetology Research Center, Beijing, China
13298998837@163.com

Ethnopharmacological relevance: Tibetan medicine is an important part of traditional world medicine, characterized by a unique theoretical system and rich clinical practice. *Lum* Medicinal Bathing of Sowa Rigpa (Tibetan herbal bath) is a precious external treatment method and was inscribed on UNESCO's Representative List of the Intangible Cultural Heritage of Humanity in 2018.

Aim of the study: This article takes Tibetan herbal baths as an entry point to systematically review their theoretical foundations, core formula «*Wuwei Ganlu*,» clinical indications, mechanisms of action, and standardized research, and to analyze the diagnostic and therapeutic wisdom of Tibetan medicine from the holistic perspectives of “*Internal diseases treated externally*” and “*Three causes and Five sources*.”

Materials and methods: Based on the classic Tibetan medical treatise *The Four Medical Tantras (rGyud bzhi)* and relevant literature from databases such as CNKI, WANFANG, and VIP, this paper systematically discusses the clinical efficacy and mechanism of action of Tibetan herbal bath therapy.

Results: Tibetan herbal baths have shown remarkable efficacy in treating rheumatoid arthritis, osteoarthritis, and neurological disorders. Modern research is gradually elucidating their scientific basis in immune regulation, anti-inflammatory effects, and pain relief.

Conclusion: The development of Tibetan herbal bath exemplifies the inheritance of core traditional knowledge and innovation in Tibetan medicine. Integrating traditional wisdom with modern scientific validation supports its broader therapeutic potential.

LIGHT SPECTRUM-DEPENDENT MODULATION OF METABOLOME, ANTIOXIDANT CAPACITY, AND IMMUNOMODULATORY ACTIVITY OF *AZOLLA FILICULOIDES*

Giorgia Renga¹, Maria Cristina Valeri², Leilei Zhang³, Giacomo Tosti⁴, Lara Reale⁴, Thi Thuy Linh Nguyen⁴, Quoc Anh Ngo⁴, Luigi Lucini³, Domenico Vittorio Delfino⁵, Francesco Paolocci²

¹ Foligno Nursing School, Department of Medicine and Surgery, University of Perugia, Perugia, Italy

² Institute of Bioscience and Bioresources, National Research Council, Perugia, Italy

³ Department for Sustainable Food Process (DiSTAS), Università Cattolica del Sacro Cuore, Piacenza, Italy

⁴ Department of Agricultural, Food and Environmental Sciences, University of Perugia, Perugia, Italy;

⁵ Department of Medicine and Surgery, University of Perugia, Italy

rengagiorgia@gmail.com

Azolla spp. are aquatic ferns traditionally used in folk medicine for the treatment of inflammation, infections, fever, and cardiovascular disorders [1,2]. These ethnomedicinal applications are supported by studies demonstrating the antioxidant, antimicrobial, anti-inflammatory, antidiabetic, and cardioprotective activities of *Azolla* extracts and their secondary metabolites [3]. Indeed, environmental factors can influence the accumulation of biologically active metabolites in *A. filiculoides* [4,5]. Here, we compared the antioxidant and immunomodulatory effects of extracts from *A. filiculoides* grown under a solar-like spectrum (C) with those from *A. filiculoides* elicited for the accumulation of secondary metabolites by two different light treatments, Blue:Red light ratio 4:1 (BR4:1) at light intensity as in C, and Solar-like spectrum at double intensity (SolarMAX).

Azolla methanolic extracts were subjected to untargeted metabolomics via ultrahigh performance liquid chromatography coupled to high-resolution mass spectrometry. Their biological activity was tested on RAW 264.7 macrophages, a key cellular component of the innate immune response, stimulated with PMA and *Aspergillus fumigatus* (Af293 strain). Metabolomics highlighted a clear separation among treatments in Principal Coordinates Analysis, indicating extensive metabolic reprogramming in response to light conditions. SolarMAX promoted the accumulation of small phenolic compounds, whereas BR 4:1 reduced their abundance relative to C. Conversely, total flavonoids were over-accumulated in BR 4:1 and Smax treatments. At 12.5 mg/mL, none of the extracts showed cytotoxic effects, while all significantly reduced oxidative stress. Among them, the BR 4:1 extract exerted the strongest inhibition of intracellular ROS production. In line with these findings, luminol-based assays showed a pronounced decrease in extracellular ROS generation in macrophages stimulated with PMA and Af293, especially after treatment with BR 4:1 and SolarMAX extracts. Moreover, *Azolla*-treated macrophages challenged with Af293 displayed markedly reduced TNF- α secretion, whereas IL-10 and IL-1 β levels were only partially modulated.

Overall, this study demonstrated a strong association between the phytochemical profile and biological functions of *A. filiculoides*, highlighting the optimization of light conditions as a promising approach to enhance the accumulation of valuable bioactive compounds for potential ethnopharmacological applications.

Acknowledgements: This study was supported by CNR-VAST 2025-2026 bilateral project "Exploiting the biodiversity, phytochemistry and biological activities of *Azolla* spp, as a novel and sustainable source of drugs for human health."

References:

- [1] M. N. Randriamiharisoa et al. (2015). *Journal of Ethnobiology and Ethnomedicine*, 11, 60
- [2] T. Ramesh et al. (2021). *International Advanced Research Journal in Science, Engineering and Technology*, 8, 144-146
- [3] T. Ramesh et al. (2021). *International Advanced Research Journal in Science, Engineering and Technology*, 8, 144-146
- [4] A. Costarelli et al. (2021). *Frontiers in Plant Science*, 12, 727667
- [5] S. Cannavò et al. (2023). *International Journal of Molecular Science*, 24, 8554

CYANIDIN-3-O-GLUCOSIDE MITIGATES DYSLIPIDEMIA BY MODULATING MITOCHONDRIAL FUNCTION AND REDOX HOMEOSTASIS IN ENDOTHELIAL CELLS AND HIGH-FAT-DIET-INDUCED OBESE MOUSE MODEL

Chuttikran Ronsiri, Uraiwan Panich

Department of Pharmacology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand
chuttikran.ron@student.mahidol.edu

Ethnopharmacological relevance: Anthocyanin-rich plants, particularly those containing cyanidin-3-O-glucoside (C3G), have long been used in traditional medicine to support cardiovascular health and manage metabolic disorders. However, their mechanistic role in obesity-associated endothelial dysfunction remains unclear.

Aim of the study: This study aimed to evaluate whether C3G (i) improves high-fat diet (HFD)-induced dyslipidemia in mice and (ii) protects endothelial cells from palmitate-induced lipotoxicity, focusing on lipid accumulation, oxidative stress, and mitochondrial stress-adaptive signaling, including PGC-1 α .

Materials and methods: Male C57BL/6 mice were fed a 60% HFD and treated with C3G. Body weight, energy efficiency, and serum lipid profiles (total cholesterol, triglycerides, HDL-C, LDL-C) were assessed, and aortic tissues were analyzed for oxidative stress markers. *In vitro*, EA.hy926 endothelial cells were exposed to palmitic acid and treated with C3G. Cell viability, intracellular ROS, lipid accumulation, and PGC-1 α nuclear localization were evaluated using imaging-based and molecular assays.

Results: HFD increased body weight, circulating lipid levels, and hepatic steatosis, key features of metabolic disorders, whereas C3G improved these parameters. Palmitic acid induced endothelial lipotoxicity, as evidenced by reduced cell viability, increased ROS production, and lipid accumulation, along with enhanced nuclear localization of PGC-1 α . C3G attenuated these effects.

Conclusion: C3G ameliorates dyslipidemia and protects against endothelial lipotoxicity by modulating oxidative stress and mitochondrial adaptive responses. These findings support the ethnopharmacological relevance of anthocyanin-rich plants and their potential in preventing obesity-related vascular dysfunction.

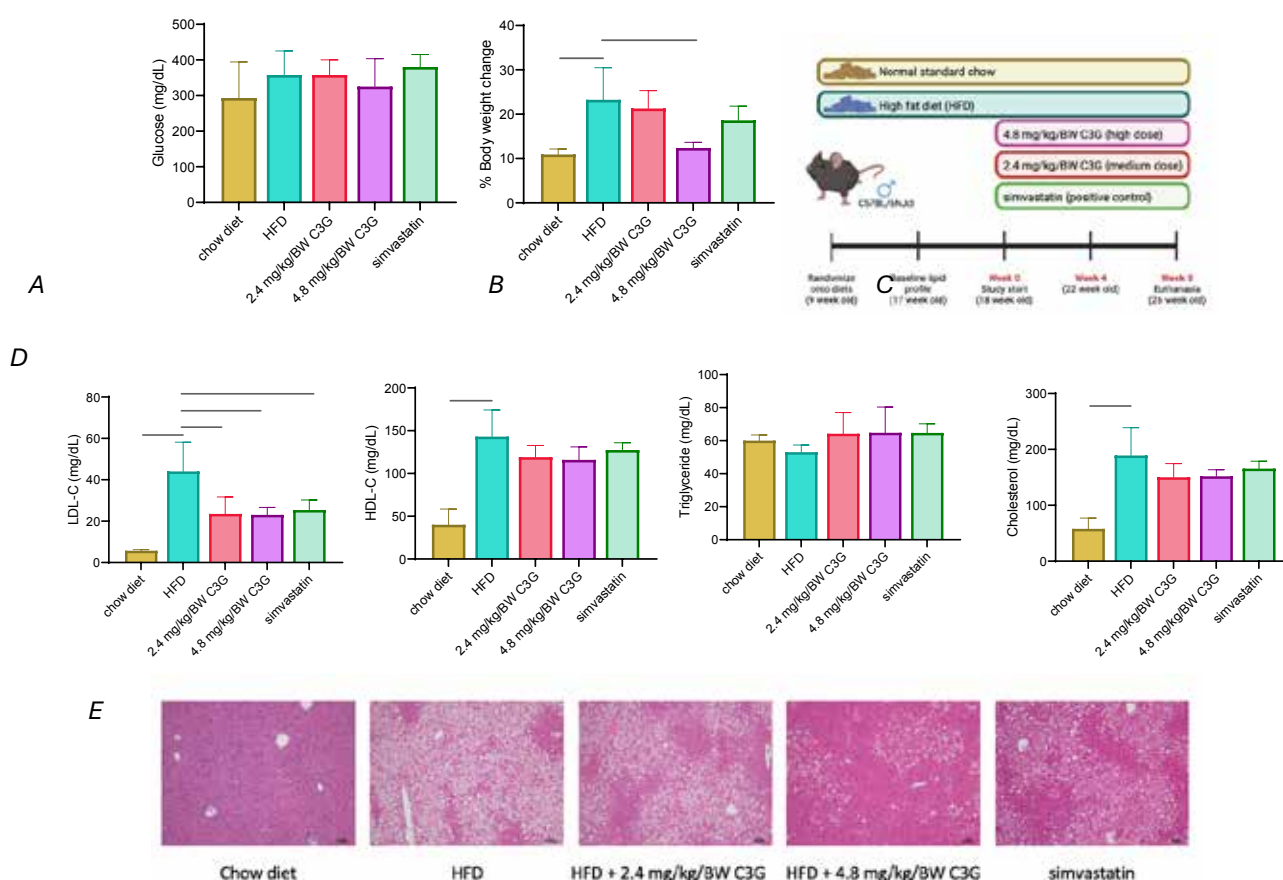


Figure 1: HFD-induced obese mouse model (A) Schematic representation of the HFD-induced obesity model. (B) Percent of body weight change of mice in each experimental group. (C) Serum biochemical parameters, including glucose, (D) lipid profile including total cholesterol, triglycerides, HDL-C, and LDL-C. (E) Hepatic steatosis assessed by hematoxylin and eosin (H&E) staining. Statistical analysis was performed using an unpaired t-test for chow diet vs. HFD groups, and one-way ANOVA followed by Dunnett's post hoc test for comparisons between HFD and treatment groups. $p < 0.05$ was considered statistically significant.

PREPARATION AND PHYTOCHEMICAL ANALYSIS OF POLYHERBAL OIL FOR ALOPECIA

Pritisha Sadhu¹, Alok Goyal¹, Sanjay M. Jachak^{1*}¹Department of Natural Products, National Institute of Pharmaceutical Education and Research, Mohali, India
pritishatina1998@gmail.com

Ethnopharmacological relevance: Six medicinal plants were selected based on their ethnopharmacological relevance, i.e., *Eclipta alba* (L.) Hassk., traditionally used in Ayurveda for promoting hair growth ^[1], *Salvia rosmarinus* Spenn., known for supporting scalp circulation ^[2], *Nigella sativa* L., known for its anti-oxidant and anti-inflammatory benefits, *Murraya koenigii* (L.) Spreng. for hair strength and pigmentation ^[3], *Melaleuca alternifolia* for antibacterial and anti-inflammatory qualities, and, *Garcinia mangostana* L. known for its anti-fungal and anti-inflammatory action ^[4,5]. These plants as a combination, is not explored for the management of alopecia till now.

Aim of the study: To prepare and perform phytochemical analysis of polyherbal oil (PHO).

Materials and methods: The polyherbal oil was prepared by combining the methanolic extracts of *Eclipta alba*, *Salvia rosmarinus*, *Murraya koenigii*, *Garcinia mangostana*; hexane extract of *Nigella sativa* and, essential oil of *Melaleuca alternifolia*. The formulated oil was evaluated for its organoleptic properties, specific gravity, density, pH, acid value and viscosity. The PHO was characterized using GC-MS analysis for further identification of the phytochemicals present in it.

Results: The prepared oil was evaluated for its physicochemical parameters, i.e., specific gravity, density, pH and viscosity was found to be 0.982, 0.91 g/cm³, 6.42 and 8 cps respectively. The obtained results were found to be within the standard limits. In PHO, tentatively 13 phytochemicals were identified through GC-MS analysis, which showed the presence of *p*-cymene, eucalyptol, terpinen-4-ol and linalool as major peaks with area percentage of 4.975, 3.408, 2.755 and 23.376 respectively.

Conclusion: PHO has been successfully developed and characterized based on ethnopharmacological evidence and phytochemical analysis. These results may support its potential therapeutic option for alopecia and further investigation for its *in vitro* and *in vivo* anti-alpecia activity.

References:

- [1] Jahan R, Al-Nahain A, Majumder S, Rahmatullah M, *Int. Sch. Res. Notices. Ethnopharmacological significance of Eclipta alba* (L.) hassk.(Asteraceae) **2014**, 2014(1), 385969.
- [2] Elachouri M, Ouasti I, Fakchich J, Bussmann RW, *Ethnobotany of Northern Africa and Levant. Rosmarinus officinalis L. Lamiaceae* **2024**, Springer Nature, Switzerland, 1787-1798.
- [3] Goyal P, Chhabra R, Vij L, *Curr. J. Appl. Sci. Technol. Ethnobotany, phytochemical, pharmacological potentials of Murraya koenigii, and its health benefits—a review* **2020**; 39(26), 29-38.
- [4] Chew YL, Sang SH, Akuwoah GA, Liew KB, *Nat. Prod. J. Garcinia mangostana pericarp extracts and α-mangostin in hair care: an insight into their potential as functional ingredients and the biological properties* **2023**, 13(7), 27-36.
- [5] Li X, Chen S, Wu Y, Liu F, Jumai A, Zhu B, Xiong B, Qiu SX. *J. Ethnopharmacol. γ-mangostin from Garcinia mangostana* (L.) exerts the antifungal activity against *Cryptococcus neoformans* by inhibiting ribosome biogenesis **2026**, 358, 120986.

DEVELOPMENT OF HPTLC AND HPLC METHODS FOR QUALITY EVALUATION OF UNDERDOCUMENTED TRADITIONAL MEDICINAL PLANTS: *Mordica charantia* AND *Dendropanax morbifera*

Jaeuk Seo¹, Zuhkyung Seong¹, Sohee Jang¹, Yeyeoung Hong¹, Wookyu Lee¹, Jaehee Hyun¹, Changsoo Kim¹, Jiyeon Kim¹

¹ National Management Center for Herbal Medicine Resources, Herbal Medicine Research Division, National Institute of Food and Drug Safety Evaluation, Republic of Korea
smile75@korea.kr

Ethnopharmacological relevance: The use of herbal medicines is increasing, yet many traditional medicinal plants are not listed in official pharmacopoeias or formularies. Extracts and mixtures of these herbs are increasingly incorporated into health functional foods and cosmetics, creating an urgent need for standardized quality evaluation methods.

Aim of the study: To develop reliable identification methods for underdocumented traditional medicinal plants using HPTLC and HPLC.

Materials and methods: Two traditional medicinal plants, *Momordica charantia* (bitter melon) and *Dendropanax morbifera* (Hwangchil), were selected. HPTLC and HPLC analyses were conducted to establish confirmatory identification methods. Literature review was conducted to determine appropriate marker compounds for each herb. Momordicin I was selected as the marker compound for *M. charantia*, while rutin and syringin were chosen for *D. morbifera*.

Results: *M. charantia*, an annual plant of the Cucurbitaceae family^[1], is widely known for antidiabetic, anticancer, antibacterial, and antioxidant activities^[2,3]. *D. morbifera*, belonging to the Araliaceae family and endemic to fertile, humid regions of Jeju Island and selected western coastal islands of Korea^[4], exhibits antibacterial, antioxidant, and anticancer properties^[5]. Identification methods targeting the selected marker compounds were successfully established for both herbs and provide a basis for quality control of *M. charantia* and *D. morbifera*.

Conclusion: The study established HPTLC and HPLC-based identification methods for underdocumented traditional medicinal plants, supporting their safe and standardized use in functional food and cosmetic products.

Key words: traditional medicinal plants, *Momordica charantia*, *Dendropanax morbifera*, herbal identification, quality control

References:

- [1] Renner, Susanne S., Bitter gourd from Africa expanded to Southeast Asia and was domesticated there: A new insight from parallel studies, *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*, **2020**, 117(40), 24630-24631
- [2] Grover JK, Yadav SP. Pharmacological actions and potential uses of *Momordica charantia*: a review. *J Ethnopharmacology*, **2004**, 93(1):123-132
- [3] Jia, S., Shen, M., Zhang, F., & Xie, J. Recent advances in *Momordica charantia*: Functional components and biological activities. *International Journal of Molecular Science*, **2017**, 18(12), 2555
- [4] Youn et al. Antioxidant activity and contents of leaf extracts obtained from *Dendropanax morbifera* LEV are dependent on the collecting season and extraction conditions, *Food Science and Technology*, **2019**, 28(1), 201-207
- [5] CHOI, Eun-Young, et al. *Dendropanax morbiferus* H. Lévl. Leaf Extract Inhibits the Proliferation of MDA-MB-231 Breast Cancer Cells and Induces Apoptosis via the MAPK Pathway In Vitro and In Vivo. *Anticancer Research*, **2023**, 43.7: 3047-3056.

NATIVE CHILEAN LOBELIA SPECIES AS SOURCES OF NEUROACTIVE ALKALOIDS AND PHENOLIC COMPOUNDS

Pablo Sepúlveda-Orellana¹, Sabrina Apablaza-Fouere¹, Yusser Olguin^{2,3,4}, Eugenio Figueroa Leigh^{5,6},
María Carolina Otero¹

¹ Escuela de Química y Farmacia, Facultad de Medicina, Universidad Andrés Bello, Santiago, Chile

² Departamento de Química y Medio Ambiente, Universidad Técnica Federico Santa María, Valparaíso, Chile

³ Centro científico y tecnológico de Valparaíso (CCTVal), Universidad Técnica Federico Santa María, Valparaíso, Chile

⁴ Centro de Biotecnología, Universidad Técnica Federico Santa María, Valparaíso, Chile

⁵ Fundación Lobeliana, Santiago, Chile

⁶ Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile, Santiago, Chile

pabl.sepulveda@uandresbello.edu

Ethnopharmacological relevance: Native Chilean Lobelia species, particularly *Lobelia tupa*, have traditionally been used by Mapuche and rural communities to treat toothache and respiratory conditions, and in ritual practices associated with psychoactive effects [1,2].

Aim of the study: This study aimed to perform a preliminary phytochemical and pharmacological characterization of alkaloid-enriched extracts from *L. tupa*, *L. excelsa*, and *L. polyphylla* in order to evaluate their potential as sources of neuroactive compounds.

Materials and methods: Total alkaloids were obtained by classical acid-base extraction. Extracts were analyzed by thin-layer chromatography using Dragendorff reagent for qualitative profiling and by a methyl orange spectrophotometric assay for total alkaloid quantification. Phenolic compounds were additionally characterized by HPLC-MS. Biological safety was assessed in differentiated PC12 cells, a neuronal-like model commonly used in neuropharmacological studies [3,4].

Results: TLC analysis revealed differential alkaloid profiles among the three native species, with all extracts showing a band compatible with lobeline. *L. tupa* displayed the most intense alkaloid pattern, which was consistent with spectrophotometric quantification. Based on total alkaloid content, the species were ranked from highest to lowest as *L. tupa*, *L. excelsa*, and *L. polyphylla*. HPLC-MS analysis detected several phenolic compounds, including benzoic acid, catechin, rutin, quercetin, epicatechin, and myricetin, with species-specific differences in abundance. Importantly, alkaloid extracts from all three species did not show cytotoxicity in differentiated PC12 cells under the tested conditions.

Conclusion: These findings indicate that native Chilean Lobelia species, especially *L. tupa*, are promising sources of alkaloids and phenolic compounds with potential neuropharmacological relevance, supporting further studies on their bioactivity and mechanisms of action.

References:

- [1] Hoffmann J.A. Flora silvestre de Chile. Zona araucana; una guía ilustrada para la identificación de las especies de plantas leñosas del sur de Chile. Fundación Claudio Gay, 1997.
- [2] Estomba D, Ladio A, Lozada M. Journal of Ethnopharmacology 2006, 103, 109-119.
- [3] Shamsa F, Monsef H, Ghamooshi R, Verdian-rizi M. The Thai Journal of Pharmaceutical Sciences 2008, 32, 17-20.
- [4] Greene LA, Tischler AS. Proceedings of the National Academy of Sciences of the USA 1976, 73, 2424-2428.

OBTAINMENT OF A MEDITERRANEAN HERBAL EXTRACT WITH ENRICHED ANTI-SARCOPENIC PROPERTIES

Tommaso Raiteri¹, Hajar Meskine², Andrea Tralbalzini¹, Martina Paiella², Ina Varfaj³, Laura Salvadori², Sara Chiappalupi¹, Francesca Riuzzi¹, Fabio Orlandi⁴, Marco Fornaciari⁴, Roccoaldo Sardella³, Nicoletta Filigheddu², Guglielmo Sorci¹

¹ Department of Medicine and Surgery, University of Perugia, Perugia, Italy

² Department of Translational Medicine, University of Piemonte Orientale, Novara, Italy

³ Department of Pharmaceutical Sciences, University of Perugia, Perugia, Italy

⁴ Department of Civil and Environmental Engineering, University of Perugia, Perugia, Italy

guglielmo.sorci@unipg.it

Ethnopharmacological relevance: Sarcopenia is the age-related loss of muscle mass and function, leading to increased risk of frailty, fractures, and loss of independence, ultimately reducing the quality of life and increasing morbidity and mortality^[1]. Sarcopenia represents an urgent health problem, especially in Western countries, against which no pharmacological drugs are available. Thanks to their content in bioactive compounds, herbal extracts may be useful in counteracting the mechanisms fueling sarcopenia, and agronomic practices may significantly influence the accumulation of bioactive phytochemicals in plants.

Aim of the study: To identify a Mediterranean herbal extract enriched in active metabolites with anti-sarcopenic activity to be used as a nutritional supplement in the elderly.

Materials and methods: Hydroalcoholic extracts of fifty Mediterranean plants (100µg/ml) were tested on C2C12 myotubes treated with the proinflammatory cytokines TNFα/IFNγ (10ng/ml and 20ng/ml) to mimic sarcopenic conditions. The three most efficacious plants in counteracting myotube atrophy were cultivated under different protocols by modulating three agronomic factors, i.e., inoculation with plant growth-promoting rhizobacteria (PGPR), fertilization rates (high or low K₂O and P₂O₅), and water stress (40% or full field capacity) for a total of eight combinations. The obtained leaf hydroalcoholic extracts were evaluated for the total antioxidant capacity^[2] and tested again on C2C12 myotubes in the presence of TNFα/IFNγ to select the product with the highest anti-atrophic properties.

Results: The hydroalcoholic extract of *Silybum marianum* L. (milk thistle) cultivated in the presence of PGPR, low K₂O and P₂O₅ fertilization, and full irrigation resulted as the most efficacious one in counteracting myotube atrophy induced by TNFα/IFNγ.

Conclusion: Our findings suggest that *S. marianum* could serve as a promising nutraceutical intervention to counteract muscle atrophy associated with aging and disuse. Moreover, the study demonstrates the importance of managing cultivation practices to enhance specific bioactive compounds with health benefit implications in the plant extracts.

Acknowledgements: The present research was funded by the European Union-Next Generation EU, Mission 4 Component 1, CUP J53D23012660006 - Project PRIN #2022B8KE33 PhytoMuscleBone.

References:

- [1] A.A. Sayer, R. Cooper, H. Arai, P.M. Cawthon, M.J. Ntsama Essomba, R.A. Fielding, M.D. Grounds, M.D. Witham, A.J. Cruz-Jentoft. *Nat Rev Dis Primers*. **2024**, 10(1):68.
- [2] A. Tralbalzini, I. Varfaj, G. Sorci, R. Sardella, F. Orlandi, M. Fornaciari. *Applied Sciences* **2026**, 16(9):4146.

MEDICAL VALUE AND INTANGIBLE CULTURAL HERITAGE INHERITANCE OF TIBETAN MEDICAL MANTHANG

Suo Jinlan

*Beijing Hospital of Tibetan Medicine
13120424219@163.com*

Ethnopharmacological relevance: Tibetan medical Manthang (painted medical thangkas) are visual encyclopedias based on “The Four Medical Tantras”. They systematically illustrate Tibetan pharmacological theories, herbal formulas, disease classification, and treatment methods, serving as a unique carrier of ethnic medicine knowledge. Their relevance lies in integrating medicinal plant knowledge, clinical practice, and cultural transmission into an intuitive graphic system.

Aim of the study: This study aims to explore the medical value, scientific connotation, and intangible cultural heritage (ICH) significance of Tibetan medical Manthang, and to analyze their role in the inheritance of ethnic medicine, modernization of Tibetan medicine, and cross-cultural exchange.

Materials and methods: A comprehensive literature review and content analysis were conducted on the complete set of 80 Manthang (containing over 4,900 illustrations). Historical documents, clinical records, and ICH evaluation reports related to Manthang were examined. Comparative analysis was performed between anatomical and pathophysiological concepts in Manthang and modern medical knowledge.

Results: Manthang cover the entire system of Tibetan medicine, including embryology, anatomy, meridians, etiology, syndrome differentiation (cold-heat), herbal prescriptions, external therapies, and preventive health care. Many anatomical depictions are highly consistent with modern medicine. The cold-heat syndrome differentiation aligns with plateau disease patterns. The concepts of “harmony between human and nature” and “preventive treatment of disease” resonate with modern preventive and ecological medicine. Manthang have been inscribed on the ICH list and serve as a vital bridge for international exchange of traditional medicines.

Conclusion: Tibetan medical Manthang are irreplaceable for the preservation of endangered ancient Tibetan formulas and techniques, the modernization of Tibetan medicine, and collaborative research between traditional Chinese and Western medicine. Their structured visual approach offers a model for the innovative transformation and living inheritance of ethnic medicine, with significant practical implications for global traditional medicine research.

FOOD AS MEDICINE IN BYZANTIUM: ETHNOPHARMACOLOGICAL PERSPECTIVES FROM THEOPHANES NONNUS

Ekaterina-Michaela Tomou¹, Maria Anagnostou¹, Elias Valiakos², Helen Skaltsa¹

¹ Section of Pharmacognosy and Chemistry of Natural Products, Department of Pharmacy, School of Health Sciences, National and Kapodistrian University of Athens, Greece

² Department of Nursing, School of Health Sciences, University of Thessaly, Larissa, Greece
ktomou@pharm.uoa.gr

Ethnopharmacological relevance: In recent decades, the study of historical medical texts has attracted increasing scholarly interest, particularly within the field of ethnopharmacology. The tenth-century physician Theophanes Nonnus, also known as Theophanes Chrysobalantes, represents an important yet understudied figure in this context. In the study by Sonderkamp (1984)^[1], evidence is adduced to support the conclusion that he was active in the 10th century within the court milieu of Constantine VII Porphyrogenitus. This study examines the structure and content of *De alimentis*, with the aim of analyzing the systematic classification of foods and their functional properties within a historical continuum.

Materials and methods: The analysis is based on close textual examination, focusing on the beginnings and the internal organization of the treatise. Attention is given to the classification of natural and animal-derived sources and their associated health effects.

Results: The text articulates a structured and practice-oriented system in which foods, natural substances, and therapeutic interventions are integrated within a unified continuum. Composed under imperial patronage and addressed to a broad audience, it seeks to render dietary knowledge accessible to both the general public and educated elites. The first part delineates the content and overall organization of the treatise, while the second part introduces categories based on qualitative effects, digestibility, and potential harmfulness. This framework is further elaborated through a systematic classification of individual foods, organized into plant-based and animal-derived groups and correlated with their health effects.

Conclusion: The work reveals a sophisticated and systematically organized body of knowledge in which foods are interpreted through their functional effects. As such, it contributes to a deeper understanding of how food-based knowledge systems evolve across time and cultural contexts, aligning closely with ethnopharmacological research on the transmission and adaptation of traditional knowledge.

Reference:

[1] J.A. M. Sonderkamp, 1984. Symposium on Byzantine Medicine, 38, 29-41.

PRECLINICAL EVIDENCE SUPPORTING THE THERAPEUTIC POTENTIAL OF ENDEMIC VIETNAMESE MEDICINAL PLANTS IN INFLAMMATORY AND IMMUNE-RELATED DISORDERS

Trinh Thi Thuy¹, Nguyen Thi Thuy Linh¹, Ba Thi Cham¹, Nguyen Thi Hoang Anh¹, Sabrina Adorisio², Domicco V. Delfino²

¹ Institute of Chemistry, Vietnam Academy of Science and Technology (VAST), Viet Nam

² Department of Medicine and Surgery, University of Perugia, 06132, Italy
thuy@ich.vast.vn

Ethnopharmacological relevance: Vietnamese medicinal plants have long been used in traditional medicine for the treatment of inflammatory and immune-related disorders. However, many endemic species remain insufficiently characterized in modern pharmacological studies.^{[1], [2]}

Aim of the study: To summarize our recent studies in the pharmacological validation of selected endemic Vietnamese medicinal plants, *Artocarpus tonkinensis*, *Elaeocarpus hainanensis*, and *Gnetum latifolium* var. *funiculare*, with a focus on their immunomodulatory, anti-inflammatory, and preclinical anticancer activities.

Materials and methods: Phytochemical constituents were isolated using chromatographic techniques and structurally characterized by HR-ESI-MS and 1D/2D NMR spectroscopy. Biological activities were evaluated *in vitro* and *in vivo* using lipopolysaccharide (LPS)-stimulated macrophages, RANKL-induced osteoclast differentiation assays, collagen-induced arthritis (CIA) models, and acute myeloid leukemia (AML) cell lines.

Results: Flavonoid-rich extracts of *A. tonkinensis*, traditionally used by the Hmong people for arthritis and back pain, significantly reduced arthritis severity in collagen-induced arthritis models. These extracts inhibited nitric oxide (NO) and interleukin-6 (IL-6) production in activated macrophages and suppressed RANKL-induced osteoclastogenesis.^{[1], [2]}

Cucurbitacin D isolated from *E. hainanensis*, an ornamental plant used in Asian landscapes and gardens, demonstrated potent anti-leukemic activity in NPM1-mutated AML cells by inducing apoptosis, arresting cell cycle progression, and downregulating ZNF217 oncogene expression.^[3]

G. latifolium var. *funiculare* is a Vietnamese medicinal plant used for treating pain and snake bites. Stilbenoids isolated from this plant, including four new derivatives (1-4) (Fig. 2), inhibited NO production in LPS-stimulated RAW264.7 macrophages, with IC₅₀ values ranging from 46.81 to 68.10 µM.^[4]

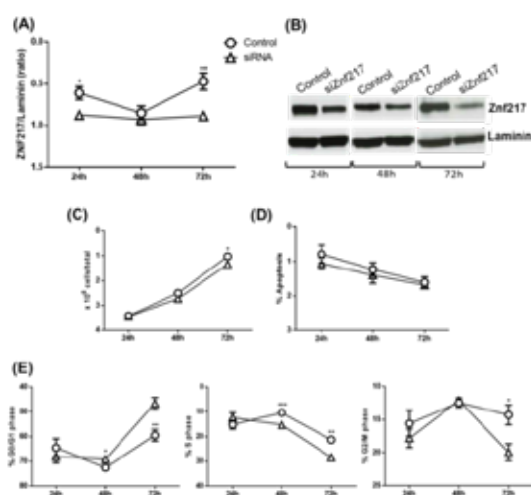


Figure 1. Effect of silencing ZNF217 on the viability of OCI-AML3 cells

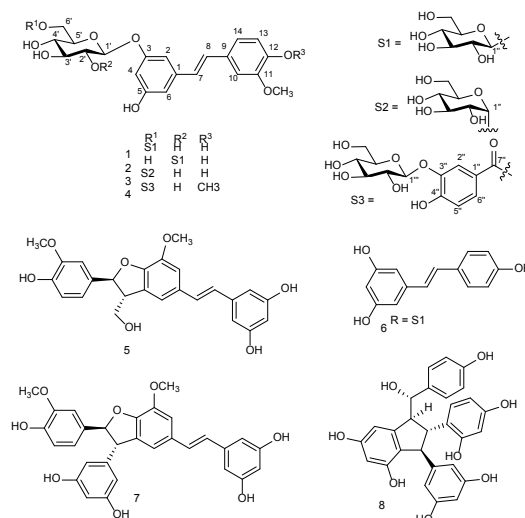


Figure 2. Some compounds 1 – 8 isolated from *G. latifolium* var. *funiculare*

Conclusions: These findings provide pharmacological evidence supporting the traditional use of endemic Vietnamese medicinal plants in the management of inflammatory and immune-related disorders. Moreover, they highlight these species as promising sources of bioactive compounds for the development of novel immunomodulatory, anti-inflammatory, and anticancer agents, thereby strengthening the scientific basis for their ethnomedicinal applications.

Acknowledgements: TTThuy would like to thank to the National Foundation for Science and Technology Development of Vietnam (NAFOSTED) for providing partial funding.

References:

[1] Adorisio S., Fierabracci A., Muscari I., Liberati AM., Calvitti M., Cossignani L., Blasi F., Quan TD, Tam NT, Tran Van Sung,

POSTER **PO 61**

- Riccardi C., Thuy TT., Delfino D. *Artocarpus tonkinensis* protects mice against collagen-induced arthritis and decreases Th17 cell function, *Front Pharmacol.* **2019**, *10*, 503 DOI:10.3389/fphar.2019.00503.
- [2] Orecchini E, Mondanelli G, Orabona C, Volpi C, Adorisio S, Calvitti M, Thuy TT, Delfino DV, Belladonna ML. *Artocarpus tonkinensis* extract inhibits LPS-triggered inflammation markers and suppresses RANKL-induced osteoclastogenesis in RAW246.7. *Front Pharmacol.* **2021**. *11*:593829. doi.org/10.3389/fphar.2020.593829.
- [3] Adorisio S., Fierabracci A., Cham B.T., Hoang VD., Thuy Linh, NT., Nhung LTH., Martelli MP., Ayroldi E., Ronchetti S., Rosati L., Thuy TT, Delfino. Modulatory effect of Cucurbitacin D from *Elaeocarpus hainanensis* on ZNF217 oncogene expression in NPM-mutated acute myeloid leukemia *Pharmaceuticals* **2024**, *17*(12), 1561. doi.org/10.3390/ph17121561
- [4] Thuy TT., Thu Hoa NT., Thuy Linh NT., Cham BT., Hoang Anh NT., Hiep NT., Adorisio S., Delfino D., Bang NA., Tai BH., Kiem PV. Four new stilbene derivatives isolated from *Gnetum latifolium* var. *funiculare* Markgr. and their inhibition of NO production in LPS-activated RAW264.7 Cells. *Chem. Biodivers.* **2023** *20*(10): e202301166. doi:10.1002/cbdv.202301166

QUALITY AND SAFETY OF PYOURA®: A BRAND DEALING WITH COLD DISTILLATES OF MEDICINAL PLANTS

Amit Varma¹, Sayeed Ahmad²

¹Ayurfresh Greens LLP

²Centre of Excellence in Unani Medicine (Pharmacognosy and Pharmacology), Bioactive Natural Product Laboratory, School of Pharmaceutical Education and Research, Jamia Hamdard, New Delhi India-110062, India.

Ethnopharmacological relevance Distillates of medicinal plants have long been utilized in traditional healthcare systems due to their perceived therapeutic efficacy, pleasant organoleptic properties, and natural origin. Use of the cold distillation method opens up the possibility of improved phyto-chemical profile of the distillate given better control on process conditions and parameters. However, scientific evidence regarding the phytochemical composition, quality consistency, and safety profile of such cold distillates remains limited.

Aim of the study The present study aimed to evaluate the quality and safety of Pyoura®, a commercial brand specializing in cold distillates of medicinal plants, through comprehensive phytochemical and analytical characterization.

Materials and methods Multiple Pyoura distillates were subjected to solvent fractionation using ethyl acetate and dichloromethane (DCM) to isolate bioactive constituents of varying polarity. Preliminary chemical profiling and quality assessment were performed through thin-layer chromatography (TLC) fingerprinting to establish phytochemical consistency among formulations. Further characterization of volatile and semi-volatile constituents was conducted using gas chromatography–mass spectrometry (GC–MS). Toxicity studies of the distillates were conducted using zebrafish embryos as per OECD 236 guidelines to evaluate developmental toxicity and establish the safety profile of the formulations.

Results GC–MS analysis revealed diverse phytoconstituents, including terpenoids, aromatic alcohols, aldehydes, esters, hydrocarbons, and fatty acid derivatives indicating potential antimicrobial, antioxidant, cooling, and anti-inflammatory activities. Zebrafish embryo toxicity studies confirmed the safety of the distillates within the tested concentration range, supporting their non-toxic nature.

Conclusion The findings provide scientific evidence supporting the phytochemical integrity, quality, and safety of Pyoura cold distillates and establish an analytical framework for their future standardization, pharmacological validation, and broader acceptance as evidence-based natural health products.

Keywords: Pyoura®; Cold distillates; Medicinal plants; Quality assessment; Safety evaluation; Thin-layer chromatography (TLC); Gas chromatography–mass spectrometry (GC–MS); Phytochemical profiling

MEDICINAL PLANT USE THROUGH TIME IN ROMANIA: AN INTERGENERATIONAL COMPARISON OF KNOWLEDGE, ATTITUDES AND PRACTICES

Delia Vasile¹, Marilena Gilca²

¹Faculty of medicine, Carol Davila University of Medicine and Pharmacy, Bucharest, Romania

²Department of Functional Sciences I/Biochemistry, Faculty of Medicine, Carol Davila University of Medicine and Pharmacy, Bucharest, Romania
delia.vasile0721@stud.umfcd.ro

Ethnopharmacological relevance: Romania possesses a rich ethnobotanical heritage grounded in both oral tradition and historical writings, yet a significant decline in medicinal plant knowledge across generations has been documented^[1,2]. Herbal product use nonetheless remains highly prevalent among young Romanian adults^[3]. In this context, intergenerational comparisons of knowledge, attitudes and practices regarding medicinal plants remain poorly documented.

Aim of the study: To compare knowledge, attitudes, and practices (KAP) regarding medicinal plants across three generations in Romania: G1 (born 1928–1964), G2 (born 1965–1996) and G3 (born 1997–2012), based on established generational frameworks^[4].

Materials and methods: A cross-sectional online survey was conducted via Qualtrics with 45 participants from 14 counties across Romania, representing three generational groups (G1: n=10; G2: n=17; G3: n=18). The questionnaire assessed: general beliefs regarding safety and efficacy; sources of information; frequency of use; declaration to physicians; forms of procurement and administration; and detailed use of 125 specific medicinal plants. Chi-square and Fisher's exact tests were performed in Jamovi.

Results: Medicinal plant use was nearly universal (98%). Significant generational differences ($p < 0.05$) were observed in beliefs and behaviours (Figure 1).

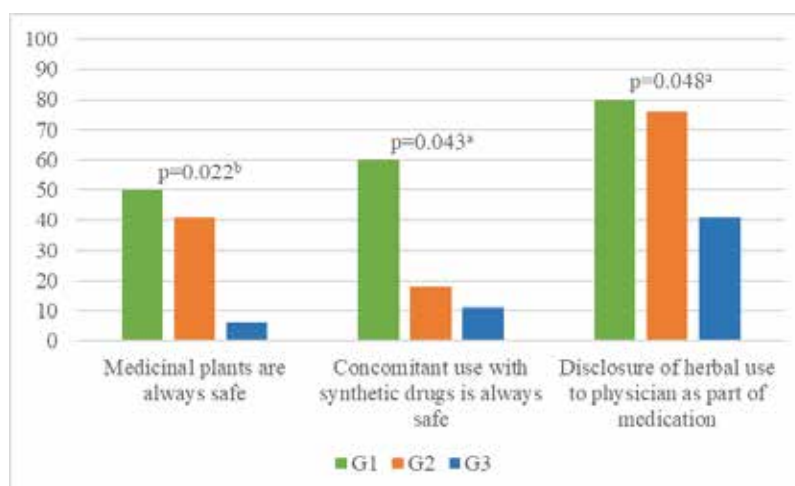


Figure 1: Percentage of respondents answering 'yes' to selected KAP items, by generation. ^aChi-square test; ^bFisher's exact test.

Traditional family knowledge was the leading information source overall (60%), while internet use was highest in G3 (56%). G1 relied more on wild-harvested plants (40%), reporting a higher proportion of locally-sourced plants (e.g., rosehip, ribwort plantain). In contrast, younger generations showed a strong preference for processed commercial forms (G2: 88%; G3: 94%) frequently including non-native species (e.g., green tea, ashwagandha). Tea was the predominant form of administration across all groups (41%). Mean number of different plants reported per respondent was 45 in G1, 24 in G2 and 21 in G3.

Conclusion: These findings highlight the need for targeted safety education, improved physician disclosure, and active preservation of traditional plant knowledge to prevent further erosion of ethnobotanical heritage.

References:

- [1] M. Petran, D. Dragoş, I. Stoian, A. Vlad, and M. Gilca, "Current use of medicinal plants for children's diseases among mothers in Southern Romania", *Front. Pharmacol.* **2024**, Vol. 15, p. 1377341.
- [2] D. Benedec, I. Oniga, D. Hanganu, "Medicinal herbs in Romanian Pharmacopoeias - 155 years of history", *Hop and Medicinal Plants* **2017**, Vol. 25, no. 1–2, pages 69–78.
- [3] A. Garcia-Alvarez et al., "Usage of plant food supplements across six European countries: findings from the PlantLIBRA consumer survey" *PLoS One* **2014**, Vol. 9, no. 3, e92265.
- [4] M. Dimock, "Where Millennials end and Generation Z begins", *Pew Research Center* **2019**. Available: <https://www.pewresearch.org/short-reads/2019/01/17/where-millennials-end-and-generation-z-begins/>

ANTIBACTERIAL AND NUTRITIONAL PROPERTIES OF *MORINGA OLEIFERA* BASED PHYTOTHERAPEUTIC RECIPES FOR THE MANAGEMENT OF INFANT MALNUTRITION IN BENIN

Ahamidé Carel Sosthène Vissoh^{1*}, Eric Agbodjento¹, Hornel Koudokpon¹, Aimé Cézaire Ayena¹, Toussaint Sovegnon¹, Ferdinand Hounkponou¹, Melaine Bete¹, Fréjus Ohouko¹, Eskyl Togbe¹, Victorien Dougnon¹, Jean Robert Klotoé^{1,2}

¹ Research Unit in Applied Microbiology and Pharmacology of Natural Substances (URMAPha), Polytechnic School of Abomey-Calavi, University of Abomey-Calavi, Benin

² Multidisciplinary Research Laboratory for Technical Education (LARPET), ENSET Lokossa, National University of Science, Technology, Engineering and Mathematics (UNSTIM), Abomey, Benin
krelvissoh@gmail.com

Ethnopharmacological relevance: In Benin, child malnutrition remains a major public health concern, frequently associated with bacterial infections such as diarrhea^[1]. Beninese mothers and traditional healers commonly use *Moringa oleifera*, alone or combined with other medicinal plants, to manage these intertwined conditions^[2].

Aim of the study: To evaluate the nutritional, antibacterial and antioxidant properties of phytotherapeutic recipes based on *Moringa oleifera* and six associated plants used in the management of infant malnutrition in Benin.

Materials and methods: Thirteen recipes were prepared from leaves of *M. oleifera* Lam., *Mangifera indica* L., *Heliotropium indicum* L., *Carica papaya* L., *Crateva adansonii* DC., *Sterculia setigera* Delile and *Senna occidentalis* (L.) Link: seven single-plant recipes and six combinations with *M. oleifera* (50/50). Aqueous, ethanolic and hydroethanolic extracts were produced. Proximate composition (water, lipids, ash, proteins, carbohydrates), vitamins (A, B9, C), iron and zinc were quantified using standardized methods (Kjeldahl, Soxhlet, atomic absorption spectrometry)^[3]. Antibacterial activity was assessed against twelve multidrug-resistant clinical and reference strains (*E. coli*, *K. pneumoniae*, *E. cloacae*, *S. aureus*, *Enterococcus* spp.); MIC and MBC were determined. Antioxidant capacity was measured by DPPH, with quantification of polyphenols, flavonoids and tannins^[4].

Results: *M. oleifera* was rich in proteins, ash, vitamin C and iron. Combinations with *M. indica* and *C. adansonii* significantly improved iron, zinc and carbohydrate contents ($p < 0.05$). Among single extracts, only *M. indica* showed antibacterial activity, with ethanolic extract inhibition zones up to 19.66 mm against *S. aureus* and *Enterococcus* spp. The *M. oleifera* + *M. indica* combination yielded the strongest activity (up to 18.33 mm), suggesting a synergistic effect, with enhanced antioxidant activity^[5].

Conclusion: The *M. oleifera* + *M. indica* recipe combines nutritional richness with marked antibacterial and antioxidant potential, supporting its use as an integrated strategy for managing infant malnutrition and associated bacterial infections in Benin.

Keywords: Infant malnutrition; *Moringa oleifera*; *Mangifera indica*; Antibacterial activity; Phytotherapeutic recipes; Benin.

Acknowledgements: This study was funded by the PFCR-ENSET Programme (UNSTIM, Benin) through the “Moringa+” Project.

References:

- [1] R. Black et al., *Lancet* **2013**, 382, 427-451.
- [2] A.C.S. Vissoh et al., *J. Ethnobiol. Ethnomed.* **2024**, 20, 47.
- [3] AOAC, *Official Methods of Analysis*, 22nd Edition **2023**, AOAC International, Rockville.
- [4] J.R. Klotoé et al., *J. Pharm. Res. Int.* **2020**, 32, 1-12.
- [5] M.A. Alaiya, M.A. Odeniyi, *Future J. Pharm. Sci.* **2023**, 9, 29.

INTEGRATING ETHNOPHARMACOLOGICAL APPROACHES INTO HOLISTIC MANAGEMENT OF FIBROMYALGIA: IMPLICATIONS FOR NURSING EDUCATION

Lourdes Webster MSN-Ed, RN, CNE

Georgi Highlands College, USA
lwebser@highlands.edu

Ethnopharmacological relevance: Fibromyalgia is a chronic pain disorder characterized by widespread musculoskeletal pain, fatigue, sleep disturbances, and cognitive dysfunction¹. Despite advances in pharmacologic management, many patients continue to report inadequate symptom relief and increasingly seek complementary and alternative therapies rooted in cultural and traditional healing practices. Ethnopharmacology provides a valuable framework for examining the role of plant-based remedies and traditional systems of care in addressing the complex symptom profile of fibromyalgia.

Aim of the study: To explore the potential role of ethnopharmacological interventions in the management of fibromyalgia symptoms and to examine implications for nursing education and practice.

Materials and methods: A narrative review of the literature was conducted to examine ethnopharmacological therapies, including herbal remedies such as *Curcuma longa* (turmeric)¹, *Capsicum annuum* (capsaicin)³, and *Crocus sativus* (saffron)⁴, as well as traditional healing systems such as Ayurveda and Traditional Chinese Medicine². Sources were selected based on relevance to symptom management, including analgesic, anti-inflammatory, and anxiolytic effects.

Results: Findings suggest that selected herbal therapies and traditional practices may contribute to symptom relief in individuals with fibromyalgia through anti-inflammatory, analgesic, and mood-regulating mechanisms. Evidence indicates potential improvements in pain, sleep quality, and overall well-being; however, variability in study design and limited high-quality clinical trials highlight the need for cautious interpretation.

Conclusion: Incorporating ethnopharmacological approaches alongside conventional treatments may enhance symptom management for individuals with fibromyalgia. Implications for nursing education include integrating culturally responsive, evidence-informed content into curricula and preparing students to evaluate complementary therapies, including safety considerations such as herb–drug interactions. Further research is needed to establish the efficacy and safety of these interventions and to support their integration into clinical practice.

References:

1. Badaeva A, Danilov A, Kosareva A, Lepshina M, Novikov V, Vorobyeva Y, Danilov A. Neuronutritional approach to fibromyalgia management: A narrative review. *Pain Ther.* 2024;13(5):1047-1061. doi:10.1007/s40122-024-00641-2
2. Badanta B, Álvarez-Pérez I, Bonilla Sierra P, González-Cano-Caballero M, Lucchetti G, de Diego-Cordero R. Complementary and alternative medicine to treat fibromyalgia symptoms: A systematic review. *J Pain Res.* 2024;17:1709-1723. doi:10.2147/JPR.S450735
3. Casanueva B, Rodero B, Quintial C, Llorca J, González-Gay MA. Short-term efficacy of topical capsaicin therapy in severely affected fibromyalgia patients. *Rheumatol Int.* 2013;33(10):2665-2670.
4. Shakiba M, Moazen-Zadeh E, Noorbala AA, et al. Saffron (*Crocus sativus*) versus duloxetine for treatment of patients with fibromyalgia: A randomized double-blind clinical trial. *Avicenna J Phytomed.* 2018;8(6):513-523.

SCIENTIFIC RESEARCH ON MINERAL TIBETAN MEDICINES

Xin Feng¹, Junsong Wang², Ruixi Gan²¹ Institute for Tibetan Medicine, China Tibetology Research Center, Beijing, China² Center of Molecular Metabolism, Nanjing University of Science and Technology, Nanjing, China
Fengxin0303@163.com

Ethnopharmacological relevance: Within the Tibetan medical system, mineral medicines constitute a core therapeutic pillar. Comprehensive analyses of Tibetan pharmacological literature confirm that they account for a large proportion of documented substances in classical Tibetan materia medica and are incorporated into 21.5-43% of standardized Tibetan formulas. While traditional Tibetan processing and multi-component polypharmacy historically mitigate potential heavy metal toxicity, rigorous modern safety validation remains critical to address regulatory concerns and ensure evidence-based clinical application.

Aim of the study: To systematically evaluate the safety differences between classical Tibetan mineral-containing formulas and key single mineral components under acute exposure, providing theoretical support and experimental evidence for rational clinical application.

Materials and methods: Male SD rats received 7-day oral administration of three paired models: Ershiwuwei Shanhu pill/Halloysitum rubrum, 25-flavor turquoise pill/turquoise, and Qiwei Tiexie pill/processed iron powder at 10× and 40× clinical doses. Hepatorenal toxicity was assessed via histopathology, serum biochemistry, oxidative stress markers, and multi-platform (¹H-NMR/LC-MS) metabolomics with qPCR validation.

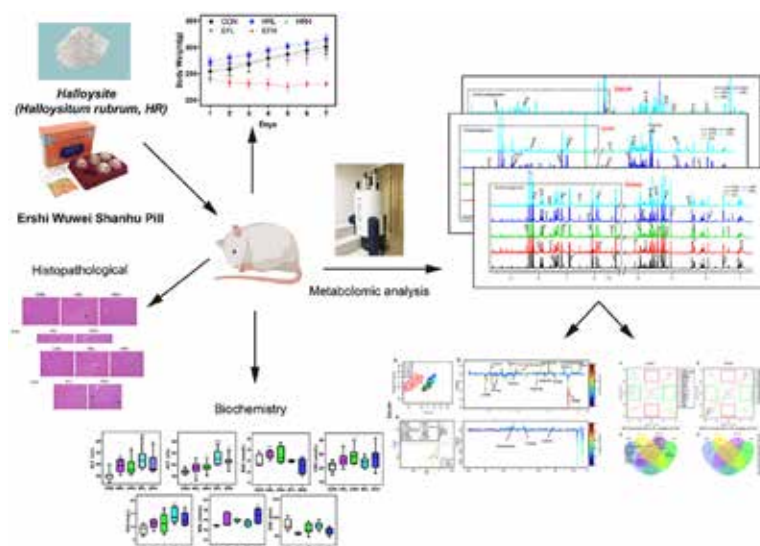


Figure 1. Schematic workflow of the experimental design and integrated safety assessment of Ershi Wuwei Shanhu Pill (ESP) and Halloysite (*Halloysitum rubrum*, HR)^[1]

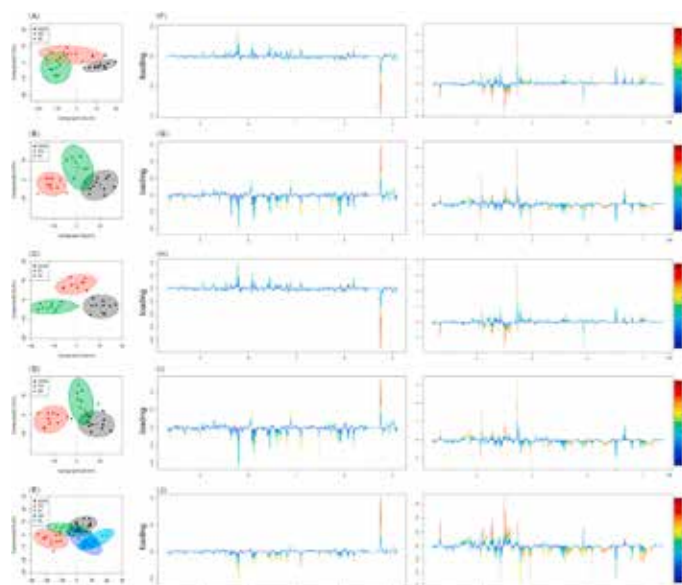


Figure 2. OSC-PLSDA analysis of metabolic profiles of serum with all groups. Scores plots (A, B, C, D, E), loadings plots (F, G, H, I, J) The color bar corresponds to the weight of the corresponding variable in the discrimination of statistically significant (red) or non-significant (blue). Positive and negative peaks indicate a relatively decreased and increased metabolite level.^[2]

POSTER PO 66

Results: Single minerals induced dose-dependent hepatorenal stress, featuring TCA cycle disruption, BCAA catabolism, glutathione depletion, and a functional “hepato-renal disconnect”^[1-3]. Conversely, all formula groups maintained normal tissue architecture and stable biochemistry. Metabolomics revealed that herbal constituents synergistically chelate free metals, restore redox balance, and buffer metabolic reprogramming, validating traditional “formula-based detoxification”^[1,3]. Low-dose formulas demonstrated adaptive metabolic regulation without structural damage, confirming a wide clinical safety window^[2].

Conclusion: Tibetan mineral-containing formulas exhibit superior safety over isolated minerals through multi-target metabolic buffering and herb-mineral synergy. This integrated toxicometabolomics paradigm validates classical Tibetan pharmacology, supporting rational clinical dosing, special population monitoring, and modern quality standard development.

References:

- [1] Ruan L, Zhao W, Luo BX, et al. NMR-based metabolomics approach to evaluate the toxicological risks of Tibetan medicine ‘Ershiwuwei Shanhu’ pill in rats. *J Ethnopharmacol.* 2022;282:114629. doi:10.1016/j.jep.2021.114629.
- [2] Liu ZC, Wng Q, Zheng Q, et al. Acute hepatotoxicity and nephrotoxicity risk assessment of the Tibetan medicine 25 flavors of the turquoise pill based on ¹H-NMR metabonomics. *J Ethnopharmacol.* 2021;279:113916. doi:10.1016/j.jep.2021.11391.
- [3] Zheng Q, Liu W, Wang C, et al. Comprehensive safety assessment of Qiwei Tiexie Pill: integrating histopathological, biochemical, and metabolomic analyses in a rat model. *Front Pharmacol.* 2025;16:1567316. doi:10.3389/fphar.2025.1567316.

METAPATH-GUIDED TRANSFER LEARNING WITH CLINICAL VALIDATION FOR IDENTIFYING HERB-DRUG INTERACTIONS

Won-Yung Lee¹, Kyoung Hoon Mo², Jeong-Su Yang¹, Jun-Ho Lee¹, Choon Ok Kim², Young Woo Kim³

¹ School of Korean Medicine, Wonkwang University, Iksan, Republic of Korea

² Department of Clinical Pharmacology, Severance Hospital, Yonsei University Health System, Seoul, Republic of Korea

³ School of Korean Medicine, Dongguk University, Gyeongju, Republic of Korea

wonyung@wku.ac.kr

Ethnopharmacological relevance: Herbal medicines are widely co-administered with conventional drugs, with reported co-use rates of 5–88% depending on the population^[3]. Because a single herbal formula contains dozens of phytochemicals acting on multiple targets, herb–drug interactions (HDIs) are far harder to anticipate than drug–drug interactions (DDIs) and can cause clinically significant adverse outcomes^[2], yet experimentally validated HDI cases remain scarce.

Aim of the study: To develop Meta-HDI, a metapath-guided transfer-learning framework that exploits large DDI knowledge graphs to improve HDI prediction and mechanistic interpretability, and to prospectively confirm its predictions at the level of clinical pharmacokinetics (PK).

Materials and methods: A heterogeneous knowledge graph of 26,519 nodes (514 herbs, 7,036 phytochemicals, 1,709 drugs, 17,260 proteins) and 6.09×10^5 edges was encoded with a graph-convolutional network; shortest paths were encoded by an LSTM under hierarchical node-, path- and compound-level attention. The model was pre-trained on >120,000 structured Drug-Bank DDIs^[4,5] and fine-tuned on 159 curated HDIs. The two highest-confidence predictions were tested in an open-label, randomised, multiple-dose crossover trial in 18 healthy Korean volunteers receiving donepezil 5 mg alone or with the multi-herb formulas Gami-soyosan or Ojeok-san, followed by CYP inhibition assays in human liver microsomes.

Results: Meta-HDI raised the micro-averaged AUROC to 0.95 (baselines ≤ 0.60) and correctly classified all eight unseen clinical cases; ablation confirmed protein–protein and drug–protein edges as essential. Clinically, co-administration increased donepezil $C_{\max,ss}$ 1.6-fold and $AUC_{\tau,ss}$ 1.5-fold (90% CIs outside 0.80–1.25) with no serious adverse events. Compound-level attention nominated falcarninol (Ojeok-san) and glabranin (licorice) as causal constituents, and microsomal assays confirmed CYP2D6 inhibition (IC_{50} 45 μ M and 4.5 μ M, respectively).

Conclusion: Transfer learning from DDI graphs mitigates HDI data scarcity and yields mechanistic, clinically actionable predictions. Meta-HDI links traditional multi-herb formulas to measurable PK outcomes and identifies the responsible phytochemicals, supporting decision-making for herb–drug co-administration^[1].

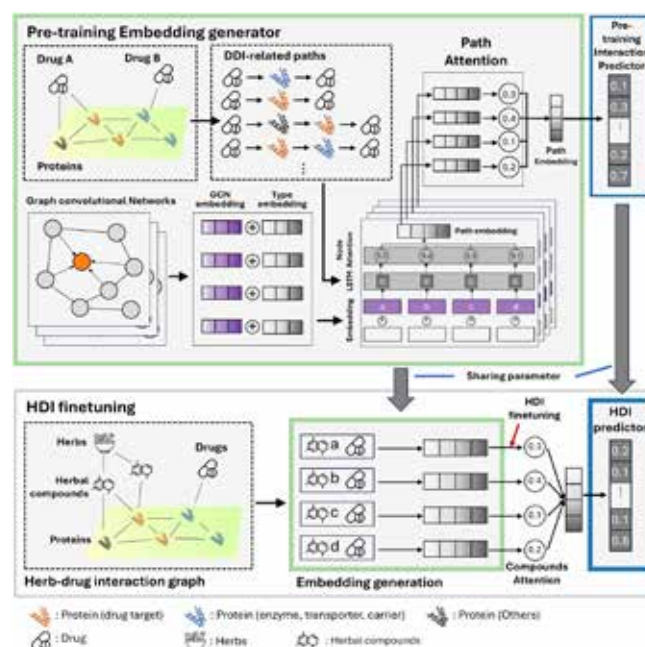


Figure 1: Architecture of Meta-HDI. Pre-training embedding generator (green panel) learns from the drug–protein graph; HDI fine-tuning (yellow panel) adapts the shared parameters to the herb–compound–protein–drug graph with node-, path- and compound-level attention.

References:

- [1] W.-Y. Lee, K.H. Mo, S. Kim *et al.*, *Phytomedicine* **2026**, 159, 158421.
- [2] P. Posadzki, L. Watson, E. Ernst, *Br. J. Clin. Pharmacol.* **2013**, 75, 603–618.
- [3] T.N. Agbabiaka, B. Wider, L.K. Watson, C. Goodman, *Drugs Aging* **2017**, 34, 891–905.
- [4] D.S. Wishart, Y.D. Feunang, A.C. Guo *et al.*, *Nucleic Acids Res.* **2018**, 46, D1074–D1082.
- [5] Y. Yu, K. Huang, C. Zhang *et al.*, *Bioinformatics* **2021**, 37, 2988–2995.

ETHCSTWIN: REINFORCING THE SCIENTIFIC EXCELLENCE OF THE INSTITUTE FOR ETHNOPHARMACOLOGICAL STUDIES AND PHYTOTHERAPY (IESP) THROUGH TWINNING WITH COMPUTER SCIENCE (CS)

Nektarios Aligiannis¹, George Baltatzis¹, Andrea Pieroni², Avni Hajdari⁵, Marc Jacobs³, Christian Ebeling³, Vijay Ingalalli⁴, Dimitrios Gunopulos¹, Vasiliki Chrysanthopoulou¹, Petros Bouras-Valianatos¹

¹ Institute for Ethnopharmacological Studies and Phytotherapy (IESP), University Center of Research and Innovation, National & Kapodistrian University of Athens, Greece.

² University of Gastronomic Sciences, Pollenzo, Italy.

³ Fraunhofer-Institute for Algorithms and Scientific Computing (SCAI), Department of Bioinformatics, Germany.

⁴ Pangea Botanica GmbH, Germany.

⁵ University of Prishtina, Faculty of Mathematics and Natural Sciences, Department of Biology, Kosovo
aligiannis@pharm.uoa.gr

Ethnopharmacological relevance: Ethnopharmacology bridges traditional medicinal knowledge with modern scientific innovation, offering valuable insights for drug discovery and cultural heritage preservation. The ETHCSTWIN project highlights the importance of systematically collecting and analysing ethnopharmacological data from diverse sources, including manuscripts, folklore, and ethnobotanical studies, to safeguard and reinterpret traditional knowledge within contemporary research frameworks.

Aim of the study: This study aims to reinforce the scientific excellence of the Institute for Ethnopharmacological Studies and Phytotherapy (IESP) by establishing a European collaborative network and integrating ethnopharmacological knowledge with advanced computational approaches, including artificial intelligence (AI), machine learning, and data mining.

Materials and methods: A multidisciplinary methodology is employed, combining qualitative and quantitative data derived from ethnopharmacological literature, historical archives, and field-based ethnobotanical studies. These data are processed using AI-driven analytical tools and incorporated into a digital platform designed for data collection, curation, and relational database development. The project also includes capacity-building activities such as staff exchanges, training, and knowledge transfer among academic and industrial partners.

Results: The project is expected to deliver a comprehensive digital infrastructure, including an extensive ethnopharmacological database and analytical toolkit. It will establish an open science ecosystem to facilitate data sharing, stakeholder engagement, and training. Additionally, the initiative will enhance interdisciplinary collaboration and strengthen research capabilities across partner institutions in Europe.

Conclusion: ETHCSTWIN demonstrates how integrating traditional ethnopharmacological knowledge with cutting-edge computational technologies can advance research and innovation. The project contributes to the preservation of cultural heritage while enabling novel scientific approaches, positioning ethnopharmacology at the intersection of tradition and digital transformation.

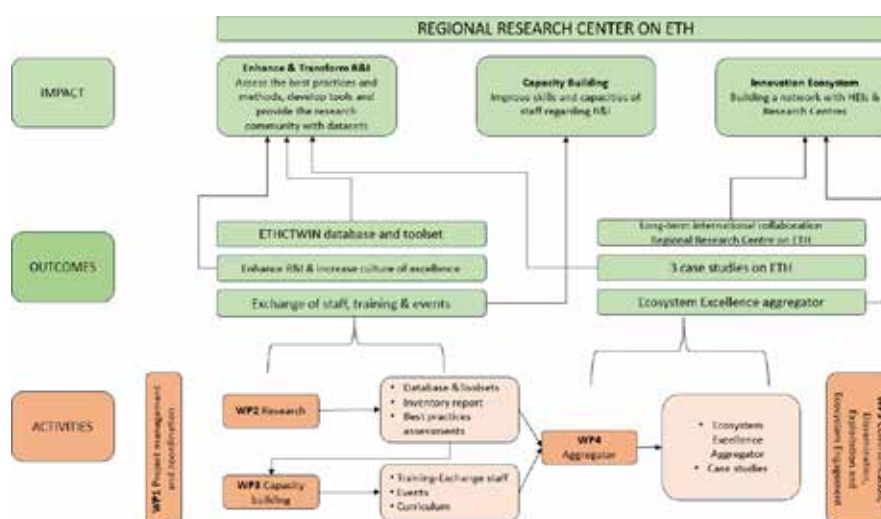


Figure 1: Work Plan and Resources

Acknowledgements: This work has been funded by the European Union's Horizon Europe Research & Innovation Programme under Grant agreement ID: 101159928-ETHCSTWIN.

ORGANIZING SECRETARIAT



YES Meet Agency (www.yesmeet.com)