

EPPAD Bulletin

Vol 4, Number 2

September 2024

Official Biannual Publication of the
Ethiopian Pharmacists and
Pharmaceutical Scientists
Association in the Diaspora (EPPAD)

Editor-in-Chief: Fekadu Fullas, PhD

Editors: Aklile G Giorgis, MIA
Bisrat Hailemeskel, PharmD
Helen HaileSelassie, PharmD
Tesfaye Biftu, PhD, MBA

Associate Editor: Pawlose Ketema, PharmD

Published in Springfield, VA - USA

Manuscripts to the Bulletin can be sent
to our email address: @Fekadu.Fullas53@gmail.com

In This Edition

Editor's Corner.....	3
EPPAD News and Highlights	4
Highlights on Books.....	6
Pioneers of Ethiopian Pharmacy.....	8
Meet our EPPAD Board Members.....	10
Establishment of a Nutraceutical Research Development Center at Bahir Dar Institute of Technology, Bahir Dar University.....	11
PharmD for Ethiopia? Is It Still the Key to Success.....	18
Ethiopia's Green Petroleum: <i>Vernonia galamensis</i> a New Potential Industrial Oilseed Crop.....	21

Editor's Corner

Dear Readers,

Welcome to the current issue of EPPAD Bulletin, Volume 4, Number 2. It comes on the heels of the upcoming Annual EPPAD Conference which will be held on November 2, 2024, in Alexandria, VA. This issue features several news items of interest and three articles. In the News and Highlights section, Dr. Ermias Tilahun provides a report on his recent trip to Ethiopia focusing on several EPPAD-related activities. Also, in this section, short information on recently published books is presented. It includes information on Dr. Dawit Lakew's books titled: "Cardiovascular Diseases: Stroke, heart attack, hypertension, coronary artery disease, heart failure and others" and "CANCER - What it is, predisposing factors, prevention and management"; a biography of Dr. Tesfaye Biftu and on a book by Dr. Fekadu Fullas titled "A Treatise on Ethiopian Traditional Medicinal Plants." In the Pioneers of Pharmacy section, Dr. Mariamawit's excellent profile is published. Her commitment to the profession of pharmacy and research in natural products is a model for other practitioners to emulate.

Three articles appear in this issue. A Nutraceutical Research and Development Center is in the process of being established at Bahir Dar University, Ethiopia. Ato Abebaw Ayalew gives a detailed description of the objectives and plans of the Center. Professor Bisrat Hailemeskel's article on the evolution of the Doctor of Pharmacy (PharmD) degree program in the USA is very informative. He outlines the challenges and prospects of establishing a similar program in Ethiopia. Ato Gabriel Daniel (aka Aklile G Giorgis) gives a detailed account of the plant *Vernonia galamensis*, which is of immense economic importance. The article explores the potentials of the plant as an income-generating industrial crop in Ethiopia.

The Editorial Team hopes readers will enjoy this issue.

Fekadu Fullas, PhD

Editor-in-Chief,
EPPAD Bulletin

EPPAD News and Highlights

Dr. Ermias Tilahun's Visit to Ethiopia: Strengthening EPPAD's Collaborative Efforts with Key Stakeholders in Ethiopia

(Prepared by ET)

Dr. Ermias Tilahun, President of the Ethiopian Pharmacists and Pharmaceutical Scientists Association in Diaspora (EPPAD), recently conducted a series of high-level meetings in Ethiopia to explore collaborative opportunities and address challenges in the country's pharmaceutical and healthcare sectors. His visit included engagements with Addis Ababa University, the Ethiopian Food and Drug Authority (EFDA), the Ethiopian Ministry of Health, and various research institutions.

Key Meetings and Discussions

- 1. Addis Ababa University - Challenges in Pharmacy Education** Dr. Ermias met with Alfoalem Araba, Associate Dean of Addis Ababa University School of Pharmacy, to discuss pressing issues in the pharmacy education sector. Key challenges identified included the quality of education in private pharmacy schools, limited internship opportunities, insufficient scholarships, lack of a publishing mechanism for theses, and the need to strengthen the consortium of pharmacy schools. Action points included follow-up meetings.
- 2. Engagement with Ethiopian FDA** In a meeting with Heran Gerba, Director General of EFDA, Dr. Ermias emphasized the need for a direct communication channel between EFDA and EPPAD's regulatory team. He advocated for participation of EPPAD regulatory team members as observers in European Pharmacopeia meetings alongside EFDA colleagues and discussed registration requirements for Clinical Research Organizations (CROs). EFDA's needs were outlined, including achieving maturity level 3, system-level support, and equipment for medicine laboratories. Ms. Heran promised to assign a liaison to strengthen this collaboration.
- 3. Meeting with the Ministry of Health (Traditional Medicine Desk)** At the Ethiopian Ministry of Health, Dr. Ermias discussed potential areas for collaboration in the field of traditional medicine, including research and development, setting standards, webinars, and clinical trials. The Ministry expressed interest in developing a national database and hosting a Traditional Medicine Day.
- 4. Exploring Investment Opportunities with EPPAD's Working Group** Dr. Ermias also represented EPPAD's investment working group in discussions with key figures from various institutions, such as the Armauer Hansen Research Institute (AHRI), St. Paulos Hospital, Gonder University, and CDT Africa. These discussions focused on expanding the CRO business and enhancing clinical research capacities in Ethiopia.
- 5. Philanthropic Visit to Mekodonia Senior Wellness Center** Dr. Ermias visited the Mekodonia Senior Wellness Center, where he delivered blood pressure monitors and a modern wheelchair. He discussed future expansion plans and support through EPPAD's philanthropy efforts with the founder of the center, Dr. Benyam Belete.

Conclusion

Dr. Ermias Tilahun's visit marked a significant step in fostering EPPAD's collaboration between Ethiopian institutions and the diaspora. EPPAD's commitments in supporting Ethiopia's pharmaceutical and healthcare sectors is evident through these constructive engagements, aimed at addressing challenges and exploring new opportunities for growth and development.



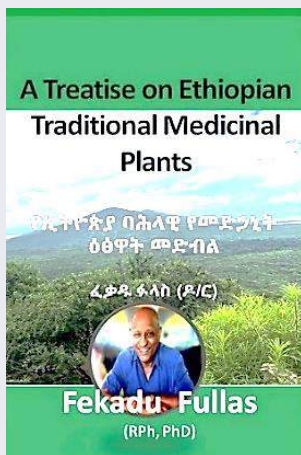
Highlights on Books

(Prepared by Gabriel Daniel and Fekadu Fullas)

As part of our effort to inform readers about items of interest, in this issue we highlight books published by/about our members.

A Treatise on Ethiopian Traditional Medicinal Plants (የኢትዮጵያ ባሕላዊ የመድኃኒት ዕጽዋት መድብል) 579 pages

By Fekadu Fullas (RPh, PhD) 2024



This book is a *de novo* synthesis of the previous four volumes written by the same author on the subject. The book has five parts focusing on various aspects of Ethiopian traditional medicine. The first part – Ethiopian Traditional Medicine: Common Medicinal Plants in Perspective- traces back the history of traditional medicine in Ethiopia and presents selected plant

monographs from a scientific standpoint. The second part – Spice Plants in Ethiopia Their Culinary and Medicinal Applications - provides comprehensive monographs, ancient history and applications of 30 spice plants which are widely used in Ethiopia. Part three – Interactions of Ethiopian Herbal Medicines and Spices with Conventional Drugs: A Practical Guide – provides monographs of Herb-Drug interactions of 38 commonly used Ethiopian herbal medicines and spices. It also provides precaution and clinical management to interactions. Part four of the book has a section devoted to miscellaneous popular articles written and presented by the author over the years on several platforms. Finally, in Part 5 of the book, several medicinal plants are treated in Amharic (አማርኛ) and the section provides a comprehensive background on Ethiopian traditional medicine and treats 32 plants which have received scientific studies of various depths.

This book is available on Amazon or, may contact the author (Fekadu.Fullas53@gmail.com) for more information.

Cardiovascular diseases: Stroke, heart attack, hypertension, coronary artery disease, heart failure and others (Written in Amharic) 325 pages

By Dawit Lakew (PharmD, BCPS); 2022

የልብ እና የደም ስር በሽታዎች: ስትሮክ፣ ሽርት አታክ፣ የደም ግፊት፣ የኮሮናሪ አርተሪ ዲዝዝ፣ ሽርትፌለር እና ሌሎችም...



በዚህ መፀሐፍ ውስጥ ፀሐፊው በቀላል ቋንቋ እና ለመረዳት በሚያስችል ገለፃ፡ የልብ እና የደም ሥር በሽታ አይነቶችን፣ መነሻቸውን፣ የመያዝ ምክንያቶቻቸውን፣ መከላከያዎቻቸውን፣ የምርመራዎቹን አይነቶች፣ የሕክምናዎቹን አማራጮች እንዲሁም የአኗኗር ዘይቤን የማሻሻያ መንገዶችን ያብራራል። እንዲሁም አንባቢያን ስለ በሽታዎቹ ቅድመ ሁኔታዎች እና አጋላጭ ሁኔታዎች በመረዳት የልብና የደም ሥር (cardiovascular) በሽታዎችን አንድ አርምጃ እንዴት መቅደም እንደሚችሉ በዝርዝር ያስረዳል።

ይህ መፀሐፍ በአጠቃላይ ለማህበረሰባችን፡ የልብ እና ጤና ጉዳዮች ላይ አስፈላጊ፣ ሳይንስን መሠረት ያደረጉ ግኝቶችን እና ግንዛቤዎችን ለአማርኛ አንባቢው በተስማሚ ቋንቋ እና አገላለጽ ይዞ መጥቷል። መፀሐፉ ለተማሪ ወይም ለአስተማሪ፣ ለልብ ህመምተኛ ወይም ለአስታማሚ፣ በጠቅላላ ስለ ወገን እና ቤተሰብ የአኗኗር ዘይቤ እና ጤንነት ለሚጨነቁ ባለሙያዎችም ቢሆን እንዲጠቅም በማሰብ፡ ማህበረሰባችን ስለበሽታው መረጃ በማጣት ብቸኝነት እንዳይሰማው እና ለተሻለ የጤና እንክብካቤ እያንዳንዱ ግለሰብ ለአራሱ ጤንነት ተሟጋች እንዲሆን ይረዳው ዘንድ በቀላል እና ለመረዳት በሚገባ መንገድ ተዘጋጅቶ ቀርቧል።

CANCER - What it is, predisposing factors, prevention and management (Written in Amharic) 329 pages

By Dawit Lakew (PharmD, BCPS); 2021



በዚህ መፅሐፍ ውስጥ በዓለማችን እና በማህበረሰባችን ላይ በጣም በብዛት የሚታዩት ዋና ዋናዎቹ የካንሰር አይነቶች ተካተዋል፤ ስለነሱም የብዙ ሰዎችን ጥያቄዎች በመጨመር በሳይንስ ላይ የተመሠረተ መረጃ ተዘጋጅቶ ቀርቧል። ይህም መረጃ አነቃቂ በመሆኑ፤ የአኗኗር ዘይቤያችንን እንዲለዩ መኖርን ለመጠቀም ጠቃሚ እንደሚሆን ይታመናል።

ካንሰር ምንድን ነው? ምልክቶቹስ ምንድናቸው? ካንሰርን መከላከል ይቻላል? እንዴትስ ከአጋላጭ ምክንያቶች እራሳችንን መጠበቅ

እንችላለን? ለካንሰር ማጣሪያ (screening) ምርመራ አለ? መቼ መመርመር አለብኝ? ካንሰር ላይ አስቀድሞ መድረስ ጥቅሙ ምንድነው? የካንሰር ደረጃዎች ምንድን ናቸው? ምንስ ማለት ናቸው? የካንሰር የህክምና አማራጮች ምንድን ናቸው? የካንሰር መድኃኒቶች እንዴት ይሠራሉ? ጤነኛ አመጋገብ፤ የአካል ብቃት እንቅስቃሴ ልማድ እና የሰውነት ክብደትን መቆጣጠር ከካንሰር ጋር እንዴት ይገናኛል?

የህመም እና የምርመራ እንዲሁም ሌሎችንም ጨምሮ የህክምና ቃላቶችን ለማስተዋወቅ መፅሐፉ ይሞክራል፤ ይህም በሐኪም ጉብኝት ጊዜ ከሐኪም ጋር የመግባባት ሁኔታዎችን ያመቻቻል የሚል ዕምነት አለ።

This book is available on Amazon or may contact the author (drakew@yahoo.com) for more information.

Authors/Publisher: Beniam T. Biftu and Moa T. Biftu Printed in the USA, Middletown, USA, 2024 (by Amazon) ages: 1-269 (plus i-vii)

Excerpts from a Book Review by Fekadu Fullas on “The Habesha”



“..... The stories told in the book have something to convey to everybody—the lay reader, the beginner in chemistry, the rising researcher in medicinal chemistry and other scientists alike in various disciplines. It is a reminder that endurance in scientific pursuit in the face of challenges pays off at the end. Dr. Tesfaye’s story is an encapsulation of how a brilliant medicinal chemist like himself is shaped from the beginning to attain the pinnacle of a career.

The book is divided into 18 chapters (Chapters 1-18) and 3 annexes (Annexes I-III). The chapters have various lengths, with Chapter 10 being the shortest (3 pages) and Chapter 17 the longest (31 pages). His early primary education began in Agaro, Jimma, followed by high school in Addis Ababa at General Wingate Secondary School, and then he received further training at Bahir Dar Polytechnic Institute. He travelled abroad and obtained a PhD degree at Brandeis University in the USA.....”

The book is available on Amazon.

Pioneers of Ethiopian Pharmacy

This issue of EPPAD Bulletin features Dr Mariamawit Yonathan Yeshak whose contribution in pharmacy academia, research, and family value deserves special recognition.



Dr Mariamawit is an Associate Professor of Pharmacognosy at School of Pharmacy, College of Health Sciences, Addis Ababa University (AAU) and is the Director of Academic Staff Affairs of the institution.

Mariamawit completed her tertiary schooling in Pharmacy at Addis Ababa University with a B. Pharm in 2001 and M.Sc. in 2005. She got her PhD from Uppsala University in 2012. She leads a research group called BaSIL (Bioactive Secondary Metabolites for Improving Life), which studies biochemical properties of medicinal plants, and is still funded by the International Science Program. With an Ethiopian Government grant, she studies indigenous knowledge systems specifically the clinical applications of traditional medicine. Findings from her studies are published in peer reviewed journals.

Mariamawit is a founding fellow of the Ethiopian Young Academy of Sciences and served as a Vice Chair and a Chair. She is an alumnus of Young Affiliate of The World Academy of Sciences (TWAS), an inaugural fellow of the Africa Science Leadership Program, and an ambassador of the Next Einstein Forum (NEF). She recently won the University Administration Support Program (UASP) Fellowship in Research Management funded by the Carnegie Corporation of New York and administered by International Research and Exchanges Board (IREX).

EPPAD Editorial Board has chosen to share Dr Mariamawit's story as told by her directly:

My Story, as I would like to call it a Story of Empowerment

I currently hold a director's position at Addis Ababa University (AAU) and lead a Pharmacognosy research group in my department. I am an Associate Professor of Pharmacognosy, and a fellow and ambassador of different programs and academies. I am also a wife and a mother of three.

I was not all these before I set foot in Sweden in 2005. My CV had only 'master's degree' under the education section, and a 'two years of a graduate assistant position' under the work experience. I went to Sweden to do my PhD studies at Uppsala University, the division of pharmacognosy at the medicinal chemistry department. The funding was from a bilateral program supported by SIDA for a project led by none other than the seniors, in every sense, of our School, i.e., Prof Tsige GebreMariam, Prof Kaleab Asres and Prof Ephrem Engidawork. The funds were administered by the International Science Program (ISP), Uppsala University.

I gave birth to two beautiful girls when I was doing my PhD in Uppsala. My husband had to stay in Ethiopia during the time; taking care of our children was my duty along with my studies. I know a number, and not so small a number, of friends, friends of friends and colleagues who had to quit or change their career path to start families, or the other way round. My story was different. But what made my case different? Why wasn't I put in that crossroad of choice between career and family?

I enjoyed being a mother and being a career woman simultaneously because I was in an empowering environment. The family-friendly system in Sweden, the immense support from friends and the encouragement from my supervisor helped a lot. Having all these within my reach though, there needed to be a rule broken to make mine a success story. Some authorities in SIDA were concerned about students starting a family while being supported for their studies with SIDA, as the support did

not include family allowance. Hence, students either must leave the program or leave their spouse and children back home. That would have been the end for me as well, as I naturally would have chosen to stay with my children. But ISP fought for my case, they appealed to SIDA to consider the rules and give this case a chance. I had no idea of what was going on in the background until my graduation day where both sides (ISP and SIDA) presented it as a success story. Likewise, the professors back home provided me with all the support needed, encouraged me to stay in school and made sure my landing was as swift as it could get when I returned to the School of Pharmacy- home.

I returned with a seed grant from ISP to start a research group. The then graduate assistant now became an assistant professor; and a year later I had to oversee the department. I was the only female faculty in the department's history. Within two years of my department leadership, five girls joined us as young faculty. We had no campaign or gender movement. The girls were looking for a role model who could do it in this all-men department, and there I was, and I was there because I was empowered.

Our group supported several graduate students, we made networks both in Global north and Global south, and we won other local and international grants. With these, we were at an empowered position to launch the PhD program in Pharmacognosy, and we did. Today, we have grown in the number of students we support and in the ways we provide support to them. And though we face a challenge in maintenance of major lab equipment, the grants we got support the running of our lab.

My career journey in academia started at the School of Pharmacy, Addis Ababa University, where I graduated with a B. Pharm in 2001. I joined the department of Pharmacognosy as a graduate assistant right after my graduation. I grew up looking up to the excelling Prof Kaleab Asres who set the bar high for all of us, and Prof Tsige who always states, 'the sky is the limit'. What is between this paragraph and the very first one is a story of how a young girl with a humble beginning, empowered by colleagues, institutions and community, could become a leader at one of the senior positions in her university, lead a research group to support other young people, and make a difference in her life.

Email: Mariamawit.yonathan@aau.edu.et

Twitter: @YMariamawit

Meet Our EPPAD Board Members



Sarem Hailemariam, PhD is a biomedical scientist with more than ten years of process development experience across both biotech and academic settings. In her current role as a process development consultant at Sartorius Stedim, she works with early-stage companies to facilitate the development of robust processes for production of various protein-based therapies. Prior to joining Sartorius Stedim, she worked as a senior scientist for MilliporeSigma where she designed and executed proof-of-concept runs for biologics.

Sarem completed her graduate work in the department of Biochemistry and Molecular Biophysics at Washington University in Saint Louis. Her thesis work focused on understanding how eukaryotes regulate cell cycle checkpoint in response to double-stranded DNA breaks (DSBs) and short telomeres. Utilizing genetic and biochemical tools, her work illustrated the orchestration between cell cycle checkpoint and repair machinery to elicit distinct responses at DSB sites and short telomeres. Summaries of her work have been published in peer-reviewed journals. While at Washington University in Saint Louis, Sarem was a recipient of the prestigious NSF Graduate Research Fellowship Program and the John E. Majors teaching and mentorship award.

Sarem is passionate about making science accessible to students of all backgrounds and has mentored junior scientists throughout her career. She is currently part of initiatives to build strong pipelines between biotech companies and local universities.

Establishment of a Nutraceutical Research Development Center at Bahir Dar Institute of Technology, Bahir Dar University

Abebaw Ayele

Lecturer and Researcher, Food and Nutrition

Alumni Management Coordinator at Bahir Dar Institute of Technology,
Bahir Dar University, Ethiopia, abebawaye2@gmail.com

1. Background

Bahir Dar University, located in the vibrant city of Bahir Dar, Ethiopia, has long been recognized as a leading institution of higher education and research in the country. With its commitment to academic excellence and addressing societal needs, the establishment of a Nutraceutical Research and Development Center at Bahir Dar University holds significant promise for advancing scientific knowledge in the field of food-based therapeutic research and promoting the utilization of food as medicine (1-4).

Currently, there are numerous initiatives in nutraceutical research worldwide (5-10). Ethiopia, known for its rich biodiversity and diverse cultural heritage, possesses a wealth of traditional knowledge regarding the use of food as a means of promoting health and preventing diseases (11). However, the systematic exploration and scientific validation of these traditional practices remain limited. The establishment of a dedicated center focused on nutraceutical research and development at Bahir Dar University would bridge this gap and contribute to the scientific understanding of the potential therapeutic benefits of food-based interventions.

The proposed Nutraceutical Research and Development Center would be uniquely positioned to leverage Bahir Dar University's existing expertise in the fields of Food, nutrition, biology, biochemistry, pharmacology, and related disciplines. By bringing together multidisciplinary teams of researchers, the center would foster collaboration and knowledge exchange, enabling scientists to explore the complex interactions between food components and human health.

The center's primary focus on food based therapeutic research would entail investigating the bioactive compounds present in traditional Ethiopian foods, medicinal plants, and natural resources. Researchers would explore their potential health benefits, mechanisms of action, and optimal delivery systems. This research would contribute to the development of evidence-based dietary interventions and personalized nutrition

approaches that address the specific health challenges prevalent in Ethiopia and beyond.

Moreover, the establishment of the Nutraceutical Research and Development Center at Bahir Dar University would align with the Ethiopian government's efforts to promote the country's healthcare sector and advance its research and innovation capabilities. By conducting cutting-edge research, the center would contribute to the development of a vibrant nutraceutical industry in Ethiopia, stimulating economic growth, and improving public health outcomes.

Professor Tesfaye Biftu, a distinguished medicinal chemist from the USA and esteemed alumnus of Bahir Dar Institute of Technology, Bahir Dar University, and a team of academic staff at BDU are currently spearheading the establishment of this groundbreaking Nutraceutical Research and Development Center at Bahir Dar Institute of Technology, which will be managed by Bahir Dar Food and Nutrition Research Center. Serving as a monumental first step, Professor Tesfaye has generously donated 209 invaluable books essential for the center's operations and initiated a research project aimed at developing a food-based therapy for diabetes and obesity. Furthermore, demonstrating his profound commitment to advancing education and research, Professor Tesfaye is also ready to deliver a specialized course for the Food and Nutritional Science PhD program at Bahir Dar University. With his expertise and vision, the center promises to make significant strides in advancing nutraceutical research and improving public health in Ethiopia.

2. Vision and Mission

Vision

To become a leading center for nutraceutical research and development in Ethiopia, promoting health and well-being through scientific innovation and collaboration.

Mission

To establish a state-of-the-art Nutraceutical Research Development Center (NRDC) at Bahir Dar University, dedicated to advancing research, innovation, and knowledge dissemination in the field of nutraceuticals, while fostering partnerships with industry, government, and international institutions.

3. Strategic Goals

Goal 1: Infrastructure Development

Objective 1.1: Establish a Dedicated Facility for the NRDC.

- Secure funding for the construction or renovation of a specialized research facility equipped with advanced laboratories, testing equipment, and storage facilities.
- Collaborate with relevant stakeholders to ensure compliance with national and international standards for research facilities.

Objective 1.2: Develop a Conducive Research Environment.

- Recruit and retain qualified researchers, technicians, and support staff with expertise in nutraceutical research.
- Create a collaborative and interdisciplinary research culture by establishing forums for knowledge sharing and collaboration among researchers within the NRDC and across different departments of the university.

Goal 2: Research and Innovation

Objective 2.1: Conduct cutting-edge research in nutraceuticals.

- Create research clusters or teams focusing on key areas of nutraceutical research, such as bioactive compounds, formulation development, safety assessment, and clinical trials.
- Seek external research grants and collaborations to support research projects and facilitate knowledge exchange with national and international research institutions.

- Establish partnerships with local communities and traditional healers to explore and validate traditional knowledge related to nutraceuticals.
- Conduct an assessment about the status of the chronic disease in Ethiopia and design a research plan accordingly.

Objective 2.2: Develop a portfolio of nutraceutical products and technologies.

- Identify potential nutraceutical products with commercialization potential and conduct feasibility studies.
- Collaborate with a technology transfer office to facilitate the commercialization of research outputs and intellectual property.
- Collaborate with industry partners or others to develop and test prototypes, ensuring adherence to regulatory requirements and quality standards.

Goal 3: Capacity Building and Training

Objective 3.1: Enhance academic programs and curriculum.

- Collaborate with relevant departments, food science and nutrition PhD program to integrate nutraceutical research and development into it.
- Develop specialized courses and training programs in nutraceutical sciences to meet the growing demand for skilled professionals in the field.
- Foster student engagement through research internships, practical training, and participation in scientific conferences and competitions.

Objective 3.2: Professional development of researchers and staff.

- Provide opportunities for researchers and staff to attend conferences, workshops, and training programs to enhance their knowledge and skills in nutraceutical research.
- Establish partnerships with international institutions to facilitate staff and student exchange programs, enabling exposure to global best practices and cutting-edge research.

Goal 4: Collaboration and Partnerships

Objective 4.1: Forge strategic partnerships with industry, academia and research institutions

- Identify and establish collaborations with local and international pharmaceutical, food, nutraceutical companies, and academia and research institutions to leverage their expertise, resources, and market reach.
- Facilitate technology transfer and licensing agreements to commercialize research outputs and foster entrepreneurship in the nutraceutical sector.

Objective 4.2: Collaborate with government and regulatory agencies.

- Engage with government bodies and regulatory agencies to contribute to the development of policies, regulations, and quality standards for nutraceuticals.
- Provide scientific expertise and support for the evaluation and registration of nutraceutical products.

Objective 4.3: Strengthen international collaborations.

- Establish research partnerships with renowned international institutions and organizations to promote knowledge exchange, joint research projects, and access to funding opportunities.
- Participate actively in international conferences, seminars, and scientific networks to enhance the visibility and reputation of the NRDC.

Goal 5: Knowledge Dissemination and Outreach

Objective 5.1: Publish research findings and scientific papers.

- Encourage researchers to publish their work in reputable scientific journals and present findings at national and international conferences.
- Establish an open-access repository to disseminate research outputs, reports, and publications.

Objective 5.2: Engage with the local community and stakeholders.

- Organize public seminars, workshops, and awareness campaigns to educate the public about the benefits and safe use of nutraceuticals.
- Collaborate with local healthcare providers, NGOs, and community organizations to conduct health screenings, nutrition programs, and outreach activities.

Objective 5.3: Policy advocacy and knowledge transfer.

- Provide evidence-based recommendations to policymakers and regulatory bodies regarding the development, regulation, and promotion of nutraceuticals.

Develop educational materials and guidelines for healthcare professionals, policymakers, and consumers to raise awareness and promote responsible use of nutraceutical products.

4. Key Research Areas

Key Research Areas, but not limited to in the Nutraceutical Research Development Center with a Focus on Food-Based Therapy or Food as Medicine:

- **Functional Foods Development:** Research on identifying and developing functional foods that possess specific health benefits beyond basic nutrition. This involves studying the bioactive components and their interactions with physiological processes to optimize the formulation and enhance the therapeutic potential of food-based products.
- **Developing innovative nutraceutical products:** The center seeks to develop novel, safe and effective nutraceutical products that can address prevalent health challenges in Ethiopia and contribute to global health solutions.
- **Nutritional Intervention for Chronic Diseases:** Research on exploring the role of specific food components and dietary patterns in the prevention and management of chronic diseases such as cardiovascular diseases, diabetes, obesity, and cancer. This involves conducting clinical trials and longitudinal studies to assess the impact of food-based interventions on disease progression and outcomes.
- **Personalized Nutrition:** Research on developing personalized dietary approaches based on individual

genetic variations, metabolic profiles, and health conditions. This includes analyzing genetic markers, biomarkers, and clinical parameters to tailor food-based interventions that optimize health outcomes for specific individuals or subgroups.

- **Gut Microbiota and Nutritional Therapy:** Research on investigating the interactions between food components and the gut microbiota, aiming to understand the role of the microbiome in modulating nutrient absorption, metabolism, and overall health. This research helps in developing targeted nutritional interventions that promote a healthy gut microbiota and improve overall well-being.
- **Nutritional Immunology:** Research on studying the effects of food components on the immune system and inflammatory processes. This involves investigating the immunomodulatory properties of specific foods, nutrients, or bioactive compounds to develop dietary strategies that support immune function and mitigate chronic inflammation.
- **Nutritional Metabolomics and Food Biomarkers:** Research on utilizing metabolomics techniques to identify specific food metabolites and biomarkers that can serve as indicators of dietary intake and nutritional status. This research helps in assessing the efficacy of food-based interventions and monitoring dietary compliance.
- **Food Processing and Bioavailability:** Research on evaluating the effects of food processing techniques on the bioavailability and bioactivity of nutrients and bioactive compounds. This includes investigating the impact of food preparation, cooking methods, and storage conditions on the nutritional content and functionality of food-based therapies.
- **Dietary Interventions for Aging and Age-Related Diseases:** Research on developing dietary strategies and food-based interventions to promote healthy aging and prevent age-related diseases. This involves studying the impact of specific nutrients, dietary patterns, and caloric restriction on longevity, cognitive function, and age-related physiological changes.
- **Nutritional Education and Behavior Change:** Research on developing effective strategies for nutritional education and behavior change to promote the adoption of healthy dietary habits. This includes

studying the psychological, social, and cultural factors that influence food choices and developing interventions that facilitate sustainable behavior modifications.

- **Nutrient-Drug Interactions:** Research on investigating the interactions between food components and medications, aiming to understand how certain foods may enhance or inhibit the efficacy of pharmaceutical treatments. This research helps in developing guidelines for optimal food consumption in conjunction with specific medications.
- **Development and characterization of research animal (rats and mice) diet:** This research focuses on the formulation and analysis of specialized diets for laboratory rodents (rats and mice) used in various studies conducted at the center. Rodents are commonly employed as animal models in preclinical research to investigate the effects of food components, nutrients, and bioactive compounds on various physiological processes, disease states, and health outcomes

These research areas focus on leveraging the potential of food-based therapy and utilizing food as medicine to prevent and manage various health conditions. By conducting research in these areas, the Nutraceutical Research Development Laboratory can contribute to evidence-based dietary interventions and personalized nutrition approaches that optimize health outcomes and improve the overall well-being of individuals.

5. Challenges and Their Proposed Solutions

Establishing a Nutraceutical Research and Development Center (NRDC) at Bahir Dar University to develop nutraceutical products for the Ethiopian and global markets is a promising initiative. However, several potential challenges may arise during the process. Below are some of these challenges, along with proposed solutions to mitigate them:

5.1. Insufficient Funding

One of the significant hurdles in establishing and operating the NRDC is securing adequate funding, which is critical for acquiring research equipment, conducting studies, and developing products. To overcome this funding challenge, Professor Tesfaye will collaborate with a team of academic staff at BDU to explore various avenues such as applying for grants from government

bodies, international research organizations, and NGOs. Engaging in partnerships with the private sector, including nutraceutical companies and pharmaceutical firms, can also provide much-needed investment and sponsorship. By developing a compelling business case that highlights the potential market impact of the nutraceutical products, the university can attract philanthropic donations and venture capital, ensuring sustainable financial support for the NRDC.

5.2. Regulatory Hurdles

Navigating the regulatory landscape for nutraceutical products can be complex, with the challenge of meeting safety, quality, and efficacy standards potentially posing a significant barrier. To address this issue, the NRDC should engage with local and international regulatory authorities early in the development process to understand and meet the necessary requirements. Collaborating with legal experts specializing in nutraceutical regulations will ensure compliance with both local and international standards. By establishing a regulatory affairs team within the NRDC, the center can maintain ongoing communication and coordination with regulatory bodies, facilitating smoother approval processes.

5.3. Limited Awareness and Acceptance

A lack of awareness and acceptance of nutraceutical products among the Ethiopian population, healthcare professionals, and policymakers could limit market penetration and the adoption of these products. To tackle this challenge, the NRDC should conduct awareness campaigns through public lectures, media outreach, and community engagement programs, educating stakeholders about the benefits of nutraceuticals. Collaborating with healthcare providers to demonstrate the efficacy of nutraceuticals in clinical settings can build credibility and trust. Engaging community leaders and influencers will further help to spread positive messages about nutraceuticals, increasing their acceptance and uptake.

5.4. Limited Research Infrastructure

The existing research infrastructure at Bahir Dar University may not be adequate to support advanced nutraceutical research and development, which could restrict the NRDC's ability to conduct cutting-edge studies. To address this challenge, the university in collaboration with esteemed alumnus Professor Tesfaye will invest in upgrading its laboratories and acquiring specialized equipment tailored to nutraceutical research

needs. Establishing partnerships with other research institutions and private sector companies can provide access to advanced research facilities and technologies. Creating an environment that encourages interdisciplinary collaboration will foster innovation and enhance the center's research capabilities.

5.5. Market Competition

Entering the highly competitive nutraceutical market poses a significant challenge, given the presence of many established players globally (12). To differentiate the NRDC's products and succeed in this competitive landscape, the center should focus on identifying unique nutraceutical ingredients that are indigenous to Ethiopia or offer specific health benefits. Conducting thorough market research to understand consumer needs and preferences will enable the development of products that cater to these demands. Building a strong brand identity and value proposition around quality, efficacy, and cultural relevance will help the NRDC compete effectively. Collaborating with marketing experts to create strategic marketing plans will also be essential for establishing a strong market presence.

6. Research Team Members

No	Name	Educational level	Academic rank	Email	Specialization
1.	Tesfaye Biftu	PhD	Professor	Tbiftu@aol.com	Medicinal Chemist
2.	Abebaw Ayele	MSc	Lecturer	abebawayele2@gmail.com	Food Technology
3.	Hirut Assaye	PhD	Associate Professor	hirutas2000@gmail.com	Food Science and Nutrition
4.	Mesfin Wogayehu	PhD	Associate Professor	mesfintenagashaw@gmail.com	Food Science and Nutrition
5.	Fentanesh Nibret	PhD	Assistant Professor	fantshnibret@gmail.com	Public Health
6.	Agimassie Agazie	MSc	Assistant Professor	agimas23@gmail.com	Food Technology
7.	Zewdie Mekonnen	MSc	Associate Professor	zewdmek2007@gmail.com	Biochemistry
8.	Yeshwas Ferede	DVM, MSc	Assistant Professor	yeshwasferede@gmail.com	Veterinary Epidemiology

7. Concluding Remarks

The establishment of the Nutraceutical Research and Development Center at Bahir Dar Institute of Technology is a significant milestone for Bahir Dar University and the field of nutraceutical research in Ethiopia. This center will serve as a hub for innovation, fostering collaborations, and driving advancements in the development of nutraceutical products. By combining traditional knowledge with modern scientific approaches, the center aims to contribute to improved health outcomes and promote the use of nutraceuticals as a viable therapeutic option. The efforts of esteemed alumnus Professor Tesfaye Biftu and the dedicated team at the center will undoubtedly pave the way for a healthier future in Ethiopia and beyond.

References

1. Sharma, V., Sharma R. Food is Medicine Initiative for Mitigating Food Insecurity in the United States. *J Prev Med Public Health*. 2024;57(2):96-107.
2. Food as medicine: translating the evidence. *Nat Med* 29, 753–754 (2023). <https://doi.org/10.1038/s41591-023-02330-7>
3. Koithan, M., Devika J. New Approaches to Nutritional Therapy. *J Nurse Pract*. 2010 Nov;6(10):805-806. doi: 10.1016/j.nurpra.2010.07.001. PMID: 21076654; PMCID: PMC2976542.
4. Volpp, K. G., Berkowitz, S. A., Sharma, S. V., Cheryl A.M. Anderson, Brewer, L. C., Mitchell S.V. Elkind, Gardner, C. D., Gervis, J. E., Harrington, R. A., Herrero, M., Lichtenstein, A. H., McClellan, M., J. Stephen Muse, Roberto, C. A., & Zachariah, J. P. (2023). Food Is Medicine: A Presidential Advisory From the American Heart Association. *Circulation*, 148(18), 1417–1439. <https://doi.org/10.1161/cir.0000000000001182>
5. Centre for Nutraceuticals: <https://www.westminster.ac.uk/research/groups-and-centres/centre-for-nutraceuticals>

6. Nutraceuticals Research:
<https://www.newcastle.edu.au/research/centre/nutraceuticals>
7. Functional Food Center:
<https://app.joinhandshake.com/employers/functional-food-center-functional-food-institute-80098>
8. Functional Food Center:
<https://www.functionalfoodscenter.net>
9. Functional food and nutraceuticals:
<https://www.gov.mb.ca/agriculture/protein/investing-in-protein/rcffn.html>
10. Functional Foods -
<https://foodscience.caes.uga.edu/research/functional-foods.html>
11. Tahir, M., Abraham, A., Beyene, T. et al. The traditional use of wild edible plants in pastoral and agro-pastoral communities of Mieso District, eastern Ethiopia. Trop Med Health 51, 10 (2023).
<https://doi.org/10.1186/s41182-023-00505-z>.
12. Nutraceutical Product Market size:
<https://www.acumenresearchandconsulting.com/nutraceutical-product-market>

Bisrat Hailemeskel, B, Pharm., MSc, Pharm.D., ABAAHP
Professor & Vice-Chair,
College of Pharmacy, Howard University
bhailemeskel@howard.edu

Abstract:

To understand the significance of the PharmD degree, we must first step back to 1870, when Howard University awarded the first pharmacy degree, marking the historic graduation of James Thomas Wormley, who became the first to hold a Doctor of Pharmacy (PharmD) degree. This pioneering moment set the stage for the evolution of the PharmD program, which gradually expanded across several institutions in the United States. By 2000, the PharmD had become the standard entry-level degree for pharmacists in the U.S., replacing previous degrees as the sole credential required to enter the practice. This paper reviews the history of the PharmD degree, the various employment opportunities it offers, and the attempts made to introduce the PharmD program to Ethiopia.

Introduction

The PharmD degree is a professional program designed to equip pharmacists with the advanced clinical knowledge and skills necessary to ensure that patients use medications safely and effectively. This degree emphasizes the pharmacist's role in patient care, expanding beyond traditional dispensing duties to include medication therapy management, patient counseling, and collaborative healthcare practices. Much like other professional degrees such as the Doctor of Medicine (MD) or the Doctor of Dental Surgery (DDS), the PharmD program follows a rigorous curriculum that integrates clinical practice with theoretical knowledge. This alignment with other healthcare doctorate programs underscores the importance of pharmacists as integral members of the healthcare team, directly contributing to improved patient outcomes through expert medication management.

The degree is a hands-on program that typically takes four years to complete after the prerequisite undergraduate coursework. Entry into a PharmD program generally requires at least two years of undergraduate study focused on courses such as biology, chemistry, and mathematics. Some programs may require a completed bachelor's degree as part of the admission criteria.

Interestingly, the first pharmacy degree was awarded at Howard University in 1870, over 150 years ago. This

marked the graduation of James Thomas Wormley, the first pharmacy student to receive a Doctor of Pharmacy (PharmD) degree from the Medical Department. The global adoption of the PharmD took years including in the United States.

Once an optional path, the PharmD degree was established as the standard for entering pharmacy practice by 2000. The American Association of Colleges of Pharmacy (AACP) recognized the need for a standardized professional doctorate, and by the 1990s, the Pharm.D. became the sole entry-level degree for pharmacists in the U.S., replacing the B. Pharm degree (AACP, 2022). The degree was gradually adopted in other countries as the role of pharmacists expanded beyond dispensing to include direct patient care, medication management, and involvement in healthcare teams. Countries such as Canada, India, Saudi Arabia, and several European nations have implemented or are in the process of implementing the Pharm.D. degree to align with the global trend towards clinical pharmacy education.

In Ethiopia, the history of modern pharmacy education began in 1961 with the establishment of the first pharmacy program at Addis Ababa University (AAU). Initially housed within the Faculty of Science, this program marked the formal introduction of pharmaceutical education in the country. Over the decades, the program gradually evolved, and by the 1990s, it had developed into a full-fledged School of Pharmacy. This expansion was a significant milestone, laying the foundation for the education and training of pharmacists in Ethiopia.

In 2010, through a collaborative effort with Howard University and support from the American International Health Alliance (AIHA) and funding from PEPFAR, the program was further expanded to offer a 5-year Bachelor of Pharmacy (B. Pharm) degree. This enhanced curriculum aimed to provide comprehensive education in pharmaceutical sciences, clinical pharmacy, and community pharmacy, reflecting the growing demand for highly skilled pharmacists in the country.

The aim of this paper is to offer a historical perspective on the PharmD degree and to examine the career outcomes of PharmD graduates in the United States. It focuses on the distribution of graduates across various fields within pharmacy and related sectors, including those who pursue residency, fellowship, and government roles. By analyzing these outcomes, this paper addresses the question posed in the title, "PharmD for Ethiopia? Is It Still the Key to Success," by exploring whether the PharmD degree could similarly benefit the healthcare system in Ethiopia, and whether it would remain a vital and required credential for success in modern pharmacy practice.

DATA COLLECTION

According to data reported by organizations such as the American Association of Colleges of Pharmacy (AACP), the American Society of Health-System Pharmacists (ASHP), and surveys conducted by individual pharmacy schools, employment was categorized into seven main sectors: job opportunities (clinical practice, community pharmacy, industry, academia, government, and non-traditional roles) and post-PharmD training (residency, fellowship). Details were provided to identify trends in employment among recent PharmD graduates (ASHP, 2023; NABP, 2023).

RESULTS

The following sections provide an overview of the various career paths and post-doctoral training opportunities available to PharmD graduates, offering insights into job satisfaction, salary trends, and global job opening rates for each option. Each section highlights the key aspects of these career paths, reflecting the dynamic and evolving landscape of the pharmacy profession worldwide.

I. Post-Doctoral Training Opportunities:

Globally, about 12% of PharmD graduates pursue residency training in clinical specialties like internal medicine, infectious disease, and emergency medicine. This advanced training is critical for pharmacists aiming to take on specialized clinical roles, which are increasingly important in modern healthcare systems. If Ethiopia were to adopt the PharmD degree, offering such residency opportunities could significantly enhance the clinical capabilities of its pharmacists, enabling them to provide higher levels of patient care.

Similarly, around 5% of PharmD graduates pursue fellowships focused on research and drug development, areas that are crucial for advancing pharmaceutical sciences. Incorporating fellowship opportunities in Ethiopia could foster a research-oriented culture among pharmacists, contributing to the development of innovative healthcare solutions within the country.

The 15-20% of students pursuing dual degrees alongside their PharmD (such as PharmD/MBA or PharmD/MPH) indicates a growing trend toward interdisciplinary expertise. If Ethiopian pharmacists were to have access to similar programs, it could open doors to leadership roles in healthcare management, public health, and policymaking, further expanding their impact beyond traditional pharmacy roles.

II. Job Opportunities:

The data also shows that about 30% of PharmD graduates globally enter clinical practice, with another 35% working in community pharmacies. These roles are fundamental to the healthcare delivery system, where pharmacists play a crucial part in medication management and patient care. For Ethiopia, adopting the PharmD degree could mean a stronger, more clinically oriented pharmacy workforce, better equipped to meet the healthcare needs of its population.

With 8% of graduates entering the pharmaceutical industry, the PharmD degree also opens doors to roles in drug development, regulatory affairs, and clinical research—fields that are still emerging in Ethiopia. Establishing a PharmD program in the country could stimulate growth in these sectors, fostering innovation and improving access to cutting-edge therapies.

In academia, around 4% of PharmD graduates take on teaching and research roles, which are vital for the ongoing development of the pharmacy profession. If Ethiopia, it could mean cultivating a new generation of pharmacy educators and researchers, helping to advance the field within the country.

Government roles attract about 6% of PharmD graduates, where they influence public health policy and drug regulation. For Ethiopia, such training can provide pharmacists in government positions a more clinically oriented knowledge to make informed decision-making.

Finally, entrepreneurship and non-traditional roles, each pursued by about 5% of PharmD graduates, highlight the

versatility of the degree. These paths offer opportunities for pharmacists to innovate and apply their skills in diverse ways.

DISCUSSION

The literature survey suggests that the PharmD degree equips graduates with a broad range of skills and opportunities that extend well beyond traditional pharmacy roles. If Ethiopia were to adopt the PharmD degree, it could transform the pharmacy profession in the country, making it more dynamic, clinical-oriented, and capable of addressing the complex healthcare challenges of the future.

As discussed earlier, there have been multiple attempts to launch a PharmD degree program at Addis Ababa University (AAU), but these efforts have not yet been successful. One of the primary challenges has been the lack of PharmD-trained pharmacists who are qualified to lead and sustain such a program. The absence of faculty with the necessary clinical expertise has made it difficult to establish a robust PharmD curriculum that meets international standards.

However, there is hope on the horizon. With the recent establishment of a PhD program at AAU, there is the potential to cultivate a new generation of clinically trained faculty members. These individuals could be instrumental in developing and managing a PharmD program, should the University choose to move in that direction. The availability of more clinically focused educators would not only strengthen the foundation of such a program but also ensure that it is capable of providing the comprehensive and advanced training that PharmD students require. If AAU decides to pursue the PharmD pathway, the groundwork laid by the PhD program could play a critical role in its successful implementation and long-term sustainability.

References

- American Association of Colleges of Pharmacy (AACP). (2022). "Profile of Pharmacy Students" - Annual Report.
- American Society of Health-System Pharmacists (ASHP). (2023). "Pharmacy Residency Match Data and Trends."
- Brown, T.A., & Patel, M.S. (2020). "Non-Traditional Roles for PharmD Graduates: Expanding Horizons." *Pharmacy Practice*.
- Jones, L.M., & Davis, K.E. (2022). "Pharmacy Graduates and Industry Careers: An Emerging Pathway." *American Journal of Pharmaceutical Research*.
- National Association of Boards of Pharmacy (NABP). (2023). "Pharmacist Workforce Survey."
- Smith, J.A., & Doe, R.T. (2021). "Trends in PharmD Career Paths: A Ten-Year Analysis." *Journal of Pharmacy Education*.
- U.S. Food and Drug Administration (FDA). (2023). "Pharmacists in Government: A Vital Role in Public Health."

- Ethiopia is the center of origin and diversity of *Vernonia galamensis*, which is a new potential industrial oilseed crop (Tesfaye Baye Jan. 2003)
- Seeds of *Vernonia* are rich in Vernolic acid, a naturally epoxidized fatty acid with unique chemical (epoxy) and physical (low viscosity) properties (Tesfaye Baye Jan. 2003)
- Chemical epoxidation of oils and fats is a relatively expensive chemical process, and the emission of volatile organic chemicals may contribute to the production of smog which causes secondary pollution (Groot, 1990).
- *Vernonia galemensis* contains 40 to 42% oil of which 73 to 80 % is Vernolic acid (TM Teynor et al Feb 1992)

I heard about *Vernonia galamensis* for the first time at a meeting held in Washington DC way back in 1986. In 1987 *semenworq* magazine published on its website (www.semenaworq.org) an article in Amharic by Prof. Seifu Belay which described *Vernonia galamensis* as the future industrial crop. In 2018, I published an article on Vernonia, Endod (*Phytolacca dodecandra*), and Teff (*Eragrostis tef*) with focus on genetic resources and benefit sharing on the same website to provide information and awareness on these three important Ethiopian indigenous plants which have attracted international attention.

I am hopeful readers will find this piece on Vernonia an interesting read and will encourage interested bodies to research more with the intent to promote the plant to benefit Ethiopian farmers, contribute further to the Ethiopian economy and global climate change.

Introduction

There is an increasing industrial interest in the development of new crops, which are optimized for specific applications. Epoxidized oils, currently manufactured from animal fats or vegetable oils treated

from petrochemicals, are widely used in oleochemical industry as plasticizers and stabilizers for plastic, in reformulation of oil-based paints, in cosmetics, and for pharmaceutical applications.

Vernonia is one such crop with several species used for food, medicine and industry. *Vernonia amygdalina* (ግራዋ) is the most studied member of the Vernonia genus as well as one of the most studied plants in Africa (Ijeh and Ejike 2011).

The establishment of a new industrial crop such as *Vernonia galamensis* can be an answer to problems facing farmers today who need a "high cash" crop as a primary source of income. Modifying oils and fats to attain desired physical and chemical qualities is a relatively expensive chemical process, and the emission of volatile organic chemicals has the potential for environmental pollution (Groot, 1990). These challenges can however be minimized by a natural low-viscosity, epoxy oil such as Vernonia oil for the manufacture of plastic formulations, protective coatings, lubricants, epoxy resins, adhesives, insecticides, and the formulation of carriers for slow-release pesticides (Mohamed, A.I., T. Mebrahtu, and T. Andebrhan. 1999).



**Photo: Family Asteraceae
Genus Vernonia Species *V. galamensis* (Cass.) Less.
(Wikipedia)**

Vernonia plant

Vernonia (Asteraceae) is the largest genus in the tribe Vernoniae with close to 1000 species (Keeley and Jones, 1979). The genus Vernonia is named after William Vernon, an English botanist who collected and identified this genus in Maryland in the late 1600s before his death in 1711 (Quattrocchi, 1999).

A plant exploration trip to Africa by R.E. Perdue, Jr. of the Agricultural Research Service of the United States

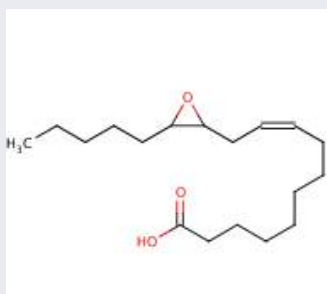
Department of Agriculture in 1964 resulted in collection of seed from mature plants that was later identified as a sub-species of *V. galamensis*. (Perdue et al. 1986).

The eastern and southeastern region of Ethiopia is considered as a natural habitat for *V. galamensis* subsp. *galamensis* var. *ethiopica* in which this botanical variety is believed to be most diverse (Gilbert, 1986)

The Ethiopian species *Vernonia galamensis* is the largest source of Vernonia oil (~ 42%) which is rich in a useful epoxy fatty acid called vernolic acid (~80%). The best producing accessions in terms of yields of kg oil/ha (kg/ha of seed multiplied by oil%) Haromaya/Alemaya University were varieties collected at Bedeno, Chirro and Gelemso which on the average produce 1,600 kg oil/ha. *Vernonia galamensis* (called ironweed) is known to farmers by the local names ‘*Ferenkundela*’, ‘*Dunfare*’, ‘*Kefathebogie*’, and ‘*Noya*’ in eastern and western Hararghe (Tesfaye Baye, 1996).

Chemistry

Vernolic acid is a major component of Vernonia oil with a molecular formula $C_{18}H_{32}O_3$. Vernolic acid (cis-12,13-epoxy-cis-9-octadecenoic) is a long chain fatty acid that is monounsaturated and contains an epoxide. It is a transparent, low-viscosity liquid that can be poured at temperatures below 0°C.



Uses and Applications

A report titled “**Possible African Solutions for US Environmental Problems**” prepared by Tropical Research and Development Inc. for AID/AFR/MDI on *Vernonia galamensis* states that Vernonia has several existing and potential uses which include:

- Protein-rich meal from seed (when the oil is removed)
- Epoxy resins which are less brittle than those in current use
- Lubricants, adhesives, and dibasic acids now obtained from petroleum and used in industrial nylon production: and
- An additive to oil-based paints which can reduce emissions of volatile organic compounds (VOC)

The report adds that scientists estimate at least one pint of Vernonia oil could be used in each of the 325 million gallons of oil-based paint produced in the US each year and thereby reduce emissions of VOC by at least 160 million pounds per year.

In its application as an epoxy oil, Vernonia oil competes with soybean or linseed oil, which supply most of the market for applications in the paint and plastic industries. Its low viscosity makes it more desirable than fully epoxidized linseed or soybean oils.

Chemical epoxidation of oils and fats is a relatively expensive chemical process, and the emission of volatile organic chemicals may contribute to the production of smog which causes secondary pollution (Groot, 1990). Compared to artificial products, naturally epoxidized oil (Vernolic acid) represent the inexpensive, environmental-friendly and renewable feedstocks that could replace petrochemicals. In addition, the Vernonia plant tolerates substantial shade, which makes it ideal for agroforestry; it may also prevent erosion and fight desertification (Perdue, 1988).

Vernonia related initiatives in Ethiopia

Despite the wide distribution of Vernonia in different parts of Ethiopia as its center of origin and diversity, the plant is known as a weed in areas where it grows in marginalized lands. Since its economic potentials are not well known in the communities it grows and potential removal of the plant by farmers in their agricultural fields to leave room for other familiar plants, there can be the danger of “de-vernoniation” and genetic erosion if farmers are not educated about its economic and other benefits. This crop can be an addition to the development of environmentally friendly and poverty reduction economic crop. It meets the criteria for pro-small farmers and

agrobusiness ticket of inventory of initiatives that can attract investors as green industry.

The following are some of the initiatives that have been put in place in the last several decades with varying successes on research, production and marketing of Vernonia and its Epoxy Oil in Ethiopia.

Government of Ethiopia: In September 1989 a National Committee headed by the Minister for Industry with representatives from: - the Plant Genetics Resource Centre - the Ministry of State Farms - the National Chemical Corporation – and the University of Addis Ababa was formed. This committee had a mandate to research and develop oil-bearing crops, and *Vernonia galamensis* has been identified as one to be included in the program. The existence of such a committee currently is not known.

Vernique Biotech Ltd - UK: The Ethiopian government's Institute of Biodiversity Conservation signed an agreement in July 2006 with Vernique Biotech on Access to, and Sharing Benefit on development of *Vernonia galamensis* and commercialize Vernonia oil as a green chemical. According to the agreement the company will have exclusive access to Vernonia seed to export and use for the purpose of developing and commercializing the Vernonia seed oil products. Based on reports, the agreement doesn't seem to deliver the expected benefits to Ethiopia.

Business in Africa online in August 2006 posted an article related to the agreement with the title: “**Ethiopian ‘weed’ has a green future**”. It said Vernonia seed is a source of epoxy compounds that, to date, have only been produced from petrochemicals. The post said that in 2003-2006 Paul McClory and Michael Dobell of Vernique linked with Ethiopian colleagues and grew plots of Vernonia throughout Ethiopia and were now ready to develop Vernonia as a commercial oilseed crop. Paul said Vernonia has the potential to become the industrial soya bean of the 21st century. In addition to a green base for the manufacture of paints, plastics and adhesives the plant has pharmaceutical potential.

BIO-T SQUARE is an American minority owned biotechnology company incorporated in Washington DC. It operates in partnership with a leading institution in Ethiopia, where its scientists conduct research and development. The company claims forming a collaborative partnership with a Vernonia farmers organization that operates in Harar, ("Heaven for Vernonia diversity") which is said to be a major player

to initiate large scale sustainable Vernonia farm as well as epoxy oil extraction. Bio-T Square is engaged in natural plant epoxy polymer where it uses contemporary applied technology as the core element of biotechnology method, biological systems, and tissue culture to create products and services in agriculture, medical sectors, as well as transfer of technology. The company claims that it has the green light from the Ethiopian Ministry of innovation & Technology, and other key stakeholders to proceed with research & development which is in-line with the Government's agenda.

Selina Wamucil is a company in Ethiopia that works with farmers to produce *Vernonia galamensis* for local and external markets. It claims to extract and provide high quality Ethiopia Vernonia (ironweed) oil to the local and export market. The company sources ironweed for processing from family growers in the eastern regions of Ethiopia. Each of the family growers has a medium plot of land of no more than 1.5 hectares.

USAID/Ethiopia under its success story flyer #11 featured an article titled “**Vernonia: a promising industrial oil crop**”.



The USAID article stated the Ethiopian Government has taken steps to attract foreign investors/business firms for commercial production of Vernonia Oilseeds. USAID funded Amhara Micro-enterprise development, Agricultural Research, Extension, and Watershed Management (AMAREW) Project to facilitate and coordinate research, production and marketing of Vernonia in the Region. It collaborated with Adet Research Center (ARC) of Amhara Regional Agricultural Research Institute (ARARI) in strengthening national and international collaboration. One of the accomplishments of the AMAREW project was enriching the germplasm accessions base of Vernonia by obtaining from Haromaya/Alemaya University 217 germplasm accessions collected from different parts of Ethiopia. These were delivered to ARC for characterization, selection, agronomic and germplasm evaluation as well as large-scale seed multiplication at its various sites. AMAREW also facilitated Vernonia potential market

linkage between US companies and Amhara Region producers through Virginia State University (VSU).

Conclusion

Vernonia is an industrial cash crop that can be an economic winner for small scale farmers and investors in Ethiopia. It can be an addition to the different potential and unique agricultural plants with the added value of contributing to global reduction of chemical/petrochemical environmental waste. The limited initiatives implemented to date can provide useful information for future scale up by systematically appraising best practices, lessons learned, risks and threats. The plant has multifaceted features that can be of interest to businesses, large- & small-scale producers, researchers, manufacturers etc.

Selected References

- *Vernonia galamensis*, a natural source of epoxy oil: variation in fatty acid composition of seed and leaf lipids. Baye T, Becker HC, Witzkeehbrecht SV., *Ind Crops Prod.* 2005;21(2):257–261. [[Google Scholar](#)]
 - *Vernonia galamensis*: a new crop for Ethiopia, Tesfaye Baye, 2006.
 - Agronomic evaluation of *Vernonia galamensis* germplasm collected from Eastern Ethiopia, Tesfaye Baye, Hirut Kebede, Ketema Belete
 - *Vernonia galamensis*, a natural source of epoxy oil: variation in fatty acid composition of seed and leaf lipids, Tesfaye Baye, Heiko C. Becker, Sabine v. Witzke-Ehbrecht
 - Genetic Resources Access and Benefit Sharing / ዘረመላዊ ሀብቶች አቅርቦትና ጥቅም ተከፋይነት [Teff/ጤፍ፡ Vernonia/ቨርኖኒያና Endod/አንዶድ] By Gabriel Daniel/ጉበርኤል ዳንኤል - August 2018 (ነሐሴ 2010); article written in Amharic semenawoq ሰምናወርቅ website (www.semenawoq.org)
 - *Vernonia galamensis*, Potential New Crop Source of Epoxy Acid. 1986. R.E. Perdue, Jr., K.D. Carlson, and M.G. Gilbert. *Economic Botany* 40(1):54-68.
 - *Vernonia galamensis*: a Promising New Industrial Crop for the Semi-arid Tropics and Subtropics. 1989. R.E. Perdue, Jr., E. Jones, and C.T. Nyati. pp. 197-207. In: G.E. Wickens, N. Haq, and P. Day (eds.), *International Symposium on New Crops for Food and Industry 1986*, Univ. of Southampton, England,
 - “Material Transfer Agreements on Teff and Vernonia – Ethiopian Plant Genetic Resources”, *Journal of Politics and Law*, Abeba Tadesse Gebreselassie, 2009.
 - Chemical epoxidation of a natural unsaturated epoxy seed oil from *Vernonia galamensis* and a look at epoxy oil markets. Carlson KD, Chang SP. *J Am Oil Chem Soc.* 1985;62(5):934–939. [[Google Scholar](#)]
 - Vernonia. 1986. Growing Industrial Materials Fact Sheet, USDA, Office of Critical Materials, Washington, DC
 - Vernonia: Teynor, D. H. Putnam, E. S. Oplinger, E. A. Oelke, K. A. Kelling, and J. D. Doll. <https://corn.agronomy.wisc.edu/Crops/Vernonia.aspx>
 - Ethnobotany, phytochemistry and pharmacological profile of *V. galamensis* (cass.) less: a review
- Boubacar Mariko., Donatien Kone, and Amidou Doucoure - université de ségou, institut universitaire de formation professionnelle (iufp), département sciences et techniques, Mali. *International Journal of Current Advanced Research* ISSN: O: 2319-6475, ISSN: P: 2319 – Available Online at www.journalijcar.org Volume 6; Issue 4; April 2017; Page No. DOI: <http://dx.doi.org/10.24327/ijcar.2017>.

