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RESEARCH PAPER

Distribution, local use, and bio-prospecting opportunity of *Ocimum americanum L.* in Northwestern part of the Amhara Region, Ethiopia

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Abstract. *Ocimum americanum* (Basil) encompasses various uses. The plant is valued both as a food additive for its aromatic qualities and in folk medicine for treating various ailments. However, its uses, distribution, and the associated community knowledge have not been properly and systematically documented. Therefore, a survey was conducted to explore the bio-prospecting potential of *Ocimum americanum* and gather baseline information on its community knowledge. Purposive and proportional samplings were used to select districts, villages, users, and growers who participated in the study. The selected districts - Dembiya, Gonder Zuria, Takusa, Alefa, Bahir Dar city, and Bahir Dar Zuria Districts - were selected based on the plant's growth potential and user availability. Data collection methods included semi-structured interviews, group discussions, and field observations. The findings revealed that basil is used for various purposes: ailment treatment (32.67%), food flavoring (26.6%), food preservative (7.7%), and to impart aroma to different foods (8.33%). Specifically, 32.67 % of the respondents used *Ocimum americanum* for traditional medicine purposes, primarily to treat depression/headaches, stomach aches, and ward off evil spirits. The methods for preparation and administration included concoction (21.05 %), direct application of plant parts (15.79%), grinding (15.79%), melting (5.26%), Fumigation (10.53%), and inhalation (31.58%). Medicinal dosage varied among users depending on the intensity, type, experience, and the severity of the disease. Nine traditional foods spiced, with basil were identified, with the highest fidelity level for basil use being food flavoring (18.33%) followed by preservation (18.33%). The direct matrix analysis indicated that chilli pepper spice was the most preferred local food sweetened by basil, followed by hot-spiced pepper. This study highlights the traditional foods spiced with basil and providesvaluable insights for bio-prospecting companies in the food and pharmacological industries.

Keywords: *Ocimum americanum*; Basil; bio-prospecting; Preservative; Flavor; Ailment; Aroma

1. Introduction

Bio-prospecting is the sustainable use of biodiversity that should motivate conservation. Nevertheless, in the biodiversity-rich tropical regions of the world, the level of bio-prospecting is far below its potential. Consequently, bio-prospecting has had a limited impact on conservation in these areas. In regions with high biodiversity, such as the tropics, bio-prospecting can be an

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alternative use of biodiversity that effectively promotes habitat protection (Harvey & Gericke, 2011).

Plants are a rich source of many natural products, extensively used for human welfare. Numerous chemical products fabricated from plants are utilized to promote health and combat diseases, and some are marketed as a food or herbal medicines (Ali et al., 2021). Herbal medicines have long been considered as a source of curative remedies based on religious and cultural traditions (Ghazanfar, 1994; Huxtable, 1992). The use of indigenous plant medicines in developing countries became a World Health Organization policy in 1970. Between 2000 and 2005, over 20 new drugs originating from terrestrial plants, terrestrial microorganisms, marine organisms, and terrestrial vertebrates and invertebrates were launched on the market (Sastry et al., 2012). However, the search for plants as potential candidates for drug development remains challenging. Of the 90 drugs that became commercially available in the United States or were approved worldwide from 1982 to 2002, approximately 79% can be traced to a natural product origins (Newman et al., 2003).

The use of *Ocimum americanum* in herbal medicine is largely based on the longstanding experience of traditional medicine practitioners. The Genus *Ocimum* (*Lamiaceae*), commonly known as basil, is widely used in Eastern Africa in folkloric practices to treat a wide range of illnesses. Despite its potential, many species within this genus have not been fully exploited. These plants are considered good sources of essential oil used in food flavoring, oral products, fragrances, and traditional medicines (Dagnachew, 2009). Out of the total 28 aromatic plants found in Ethiopia, *Ocimum americanum* is one of the aromatic herb species that flourished in various regions of the country. Basil is notable for its diverse chemical compositions, including linalool (15.3%), camphor (15.1%), and terpinen-4-ol (17.6%) (Demissew, 1993). Ethiopian farmers traditionally cultivate basil for household consumption and supply it to the local market, mainly for spice. There is also high demand for basil in the international market. Currently, some private Ethiopian companies have begun to cultivating sweet basil for export as fresh or dried herb to various countries (Egata, 2021; Yimer, 2010).

Local foods play a significant contribution to socioeconomic development. However, there are remains incomplete documentation of the local foods product, associated knowledge, and their sociocultural roles (Tadesse et al., 2020). One such example is basil, which the community has long used for flavoring and spicing, and notably in the filtering process during local melted butter production. The rich traditional knowledge and practices surrounding basil suggest untapped industrial potential. Despite this, systematic documentation, utilization, and exploration of basil's benefits are lacking. Traditionally, the local community has relied on *Ocimum americanum*. Therefore, the research aims to explore the bio-prospecting potential of *Ocimum americanum*, identify its potential distribution areas, and document the associated traditional knowledge and practice.

2. Material and method

2.1. Description of the study area

Amhara region is located in the northwestern part of Ethiopia, covering an estimated land area of 170,000 square kilometers. It shares borders with Tigray to the north, Afar to the East, Oromiya to the south, Benishangul-Gumuz to the southwest, and Sudan to the west (Assefa et al., 2016; Save the Children, 2013). The region has a total estimated population of over twenty million (Central Statistical Agency, 2015) with Bahir-Dar serving as its capital city of Amhara. Administratively, the region is divided into 11 zones and 167 districts, comprising 3,429 villages, which are smallest administrative units (Assefa et al., 2016; Save the Children, 2013). One of the administrative zones within Amhara is North Gondar, named after the city of Gondar, which served as the capital of Ethiopia until the mid-19th century. North Gondar is bordered by Lake Tana to the south, West Gojjam Zone, Awi Zone, and the Benishangul-Gumuz region to the west, Sudan to the west, Tigray to the north, Wag Hemera to the east, and Debub Gondar to the

southeast. Notable towns and cities in North Gondar include Dabat, Debarq, Emfranz, Gondar, Gorgora, and Metema (Assefa et al., 2016; Central Statistical Agency, 2015).

North Gondar Zone has a total population of 2,929,628, comprising 1,486,040 men and 1,443,588 women, spread across an area of 45,944.63 square kilometers. This results in a population density of 63.76 square kilometers. This zone includes 654,803 households. The predominant ethnic group in North Gondar is Amhara, making up 97.84% the population, whereas all other ethnic groups account for 2.16%. Amharic is the primary language spoken by 98.32% of the residents. Regarding religion, 95.38% off the population practices Ethiopian Orthodox Christianity, and 4.29% are Muslim (Assefa et al., 2016; Central Statistical Agency, 2015; Save the Children, 2013).

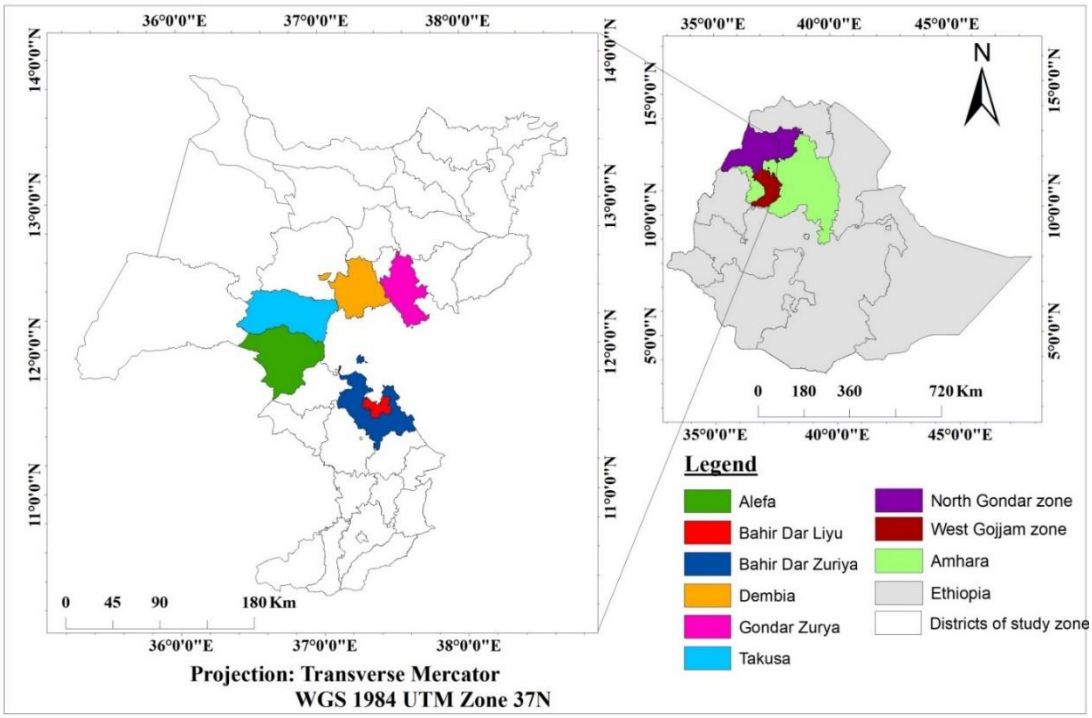


Figure1. Administrative map of the study area

West Gojjam is another administrative zone in the region, named after the former province of Gojjam. It is bordered on the south by the great Abay River, which separates it from the Oromia and Benishangul-Gumuz regions, on the west by Awi Zone, on the northwest by North Gondar, on the north by lake Tana, and on the east by Great Abay River which separates it from the South Gondar Zone, and on the east-by-East Gojjam. Its highest point is Mount Amedamit. Towns in West Gojjam Zone include Bahir Dar, Adet, Finote Selam, Bure, Quarite, Dega Damot, Sekela, Merawi, Yismala, and Dembecha. Finote Selam is the capital city of the zone.

West Gijam Zone has a total population of 2,106,596, with 1,058,272 men and 1,048,324 women. Covering an area of 13,311.94 square kilometers, it has a population density of 158.25 people per square kilometer. The zone includes 480,255 households. The largest ethnic group reported was Amhara (99.42%), sit all other ethnic groups comprising 0.52% of the population. Amharic is spoken as a first language by 99.43% residents. In terms of religion, 98.68% of the population practices Ethiopian Orthodox Christianity, and 1.19% were Muslim (Alexiades, 1996a, 1996b). The survey study was conducted in Bahir Dar city administration, Bahir Dar Zuria, Debiya, Takusa, Alefa, and Gonder Zuria Districts (Figure 1). Data was collected from one to two villages per district, resulting in a total of ten representative villages: Zege 01, Ura, Wonjeta, Yigodi, Guraba Michale, Bata, Mekonta-aybega, Chemera na-banberawa, Layiye-duge. Zengaj.

2.2. Research and sampling design

The potential distribution of *Ocimum americanum* was assessed from regional, zonal, and district annual reports. Checklists were given to the agricultural officers, who utilized their reports and field experiences to prioritize and sort the villages based on production levels, from highest to lowest.Districts and villages were purposively elected based on their wealth of *Ocimum americanum*, knowledge, and traditional consumption habits, with assistance from regional, zonal, and district agricultural officers. A purposive sampling method identified potential *Ocimum americanum* growing sites, while proportional sampling was used to select study participants. A total population (N = 1200) of cultivators and users of *Ocimum americanum* was identified. From this group, 10% of individuals were randomly selected using a lottery method, resulting in 120 key informants (both male and female) participating in the structured questionnaire (Alexiades, 1996a, 1996b; Assefa et al., 2016; Tongco, 2007).

2.3. Ethno botanical data Collection

A reconnaissance survey of all sampled sites (villages) was conducted with growers and users to assess the overall conditions of the study area. Guided field walks and observations were carried out to collect data based on a checklist. Representative specimens and photographs of *Ocimum americanum* were taken for taxonomic identification and confirmation. A semi-structured interview, translated into Amharic, was administered to respondents. Data related to bio-prospecting potential, opportunities, distribution, and local use of *Ocimum americanum* were gathered from respondents with the help of agricultural officers. Group discussions were conducted with systematically selected key informants and elderly farmers. The medicinal, flavor, aroma, and preservative traditional use of the species were discussed, and a consensus was reached with interactive meetings (Alexiades, 1996a, 1996b; Assefa et al., 2016).

2.4. Data analysis and interpretation

All collected data were analyzed using SPSS software version 21, SigmaPlot version 10.0 and Excel version 2010. The data were interpreted using descriptive statistics, fidelity level, direct matrix ranking, and Jaccard's coefficient of similarity. Descriptive statistics, such as percentages and frequencies, were used to analyze and summarize data on use categories, ethno-medicinal uses, and associated knowledge. Simple and splined curve bar graphs, pie graphs, and other charts were produced using SigmaPlot version 10.0.

2.5. Fidelity level (FL in %)

The percentage of informants claiming the use of *Ocimum americanum* for the same major purpose was calculated using the general formula FL (% = NP/N), where NP is the number of informants claiming the use of *Ocimum americanum* for a particular purpose, and N is the total number of the informants who use *Ocimum americanum* for any given purpose, following the methodology (Alexiades, 1996a, 1996b; Alexiades & Sheldon, 1996).

2.6. Direct matrix ranking

A table was created to compare *Ocimum americanum* spiced local foods commonly reported by informants with their use categories. All spiced local foods were included in the computation, and four selected use categories of *Ocimum americanum* as described by the respondents were listed. Five key informants were chosen to assign use values for each attribute, using the following scale: 5=excellent, 4= very good, 3= good, 2= less and 1= least used. Out of the total eleven use categories, the selected categories were food flavor (FF), ailment treatment (AT), food preservative (FP), and aroma to foods (AF) (Cotton, 1996; Wickwire et al., 2007).

2.7. Jaccard's coefficient of similarity (JSC)

The degree of similarity was computed to evaluate basil-spiced local foods of Alefa District, which contain the maximum composition (88.88%) of foods, compared with the five other surveyed districts, whose compositions range from the lowest (44.44 %) up to the second highest

(77.77%). The formula used for this calculation was, $JSC = C/(a+b+c)$, where JSC is Jaccard's coefficient of similarity, a is number of basils sweetened local foods in District A, b is number of basil sweetened foods in District B, and c is number of common basil-spiced local food in both District A and B, following the modification by Kent and Coker (1993).

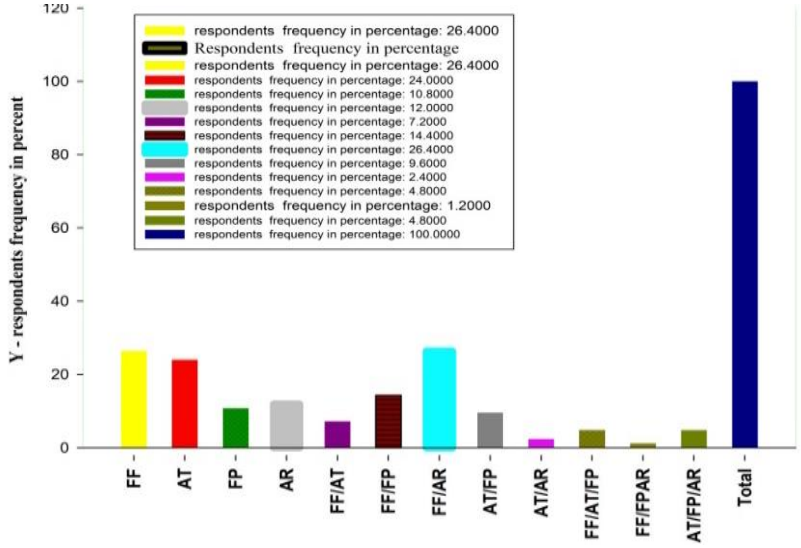
3. Result and discussion

3.1. Socio demographic characteristics

The socio-demographic variables include gender (male/female), religion, ethnicity (Amhara/others), education (illiterate/ informal/primary/ high school), occupation (farmer/ merchant/others), economic status (high/medium/low), marital status (married/ unmarried/divorced), age category (adult: 18 -35, middle age: 36-65, and senior age: above 66 years), and the respondents' residence in the study area. Most of the respondents were married (93%) and farming was the main profession (95%). Of the respondents, 64% were male and 36% were female. Based on their self-assessment, 70.8% of respondents were grouped under the medium economic class, while 21.7% fell under the low economic status, and 7.5% under the high economic class. There was no significant difference between the age of respondents and amount of *Ocimum americanum* spiced foods mentioned (α = 5%, 2-tailed independent Samples t test, $t_{(0.025,120)}$ = 0.355, p = 0.723, 95% CI [– 4.273 to 6.140]). Similarly, there was no significant difference between the respondent's levels of education (RLE) and the amount of *Ocimum americanum* spiced local foods mentioned (OASLF) (α = 5%, 2-tailed independent samples t test, $t_{(0.025,118)}$ = 0.355, p = 0.723, 95% CI [– 4.273 to 6.140]). Table1 shows socio-demographic characteristics of respondents selected from three zones, six districts, and ten villages representing the study area.

3.2. Traditional use category of Ocimum ameracanum

Out of the total respondents, 53.2 % indicated that basil was used for increasing food aroma and flavor. A substantial number of respondents (24%) reported using species for ailment treatment. Other respondents (ranging from 1.2% up to 14.4 %) mentioned using basil for various other purposes, either independently or in combination (Figure 2). A similar finding was reported by Egata (2021), who noted that basil is widely used in Ethiopia for its spice and medicinal properties. However, unlike our findings, Egata (2021) also reported that basil is used as for feed for honey bees, as an ornamental plant, and as an industrial raw material.



Acronym- FF=food flavor, AT= Ailment treatment, FP= food preservative, AR= Aromatic

Figure 2. Simple bar chart representation of general use categories *Ocimum Americanum* claimed by respondents

Table1 Categories of gender, religion, ethnicity, education, occupation and economic status of respondents by their zone, districts and villages (Kebele)

Socio-demo-graphy	Respondents Categories	Study zone- Western Gojjam Zone, Northern Gonder and Bahir city special																					
		BDR -S/Z		West Gojjam Zone District						Central Gonder Zone Districts													
		Bahir Dar city		Bahir Dar zuria						Gonder Zuria				Dembia				Takusa		Alefa		Grand total	
		Zegie 01		Ura		Wonjeta		yigodi		Layiye dugie		Zengaji		Guramb michael		Gurama/ bata		Mekaye-bega		Chemera			
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N-T	%
Gender	Male	8	7	6	5	5	4	6	5	7	6	8	7	7	6	6	5	10	9	11	10	74	64
	Female	6	5	4	3	5	4	4	3	5	4	4	3	5	4	6	5	4	3	3	2	46	36
Religion	Orthodox	14	12	10	8	10	8	10	8	12	10	12	10	12	10	12	10	14	12	14	12	120	100
	Muslim	---		---		--		--		--		--		--		--		--		--		--	--
	Total	14	12	10	8	10	8	10	8	12	10	12	10	12	10	12	10	14	10	14	12	120	100
Ethnicity	Amhara	14	12	10	8	10	8	10	10	12	10	12	10	12	10	12	10	14	10	14	12	120	100
	Other	--		--		--		--		--		--		--		--		--		--		--	--
Education	Illiterate	3	2.5	3	2	2	1.5	3	2.5	4	3	4	3	3	2.5	5	4.5	4	3	4	3.5	35	29
	Informal	4	3	3	2	3	2.5	3	2.5	3	2	3	2.5	3	2.5	4	3	4	3	4	3.5	34	28
	Primary	5	4	2	2	4	3	4	3	4	3	5	4.5	3	2.5	3	2.5	4	3	6	5	40	34
	H/school	2	2.5	2	2	1	1	--	---	1	1	--	--	3	2.5	--	--	2	2	--	--	11	9
Occupation	Farmer	13	11	9	7	9	7	9	7	10	9	12	10	12	10	12	10	14	12	14	12	114	95
	Merchant	1	1	1	1	1	1	1	1	2	1	--	--	--	--	--	--	--	--	--	--	6	5
	Other	--		--	--	--		--		--		--		--	--	--	--	--	--	--	--	--	---
E/status	High	3	2.5	2	1	1	.8	2	1	4	3.5	4	3.5	2	1.5	2	1.5	3	2.5	3	2.5	26	21.7
	Medium	8	7	5	4.	7	5	8	7	8	6.5	8	6.5	10	8.5	10	8.5	11	9.5	10	8.7	85	70.8
	Low	3	2.5	3	2.	2	1.2	--	--	--	--	--	--	--	--	--	--	--	--	1	.8	9	7.5
Marital status	Married	12	10	9	7	8	6.5	9	7	12	10	12	10	12	10	12	10	14	12	14	12	113	95
	Unmarried	1	1	--	--	1	.75	1	1	--	--	--	--	--	--	--	--	--	--	--	--	3	2.5
	Divorced	1	1	1	1	1	.75	--		--	--	--	--	--	--	--	--	--	--	--		3	2.5
Age category	Adult	5	4.2	3	2	4	3	3	2	3	2	1	0.8	3	2	3	2	5	4.2	3	2.5	34	26
	Middle age	8	7	7	6	6	5	7	6	9	8	10	8.4	9	8	9	8	8	7	10	8.7	83	71
	Senior age	1	0.8	--	--	--	--	--	--	---	--	1	0.8	--	--	--	--	1	0.8	1	0.8	4	3
Grand Total		120	100	120	100	120	120	100	120	100	120	100	120	100	120	100	120	100	120	100	120	120	120

N= number of respondents from villages, % percent of respondents within villages, -- = no value, BDR-S/Z= Bahir dar special zone,

3.3. Fidelity level

The highest FL (percentage of informants claiming *Ocimum americanum* for particular purpose) was 18.33 % food flavor, followed by the same percentage (18.33%) for both food flavor and preservative combined. The lowest fidelity level value was 0.84% for the combined used category of food flavor/preservative/aroma (Table 2).

Table 2. Fidelity level (percentage of informants claiming *Ocimum americanum* for particular purpose/use

S.N	Use category	Tabulated, FL=[NP/N*100]	FL (%)
1	Food flavor	22/120*100	18.33
2	Ailment treatment	20/120*100	16.66
3	Food preservative	9/120*100	7.50
4	Aroma to food	10/120*100	8.33
5	Food flavor and ailment treatment	6/120*100	5.00
6	Food flavor and preservative	22/120*100	18.33
7	Food flavor and Aromatic	12/120*100	10.00
8	Ailment treatment and food preservative	8/120*100	6.67
9	Ailment treatment and food aroma	2/120*100	1.67
10	Food Flavor, ailment treatment and food preservative	4/120*100	3.33
11	Food flavor, preservative and Aroma	1/120*100	0.84
12	Ailment treatment, Food preservative and Aroma	4/120*100	3.34
	Total		100

3.4. Ethno medicinal use of *Ocimum americanum*

Approximately 32.66 % of the respondents used *Ocimum americanum* as a traditional medicine for various diseases, while 67.34% did not use the plant for medicinal purposes (Figure 3). Research supporting the traditional use of *Ocimum americanum* has demonstrated its anti-fungal, anti-bacterial, and anti-viral properties in the essential oils of various *Ocimum* species (Singh & Verma, 2010). *Ocimum americanum* is used to treat conditions such as depression or headaches and to ward off evil spirit. Abera (2014) reported *Ocimum* species for headaches in Ghimbi district. This is supported by Dubick (1986), who found the essential oil extracted from the leaves of *Ocimum americanum* has anti-bacterial and anti-tubercular activities against *Mycobacterium* strains. *Ocimum americanum* is often combined with other plant-derived ingredients, such as *Allium sativum* and *Nigella sativa*, for treating ailment. Chen et al. (2013) also reported that *Ocimum americanum* exhibits anti-bacterial and antioxidant activity. Similarly, Sastry et al. (2012) highlighted the antioxidant and antimicrobial properties of *Ocimum americanum*. These findings suggest that extracts of *Ocimum americanum* contain essential secondary metabolites responsible for its medicinal effects.

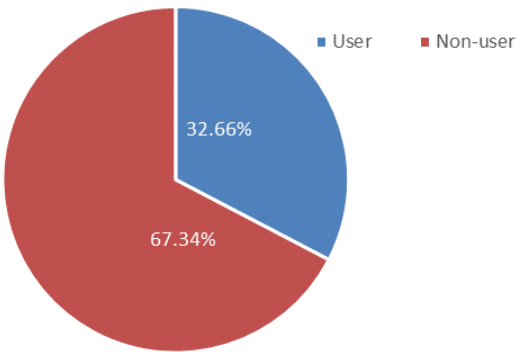


Figure 3. *Ocimum Americanum* users and non-user respondents for ailment treatment role

3.5. Ethno role of *Ocimum americanum* in Ethiopian spiced butter preparation

The majority of the respondents (84%) use *Ocimum americanum* to prepare spiced butter, while the remaining 14% do not use use it for this purpose. This finding suggests that *Ocimum americanum* plays a crucial role in spiced butter production. Respondents indicated that adding *Ocimum americanum* to butter enhances flavor, aroma, and act as a preservative (Figure 4). The method and amount of *Ocimum americanum* added during spiced butter preparation vary based on local views, knowledge, and practices across different parts of the study area. Approximately half of the respondents (49%) use *Ocimum americanum* primarily for flavorings and its preservative properties. This result suggests the presence of secondary metabolites in *Ocimum americanum* responsible for its aromatic, flavor-enhancing, and preservative effects. Chin et al. (2006) reported supportive findings on aromatic compounds found in *Ocimum* such as eugenol, methyl eugenol, citral, linalool, geraniol, and thymol, which are used as raw materials in the food industry. Among the respondents, 29% added *Ocimum americanum* to butter for flavoring purposes, while 12% used its specifically for its preservative effect. The remaining respondents (59%) used it for its aromatic properties (Figure 4). The preservative effect of *Ocimum Americanum* varies from 2 to 10 years depending on knowledge and practices in the community surround the study area. Local community use *Ocimum americanum* for flavoring foods such as hot spice or red pepper ('Berbere'), spiced stew ('Wot'), tea, and traditional foods made from grain flour ('Atmit'), roasted grains, and spiced butter. Phippen and Simon (1998) supported these findings. highlighting *Ocimum* species as aromatic plants rich in essential oils containing phenolic compounds, flavonoids, and anthocyanins. All respondents reported using *Ocimum americanum* as an additive for flavoring, aroma, and preservation when preparing spiced butter and diluted spiced paste ('chew'). This diversity of traditional knowledge underscores the potential of *Ocimum americanum* in the study area and provides valuable insights for bio-prospecting companies to explore further research and utilization of genetic resources.

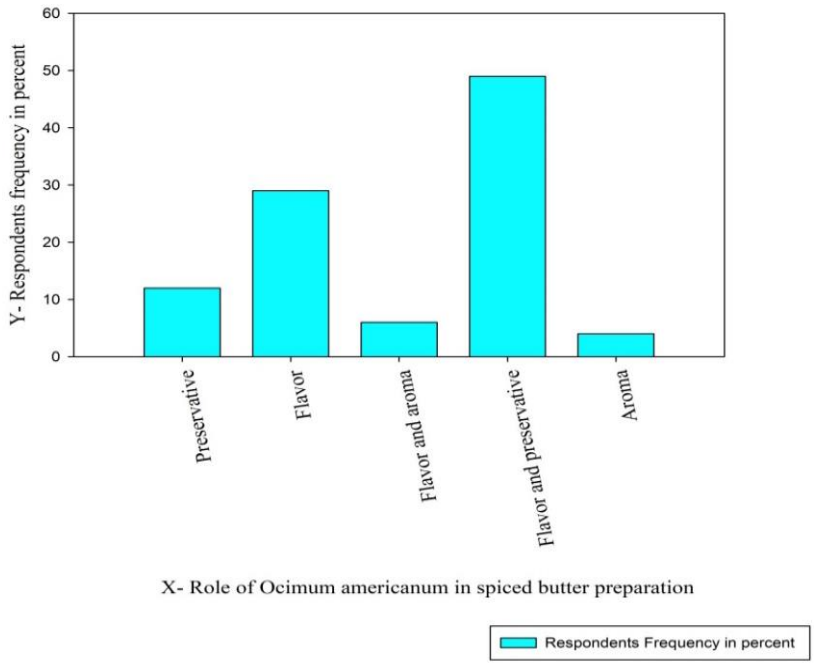


Figure 4. Simple vertical bar chart representing role of *Ocimum Americanum* in spiced butter preparation

3.6. Distribution of *Ocimum americanum* in the study area

Approximately 88% of the respondents cultivated *Ocimum americanum* in their home gardens and main fields to make the genetic resource accessible on the market, while the

remaining 12% grew it for personal use. This finding suggests that a significant market potential exists, enabling bio-prospecting companies to access this genetic resource sustainably from the local people. The local cultivation and harvest of *Ocimum americanum* ranged from 20 to 300 kg per grower. The average price of *Ocimum americanum* in the study area was approximately 2 USD (40 ETB) per kg at the time of data collection (Plate1: A, B, and C).

Plate1. *Ocimum americanum* intercropped with *Piper nigrum* at Alefa District (A), Semi processed *Ocimum americanum* at Gonder Zuria (Makisegnit) local market (B), and hot pepper spice and spiced bean flour at a mini supermarket in Bahir Dar (C).

3.7. *Ocimum americanum* spiced Local foods description and composition

The local people prepare various types of traditional foods using *Ocimum americanum* as a flavoring, preserving, and aromatic agent (Table 3 and Plate 1). Some of these local foods include hot pepper spice, water dissolved hot spice, spiced butter, white fleshy food, hot chili pepper spice, spiced stew, vegetable stew, lentil stew, and powdered hot spice (Table 3). Ethiopian cultural foods are typically well-flavored with a variety of spices and *Ocimum americanum* is one of the most known, added to many local foods for its flavoring or aromatic agent.

3.8. Direct matrix ranking

Key informants evaluated the functionality of local foods spiced with basil for the local people and indicated their scores for each local foods (on a scale of 1 to 5). Nine *Ocimum Americanum* spiced local foods were evaluated in four selected usage categories. The output of the direct matrix analysis showed that chilli pepper spice was the preferred local food sweetened with basil for its

various purposes (flavoring, preservative, aroma, and ailment treatment) by the local people, followed by hot-spiced pepper, pea/bean flour stew, and dissolved hot spice (Table 4).

Table3. *Ocimum americanum* spiced local foods summarized menu list and definition as described by the respondents

S.N	Local Name in Amharic	Corresponding English Name	Definition as described by the respondents
1	Shiro	Pea/bean flour stew	A typical Ethiopian food, ground dried or curry powder, is usually made from *Pisum sativum* or faba bean and sweetened with many spices.
2	Berbere	Hot-spiced pepper	Hot spice is a powder paste composed of many spices such as chili powder, fenugreek, ginger, garlic, and a variety of of supplementary spices, blended according to the preferences of the local chemist, often Ethiopian mothers.
3	Mitmita	Chilli pepper spice	An orange-red ground dried spice mixture typically made from hot chili pepper combined with various other spices such as cardamom, cloves, and salt.
4	Awaze	Dissolved hot spice	Water-dissolved hot spice [Plate 2] is a semi-solid or amorphous mixture of hot spice, water, oil, spiced butter, and salt
5	Shiro Wet	Spiced stew	Fully ground grain paste, usually prepared from faba bean or *Pisums sativum*, used to make a traditional spiced stew [Shiro wet].
6	Misir Wet	Lentil stew	A typical Ethiopian stew made from semi-ground lentils spiced with various flavorings.
6	Silijo	White fleshy spiced food	A portion of traditional fermented food prepared from a mixture of cooked, powdered horse bean (*Vicia faba*, and safflower (*Carthamus tinctorius*) extracts, processed into a semi-solid product and added to untreated black mustard (*Brassica nigra*) powder after being cooled.
7	AterAlichaWot	Vegetable stew	It is a type of stew made from a semi-ground Faba bean or *Pisum sativum* without hot spiced pepper.
8	Dillih	Water dissolved hot spice	A mixture of hot spice pepper and hot water that forms a semi-solid or thick, fleshy structure.
9	Nitir qibe	Spiced butter	A traditional purified (melted) mixture product, usually made from cow's milk as the primary ingredient, with several added spices, principally ginger and *Ocimum Americanum*, for their food and stimulant drinks like coffee and tea.

Plate 2. Local foods such as dissolved hot spiced pepper and *Pisum sativum* grain, are used to cook vegetable stew (photo credit, Edeget 2016, around Bahir Dar Zuria District)

Table4. Direct matrix ranking of *Ocimum americanum* spiced local foods by key informants from Alefa and Debiya District (R-15 up to R-19) based on four selected usage categories

Spiced local foods	L/ name	Preservative					Flavor					Aromatic					Ailment treatment					Total	Rank
		Key informants (R_{15}–R_{19})					Key informants (R_{15}–R_{19})					Key informants (R_{15}–R_{19})					Key informants (R_{15}–R_{19})						
Key Informants		**15**	**16**	**17**	**18**	**19**	**15**	**16**	**17**	**18**	**19**	**15**	**16**	**17**	**18**	**19**	**15**	**16**	**17**	**18**	**19**	5	-
Pea/bean flour stew	Shiro	4	3	5	3	5	4	3	5	3	5	5	3	5	3	5	5	3	5	3	5	82	**3rd**
Hot-spiced pepper	Berbere	5	4	4	5	5	5	4	4	5	5	5	4	4	5	5	5	4	4	5	5	92	**2nd**
Chilli pepper spice	Mitmita	5	4	5	5	5	5	5	5	5	5	5	4	5	5	5	5	4	5	5	5	97	**1st**
Dissolved/ hot spice	Awaze	5	4	4	3	5	5	3	4	3	5	5	3	4	3	5	5	3	4	3	5	81	**4th**
Spiced stew	Shiro Wet	4	4	3	2	4	5	5	5	5	5	5	5	5	5	5	1	1	1	1	1	72	**6th**
Lentil stew	Misir Wet	3	2	2	4	5	3	2	2	4	5	3	2	2	4	5	3	2	2	4	5	64	**7th**
fleshy spiced food	Silijo	1	1	2	5	2	1	1	2	5	2	1	1	2	5	2	1	1	2	5	2	44	**9th**
Spiced butter	Nit/qibe	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1	1	1	80	**5th**
Veg/Spiced stew	A/k-Alich	2	3	1	5	1	2	3	1	5	1	2	3	1	5	1	2	3	1	5	1	48	**8th**
Total		157					182					167					120						
Rank		**3rd**					**1st**					**2nd**					**4th**						

Table5. Summarized local basil spiced foods list with their Method of preparation, dosage, role and plant parts used

Local foods list	Preparation Methods	Dosage	Role of *basil*	Plant parts used	District	Remark
Hot pepper spice	DM	P	PR	S	ATD	-
Water dissolved hot spice	DM	P	AR	S	ATD	-
White fleshy food	DM	P	AR	S	ATD	-
Hot chili pepper spice	DM	P	AR	S	ATD	-
Spiced stew	CI	P	AR	CP	ATD	condiment
Vegetable stew	CI	P	AR	CP	ATD	condiment
Powdered hot spice)	DM	P	PR	S	ATD	-
Spiced Butter	MP	p	PR/AR/FL	S	ATD	condiment
Lentil stew	CI	P	AR/FL	CP		-

DM= drying and mixing, CI = cutting and inserting, ATD= all targeted district, PR= preservative, CP= Cut part, S = seeds, AR =aromatic, FL= flavor, P= proportional, MP=Melting and purifying

3.9. Basil spiced foods list with their Method of preparation, dosage, role and plant parts used

Ocimum americanum is added to hot pepper spice (Plate1) for its preservative, stabilizer, and aromatic qualities. It plays essential role in cooking cultural foods and is used to spice many dishes. One of the most delicious cultural and typical cultural foods enhanced by *Ocimum americam* is spiced stew or vegetable stew. During the preparation of raw materials, dried seeds of *Ocimum americanum* are added to the semi-processed Faba beans or *Pisum sativum* to increase the flavor and extend the shelf-life of the spiced stew, serving as a preservative. A live cut plant of *Ocimum americanum* is included in vegetable stew or spiced stew to provide flavor and aroma, and to increase the food's shellfire. In the preparation of white fleshy amorphous food, dried seeds of *Ocimum americanum* and other spices are added to provide flavor and a preservative effect. Local people mix the seeds of *Ocimum americanum* to water-dissolved hot spice during the first step of preparation (Plate 2) to enhance its flavor.

Traditional or cultural foods are prepared by drying, screening, and mixing a variety of spices at different stages of the local preparation. According to the information obtained from all interviewed respondents, the amount of *Ocimum americanum* added to powdered hot spice (Dilih or Dikus) and local foods listed in Table 5 is proportional and based on the quantity of the local food being prepared. Generally, local people use *Ocimum americanum* as a preservative, aromatic and flavoring agent, despite variations of food lore, perceptions, knowledge, and attitudes among the respondents interviewed. The results show that the local people possess versatile knowledge and practices regarding methods, dosages, plant parts used, and role of additives during local food preparation (Plate-2). The preparation of local foods may vary different areas depending on individual characteristics, usually associated with mothers' local knowledge, creativity, resource availability, culture, linguage, and other factors.

3.10. Ways of administration and methods of preparation during traditional medical use (TMU)

The local people have acquired various medicinal practices, customs, skills, and knowledge related the use of *Ocimum americanum* over the centuries. Common methods of preparation and administration identified include concoction, cutting and inserting the whole plant (including the flesh plant fruits), grinding, melting, and smelling for various diseases (Figure 5).

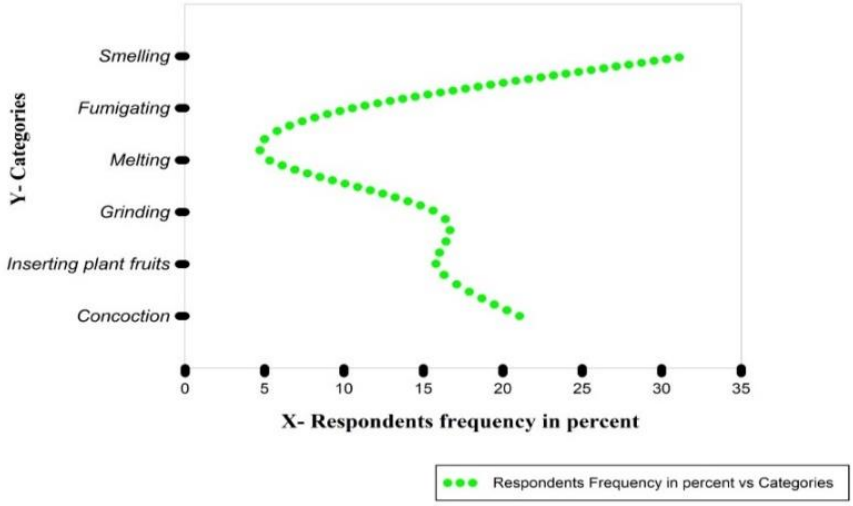


Figure 5. Simple spline curve representing ways of administration and method of preparation during the use of *Ocimum Americanum* for traditional medical use (TMU)

The plant parts utilized for medicinal purposes include leaves, stems, whole plant cuts, and fruits or seeds. The dosage recommended varies depending on the intensity and severity of the disease and it can be unlimited. Additive such as tea, coffee, water, and butter are used in different amount depending on the type of disease treated (see Table 6).

Table 6, Summarized data on disease treated, rout of administration, plant parts used, additive and method of preparation in TMU

DT	M P	F	RA	F	PPU	F	AD
DP	whole plant	2	anal	3	Whole plant	2	Tea/ coffee
TB	Concoction	1	anal	1	Leaves	2	Water
	Concoction	3	anal	2	leaves	3	-
SW	Ground	4	dermal	2	Whole plant	1	Butter
SA	melting	5	anal	1	leaves	2	coffee
DB	melting	2	anal	2	Leaves and stems	1	water
IW	grinding	1	anal	1	Leaves and stems	2	butter
ES	smelling	2	anal	1	leaves	4	water
SU	concoction	1	anal	1	leaves	2	water

3.11. Jaccard's coefficient of similarity

The highest Jaccard's coefficient of similarity was found between Alefa and three districts: Bahir dar zuria, Gonder Zuria, and Takusa (30%). Conversely, the lowest degree of similarity was observed between Alefa and Bahir Dar city (20%) (refer to Table 7). Various factors such as cultural differences, lifestyle variations, indigenous knowledge, geographic barriers, modernization, and others could be considered as potential reasons for the similarities and differences observed among these districts.

Table 7. Comparison of basil spiced local foods composition of Alefa District with the other five surveyed districts

Study Districts	Basil spiced Local foods in *a* or *b*	Common basil spiced local foods in $a \backslash b = (c)$	Jaccard's coefficient	% of similarity
Alefa	8	--	-	-
Bahir Dar City	4	3	0.20	20
Bahir Dar Zuria	5	4	0.30	30
Gonder Zuria	6	6	0.30	30
Dembia	7	6	0.28	28
Takusa	6	6	0.30	30

4. Conclusion

Literature suggests the plant has been claimed as a food additive for its aromatic properties and as a folk remedy for various ailments. The current survey also confirmed that local people traditionally use basil for its aromatic, preservative properties, flavors, and medical treatment purposes. The study suggests that the plant is 'neglected' despite its multiple valuable uses, particularly as a preservative, flavor, and aromatic enhancer in the preparation of local foods such as spiced butter, stew, and hot pepper spice. The short growth cycle of basil, its efficient use of moisture, and the ability for repetitive harvesting have provided advantages to both users and producers. Consequently, the present study indicates that *Ocimum americanum* holds promise for pharmaceutical and industrial applications. Interested bio-prospecting companies can access the plant, along with its associated local knowledge and practices, to explore new biochemical compounds. The study recommends collaboration among the government, local communities, and

interested bio-prospecting companies to leverage local knowledge and practices in the search for biochemical compounds that contribute to the plant's diverse uses. This cooperative effort could lead to the discovery of valuable compounds for pharmaceutical and industrial purposes.

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