Vegetos
https://doi.org/10.1007/s42535-024-00986-1

RESEARCH ARTICLES

Ethnobotanical study of wild edible vegetables used in agri-foods and traditional medicine in the Ogun Waterside Nigeria

Musbau Bayonle Olaniyi[1] · **Samsideen Olabiyi Rufai**[1] · **Aishat Adeola Olaniyi**[2]

Received: 12 October 2023 / Revised: 6 July 2024 / Accepted: 13 July 2024

Abstract

In recent decades, there has been an alarming decline in the traditional knowledge of wild edible plants. This study was undertaken to specifically document the awareness and understanding of wild edible vegetables (WEVs) within 11 rural communities in Ogun Waterside, Nigeria. The survey was conducted among 120 informants through a semi-structured questionnaire where 32 species from 26 genera and 15 families, mainly creepers (6.25%), climbers (12.5%), shrubs (12.5%), trees (12.5%), and herbs (56.25%), were carefully collected and identified. The results obtained revealed that the most used parts for both nutritional and therapeutic uses were the leaves (58.97%), seeds (12.82%), stems (10.26%), fruits (7.69%), bulbs (5.13%), and rhizomes (5.13%). The most commonly used plant species as foods were *Vernonia amygdalina* (92) *Celosia argentea* (88), *Talinum triangulare* (86), *Telfairia occidentalis* (80), and *Corchorus olitorius* (74) as well as remedies for various diseases such as diabetes, anaemia, dystocia, infertility, and blood impurities. Additionally, this study unveiled that a higher level of knowledge on WEVs was found among men, the elderly, the illiterate, married people, and those engaged in traditional medicine practices. This work could be a basis to be reproduced in other parts of Nigeria and be widened through nutritional and pharmacological studies to promote and conserve these important natural resources.

Keywords Conservation · Diets · Ethnobotany · Indigenous knowledge · Wild edible vegetables · Medicinal plants

Introduction

The global use of medicinal plants is on the rise due to the diminishing effectiveness of numerous synthetic drugs employed in the management of various chronic illnesses like coronary heart problems, hypertension, and diabetes (Ijarotimi et al. 2021). The direct or indirect use of plants has been with man since the beginning of human civilization as a result of the close connection between plants and man (Rajbhandary et al. 2020). Throughout human history, the utilization of plants, either directly or indirectly, has been a constant presence, closely intertwined with the development of human civilization (Rajbhandary et al. 2020). Among these plant resources, wild edible vegetables (WEVs) have emerged as a significant source of numerous bioactive compounds known as phytochemicals, found in substantial quantities. These phytochemicals possess antioxidant properties that can help counteract the effects of free radicals, modulate metabolic processes, detoxify carcinogens, and potentially impact pathways that influence the behaviour of tumour cells (Zhang et al. 2015). WEVs exist in many life forms, such as tuberous roots or rhizomes, leafy herbs or leaves, flowers or buds, fruits, and the seeds that are consumed as foods (Turner et al. 2011). The consumption of WEVs among rural inhabitants is connected to numerous health benefits owing to their medicinal properties and high nutritional value (Duguma 2020). Nigeria is blessed with varieties of WEVs that have gained wide acceptance as dietary constituents. They are not only known for their rich food nutrient content but also used for medicinal purposes, some of which are identified as underutilised due to civilization and inadequate information on these resources (Oseni and Babatunde 2015). In the same vein, WEVs possess some medicinal properties that are used in the treatment of some

✉ Musbau Bayonle Olaniyi
musbay2012@gmail.com

[1] Biomedicinal Research Centre, Forestry Research Institute of Nigeria, P.M.B 5054 Jericho Hill, Ibadan, Oyo State, Nigeria

[2] Multipurpose, Tree Multiplication and Improvement Unit, Forestry Research Institute of Nigeria, P.M.B 5054 Forest Hill, Oyo State, Ibadan, Nigeria

Published online: 26 July 2024

diseases. Some are used in traditional medicine for cardiovascular diseases, diabetes, weight management, and cancer as well as to improve overall body immunity (Chaturvedi et al. 2007). The consumption of vegetables in the daily diet has been strongly associated with overall good health, and reduced risk for some forms of cardiovascular diseases, diabetes, anaemia, gastric ulcer, and rheumatoid arthritis (Ayeni et al. 2020; Hyson 2002).

In developing nations such as Nigeria, where starchy foods are a predominant component of the daily diet, WEVs assume a central role in the nutrition of both rural and urban populations. This is primarily due to their affordability and accessibility, making them crucial sources of essential macronutrients and micronutrients (Adjatin et al. 2013). Various forms of WEVs, such as tuberous roots or rhizomes, leafy herbs or leaves, flowers or buds, fruits, and seeds, are consumed as foods (Turner et al. 2011). Many WEVs can be used as nutritional supplements for humans and livestock, especially vitamins and micronutrients (Duguma 2020; Mohapatra and Panda 2012). Primitive human beings traditionally chose and utilized wild edible plant species through a process of trial and error, ultimately leading to their domestication (Niveditha 2017). People have depended on wild plants for livelihood for a very long time, especially the rural dwellers who still depend on these plants to meet at least part of their daily nutritional needs or to cure different health problems (Rafiqul-Islam et al. 2019). WEVs have a significant impact on the livelihoods and food security of local rural communities, as they are traded as a source of income (Rafiqul-Islam et al. 2019).

In recent times, the increasing disappearance of WEVs from our surroundings has become more prevalent. This is primarily attributed to inadequate conservation strategies, excessive exploitation, and the absence of modern agricultural techniques that can effectively safeguard the population of these plant resources (Amujoyegbe et al. 2007).WEVs are constantly being neglected despite their richness in vital nutrients, which are crucial to humans for the maintenance of good health and the prevention of diseases. They are ignored and underutilised in favour of exotic species (Njume et al 2014). Furthermore, the potential of WEVs for income generation is still hidden due to a lack of awareness and is not available on a commercial scale because they are mostly not cultivated (Matenge et al. 2017). However, knowledge regarding the habitat, nutritional, and medicinal importance of WEVs is hardly transferred to younger generations due to a lack of keen interest expressed by the youths, hence the need for proper documentation of these important genetic resources. The primary objective of this study was to document the ethnobotanical uses of WEVs among the rural inhabitants of Ogun waterside communities.

Materials and methods

Study area

The research was conducted in the Ogun Waterside Local Government Area, situated on the South-eastern coast of Ogun State, Nigeria, along the Bight of Benin. This area covers approximately 1026 square kilometres (400 square miles) and is inhabited by a population of 103,200. Geographically, it is located at latitude 6°29′ 04″ N and longitude 4°23′ 10″ E (NIPOST 2020). Ogun Waterside is bordered by Ijebu-East Local Government to the Northwest, and Odigbo, Okitipupa, and Ilaje Local Government Areas of Ondo State to the Northeast, East, and Southeast, respectively. It is also adjacent to Epe Local Government and the Atlantic Ocean to the West and South respectively. The primary occupations of the residents in these sampled locations include farming, fishing, hunting, lumbering, and sand mining. This study specifically focused on eleven selected local communities within Ogun Waterside, namely: Abigi, Aiyede-ayila, Ebute-oni, Efire, Ibiade, Ilushin, Imakun-omi, Ita-otu, Itebu, Ita-ogun, and Iwopin. The choice of locations was based on the abundance and popularity of WEVs among the selected locations (Fig. 1).

Data collection

The collection of ethnobotanical data took place in the study area between March 2023 and July 2023. A total of eleven study locations were chosen from Ogun Waterside rural communities. These selections were made using a purposive sampling method based on the abundance and popularity of WEVs in the locations. Only one hundred and twenty respondents who volunteered to partake in the study were used. They are majorly herbalists, herb sellers, and farmers, comprising 83 males and 37 females who have prior knowledge and utilise the WEVs. At least 10 respondents were selected from the eleven local communities within the entire study area. Data were gathered through the use of semi-structured questionnaires, which encompassed inquiries about various aspects of WEVs. This method for the selection of participants in the study was a focus group that used and was acquainted with the WEVs. These questionnaires sought information regarding the local names of the plants, their availability, parts of the plants used, their natural habitats, methods of preparation, as well as their culinary and medicinal applications. It's worth noting that some of these vegetables are considered naturalized in the study area. Before conducting the ethnobotanical survey, explicit consent was obtained from the head of each village and individual informants. This was

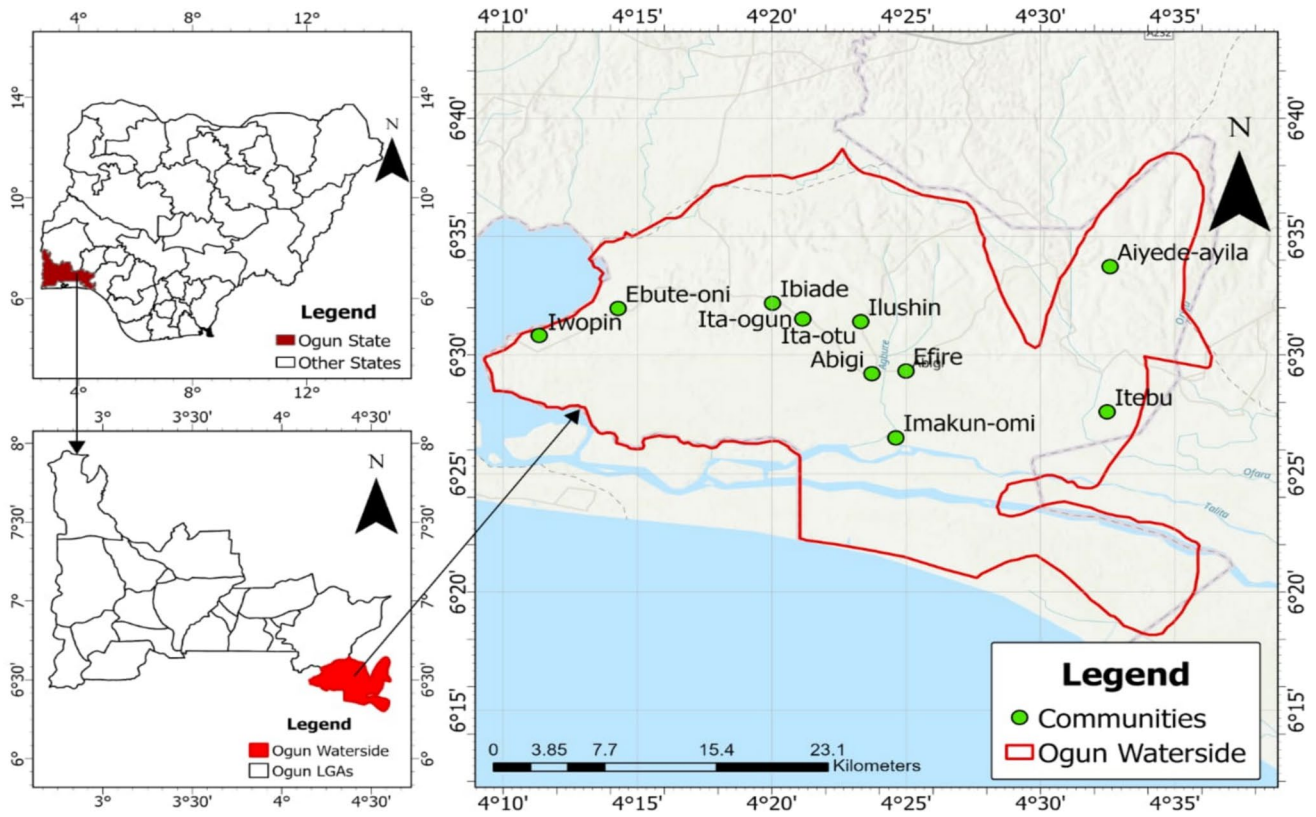

Fig. 1 Study locations selected in Ogun waterside communities in Ogun state, Nigeria

done in strict adherence to the ethical guidelines outlined by the International Society of Ethnobiology (ISE Code of Ethics, 2008). Subsequently, field studies and interviews were conducted following these ethical principles and guidelines. Plant specimens, which included information such as the local name, date of collection, collection number, collector's name, plant description, and location of the plant, were carefully pressed and labelled. These labelled specimens were then transported to the Forest Herbarium Ibadan.

Data analysis

In this study, the demographic characteristics of the respondents, number of WEVs collected, families, local names, habitat, life forms, parts used, and preparation methods were analysed by descriptive statistics such as tables, graphs, percentages, and pie charts. The ethnobotanical indices, relative frequency of citations and fidelity level for each plant use were analysed using the methods described by Tardío and Pardo-de-Santayana (2008) and Chaachouay et al. (2019), respectively.

$$RelativeFrequencyofCitation = \frac{FC}{N} \quad (1)$$

where

FC – Number of mentions for a particular wild edible plant species.

N – Overall count of participants providing information in the study.

Fidelity Level (FL): It is calculated by taking the ratio of the number of interview participants (Ns) who independently recommended a specific plant species for the treatment of a particular illness to the total number of interview participants who reported using plants for any purpose.

$$Fidelitylevel(FL) = \frac{Ns}{N}x100 \quad (2)$$

Ns – Number of participants providing the use for a particular plant species to treat a specific disease.

N – Number of participants in the study.

Results and discussion

Demographic overview of the informants

This demonstrates that there are notable disparities in the understanding of WEVs among various social groups. The findings indicate that men (62.5%) possess a more

substantial level of knowledge compared to women (37.5%). When comparing the knowledge of WEVs between male and female informants, it becomes evident that a distinct knowledge gap exists between the two groups. This shows that free knowledge is shared among male family members rather than female family members. This may be a result of the fact that most of the respondents engaged in major occupations (farming, herb selling, and herbal medicine practices), which are dominated by males in the study area. This may have led to more free interaction among the male folds than the female counterparts (Table 1).

This finding negates previous ethnobotanical studies (Cruz et al. 2013; Joshi et al. 2018; Tahir et al. 2023). However, some studies have shown that females often tend to have better traditional knowledge, because they mostly participate in activities that support their households and provide sustenance to their families (De-Costa et al. 2021). This culturally acquired knowledge is integrated with everyday information to enhance the livelihoods of their families (Singh et al. 2016). There was also a disparity in WEV knowledge between informants' age groups; older people knew more WEVs than adults and young people (Table 1), as was also indicated in other similar ethnobotanical studies (Bortolotto et al. 2015; Cheng et al. 2022). This phenomenon may be linked to the hesitance or unwillingness of young individuals to acquire and pass on knowledge of wild edible plants, as observed similarly in an ethnobotanical study reported by Ghanimi et al. (2022). From the perspective of educational attainment, there was a notable disparity in wild edible plant knowledge among individuals with varying levels of education. This indicates that individuals with lower formal education or those who are illiterate tended to possess more extensive knowledge in this field compared to their more highly educated counterparts (Table 1). This might be a result of illiterate and semi-illiterate respondents' livelihoods depending on agricultural activity, whereas non-agricultural jobs are preferred by most educated people (Cheng et al. 2022). From the perspective of informants' occupations, the knowledge difference in the number of WEVs reported between different occupations was evident in the result. Herbalists (40.8%), farmers (24.2%), and herb sellers (20.8%) hold more knowledge than informants with other occupations (14.2%) respectively (Table 1). The result is similar to the earlier report by Cheng et al. (2022), who also affirm that traditional knowledge of plants is commonly found among people who are herbalists, herb sellers, and farmers.

Table 1 Demographic attributes of respondents in the selected Ogun waterside communities in Nigeria (n = 120)

Parameters	Participant group	Number	(Percentage)
Gender	Male	83	69.2
	Female	37	30.8
Age	< 40	22	18.3
	40 – 50	18	15.1
	51 – 60	25	20.8
	> 60	55	45.8
Marital status	Married	90	75.0
	Widow	24	20.0
	Single	6	5.00
Education status	Primary	40	33.3
	Secondary	20	16.7
	Tertiary	13	10.8
	No formal education	47	39.2
Occupation	Herbalist	49	40.8
	Herb seller	25	20.8
	Farmers	29	24.2
	Others	17	14.2

Culinary uses of wild edible vegetables

Regarding the culinary applications of WEVs reported by the respondents in the chosen locations within the Ogun Waterside rural communities, most of these WEVs are either consumed in their raw form as ingredients in salads or as garnishes for various dishes. Alternatively, they are cooked and used in vegetable soups or as seasonings and condiments to enhance the flavour of food (Table 2). In the present study, the most significant edible species are typically utilized as key ingredients in soup preparations, adding to the delicacies of the dishes are *Corchorus olitorius* L., *Vernonia amygdalina* Delile, *Telfairia occidentalis* Hook. f., *Talinum triangulare* (Jacq.) Willd, *Solanum macrocarpon* L., *Solanum americanum* Mill, *Celosia leptostachya* Benth, *Launaea taraxacifolia* (Willd.), Amin ex C. Jeffrey, and *Solanecio biafrae* (Oliv. & Hiern) C. Jeffrey. Fruits of *Abelmuscus esculentus* (L.) Moench are cooked as soup, while the seeds of *Parkia biglobosa* (Jacq.) R. Br. Ex G. Don, *Prosopis africana* (Guill. & Perr.) Taub, *Cucurbita pepo* L. and *Beilschmiedia mannii* (Meisn.) Benth & Hook. f. are subjected to a series of processing under specific procedures into more nutritious foods that are consumed as condiments. A similar outcome was documented in an ethnobotanical study involving *P. africana, Irvingia wombolu* Vermoesen, *Celosia argentea* L., *P. biglobosa, and C. olitorius* (Shomkegh et al. 2013). Consistent with previous reports, their extensive knowledge of these wild resources underscores their significant role as dietary components, forming an integral part of their diets (El-Finou et al. 2023). This knowledge is of utmost importance in shaping the food culture of both the Nigerian population and Africa as a whole, as supported by previous studies (Hart et al. 2005; Sunday et al. 2021). In the study area, the identified common categories of WEVs include leafy vegetables (46.9%), culinary herbs and spices

Table 2 Wild edible vegetables consumed as foods and used as traditional medicine by rural dwellers in selected Ogun waterside communities, Nigeria

Botanical names	Family	Common names	Local names	Parts used	Life forms	Fidelity level	Relative freq. of citation	Culinary uses	Medicinal uses	Methods of preparation
Abelmuscus esculentus (L.) Moench	Malvaceae	Okra	Ila	Fruits, leaves	Herb	13.3	0.13	Fruits and leaves are cooked as draw soup	Diabetes, dysentery, fever, gonorrhoea	Infusion
Allium cepa L	Amaryllidaceae	Onion	Alubosa	Bulbs	Herb	25.0	0.25	Matured bulbs are eaten as vegetables and soup spices	Asthma, tuberculosis, convulsion, cough	Infusion
Allium fistulosum L. Douin	Amaryllidaceae	Spring onion	Alubosa elewe	Leaves	Herb	10.0	0.10	Matured leaves are eaten as fresh leafy vegetables or cooked	Asthma, cancer, tuberculosis, dysentery, diabetes, haemorrhoid	Infusion
Allium sativum L	Amaryllidaceae	Garlic	Alubosa ayu	Bulbs	Herb	25.0	0.25	Matured bulbs are eaten as food spice	Asthma, tuberculosis	Soaking
Amaranthus hybridus L	Amaranthaceae	Green amaranth	Efo tete	Leaves	Herb	31.7	0.32	Fresh leaves are cooked as soup	Fever	Cooking
Amaranthus spinosus L	Amaranthaceae	Spiny amaranth	Dagunro	Leaves	Herb	5.0	0.05	Fresh leaves are cooked as soup	Diabetes, wounds, constipation, kidney problems, snake bite	Infusion, squishing
Basella alba L	Basellaceae	African spinach	Amunututu	Leaves	Climber	21.7	0.22	Matured leaves are eaten raw or cooked as soup	Constipation	Cooking
Beilschmiedia manii (Meisn.) Benth & Hook. f	Lamiaceae	Spice cedar	Bokonisha	Seeds	Shrub	20.0	0.20	Matured seeds are processed locally and eaten as food	Cough, dysentery, headache, rheumatism	Decoction
Celosia argentea L	Amaranthaceae	Cockcomb	Somosola	Leaves, stems	Herb	73.3	0.73	Arial parts are prepared as soup	Anaemia, infertility, diarrhoea, gonorrhoea, skin infections	Squishing
Celosia leptostachya Benth	Amaranthaceae	Celosia	Ajefawola	Leaves	Herb	1.67	0.02	Succulent leaves are cooked as soup	Eye problems	Infusion
Clerodendrum volubile P. Beauv	Lamiaceae	White butterfly	Marugbo	Leaves	Climber	23.3	0.23	Matured leaves are prepared as vegetable soup	Blood impurities, fatigue, rheumatism, insomnia, arthritis	Cooking

Table 2 (continued)

Botanical names	Family	Common names	Local names	Parts used	Life forms	Fidelity level	Relative freq. of citation	Culinary uses	Medicinal uses	Methods of preparation
Corchorus olitorius L	Malvaceae	Jute	Ewedu	Leaves	Herb	61.7	0.62	Fresh leaves are cooked as draw soup	Asthma, ulcer, fever, diarrhoea, measles, prolonged birth labour	Squishing, cooking
Crassocephalum ruibens (Juss. Ex Jacq.) S. Moore	Asteraceae	Yoruba bologi	Ebolo	Leaves	Herb	3.34	0.03	Tender leaves are eaten as soup	Obesity	Cooking
Cucurbita pepo L	Cucurbitaceae	Summer squash	Elegede	Seeds	Creeper	13.3	0.13	Seeds are prepared locally as food	Infections	Infusion
Curcuma longa L	Zingiberaceae	Tumeric	Atale pupa	Rhizomes	Herb	10.0	0.10	Rhizomes are consumed spices	Convulsion, cough, fever	Soaking
Ipomoea batatas (L.) Lam	Convolvulaceae	Sweet potato	Odunkun	Leaves	Creeper	10.0	0.10	Succulent leaves are cooked as soup	Arthritis, constipation, diabetes, dysentery, fatigue	Soaking, cooking
Irvingia wombulu Vermoesen	Irvingiaceae	Wild mango	Aapon	Fruits, seeds	Tree	25.0	0.25	Fruits are eaten fresh or processed as draw soup	Diarrhoea, pile	Decoction
Jatropha tanjorensis J.L. Ellis & Saroja	Euphorbiaceae	Catholic vegetable	Iyana ipaja	Leaves	Shrub	40.0	0.40	Tender leaves are cooked as soup	Blood impurities, hypertension, anaemia	Cooking
Launaea taraxacifolia (Willd.) Amin ex C. Jeffrey	Asteraceae	Wild lettuce	Efo yanrin	Leaves, stem	Herb	10.0	0.10	The whole plant is eaten as salad/vegetable	Diabetes	Squishing
Manihot esculenta Crantz	Euphorbiaceae	Cassava	Ege	Leaves	Shrub	11.7	0.12	Young leaves are eaten as food	Headache, pains, hypertension	Decoction
Moringa oleifera Lam	Moringaceae	Drum stick	Ewe igbale	Leaves	Tree	21.7	0.22	Fresh leaves are eaten as a vegetable	Rheumatism, fever	Crushing
Ocimum gratissimum L	Lamiaceae	Scent leaf	Efinrin nla	Leaves	Herb	18.3	0.18	Matured leaves are eaten raw or as food spices	Headache, worms, coughs, stomach ache	Squshing, cooking

Table 2 (continued)

Botanical names	Family	Common names	Local names	Parts used	Life forms	Fidelity level	Relative freq. of citation	Culinary uses	Medicinal uses	Methods of preparation
Ocimum tenuiflorum L	Lamiaceae	Scent leaf	Efinrin wewe	Leaves	Herb	35.3	0.35	Fresh leaves are used as spices for soup	Blood impurities, convulsion, diabetes, diarrhoea, colds, fever	Squishing, cooking
Pakia biglobosa (Jacq.) R.Br. ex G. Don	Fabaceae	Locust bean	Iru	Seeds	Tree	30.0	0.30	Seeds are processed into food condiments	Cataract, inflammation	Fermentation
Prosopis africana (Guill. & Perr.) Taub	Fabaceae	Iron tree	Ogiri	Seeds	Tree	25.0	0.25	Seeds are processed locally into condiments	Headache, pains, toothache	Fermentation
Solanecio biafrae Oliv. & Hiern	Asteraceae	Sierra Leone bologi	Worowo	Leaves, stems	Climber	5.0	0.05	Succulent leaves and stems are cooked as food	Diabetes, hypertension, infertility	Infusion
Solanum americanum Mill	Solanaceae	Black nightshade	Efo odu	Leaves	Herb	10.0	0.10	Fresh leaves are cooked as food	Cough, infections	Cooking
Solanum macrocarpon L	Solanaceae	African eggplant	Efo igbo	Leaves, stems	Herb	16.7	0.17	Leaves and fruits are prepared as soup	Anaemia, blood impurities	Infusion
Talinum triangulare (Jacq.) Willd	Talinaceae	Waterleaf	Gbure	Leaves, stems	Herb	71.7	0.72	Leaves are cooked as soup	Anaemia, ulcer, constipation, hypertension, prolonged child labour	Cooking
Telfairia occidentalis Hook. f	Cucurbitaceae	Pumpkin	Ugu	Leaves	Climber	66.7	0.67	Leaves are eaten raw or cooked as soup	Anaemia, convulsion, blood impurities	Squishing
Vernonia amygdalina Delile	Asteraceae	Bitter leaf	Ewuro	Leaves, stems	Shrub	76.7	0.77	Fresh leaves are eaten as soup	Diabetes, blood impurities, pile, fever, stomach ache, stroke, measles	Squishing
Zngiber officinale Roscoe	Zingiberaceae	Ginger	Atale funfun	Rhizomes	Herb	5.00	0.05	Rhizomes are eaten as spice	Asthma, pile	Crushing

Source: Authors' work

(21.9%), edible seeds (15.6%), edible stems (6.3%), and edible fruits and tubers (9.4%).

Medicinal uses of wild edible vegetable species

Among the forty-one ailments and illnesses reported by the respondents, the most commonly treated disease categories with WEVs in the study area are inflammatory conditions (such as rheumatism, arthritis, wounds, ulcers, blood impurities, and anaemia), gastrointestinal issues (dysentery, diarrhoea, constipation, and stomach aches), chronic diseases (kidney failure, diabetes, obesity, and hypertension), and respiratory ailments (asthma, cough, and cold) as presented (Table 2). It is important to note that the use of WEVs extends beyond nutritional purposes and encompasses traditional medicine. This suggests that WEVs play a crucial dual role in both ensuring food security and contributing to healthcare within the communities in this region. In this study, a decoction of mature seeds of *B. mannii* is consumed orally once daily as a potent remedy for rheumatism. Meanwhile, crushed or cooked leaves of *Clerodendrum volubile* P. Beauv and *Ipomoea batatas* (L.) Lam are taken orally as remedies for arthritis, pain and fatigue. For ulcer treatment, juice extracted by squishing the leaves of *C. olitorius* is taken twice daily. Also, the mature leaves of *T. triangulare, C. olitorius, J. tanjorensis, C. argentea, and T. occidentalis* are cooked, consumed as vegetables, or squished to obtain the juice, which is taken orally twice daily for treating anaemia. However, diarrhoea is treated by eating the leaves or the juice squished from the leaves of *O. gratissimum, C. olitorius,* and *C. argentea.* While dysentery is treated orally by taking an infusion made from *A. esculentus* fruits or *I. batatas* leaves soaked in water overnight. An infusion of *Amaranthus spinosus* L. leaves soaked in water or alcohol for 2 days is used as a potent remedy for kidney-related illnesses. Additionally, an infusion made from *S. biafrae*, *A. spinosus* Linn *O. gratissimum* leaves, and *A. esculentus* fruits soaked for 72 h is used orally as an anti-diabetic. Also, the juice obtained by squishing the leaves of *V. amygdalina, L. taraxacifolia,* and *I. batatas* is used as a treatment for diabetes. For obesity, the leaves and stems of *Crassocephalum ruibens* (Juss. Ex Jacq.) S. Moore is cooked and eaten regularly as a vegetable for weight control. The leaves of *S. biafrae*, *Manihot esculenta* Crantz, *J. tanjorensis, or T. triangulare,* made into an infusion or decoction, or cooked as a vegetable are used orally as an anti-hypertensive remedy. Again, the juice of *V. amygdalina* and *C. olitorius* leaves obtained by squishing is taken orally against measles. An aqueous infusion from *S. americanum*, *C. pepo* leaves, and *A. esculentus* fruits is used as a treatment for microbial infections, including gonorrhoea. Whereas, an infusion made from the leaves of *Allium fistulosum* L is used orally once daily as a remedy for cancer. Equally, an infusion made from *Allium cepa* L. and *Allium sativum* L. bulbs is used orally as an active remedy for tuberculosis. In the same vein, an infusion combo of *A. cepa, A. fistulosum,* and *A. sativum* bulbs is used orally daily for treating asthma and coughs. Rhizomes of *Zingiber officinale* Roscoe are crushed into a paste and mixed with hot water and the resultant mixture is taken orally twice daily as a remedy for asthma and colds. The mature seeds of *P. biglobosa* and *P. africana* are fermented in water for 4 days and then crushed, the resultant products are consumed as remedies for eye problems and headaches, respectively. The WEVs considered are highly valuable due to their numerous medicinal properties, widespread availability, and potency, as evidenced by their relative frequency of citation (RFC) greater than 0.30. These species include *V. amygdalina* (0.77), *C. argentea* (0.73), *T. triangulare (*0.72), *T. occidentalis* (0.67), *C. olitorius* (0.61), *J. tanjorensis* (0.40), *O. gratissimum* (0.35), *A. hybridus* (0.32) and *P. biglobosa* (0.30). The medicinal uses reported in these study locations are similar to the medicinal uses of WEVs that were reported in the previous study (Alfred 2020) and also align with the results of a previous ethnobotanical study conducted in Ekiti State, Nigeria, where similar species were also documented (Arowosegbe et al. 2018).

Inventory of wild edible vegetable species

The study of WEVs has resulted in the identification of an inventory comprising 32 species, distributed into 26 genera and 15 families (Table 2). Notably, all 32 species mentioned by the informants are recognized for both their nutritional and medicinal properties. The Amaranthaceae, Asteraceae, and Lamiaceae were found to be the most prominent WEV families, having four species each. Amaryllidaceae was the second most popular WEV family with three species, followed by Cucurbitaceae, Euphorbiaceae, Fabaceae, Malvaceae, Solanaceae, and Zingiberaceae each with two species, while Basellaceae, Convolvulaceae, Irvingiaceae, Moringaceae, and Talinaceae had one species (Fig. 2). In the current study area, Amaranthaceae, Asteraceae, and Lamiaceae are the dominant WEV families. This may be ascribed to the fact that the majority of WEVs consumed by the inhabitants of the 11 rural communities sampled belong to three prominent families reported in this study locations. This finding is in line with the submission of Alfred (2020) who had earlier reported the same number of WEVs in the ethnobotanical study conducted in the Eastern Cape Province, South Africa where Amaranthaceae and Asteraceae were among the most popular plant families with at least 4 species. This similarity may be related to the abundance of WEVs in the Amaranthaceae, Asteraceae, and Lamiaceae family. In addition, the result in this study also supports the report of Achigan-Dako et al. (2011) in a related study focusing on vegetable diversity across 49 villages in Benin,

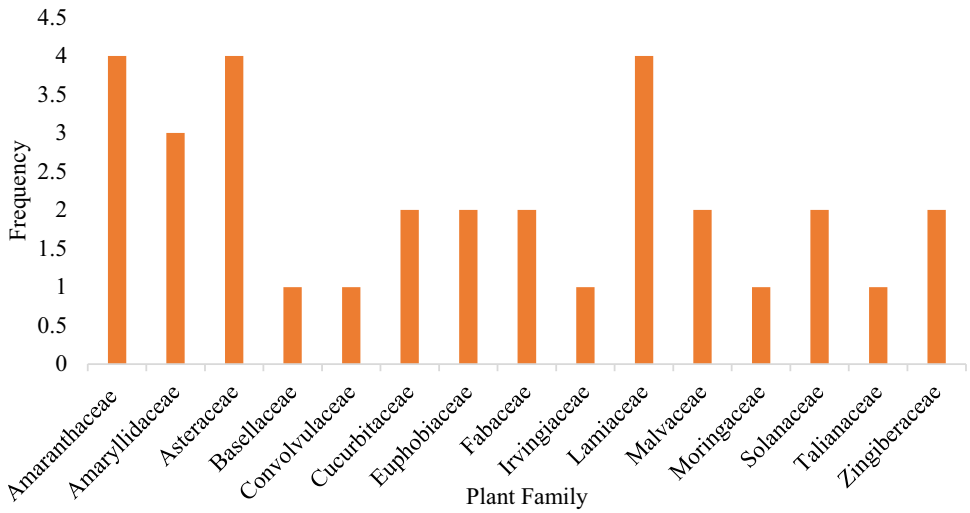

Fig. 2 Family of selected wild edible vegetable species used in Ogun waterside rural communities

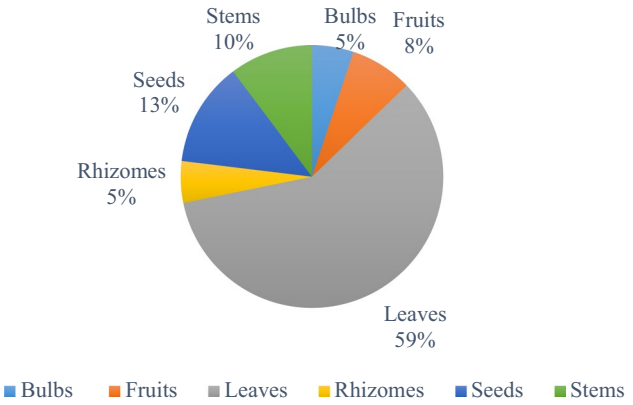

Fig. 3 Plant parts of selected wild edible vegetables used in Ogun waterside rural communities

which affirmed that Amaranthaceae and Asteraceae, were among the 5 most frequently used families (Amaranthaceae, Asteraceae, Cucurbitaceae, Fabaceae and Solanaceae) utilised as vegetable resources all over the country. This may be linked to the fact that a large number of commonly used WEVs by the locals in the study areas belong to these families (Achigan-Dako et al. 2011).

Edible parts of WEVs used

The utilization of different parts of WEVs within the study locations, both for their nutritional and medicinal values, is ranked in decreasing order of significance as follows: leaves (57%), stem-bark (16%), seeds (11%), bulbs (9%), rhizomes (5%), and fruits (2%). Aerial parts of the plants constitute the majority of use (86%), while underground parts, including bulbs and rhizomes, make up the smaller proportion (14%), as illustrated (Fig. 3). This discovery aligns with previous studies that have also highlighted leaves as the dominant plant part used for both food and medicinal purposes (Bammou et al. 2015; Manlosa et al. 2019; Olowo et al. 2022; Umartani and Nahdi 2021; Welcome and Wyk 2019). The extensive use of leaves may be attributed to the fact that leaves often serve as a storage site for essential micronutrients and secondary metabolites responsible for the plant's biological properties (El-Finou et al. 2023).

Life-forms of WEVs used

In this study, it was observed that more than half of the reported plant species were categorized as herbs (56.3%), followed by shrubs (12.5%) and climbers (12.5%), as illustrated (Fig. 4). This finding aligns with research conducted by Nutuli et al. (2012) on edible vegetables in Kwazulu-Natal province, South Africa, where herbs were also the dominant category (65%), followed by climbers (24%). Furthermore, ethnobotanical studies on edible vegetables in various African countries, including Morocco, Benin, Ethiopia, Cameroon, Kenya, and Guinea-Bissau, have consistently highlighted the prevalence of herbaceous plants, with overall percentages ranging from 61.5% to 64.5% (Catarino et al. 2019; Ngone et al. 2016).

Mode of preparation of WEVs used

The utilization of WEVs for medicinal purposes involves various modes of preparation, depending on the part of the plant being used. In this study, it was found that the majority of herbal remedies are prepared through cooking (9), infusion (8), and squishing (8), as depicted in Fig. 5. This aligns with the findings of a study conducted by El-Finou et al. (2023) where the majority of remedies were also prepared by infusion. According to the beliefs of the majority of respondents, these modes of preparation, namely cooking, infusion,

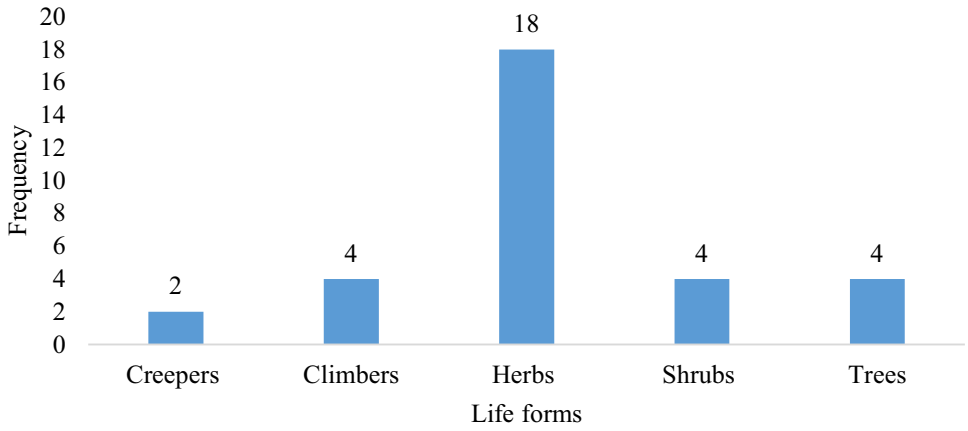

Fig. 4 Life-form of selected wild edible vegetables used in Ogun waterside rural communities

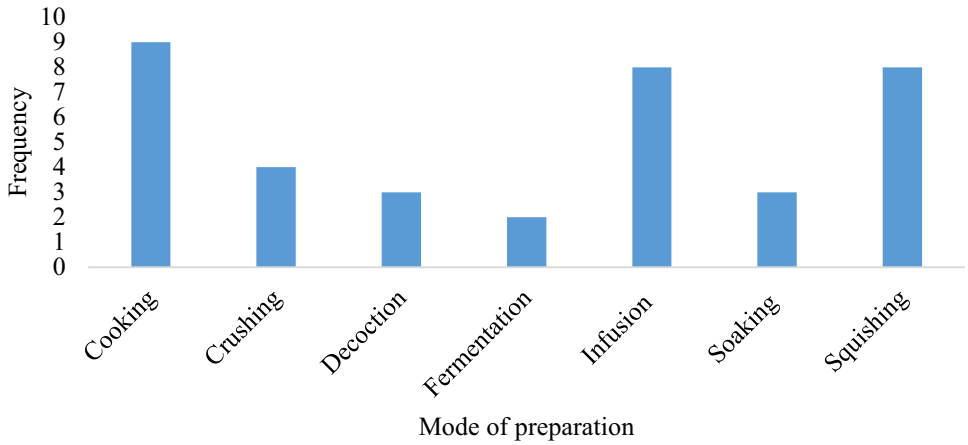

Fig. 5 Mode of preparation of selected WEVs used in Ogun waterside rural communities

and squishing, are considered the most effective methods for extracting the most active principles from certain recipes.

Conclusion

This study revealed the significance of wild edible species as a valuable source of indigenous vegetables that contribute to the dietary practices and sustainability of the local communities in Ogun Waterside. These species provide a means of local health care, addressing diverse food choices, nutritional gaps, and ethno-medicine in Ogun waterside, Southwestern Nigeria. The WEVs are integrated into the indigenous knowledge and habits of the area through the indigenous culinary dishes of the region. This study also provides valuable insights that can be harnessed to promote these plant species for wider utilization and encourage further studies on the nutritional assessment and potential toxicity of wild edible vegetables. This will help in identifying those species that may offer high nutrient quality, which can serve as functional foods, and avoiding those that may contain compounds which could pose health risks. Indigenous knowledge about plant use associated with various communities needs to be preserved for future generations to prevent knowledge erosion. It is important to prioritize the domestication of these wild edible species as a vital aspect of conservation and improving biocultural resilience.

Acknowledgements We hereby present our profound gratitude to all the community heads, elders, traditional medicine practitioners, and every other person who supported and assisted us during the field survey within the sampled rural communities in the Ogun waterside local government areas, Ogun State, Nigeria.

Author contributions All authors contributed to the conception and design of the research work. Material preparation, data collection, and analysis were performed by Olaniyi MB, Rufai SO, and Olaniyi AA. The first draft of the manuscript was written by Olaniyi MB, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Declarations

Conflict of interest All authors certify that we have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

References

Achigan-Dako E, N'Danikou S, Assogba-Komlan F et al (2011) Diversity, geographical, and consumption patterns of traditional vegetables in sociolinguistic communities in Benin: Implications for domestication and utilization. Econ Bot 65:129–145. https://doi.org/10.1007/s12231-011-9153-4

Adjatin A, Alexandre D, Marius EB, Laura EL, Myriame D, Pauline A et al (2013) Proximate, minerals and vitamin C composition of vegetables [*Crassocephalum rubeus* (Juss. Ex Jacq.) S. Moore and *Crassocephalum crepidiodes* (Benth) S. Moore] in Benin. J Biol Chem Sci 7(1):319–331

Alfred M (2020) Ethnobotanical study of wild and cultivated vegetables in the Eastern Cape Province South Africa. Biodiversita 21(9):3982–3988. https://doi.org/10.13057/biodiv/d210908

Amujoyegbe BJ, Obisesan IO, Ajayi AO, Aderanti FA (2007) Disappearance of Kersting's groundnut (*Macrotyloma geocarpum*) (Harns) Marechal and Baudet in Southern Nigeria: An indicator of genetic erosion. Plant Genetic Res Newsletter 152:45–50

Arowosegbe S, Olanipekun MK, Adeloye IA (2018) Ethnobotanical survey of indigenous leafy vegetables consumed in Ekiti state, Nigeria. Euro J Biol Med Sci Res 6(1):7–14

Ayeni MJ, Kayode J, Oladele CO (2020) Ethno-medicinal and conservation studies on the indigenous vegetables in Akinyele local government area of Oyo state, Nigeria. Budapest Int Res in Exact Sci J 2(3):323–333. https://doi.org/10.33258/birex.v2i3.1069

Bammou M, Daoudi A, Sellam K, Rhaffari L, Ibijbijen J, Nassiri L (2015) Ethnobotanical survey of asteraceae family used in meknes-tafilalet region (morocco)". Int J Innovation and Applied Studies 13(4):789–815

Bortolotto LM, Amorozo MC, Neto GG, Oldeland J, Damasceno-Junior GA (2015) Knowledge and use of wild edible plants in rural communities along Paraguay River, Pantanal, Brazil. J Ethnobiol Ethnomed 11:46–55. https://doi.org/10.1186/s13002-015-0026-2

Catarino L, Romeiras MM, Bancessi Q et al (2019) Edible leafy vegetables from West Africa (Guinea-Bissau): consumption, trade and food potential. Foods 8(10):493–499. https://doi.org/10.3390/foods8100493

Chaachouay N, Benkhnigue O, Fadli M, ElIbaoui H, Zidane L (2019) Ethnobotanical and ethnopharmacological studies of medicinal and aromatic plants used in the treatment of metabolic diseases in the Moroccan Rif. Heliyon 5(10):e02191. https://doi.org/10.1016/j.heliyon.2019.e0219

Chaturvedi N, Sharma P, Singh S (2007) Wild edible vegetables as a source of nutrients and medicine. J Food Sci Technol 44(2):153–156

Cheng Z, Lu X, Lin F, Naeem A, Chunlin LC (2022) Ethnobotanical study on wild edible plants used by Dulong people in Northwestern Yunnan. China J Ethnobiol Ethnomed 18(3):1–21. https://doi.org/10.1186/s13002-022-00501-3

Cruz MP, Peroni N, Albuquerque UP (2013) Knowledge, use and management of native wild edible plants from a seasonal dry forest (NE, Brazil). J Ethnobiol Ethnomed 9:79–84. https://doi.org/10.1186/1746-4269-9-79

De-Costa FV, Guimarães MF, Messias MC (2021) Gender differences in traditional knowledge of useful plants in a Brazilian community. PLoS One 16(7):e0253820. https://doi.org/10.1371/journal.pone.0253820

Duguma HT (2020) Wild edible plant, nutritional contribution and consumer perception in Ethiopia. Int J Food Sci 2020(1):1–16. https://doi.org/10.1155/2020/2958623

El-Finou H, Salhi N, Halmoune A, El Rhaffari L (2023) Ethnobotanical survey of aromatic and medicinal plants used in traditional medicine and agri-food in the Fez-Meknes Region. Biol Med Nat Prod Chem 12(1):133–141. https://doi.org/10.14421/biomedich.2023.121.133-141

Ghanimi R, Ouhammou A, Ahouach A, Cherkaoui M (2022) Ethnobotanical study on wild edible plants traditionally used by Messiwa people, Morocco. J Ethnobiol Ethnomed 18:16–21. https://doi.org/10.1186/s13002-022-00500-4

Hart AD, Azubuike CU, Barimalaa IS, Achinewhu SC (2005) Vegetable consumption pattern of households in selected areas of the Old Rivers State in Nigeria. Afri J Food Agric Nutri Dev 5(1):233–329. https://doi.org/10.18697/ajfand.8.1365

Hyson D (2002) The health benefits of fruits and vegetables: a scientific overview for health professionals. Produce for better health foundation, Wilmington, p 20

Ijarotimi OS, Fagbemi TN, Oboh G (2021) Blood glucose lowering, glycaemic index, carbohydrate-hydrolysing enzyme inhibitory activities of potential functional food from plantain, soy-cake, rice-bran and oat-bran. J Food Meas Charact 15(4):3751–3769. https://doi.org/10.1007/s11694-021-00992-1

ISE (2008) International Society of Ethnobiology Code of Ethics. An outline of the ethical principles and guidelines for ethnobotanists on plant research, conservation and application of traditional knowledge and their uses. http://www.ethnobiology.net/code-of-ethics/. Accessed 21 Sept 2023

Joshi SK, Ballabh AH, Negi PS, Dwivedi SK (2018) Diversity, distribution, use pattern and evaluation of wild edible plants of Uttarakhand, India. Def Life Sci 3(2):126–135. https://doi.org/10.14429/dlsj.3.12579

Manlosa AO, Hanspach J, Schultner J, Dorresteijn I, Fischer J (2019) Livelihood strategies, capital assets, and food security in rural Southwest Ethiopia. Food Secur 11:167–181. https://doi.org/10.1007/s12571-018-00883-x

Matenge S, Li J, Apau S, Tapera R (2017) Nutritional and phytochemical content of indigenous leafy vegetables consumed in Botswana. Front Food Nutri Res 3(1):1–7

Mohapatra AK, Panda PC (2012) Wild edible fruit diversity and its significance in the lvelihood of indigenous tribals: evidence from eastern India. Food Secur 4:219–234. https://doi.org/10.1007/s12571-012-0186-z

Ngone AM, Ndam LM, Mih AM (2016) Survey of wild vegetables in the Lebialem Highlands of southwestern Cameroon. J Plant Sci 4(6):172–184

NIPOST (2020) Nigeria postal service. Post offices – with the map of local government areas in Nigeria. http://www.nipost.gov.ng/postcode./aspx. Accessed 26 Sept 2023

Niveditha TM (2017) Wild edible plants of India- a review. Int J Acad Res 4(3):a025

Njume C, Goduka NI, George G (2014) Indigenous leafy vegetables in South Africa: a rich and unexplored source of nutrients and antioxidants. Afr J Biotechnol 13(9):1933–1942

Nutuli NR, Zobolo AM, Siebert SJ et al (2012) Traditional vegetables of northern KwaZulu-Natal, South Africa: has Indigenous knowledge expanded the menu? Afr J Agric Res 7(45):6027–6034. https://doi.org/10.5897/AJAR11.2195

Olowo SF, Omotayo AO, Lawal IO, Ndhlovu PT, Aremu AO (2022) Ethnobotanical use-pattern for indigenous fruits and vegetables among selected communities in Ondo State, Nigeria. South Afr J Bot 145:501–511. https://doi.org/10.1016/j.sajb.2022.03.040

Oseni K, Babatunde O (2015) Underutilised indigenous vegetables in Nigeria: a rich source of nutrients and antioxidants – a review. Annals Food Sci Technol 16(2):236–247

Rafiqul-Islam AT, Das SK, Alam MF, Rahman AH (2019) Documentation of wild edible minor fruits used by the local people of Barishal, Bangladesh with emphasis on traditional medicinal values. J Biosci 27:69–81. https://doi.org/10.3329/jbs.v27i0

Rajbhandary S, Siwakoti M, Rai SK, Jha PK (2020) An overview of plant diversity in Nepal. In: Siwakoti M, Jha PK, Rajbhandary S, Rai SK (eds) Plant diversity in Nepal. Botanical Society of Nepal, Kathmandu, pp 1–15

Shomkegh SA, Mbakwe R, Dagba BI (2013) Ethnobotanical survey of edible wild plants in Tiv communities of Benue State, Nigeria. J Nat Sci Res 3(7):17–23

Singh B, Sultan P, Hassan QP, Gairola S, Bedi YS (2016) Ethnobotany, traditional knowledge and diversity of wild edible plants and fungi: a case study in the District of Kashmir Himalaya, India. J Herbs Spices Med Plants 22(3):247–278. https://doi.org/10.1080/10496475.2016.1193833

Tahir M, Ibrahim A, Beyene T, Dinsa G, Gulama T, Alemneh Y, Van Damme P, Geletu U, Mohamed A (2023) The traditional use of wild edible plants in pastoral and agro-pastoral communities of Mieso District, Eastern Ethiopia. J Tropical Med Health 51(10):1–15. https://doi.org/10.1186/s41182-023-00505-z

Tardío J, Pardo-de-Santayana M (2008) Cultural importance indices: a comparative analysis based on the useful wild plants of Southern Cantabria (Northern Spain). Econ Botany 62:24–39. https://doi.org/10.1007/s12231-007-9004-5

Turner NJ, Łuczaj LJ, Migliorini P, Pieroni A, Dreon AL, Sacchetti LE, Paoletti MG (2011) Edible and tended wild plants. Crit Rev Plant Sci 30(1):198–225. https://doi.org/10.1080/07352689.2011.554492

Umartani LA, Nahdi MS (2021) Ethnobotanical study of edible plant communities on the slopes of Mount Merapi and Merbabu, Indonesia. Biol Med Nat Prod Chem 10(1):33–39. https://doi.org/10.14421/biomedich.2021.101.33-39

Welcome AK, Van Wyk BE (2019) An inventory and analysis of the food plants of southern Africa. South Afri J Bot 122:136–179

Zhang YJ, Gan RY, Li S, Zhou Y, Li AN, Xu DP, Li HB (2015) Antioxidant phytochemicals for the prevention and treatment of chronic diseases. Molecules 20(12):21138–21156. https://doi.org/10.3390/molecules201219753