*Article*

# Edible plants with medicinal properties used in a community of the Meranao people of Marawi City, the Philippines

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**Abstract**

The present study investigates the traditional knowledge of the Meranao people residing in Marawi City, the Philippines, regarding the use of edible plant species purported to possess medicinal attributes. This indigenous Filipino community has amassed a wealth of knowledge regarding alternative medicine sources over several decades. This study, therefore, was undertaken on the grounds that the information produced holds immense potential for the advancement of traditional medicine and the conservation of biodiversity. Results of the survey show seventeen food plant species with medicinal properties were identified, demonstrating the rich botanical diversity in the area. Network analysis examining the ethnopharmacological properties of food plants in an effort to determine their potential medicinal value indicates that these plants were utilized not only as sources of nutrition but also to treat a wide range of health conditions, including minor wounds and cancer. This study demonstrates the importance of employing these plant species not only for culinary purposes but also as traditional remedies for the purpose of addressing and controlling local maladies. This research provides valuable insights into the function of specific food plant species within indigenous healthcare systems through an examination of the links between these plants and their traditional medicinal properties, as well as their utilization as food sources. However, additional research should be conducted to ascertain the safety and efficacy of the documented plant species.

**Keywords** bioactive compounds; ethnomedicine; network analysis; traditional medicine.

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## 1 Introduction

The nutritional value of numerous species of food plants has been the subject of extensive research; nevertheless, the potential ecological ramifications that may arise from the increased utilization of these

plants in times of food scarcity, for instance, are not well understood. These plants can thrive in unfavorable environmental conditions, such as drought, poor soil quality, and other stresses; a significant proportion of food plant species are categorized as emergency crops (Gitz, 2016). While further investigation is necessary to assess the environmental sustainability of their utilization, including aspects such as pest resistance, propagation methods, and potential impacts on local biodiversity, it is argued that further research is critical for the development of sustainable strategies that facilitate the utilization of numerous food plant species without endangering long-term food insecurity or detrimentally affecting local ecosystems.

Numerous indigenous local communities acknowledge the profound nutritional value and potential therapeutic properties of countless indigenous plant species (Bassam, 2012). Local and popular customs of numerous ethnic societies are often ascribed to the pharmacologic properties of traditional remedies, the majority of which are derived from edible plants harvested in the wild. Abbasi et al. (2015) assert that they are frequently associated with favorable outcomes. For human consumption outside of agricultural areas, a number of these sustenance plants comprise all plant resources harvested or collected from the wild. An assortment of botanical components presents in these numerous plant species utilized as food items find utility as pharmaceuticals, dietary supplements, and sources of bioactive substances. For instance, the incorporation of alternative plant species into the cuisines of diverse ethnic communities may differ regionally. Still, significant improvements in the food and nutrition security, health, and overall welfare of the communities in which they are identified are achieved. As a result of their potential uses as pharmaceuticals, dietary supplements, and sources of bioactive substances, a multitude of plant species used as food have recently attracted considerable interest. Significantly enhancing food and nutrition security, their implementation also improves the health and well-being of many local communities. It is worth noting that medicinal plants and their application in traditional medicine have been documented in virtually every cultural group across the globe (Ahn, 2017). It is, therefore essential to know that the foundation for establishing connections between plants and their therapeutic functions is laid by the pre-existing knowledge pertaining to the therapeutic properties of various medicinal plants utilized by local communities, such as the Meranao people residing in Marawi City. By examining the profound interrelationships among these sustenance food plants and their attributes, we will attain a comprehensive understanding of the interrelationships between nutrition and their therapeutic applications. Implementing such a holistic strategy not only facilitates the discovery of innovative compounds that may have implications in the pharmaceutical or nutritional fields but also ensures the preservation of standard knowledge systems. A multitude of studies has provided evidence that the conservation of various indigenous plants in regional food cultures is inextricably linked to conventional medicinal systems (Fleuret, 1993). Chinese medical theories and food therapy have encompassed the notion of "food as medicine" since ancient times (Weng and Chen, 1996). The medicinal and dietary applications of a diverse range of natural plants were revealed by Etkin and Ross (1991) in their research conducted in West Africa. They hypothesize that humans have selected nutrition-providing, hunger-suppressing, and therapeutically beneficial food plants through trial and error; thus, based on this premise, the present study may reveal that numerous food or sustenance plants must possess ethnomedicinal or therapeutic properties collectively. To discern and grasp the intricate interrelationships among the various medicinal properties of these food plants, network analysis on the associations between these food plant species utilized by the Meranao people and their therapeutic significance was conducted. This study will provide not only information on the utilization of food plants used by the community but may also provide invaluable knowledge on the potential impact of these plants on local food security. By elucidating potential novel therapeutic sources for numerous health problems, the application of network analysis may help improve comprehension of ethnomedical knowledge regarding the use of identified food plants, which is

crucial, and also for possible policies in the conservation and utilization of these botanical resources.

## 2 Materials and Methods

### 2.1 Description of the study area

Marawi City is the headquarters of the province of Lanao del Sur, which has the country's second-largest and deepest lake. The city's land area is 87.55 square kilometers, equivalent to 33.80 square miles, and it accounts for 0.58% of the total land area of Lanao del Sur. According to the results of the Census that was conducted in the year 2020, its population was 207,010. This accounted for 17.32% of the total population in the province of Lanao del Sur, equivalent to 4.70% of the entire population in the Bangsamoro Autonomous Region in Muslim Mindanao.

### 2.2 Investigative method

To get a good look at how people in Marawi City use medicinal plants, the study used a strategic sample method that targeted healthcare providers, native residents, traditional healers, and traditional practitioners. This targeted approach allowed the researcher to ensure that many different perspectives and bodies of information were considered and included. Twenty barangays in Marawi City were included in the research. Considering elements like cultural relevance and geographical diversity, these barangays were selected on purpose to provide a complete portrayal of the urban landscape. The rationale behind this strategy was to learn whatever there was to know about the community's traditional medical practices—utilizing a variety of viewpoints and expertise.

### 2.3 Data mining

Research articles and publications on medicinal food plants laid the groundwork for the field of data mining. The present analysis also collected data from various published sources, including scientific terminologies pertinent to the species under study. In addition, detailed records were maintained regarding the specific botanical components used and their related ethnomedicinal applications. Furthermore, the processes employed in researching and formulating these plant-derived treatments were also recorded. In addition, an extensive examination of the existing literature was conducted to determine the bioactive chemicals present in these formulations, and their biological activities were evaluated. This essential information was systematically arranged and retained using an extensive, meticulously kept database.

### 2.4 Quantitative analysis

2.4.1 Informant Consensus Factor (ICF)

ICF was used to assess the degree of agreement between the informants' knowledge of each type of disease (Trotter and Logan, 1986; Heinrich et al., 1998, 2009). The following formula was used to compute the ICF:

$$ICF = (\eta ur - \eta t)/ (\eta ur - 1)$$

where $\eta_{ur}$ is the number of informant use reports for a specific ailment category, and $\eta_t$ is the number of species utilized by all informants for that illness.

2.4.2 Fidelity Level (FL)

The FL will identify the most critical plant species utilized by local herbal practitioners and older persons living in the study area to treat specific conditions (Alexiades, 1996; Kim and Song, 2008). The following formula was used to determine the FL:

$$FL\ (percent) = Np \times 100/N$$

where Np is the number of informants who reported specific plant species used to treat specific ailments, and N is the overall number of informants who utilized the plants as medicine to treat any illness.

## 3 Results and Discussion

### 3.1 Demographic characteristics of informants

A total of 100 informants were randomly selected in the community. Out of these, 37 were male and 63 were female. The informants were selected from a target age range of 16 to 46 years old and above. The field investigation lasted from June 2022–April 2023.

**Table 1** Demographic characteristics of informants.

| Factor | Categories | Percentage (%) |
|---|---|---|
| **Sex** | Male (37) | 37% |
| | Female (63) | 63% |
| **Educational Attainment** | No Formal Education | 13% |
| | Elementary Level | 17% |
| | Secondary Level | 26% |
| | Undergraduate | 31% |
| | Graduate (Higher Education) | 13% |
| **Age** | 16-25 Years old (21) | 21% |
| | 26-45 Years old (44) | 44% |
| | 46 Years old and above (35) | 35% |

### 3.2 Ethnomedicinal uses

Plants have continued to play essential roles in supporting human life in different parts of the world (Karuo, 2011). Studies of ethnomedicine on plants require standardized methods for botanical identification and reliable documentation of indigenous knowledge about the distribution, management, and traditional applications of plants for medicinal purposes (Alebie, 2017). In this study, Meranaos utilized various food plants to treat different ailments. The data collected reveal that 17 species of plants, mostly leaf, fruit, stem, root corms, rhizome, and seeds belonging to 17 families, were identified. According to the findings of this study, the same type of plant can heal various diseases by employing different parts of the plant (Table 2).

Based on the data gathered, many plants are in the study area, many of which have important medical uses. Moreover, the inhabitants in the study area rely heavily on traditional medical practices since they lack access to modern healthcare facilities despite the area's urban location. According to the data gathered, the leaves were the most often used part of the plant for medicinal purposes. Compared to other plant components, leaves are used more often to make herbal remedies since they are simpler to gather and don't represent as much of a risk to the local flora. Leaves are always available for most plant species at all seasons and are readily accessible in case of emergencies. Collecting leaves is more sustainable than gathering other plant parts, such as barks and roots, that can cause damaging effects and even mortality to a plant if harvested in large quantities. Leaves contain the highest secondary metabolites with an antimicrobial effect (Chanda and Kaneria, 2011), antioxidant properties, antibiotic activity, and antidiabetic potential compared with other plant parts (Jain et al., 2019). This is similar to the research findings of (Sabiu et al., 2019), where leaves were the most used

plant part. As mentioned by Lulekal et al. (2008), harvesting roots negatively influences the survival and continuity of medicinal plants, affecting their sustainable utilization. Using more leaves than other plant parts implies that the traditional medical culture in the area does not threaten biological diversity (Bekalo, 2009). Moreover, the collection and mode of preparation of medicine from leaves is much easier than other parts of the plant and makes them the first choice for use (Giday et al., 2009; Telefo et al., 2011).

Regular leaf consumption substantially contributes to the survival and propagation of valuable botanical species with therapeutic capabilities, enabling the long-term growth of those plants within a region. However, different medicinal plants require other methods of preparation and administration when used to treat various illnesses. Decoction, pounding, raw, crushing, aqueous, and extraction were the six types of preparation methods noted in this study. The decoction was the most employed method of preparation compared to other methods. Similar results for the most used form of practice were reported by Tjeck et al. (2017), Gbolade et al. (2012), and Kpodar et al. (2015). According to the latter authors, the fast nature of decoction, when compared to the application of other methods in which the extraction process takes a more extended period, may be responsible for it being the most preferred preparation method. Studies from different parts of Africa have also reported that decoction was the most frequently used method of herbal remedy preparation, commonly using water as a solvent (Nguta, 2010).

**Table 2** Ethnomedicinal uses of the food plants by the Meranaos.

| Scientific Name | common Name | Ethnomedicinal Uses | Parts Used | Mode of preparation | Mode of Consumption |
|---|---|---|---|---|---|
| ***Alternanthera sessilis (L.) R. Br. ex DC.*** | Shanti shak | | Leaves, stem | Aqueous | cooked as vegetable |
| ***Annona Muricata*** | Soursop | Leaves are used to treat skin diseases and ulcers | Whole plant | Decoction, Raw, and Juice | The ripe fruit can be eaten raw, and the juice can be drink |
| ***Colocasia esculenta*** | Taro | Bacterial and fungal infections, fever, respiratory and skin illnesses, diabetes, internal and external parasites, malaria, stomach ache, parasitic infections, and cancer | Leaves, Corms | Aqueius, Decoctionm Heating, Crushing | Boil the tuber and eat |
| ***Phyllostachys edulis*** | Bamboo Shoot/Labong | Taro leaves and corms were cooked and eaten by women who were having trouble giving birth. Additionally, heated tubers were applied to rheumatoid arthritis sore spots as a defense against wasp stings and other insect bites. | Stem | Raw, Decoction | Cooked as vegetable w/ dried seafood |

| | | | | | |
|---|---|---|---|---|---|
| ***Chenopodium album I..*** | Bothua | Use to treat allergies, headaches, and common colds, improving appetite and digestion. | Leaves, Stem | Aqueous, Decoction | Cooked as vegetable |
| ***Ipomoeba batatas Poir.*** | Sweet Potato | Laxative, diuretic, sedative, rheumatism, antidiarrhoeal, antidiarrhoeal, antiphlogistic, antirheumatic, contraceptive, odontalgic, cardiotonic, antiscorbutic, blood purifier, digestive, aphrodisiac, for the treatment of dyspepsia, flatulence, seminal weakness, pharyngopathy, splenopathy, hemorrhoids, ophthalamopathy, cardiac disorder, hepatic disorder, spleen enlargement, biliousness, intestinal ulcers | Leaves | Pounding | Can be boiled, baked, steamed or fried |
| ***Momordica charantia*** | Bitter gourd | Leaves are used to treat debility and diarrhea. The seed is employed in the ulcer treatment, liver and spleen problems, Diabetes, high cholesterol, parasites in the intestines, and Intestinal gas, wound healing, stomachache. On the other hand, the fruit used in asthma, burning sensation, constipation, cough, | Fruits, Seed | Squeeze the gourd fruit to extract the juice | Cooked as vegetable |
| ***LiuDioscoreaalata*** | Purple yam | Fever (malaria), gout, helminthiases, skin diseases | Root | Decoction, Crushing | Boil the tuber and eat |

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|---|---|---|---|---|---|
| ***Manihot esculenta*** | Cassava | Menopausal symptoms, osteoporosis, rheumatoid arthritis, and infertility are all conditions it is used to treat | Leaves, Root | Aqueous | Cooked and pounded, staple food |
| ***Vigna radiata*** | Mung bean | Can be used to treat high blood pressure, wounds, and ulcers. The seeds are used in the treatment of paralysis, rheumatism, coughs, fevers, and liver ailments treat acne, eczema, | Seeds | Pounding, Crushing | Cooked as vegetable |
| ***Corchorus olitorius*** | Molokhia | Dermatitis and relieving itchiness | Leaves | Decoction, Crushing | Cooked as vegetable w/ dried fish |
| ***Artocarpus heterophyllus Lam.*** | Jack fruit/Langka | Fever and inflammation, Joint pain, Weak muscle, Stiffness, Muscle Rigidity | Leaves, Seed | Pounding, Crushing | The unripe fruit is cooked as a vegetable with/ dried fish; the ripe fruits can be mixedwith other fruits. |
| ***Moringa oleifera Lam*** | Moringa | Seeds used against constipation | Leaves, Fruit | Extraction, Decoction, Juice | cooked as vegetable |
| ***Musa x paradisiaca L.*** | Plantain | Malaria and fever to hypertension and Diabetes | Flower, Fruit | Pounding, Decoction | Eaten raw when ripe, It can be fried also |
| ***Curcuma longa*** | Turmeric | Fruits that fight diarrhea, hematemesis, and anemia. Pseudostems and flowers are used to treat chronic dysentery. | Rhizome | Pounding, Decoction, Aqueous | Dried and crystalized, it can be added as spice and food color to fish, meat, and rice. |
| ***Zingiber officinale*** | Ginger | Cancer, Diabetes, Arthritis, diarrhea, inflammation, psoriasis, hepatobiliary diseases, gastric and peptic ulcers. | Roots, Rhizomes, and leaves | Pounding, Crushing, and Aqueous | Pounded and used as seasoning |
| | | Headaches, Colds, Nausea, obesity, Diabetes | | | |

The study has also considered the bioactive compounds unique to each plant species because these compounds play an increasingly important function in each species thus, data from studies on the bioactive compounds in these plants were examined (Table 3). Bioactive compounds from ethnomedicinal plants may offer leads for drug discovery and development. Studying these compounds may lead to new pharmaceuticals

or treatments. Plant bioactive chemicals are essential to human health due to their diverse biological effects. These benefits include antioxidant, anti-inflammatory, and antibacterial activity, which can potentially have a therapeutic effect on various non-contagious conditions.

**Table 3** Reported bioactive and biological activities of the food plant species.

| Scientific Name | Bioactive Compounds | Biological Activities | References |
|---|---|---|---|
| ***Alternanthera sessilis (L.) R. Br. ex DC.*** | Flavonols, triterpenoids, steroids and tannins | Anti-inflammatory, Hematinic, Wound healing, Antidiabetic. | Hygeia and Issin, 2010<br>Arollado and Osi, 2010<br>Kumarasamyraja et al., 2012<br>Boddupalli et al., 2012 |
| ***Annona Muricata*** | Acetogenins, alkaloids, flavonoids, essential oils, vitamins, carotenoids, amides, and cyclopeptides | Anticancer, Antiulcer, Antidiarrhea, Antiprotozoal, Antidiabetic, Antibacterial and Antihypertensive | Drishya et al., 2005<br>Afroz et al., 2020<br>Adefegha et al., 2015<br>Nwokocha et al., 2012<br>Reyad-ul-Ferdous et al., 2023<br>Brown et al., 2005<br>Patil and Ageely et al., 2011 |
| ***Colocasia esculenta*** | Vitamin C, Starch, Amino Acid, Protein, Anthocyaninsperlargonidin 3-glucoside, Cyaniding 3-glucoside, B-sitosterol, sterorids, Flavonoids, Calcium, Phosporous, Iron, Vitamin C, Thaiamine, Riboflavin, Niacin, Minerals, Saponins, Terpens, Anthraquinones, Cardiac Glycosides, Alkaloids and Ascorbic Acid | Antimicrobial, Antihepatotoxic, Anti-lipid peroxidative, Antidiabetic, Anti-melanogenic and Antihelmentic activity | Singh et al., 2011<br>Mengane et al., 2015<br>Kumuwat et al., 2010<br>Patil and Ageely, 2011<br>Shah et al., 2007<br>Kundu et al., 2012 |
| ***Phyllostachys edulis*** | Phytosterols and phenols | antioxidant, anti-inflammatory, antimicrobial, antifungal, antiapoptotic, anticancer, antiviral, antibacterial, and anti-fatigue. | Hu et al., 2000<br>Lu et al., 2005<br>Fujimura et al., 2005<br>Hong et al., 2010<br>Shi et al., 1992<br>Zhang et al., 2006 |
| ***Chenopodium album I..*** | Phenols, lignins, alkaloids, flavonoids, glycosides, saponins, ascorbic acid, β-carotene, catechin, gallocatechin, caffeic acid, p-coumaric acid, ferulic acid, β-sitosterol, campesterol, | Antioxidant, antimicrobial, Anthelmintic, anti-inflammatory, anticancer | Elif Korcan et al., 2013<br>Kaur and Kapoor et al., 2002<br>Jabbar et al., 2007<br>Usman et al., 2010<br>Khoobchandani et al., 2009 |

| | | | |
|---|---|---|---|
| | xanthotoxin, stigmasterol, n-triacontanol, imperatorin, ecdysteroid | | |
| ***Ipomoeba batatas Poir.*** | Phenolic acids, Flavonoids, Mono-and di-galactosyldiacylglycerol, Carotenoids, Dietary fiber, Dietary Fiber, Dietary protein, polysaccharides, Alkaloids, Saponins, Coumarins and Chenopodiaceae tannins | Anticancer, hepato-protection, anti-inflammatory, antidiabetic | Ezekiel et al., 2013<br>Wang et al., 2014<br>Wang et al., 2014<br>Knek et al. 2002 |
| ***Momordica charantia*** | Polysaccharides, Peptides and proteins, Lipids, Terpenoids, Saponins, Phenolics and sterols | Antioxidant, Antiviral, Antimicrobial, Anti-inflammatory, Anti-tumor, Hypolipidemic, Immunomodulatory, and wound Healing activity. | Liu et al., 2010<br>Beloin et al., 2005<br>Braca et al., 2008<br>Bao et al., 2013<br>Grover and Yadav, 2004<br>Chatturvedi et al., 2005<br>Juvekar et al., 2015<br>Singer and Clark, 1999 |
| ***LiuDioscoreaalata*** | Polysaccharides, Steroidal saponins, Polyphenols, allantoin and Alkaloids | Antioxidant, Immunomodulatory, Antihypertensive, Antimicrobial, Estrogenic effect and Anti-tumor effect. | Araghiniknam et al., 1996<br>Fang et al., 2011<br>Hou et al., 2001<br>Hsu et al., 2002<br>Liu et al., 2007<br>Wu et al., 2016 |
| ***Manihot esculenta*** | Alkaloids, Glycosides, Flavonoids, Phenols, Carotenoids and Vitamins | antioxidant, antiradical, anticancer, antibacterial, antifungal, antidiarrheal and analgesic | Rajendran et al., 2011<br>Tsumbu et al., 2011<br>Arafa et al., 2023<br>Saad et al., 2014<br>Ehiobu and Ogu, 2018<br>Bahekar and Kale, 2015<br>Miladiyah et al.,2011 |
| ***Vigna radiata*** | Tannins, phytic acid, trypsin inhibitors, hemagglutinin and other antinutrients | Antioxidant, Antidiabetic, Antihyperlipidemic, Antihypertensive, Antimicrobial, Anti-inflammatory and | Wongsiri et al., 1956-1964<br>Yeap et al., 2012<br>Baudry et al., 2017<br>Hafidh et al., 2015<br>Luo et al., 201 |

| | | | |
|---|---|---|---|
| | | Anticancer | Hafidh et al., 2012<br>Mouas et al., 2021 |
| ***Corchorus olitorius*** | Phenolic acid, Terpenes, fatty acids, ionones, Flavonoids, coumarins, Steroidal, Miscellaneous | Antioxidant, Anti-inflammatory, Hepatoprotective, anti-tumor, antimicrobial, antidiabetic, analgesic, Cardioprotective and antiviral | Yan et al., 2013<br>Do et al., 2021<br>Nishiumi et al., 2006<br>Sumengen et al., 2019<br>Ahmed et al., 2021<br>Parvin et al., 2015<br>Das et al., 2010<br>Mesli et al., 2022 |
| ***Artocarpus heterophyllus Lam.*** | Carotenoids, flavonoids, volatile acid sterols and tannins | Anti-inflammatory, Antioxidant, Antimicrobial, Anticancer, Anti-osteoporotic Activity | Meera et al., 2017<br>Zhu et al., 2019<br>Siritapetawee et al., 2023<br>Arung et al., 2010<br>Yuan et al., 2017 |
| ***Moringa oleifera Lam*** | Vitamins, carotenoids, polyphenols, phenolic acids, flavonoids, alkaloids, glucosinolates, isothiocyanates, tannins, and saponins | gastric ulcers are antidiabetic, hypotensive, and anti-inflammatory | Pal et al., 1995<br>Woldekidan et al., 2021<br>Faizi et al., 1998<br>Amutha and Selvakumari, 2014 |
| ***Musa x paradisiaca L.*** | Tannic acid, Catechin, Gallic Acid, Cinnamic Acid, p-Coumaric acid, Gallocatechin gallate, Quercetin, Ferulic acid, Trans-α carotene, Trans-β carotene, Cryptoxanthin, Serotonin, Dopamine, Catecholamines, β-Sitosterol, Campesterol and stigmasterol | Wound healing, Anticancer, Antidiabetic, Antiulcer | Vijayakumar et al., 2017<br>Vilhena et al., 2020<br>Boehme et al., 2007<br>Uzunnhisarcikli and Alanturk, 2019 |
| ***Curcuma longa*** | Polyphenols, sesquiterpenes, Diterpenes, Triterpenoids, sterols, and alkaloids. | Antioxidant, Hepatoprotective, Anti-osteoarthritis, anti-inflammatory, anticancer, anti-arthritic, antidiabetic and anti-depressant | Razavi and Marjan, 2020<br>Nicoliche et al., 2020<br>Kinney et al., 2015<br>Jia et al., 2014<br>Nonose et al., 2014<br>Xu et al., 2019<br>Aggarwal et al., 2013<br>Nile and Park, 2015 |
| ***Zingiber officinale*** | Phenolic and terpene | Antioxidant, Anti-inflammatory, antimicrobial and anticancer | Zhang et al., 2016<br>Kumar et al., 2014<br>Citronberg et al., 2013 |

### 3.3 Quantitative analysis

3.3.1 Informant Consensus Factor (ICF)

The informants' degree of agreement with the knowledge regarding medicinal plants was measured using the informant consensus factor. In the context of a particular disease category, high ICF values suggest that a significant proportion of the informants mentioned one or a small number of medicinal plants. The result shows that 20 different disease categories were recorded in this study (Table 4). Among the illness categories, chronic disorders, dental and oral-related, and eye disorders have the highest degree of consensus, scoring 1.00. In contrast, the lowest level of consensus was observed for cardiovascular conditions. It is widely believed that the abundance of fast food establishments, cafes, and restaurants serving meals high in unhealthy fats, salt, and additives is to blame for the widespread agreement on this topic because cafes are popular hangouts for many individuals these days, particularly teens.

**Table 4** Category of ailments mentioned and their Informants Consensus Factor (ICF).

| Disease Category | Nur | Nt | ICF |
|---|---|---|---|
| Cardiovascular Disorder | 5 | 4 | 0.25 |
| Chronic Disorder | 2 | 1 | 1 |
| Dental and oral-related | 6 | 1 | 1 |
| Dermatological Disorder | 6 | 2 | 0.8 |
| Digestive Disorder | 4 | 3 | 0.333 |
| Eye Disorder | 12 | 1 | 1 |
| Fever/Febric Condition | 63 | 2 | 0.984 |
| Gastrointestinal Disorder | 34 | 9 | 0.758 |
| Genetic Disorder | 3 | 2 | 0.5 |
| Immune Disorder | 3 | 2 | 0.5 |
| Infectious Disease | 22 | 7 | 0.714 |
| Metabolic Disorder | 5 | 3 | 0.5 |
| Musculoskeletal Disorder | 13 | 3 | 0.833 |
| Neurological Disorder | 6 | 4 | 0.4 |
| Parasitic Disease | 3 | 2 | 0.5 |
| Reproductive Health | 4 | 3 | 0.333 |
| Respiratory Disorder | 8 | 3 | 0.714 |
| Rheumatic Disorder | 9 | 4 | 0.625 |
| Skin Disorder | 10 | 4 | 0.667 |
| Wound and Injury Related | 13 | 2 | 0.917 |

3.3.2 Fidelity Level (FL)

Depending on the use report cited by the informants for a given species for a specific ailment, this study assigned an FL of 100 percent to two plant species, *M. oleifera Lam* and *M. charantia*, excluding plants which are only mentioned once for greater precision. The information reveals that the informants relied on one specific plant species for treating one ailment rather than several different elements.

### 3.4 Network analysis

The network relationship of health issues and the medicinal food plants utilized by the Meranao people of

Marawi City is depicted in Fig. 1. Nodes in this network symbolize ailments or medicinal food plants, while boundaries delineate the documented utilization of a specific plant for the treatment of a particular condition. In a proportional relationship, the degree of a node determines the number of edges that are connected to it. The magnitude of an edge is directly correlated with the frequency with which a specific plant has been documented as a remedy for a particular malady. The network map was constructed with the purpose of examining the correlation between the medicinal plants utilized by the inhabitants of Marawi City for sustenance purposes, as well as to illuminate the interdependence and importance of different plant species in the treatment of specific ailments. Significant observations regarding regional medical practices have been unveiled through the utilization of this visualization, which has revealed noteworthy patterns and critical nodes.

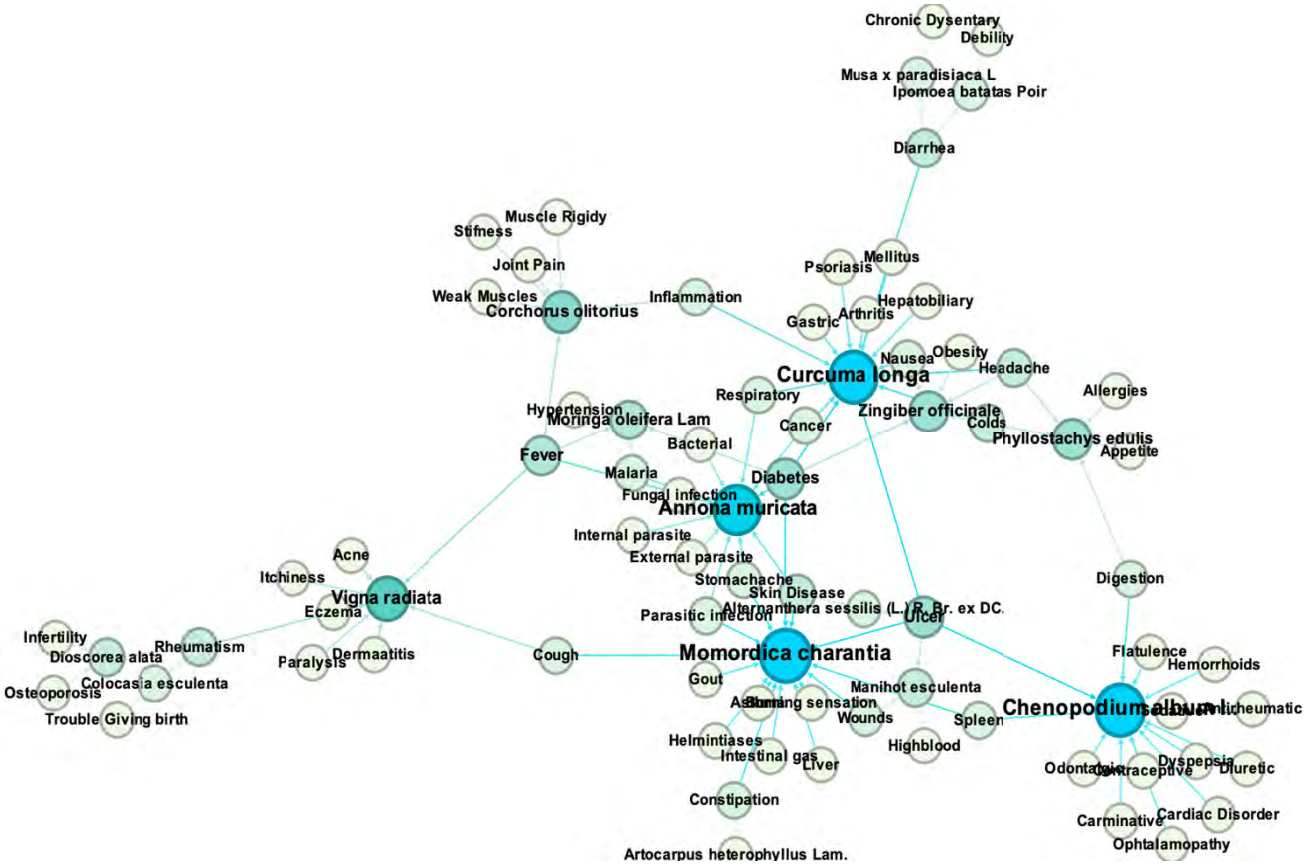


**Fig. 1** Network of medicinal food plants and the addressed ailments.

Based from the figure, *M. charantia*, *Curcuma longa*, and *Chenopodium album* signify their larger value in managing multiple health issues. These three different plant species showed that they are connected to one of the ailments, ulcers. The medicinal properties of *M. charantia* have been demonstrated to be effective in treating various conditions. Aside from that, because of the abundance of vitamins, minerals, and other substances that are beneficial to your health, it is an excellent choice for the local traditional medicinal practices. According to (Leung et al., 2009), *M. charantia* has been extensively studied worldwide for its medicinal properties to treat several diseases.It is a versatile plant worthy of treating almost any disease inflicted on humanity. This may be because the plant possesses over 225 medicinal constituents (Taylor, 2002). Similarly, *C. longa* contains a wide variety of therapeutic effects. It remains significant in addressing

prevalent ailments. In certain traditional practices, *C. longa* is used to remedy respiratory issues like coughs, asthma, and bronchitis due to its expectorant and anti-inflammatory properties. Although *Artocarpus heterophyllus* Lam and *Alternanthera sessilis* (L.) present a lower degree compared to *M. charantia, C. longa*, and *C. album*, they somehow stand out as they can also heal some ailments such as skin disease and constipation.

The prominence of ulcers, indicated by enlarged nodes in the context of treated illnesses, indicates their extensive occurrence within the community. The prevalence of ulcers in the network suggests a strong need for efficient treatments to control this condition, highlighting the importance of medicinal plants such as *M. charantia*, *C. longa*, and *C. album* in addressing this health issue.

The Meranao people of Lanao Del Sur province mostly have traditional reliance on plant medicines. The ethnomedicinal knowledge of the Maranao people reflects a deep connection between their culture, environment, and traditional healing practices. Documenting and preserving this knowledge contribute to the understanding of conventional medicine but also highlights the importance of cultural heritage and indigenous healthcare systems. The utilization of these plants in traditional medicine represents the cultural legacy of the local community as well as the indigenous knowledge of its members. In addition to its medical properties, these food plants are intricately connected to the cultural and societal structure of Marawi City. Incorporating these plants in traditional medicine exemplifies local communities' cultural history and indigenous knowledge. The preservation and comprehension of these plants entail their therapeutic advantages and the protection of traditional cultural practices.

## 4 Conclusion

The efficacy and effectivity of the therapeutic claims of these species must be further pharmacologically investigated and validated. Many people worldwide have relied on many plant species for hundreds of years because they have been shown to treat various illnesses. The study of food plants with medicinal importance contributes significantly to the vast body of traditional knowledge and practices. The Meranao peoples' traditional knowledge of not only the nutritional values of the plants but also their therapeutic uses also helps provide more treatment options, making them potentially useful for the therapy of both pre-existing and newly discovered ailments. The indigenous knowledge of the Meranao of Marawi City regarding the utilization of the food plants for nutrition and as medicine is of the utmost importance to document. This is important before indigenous knowledge is lost forever as a result of not only the lack of interest on the part of younger generations but also the extinction of the species, as these are not primarily considered the most important species by many.

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## References

Ahmed F. 2021. In vitro hypoglycemic effects of molokhia leaves (*Corchorus olitorius* L.). Pharmacognosy Magazine, 17: S246-250

Abbasi AM, Shah MH, Khan MA. 2015. Wild Edible Vegetables of lesser Himalayas. Ethnobotanical and Nutraceutical Aspects, Springer International Publishing, Switzerland

Adefegha SA, Oyeleye SI, Oboh G. 2015. Distribution of phenolic contents, antidiabetic potentials, antihypertensive properties, and antioxidative effects of Soursop (*Annona muricata*L.) fruit parts in vitro. Biochemistry Research International, 2015: 347673. https://doi.org/10.1155/2015/347673

Afroz N. 2020. Methanol soluble fraction of fruits of *Annona muricata* possesses significant antidiarrheal activities. Heliyon, 6: e03112

Aggarwal BB, W. Yuan S, Li, Gupta SC. 2013. Curcumin-free turmeric exhibits anti-inflammatory and anticancer activities: identification of novel components of Turmeric. Molecular Nutrition and Food Research, 57: 1529-1542

Ahn K. 2017. The worldwide trend of using botanical drugs and strategies for developing global drugs. BMB Reports. 50(3): 111–116.doi:10.5483/BMBRep

Alebie G, Urga B, Worku A. 2017. Systematic review on traditional medicinal plants used for the treatment of malaria in Ethiopia: trends and perspectives. Malaria Journal, 16(1): 307. doi: 10.1186/s12936-017-1953-2

Alexiades MN. 1996. Selected guidelines for ethnobotanical research: A field manual. Advances in Economic Botany. The New York Botanical Garden Press, New York, USA

Amutha K. Selvakumari U. 2014. Wound healing activity of methanolic stem extract of *Musa paradisiaca* Linn.(Banana) in Wistar albino rats. International Wound Journal, 13(5): 763-767

Arafa N, Moawad M, Shabrawi H. 2016. Comparison the organic and inorganic solvents effect on phenolic compounds extraction and the activity against breast carcinoma cell lines from callus cultures of *Manihot esculenta*. International Journal of PharmTech Research, 9(12): 380-396

Araghiniknam M, Chung S, Nelson-White T, Eskelson C, Watson RR. 1996. Antioxidant activity of dioscorea and dehydroepiandrosterone (DHEA) in older humans. Life Sciences, 59(11): PL147-157

Arollado EC, Osi MO. 2010. Hematinic activity of *Alternan thera sessilis* (L.) R.BR. (Amaranthaceae) in mice and rats. E-International Scientific Research Journal. 2: 110-117

Arung ET. 2010. Cytotoxic effect of artocarpin on T47D cells. Journal of Natural Medicines. 64(4): 423-429

Bahekar S, Kale R. 2015. Antidiarrheal activity of ethanolic extract of *Manihot esculenta* Crantz leaves in Wistar rats. Journal of Ayurveda and Integrative Medicine, 6(1): 35-40

Bao B. 2013. *Momordica charantia* (Bitter Melon) reduces obesity-associated macrophage and mast cell infiltration as well as inflammatory cytokine expression in adipose tissues. PLoS ONE, 8(12): e84075

Bassam A. 2012. Medicinal plants (importance and uses). Pharmaceutica Analytica Acta, 3: e139. doi:10.4172/2153-2435.1000e139

Baudry J. 2017. Association between organic food consumption and metabolic syndrome: cross-sectional results from the NutriNet-Santé study. European Journal of Nutrition, 57(7): 2477-2488. ff10.1007/s00394-017-1520-1ff. ffhal-01794035

Bekalo TH, WoodmatasSD, WoldemariamZA. 2009. An ethnobotanical study of medicinal plants usedby local people in the lowlands of Konta Special Woreda, southern nations, nationalities, and peoplesregional state, Ethiopia. Journal of Ethnobiology and Ethnomedicine, 5: 1-26

Beloin N. 2005. Ethnomedicinal uses of *Momordica charantia* (Cucurbitaceae) in Togo and relation to its phytochemistry and biological activity. Journal of Ethnopharmacology, 96(1): 49-55

Boddupalli A. Kumanan R, Elumalai A, Eswaraiah MC,Veldi N, Pendem N. 2012. A twelve-monthly review on anti diabetic plants. International Research Journal of Pharmacy, 3: 77-80

Boehme MWJ, Autschbach F, Ell C, Raeth U. 2023. Prevalence of silent gastric ulcer, erosions or severe

acute gastritis in patients with type 2 *Diabetes mellitus*- a cross-sectional study. Hepato-Gastroenterology, 54(74): 643-648

Braca A, Siciliano T, D'Arrigo M, Germanò MP. 2008. Chemical composition and antimicrobial activity of *Momordica charantia* seed essential oil. Fitoterapia, 79(2): 123-125

Brown AC, Reitzenstein JE, Liu J, Jadus MR. 2005. The anticancer effects of poi(*Colocasia esculenta*) on colonic adenocarcinoma cells in vitro. Phytotherapy Research, 19(9): 767-771

Chanda S, Kaneria M. 2011. Indian Nutraceutical Plant Leaves As A Potential Source of Natural Antimicrobial Agents In Science Against Microbial Pathogens: Communicating Current Research and Technological Advances (Vilas M, ed). 1251-1259, Formatex Research Center, Badajoz, Spain

Chaturvedi P. 2005. Role of *Momordica charantia* in maintaining the normal levels of lipids and glucose in diabetic rats fed a high-fat and low-carbohydrate diet. British Journal of Biomedical Science, 62(3): 124-126

Citronberg J. 2013. Effects of ginger supplementation on cell-cycle biomarkers in the normal-appearing colonic mucosa of patients at increased risk for colorectal cancer: Results from a pilot, randomized, and controlled trial. Cancer Prevention Research, 6(4): 271-281

Das AK. 2010. Arsenic-induced myocardial injury: Protective role of *Corchorus olitorius* leaves. Food and Chemical Toxicology, 48(5): 1210-1217

Do MH. 2021. *Corchorus olitorius* L. ameliorates alcoholic liver disease by regulating gut-liver axis. Journal of Functional Foods, 85: 104648. https://doi.org/10.1016/j.jff.2021.104648

Drishya G. 2020. RECK and TIMP-2 mediate inhibition of MMP-2 and MMP-9 by *Annona muricata*. Journal of Biosciences, 45: 89.DOI: 10.1007/s12038-020-00056-z

Ehiobu JM, Ogu GI. 2018. Phytochemical Content and *in vitro* Antimycelial efficacy of *Colocasia esculenta* (L), *Manihot esculenta* (Crantz) and *Dioscorea rotundata* (Poir) Leaf Extracts on *Aspergillus niger* and *Botryodiplodiatheobromae.* Journal of Horticulture and Plant Research, 1: 9-18

Elif Korcan S, Aksoy O, Feyza Erdoğmuş S, Hakkı Ciğerci İ, Konuk M. 2013. Evaluation of antibacterial, antioxidant and DNA protective capacity of *Chenopodium album*'s ethanolic leaf extract. Chemosphere, 90(2): 374-379

EtkinNL, Ross PJ. 1991. Should we set a place for diet in ethnopharmacology? Journal of Ethnopharmacology, 32(3): 25-36

Ezekiel R, Singh N, Sharma S, and Kaur A. 2013. Beneficial phytochemicals in potato-a review. Food Research International, 50(2): 487-496

Faizi S. Siddiqui B, Saleem R, Aftab K, Shaheen F, Gilani AH, 1998. Hypotensive constituents from the pods of *Moringa oleifera*. Planta Medica, 64(03): 225-228

Fang Z, Wu D, Yü D, Ye X, Liu D, Chen J. 2011. Phenolic compounds in Chinese purple yam and changes during vacuum frying. Food Chemistry, 128(4): 943-948

Fleuret A. 1993. Dietary and therapeutic uses of fruit in three Taita communities. In: Plants in Indigenous Medicine and Diet (Etkin N, ed). 151-170, Redgrave, Bedford Hills, NY, USA

Fujimura M, Ideguchi M, Minami Y, Watanabe K, Tadera K. 2005 Amino acid sequence and antimicrobial activity of chitin-binding peptides, Pp-AMP 1 and Pp-AMP 2, from Japanese bamboo shoots (*Phyllostachys pubescens*). Bioscience, Biotechnology, and Biochemistry, 69(3): 642-645

Gbolade A. 2012. Ethnobotanical study of plants used in treating hypertension in Edo State of Nigeria. Journal of Ethnopharmacology, 144: 1-10

Giday M, Asfaw Z, Woldu Z. 2009. Medicinal plants of the Meinit ethnic group of Ethiopia: an ethnobotanical study. Journal of Ethnopharmacology, 124(3): 513-521

GitzV, Meybeck A, Lipper L, Young CD, Braatz S. 2016. Climate change and food security: risks andresponses. Food and Agriculture Organization of the United Nations (FAO) Report, https://www.fao.org/3/i5188e/I5188E.pdf

Grover JK, Yadav SP. 2004. Pharmacological actions and potential uses of *Momordica charantia*: a review. Journal of Ethnopharmacology, 93(1):123-132

Hafidh RR, Abdulamir AS, Abu Bakar F, Sekawi Z, Jahansheri F, Jalilian FA.2015. Novel antiviral activity of mung bean sprouts against respiratory syncytial virus and *Herpes simplex* virus −1: an in vitro study on virally infected Vero and MRC-5 cells lines. BMC Complementary and Alternative Medicine, 15: 179. doi: 10.1186/s12906-015-0688-2

Hafidh RR, Abdulamir AS, Bakar FA, Jalilian FA, Abas F, Sekawi Z.2012. Novel molecular, cytotoxical, and immunological study on promising and selective anticancer activity of Mung bean sprouts. BMC Complementary and Alternative Medicine, 12:208. http://www.biomedcentral.com/1472-6882/12/208.

Heinrich M, Ankli A, Frei B, Weimann C, Sticher O. 1998. Medicinal plants in Mexico: healers' consensus and cultural importance. Social Science and Medicine, 47: 1859-1871

Heinrich M, Edwards S, Moerman DE, Leonti M. 2009. Ethnopharmacolgical field studies: A critical assessment of their conceptual basis and methods. Journal of Ethnopharmacology, 124: 1-17

Hong EJ. 2010. Protective effects of the pyrolyzates derived from bamboo against neuronal damage and hematoaggregation. Journal of Ethnopharmacology, 128(3): 594-599

Hou WC. 2001. Antioxidant activities of dioscorin, the storage protein of yam (*Dioscorea batatas*Decne) tuber. Journal of Agricultural and Food Chemistry, 49(10): 4956-4960

Hsu FL, Lin YH, Lee MH, LinCL, Hou WC. 2002. Both dioscorin, the tuber storage protein of yam (*Dioscorea alatacv*. Tainong No. 1), and its peptic hydrolysates exhibited angiotensin converting enzyme inhibitory activities. Journal of Agricultural and Food Chemistry, 50(21): 6109-6113

Hu C, Zhang Y, Kitts DD. 2000. Evaluation of Antioxidant and prooxidant activities of bamboo *Phyllostachys nigra* Var. *Henonis* leaf extract in vitro. Journal of Agricultural and Food Chemistry, 48(8): 3170-3176

Jabbar A, Zaman MA, Iqbal Z, Yaseen M, Shamim A. 2007. Anthelmintic activity of *Chenopodium album* (L.) and *Caesalpinia crista* (L.) against trichostrongylid nematodes of sheep. Journal of Ethnopharmacology, 114(1): 86-91

Jain C, Khatan S, Vijayvergia R. 2019. Bioactivity of secondary metabolites of various plants: A review. International Journal of Pharmaceutical Sciences and Research, 10: 494-504

Jia T, Zhang L, Duan Y, Zhang M, Wang G, Zhang J, Zhao Z. 2014. The differential susceptibilities of MCF-7 and MDA-MB-231 cells to the cytotoxic effects of curcumin are associated with the PI3K/Akt-SKP2-Cip/Kips pathway Cancer Cell International, 14(1): 126. doi: 10.1186/s12935-014-0126-4. eCollection 2014

Juvekar A, Hule A, Sakat S, Chaughule VA. 2009. In vitro and in vivo evaluation of immunomodulatory activity of methanol extract of *Momordica charantia* fruits. Drug Invention Today, 1: 89-94

Karou SD. 2011. Sub-Saharan Rubiaceae: A review of their traditional uses, phytochemistry and biological activities., PJBS **(**14): 149-169

Kaur C, Kapoor HC. 2002. Antioxidant activity and total phenolic content of some Asianvegetables, International Journal of Food Science and Technology, 37(2): 153-161

Khoobchandani M, Ojeswi BK, Sharma B, Srivastava MM. 2009. *Chenopodium album* preventsprogression

of cell growth and enhances cell toxicity in human breast cancer cell lines. Oxidative Medicineand Cellular Longevity, 2(3): 160–165.

Kim H, Song MJ. 2008. Ethnobotany. Worldscience Co., Seoul, Korea

Kinney SR, Carlson L, Ser-Dolansky J, Thompson C, Shah S, Gambrah A, Xing W, Schneider SS, Mathias CB. 2015. Curcumin ingestion inhibits mastocytosis and suppresses intestinal anaphylaxis in a murine model of food allergy. PLoS One, 10: e0132467

Knekt P. 2002. Flavonoid intake and risk of chronic diseases. The American Journal of Clinical Nutrition, 76(3): 560-568

KpodarMS, Lawson-Evi P, Bakoma B, Eklu-Gadegbeku K, Agbonon A. Aklikokou K, Gbeassor M. 2015.Ethnopharmacological survey of plants used in the treatment of *Diabetes mellitus* in the south of Togo (Maritime Region). Journal of Herbal Medicine, 5(3):147-152

Kumarasamyraja D, Jeganathan NS, Manavalan R. 2012. A review on medicinal plants with potential wound healing activity. International Journal of Pharmaceutical Sciences, v2: 105-111

Kumawat NS, Chaudhari SP, Wani NS, Deshmukh TA,Patil VR. 2010. Antidiabetic activity of ethanol extract of*Colocasia esculenta* leaves in alloxan-induced diabetic rats. International Journal of PharmTech Research, 2(2): 1246-1249

Kundu N, Campbell P, Hampton B, Lin CY, Ma X, 2012. Ambulos N, Zhao F,Goloubeva O, Holt D, and Fulton AM. 2011. Antimetastatic activity isolated from *Colocasia esculenta* (taro). Anticancer Drugs, 23(2): 200-211.doi: 10.1097/CAD.0b013e32834b85e8

Leung L, Birtwhistle R, Kotecha J, Hannah S, Cuthbertson S 2009. Antidiabetic and hypoglycaemic effects of *Momordica charantia* (bitter melon): a mini review. Br J Nutr.102:1703-1708

Liu CH, Yen MH, Tsang SF, Gan KH, Hsu HY, Lin CN. 2010. Antioxidant triterpenoids from the stems of *Momordica charantia*. Food Chemistry, 118(3): 751-756

Liu YW, Shang HF, Wang CK, Hsu FL, and Hou WC. 2007. Immunomodulatory activity of dioscorin, the storage protein of yam (*Dioscorea alata* cv. Tainong No. 1) tuber. Food and Chemical Toxicology: An International Journal Published for the British Industrial Biological Research Association, 45(11): 2312–2318

Lu B, Wu X, Tie X, Zhang Y, Zhang Y. 2005. Toxicology and safety of antioxidant of bamboo leaves. Part 1: Acute and subchronic toxicity studies on antioxidant of bamboo leaves. Food and Chemical Toxicology, 43(5): 783-792

LulekalE, Kelbessa E, Bekele T, Yineger H. 2008. An ethnobotanical study of medicinal plants in Mana Angetu District, southeastern Ethiopia. Journal of Ethnobiology and Ethnomedicine, 4: 10

Luo J, Cai W, Wu T, Xu B.2016. Phytochemical distribution in hull and cotyledon of adzuki bean (*Vigna angularis* L.) and mung bean (*Vigna radiata* L.), and their contribution to antioxidant, anti-inflammatory and antidiabetic activities. Food Chemistry, 201: 350-360

Meera M, Ruckmani A, Saravanan R, Lakshmipathy Prabhu R. 2017. Anti-inflammatory effect of ethanolicextract of spine, skin and rind of Jack fruit peel–A comparative study. Natural Product Research, 32(22): 2740-2744

Mengane S. 2015. Antifungal activity of the crude extracts of *Colacasia Esculenta* leaves in vitro on plant pathogenicfungi. International Research Journal of Pharmacy, 6(10): 713-714

Mesli F, Ghalem M, Daoud I, Ghalem S. 2022. Potential inhibitors of angiotensin converting enzyme 2 receptor of COVID-19 by *Corchorus olitorius* Linn using docking, molecular dynamics, conceptual DFT investigation and pharmacophore mapping. Journal of Biomolecular Structure and Dynamics, 40(16): 7311-7323

Miladiyah I. 2011. Analgesic activity of ethanolic extract of *Manihot esculenta* Crantz leaves in mice. Universa Medicina, 30(1): 3-10

Mouas TN, Kabouche Z.; Benabid N, Bendal M. 2021. Investigations on bioactive compounds and in vitro biological potent of *Corchorus olitorius*. L from Algerian cultivar. Proceedings, 65x. https://doi.org/10.3390/xxxxx

Nonose N, Pereira JA, Machado PRM, Rodrigues MR, Sato DT, Martinez CAR. 2014. Oraladministration of curcumin (*Curcuma longa*) can attenuate the neutrophil inflammatory response in zymosan-induced Arthritis in rats. Acta Cirurgica Brasil, 29: 727-734

Nicoliche T, Maldonado DC, Faber J, M.C.P.d. 2020. Silva evaluation of the articular cartilage in the knees of rats with induced Arthritis treated with curcumin. PLoS One, 15(3): e0230228. https://doi. org/10.1371/journal.pone.0230228

Nile SH, Park SW. 2015. Chromatographic analysis, antioxidant, anti-inflammatory, and xanthine oxidase inhibitory activities of ginger extracts and its reference compounds. Industrial Crops and Products, 70: 238-244

Nishiumi S, Yabushita Y, Fukuda I, Mukai R, Yoshida K, Ashida H. 2006. Molokhia (*Corchorus olitorius* L.) extract suppresses transformation of the aryl hydrocarbon receptor induced by dioxins. Food and Chemical Toxicology, 44(2): 250-260

Nguta JM, Mbaria JM, Gakuya DW, Gathumbi PK, Kiama SG. 2010 Antimalarial herbal remedies of Msambweni, Kenya. Jornal of Ethnopharmacology, 128: 424-432

Nwokocha CR. 2012. Possible mechanisms of action of the hypotensive effect of *Annona muricata*(soursop) in normotensive Sprague–Dawley rats. Pharmaceutical Biology. 50(11): 1436-1441

Pal SK, Mukherjee PK, and Saha BP. 1995. Studies on the antiulcer activity of *Moringa oleifera* leaf extract on gastric ulcer models in rats. Phytotherapy Research, 9(6): 463-465

Parvin S, Marzan M, Rahman S, Das A, Haque S, Rahmatullah M. 2015. Preliminary phytochemical screening, antihyperglycemic, analgesic and toxicity studies on methanolic extract of aerial parts of *Corchorusolitorius* L. Journal of Applied Pharmaceutical Science, 5(9): 068-071

Patil B, Ageely H. 2011. Antihepatotoxic activity of *Colocasia esculenta* leaf juice. International Journal of Advanced Biotechnology and Research, 2: 296-304

Patil BR, Ageely HM.2011. Antihepatotoxic activity of *Colocasia esculenta* leaf Juice. International Journal of Advanced Biotechnology and Research, 2(2): 296-304

Rajendran S, Aravanakumar M, Suganyadevi P. 2011. Anthocyanins from Indian Cassava (*Manihot esculenta*Crantz) and its antioxidant properties. International Journal of Pharmaceutical Sciences and Research, 2(7): 1819-1828

Razavi BM, HosseinzadehH. 2020. Antioxidant effects of *Curcuma longa* and its active constituent, curcumin, for the therapy of neurological disorders. In: Oxidative Stress and Dietary Antioxidants in Neurological Diseases. 249-269, Elsevier. doi:10.1016/B978-0-12-817780-8.00017-7

Reyad-ul-Ferdous M. 2023. Biologically potential for pharmacologicals and phytochemicals of medicinal plants of *Colocasia esculenta*: A Comprehensive Review. American Journal of Clinical and Experimental Medicine, 3(5): 7-11

Saad R, Appalasamy L, Khan J, Kazi H, YusufE, Asmani F. 2014. Phytochemical screening and antibacterial activity of five Malaysian Medicinal plants. British Journal of Pharmaceutical Research, 4(17): 2019-2032

Sabiu S, Madende M, Ayokun-nun Ajao A, Adepemi O, LekenaN, Adekunle K. 2019. The scope of Phytotherapy in Southern African antidiabetic healthcare. Transactions of the Royal Society of South

Africa, 74: 1-18

Singer AJ, Clark RAF. 1999. Cutaneous wound healing. New England Journal of Medicine, 341(10): 738-746

Singh B, Namrata, Kumar L, Dwivedi SC. 2011. Antibacterial and antifungal activity of *Colocasia esculenta*aqueousextract: An edible plant. Journal of Pharmacy Research, 4(5): 1459-1460

Shi QT, Yang KS. 1992. Study on relationship between nutrients in bamboo shoots and human health. Proceedings of the International Symposium onIndustrial Use of Bamboo. In: Bamboo and its Use. 338-346, International Tropical Timber Organization and Chinese Academy, Beijing, China

Siritapetawee J, Thammasirirak S, Samosornsuk W. 2012. Antimicrobial activity of a 48-kDa protease (AMP48) from *Artocarpus heterophyllus* latex. European Review for Medical and Pharmacological Sciences, 16(1): 132-137

Subhashini T, Krishnaveni V, Reddy C. 2010. Anti-inflammatory activity of leaf extracts of *Alternanthera sessilis*. Hygeia, 2: 54-56

Sumengen Ozdenefe M, Muhammed Suer K, Guler E, Mercimektakci H. 2019. determination of Antimicrobial Activity of *Corchorus olitorius* leaf extracts. Cyprus Journal of Medical Sciences, 3(3): 159-163

Tjeck OP, Souza A, Mickala P, Lepengue AN, M'Batchi B. 2017. Bio-efficacy of medicinal plants used for the management of *Diabetes mellitus* in Gabon: An ethnopharmacological approach. Journal of Intercultural Ethnopharmacology, 6: 206–217

Taylor L. 2002. Herbal secrets of the rainforest. In: Bitter melon (*Momordica charantia*) (2nd ed) (Texas A, ed). Sage Press, USA

Telefo PB, Lienou MD. YemeleMC, Lemfack C, Mouokeu, Goka CS, Tagne SR, Moundipa, FP. 2011. Ethnopharmacological survey of plants used for the treatment of female infertility in Baham, Cameroon, 136(1): 1-187

Trotter R, Logan M. 1986. Informant consensus: a new approach for identifying potentially effective medicinal plants. In: Plants in Indigenous Medicine and Diet: Biobehavioural Approaches (Etkin NL, ed). 91-112, Redgrave Publishers, Bedfort Hills, New York, USA

Tsumbu CN. 2011. Antioxidant and antiradical activities of *Manihot esculenta* Crantz (Euphorbiaceae) leaves and other selected tropical green vegetables investigated on Lipoperoxidation and Phorbol-12-myristate-13-acetate (PMA) activated monocytes. Nutrients, 3(9): 818-838

Vijendra Kumar N, Murthy PS, Manjunatha JR, Bettadaiah BK. 2014. Synthesis and quorum sensing inhibitory activity of key phenolic compounds of ginger and their derivatives. Food Chemistry, 159: 451-457

Vilhena RO. 2020. Antidiabetic activity of *Musa x paradisiaca* extracts in streptozotocin-induced diabetic rats and chemical characterization by HPLC-DAD-MS. Journal of Ethnopharmacology, 254: 112666

Vijayakumar S, 2017. Therapeutic effects of gold nanoparticles synthesized using *Musa paradisiaca* peel extract against multiple antibiotic resistant *Enterococcus faecalis* biofilms and human lung cancer cells (A549). 102: 173-183

Usman LA, Hamid AA, Muhammad NO, Olawore NO, Edewor TI, Saliu BK. 2010. Chemical constituents and anti-inflammatory activity of leaf essential oil of Nigerian grown *Chenopodium album* L. EXCLI Journal, 9: 181-186

Uzunhisarcikli M, Aslanturk A. 2019. Hepatoprotective effects of curcumin and taurine against bisphenol A-

Wang W. 2014. Oral Hepatoprotective Ability Evaluation of Purple Sweet Potato Anthocyanins on Acute and induced liver injury in rats. Environmental Science and Pollution Research, 26: 37242-37253

Weng W, Chen J. 1996. The Eastern perspective on functional foods based on traditional Chinese medicine. Nutrition Reviews, 54: S11-S16

Woldekidan S. 2021. Evaluation of antihyperglycemic effect of extract of *Moringa stenopetala* (Baker f.) aqueous leaves on alloxan-induced diabetic rats. Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy, 14: 185-192

Wongsiri S, Ohshima T, Duangmal K. 2015. Chemical composition, amino acid profile and antioxidant activities of germinated mung beans (*Vigna radiata*). Journal of Food Processing and Preservation, 39(6): 1956-1964

Wu ZG, Jiang W, Nitin M. Bao XQ, Chen SL, Tao ZM. 2016. Characterizing diversity based on nutritionalandbioactive compositions of yam germplasm (*Dioscorea spp*.) commonly cultivated in China. Journal of Food and Drug Analysis, 24(2): 367-375

Xu L, DingL, Su Y, Shao R, Liu J, Huang Y. 2019. Neuroprotective effects of curcumin against rats withfocal cerebral ischemia-reperfusion injury. International Journal of Molecular Medicine, 43: 1879-1887

Yan YY, Wang YW, Chen SL, Zhuang SR, Wang CK. 2013. Anti-inflammatory effects of phenolic crude extracts from five fractions of *Corchorus Olitorius* L. Food Chemistry, 138(2–3): 1008-1014

Yeap SK. 2012. Antihyperglycemic Effects of Fermented and Nonfermented Mung Bean Extracts on Alloxan-Induced-Diabetic Mice. Journal of Biomedicine and Biotechnology, 2012: 1-7

Yuan WJ, Yuan JB, Peng JB, Ding YQ, Zhu JX, Ren G. 2017. Flavonoids from the roots of *Artocarpus heterophyllus*. Fitoterapia, 117: 133-137

Zhang M. 2016. Edible ginger-derived nanoparticles: A novel therapeutic approach for the prevention and treatment of inflammatory bowel disease and colitis-associated cancer. Biomaterials, 101: 321-340

Zhang Y, Yao X, Bao B, and Zhang Y. 2006. Anti-fatigue activity of a triterpenoid-rich extract from Chinese bamboo shavings (*Caulis bamfusaeintaeniam*). Phytotherapy Research, 20(10): 872-876

Zhu K. 2019. Effects of in vitro saliva, gastric and intestinal digestion on the chemical properties, antioxidant activity of polysaccharide from *Artocarpus heterophyllus* Lam. (Jackfruit) pulp. Food Hydrocolloids, 87: 952-959