Phytochemical Screening of Selected Medicinal Plants Used By B'laan Tribe

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ABSTRACT

Phytochemicals are compounds found in plants that help the plants survive and defend themselves against threats. In medicinal plants, these compounds are responsible for the plant's effectiveness in treating different illnesses. Most of these medicinal plants lack phytochemical studies, and some studies only target a specific part of the plant. This study aims to identify the specific phytochemical compounds that are present in the selected medicinal plants used by the B'laan tribe. This study used a descriptive research design to describe and interpret the selected medicinal plants: Gmelina (*Gmelina arborea*), Balbas-pusa (*Orthosiphon aristatus*), and Agik-agik (*Acmella oleracea*). Plant samples were collected at Barangay Assumption, Koronadal, South Cotabato, Philippines, sealed in a zip-lock bag, and directly delivered to the WVN Research Laboratory located at Davao City, Philippines. Two tests, qualitative test and quantitative test, showed that flavonoids, tannins, phlobotannins, steroids, and glycosides were present in all three samples. At the same time, alkaloids were only present in Gmelina, and saponins were absent in all three. These compounds are significant for the anti-inflammatory, antiviral, antimicrobial, analgesic, antipyretic, and antioxidant properties of plants, Quantitative test results on Gmelina shows a strong concentration on flavonoids and tannins with 16.52 mg/g and 15.21 mg/g respectively, phlobotannins 7.56 mg/g and small concentration of glycosides, alkaloids, and steroids containing 3.25 mg/g, 3.52 mg/g, and 1.42 mg/g respectively. Flavonoids and tannins contain 14.22 mg/g and 10.24 mg/g, respectively, on Balbas-pusa. Plobotannins, glycosides, and steroids with 5.26 mg/g, 2.12 mg/g, and 1.23 mg/g, respectively. Lastly, Agik-agik contains 12.65 mg/g and 11.28 mg/g of flavonoids and tannins. Plobotannins, glycosides, and steroids contain 4.23 mg/g, 2.45 mg/g, and 1.32 mg/g, respectively. These results show the medicinal plants used by the tribe and the specific illnesses they treat. They will be helpful in future pharmacological studies of these plants to develop medicines.

Keywords: plant biology, medicinal plants, b'laan tribe, phytochemical screening, descriptive research design

INTRODUCTION

B'laan tribe has a rich ethnomedical background based on their cultural heritage and the close connection with nature. They practice traditional healing methods which entail the use of different medicinal plants of 100 species and 33 families used to cure various diseases, including cholera, scabies, viral diseases, warts, beriberi, diabetes, and gastric ulcers. As stated by Balick and Cox (2020), indigenous peoples around the globe depend on medicinal plants to treat physical illnesses but also to heal and maintain cultural identity, as well as to treat spiritual illnesses.

Traditional healers of indigenous tribes in Mexico also incorporate medicinal plants into their shamanistic and faith-based healing, aiming to provide holistic treatment for both physical and spiritual health. Globally, indigenous knowledge has significantly contributed to modern medicine, as evidenced by widely used plant-based drugs such as artemisinin from Artemisia annua (Cordero et al., 2022; Alum, E., 2024). Phytochemical compounds such as quercetin, rosmarinic acid, kaempferol, B-sitosterol, amyrins, and various terpenes have been identified in some medicinal plants such as Cordia dodecandra and Galtheria odorata. These compounds contribute to the plant's antibacterial, antioxidant, and anti-inflammatory properties, validating their ethnomedicinal use (De la Cruz-Jimenez et al., 2022).

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Meanwhile, according to the study of Mesa et al. (2022), the Bukidnon tribe of the Philippines uses 131 medicinal plant species across 16 disease categories, reflecting the rich ethnobotanical knowledge influenced by cultural and spiritual beliefs. Phytochemical screening revealed the presence of alkaloids in *Acmella grandiflora*, *Anodendron borneense*, and *Homalomena philippinensis* and condensed tannins in *Acmella grandiflora* and *Hellenia speciosa*. These compounds correlate with the traditional use of the plants for various ailments, including inflammation, infection, and other health problems.

In Barangay Assumption, Koronadal, South Cotabato, the researchers conducted an ethnobotanical journal study in 2022 on the medicinal plants used by the B'laan tribe. They have recorded various plants used to treat different ailments such as common colds, cough, urinary tract infections, diabetes, hypertension, toothache, headache, diarrhea, and menstrual disorders. Although most of the plants used by the tribe have undergone phytochemical screening, some studies have focused only on specific parts, such as fruits, leaves, flowers, and branches. This study will have significant value in validating the use of these plants for disease treatment and in assessing their potential in pharmaceutical and medicinal research.

Despite extensive documentation of the traditional use and pharmacological potential, some parts of the plant remain underexplored, particularly the stems and roots of *Acmella oleracea* for their phytochemical composition and bioactivity (Spinozzi et al., 2022). Fruits and seeds of Gmelina arborea also have less information despite their local medicinal use (Waghchaure et al., 2022). Additionally, flowers, stems, and roots receive minimal attention on phytochemical profiling (Rizkita et al., 2023).

This study would give significant value in validating the use of these plants for disease treatment and in assessing their potential in pharmaceutical and medicinal research.

REVIEW OF RELATED LITERATURE

This chapter discusses the studies and literature that are related to or bear similarity to this study. In doing so, discussing previous studies provides a clear understanding of the research gaps and relevant concepts that inform the framework of this study. It gives the authors sufficient background to understand the study. This review of related literature focuses on the following themes: Medicinal Plants, Phytochemical Analysis and Composition, Flavonoids, Alkaloids, Terpenoids, Saponins, Tannins, Phytosterols, Polyphenols, Ethnobotanical Knowledge and Medicinal Plant Diversity in Mindanao, Proving Traditional Knowledge with Scientific Evidence, and the Medicinal Plants Used by the B'laan Tribe of South Cotabato.

Medicinal Plants. The use of medicinal plants has always been a critical component of traditional health care systems, particularly among indigenous populations, where the experience of using herbs or their components has consistently been transmitted between generations (Baddu & Quano, 2018). Medicinal plants can be used in different ways and for different types of treatment; even Gmelina (*Gmelina arborea*), Balbas-pusa (*Orthosiphon aristatus*), and Agik-agik (*Acmella oleracea*) are utilized for specific ailments, such as cough, cold, diabetes, and toothache, respectively. In addition, medicinal plants serve as primary healthcare to more than 80 percent of the global population, especially in developing countries (World Health Organization (WHO, 2019).

These plants have found use beyond traditional healing because many pharmaceutical drugs are derived from plant compounds with therapeutic effects (Najmi et al., 2022). Furthermore, Balick and Cox (2020) state that native communities worldwide have used medicinal plants for spiritual healing and to preserve cultural identity. These medicinal plants are also associated with the sustainability and effectiveness of preserving ethnobotanical knowledge that is transmitted through generations.

Phytochemical and pharmacological research demonstrate the traditional use of herbal medicine within standard treatment protocols (Cordero et al., 2022). Although the scientific attention to medicinal plants is increasing, some issues remain: standardization, quality control, and sustainable harvesting to preserve biodiversity (Najmi et al., 2022).

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Therefore, research integrating indigenous knowledge and modern science should continue to improve the effectiveness of medicinal plants. The significance of ethnopharmacological research in identifying new drug leads through medicinal plants is critical.

In the Philippines, the B'laan tribe, and other indigenous peoples of this country make extensive use of local plants in medicine to treat an array of disorders, including infections, inflammation, and chronic diseases, often using specific preparation techniques, such as decoctions, poultices, and infusions. Ethnobotanical records in Panay, Bukidnon, in Western Visayas have listed 131 medicinal plant species across 57 families, with Fabaceae, Lamiaceae, and Poaceae as the major ones. The most used part of the plant is the leaves, and the most common preparation method is decoction.

Curcuma longa and Blumea balsamifera were both high in informant consensus and use value for respiratory ailments and wound treatment, respectively, highlighting the therapeutic importance of these plants (Cordero et al., 2022). Meditational plant diversity is abundant in the Philippines, and indigenous people used it as traditional medicine. In the same way, an ethnobotanical survey on the tribe of Y'Apayaos in Northern Philippines reported 38 species of medicinal plants that are normally used to treat diseases like the common cold, fever, urinary tract infections, among others. The crops were primarily trees and herbs that were found in the vicinity of settlement areas and forests. Leaves are popularly used parts and are used to make various concoctions (Baddu & Ouano, 2018).

Meanwhile, Alinsug et al. (2022) on indigenous peoples in Mindanao has documented more than 500 medicinal plant species used to treat various health conditions, including infections, inflammation, and chronic diseases. Those studies focus on highlighting the immense knowledge of indigenous practices for sustaining cultural heritage and for providing investigation for drug discovery foundations and biodiversity safeguarding. Another tribe that demonstrates a rich use of medicinal plants is the Manobo tribe in Agusan, which has identified 40 medicinal species. The most common family was Asteraceae, which is used to treat pain, high blood pressure, and infection (Paraguison et al., 2021). This series of ethnobotanical research indicates the vital role of medicinal plants in the indigenous healthcare system of the Filipino people and the urgency of scientific validation to substantiate their effectiveness and support their conservation.

These medicinal plants have been found to exert effects through a range of phytochemicals, including alkaloids, tannins, flavonoids, saponins, and phenolic compounds, which exhibit antioxidant, anti-inflammatory, analgesic, and antimicrobial (Kumar et al., 2023). Phytochemical screening of these medicinal plants is used to identify bioactive compounds that contribute to the therapeutic effects of these medicinal plants in order to facilitate the incorporation of traditional remedies into mainstream medical applications.

On the other hand, Dogra & Kaushik (2022) highlighted that Gmelina (Gmelina arborea) is a rapidly growing deciduous plant species in the family Lamiaceae and is highly valued in traditional systems of medicine in the tropical areas, especially in South and Southeast Asia. Gmelina has a wide range of pharmacological properties, making it a useful compound in treating several ailments. The pharmacological experiments proved that Gmelina is effective in wound healing, cardio-protection, antipyretic activity, and antidiabetic activity. The tree produces leaves and aqueous extracts of Methanol used for methanol production show high anti-inflammatory and antinociceptive effects in animal models, thereby justifying its ethnomedicinal application in the treatment of pain and inflammation (Arora & Tamrakar, 2017). Gmelina species (Gmelina philippenensis and Gmelina arborea) have been reported to have flavonoids, tannins, terpenoids, and saponins (Offor, 2016).

Similarly, Kumar et al. (2023) discovered that the recorded compounds exhibit antioxidant and antimicrobial effects, consistent with the historical applications of the leaves to address inflammation and infection. In addition, a study on medicinal plants used by the B’laan tribe of South Cotabato, Pilapil et al. (2024) found that Gmelina is effective in treating cough. Furthermore, the toxicity studies reveal that Gmelina extracts are safe at the established dosages, with no noticeable hepatic or nephrotoxic effects, which underlines the potential for further preclinical and clinical studies (Dogra & Kaushik, 2022). Besides its use in medicine, Gmelina has other ecological and agroforestry roles, such as being a source of timber and biomass with excellent coppicing capacity; thus, sustainable cultivation of Gmelina is beneficial in addition to its medicinal use (Kumar et al., 2023).

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In other parts of the world, Gmelina arborea, also known as Beechwood or Gambhari, was reported to have anti-inflammatory, antioxidant, antimicrobial, hepatoprotective, and analgesic properties. The use of traditional remedies for fever, rheumatism, jaundice, ulcers, wounds, and respiratory infections has been validated by the studies (Arora & Tamrakar, 2017). Further, pharmacological research indicates that gmelina leaf and bark extracts have great hepatoprotective properties in test animals. exposed to hepatotoxins, which show potent free radical scavenging and antioxidant activity (Thacker & Ram, 2024). The paper demonstrates the plant's potential for the management of liver disease worldwide.

Subsequent investigations demonstrated antimicrobial activity against a wide range of bacteria and fungi, indicating its potential for treating infectious diseases and supporting ethnomedicinal assertions (Dogra & Kaushik, 2022). It has been associated with analgesic and anti-inflammatory effects, as well as with prostaglandin synthesis of prostaglandins and the regulation of inflammatory mediators, which justifies its application in the treatment of pain and inflammation (Arora & Tamrakar, 2017). Gmelina arborea also exhibits antidiabetic activity by increasing insulin secretion and glucose uptake, consistent with its use in rural folk medicine in the treatment of diabetes mellitus (Attanayake et al., 2016a). The variety of pharmacological activities underscores the significance of gmelina not only as a traditional medicine but also as a promising pharmaceutical product worldwide.

Consequently, Gmelina is widely used in the traditional medicine of the Philippines. Ethnobotanical surveys of indigenous populations in Western Visayas (Panay Bukidnon) and in the Luzon (Kalanguya tribe) and other ethnic communities revealed that Gmelina arborea leaves, bark, and roots were used in various medicinal purposes (Cordero et al., 2022). Gmelina arborea has been used conventionally as an antipyretic, analgesic, antiinflammatory, and antimicrobial agent. Tribe healers also treat common illnesses such as cough, fever, urinary tract infection, hypertension, and wounds using leaf decoction (Dogra & Kaushik, 2022). Leaves and roots are used as poultices to treat toothache and skin infections, with preparations used both internally and topically.

Furthermore, Gmelina arborea has been known to have traditional medical uses to the native people of Mindanao, including the Manobo and Mandaya tribes. The plant is commonly used as an herbal medicine for the treatment of a variety of illnesses, which include fever, cough, rheumatism, wounds, and inflammation. Scientists in the area seek to establish traditional applications by screening bioactive compounds and by testing their pharmacological effects to emphasize their continued significance in healthcare systems of the indigenous populations. Local healers use leaf and bark decoctions to treat the symptoms of respiratory infections and to stimulate wound healing. Ethnobotanical surveys confirmed that Gmelina is among the most cited medicinal plants in Mindanao because of its accessibility and wide therapeutic spectrum (Pucot et al., 2019).

Balbas-pusa, also known as Orthosiphon aristatus, is a widely used medicinal plant in Southeast Asia, particularly valued because of its therapeutic properties in traditional medicine. Commonly known as "cat's whiskers," it has been used as a diuretic and herbal remedy for ailments such as kidney and urinary tract problems, hypertension, diabetes, and inflammation (Shaikh & Shaikh., 2022). Moreover, phytochemical screening of Balbas-pusa (Orthosiphon aristatus) revealed significant levels of phenolic acids and flavonoids, including rasmorinic acid, known for its antioxidant and anti- inflammatory effects (Lim et al., 2018). Pharmacological studies support its traditional application in treating oxidative-stress-related diseases, with genotypic variations that influence its efficacy (Mangali, 2020).

In addition, Pimentel et al. (2022) revealed multiple pharmacological effects, including antidiabetic, nephroprotective, and antimicrobial properties. Leaf extracts inhibit the production of inflammatory mediators and free radicals, which supports its traditional use for inflammatory diseases and kidney disorders. They also highlight Balbas-pusa's potential to regulate blood glucose levels and alleviate obesity related symptoms. The combination of its bioactive compounds contributes to its effectiveness in managing chronic conditions like diabetes and hypertension (Mangali, 2020). The plant is primarily used for its diuretic properties that aid in treating kidney stones, cystitis, urethritis, gout, and other urinary tract disorders.

Orthosiphon aristatus extracts demonstrated antihypertensive, anti-inflammatory, and antioxidant activities clinically and experimentally. Key bioactive compounds, including rosmarinic acid, sinensetin, eupatorin, and

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ursolic acid, help reduce edema, inhibit nitric oxide production, and protect against oxidative tissue damage (Ashraf et al., 2018). Additionally, Nisa et al. (2021) mentioned that the plant exhibits antidiabetic effects by regulating glucose metabolism and insulin secretion, and by increasing and inhibiting carbohydrate-digesting enzymes, including β-glucosidase and α-amylase. In wound healing, including diabetic foot ulcers, Orthosiphon aristatus is known for its antiinflammatory, antioxidant, and antihyperglycemic activities. In oral administration, this plant extract has been reported to be non-toxic at high doses (Abdullah et al., 2020).

Orthosiphon aristatus, also known as Cat whiskers or Java tea, is renowned across Southeast Asia and other tropical regions for its diverse medicinal properties. Traditionally, this plant is utilized in Malaysia, Indonesia, Thailand, and the Philippines. The plant is primarily used to treat urinary tract infections, kidney stones, hypertension, diabetes, and inflammatory conditions (Pandalake et al., 2024). Research indicates that it has an effective diuretic, anti-inflammatory, antioxidant, antimicrobial, hepatoprotective, and antidiabetic effect (Ashraf et al., 2018). Additionally, the plant is valued in traditional medicine for its usefulness in the treatment of rheumatoid arthritis, gallstones, menstrual disorders, and respiratory disorders (Rizkita et al., 2023). These plants are commonly used to make tea or, in tropical regions, to make tea with their leaves.

Meanhile, in the words of Cordero et al. (2022), Orthosiphon aristatus, commonly known as balbas-pusa or kaling-gubat in the Philippines, is widely used as a medicinal herb in the country. It is a plant that naturally grows in thickets at low and medium altitudes in such provinces as Cagayan, Isabela, Nueva Ecija, Pampanga, Bulacan, and Rizal in Luzon and the Panay Island, including Iloilo Province in Visayas, Agusan del Norte, Davao del Sur, Zamboanga del Norte, Bukidnon, and Cotabato. Research in Panay and Bukidnon demonstrates that this plant is used as a diuretic or to treat kidney and urinary tract diseases and that this practice has remained unchanged over generation. The leaves are used in forms of decoctions or teas to treat hypertension, edema, inflammation, and urinary tract infections (Pimentel et al., 2022).

In Mindanao, O. aristatus is used in indigenous communities, including Manobo and Subanen, as a diuretic and treatment of kidney and urinary tract conditions, including urinary tract infection, kidney stones, hypertension, and edema (Cordero et al., 2022). To boost renal health and support detoxification, it is commonly brewed into tea. Indigenous medicine in Mindanao is known to have a rich biodiversity and cultural heritage, with O. aristatus serving as a source of medicine not only in indigenous healthcare but also in the development of potential drugs. On the other hand, Agik-agik, is a medicinal and culinary plant used in traditional medicine among various indigenous groups in the Philippines and other tropical regions.

According to Savant & Kareppa (2022). Agik-agik is known for its analgesic, antiinflammatory, and antimicrobial properties, largely attributed to its rich phytochemical profile, including alkaloids, flavonoids, and phenolic compounds. These findings justify the traditional uses of Agik-agik in pain relief and its emerging status as a nutraceutical resource. Ethnobotanical studies documented the uses of Agik-agik in treating oral health issues, wounds, and inflammation. The plant is also traditionally used to alleviate toothaches, muscle pain, and skin conditions, often as a poultice or a decoction (Baddu & Ouano, 2018).

Acmella oleracea is widely recognized for its medicinal and pharmacological applications, particularly its bioactive compounds, including spilanthol, which is a potent isobutylamide. The plant is traditionally used to treat toothache, gum infection, sore throat, and various inflammatory conditions due to its local anesthetic and anti-inflammatory effects (Savant & Kareppa, 2022). The significance of *Acmella oleracea* is also highlighted by its nutritional value, which is used in both food and medicinal plants in Filipino indigenous communities. These two roles promote conservation and proper interest in its phytochemical screening and pharmacological validation for a wider therapeutic application.

Recent in vitro studies by Shivananda et al. (2024) showed that ethanol extracts of Spilanthes acmella (synonym *Acmella oleracea*) demonstrate antibacterial activity against oral pathogens such as Streptococcus mutans and Lactobacillus fermentum, which are responsible for dental caries, and Porphyromonas gingivalis and Capnocytophaga gingivalis are associated with periodontal disease. The antimicrobial effects were said to be concentration-dependent, meaning that at higher concentrations they showed stronger inhibition zones, comparable in respect to those of erythromycin. In addition, an adjunctive randomized controlled clinical trial evaluated scaling and root planning (SRP) for the treatment of chronic generalized periodontitis.

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Moreover, local drug-delivery gels containing A. oleracea (1%) or Acacia catechu (1%) were used to treat 30 patients compared to SRP alone. Improvements in clinical parameters, including the gingival index, plaque depth, and clinical attachment level, were statistically significant over six months. However, microbial analysis showed nonsignificant but positive trends in reducing periodontopathogens. According to Verma et al. (2022), A. Oleracea gel combined with SRP has beneficial anti-inflammatory and healing effects in the management. These results scientifically validate the traditional uses of Agik-agik for toothache relief, oral wounds, and infection control, suggesting potential as a natural ingredient in dental care products.

Furthermore, the leaves and flowers of Agik-agik are commonly used in decoctions or poultices for oral health, respiratory conditions such as coughs and influenza, and as a remedy for rheumatism, dysentery, and gastrointestinal disorders (Savant & Kareppa, 2022). *Acmella oleracea* also exhibits significant antimicrobial, antifungal, and antimalarial activities, supporting traditional use of combating infectious diseases (Ahmad et al., 2025). Additionally, this plant is used in cosmetics for its Anti-wrinkle and muscle-relaxant properties, which also contribute to its vasorelaxant and antioxidant activities, making it an ingredient in anti-aging formulations (Ashraf et al., 2018). In modern applications, it is also used as a natural insecticide and food preservative (Savant & Kareppa, 2022). In general, there is a sustained scientific focus on *Acmela oleracea* due to its wide range of therapeutic applications, and it serves as a link between modern medicine and business.

Acmella oleracea, also called toothache plant in the Philippines, has a wide range of uses as an analgesic, anti-inflammatory, and antimicrobial agent. The flowers and the leaves of this plant are the most commonly used parts that have been used as decoctions or poultices in the treatment of toothache, sore throat, gum infections, and oral inflammations. The plant is commonly utilized as a herbal medicine for the digestive system and a natural insecticide due to its larvicidal effects against mosquito vectors in the Visayas (Savant & Kareppa, 2022). It also has anti-inflammatory potential, and it is used to treat skin (dermatitis) and eye (saccharomycosis) problems.

Phytochemical Analysis and Composition. Phytochemical screening is an important initial step in the assessment of medicinal plants, aimed at identifying the bioactive secondary metabolites that mediate their therapeutic properties. Compounds such as alkaloids, flavonoids, phenols, tannins, saponins, steroids, and terpenoids play a significant role in the pharmacological activities of the plant's extracts (Sharma et al., 2020). Studies have shown that flavonoids, alkaloids, and phenols are among the most abundant phytochemicals in many medicinal plants, contributing to the antioxidant, antimicrobial, anti-inflammatory, and anticancer properties. Examples of this include the phytochemical screening of traditionally used plants in Ethiopia, which revealed numerous plants with numerous occurrences of these compounds, which correlates well with observed antimicrobial activities (Dubale et al., 2023).

In Saudi Arabia, qualitative phytochemical investigations of medicinal plants have identified alkaloids, glycosides, saponins, tannins, and flavonoids as the prominent compounds. These phytochemicals justify the ethnomedical use of these plants in treating infections and other ailments (Alhaithloul, 2023). Phytochemicals detected during the screenings often serve as biochemical markers for drug development. The identification of such compounds supports further bioactive-guided fractionation and isolation to discover novel drugs with fewer side effects than synthetic drugs (Sharma et al., 2020; Batiha et al., 2020). Overall, phytochemical screening remains a fundamental investigative tool that provides scientific evidence for the use of traditional medicinal plants and serves as a foundation for pharmacological and toxicological studies.

Phytochemicals are bioactive chemical compounds produced by plants and contribute to their therapeutic properties. These organic substances can be categorized into primary metabolites, which are critical to plants, such as carbohydrates, proteins, and lipids. Polyphenols also act as antioxidants and have antiviral, antidiabetic, anticancer, and cardioprotective properties. The mechanism of this compound involves free radical scavenging and regulation of the enzyme activities in the disease mechanisms.

Secondary metabolites do not directly contribute to growth, but they provide protection and facilitation of ecological interactions (Thacker & Ram, 2024). Phytochemicals do not just help plants in their defense mechanisms; they are also of immeasurable health benefits to human beings. These compounds have antioxidant effects, which contribute to the neutralization of the free radicals, which, in turn, suppresses the oxidative stress

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as one of the primary causes of chronic disease, including cancer, diabetes, and cardiovascular conditions (Wang et al., 2023).

Polyphenols, flavonoids, alkaloids, saponins, tannins, terpenoids, and phytosterols are examples of secondary metabolites. Such compounds have shown a variety of biological activities, including antioxidant, antimicrobial, anti-inflammatory, anticancer, and hepatoprotective effects. Phenolic phytochemicals exhibit strong antioxidant activity, inhibiting lipid peroxidation and DNA damage, thereby supporting their use as cancer prevention and anti-inflammatory agents. Such compounds are simple phenols, phenolic acids, and complex polyphenols (Yang et al., 2020).

These phytochemical compounds in medicinal plants, as a group, have formed the pharmacological foundation for the traditional and modern therapeutic uses of these plants, and that is why phytochemical screening and characterization are important in drug discovery and development (Afzal et al., 2023). The bioavailability and pharmacokinetics of these phytochemicals have been improved through formulation advances, including nano capsulation, thereby increasing the therapeutic potential for their clinical applications. These findings prove that continued exploration of phytochemical compounds is vital to unlock novel therapeutic agents for human health.

Flavonoids. Flavonoids have anti-inflammatory, antibacterial, antiviral, and hepatoprotective properties. Flavonoids strengthen the immune system and protect against oxidative stress (Afzal et al., 2023). Flavonoids are a subclass of polyphenols; these compounds demonstrate antiviral, neuroprotective, cardioprotective, and immunomodulatory effects. The structural diversity of flavonoids interacts with multiple molecular targets, aiding the prevention and treatment of degenerative diseases (Yang et al., 2020).

Alkaloids. Nitrogenous compounds have significant effects in pharmacology, including analgesic, antimicrobial, anticancer, and anti-inflammatory activities. Common alkaloids include morphine, quinine, and caffeine (Afzal et al., 2023). Alkaloids also possess a wide range of bioactive compounds that act as analgesics, antimalarials, antiasthmatics, and CNS stimulants or depressants. The efficacy of these compounds, like quinine and morphine, in modern medicine underscores the relevance of phytochemical research (Patil & Patil, 2023).

Terpenoids. Another large group involved in the defense possesses anticancer, antimalarial, and anti-ulcer properties. Terpenoids are known to disrupt microbial membranes and inhibit tumor growth (Thacker & Ram, 2024). Recent advances have highlighted the role of terpenoids in cancer, as they induce apoptosis and inhibit tumor growth through multiple signaling pathways. Terpenoids' anti-inflammatory properties also make them a candidate for the management of chronic inflammatory diseases (Yang et al., 2020).

Saponins. Possesses antifungal, antimicrobial, hypoglycemic, and antiinflammatory effects and has been studied for its role in injury recovery and systemic diseases (Afzal et al., 2023). Saponins are naturally occurring glycosides present in many medicinal plants and have developed interests due to their wide range of biological activities. These compounds exhibit antioxidant and anticancer properties. They also contribute to cardiovascular health by reducing cholesterol levels by forming insoluble complexes with cholesterol and bile acids, thus inhibiting their absorption. In addition, these compounds show promising potential for managing diabetes by stimulating insulin secretion and enhancing glucose metabolism (Kumar et al., 2023).

Moreover, saponins are valued in the pharmaceutical and cosmetic industries for their surfactant and foaming properties, and are used in formulations such as shampoos and dental care products. The photoprotective effects of saponins also contribute to antiaging skincare through protection against ultraviolet radiation (Thacker & Ram, 2024).

Tannins. They are a class of polyphenolic compounds found in many medicinal plants, primarily known for their astringent properties and ability to precipitate proteins. Tannins exhibit antioxidant, antimicrobial, anti-inflammatory, and antiviral activities that are significant to their therapeutic potential. This compound helps protect plants against pathogens and oxidative stress, making it valuable for treating wounds and gastrointestinal disorders, and preventing cardiovascular damage caused by oxidative agents. The diverse bioactivities of tannin-rich plants support their use in both traditional and modern medicine (Kumar et al., 2023).

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The effectiveness of tannins is due to their presence in medicinal plants, which provide a natural defense mechanism that has been exploited in traditional healing practices worldwide. Their importance in phytotherapy is also supported by their ability to promote wound healing and manage infections through their capacity to precipitate proteins and their antimicrobial properties (Mazumder et al., 2022).

Phytosterols. Plays a role in cholesterol metabolism, anti-inflammatory and anticancer, and cardiovascular health (Thacker & Ram, 2024). These are plant sterol compounds that are structurally similar to cholesterol and are abundant in cereals, nuts, vegetables, and legumes. The most common of these compounds are beta-sitosterol, campesterol, and stigmasterol.

Phytosterols reduce blood cholesterol levels by interfering with cholesterol absorption in the intestines, which provides cardioprotective effects (Dogra & Kaushik, 2022). In addition to their lipid-lowering effects, phytosterols also possess antiinflammatory, anticancer, antidiabetic, and neuroprotective properties. For example, betasitosterol modulates key signaling pathways, such as NF-kB and ERK, thereby suppressing inflammation and tumor growth (Mustafa et al., 2022). Both saponins and phytosterols have attracted attention for their synergistic effects when combined with other therapeutic compounds and as a natural alternative for managing chronic diseases with minimal side effects (Thacker & Ram, 2024).

Ethnobotanical Knowledge and Medicinal Plant Diversity in Mindanao. Mindanao, the second-largest island in the Philippines, is known for its biodiversity, including a wide variety of medicinal plants. Ethnobotanical studies identified over 530 verified medicinal plant species across 372 genera and 118 families in Mindanao, including Fabaceae, Asteraceae, and Lamiaceae, among the most represented families, with common genera including Ficus and Psidium. Moreover, ethnolinguistic diversity and adaptation to local flora were reflected in the fact that 28 out of such medicinal plant species are threatened nationally or globally, which testifies to the vulnerability of these resources (Meñiza et al., 2024).

Knowledge of these plants is mainly passed down by indigenous peoples such as the B'laan, Manobo, Mamanwa, and Maguindanaoan. These groups used to address basic diseases, such as digestive issues, infections, and inflammation, by using methods such as leaf decoctions (Nuneza et al., 2021; Pucot et al., 2019). The plants not only have therapeutic resources, but are also culturally important, and the most important means of preservation is oral delivery of knowledge. This knowledge of ethnobotany not only provides the local communities with immediate health care, but also creates a valuable repository for drug discovery, biodiversity conservation, and utilization of sustainable initiatives that focus on the indigenous knowledge.

Based on the ethnobotanical study, the most mentioned medicinal plants in Mindanao, Philippines, were Euphorbia hirta L. and Psidium guajava L. These species are frequently used in local traditional medicine for treating a variety of ailments (Meñiza et al., 2024). Others include Piper decumanum (lunas-bagon tapol), Anodendron borneense (lunas-taguli), Micromelum minutum (lunas-kahoy), Arcangelisia flava (albutra), and Cinnamomum mercadoi (kaningag). These plants are typically used to treat insect and snake bites, reproductive health issues, cancer, ulcers, diarrhea, infections, and other conditions among the tribal communities of Mindanao, including Agusan Manobo (Sarmiento, 2020). Additionally, Annona muricata (soursop) is widely used to treat multiple diseases, including urinary tract infections, cancer, and hypertension, and has demonstrated pharmacological activities (Cordero et al., 2022).

Furthermore, recent phytochemical analyses of these plants have identified key bioactive secondary metabolites, including alkaloids, flavonoids, saponins, tannins, terpenoids, sterols, and phenols. The said compounds are responsible for the antimicrobial, antioxidant, anti-inflammatory, and anticancer properties that support their traditional therapeutic uses, biochemical studies. Notably, species such as Abelmoschus esculentus (okra), Clitoria ternetea (balog-balog), and Luffa acutangula (patola) exhibit various bioactivities, confirmed by phytochemical and pharmacological tests. These findings underscore the potential of medicinal plants in Mindanao as a natural source of bioactive compounds for drug development. However, some species are endangered by habitat loss and overharvesting, which is why it is so important that conservation activities are recorded and verified by scientific methods. Ethnobotany and phytochemistry are two fields that can be used to enhance each other in order to improve the preservation of indigenous knowledge and the development of sustainable healthcare solutions (Acosta et al., 2022).

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Scientific Proof of Traditional Knowledge. The B'laan tribe is an indigenous cultural group that primarily lives in the Mount Matutum Protected Landscape and other portions of Southern Mindanao, Philippines. Their strong connection to nature is part of their heritage, reflected in the tribe's extensive traditional ethnomedicinal knowledge of plants. It was reported that 100 medicinal plant species were found and they represented 30 plant families, such as gmelina, balbas-pusa, and agik-agik, which the tribe uses in treating a diverse range of illnesses infections, inflammation, and chronic diseases (Pucot et al., 2019).

Medicinal plants are an essential part of the B'laan healing systems, and the most prevalent are roots and leaves that are typically prepared as a decoction and then given orally. Ethnomedicinal knowledge is passed orally from generation to generation. It encompasses holistic forms of healing that involve the use of herbal medicines and rituals conducted by traditional healers of Babaylans, who also perform spiritual healing rituals (Awoke & Cosendey, 2025).

Nonetheless, B'laan health systems have changed significantly due to external factors, including government healthcare intervention, modernization, and acculturation to Western medicine. Such changes influence the use and transfer of indigenous health knowledge, such as herbal practices, resulting in a reduced increase in the number of traditional healers and changes in health-seeking practices (Cordero et al., 2022).

Nevertheless, the cultural identity and traditional medical practices of the B'laan tribe continue to provide valuable insights into biocultural conservation and pharmacological studies of the medicinal plants they use (Alinsug et al., 2022; Pucot et al., 2019). Additionally, an ethnobotanical survey of the B'laan tribe in Southern Mindanao shows a strong tradition of using locally available plants, including Gmelina, Balbas-pusa, and Agik-agik, to treat several ailments. The paper emphasizes the need to conserve knowledge by scientifically validating it, since the existing information regarding their phytochemical properties is scarce (Alinsug et al., 2022; Vigor, 2025). Moreover, through the isolation and characterization of phytochemicals, researchers can perform a correlation of particular plant compounds with ethnomedicinal claims by providing biochemical data that supports the traditional knowledge.

Plants contain flavonoids and tannins, which are usually associated with their application in the treatment of infections and inflammation and scientifically confirmed the assertions about remedies (Sharma et al., 2020). More so, phytochemical screening is the basis of future pharmacological studies and drug development because it establishes promising compounds found naturally in plants that have anecdotal efficacy (Najmi et al., 2022). This is a scientific practice that maintains native knowledge and combines it with contemporary medicine, which encourages the logical application of herbal medicines.

Medicinal Plants Used by the B'laan Tribe of South Cotabato. The researchers have conducted an ethnobotanical study about the medicinal plants used by the B'laan tribe residing in Barangay Assumption, Koronadal, South Cotabato. Their study shows that the tribe suffers from a variety of illnesses inherited from ancestors. Some of the most frequently mentioned medicinal plants are Gmelina, Balbas-pusa, and Agik-agik, which are widely used because of their efficacy and abundance in the area. These plants were used for treating cough, diabetes, and toothache, respectively.

Tribe healers and other residents were interviewed for the study, wherein they recorded various medicinal plants, including Gmelina, Balbas-pusa, and Agik-agik. The leaves of Gmelina, or Gmelina arborea, were used as a poultice to treat cough. They roll the leaves between their palms until the leaf extracts are obtained. They will then spread the mashed leaves evenly over the patient's back and chest. It is said to soothe and relieve cough and cold, supported by a study by Pucot et al. (2019). Phytochemical screening of the plant has already been recorded; however, this study will focus on the leaves of Gmelina arborea.

The Orthosiphon aristatus, or the balbas-pusa, was used by the B'laan tribe as a treatment for diabetes and menstrual disorders using the leaves and flowers as a decoction or tea (Pilapil et al., 2024). The plant leaves have already been screened for phytochemicals, prompting the researchers to focus on the plant's flowers. Furthermore, the B'laan tribe primarily used Agik-agik as a poultice for treating toothache. The plant's flower is crushed and applied to the affected area. Another plants they use in treating toothache is Tinospora rumphii, or locally known as "Panyawan", wherein they use its sap as a drop, they will apply the sap on the side of the

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eye opposite to where the affected tooth is located. They also use this plant for treating diabetes. The plant's flowers have already been screened for phytochemicals, prompting the researchers to focus on its roots.

Theoretical Framework

This study is anchored on the non-random medicinal plant theory by Daniel Moerman in 1979. This theory holds that traditional medicinal practices do not select plants randomly; instead, plant selection is often influenced by therapeutic efficacy. This phylogenetic analysis indicates that certain plant families are used in traditional medicine, suggesting that cultural selection is partially based on their medicinal properties.

Leaves of Gmelina (*Gmelina arborea*), Babas-pusa (*Orthosiphon aristatus*), and Agik-agik (*Acmella oleracea*) are known as medicinal plants practiced by the B'laan Tribe of Brgy. Koronadal, Assumption, South Cotabato. It is known that medicinal plants contain a broad range of bioactive compounds, including alkaloids, Flavonoids, tannins, saponins, terpenoids, and phenolic compounds. It is these compounds that give these plants health benefits (Sharma et al., 2020). All phytochemical classes have distinct pharmacological actions, and they are also important in both traditional and alternative medicine.

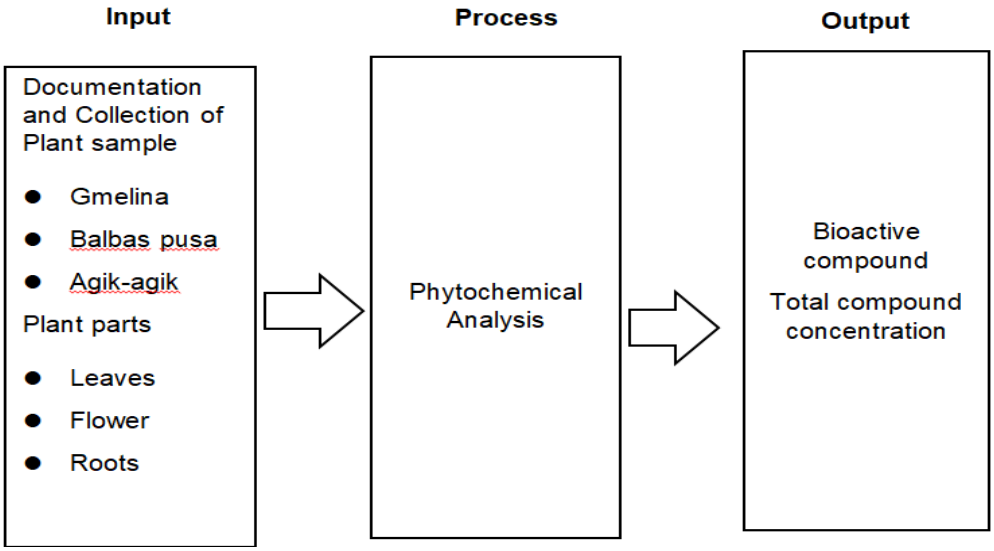

Figure 1. Conceptual Framework

Statement Of the Problem

The objective of this paper was to determine some of the phytochemical characteristics of medicinal plants used by the B'laan tribe.

Specifically, it will attempt to respond to the following questions:

1. Which bioactive compounds do you find in each of the chosen medicinal plants?

1.1 Gmelina (*Gmelina arborea)*

1.2 Balbas-pusa (*Orthosiphon aristatus)*

1.3 Agik-agik (*Acmella oleracea)*

2. What are the bioactive concentration of total bioactive compounds in each plant?

2.1 Gmelina (*Gmelina arborea)*

2.2 Balbas-pusa (*Orthosiphon aristatus)*

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2.3 Agik-agik (*Acmella oleracea)*

Scope And Delimitations

The phytochemical screening of three medicinal plants that are traditionally used as medicine by the B'laan tribe in South Cotabato, which are Gmelina (*Gmelina arborea*), Balbas pusa (*Orthosiphon aristatus*), and Agik-agik (*Acmella oleracea*), was used as a topic of the study. This study was carried out during the academic year 2025-2026. In Barangay Assumption, Koronadal, South Cotabato, the researcher intended to determine the existence of the major bioactive compounds, including alkaloids, flavonoids, tannins, saponins, terpenoids, and phenolics. This result is put into perspective within the non-random theory of medicinal plant selection. Yet the study is geographically restricted to a single indigenous group and may not accurately reflect ethnobotanical practices of other cultures and regions. This study also used a laboratory-based method to identify phytochemicals present and their concentrations in selected medicinal plants used by the B'laan tribe. The plant parts were kept in clean, labeled zip-lock pouches and tested by using standard procedures. The positive and negative values were determined to show the presence of various compounds, and the overall concentration was observed in the chosen medicinal plant. The experiment was not a test of the of the compounds, medical action of the compounds, but rather to determine all the compounds.

Significance Of The Study

The study is useful to the following:

Local Communities. For the B'laan tribe and other nearby communities, the study enhanced cultural pride and increased awareness of the medicinal resources found in their environment. It also emphasized the need for sustainable harvesting methods.

Local Health Office. This research supported the value of both alternative and traditional medicine practices. It also contributed to the development of herbal medicines and their possible inclusion in the local healthcare system.

Ethnobotanists and Pharmacologists. This research provided a valuable reference for identifying potential new drug sources and reinforced the role of indigenous knowledge in bioprospecting. It may also pave the way for further investigations into plant-based pharmaceuticals.

Future Research. The study provided a foundation for further scientific research on the effectiveness, safety, and active components of traditional medicinal plants in the Philippines and other regions.

Definition Of Terms

The following terms and concepts are defined conceptually as used in the research investigation.

Agik-agik. This term refers to a trailing herbaceous plant and is widely used by traditional medicine to treat toothache, fever, malaria, and as an anticancer plant (Rondanelli et al., 2020).

Balbas Pusa. This term refers to a medicinal herbal plant commonly known as 'cat whiskers' used by traditional medicine for hypertension (Ashraf et al., 2018).

B'laan Tribe. This term refers to one of the indigenous people (IP) who have their own traditional belief in life, famous for their traditional colorful costumes (Fajinmi & Oloyede, 2025)

Gmelina. This term refers to a method widely used in traditional medicine, with various ways to treat many disorders. It possesses properties such as wound-healing, antidiabetic potential, analgesic, and antioxidant (Warrier et al., 2021).

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Documentation and Sample Collection. This term refers to the methodical procedure of documenting traditional knowledge by means of key informant interviews and the collection of plant specimens from the research region for further laboratory investigation (Liu & Liu, 2023).

Phytochemical Screening. This term refers to the laboratory procedure used to detect the secondary metabolites found in plants. In this study, phytochemical tests were performed to identify which compound groups were present in the selected medicinal plants (Dubale et al., 2023).

Phytochemical Analysis. This term refers to the laboratory procedure used to determine the quantitative concentration of bioactive substances in a plant extract. Milligrams per gram (mg/g) of plant material is a common unit of measurement for these assays (Sawalha et al., 2025).

METHODS

This clearly defines the research methods used to conduct the study. The researcher explains how the necessary data and information to address the research objectives and questions were collected, presented, and analyzed. Reasons and justification for the research design, research instrument, data collection techniques, and research procedures.

Research Design

The researcher used a descriptive research design. This approach will explain and give meaning to the current status of the sampled medicinal plants Gmelina (*Gmelina arborea*), Balbas pusa (*Orthosiphon aristatus*), and Agik-agik *(Acmella oleracea*) used by the B'laan Tribe. This study is not intended to manipulate variables; therefore, it will be used in conjunction with laboratory analysis to determine the types and concentration levels of phytochemicals in these plants. Most approaches are considered descriptive because they enable the researcher to organize and analyze data obtained through laboratory tests and observations. As defined by Shinija (2024), descriptive research is a type of research in which variables are used to describe features of a population or a phenomenon under investigation. It creates a clear, accurate picture of facts, actions, and interactions without altering them. The design assists the researcher in describing and recording the phytochemical characteristics with the actual laboratory findings and observations.

Research Locale

This study was conducted in Barangay Assumption, Koronadal, located in South Cotabato. Koronadal is part of the municipality in the SOCCSARGEN region in Mindanao. The city has 27 barangays, including Barangay Assumption. It serves as the capital province of SOCSARGEN, where Koronadal is situated, and is known for its rich culture, fertile agricultural land, and diverse communities composed of indigenous groups, settlers, and migrants. Koronadal originated from two B'laan words: koron, meaning cogon grass, and nadal, meaning plain. In the past, they called it marbel, which comes from the word murky waters. When the locals lived in the city, these names best reflected the location. This region lies in the southeastern part of Davao and is home to the B'laan people.

The B'laan people's name possibly originates from the prefix "bla," meaning "opponent," and the suffix "an," meaning "people." A recent 2021 DNA analysis revealed that the B'laan people have Papuan admixture. According to the 2020 census, 2,291 individuals currently reside in Brgy. Assumption, accounting for 1.17% of Korondal's total population. The establishment of General Santos in 1939 led to the displacement of some B'laan natives due to the city's development. Assumption is formerly known as 'Bulol', and is situated at approximately 6.4459, 124.8401, in the island of Mindanao. The elevation at these coordinates is estimated at 322.6 meters (1,058.4 feet) above sea level.

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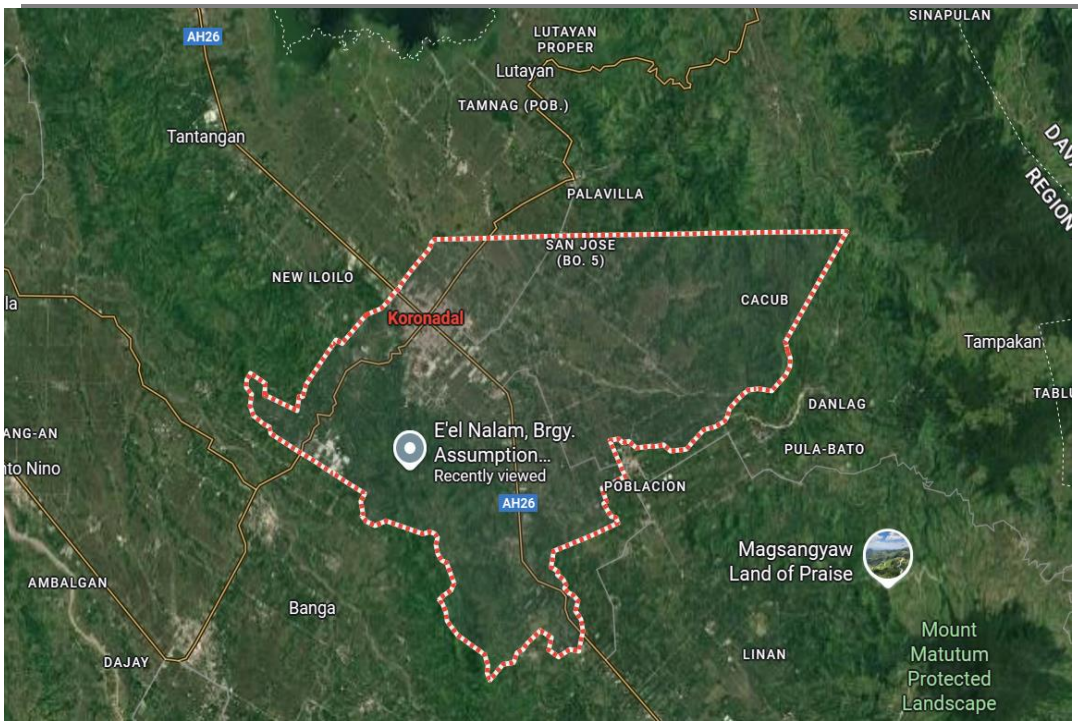

Figure 2. Map of Koronadal City, Highlighting Barangay Assumption

Research Instruments

In this study, researchers used a mobile phone for taking pictures and documentation, a journal notebook for writing important details, scissors were used to cut the needed plant parts, such as the intermediate leaves of Gmelina and flowers of Balbas- pusa and roots of Agik- agik. The collected samples were then placed in labeled zip-lock pouches in each plant sample for proper storage and transport. Furthermore, this study tested the phytochemical compounds present on selected medicinal plants of the B'laan tribe, specifically, Gmelina (*Gmelina arborea*), Balbas-pusa (*Orthosiphon aristatus*), and Agik-agik (*Acmella oleracea*). The phytochemical screening used a descriptive method to elaborate on the results and ensure clearer and well-explained results. In doing so, the claims about the tribe's effectiveness and knowledge were shown to be scientifically valid.

The presence of phytochemicals was determined using the laboratory's qualitative scale:

Table 1: WVN Research Laboratory (Qualitative scale)

Qualitative Scale	Description
+++	Strongly Positive
++	Moderately positive
+	Weakly positive
-	Negative

Research Procedure

This part of the study describes the processes used in conducting the study. It describes how the processes were gathered and how the ethical and environmental principles were maintained during the research.

Authorization for Collection. The formal letter of permission was also taken to the relevant local authorities in the places where the plant species naturally occur before plant samples were collected. This also ensured that the collection process complied with local environmental regulations and research ethical standards.

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Collection of Plant Samples. Gmelina, Balbas-pusa, and Agik-agik plant specimens were collected from their natural habitats. The right consent was obtained by obtaining a letter of permission from the relevant local authorities before the collection was done ethically and legally.

Selection of Plant Material. The sampling was conducted on healthy and mature plants. Certain sections of every plant were targeted: Gmelina is Intermediate leaves, Balbas-pusa is flowers, and Agik-agik is roots.

Sample Handling. To avoid contamination during handling, rubber gloves were used. The plant parts were cut with clean and sterilized instruments, e.g., scissors. All collected samples were properly handled to prevent physical damage and contamination.

Labeling and Documentation. Name tags were affixed to all samples, including the collection date and other pertinent information. This information was also documented in a journal notebook for reference and tracking.

Storage and Transport. The samples of the different parts of the plants had been collected in individually labeled zip-lock bags. The samples were kept in a clean environment and mishandled to avoid cross-contamination. Labeling and documentation were properly in place to preserve the reliability and validity of the further phytochemical testing.

Submission for Phytochemical Analysis. Phytochemical screening of the plants and the labeled were forwarded to the WVN Research laboratory in Davao City, Davao del Sur, Philippines. The laboratory study will determine the bioactive compounds contained in and the quantity of the selected medicinal plants. This will help to confirm the claims of traditional medicines and justify their possible use in the treatment of certain diseases.

Presentation, Analysis, And Interpretation Of Data

In this chapter, the researcher presented and commented on the outcomes of the phytochemical screening of the three chosen medicinal plants used by the B'laan tribe. This analysis is based on the official results provided by the WVN Testing and Research Laboratory.

Bioactive Compounds Present in Each Selected Medicinal Plant Extract.

Gmelina (*Gmelina arborea).* The study employed qualitative phytochemical screening methods to identify and characterize bioactive compounds in the plant. The results were presented in:

Table 1: Gmelina (*Gmelina arborea).*

Phytochemical compound	Qualitative Screening	Qualitative Description
Alkaloids	+	Weakly positive
Flavonoids	+++	Strongly positive
Tannins	+++	Strongly positive
Saponins	-	Negative
Plobotanins	++	Moderately positive
Steroids	++	Moderately positive
Glycosides	+	Weakly positive

Table 1 presents the results of the quantitative screening of Gmelina (*Gmelina arborea*), which revealed important bioactive compounds present in the plant. Bioactive compounds such as flavonoids and tannins were

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strongly present (+++) in the Gmelina, indicating that the plant has antioxidant, anti-inflammatory, and antiviral potential. These results align with the claims that G. arborea contains flavonoids, tannins, terpenoids, and saponins (Offor et al., 2016; Yang et al., 2020). These compounds support the tribe's claims for treating common sicknesses such as cough, fever, urinary tract infections, hypertension, and wounds (Cordero et al., 2022). Some also use this to treat rheumatism, according to Pucot et al (2019).

Plobotannins and steroids were also found in the plant sample in moderate (++) amounts, suggesting additional benefits beyond the plant's antimicrobial, anti-inflammatory, and diuretic effects of the plant. This corresponds with studies that Gmelina contains hepatoprotective, antidiabetic, antimicrobial, and antipyretic properties. Analgesic and anti-inflammatory actions have been linked to inhibition of prostaglandin synthesis and modulation of inflammatory mediators, which supports its use in pain and inflammation management (Arora & Tamrakar, 2017). Glycosides and alkaloids were weakly present (+), indicating that the plant has therapeutic effects, such as analgesics.

However, saponins were not detected in the plant, indicating that they do not contribute to medicinal properties. Though literature emphasized its importance as a natural glycoside with notable hypoglycemic and antidiabetic activity. Saponins are reported to stimulate insulin secretion and enhance glucose metabolism, which makes them promising for managing diabetes (Thacker & Ram, 2024; Kumar et al., 2023).

In general, Gmelina arborea contains beneficial phytochemicals, which explains its traditional and modern use as a herbal medicine. The strong presence of flavonoids and tannins, supported by ethnobotanical and pharmacological studies, shows that Gmelina is a valuable natural remedy for cough, inflammation, and infections (Arora & Tamrakar, 2017).

Balbas-pusa (*Orthosiphon aristatus*). The study employed qualitative phytochemical screening methods to identify and characterize bioactive compounds in the plant. The results are presented in:

Table 2: Balbas-pusa (*Orthosiphon aristatus*)

Phytochemical compound	Qualitative Screening	Qualitative Description
Alkaloids	-	Negative
Flavonoids	++	Moderately positive
Tannins	++	Moderately positive
Saponins	-	Negative
Plobotannins	+	Weakly positive
Steroids	+	Weakly positive
Glycosides	+	Weakly positive

Table 2 presents the qualitative screening of Balbas-pusa (*Orthosiphon aristatus*). The table presented the presence (+) or absence (-) of plants that contain several important bioactive compounds found in the plant extract. Flavonoids and Tannins were moderately positive (++), indicating that the plant has high antioxidant and anti-inflammatory potential. These findings align with the literature, which states that O. aristatus contains phenolic acids and flavonoids, particularly rosmarinic acid, which contribute to the antioxidant and anti-inflammatory activities. These compounds support their traditional use for urinary problems and kidney cleansing, consistent with studies showing that the plant is widely used as a diuretic and for treatment of urinary tract infections, kidney stones, hypertension, and inflammation (Pimentel et al., 2022). Plobotannins, steroids, and glycosides were also detected weakly positive (+). Their presence suggests additional benefits, including antimicrobial, diuretic, and anti-inflammatory effects.

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This is consistent with reports that Orthosiphon aristatus exhibits nephroprotective, antidiabetic, and antimicrobial properties, with key compounds such as sinensetin, eupatorin, and ursolic acid contributing to these effects (Ashraf et al., 2018; Nisa et al. (2021). In the meantime, Alkaloids and Saponins showed a negative (-) result, indicating that they do not play a major role in the medicinal value of this plant. The literature, however, highlights that saponins, naturally occurring glycosides, contain significant hypoglycemic and antidiabetic actions. It is reported that they trigger insulin release and improve glucose utilization, making them an effective choice in managing diabetes (Thacker & Ram, 2024; Kumar et al., 2023).

Generally, the findings demonstrate that Balbas-pusa contains beneficial phytochemicals that support the conventional and contemporary application of the herb as an alternative medicine. Ethnobotanical and pharmacological research has shown that the plant contains high levels of flavonoids and tannins, indicating that the product can be used as an effective natural detoxifier for the treatment of urinary infection, inflammatory, and metabolic disorders (Pilapil et al., 2022).

Agik-agik (*Acmella oleracea*). The study employed qualitative phytochemical screening methods to identify and characterize bioactive compounds in the plant. The results are presented in:

Table 3: Agik-agik (*Acmella oleracea*)

Phytochemical compound	Qualitative Screening	Qualitative Description
Alkaloids	-	Negative
Flavonoids	+	Weakly positive
Tannins	+	Weakly positive
Saponins	-	Negative
Plobotannins	+	Weakly positive
Steroids	+	Weakly positive
Glycosides	+	Weakly positive

Table 3 illustrates the results of the qualitative screening of Agik-agik (*Acmella oleracea*). The table presented the presence (+) or absence (-) of different bioactive compounds found in the plant extract.

The results showed that flavonoids, tannins, plobotannins, steroids, and glycosides tested weakly positive (+), indicating that these compounds are present in Agik-agik. These phytochemicals are recognized to have many biological functions. Just like flavonoids have anti-inflammatory, antimicrobial, antiviral, and hepatoprotective properties, and are synthesized by plants in response to microbial infection. It can help nourish the immune system and provide protection against oxidative stress (Afzal et al., 2023). And tannins also have antioxidant, antimicrobial, and anti-inflammatory properties, which are important for medicinal properties. And it can prevent cardiovascular damage caused by oxidative agents (Kumar et al., 2022). Saponins possess anti-fungal, hypoglycemic, and anti-inflammatory effects, and these properties have been studied for their role in injury recovery and systemic disease.

Glycosides present in many medicinal plants have attracted attention due to their diverse biological activities. These compounds exhibit antioxidant and anticancer properties. They also contribute to cardiovascular health by reducing cholesterol levels by forming insoluble complexes with cholesterol and bile acids, thus inhibiting their absorption. In addition, these compounds also show promise in managing diabetes by stimulating insulin secretion and enhancing glucose metabolism (Thacker & Ram, 2024; Kumar et al., 2023).

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The benefits of steroids include regulating cholesterol metabolism, possessing anti-inflammatory and anticancer effects, and contributing to cardiovascular health (Thacker & Ram, 2024). Phlobotanins are also present in Agik-agik. These compounds are found to have rich antioxidant and anti-microbial activities.

The Total Bioactive Compound Concentrations Present in Each Plant.

Gmelina (*Gmelina arborea*). The study employed quantitative phytochemical screening methods to identify and quantify the concentrations of bioactive compounds of the plant. The results are presented in:

Table 4: Gmelina (*Gmelina arborea)*

Phytochemical test	Quantitative concentration
Alkaloids	3.52
Flavanoids	16.52
Tannins	15.21
Plobotannins	7.56
Steroids	1.42
Glycosides	3.25

Table 4 showed the quantitative concentrations of Gmelina (*Gmelina arborea*). Gmelina leaves, expressed in milligrams per gram (mg/g) using appropriate standards. Among the said compounds, flavonoids have the highest concentration (16.52 mg/g as quercetin). This result shows that Gmelina arborea is rich in flavonoids, which are its primary source of antioxidant and anti-inflammatory properties. As shown, tannins also have a high concentration (15.21 mg/g as tannic acid). Tannins have antimicrobial properties that support the traditional use of Gmelina as treatment for cough, colds, and fever. In addition, the presence of phlobotannins, glycosides, alkaloids, and steroids may improve the plant's overall biological effects as a traditional medicine.

Though there are no fixed standards, Offor et al (2016) report saponins (3.85 ± 0.07 mg/100g), glycosides (1.77 ± 0.06 mg/100g), phenols (0.32 mg/100g), and lower levels of tannins, flavonoids, alkaloids, and steroid ranges (0.06–0.09 mg/100g). In general, the phytochemicals identified in this test were identical to those reported in previous studies. These findings provide validation and support for the traditional use of Gmelina arborea in the treatment of cough, cold, and fever.

Balbas-pusa (*Orthosiphon aristatus*). The study employed quantitative phytochemical screening methods to identify and quantify the concentrations of bioactive compounds of the plant. The results are presented in:

Table 5: Balbas-pusa (*Orthosiphon aristatus*)

Phytochemical test	Quantitative concentration
Flavonoids	14.22
Tannins	10.24
Plobotannins	5.26
Steroids	1.23
Glycosides	2.12

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Table 5 showed the quantitative concentrations of Balbas-pusa (*Orthosiphon aristatus*). Using properly situated standards, the *O. aristatus* flower was calculated in milligrams per gram (mg/g). These compounds included flavonoids, which had the highest concentrations (14.22 mg/g quercetin equivalent). The given outcome aligns with previous research, indicating that *O. aristatus* is rich in flavonoids and phenolic compounds that have been reported to have potent antioxidant and anti-inflammatory properties.

The tannins were also found in significant contents (10.2410.88 mg/g tannic acid equivalent). These compounds possess antimicrobial and anti-inflammatory effects, which may explain the traditional use of *O. aristatus* as a medicinal treatment for kidney and urinary tract issues. Furthermore, the inclusion of phlobotannins, steroids, and glycosides could supplement the overall biological impacts of the plant.

According to the Committee on Herbal Medicinal Products (2021), a high percentage of rosmarinic acid (3 mg/g dried leaf) is used as a quality indicator; Philippine research shows 1.594-2.957 mg/200g sample. Overall, the phytochemicals identified in this study are similar to those reported in previous research. These findings provide scientific validation for the traditional use of O. aristatus in managing diabetes, kidney-related, inflammatory, and metabolic conditions.

Agik-agik (*Acmella oleracea*). The study employed quantitative phytochemical screening methods to identify and quantify the concentrations of bioactive compounds of the plant. The results are presented in:

Table 6: Agik-agik (*Acmella oleracea*)

Phytochemical test	Quantitative concentration
Flavonoids	12.65
Tannins	11.28
Plobotannins	4.23
Steroids	1.32
Glaycosides	2.45

Table 6 showed the quantitative concentrations of agik-agik (*Acmella oleracea*). Acmella roots, expressed in milligrams per gram (mg/g) using appropriate standards. Among these compounds, flavonoids have the highest concentration at (12.65 mg/g as quercetin). This indicates that flavonoids are the predominant bioactive compounds in Acmella roots, with anti-inflammatory and antimicrobial properties that support immune system function. Flavonoids are known for their antioxidant properties and for defending cells from oxidative stress. Tannins are also present at a high concentration (11.28 mg/g as tannic acid). The essential tannin contents that Acmella roots possess also include antioxidants, anti-microbial, and anti-inflammatory compounds, which are important to medicinal properties. At the same time, the saponins were detected at a moderate concentration of 4.23 mg/g, indicating that they have an anti-fungal, hypoglycemic, and inflammatory effect and play a role in injury recovery and systemic disease.

In contrast, glycosides and steroids were found at lower concentrations, measuring 2.45 (mg/g) and 1.32(mg/g), respectively. Even at a lower level, this compound remains biologically important. Glycosides may contribute to cardiovascular health; these compounds also show antidiabetic potential and hypoglycemic activity, while steroids are closely tied to cholesterol metabolism regulation and anticancer effects.

Spilanthol content reaches 99.97% in several species in the genus Acmella, including *A. Oleracea*, with no standard concentration on their bioactive compounds (Alperth et al., 2024). Overall, the results indicate that Agik-agik (*Acmella oleracea*) is rich in phenolic compounds, particularly flavonoids and tannins, which likely contribute significantly to its biological and medicinal properties. These findings provide validation and support for the traditional use of Agik-agik (*Acmella oleracea*) in treating toothache (Pilapil et al., 2022).

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SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

This chapter summarizes the study's findings, conclusions, and recommendations. It focuses on the phytochemical composition of the selected medicinal plants used by the B'laan tribe and discusses their significant medicinal value.

Summary Of Findings

The results provided by the WVN Testing and Research Laboratory, by conducting two tests, which are the qualitative and the quantitative tests on the plants *Gmelina arborea*, *Orthosiphon aristatus*, and *Acmella oleracea*, are shown in the tables below:

1. Results showed that Gmelina possesses a great number of flavonoids and tannins, as they appear to be strongly positive (+++). Gmelina also contains phlobotannins and steroids, which showed to be moderately positive (++). Lastly, the test also shows that Gmelina contains glycosides and alkaloids in minimal amounts, as indicated weakly positive (+), and the absence of saponins. These compounds help in the overall effectiveness of *Gmelina arborea* in traditional healing, as these compounds are responsible for the antimicrobial, anti-inflammatory, antipyretic, analgesic, antiviral, and antioxidant.

2. Flavonoids and tannins were found to be moderately positive (++) while phlobotannins, steroids, and glycosides are weakly positive (+). However, both alkaloids and saponins were absent. The qualitative result for the Balbas-pusa may not be strongly positive, but it still serves its purpose traditionally in the tribe's practice. The compounds present are responsible for the antimicrobial, anti-inflammatory, antidiabetic, and diuretic effects, which the tribe uses in treating diabetes.

3. Results showed that flavonoids, tannins, phlobotannins, steroids, and glycosides are weakly positive (+). However, alkaloids and saponins were absent. These compounds may be weakly positive throughout the plant. However, significantly enhance the plant's overall effect in relieving toothache as they have anti-inflammatory, antimicrobial, antiviral, and antioxidant properties.

4. Flavonoids have the highest amount of 16.52 mg/g, followed by tannins with 15.21 mg/g as the most abundant compound in the plant. Phlobotannins also show significant levels of 7.56 mg/g, glycosides at 3.25 mg/g and 3.52 mg/g, respectively, and a low concentration of steroids containing only 1.42 mg/g. This amount of concentration is significant for the benefits and healing properties of gmelina.

5. This data shows that flavonoids are the most dominant compound with a concentration of 14.22 mg/g, followed by tannins with 10.24 mg/g. Phlobotannins showed the highest concentration at 5.26 mg/g, while glycosides and steroids had the lowest concentration of 2.12 mg/g and 1.23 mg/g, respectively. These concentrations are significant in the overall effect of the Balbas-pusa as a treatment for diabetes.

6. Tests revealed that flavonoids have the highest concentration of 12.65 mg/g, followed by tannins with 11.28 mg/g. Phlobotannins, glycosides, and steroids have the lowest concentration with 4.23 mg/g, 2.45 mg/g, and 1.32 mg/g, respectively. The effectiveness of the plant as medicine or treatment for inflammation and infections has been supported by this level of concentration.

CONCLUSIONS

The results indicated the presence of medicinally relevant compounds in the plants that were being tested. *Gmelina arborea*, *Orthosiphon aristatus*, and *Acmella oleracea* contain important phytochemicals that contribute to therapeutic efficacy. All plant samples contain flavonoids and tannins, indicating that these phenolic compounds play major roles in plants as antioxidants, antimicrobials, and anti-inflammatory properties. *Gmelina arborea* has the richest phytochemical profile, supporting its traditional use in the treatment of fever, cold, and cough. Important phytochemicals linked to diabetes, kidney-related conditions, inflammation, and metabolic conditions are found in *Orthosiphon aristatus.* Despite having a lower concentration, *Acmella oleracea* demonstrated a vital bioactive compound that supports its use for toothaches.

It is strongly recommended that the traditional use of these plants be supported, and confirms that these natural sources of bioactive compounds have potential for pharmacological therapeutic research.

RECOMMENDATIONS

According to the results of the research conducted within the framework of the current study, it is possible to suggest the following recommendations to conduct future research and practice:

1. B'laan traditional healers and indigenous communities are motivated to continue preserving and practicing their traditional healing knowledge. These practices should be documented and validated to conserve cultural heritage and acknowledge the great contributions of owners of indigenous knowledge in community healthcare and scientific progress. The outcomes of these phytochemical studies can serve as scientific evidence to demonstrate the safety, efficacy, and stability of the traditional remedies, as well as facilitate cooperation with contemporary medical practice.

2. The communities, especially the B'laan tribe and those around them, are also urged to enhance their knowledge and understanding of medicinal plants found in and around them. Its natural resource sustainability would prevent the company by encouraging sustainable harvesting and conservation programs to ensure the long-term availability of these superior natural resources.

3. This research might be utilized by local health offices as a reference to perceiving the prospect of traditional and alternative medicines. The outcome could aid in the development, legislation, and potential introduction of safe herbal medications in the local health services and community-based health systems.

4. This study can be used by ethnobotanists and Pharmacologists as a source of information on the identification of medicinal plants that have applications in the pharmaceutical industry. The results indicate the importance of native understanding of bioprospecting and can serve as a basis for other studies on plant-based drug development based on plants.

5. As research in the future, it is recommended that committed researchers employ more studies to extend the effectiveness, safety, and active constituents of the traditional medicinal plants in the Philippines, as well as in other areas. It is suggested that laboratory studies, clinical validation, and comparisons ne conducted to enhance the science of traditional medicines.

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