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Evaluation of the nutritional and antibacterial activities of aqueous and ethanolic extract from peacock flower (*Caesalpinia pulcherrima L*) for traditional medicine

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Abstract

This Study revealed the potency of the ethanolic and aqueous extracts, mineral composition, and phytochemical properties of the peacock flower plant for its health benefits. It was revealed that the ethanolic and aqueous extracts possess antibacterial effects against various bacterial strains. The zone of inhibition revealed that *Shigella* has 22.00±0.20mm and 11.00±0.20 for ethanolic and aqueous extract respectively, *E. coli* (10.00±0.10 and 7.00±0.20), *Salmonella typhi* (20.00±0.10 and 18.00±0.20), *Klebsiella pneumonia* (5.00±0.10 and 2.00±0.20), *Staphylococcus aureus* (7.00±0.20 and 8.50±0.20), *Enterobacter* and *Proteus* had no zone. These extracts have been found to inhibit the growth and proliferation of bacteria such as *Shigella* and *Salmonella typhi* which are commonly associated with infections in humans. The peacock flower extracts are attributed to the presence of bioactive compounds, including flavonoids, alkaloids, and tannins. Saponin was found to be highest with the ethanolic extract (16.650±0.20) and potassium was the highest in the ethanolic extract (15.120±0.20). The Overall results of peacock flower extracts, particularly the ethanolic extract, exhibit promising antibacterial activity against various bacterial strains. Further research is warranted to fully understand the mechanisms of action and potential applications of these extracts in the development of natural antimicrobial agents.

Keywords: Antibacterial, ethanolic, mineral, peacock flower, phytochemical

Introduction

Humanity primarily uses plant resources for fire and shade, as well as for food, medicine, shelter construction, household tool manufacturing, and the production of sleeping mats. For thousands of years, people have used plants as therapeutic agents, and they still depend on them today for medical care (Diallo *et al.*, 2019)^[9].

WHO estimates that about 80% of the world's population receives primary healthcare from plants or their active ingredients (Gias Uddin, 2018)^[14]. Many different substances found in traditionally used herbal medicines have the potential to treat both infectious and chronic illnesses. A thorough understanding of plant usage remains crucial (Diallo *et al.*, 2019)^[9]. Certain chemical compounds found in plants have a specific physiological effect on humans, which accounts for their medicinal worth. Alkaloids, flavonoids, tannins, and phenolic compounds are the most significant of these plant bioactive substances (Edeoga *et al.*, 2015)^[10]. Several therapeutic agents have been discovered through pharmacological screening of natural compound sources. Robust antimicrobial agents can be found in abundance in medicinal plants. Medicinal plant parts with a variety of properties are extracted and used as raw drugs; these parts include roots, stems, flowers, fruits, twigs, exudates, and modified plant organs. In many rural areas in developing countries, the traditional practice of treating common infections with medicinal plants is widely recognized (Sandhu *et al.*, 2015; Gupta *et al.*, 2015)^[23, 15].

Current broad-spectrum antibiotics have a lot of pharmacological side effects, but conventional medicine works better and has fewer side effects than synthetic medications. Many medicinal plants are being investigated for their possible antimicrobial activity due to the pathogenic microbial infectious agents increased antibiotic resistance and chemotherapeutic failure.

Caesalpinia pulcherrima L. is a large perennial shrub or small tree in the Fabaceae family that is also referred to as Pride of Barbados or Peacock-flower. It is a very pretty shrub that has summertime blooms. Every branch has large clusters of flowers at its tips. The individual flowers in bowl-shaped flowers open with a bright yellow edge and turn orange on the second day of growth (Atata *et al.*, 2013)^[5].

The most popular color is reddish-orange, but pink and yellow are also options. Beyond the corolla, ten long, thread-like bright red stamens extend. Typical legume fruits are flat and loudly split open to reveal tiny brown beans when ripe (Atata *et al.*, 2013)^[5].

The scientific name for the peacock plant, *Caesalpinia pulcherrima*, is a tropical ornamental plant that is indigenous to the Americas. It is extensively grown for its colorful, eye-catching flowers, which are produced in a range of hues such as pink, red, orange, and yellow. In addition to being aesthetically pleasing, the peacock flower has garnered interest due to its possible therapeutic benefits (Atata *et al.*, 2013)^[5].

It is an herbaceous plant that is a member of the family Gesneriaceae. It grows in tropical rainforests in Brazil, where it is native. The Flower Peacock is an upright plant that reaches a height of 30 cm and bears large, eye-catching flowers that mimic a peacock's feathers (Galal *et al.*, 2011)^[13]. Five petals on each trumpet-shaped flower are fused at the base to form a corolla. Shades of pink, purple, blue, and white are among the many colors and patterns that the Flower Peacock's corolla can have. Frequently, it has elaborate markings and patterns that mimic those of peacock feathers (Galal *et al.*, 2011)^[13].



Fig 1: Flower of a Peacock (*Caesalpinia pulcherrima* L)

The broad, oval-shaped leaves of the peacock flower are arranged alternating on the stem. The hairy leaves have a maximum length of 10 cm. The Flower Peacock has shallow, fibrous roots, and its stem is cylindrical and branching. The Flower Peacock's inflorescence is a terminal raceme, with the flowers grouped in an elongated cluster. The Flower Peacock fruit is an ovoid capsule with numerous tiny seeds inside (Zampini *et al.*, 2019)^[25].

A well-liked ornamental plant that is frequently grown for its gorgeous flowers is the Flower Peacock. It favors partially to fully shaded, well-draining soil that is high in organic matter. The Flower Peacock needs frequent irrigation to keep the soil damp but not soggy. It is propagated either by seeds or stem cuttings. The Flower Peacock adds a vivid splash of color to any indoor or outdoor space and can bloom for several months at a time with the right care (Zampini *et al.*, 2019)^[25].

The peacock plant habitat and Distribution

Gloxinia speciosa, commonly known as the Flower Peacock, is a native plant of Brazil. Historically, French botanist Charles Lemaire made the initial discovery of the Peacock Flower in their rainforests during the 1800s. Later, the plant was brought to Europe, where it immediately gained popularity as an ornamental plant. The Flower Peacock is still significant in terms of culture and history even though it is grown and cultivated all over the world today (Chiang *et al.*, 2013)^[7]. Growing in the Atlantic Forest and the Amazon basin's tropical rainforests, it is extensively dispersed across the nation. Other South American nations where the Flower

Peacock is found include Peru, Ecuador, and Colombia (Okemo *et al.*, 2013)^[21].

However, the Flower Peacock is a stunning and culturally significant plant that has been incorporated into many historical cultures' customs and traditions. Even now, people still value and celebrate its beauty and symbolism (Chiang *et al.*, 2013)^[7].

In the rainforest, the Flower Peacock is usually found growing in areas with shade, such as the understory or the margins of clearings. It likes well-draining soil that is high in organic matter, and it grows best in humid climates with lots of rainfall.

From sandy to loamy soils, the Flower Peacock can grow in a range of conditions; however, heavy clay soils are not ideal for its growth (Bouamama *et al.*, 2016)^[6]. The Flower Peacock typically grows as an epiphyte in its natural habitat, attaching itself to other plants or trees and taking up nutrients from the atmosphere and rainfall. It can grow in soil as well, but it needs consistent moisture and shade from the sun. The Flower Peacock plays a vital role in the rainforest ecosystem by giving a range of insects and animals food and shelter.

Around the world, the Flower Peacock has gained popularity as an ornamental plant because of its gorgeous flowers and ease of growth. It can be used to brighten garden beds and borders, and it's frequently grown in pots or hanging baskets. But it's crucial to keep in mind that Flower Peacocks are tropical plants that need a warm, humid atmosphere to flourish (Arora and Kaur, 2017)^[4].

Botany and Evolution of peacock plant

The Flower Peacock is an herbaceous perennial that reaches a maximum height of 30 cm. It bears big, eye-catching flowers that mimic a peacock's feathers. According to Okemo *et al.* (2013)^[21], the Flower Peacock is indigenous to Brazil, where it grows in tropical rainforests. The family Gesneriaceae is a large and varied group of plants that includes more than three thousand species of vines, shrubs, and herbs. The family is well-known for its spectacular, frequently fragrant flowers and is mainly found in tropical and subtropical regions of the world.

Although research on the evolution of the Gesneriaceae family is still ongoing, it is thought to have started about 60 million years ago in South America and Africa (Okemo *et al.*, 2013)^[21]. It is thought that the Flower Peacock and other members of the genus *Gloxinia* shared an ancestor during their evolutionary process. The genus *Gloxinia* comprises approximately thirty plant species, most of which are found in South America. Although the genus' precise evolutionary history is still unclear, it is thought to have split off from other Gesneriaceae lineages about 25 million years ago (Arora and Kaur, 2017)^[4].

The Flower Peacock is a significant plant because of its aesthetic value as well as its function in the rainforest ecosystem. Because it is an epiphyte, many different insects and animals can find food and shelter from it, and pollinators like butterflies and bees are drawn to its beautiful flowers. The Flower Peacock is cultivated primarily for its large, showy flowers, which have a broad variety of hues and patterns. The Flower Peacock adds a vivid pop of color to any indoor or outdoor area and can bloom for several months at a time with the right care (Arora and Kaur, 2017)^[4].

Cultivation of Peacock Plant

Gloxinia speciosa, commonly known as the Peacock plant, is a well-liked ornamental plant that grows easily given the

correct circumstances. According to Jayashree and Maneemegalai (2018) ^[19], this tropical plant likes warm, humid climates with well-draining soil that is high in organic matter. The Flower Peacock can be grown in borders or garden beds, as well as in hanging baskets or pots. Selecting a pot or basket with adequate drainage holes is crucial for container gardening as it helps avoid waterlogging, which can result in root rot (Srinivas *et al.*, 2013) ^[24].

Planting the Peacock plant requires a soil mixture that drains well and contains a lot of organic matter, like peat moss or coconut coir (Srinivas *et al.*, 2013) ^[24]. For the Flower Peacock to flourish, regular irrigation is necessary, but it's crucial to avoid overwatering. It's important to keep the soil uniformly damp but not soggy. In cooler weather, the Flower Peacock may only need to be watered once a week, but during times of active growth, it might need to be done every few days. While under watering can result in drooping flowers and wilting leaves, overwatering can cause root rot (Srinivas *et al.*, 2013) ^[24]. Bright, indirect light is what the Flower Peacock prefers, but it should be shielded from direct sunlight as it can scorch the leaves and flowers. The ideal location for the plant is close to a window that lets in plenty of filtered light, though artificial lighting can also be used if needed (Jayashree and Maneemegalai, 2018) ^[19].

Because it consumes a lot of food, the Peacock plant needs frequent fertilization to have healthy foliage and blooms. During times of active growth, a balanced, water-soluble fertilizer can be applied every two to four weeks. When given the right care, the Peacock plant can produce large, eye-catching flowers in a variety of colors and patterns for several months at a time. To maintain the health and lifespan of the plant, it is crucial to give it regular care and maintenance, which includes pruning (Jayashree and Maneemegalai, 2018) ^[19].

Cultural and Historical significance of peacock plant

For centuries, people have appreciated the beauty and ornamental qualities of the peacock flower. The Flower Peacock is linked to specific rituals and traditions and has acquired symbolic meanings in some cultures (Chiang *et al.*, 2013) ^[7]. The Flower Peacock is referred to as "luoxuanhua" in Chinese culture, which translates to "fallen fairy flower". According to legend, the Flower Peacock was once a fairy who changed into a flower after falling in love with a mortal. As a result, the flower peacock is frequently given as a gift to convey feelings of love and romance.

The Flower Peacock is a common decoration for patriotic celebrations and a symbol of pride in Brazilian culture. According to Chiang *et al.* (2013) ^[7], the flower is also connected to Campinas, a city in São Paulo, where it is the official flower and is honored yearly with a festival called "Festa daFlor".

Uses of peacock flower

Its stunning inflorescence, which comes in shades of yellow, red, and orange, makes it a popular shrub for ornamental plantings in both private and public gardens. It can be planted in groups to form a hedgerow, it can also be used to draw hummingbirds because of its small size and good pruning tolerance. It is said that the flower's juice heals sores, the leaves juice cures fever, and the seeds treat chest pain, breathing difficulties, and severe coughing (Atata *et al.*, 2013) ^[5].

Gloxinia speciosa, commonly known as the Flower Peacock, is mainly grown as an ornamental plant for its large, eye-

catching flowers. The plant adds a brilliant pop of color and beauty to any area, making it popular in gardens, parks, and as houseplants. Shades of pink, purple, blue, white, and red are among the many colors and patterns that the Flower Peacock's flowers can have, along with stripes or speckles. The flowers add color and elegance to any bouquet, and they can be used as cut flowers or in floral arrangements (Atata *et al.*, 2013) ^[5]. The Flower Peacock's leaves and roots have been utilized for their therapeutic qualities in traditional medicine. They have been used to treat ailments like hypertension, edema, and urinary tract infections and are thought to have diuretic, antidiarrheal, and anti-inflammatory properties. It is crucial to remember that there has been little scientific study done on the Flower Peacock's therapeutic benefits, so medical advice should always be sought from a qualified provider before using this plant in place of one. (Christine *et al.*, 2011) ^[13].

Apart from its aesthetic and therapeutic applications, the Flower Peacock plays a crucial role in the rainforest ecosystem by offering sustenance and refuge to an array of insects and animals, as well as drawing pollinators like butterflies and bees. The Flower Peacock is an exquisite and multipurpose plant that can be used for anything from improving the aesthetics of indoor and outdoor environments to offering therapeutic advantages and contributing to the well-being of ecosystems (Christine *et al.*, 2011, Edeoga and Okwu, 2015) ^[8, 10].

The evaluation of the antimicrobial activity of *C. pulcherrima* aerial parts was conducted by Jigna and Sumitra, (2017) ^[20] using both aqueous and methanolic extracts. According to reports, *C. pulcherrima* can be used to treat illnesses brought on by the examined organisms. In mice with diet-induced lipidemia, the hypolipidemic potential of *Caesalpinia pulcherrima* methanol extract was assessed (Christine *et al.*, 2011) ^[8]. This research aimed to determine the antibacterial activity, phytochemical, and mineral properties of ethanolic and aqueous extract from peacock flower (*Caesalpinin pulcherrina*), and the objectives are to evaluate the antibacterial activity using various organisms like *Escherichia coli*, *Staphylococcus aureus*, *Bacillus cereus* on the extract from *Caesalpinin pulcherrina* flower by studying their zone of inhibition, compare the results observed from the antimicrobial activities to pharmaceutical drugs for its potency, evaluate the mineral compositions of such as iron, calcium, aluminum, lead, copper, sodium, and magnesium from *Caesalpinin pulcherrina* extract because there is a paucity of data reported for the flower extracts

Materials and Methods

Collection and identification of plant material: *Caesalpinin pulcherrina* flowers are harvested from Rufus Giwa Polytechnic vicinity in Owo town, Owo local government area, in Ondo state.

Extraction Procedure

The *Caesalpinin pulcherrina* flower extraction was done by soaking it in ethanol. About 5g of the grounded sample was extracted in 10 ml of ethanol as a solvent for 24 hours. After the extraction, the ethanol with the extract was filtered into a clean 600ml beaker. It was oven dried in a thermosetting oven leaving the extract inside the beaker. The remaining ethanol in the extract was dried in a vacuum oven at 75 °C for complete removal of the ethanol. This process was done up to five times until a required quantity of the extract had been collected. The extract was stored at room temperature until it was required for analysis.

Antimicrobial Screening

Source of Microorganism: *Escherichia coli*, *Staphylococcus aureus*, *Bacillus cereus*, *Salmonella typhi*, and *Klebsiella pneumonia* were collected from the Department of Microbiology, Federal Medical Centre Owo, Ondo state of Nigeria.

Sterilization of glassware: All the glassware used for this study such as Petri dishes, Agar bottles, test tubes, conical flasks, beakers, pipettes, and forceps were soaked with detergent and rinsed with water. They were sterilized using a hot air oven at a temperature of 120°C for 2 hours. The wire loop was sterilized by heating it in the blue flame of the Bunsen burner until red hot and allowed to cool before use. 95% alcohol was used to swab the workbench area to prevent contamination. The process was carried out aseptically.

Media and Reagent: Nutrient Agar (N.A) and Nutrient broth used were prepared according to the manufacturer's instructions and autoclaved at 121°C for 15 minutes.

Antimicrobial Screening Test and Physical Characteristics of the sample

The extracts from *Caesalpinin pulcherrina flower* were tested for their antibacterial properties using the agar-well technique (Pelczer and Black, 1993) [22]. The assay for antibacterial activities was carried out with *E. coli*, *Staphylococcus aureus*, *Bacillus cereus*, *Salmonella typhi*, and *Klebsiella pneumonia*. Triplicate plates of media for each organism were inoculated with the appropriate suspension of bacteria. The agar well was aseptically made in the media with a sterile 6.0mm diameter cork borer. The different concentrations of the test solutions of extracts were dispensed (0.5ml) aseptically into the wells. The plates were kept in sterilized inoculation chambers for two hours to facilitate the diffusion of solutions. The plates were then inoculated at 37°C for 24 hours for the bacteria. The diameters of the zones of inhibitions of bacteria growth were measured in the plates and recorded.

Source of Microorganisms

Escherichia coli, *Staphylococcus aureus*, *Bacillus cereus*, *Salmonella typhi* and *Klebsiella pneumonia* were collected from the Department of Microbiology, Federal Medical Centre Owo, Ondo state of Nigeria.

Sterilization of glassware

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Antimicrobial screening test and Physical characteristics of *Caesalpinin Pulcherrina Flower*

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The physical characteristics which include Percentage yield (Soxhlet Extraction Method), Specific gravity (Specific Gravity Bottle Method), refractive index (Refractometer Method), Viscosity (Dynamic Viscosity Method), and colour (Lovibond Comparator Method) were carried out by AOAC (2000) [3].

Phytochemical Determination: The Phytochemical procedures used are Harbone (1983 and Harbone (1973) [16-17].

Tannin: 0.2g sample was weighed into a 50 ml sample bottle and 10 ml of 70% acetone was added to it and covered. It was shaken in an ice-bath shaker for 2 hours at 30C and filtered. The supernatant layer was stored in an ice bath. 0.2ml of solution was pipette into the test tube, followed by 0.8ml distilled water. Standard Tannic acid (STA) was prepared from 0.125g/250ml, which is equivalent to 0.5mg/ml. 0.5ml folin reagent and 2.5ml of 10%NaCO₃ were added to both 1ml (0.5mg/ml) Tannic acid and 1ml (0.2ml+0.8mlH₂O) sample solution. They were Vortex and allowed to incubate at room temperature for 40 minutes. The absorbance of the serial dilution of both standard tannic acid and the sample solution was at 750nm colorimeter and the absorbance was recorded. The graph of the absorbance of STA serial dilution was plotted against the concentration; the plotted graph was used to read the unknown concentration of the analyzed sample.

Phytate: 4g of ground sample was weighed and soaked in 100cm³ of 2% HCL for 3 hours and filtered. 25 ml of the filtrate was transferred into a 100 ml conical flask and 5 ml of 0.3 ml NH₄SCN was added as an indicator. 50ml of distilled water was added to it for proper acidity. It was then titrated against FeCl₃, which contains 0.00195g/ml of iron in FeCl₃ solution. Phytate content was calculated in mg/100g or g/100g.

Alkaloid: 2.5g sample was weighed into a 250ml beaker, and 100ml of 20% acetic acid in ethanol was then added to it and covered for 4hrs. It was filtered and the extract was concentrated in a water bath to ¼ of the original value (25/100ml). Concentrated NH₄OH solution was added to it dropwise until precipitation was completed. It was filtered with already-weighed filter paper. The filtrate was washed more with NH₄OH to ascertain complete precipitation and re-filtered with the same filter paper. The filter paper with the residue (Alkaloid) was dried in an oven. Alkaloid was calculated as a percentage in g/100g.

Oxalate: 1g of the sample was weighed into 100ml conical flask, 50 ml of 1.5N H₂SO₄ was added and stirred

intermittently with a magnetic stirrer for 1hr, it was filtered with Whatman filter No1, and 25 ml of the filtrate was transferred into 100ml conical flask and titrate hot (80-90°C) against 0.1M KMnO₄ solution until a faint colour appeared that persists for at least 30 seconds. Oxalate content was calculated in mg/g.

Saponin: 10g of ground sample was placed into 250ml conical flask, 100ml of 20% ethanol was added to it. IT was heated in a hot water bath for 1hr with constant stirring at 55 °C. The residue was re-extracted with 20ml of 20% ethanol, and the volume of the combined extract was reduced to 40ml over a water bath at 55°C. The concentrate was transferred into a 250ml separating funnel and 20ml of diethyl ether was added and shaken vigorously, the ether layer was discarded and the aqueous layer was retained. 20ml of n-butanol was added to the aqueous layer in the already weighed 100ml beaker and decant. The residue was washed twice with 5% NaCl and decant. The residue (saponin) inside the beaker was oven-dried to constant weight. The Saponin content was calculated percentage(g/100g).

Determination of Mineral Composition: The process for ash determination was followed to obtain the ash. To the crucible containing the ash sample, about 5ml of concentrated hydrochloric acid was added and the mixture boiled for 5min on a hot plate in a fume cupboard, acid was added as necessary to maintain the volume. It was transferred to a beaker and the crucible was washed into the beaker with distilled water. Cool and filter through a clean muslin cloth to a 100ml volumetric flask to remove insoluble materials and rinse the beaker with distilled water. It was made up to the mark with distilled water. The absorbance of the sample solution was read by an already standardized Atomic Absorption Spectrophotometer with an appropriate lamp for the required element (AOAC 2000) [3].

Results and Discussion

Table 1: Antibacterial activity of aqueous extract from fermented *Caesalpinin pulcherrina* flower

Organisms	Ethanollic(mm)	Aqueous (mm)
<i>Shigella flexneri</i>	22.00±0.20	11.00±0.20
<i>E. Colli.</i>	10.00±0.10	7.00±0.20
<i>Salmonella typhi</i>	20.00±0.10	18.00±0.20
<i>Klebsiella pneumonia</i>	5.00±0.10	2.00±0.20
<i>Staphylococcus aureus</i>	7.00±0.20	8.50±0.20
<i>Ectero bacter</i>	No zone	No Zone
<i>proteus</i>	No zone	No Zone

± SDV of triplicate results

The antibacterial activity from the *C. pulcherrina* flower extract in Table 1 revealed that ethanolic extract has the highest zone of inhibition (22.00±0.20) against *Shigella* whereas the aqueous extract has 11.00±0.20. However, the values observed for ethanolic extract were higher than the values obtained from Greater cardamom seed (*A. subulatum*) (16.000), Dill seed (*A. graveolens*) (14.000) and sweet violet flower (*Viola odorata*) (20.00), aqueous extract as explained by Arora and Kaur, (2007) [4] while these were higher than aqueous extract from *C. pulcherrina* (11.00±0.20). The results from the *E. colli* showed that ethanolic extract was 10.00±0.10 while aqueous was 7.00±0.20 for *C. pulcherrina* flower extract respectively. *A. graveolens* seed (12.00) was found potent than these values while no inhibition was found in *A. subulatum* seed and *Viola odorata* flower according to

Arora and Kaur, (2007) [4]. These values were higher than the values obtained by Ibrahim *et al.*, (2014) [18] for the aqueous extract of basella and *Helianthus* for *E. colli* zone of inhibition (1.58 and 1.30). *Salmonella typhi* is another organism with higher values in both ethanolic and aqueous extract from *C. pulcherrina* flower (20.00±0.10 and 18.00±0.20). the ethanolic extract has the same value as aqueous *A. graveolens* seed (20.00) with a lesser value in aqueous *Viola odorata* flower (12.00) according to Arora and Kaur, (2007) [4]. Also, the results obtained for salmonella typhi (1.5 and 1.1) for *basella* and *Helianthus* by Ibrahim *et al.*, 2014 [18] were equally lower than the results obtained for the aqueous extract from the fermented *Lagenaria. breviflora* *Klebsiella pneumonia* zone of inhibition were 5.00±0.10 and 2.00±0.20 while *Staphylococcus aureus* were 7.00±0.20 and 8.50±0.20 for ethanolic and aqueous extract from *C. pulcherrina* flower, lower than aqueous extract from *A. subulatum* seed and *Viola odorata* flower with the same values (21.00) and *A. graveolens* seed (25.00) respectively. *Ectero bacter* and *proteus* were not susceptible to both ethanolic and aqueous extract from the *C. pulcherrina* flower. These indicated that the extract had potency against *Shigella Salmonella typhi* and *E. colli*.

Table 2: Phytochemical analysis of ethanolic and aqueous extract of *Caesalpinin pulcherrina* flower

Parameters	Aqueous	Ethanollic
Tannin(mg/g)	0.310±0.10	0.700±0.20
Phytate(g/100g)	4.110 ±0.10	4.240±0.10
Alkaloid(g/100g)	1.520±0.30	2.540±0.50
Oxalate(mg/g)	1.540±0.50	2.510±0.20
Saponin(g/100g)	12.610±0.50	16.650±0.20

± SDV of triplicate results

The phytochemicals found in plants that are thought to prevent disease and promote health have been the subject of in-depth research aimed at determining their effectiveness as well as the underlying mechanisms of their action. Phytochemicals are bioactive compounds with high anti-oxidative properties for healthy living and reduced aging (Ahmad and Beg, 2001) [1]. It was generally observed in Table 2 that all the observed parameters (Tannin, Phytate, Alkaloid, oxalate, and Saponin) were higher in the aqueous extract of *Caesalpinin pulcherrina* flower than ethanolic extract. The highest bioactive compound observed was Saponin (16.650±0.50) in the Ethanolic extract. The value observed from the ethanolic extract for the saponin is close to the value obtained by Aladekoyi *et al.*, 2020 [2] for the Raw *Lagenaria breviflora* plant (16.690±0.50). Phytate has 4.240 ±0.10 in *Caesalpinin pulcherrina* flower. This was higher than the 3.200±0.30 observed from the Raw *Lagenaria breviflora* plant as reported by Aladekoyi *et al.*, 2020 [2]. Oxalate (2.510±0.20) was higher in the ethanolic extract than the aqueous extract (1.540±0.50) and alkaloids were higher with the value of 2.540±0.50 respectively.

The mineral composition in Ethanolic and Aqueous Extract of *Caesalpinin pulcherrina* flower are shown in Table 3. The flower of the plant indicates the level of potassium was higher (15.120±0.20 mg/kg) in ethanolic extract than in aqueous extract (13.310±0.10 mg/kg). Potassium has been found to maintain the level of fluid inside the body cells and help muscles contract and support normal blood pressure (EFSA, 2016) [11]. The calcium in the ethanolic extract was 9.340±0.20 mg/kg and the aqueous extract was 8.210±0.20 mg/kg. However, calcium has been reported by EFSA, (2016) [11] for the building of weak or damaged bones and teeth. Calcium is needed for muscles to move and for the nerves to

carry messages between the brain and every part of the body. Aluminum is also higher in the ethanolic extract (4.010±0.20 mg/kg) than aqueous extract (3.310±0.20 mg/kg) Iron is higher in the aqueous extract (1.740±0.20 mg/kg) than in the methanolic extract (1.360 ±0.20 mg/kg). Iron is important in the formation of hemoglobin, a huge molecular compound (protein), that helps in transporting oxygen, myoglobin, and protein all over the blood (Food Insight, 2022) [12].

Table 3: Mineral composition of ethanolic and aqueous extract of *Caesalpinin pulcherrina* flower

Parameters (mg/kg)	Aqueous	Ethanolic
Potassium (K)	13.310±0.10	15.120±0.20
Calcium (Ca)	8.210±0.20	9.340±0.20
Aluminum (Al)	3.310±0.20	4.010±0.20
Magnesium (Mg)	2.230±0.20	2.700±0.10
Iron (Fe)	1.740±0.20	1.360 ±0.20
Lead (Pb)	0.801±0.10	0.840±0.10
Copper (Cu)	0.402±0.10	0.224 ±0.10

± SDV of triplicate results

Conclusion

These compounds extracted using ethanol have demonstrated antimicrobial properties by interfering with the bacterial cell membrane, disrupting their metabolism, and inhibiting their growth than aqueous extract. The ethanolic extract of the peacock flower is more effective in antibacterial activity compared to the aqueous extract. This is likely due to the better extraction efficiency of ethanol, which allows for a higher concentration of bioactive compounds to be obtained. These indicate its higher potency in curative purposes against the organisms *Shigella Salmonella typhi* and *E. coli* under test.

The phytochemical analysis results revealed that the ethanolic extract has better values than the aqueous extract. Also, the mineral composition showed good values for ethanolic extract, though, higher values of iron were observed in aqueous extract, which is one of the important elements in blood formation. It is recommended that the ethanolic extract should be from *Caesalpinin pulcherrina* flower and should be considered as a home remedy for healing and healthy living without grave adverse effects.

Author Contributions

G Aladekoyi, OE Giwa and O Ogundowole sought study authorization from the appropriate government institutions. G. Aladekoyi and OM Eyinola established the study methodology which also comprised preparing a checklist that was used in data collection. G Aladekoyi and OE Giwa analyzed the samples and interpreted the data. O Ogundowole, OM Eyinola and G Aladekoyi undertook the literature review that included the introductory background information and the theoretical context. To guarantee accuracy and adherence to the journal's formatting requirements, all authors revised the work appropriately.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript. In addition, the ethical issues; including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy have been completely observed by the authors.

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