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Pharmacognostical And Pharmacological Evaluation of Medicinally Important *Fingerhuthia Africana*. Lehm.

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Many medicinal plants have been utilized for centuries despite the lack of scientific evidence of their therapeutic effects. This study evaluated the phytochemical and dual biological profiling, namely, antimicrobial and cytotoxic properties of *Fingerhuthia africana*. The extract of the plant was subjected to qualitative phytochemical screening using the established protocol and disc diffusion and microdilution assays were used for the antibacterial and antifungal activities. The qualitative Phytochemical analysis illustrated that methanol extracts of *F. africana* were rich in different phytochemicals including Carbohydrates, terpenoids, flavonoids, fats oil, glycosides, phenols and tannins. and absence of alkaloids and steroids. The result of antibacterial activity of methanolic extract of *F. africana* showed that the highest zone of inhibition (28.0±1.00 mm) was measured against *Escherichia coli* at the maximum (300 mg/ml) extract concentration. followed by *P. aeruginosa* and *S. aureus* (27.3±1.52 mm), (27.6±1.52mm) and the lowest zone of inhibition (6.66±2.08 mm) by *E. coli* at minimum (100 mg/ml) extract concentration. The results of antifungal activity revealed that the methanolic extract of *F. africana* showed significant antifungal activity (18.66±1.52 mm) against *Aspergillus flavus* at the maximum (300 mg/ml) extract concentration. followed by *A. terreus* and *F. oquiseti* (13.33±1.52mm) (16.0±1.00mm) and lowest antifungal activity against *Aspergillus flavus* (4.00±1.732 mm) at minimum (100 mg/ml) extract concentration. The results of cytotoxic potential to kill brine shrimp napulii. 10 mg/ml, 100 mg/ml and 1000 mg/ml of dose of methanolic extract showed (6.67%) (6.67%) and (33.34%). cytotoxic potential to kill brine shrimp napulii. 1000 mg/ml of dose of methanolic extract showed the highest (33.34%) death rate of brine shrimps. 10 mg/ml of methanolic extract validated the lowest mortality rate (6.67 %). The results showed that *F. africana* had a substantial potential for pharmacological activity, in general. The analysis that was suggested provided a way to extract the bioactive elements and will aid in the development of new drugs that have fewer side effects. The findings clearly demonstrate that *F. africana* has the capacity to treat a variety of diseases due to its effectiveness against a range of ailments.

Keywords: Photochemical screening, Antibacterial, Antifungal, cytotoxic, *Fingerhuthia africana.*

INTRODUCTION

Traditional medicine includes a variety of therapeutic modalities derived from Earth's natural resources, including Siddha, Unani, Chinese, and Ayurvedic medical systems. Over half of the medications used in clinical settings worldwide are derived from natural products and their derivatives. A survey conducted by the World Health Organization (WHO) in developing countries revealed that approximately 80% of the population depends on plant-based medicines (Yadav *et al*., 2022).

Chemical constituents play a crucial role in the advancement of the world. Currently, natural bioactive compounds derived from plants are being recognized as safer alternatives to synthetic drugs. These bioactive compounds have been employed in the treatment of various human diseases. Phytochemicals such as alkaloids, flavonoids, tannins, saponins, and glycosides are particularly important as they contribute to the defense mechanisms of plants. Conducting a preliminary phytochemical analysis provides a comprehensive understanding of the presence of bioactive substances like, steroids, phenolic compounds proteins, amino acids

carbohydrates and (Rana *et al.,* 2022).

Antibacterial drugs are medications that inhibit the growth or eliminate harmful bacteria. They are commonly used to prevent or treat bacterial infections. The two primary categories of these medications are bactericidal and bacteriostatic. medications that are bacteriostatic prevent bacterial growth whereas bactericidal medications actively destroy microorganisms. Additionally, these substances help prevent the buildup of bacteria in the mouth. Many plants contain a significant quantity of compounds that possess antibacterial properties (Sharma, 2017).

Antifungal medications are designed to combat fungal infections by inhibiting the growth of fungal species. These infections can lead to various serious diseases in both plants and animals. While there are certain classes of drugs that are commonly associated with antifungal treatment, it is worth noting that some important medications like flucytosine and fluctosine are not always categorized as traditional antifungal drugs, even though they are effectively used to treat fungal infections (Benitez *et al*., 2019).

Cytotoxic properties present in natural compounds can hinder the attachment of cells, induce noticeable changes in their appearance, impede the cell cycle and DNA replication processes, ultimately resulting in a significant decrease in cell viability (Pilut *et al*., 2022). Assessing the toxicity of these compounds at a cellular level can be valuable in uncovering potential hazards associated with herbal extracts. Additionally, it makes it easier to find, examine, and analyze a variety of naturally occurring bioactive chemicals. Prior to the discovery and development of novel anti-cancer medicines, these efforts are made with the intention of reducing any adverse effects on healthy cells, which frequently impose restrictions on the use of many anti-cancer treatments now on the market (Barmoudeh *et al.*, 2022).

*Fingerhuthia africana i*s a tufted perennial plant belongs to family poacaea and commonly known as thumble grass. It is distributed in Karak, Bannu and D.I Khan in Pakistan. They are widely distributed in Africa, United State, Afghanistan, Oman and Saudi Arabia. The family poaceae are not only used as fodder and forage but also used for the treatment of different ailments like inflammation, cancer, microbial infection, eyes infection, malaria and skin allergies (Majeed *et al*., 2020). The present study is aimed to investigates various bioactive compounds, antimicrobial activities and cytotoxic activity of medicinally important *Fingerhuthia africana.*

MATERIALS AND METHODS

Collection and identifications:

Plants of *Fingerhuthia Africana* was collected from Muhabati Killla in District Karak (33°6'37.72"N and 71°5'28.95"E), Khyber Pakhtunkhwa, Pakistan. The plant was identified with the help of flora of Pakistan and available literature. Taxonomist. The specimen and voucher number Rehnaz was deposited in the Herbarium of the Department of Chemical and Life Sciences, Qurtuba University of Science and Information Technology, Peshawar, Pakistan for future reference.

Plant Extraction:

The collected plant was washed, dried and grinded to form fine powder. The powder was transferred to an airtight container. the resultant powdered plant was dissolved in methanol to obtain extract. after through shaking for 72 hrs, the extract was passed through a rotary evaporator to separate solvent and extract. the extracts were placed on a water bath to remove the remaining solvent and then will be dried (Wali *et al*., 2017).

Materials:

Beakers, a test tube, a vacuum evaporator, a water bath, a starrier, filter paper, stands, aluminum foil, a micropipette, scissors, a spirit's lamp, a cutter, a Laminar flow hood machine, a GPS, Petri dishes, a digital scale, weight, and distilled water.

Phytochemical analysis:

Phytochemical studies was conducted with 100 gram ground materials and subjecting it to successive extraction in a Soxhlet apparatus with various chemicals and protein (Millon's test), carbohydrate (Molish's test) fixed oil and fat (tincture alkane), terpenoids (Lieberman burchard tests), steroids and alkaloid (Dragendroff' tests/Mayer's test), glycosides (Legals tests), phenols and tannins (ferrics chlorides tests), etc. will be detected by following the protocol of (Atta-ur-Rahman & Abbas, 1991).

Preliminary phytochemical qualitative tests:

Different qualitative analysis was done on the crude extract of Fingerhuthia Africana to identify for carbohydrate, saponins, tannins, terpenoids, phenols, phytosterols, alkaloids, flavonoids, protein and fixed oil.

Test for carbohydrates detection:

In the Fehling's test, a sample solution is combined with equal parts of Fehling's A (copper sulfate in distilled water) and Fehling's B (potassium tartrate and sodium hydroxide in distilled water) reagents, which are then boiled to determine whether reducing sugar is present (Evans, 2002).

Test for alkaloid detection Wanger's test:

The addition of a small amount of Wagner's reagent to the sample solution resulted in the formation of a red precipitate, which suggests the existence of alkaloids in the solution (Khandelwal, 2004).

Test for protein detection Ninhydrine test:
According to Kumar and Kiladi (2009), The appearance of a violet colour after adding a 0.2% Ninhydrin solution to the extract solution in a test tube indicates the presence of protein.

Test for phytosterols and terpenoids Salkowski's test:
The addition of a small amount of methanolic to the extract solution results in the appearance of a red color at the lower side, indicating the presence of triterpenoids. Conversely, the appearance of a yellow color suggests the presence of phytosterols (Roopalatha, 2013).

Test for phenolic compounds Ferric chloride test:
Adding 2 ml of the extract solution A dark bluish green color appearance with the addition of 2ml ferric chloride will show the existence of phenols (Trease and Evans, 1989).

Test for fixed oil:
The presence of fixed oils is indicated if a greasy patch is found on the filter paper after the extract has been pressed between its folds (Trease and Evans, 1989).

Test for Tannins Ferric chloride test:
The addition of FeCl3 to the extract solution will result in the emergence of a blue-green color, which serves as an indicator of the presence of tannins (Iyengar, 1995).

Test for Flavonoids:
When the extract solution was mixed with a solution of sodium hydroxide, the detection of flavonoids was indicated by the formation of a reddish-yellow precipitate. (Trease and Evans, 1989).

Test for Saponin Frothing test:
When 5ml of the extract solution was shaken in a test tube, froth formed, indicating the presence of saponin (Ngoci *et al*., 2011).

Antimicrobial Activities:

By Agar Well Diffusion method:
To check the antimicrobial activities, Agar diffusion method was used. Nutrient agar media were be prepared in petri plates and was applied for inoculation of each microbial strain. Ciprofloxacin was used as Standard drugs (positive control). Methanolic extracts (100, 200 and 300mL) was tested for antimicrobial activity against different species of Gram-positive bacteria (*P. aeruginosa* and *S. aureus*), Gram negative bacterial strains, *Escherichia coli* and fungal species *(Aspergillus flavus*, *Aspergillus terreus, Fusarium equiseti.* The zone of inhibition will be calculated by CL SI procedures (Khalid *et al*., 2011).

Cytotoxic activity:
Brine shrimp assay was performed using methonolic extract of the selected plant for cytotoxic potential following procedure of (Rahman *et al.*, 2001). For the egg hatching process, the hatching tray were kept at 24°C. The open portion of the tray will be brightened by a lamp that was suspended above it. After hatching active movement of the nauplii swarm through the perforated partition in the direction of the lighter area were observed. 20 milligram extract of was dissolved in 2.0 mL of methanolic solvent, and then 5, 50, and 500 mL of the resulting solution equivalent to 10, 100, d 1000 g/mL were transferred to vials (three vials for each concentration). Each vial was received 5mL of seawater solution (38g/L), which was added after the solvent had been allowed to evaporate overnight. 10 larvae will be added to each vial using a Pasteur pipette after hatching and maturing. The vials were positioned under illumination and at ambient temperature (25–27 °C). Brine solution-filled vial for both the negative and the positive controls.

Statistical analysis:
The number of live and dead nauplii in each treatment was counted after 24 hours, and the data were then analyzed using a computer programme to produce 95% confidence intervals around the LD_{50} values (Saeed *et al*., 2010).

RESULTS

Phytochemical screening:
The qualitative Phytochemical screening analysis illustrated that methanol extracts of *Fingerhuthia africana* were rich in different phytochemicals including Carbohydrates, terpenoids, flavonoids, fats oil, glycosides, phenols and tannins. and absence of alkaloids and steroids (Table .1).

Table 1: Phytochemical screening of methanolic extract of *Fingerhuthia africana.*

Fingerhuthia africana	
Chemical constituents	**Results**
Flavonoids	+
Tannins	+
Alkaloids	_
Triterpenoids	+
Steroids	_
Carbohydrates	+
Glycosides	+
Fats oil	+
Phenols	+

Antibacterial activity:
The antibacterial activity of methanolic extract of *Fingerhuthia africana* showed that the highest zone of

inhibition (28.0±1.00 mm) was measured against *Escherichia coli* at the maximum (300 mg/ml) extract concentration. followed by *P. aeruginosa and S. aureus* (27.3±1.52 mm), (27.6±1.52mm) and the lowest zone of inhibition (6.66±2.08 mm) by *E. coli* at minimum (100 mg/ml) extract concentration (Table 2).

Antifungal activity:

The antifungal activity revealed that the methanolic extract of *Fingerhuthia africana* showed significant antifungal activity (18.66±1.52 mm) against *Aspergillus flavus* at the maximum (300 mg/ml) extract concentration. followed by *A. terreus F. oquiseti*, (13.33±1.52mm) (16.0±1.00mm) and lowest antifungal activity against *Aspergillus flavus* (4.00±1.732 mm) at minimum (100 mg/ml) extract concentration (Table 3).

Table 2: Antibacterial activity of methanolic extract of *Fingerhuthia africana*

Bacteria	Zone of inhibition (mm)				
	100 (mg/ml)	200 (mg/ml)	300 (mg/ml)	+ve control	-ve control
E. coli	6.66±2.08	17.0±2.645	28.0±1.00	30	0
P. aeruginosa	8.66±0.57	14.0±2.00	27.3±1.52	29	0
S. aureus	6.66±2.08	15.66±2.081	27.6±1.52	29	0

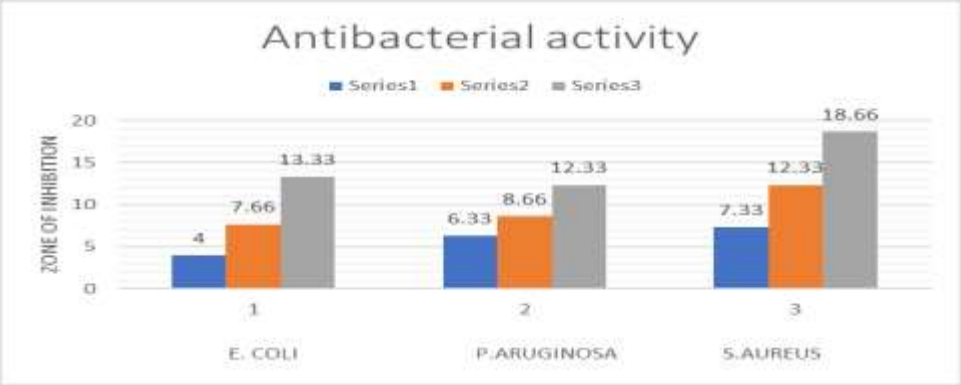

Figure 1: Antibacterial activity of methanolic extract of *Fingerhuthia africana*

Table 3: Antifungal activity of methanolic extract of *Fingerhuthia africana*

Fungi	Zone of inhibition (mm)				
	100 (mg/ml)	200 (mg/ml)	300 (mg/ml)	+ve Control	-ve control
A. flavus	4.00±1.732	7.66±1.52	13.33±1.52	30	0
A. terreus	6.33±1.52	8.66±0.57735	16.0±1.00	29	0
F. oquiseti	7.33±1.52	12.33±1.52753	18.66±1.52	30	0

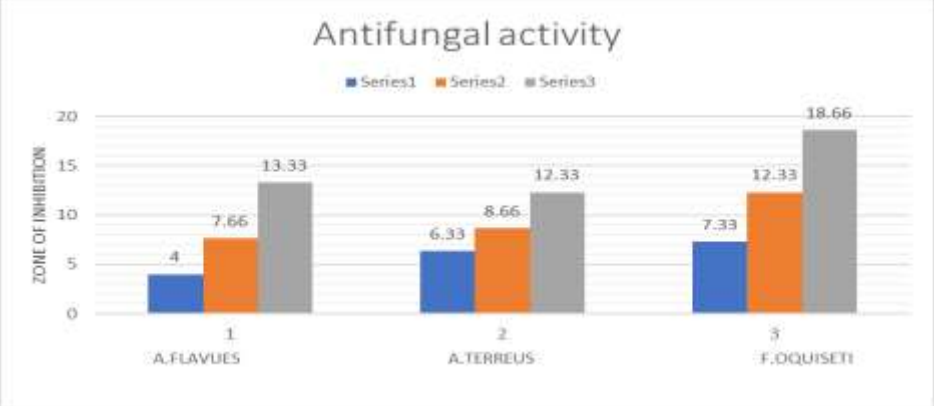

Figure 2: Antifungal activity of methanolic extract of *Fingerhuthia africana*

Cytotoxic Activity

Fingerhuthia africana were investigated for their cytotoxic potential to kill brine shrimp napulii. 10 mg/ml, 100 mg/ml and 1000 mg/ml of dose of methanolic extract showed (6.67%) (6.67%) and (33.34%). cytotoxic potential to kill brine shrimp napulii. 1000 mg/ml of dose of methanolic extract showed the highest (33.34%) death rate of brine shrimps. 10 mg/ml of methanolic extract validated the lowest mortality rate (6.67 %) (Table. 4).

Table 4: Cytotoxic Activity of methanolic extract of *Fingerhuthia africana*

Dose (mg/ml)	No. of Shrimps	No. of Survivors	Mortality %	STD. Drug
10	30	28	6.67%	Etoposide
100	30	28	6.67%	
300	30	20	33.34%	

DISCUSSION

The World Health Organization estimates that 80% of the world's population uses traditional remedies made from plants to cure different microbiological illnesses. Traditional medicine is very common in Ethiopia, where 70% of the human population and 90% of the cattle population rely on it. These medicinal plants' natural chemical components, or phytochemical compounds, are what determine how effective they are as treatments. Significant secondary metabolites found in these plants include flavonoids, alkaloids, and glycosides, which have antioxidant, anti-inflammatory, anti-cancer, and antibacterial activity capabilities Gizaw *et al*. (2022). In the current study the qualitative phytochemical screening of methanolic extracts of *F. africana* is carried out Carbohydrates, terpenoids, flavonoids, fats oil, phenols and tannins as shown in (Table 1). These results are consistent with Inayat Ullah *et al.* (2022) who reported similar results from the methanolic extract of *Rhinachantus nasutus.* Antimicrobial resistance (AMR) poses a significant challenge to modern medicine, as highlighted by Al-Brahim and Mohammed (2020) and recognized as a major public health concern in the 21st century by the antimicrobial resistance collaborators (2022). AMR refers to the ability of microorganisms to withstand the effects of drugs that would typically impede their growth and potentially eliminate them (Philip *et al*., 2022). In current study the antibacterial activity of methanolic extract of *F. africana* showed that the highest zone of inhibition (28.0±1.00 mm) was measured against *Escherichia coli* at the maximum (300 mg/ml) extract concentration. followed by *P. aeruginosa and S. aureus* (27.3±1.52 mm), (27.6±1.52mm) and the lowest zone of inhibition (6.66±2.08 mm) by *E. coli* at minimum (100 mg/ml) extract concentration (Table 2). These results are in line with Nabi *et al.* (2022) who reported similar results from the methanolic extract of *Skimmia anquetilia.* Plant diseases caused by fungal pathogens account for 20-40% of all documented plant diseases. To mitigate the harmful effects of fungal infections on crop yield and quality, the predominant approach involves the use of fungicides. Although chemical fungicides have demonstrated undeniable efficacy in controlling fungal diseases, they will encounter significant challenges in the future due to various notable issues. Additionally, the use of chemical fungicides carries the risk of severe health consequences, including the development of life-threatening conditions such as cancer El-Shahir *et al*. (2022). In the current study the antifungal activity revealed that the methanolic extract of *F. africana* showed significant antifungal activity (18.66±1.52 mm) against *Aspergillus flavus* at the maximum (300 mg/ml) extract concentration. followed by *A. terreus* and *F. oquiseti*, (13.33±1.52mm) (16.0±1.00mm) and lowest antifungal activity against *Aspergillus flavus* (4.00±1.732 mm) at minimum (100 mg/ml) extract concentration (Table 3). These results are in line with Soliman *et al.* (2023) who reported similar results from *S. costus* Root extracts against *C. albicans.* The importance of natural products in the fight against cancer was first realized in the 1950s, leading to the discovery of several important plant-based anticancer therapeutics such as vincristine, vinblastine, etoposide, terpenoids, and paclitaxel. These chemotherapeutic agents are either directly obtained from plants or derived from their lead structures Khan *et al*. (2022). *F. africana* were investigated for their cytotoxic potential to kill brine shrimp napulii. 10 mg/ml, 100 mg/ml and 1000 mg/ml of dose of methanolic extract showed (6.67%) (6.67%) and (33.34%). cytotoxic potential to kill brine shrimp napulii. 1000 mg/ml of dose of methanolic extract showed the highest (33.34%) death rate of brine shrimps. 10 mg/ml of methanolic extract validated the lowest mortality rate (6.67 %) (Table. 4). These results indicated that Lima *et al.* (2022) who reported similar results from methanol extracts of *Chamaecrista duckeana.*

CONCLUSIONS

A recent study indicates that *Fingerhuthia Africana* contains various bioactive compounds such as carbohydrates, terpenoids, flavonoids, fats oil, glycosides, phenols, and tannins. These substances have the potential to treat infectious disorders and provide protection against microbial diseases. The utilization of plant remedies in traditional medicine systems suggests that they could be a valuable resource for the development of novel pharmaceuticals, including those with antibacterial properties.

Supplementary materials

Not applicable.

Author contributions

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Conflict of interest
The authors declared that present study was performed in absence of any conflict of interest.

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