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Online ISSN 3007-3197

Print ISSN 3007-3189

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Phytochemical and Antibacterial Screening of Medicinal Plant: Eight Members of family Fabaceae

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Print ISSN 3007-3189

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Abstract

Medicinal plants pose utmost importance in rural localities of low income countries like Pakistan due to their affordability, accessibility, and cultural acceptance. Members of the *Fabaceae* family from Balochistan, Pakistan are widely recognized for their pharmacological potential, including their antimicrobial activity. The study aimed to investigate the antibacterial activity and phytochemical composition of eight members of *Fabaceae* family including *Acacia nilotica, Acacia modesta, Senna alexandrina, Cassia absus, Alhagi maurorum, Senna tora, Glycyrrhiza glabra, and Acacia catechu.* Qualitative phytochemical analyses were performed using four solvents ethanol, methanol, chloroform, and distilled water to identify the bio-active compounds. Herein, we studied the antibacterial potential of methanolic extracts against *S. aureus*, and *K. pneumoniae*, *E. coli*, and *P. aeruginosa* by disc and agar well diffusion methods. Our findings showed maximum extractability and qualitative abundance of phytochemicals in methanol, ethanol, and aqueous solvents whereas chloroform yield was found lowest. Comparative antibacterial evaluation revealed that the disc diffusion method was more effective inhibiting ~45% of bacterial growth in comparison to 20% zone inhibition by agar well diffusion method. Among the eight species studied, *G. glabra* showed the strongest antibacterial activity against *S. aureus* and *E. coli* (15 mm inhibition zone), while *Senna tora* exhibited notable inhibition against *K. pneumoniae* (10 mm) and *P. aeruginosa* (8 mm). *Alhagi maurorum* also showed comparable *Senna tora* in its inhibition activity against *K. pneumoniae* (10 mm). We conclude that *Fabaceae* family members possess antibacterial and phytochemical potential, specifically when extracted with polar solvents. *G. glabra*, *S. tora*, and *A. maurorum* emerged as promising candidates for the development of natural antibacterial agents.

Keywords: Balochistan flora, *Fabaceae*, Phytochemical analysis, antibacterial activity

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Print ISSN 3007-3189

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Introduction

Primary and secondary metabolites produced by medicinal plants have pharmacological effects on the human body (Srivastava 2018). These metabolites include alkaloids, sterols, quinones, terpenes, flavonoids, saponins, glycosides, cyanogenic, tannins, resins, lactones, glucosinolates, volatile oil, etc. Nature has served as a reservoir of medicinal agents for decades. Herbiceuticals, referred to active compounds of metabolites, are the products isolated from plants and used to treat various diseases (Khade et al. 2023). The World Health Organization (WHO) reports that approximately 21,000 plant species are employed in traditional medicines (Kumar et al. 2021). Literature suggests that almost 80% of world's population is primarily dependent on this plant-based traditional medicinal system meeting the major needs of human health care (Anwar et al. 2024). Pakistan's diverse biosphere with nine distinct ecological zones, makes region rich botanically due to the presence of 5521 species of flowering plants, among which 400–600 are of significant medicinal importance (Ali 2008). Notably, the highland regions of northern Balochistan are known for their unique ecosystems and plant diversity serving as hotspots for the presence of medicinal and rare plant species (Bibi et al. 2015).

In addition to the importance of local flora as medicinal plants, there are pathogenic bacteria developing resistance to currently available antibiotics due to excessive and unattended use compelling the researchers to search for a new antibacterial agents (Abdulhamid et al. 2023). Gram-negative bacteria for instance 1) *P. aeruginosa*, is a multidrug-resistant opportunistic, nosocomial bacteria causes urinary tract, lung, wound and skin burn infection (Elfadadny et al. 2024). 2) *K. pneumonia* typically occurs in the normal flora of skin, mouth and intestine, causes pneumonia in the form of bronchopneumonia and bronchitis (Chang et al. 2021). 3) *E. coli*, found in the intestines cause septicemia and urinary tract infection (Mueller and Tainter 2023). Similarly, Gram-positive bacteria like *S. aureus* causes a range of diseases e.g., osteomyelitis, food poisoning, toxic shock syndrome, endocarditis and post-operative wound infection. The treatment remains challenging due to the emergence of its multidrug-resistant strains (Chambers and DeLeo 2009). Efforts have been made to identify the active phyto-compounds produced by

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Print ISSN 3007-3189

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medicinal plants that work as antimicrobial agents for the treatment of different microbial diseases, as safe and an alternate to chemically synthesized antibiotics (Lone et al. 2024).

Fabaceae is the third-largest family of flowering plants with 730 genera and more than 19,400 species (Hughes and Group 2017). Several members of the *Fabaceae* have been studied to identify the presence of phytochemicals exhibiting pharmacological potential to treat various ailments (Usman et al. 2022) (Maroyi 2023). The eight important members including *Senna alexandrina* (Genus: Senna), *Senna tora* (or *Cassia tora*), *Alhagi maurorum*, *Cassia absus* (genus: chamaecrista), *Glycyrrhiza glabra Linn*, *Acacia Catechu, Acacia Modesta, Acacia Nilotica Linn* regional to Asian countries including China, Bangladesh, Sirilanka, India, Pakistan, Afghanistan, Iran, Iraq, spanning to middle Eastern countries, Egypt, Sudan, and Eurasia including Turkey, while *G. glabra* were also reported from nothern parts of Africa as well as *C. absus* from Americas and Australia (Khan and Malik 2022; Smita Jain and Patil 2010; Sebei et al. 2014; Salah et al. 2020; Sher et al. 2012; Sharma and Kumar 2013; Ali et al. 2012). Most of these plans have been reported for their effectiveness to treat digestive disorders including irritable bowel syndrome and also given as laxatives (Osunga et al. 2023; Alambayan et al. 2015; Salah,Ibrahimand 2020; Sultana et al. 2018). Some species e.g. *C. absus* and *G. glabra* treat common respiratory tract disorders from cough to bronchitis and mild asthma (Nancy and Ashlesha 2015; Kaur et al. 2013). *A. modesta* has been reported to treat dental problems and also work as an anti-inflammatory agent along with *G. glabra* and *S. tora* (Rahman et al. 2023; AL-Amili and AL-Jobori 2025). *A. modesta* has also been involved in treatment of Hyperglycemia, platelet aggregation and cytotoxicity (Bukhari et al. 2010). *Acacia Nilotica Linn* (*A. nilotica*) With roughly 1350 species has long been part of old Greak medicine (Bashir et al. 2014). Its phytochemicals have been studied for their role as anti-inflammatory and anti-hypertensive agents (Ali, Akhtarand 2012). In this study, the above discussed eight medicinal plants from the *Fabacea* family were selected based on their ethnobotanical uses by Pakistani rural communities to 1) analyze the presence of phytochemical constituents in four different solvents and 2) to evaluate the antibacterial activity of methanolic extract against human pathogenic bacteria. The implications for the findings are discussed.

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MATERIALS AND METHODS

Sample Collection and Identification

Healthy and disease-free plant parts that belong to the *Fabaceae* family were collected from Quetta and Sibi regions of Balochistan Pakistan, during their respective growing seasons. Identification and uses of the collected plants were carried out with the help of locals and expert taxonomists. This information includes the local name, part used, and diseases treated (Table 1).

Processing of Plant Samples

The collected plant samples, including gum (*A. nilotica*, *A. modesta*), leaves (*S. alexandrina*), seeds (*C. absus, A. maurorum, S. tora*), bark and stem (*G. glabra, A. catechu*), were thoroughly washed to remove dust and dried under shade. The dried part of the plant samples was crushed into a fine powder with the help of an electric blender. The powder was kept in airtight plastic bags for later use.

Extraction Preparation

For the preparation of extract, 15 grams of each plant powder was added to 100ml of ethanol, methanol, chloroform, and aqueous solvent respectively, and were kept in an orbital shaker at 150 rpm at room temperature for 48 hours. The crude extract was filtered using Whatman filter paper No.1. The filtrates were collected and stored in airtight bottles, which were used for phytochemical analysis and antimicrobial activity tests.

Qualitative Phytochemical Screening

The qualitative phytochemical analysis of eight medicinal plants, with four different solvents (ethanol, methanol, chloroform and aqueous) was carried out as described by (Balamurugan et al. 2019; Harborne 1973) with some modification, to identify the presence or absence of primary and secondary metabolites like carbohydrate, anthocyanins, anthraquinones (Molish test, Benedict's test and Fehling's test). Alkaloids (Mayer's test, Wagner's test) phenol compounds, Leucoanthocyanin (Lead acetate test, potassium dichromate test and $FeCl_3$ test) glycosides,

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flavonoids (Acetic acid test, Liebermann's test) proteins (Biuret test, Conc. HNO_3 test, Ninhydrin solution test), Saponin (Foam test with Water and $NaHCO_3$).

Collection of Microorganisms and Preparation of Media

Bacterial strains (*S. aureus*, *K. pneumonia*, *E. coli*, and *P. aeruginosa*) were collected from the Center for Advanced Studies in Vaccinology & Biotechnology Balochistan (CASVAB) and used to conduct the antibacterial activity of selected medicinal plants. The isolates were kept in the refrigerator at 4°C until used.

Determination of Antibacterial Activity

During this study, two methods, disc diffusion and agar well diffusion assay were used to assess the antibacterial activity. In Agar Well diffusion assay, bacterial strains were streaked on the surface of sterile Muller Hinton agar (Sigma-Aldrich, 70191) plates. Four wells about a diameter of 6 mm were punched into agar plates and filled with 10µl plant extracts with the help of a micropipette. Plates were then left for a while to allow the extract to diffuse into the media before being incubated for 24 hours at 37°C. Thermo Scientific Oxoid Fosfomycin antimicrobial disc 200µg (CT0758B) used as positive control (Bakht et al. 2011) .

Disc diffusion assay was carried out according to the standard method described by (Bauer 1996). Bacterial strain (OD: 0.5) was spread on surface of Muller Hinton agar plate using sterile swap. Incubate the plates for 15 mint and place the disc soaked already with series of plant extracts (10 ul). After that, plates were incubated for 24 hours at 37°C (Zaidan et al. 2005).

RESULTS AND DISCUSSION

The rising prevalence of multi-drug-resistant microorganisms has prompted many studies to identify new and more effective compounds against different pathogens. Medicinal plants, being a reservoir of bioactive compounds, have significant pharmacological importance and therefore have been used in numerous research to select new compounds. This study analyzed

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phytochemicals and has evaluated the antimicrobial activity of the extracts of eight members from *Fabaceae* family (detailed description listed in table 1).

Qualitative Phytochemical Analysis

Qualitative phytochemical screening was carried out by using four polar solvents chloroform, ethanol, methanol, and water. Phenols, tannins, terpenes, flavonoids and carbohydrates were detected in plant extracts (table 2). Carbohydrates were found in all solvent extract of eight plants species, especially in *G. glabra, A.nilotica*, *A. catechu* and *S. tora*. Alkaloids have antibacterial and pharmacological activities, was significantly present in *G. glabra*, *A,maurorum*, *S. tora* and *C. absus* in chloroform and methanol extracts. Flavonoids have strong antioxidants properties, and are commonly distributed throughout testedmembers, especially in *S. tora*, *A, catechu* and *A. maurorum*. Occurrence of steroids was limited, only in methanolic extract of *C. absus* showed positives results. Cardiac glycoside and terpenoids appeared significantly in *C. absus*, *A. modesta* and *A. maurorum*, with aqueous and methanolic extract producing strong reaction. The widespread presence of Phenols and Phlobatannis constitutes in all extracts indicating strong antimicrobial and antibacterial potential. Tannis were observed in *S. tora* and *A. catechu*, consistent with their known astringent properties. Coumarins were detected in *G. glabra* and *A. maurorum*, while Quinones were observed in *S. tora* and *C. absus*, indicating possible antimicrobial or cytotoxic potential. Fatty acids, amino acids and saponins were negatively detected or generally absent, suggesting their reduced solubility or low concentration in tested crude extract.

The presence of these phytochemical compounds might be responsible for the therapeutic potential of plants under study. Phenolic compounds are considered strong antioxidants, anti-fungal and anti-film agents and were identified in all plants under investigation. Plant Terpenoids and tannins are reported to have anti-cancer, anti-bacterial, anti-virus and anti-inflammation properties. Steroids have an important role in the treatment of autoimmune diseases such as rheumatoid arthritis, asthma and eczema. However, the presence of steroids was only found in the chloroform extract of *A. mourouram.* Alkaloids are known for their use as medicines against

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inflammation, cancer, malaria, microbial, and diabetic disease (Bribi 2018). The presence of alkaloids was found in the ethanolic, methanolic and aqueous extracts of *C. absus*, *G. glabra*, *S. alexandrina*, and *S. tora*. Flavonoids have anticancer, antioxidant, anti-inflammatory, and antiviral effects, among other health advantages. Additionally, they have cardio-protective and neuroprotective effects. Except for aqueous solutions, all *C. absus* and *S. tora* solutions contained flavonoids. It was identified in Catechu's aqueous and chloroform solution, as well as in ethanolic extracts of the *G. glabra* and ethanol and methanolic *A. mourouram* (Table 2).

The choice of solvent was the most critical factor affecting the efficiency of phytochemical extraction. Out of the solvents tested ethanol, followed by methanol, proved to be the effective solvent, for the extraction of up to 50% of the bioactive compounds from *A. modesta*, *A. nilotica, A. mourouram*, *C. absus* and *S. tora*. These emulsions are polar and miscible with water, which allows them to extract both polar and non-polar compounds, such as terpenoids, flavonoids, saponin, tanins and alkaloids, well known for their antibacterial properties (Lee et al. 2024). However, in case of *A. catechu* and *G. glabra*, aqueous extracts showed the highest number of phytochemicals up to 40%, indicating that the bioactive components in these plants could be more soluble in water (Abubakar and Haque 2020). The ethanol, methanol and aqueous extracts of *S. Alexendrian* contained approximately 40%-50% phytochemicals. In contrast, the chloroform extracts were less efficient in extracting most phytochemicals, likely due to the solubility limitations of the solvents Fig1.

Evaluation of Antibacterial Activity

Methanolic extracts of eight members of *Fabacea* family were used to evaluate the antibacterial activity against *S. aureus*, *K. pneumonia*, *E. coli*, and *P. aeruginosa*. The zone of inhibition (mm) was observed and listed in table 3. The disc diffusion assay proved to be more effective in determining about 81% antibacterial activity, as compared to agar well diffusion (Fig4), which recorded approximately 53% for the tested bacterial strain (Table 3). In this study, the root extract of *G. glabra* showed maximum inhibition, against *S. aureus* (15mm) and *E. coli* (15mm) in disc diffusion assay (Fig2) and 16mm *S. aureus* in agar well diffusion assaycompared to

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standard antibiotic Fosfomycin (positive control) (Fig3). The similar findings were reported where root extract showed significant antibacterial effect against Gram-positive and gram-negative bacteria (Nitalikar et al. 2010). Previously, it was reported that *G. glabra* was found to be effective against oral pathogens (Sedighinia et al. 2012; AL-Amili and AL-Jobori 2025). Recently, the extract of *G. glabra* was used as a preservative in mango nectar instead of chemical-based preservatives to protect the nectar from harmful bacteria (Goda et al. 2025).

A.catechu and *S. tora* also exhibited notable activity against *E. coli* (12mm, 10mm) and *S. aureus* (8mm, 7mm), while *P. aeruginosa* was maximum susceptible to *A. modesta, A. maurorum,* and *C. absus* (10mm, 9mm, 10mm), compared to positive control (6mm). These findings are consistent with previous studies where *A. catechu, S. tora, A. nilotica* and *C. absus* showed maximum antibacterial activity (Ahmad et al. 2018). Recently, it was reported that stem and resins extract of *A.catechu* showed significant antibacterial activity and was used as urobactericidal to treat urinary tract infection (Panigrahy et al. 2025). (Ahad and Varghese 2020) reported similar against *E.coli*, *S. aureus* and *P. aeruginosa*. Moreover, it was observed that extracts of four plants, *A. maurorum, G.glabra, S. alexandrian,* and *S. tora* were found effective in inhibiting the growth of *K. pneumonia* (resistance to antibiotics) 10mm equal to the positive control. These results are consistence with preious finding in which methanolic extract of *A. maurorum* showed maximum activity against *K. pneumonia* (7mm) (AE 2015). Recently it was reported that the ethanolic extract of *G. glabra* was found to be more effective against *S. aureus* than it did against *K. pneumonia* (Sivanantham et al. 2023). These findings suggested that the solubility of active phytochemicals (that function as bactericidal) are more efficient in methanol solvents as compared to ethanol, chloroform and aqueous. In agar well diffusion method, *S. tora* has shown maximum inhibition against *S. aureus* (15mm) and *P. aeruginosa* (8mm), but in case of *K. pneumonia*, *S. tora, S. alexendrina*, and *A. modesta* was equal to positive control (10mm). In this study, it was observed that the solubility of phytochemical compounds was affected by different solvents, extraction techniques, and concentration. Different phytochemical compounds dissolved completely in appropriate solvents, which further affect the antibacterial activity and showed contradiction with previous findings.

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Conclusion

In conclusion, *C. Absus, S. alexandrina, A. maurorum* and *G. glabra* showed presence of maximum bioactive compound (Fig 1) while in comparison of disc diffusion and agar well diffusion method *G glabra, S. tora, A. catechus* found to be more effective in inhibiting the tested bacterial growth (Fig 4). Further studies are needed to identify which phytochemicals are most active against antibacterial activity and their quantity in specific medicinal plants.

Acknowledgement

Authors are grateful to CASVAB lab for providing bacterial strains used under this study. In addition, we are thankful to our laboratory colleagues for their help and support .

Ethical Statement of humans and animals

This study was conducted in accordance with ethical standard, with no human participation or living animals directly involved in this research work.

Funding source

This work partially supported by the " National Research Program for Universities (NRPU)-Higher Education Commission grant #17642 entitled **"**Diversity analyses of CLCuD and other Geminiviruses from potential areas of Balochistan for upland cotton cultivation**"**

Conflict of interest

The authors declared that there is no conflict of interest, all authors have read and approved the final manuscript for publication

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Table 1. Detail description of selected Medicinal Plants and their Uses

S.No	Botanical name	Common name	Local name	Family	Specie	Medicinal Uses
1	***Acacia Catechu/ Senegalia***	Black Catechu/ Khair	Khadira	*Fabaceae*	*S. Catechu*	Sore throats, bronchial asthma, gastric problems,

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	Catechu					diarrhea, high blood pressure, dysentery colitis, cough, leucorrhoea, and leprosy
2	***Acacia Modesta/ Senegalia Modesta***		Phulai	*Fabaceae*	*S. Modesta*	Chronic stomach disorders, gastric troubles, dental diseases. Gum is used as a tonic and to cure dysentery
3	***Acacia Nilotica / vachellia Nilotica***	Gum arabic tree	Kikar/ Babool	*Fabaceae*	*V. Nilotica*	HIV, hepatitis C, cancer, nausea, burns and wounds, stomachache, and diarrhea
4	***Alhagi Maurorum***	Camelthorn/Persian manna	Turanja been	*Fabaceae*	*A. mourorum*	Treat piles, migraine, warts, rheumatism, gastric ulcer, intestinal tract infection
5	***Cassia Absus***	Jasmeejaz	Chaksu	*Fabaceae*	*Cassia Absus L.*	Bronchitis, asthma, cough, leukoderma, venereal ulcer, headache, hemorrhoids and wound healing,

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						tumor, constipation, renal and hepatic diseases
6	***Glycyrrhiza glabra***	Licorice/ Licorice	Mulethi	*Fabaceae*	*G. glabra*	Digestive system disorders, respiratory tract disorders, epilepsy, fever, paralysis, rheumatism
7	***Senna alexandrina / Cassia Senna***		Sana Makki	*Fabaceae*	*S. Alexandrina*	Splenic enlargement, anemia, thyroid enlargement, anemia, typhoid, cholera, jaundice, rheumatism
8	***Senna tora / Cassia tora***	sickle senna/ sicklepod	Panwarh	*Fabaceae*	*S. tora*	used for treating liver skin diseases, rheumatic disorders

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Table 2. Phytochemical analysis from eight members of *Fabaceae*

		Acacia catechu (Khadira)				Acacia modesta (Phulai)				Acacia nilotica (Kikar)				Alhagi maurorum (Turanjabeen)				Cassia absus (Chaksu)				Glycyrrhiza glabra (Mulethi)				Senna alexandrian (Sana Makhi)				Senna tora (Panwar)			
		Extracts																															
S. no	Phyto-constituents	Ethanol	Methanol	Chloroform	aqueous	Ethanol	Methanol	Chloroform	aqueous	Ethanol	Methanol	Chloroform	aqueous	Ethanol	Methanol	Chloroform	aqueous	Ethanol	Methanol	Chloroform	aqueous	Ethanol	Methanol	Chloroform	aqueous	Ethanol	Methanol	Chloroform	aqueous	Ethanol	Methanol	Chloroform	aqueous
1	Carbohydrate	+	+	+	-	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+
2	Steroids	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	Proteins	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	+	-
4	Amino acids	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	Alkaloid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	+	+	+	+	+	+	+	-	+
6	Flavonoids	-	-	+	+	-	-	-	-	-	-	-	-	+	+	-	-	+	+	+	-	+	-	-	-	-	-	-	-	+	+	+	-
7	Terpenoids	-	+	-	+	+	-	-	-	+	+	-	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-
8	Cardiac glycosides	-	-	-	+	+	-	-	+	-	+	-	+	+	+	-	+	+	+	-	+	-	-	+	+	-	-	+	+	+	+	-	+
9	Tannins	-	-	-	+	-	+	-	-	-	-	-	-	+	+	-	+	+	+	-	+	-	+	-	+	+	+	-	+	+	+	-	-
10	Saponins	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	Phlobatanins	+	+	+	+	-	-	-	-	-	-	-	-	+	-	-	-	+	+	-	-	-	-	-	+	+	+	-	-	-	-	-	-

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12	Fatty acids	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Leuco-Anthocyanins	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-
14	Coumarins	-	-	-	-	-	+	-	+	-	-	-	-	+	+	-	+	+	+	+	+	-	-	-	-	-	+	+	+	-	-	+	-
15	Phenols	+	+	+	+	+	+	-	+	+	-	-	-	+	+	-	+	+	+	+	+	-	+	+	+	-	+	-	+	+	+	-	+
16	Quinones	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	-	-	-	-

-, Absence of active compound, + active compound detected/ present in plant

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Methanolic Extract

Name of Plants	Disc Diffusion Method				Agar Well Diffusion Method			
	S. Aureus	***E. Coli***	***K. Pneumonia***	***P. Aeruginosa***	***S. Aureus***	***E Coli***	***K. Pneumonia***	***P. Aeruginosa***
Acacia Catechu	8±0.2	12±0.1	6±0.2	5±0.1	8±0.4	5±0.2	5±0.2	4±0.1
Acacia Modesta	3±0.2	10±0.3	8±0.4	10±0.4	0mm	6±0.3	10±0.1	5±0.1
Acacia Nilotica	0mm	5±0.1	0mm	5-7±0.1	0mm	0mm	0mm	0mm
Alhagi Maurorum	5±0.1	8±0.2	10±0.2	9±0.1	0mm	0mm	4±0.3	0mm
Cassia Absus	5±0.2	5±0.2	5±0.3	10±0.2	0mm	0mm	0mm	0mm
Glycyrrhiza glabra	15±0.2	15±0.1	10±0.1	0mm	16±0.2	5±0.1	0mm	0mm
Senna Alexandrian	0mm	9±0.1	10±0.1	0mm	0mm	10±0.2	10±0.3	5±0.2
Senna tora	7±0.3	10±0.1	10±0.2	0mm	15±0.1	10±0.3	10±0.1	8±0.1
Standard Fosfomycin	7±0.2	9±0.5	10±0.1	6±0.2	7±0.2	9±0.5	10±0.1	6±0.2

Table 3. Antibacterial activity of the selected medicinal plants

Figure legends

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Figure1.

The graph represents Percentage of phytochemical compounds detected in solvent extract of eight members of *Fabaceae* family. X-axis represents the crude extract of *Acacia catechu*, *Acacia modesta*, *Acacia nilotica*, *Alhagi maurorum*, *Cassia absus*, *Glycyrrhiza glabra*, *Senna alexandrina*, and *Senna tora* in four different solvents (aqueous, methanol, ethanol and chloroform). Y-axis represents the percentage of bioactive compounds extracted from each plant.

Figure2*:* Antibacterial activity of methanolic crude extract by disc diffusion method a) *Glycyrrhiza glabra* methanolic extract against *K. pneumonia* **b)** *Alhagi* Maurorum against *K. Pneumonia* **c)** *Acacia Modesta* against *K. pneumonia*, d) *Cassia Absus* against *E. coli* **e)** *Senna Alexandrina* against *K. pneumonia* **f)** *Cassia Absus* against *S. aureus* **g)** Graphical Comparison of antibacterial activity of plant extracts on *E.coli, S.aureus, K. pneumonia and P. aeruginosa.*

Figure3. Antibacterial activity of methanolic crude extract by the Agar well diffusion method a) *Acacia Catechu* against *S. aureus* **b)** *Acacia Catechu* against *K. pneumonia* **c)** *Acacia Catechu* against *P. aeruginosa.* **d)** Graphical comparison of antibacterial activity of plant extracts on *E. coli, S.aureus, K. pneumonia and P. aeruginosa*

Figure 4. The graph represents comparative effectiveness between disc diffusion and agar well diffusion assay using methanolic crude extracts. X-axis represents the methanolic crude extract of *Acacia catechu*, *Acacia modesta*, *Acacia nilotica*, *Alhagi maurorum*, *Cassia absus*, *Glycyrrhiza glabra*, *Senna alexandrina*, and *Senna tora* against four bacterial starins (*E. coli, S. aureus, P. aeruginosa and K. pneumonia*). Y-axis represents the Zone of inhibition (mm)

Figure 1.

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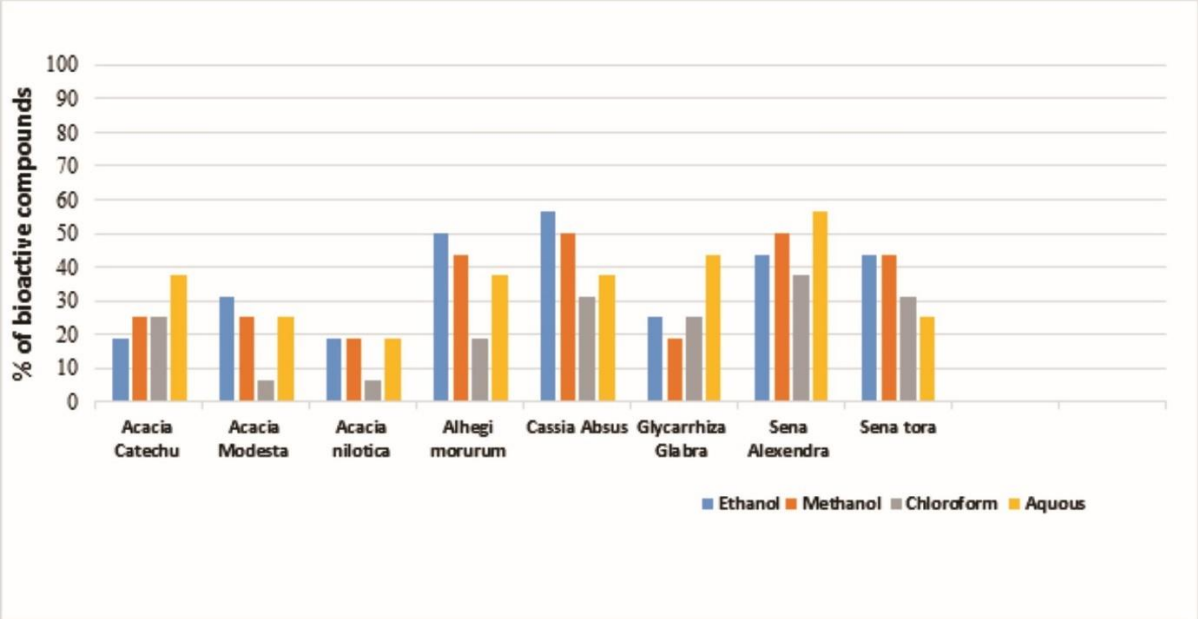

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Figure 2

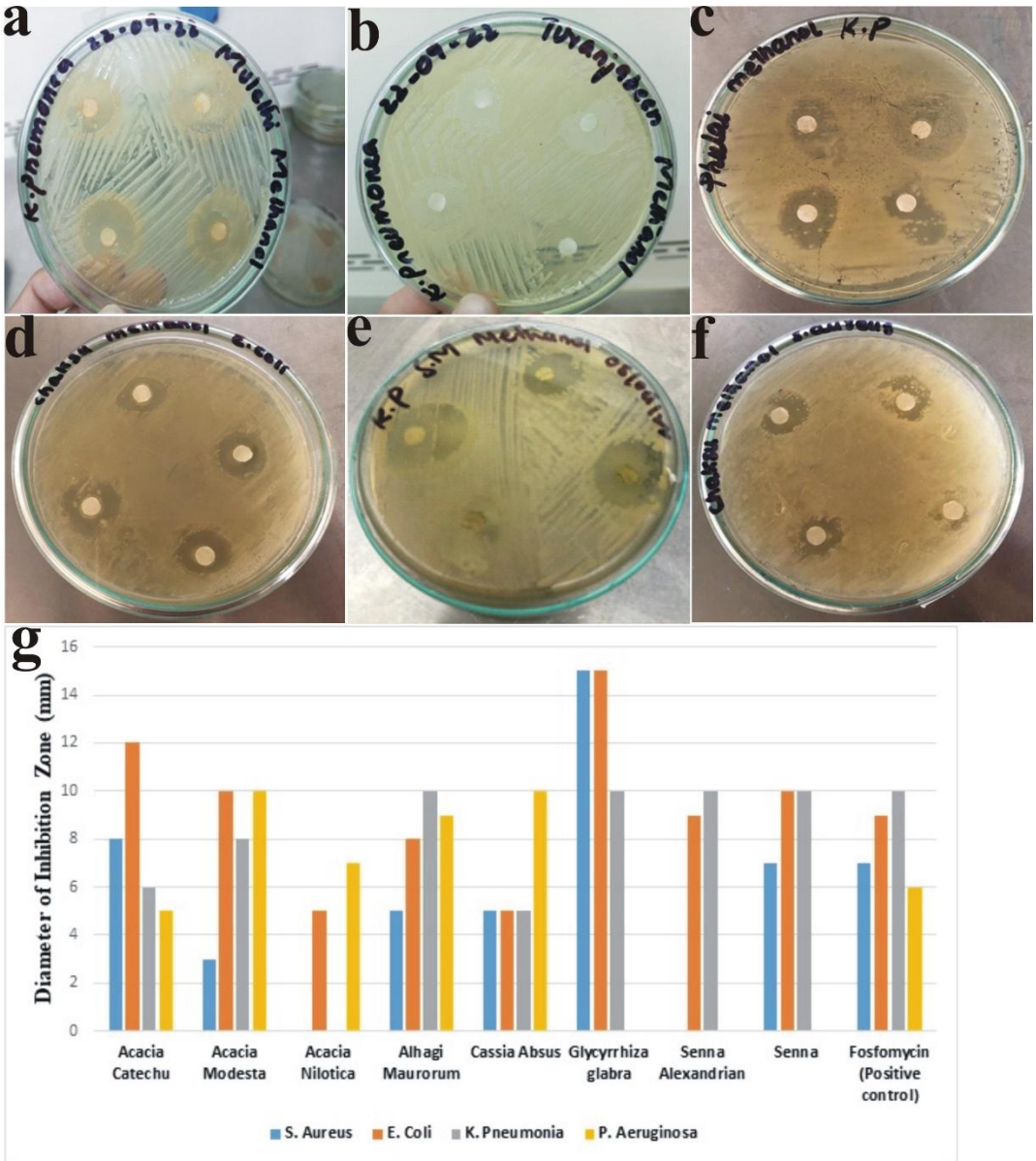

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Figure 3

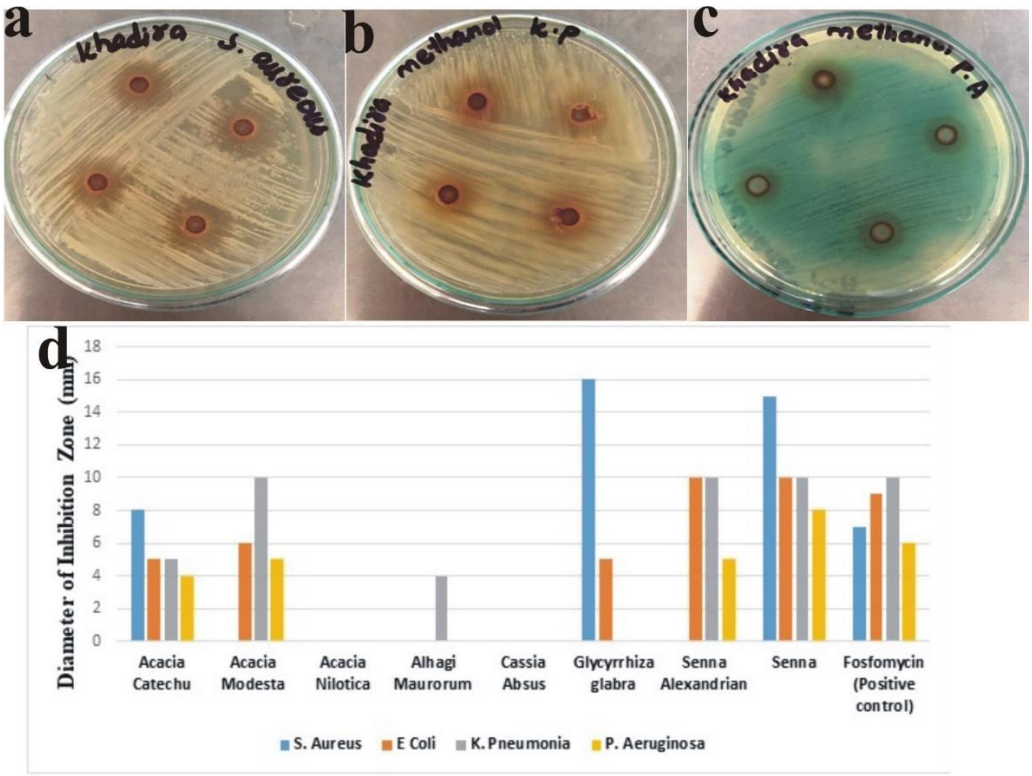

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Figure 4