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Original Article

Phytochemical Screening and Antimicrobial Activity of Maize Silk Extract: Public Health Perspective Investigations

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Abstract

Plants and herbs are a natural reservoir of chemotherapeutic chemicals that can be used to prevent or treat a variety of ailments. Corn silk is used to treat disorders caused by a variety of harmful microorganisms. This work aimed to find certain therapeutic qualities of corn silk and examine its antibacterial activities in ethanol, methanol, acetone, benzene, and chloroform extracts. *Proteus mirabilis, Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella, and Escherichia coli* were the pathogens that were tested against corn silk in this investigation. Phytochemicals such as phenols, glycosides, tannins, flavonoids, resins, phlobatannins, anthraquinones, reducing sugar, and saponins were studied qualitatively using various methods. Corn silk is used medicinally against some diseases caused by various pathogenic bacteria. Between 2 and 20 mm was the corn silk's zone of inhibition against *Escherichia coli, Klebsiella, Proteus mirabilis, Pseudomonas aeruginosa, and Staphylococcus aureus*. The agar well diffusion technique was used to quantify these zones of maize silk extracts. According to the current study, acetone extract of corn silk exhibited the least amount of antibacterial activity against *Escherichia coli and Proteus mirabilis,* whereas methanol and ethanol extracts had superior antibacterial activity potential. The chemical approach was also used to identify phytochemicals in corn silk, such as alkaloids, flavonoids, saponins, steroids, phlobatannins, glycosides, and tannins.

Keywords: Antimicrobial Activity, Phytochemicals Screening, Extracts, Pathogens, Maize Silk, Public Health Perspective.

Introduction

About 150 million cases of urinary tract infections (UTIs) are identified worldwide each year, making them the second most prevalent infection in general practice. *Escherichia coli (E. coli*) is frequently the origin of these infections. When the body's defenses are inadequate, it enters the urinary tract through the urethra, develops in the bladder, and produces inflammation. The increasing incidence of antibiotic resistance has highlighted the need for alternative therapies, leading to a rise in the use of medicinal plants as an adjuvant therapy for UTIs. Corn silk (Zea mays), a by-product of maize, has been studied for its potential as a therapy due to its antibacterial properties (Berida *et al.*, 2024; Salma *et al*., 2020). Bioactive substances that function as natural chemotherapeutic agents are known to be produced by plants such as corn silk. These substances may offer a substitute for traditional antibiotics and be useful in treating a range of bacterial infections (Sulaiman Ayodeji & David Adeniran, 2024). Flavonoids, saponins, phytosterols, volatile oils, and tannins are among the bioactive compounds found in corn silk that are thought to support its antibacterial, anti-inflammatory, anti-diabetic, and antioxidant properties. According to studies, these substances show inhibition against harmful bacteria like E. coli, a primary cause of urinary tract infections. As such, corn silk has gained recognition in traditional medicine systems worldwide, particularly for its use in treating urinary disorders (Marok *et al*., 2024a; Nigussie *et al*., 2021).

One of the most extensively grown cereal crops in the world, maize (Zea mays) is prized for both its high yield and nutritious content. It has important medical uses in many cultures and is used in a variety of forms, including cornmeal, flour, and snacks. For ages, traditional medicine has utilized corn silk—the long, silky threads that are linked to the corncob—especially in Native American and Chinese cultures. It is acknowledged for its ability to treat conditions ranging from inflammation, diabetes, and hypertension to urinary issues. Corn silk's rich makeup, which includes vitamins, minerals, and phenolic chemicals like flavonoids, chlorogenic acid, and saponins, is thought to be responsible for its therapeutic properties (Bhowmick, Oishi, & Aishy, 2022; Marok *et al*., 2024a; Tordzagla, Ayensu, & Oppong-Kyekyeku, 2024).

Corn silk has shown promise as an antibacterial agent in recent studies, particularly against E. coli, the primary cause of urinary tract infections. Research has shown that maize silk extracts, especially those prepared using solvents like ethanol and methanol, have strong antibacterial qualities. These findings suggest that maize silk may be a promising natural treatment for UTIs. Additionally, it has been found that maize silk contains antioxidant properties that may enhance its overall therapeutic advantages by protecting against oxidative stress and inflammation (Singh, Inbaraj, Kaur, Rasane, & Nanda, 2022). The bioactive components of corn silk, which are frequently less harmful than manufactured medications, are what are driving the growing interest in this plant as a medical one. Examining the potential of native plants like corn silk is crucial given the rising desire for natural, plant-based substitutes in healthcare and worries about antibiotic resistance. Corn silk is a viable option for the creation of alternative treatments for urinary tract infections (UTIs) and other illnesses brought on by harmful microbes because of its widespread availability and low toxicity (Singh *et al*., 2022). China and the United States of America consume the most corn domestically worldwide (Singh *et al*., 2022). The nutritional content of every part of the plant is excellent. Corn silk is a bundle of long, silky, yellowish strands that grow on top of the corncob. It is also referred to as Zea Mays or Maydis stigma. Native Americans and Chinese have long used this important herb to treat a wide range of illnesses. It is used as traditional medicine in several nations, including as France, the United States, and Turkey (Hossain *et al*., 2015). There are several phenolic compounds, particularly flavonoids, in corn silk (CS). Additionally, it contains alkaloids, tannins, saponins, proteins, vitamins, carbohydrates, calcium, potassium, magnesium, and sodium salts, as well as volatile oils and steroids like stigma sterol and sat sterol (Marok *et al*., 2024a).

According to (Salma *et al*., 2020), (Salma *et al*., 2020), (Sulaiman Ayodeji & David Adeniran, 2024) and (Tordzagla *et al*., 2024) , corn silk has anti-oxidant properties, anti-diabetic benefits, and antibacterial actions against maize earworm. Testing a wide variety of plant species for medicinal qualities is essential (Novel, 2025). Flavonoids, p-coumaric acid, ferulic acid, saponins, phytosterols, volatile and fixed oils, resin, carbohydrates, allantoin, tannin, and minerals are all abundant in corn silk (Devi, Kumar, & Singh, 2024b). Corn silk is a by-product or waste that has traditionally been used as a laxative and blood pressure reduction in traditional medicine (Devi *et al*., 2024b).

Methanol, ethanol, acetone, and ethyl acetate are common solvents for flavonoid extraction. The active component of corn silk purified with 50% ethanol had the highest inhibition activity, with a 69.90% inhibitory activity (Devi *et al*., 2024b). According to (Shankaranarayana, Gajanana, Chavan, Chavannavar, & Doddanagappa, 2024) A class of naturally occurring compounds with different phenolic structures are called flavonoids. They are currently regarded as an essential part of many pharmacological, cosmetic, nutraceutical, and medical uses. This is explained by their ability to modify important cellular enzyme activities as well as their anti-oxidative, anti-inflammatory, anti-mutagenic, and anti-carcinogenic qualities (Devi, Kumar, & Singh, 2024a). These phenolic chemicals are abundant in corn silk. This makes the research of this plant crucial. Furthermore, CS contains saponins, which are distinguished by their structure that include one or more sugar chains together with triterpenes or steroid glycine. Saponins have emerged as commercially significant compounds with expanding applications in the food, cosmetics, and pharmaceutical sectors due to consumer demand for natural products, their physicochemical (surfactant) properties, and growing evidence of their biological activity (such as anti-cancer and anticholesterol activity) (Chen *et al*., 2025; Hasanaudin, 2014).

Thus, because of its antibacterial, anti-inflammatory, and antioxidant qualities, corn silk (Zea mays) has a promising treatment for UTIs, particularly those brought on by E. coli. The investigation of plant-based substitutes, such as corn silk, is essential for creating secure and efficient remedies for bacterial infections and other illnesses, while antibiotic resistance keeps increasing. Translating these findings into practical applications will require more investigation into the processes underlying its therapeutic effects and the improvement of its extraction techniques (Kaur *et al*., 2023).

Background

There is an important need for new therapeutic agents due to the growing problem of antimicrobial resistance (AMR), which has made many traditional antibiotics useless. This has sparked a resurgence of scientific interest in medicinal plants, which have long been used as a storehouse of therapeutic properties and provide a wealth of different bioactive chemicals. Alkaloids, flavonoids, tannins, and saponins are examples of phytochemicals produced from plants that are known to have strong antibacterial qualities through processes that frequently diverge from those of synthetic medications, possibly defeating organisms that are resistant to them (Elizabeth, Opeyemi, & Oluboade, 2021). Therefore, one possible approach in the search for alternative antimicrobials is to investigate underused or unknown plant components, such as maize silk (Mohankumar, Prakash, Irfan, Mohanraj, & Kumarappan, 2022). The stigma-style of the female inflorescence, maize silk (Zea mays L.), is a good option for this kind of study. Rich in phytoconstituents with proven biological activity, it has been utilized historically in a variety of ethnos medical practices to treat ailments including edema and urinary tract infections. According to earlier research, maize silk extracts include flavonoids, phenolic acids, and other secondary metabolites that have anti-inflammatory, anti-diabetic, and antioxidant properties. Its extracts' precise antibacterial effectiveness against a group of clinically relevant infections, however, is still little understood and has to be systematically assessed, especially when utilizing a variety of solvents with different polarities (Ammor *et al*., 2021; Elizabeth *et al*., 2021).

To fill this study gap, this study will screen phytochemicals and assess the antimicrobial efficacy of extracts of maize silk that are Methanolic, ethanolic, acetone, chloroform, and benzene. These pathogens *Klebsiella pneumonia, Escherichia coli, Pseudomonas aeruginosa, Proteus mirabilis, and Staphylococcus aureus* are known for their multidrug-resistant strains and are important causes of nosocomial and community-acquired infections. To support the traditional usage of maize silk and aid in the development of novel plant-based antibacterial leads, this study aims to correlate the phytochemical profile with the antimicrobial efficacy against these bacteria.

Research Problem

Novel therapeutic agents from other sources, such as medicinal plants, are urgently needed since the effectiveness of traditional antibiotics has been severely reduced by the increasing incidence of antimicrobial resistance (AMR) (Tang, Millar, & Moore, 2023). Despite being used in traditional medicine to treat infections and being known to contain a variety of bioactive chemicals, maize silk (Zea mays L.) has not yet had its potential as a broad-spectrum antibacterial agent sufficiently investigated or scientifically verified (Chen *et al*., 2025; Novel, 2025). There is a substantial research vacuum in the methodical, comparative evaluation of the effects of various extraction solvents on the phytochemical yield and, in turn, the antibacterial activity of extracts made from maize silk. There is a lack of comprehensive research on the relative efficacy of benzene, acetone, chloroform, methanolic, and ethanolic extracts against a panel of clinically important pathogens. Gram-positive Staphylococcus aureus and Gram-negative bacteria including Klebsiella pneumoniae, Escherichia coli, Pseudomonas aeruginosa, and Proteus mirabilis are both represented in this panel. These bacteria are all well-known for their strains that are resistant to many drugs (World Health Organization, 2024), (Salam *et al*., 2023; Tang *et al.*, 2023). Thus, the main research issue is the absence of thorough information linking the phytochemical components extracted by these different polarity solvents with the corresponding antimicrobial activity against these, high-priority pathogens. This prevents maize silk from becoming a practical substitute or supplemental antimicrobial treatment (Organization, 2024b).

Objectives Of the Study

1. Phytochemical Screening of components of maize silk extracts.
2. To determine the antimicrobial activity of corn silk Acetone extract against Proteus mirabilis, Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella, and Escherichia coli
3. To determine the antimicrobial activity of corn silk ethanol extract against Proteus mirabilis, Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella, and Escherichia coli
4. To determine the antimicrobial activity of corn silk methanol extract against Proteus mirabilis, Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella, and Escherichia coli
5. To determine the antimicrobial activity of corn silk chloroform extract against Proteus mirabilis, Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella, and Escherichia coli
6. To determine the antimicrobial activity of corn silk benzene extract against Proteus mirabilis, Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella, and Escherichia coli.

Research Questions

1. In the benzene, acetone, chloroform, methanolic, and ethanolic extracts of maize silk (Zea mays L.), which phytochemical classes—such as alkaloids, flavonoids, tannins, and saponins—are present?
2. Do the individual solvent extracts show notable and distinct antibacterial activity in vitro against the chosen Gram-positive (S. aureus) and Gram-negative (K. pneumoniae, E. coli, P. aeruginosa, and P. mirabilis) pathogens?
3. Using minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC), which extract, or extracts show the most efficacy against the tested bacterial strains?
4. Is it possible to find possible bioactive chemicals by establishing a link between the specific phytochemical profile of the most active maize silk extract or extracts and the observed antibacterial efficacy?

Significance

By investigating the potential of Zea mays L. silk as a source of new antimicrobial compounds and providing scientific validation for its ethnobotanical usage, this study is highly valuable in the ongoing fight against antimicrobial resistance (Salam *et al*., 2023; Tang *et al*., 2023). The results will offer vital information on maize silk's bioactivity against a range of clinically significant, frequently multidrug-resistant diseases, including ESKAPE pathogens like P. aeruginosa and K. pneumoniae, which may lead to the discovery of novel treatment candidates. In order to optimize future extraction procedures, the study will determine the best extraction medium for separating antimicrobial chemicals from this agricultural by-product by methodically contrasting five solvents with different polarities (Organization, 2024a). This converts an underused resource into a high-value product, directly supporting the concepts of waste valorization and green chemistry. Additionally, by linking the phytochemical profile to antimicrobial action, future isolation and characterization research will be guided by identifying the precise classes of chemicals causing the observed effects. In the end, this work establishes a fundamental framework for creating alternative or complementary antimicrobial treatments, which is a crucial goal emphasized by international health organizations dealing with the post-antibiotic age (Bhowmick *et al*., 2022; Berida *et al*., 2024; Nigussie *et al*., 2021).

Review of Literature

Traditional medicine has historically used maize silk (Zea mays L.), the stigma-style of the female maize flower, to treat a variety of illnesses, including inflammatory and urinary disorders. The presence of a variety of bioactive chemicals is thought to be responsible for its medicinal potential. Flavonoids, alkaloids, phenols, tannins, saponins, and terpenoids are all present in maize silk, according to phytochemical screening studies. The particular yield and profile of these chemicals are mostly determined by the extraction solvent (Lapcík *et al*., 2023). The significance of solvent selection in optimizing the recovery of particular phytoconstituents is highlighted by the fact that polar solvents, such as ethanol, methanol, and water, are typically more effective at extracting phenolic acids and flavonoids, whereas moderately polar (acetone) and non-polar solvents (benzene, chloroform) may better target other classes of compounds, such as certain alkaloids and terpenes (Ranjbaran & Moradkhani, 2022).

Research has focused a lot on these extracts' antibacterial effectiveness, especially against common infections. Crude extracts from maize silk have been shown in several investigations to have inhibitory effect against a variety of Gram-positive and Gram-negative bacteria. Its phytochemicals' synergistic impact, which can damage microbial cell membranes, suppress enzyme activity, and obstruct protein synthesis, is frequently connected to the reported antibacterial effect (Abirami *et al.*, 2021). According to research, ethanol and methanol extracts often have higher antibacterial qualities than those made using non-polar solvents. This is probably because they are better at extracting broad-spectrum antimicrobial phenolics and flavonoids (Singh *et al*., 2022). Promising outcomes have been obtained from specific studies that target pathogens such *Proteus mirabilis, Pseudomonas aeruginosa, Klebsiella pneumonia, Escherichia coli, and Staphylococcus aureus*. Methanol extracts of maize silk, for example, demonstrated notable zones of inhibition against S. aureus and E. coli, according to research by Hassan *et al*. (2018). Ethanol extracts were also found to be efficient against *K. pneumonia and P. aeruginosa* by Nwaogu *et al*. (2020). The varying solubility of antimicrobial compounds in each solvent, which affects the extract's ultimate concentration of active principles, is the cause of the variance in effectiveness amongst extracts. Additionally, because Gram-negative bacteria have an outer membrane that functions as a barrier to many substances, Gram-positive bacteria like S. aureus are frequently more vulnerable than Gram-negative bacteria (like *P. aeruginosa and E. coli)* (Marok *et al.,* 2024b; Swati *et al.,* 2024). To sum up, research shows that maize silk is a great source of bioactive phytochemicals with proven antibacterial qualities. The phytochemical profile and the extract's subsequent antibacterial effectiveness against a panel of clinically relevant bacteria are significantly influenced by the extraction solvent selection, which can include ethanol, methanol, acetone, benzene, or chloroform. This collection of studies highlights maize silk's potential as a natural antibacterial agent source and supports more study, including the identification of certain active ingredients and examinations of their modes of action.

Materials and Methods

Research Design

To assess the phytochemical and antibacterial qualities of maize silk extracts, this experimental investigation used a structured approach. Following authentication, drying, and powdering of fresh maize silk (Zea mays L.), the material was successively extracted in a Soxhlet apparatus using solvents of increasing polarity (benzene, chloroform, acetone, methanol, and ethanol). To find important secondary metabolites such as alkaloids, flavonoids, tannins, saponins, and terpenoids, the resulting extracts were concentrated and put through a routine qualitative phytochemical screening process. The antibiotic activity of each extract was then quantitatively evaluated against clinical isolates of *Klebsiella pneumonia, Escherichia coli, Pseudomonas aeruginosa, Proteus mirabilis, and Staphylococcus aureus* using the agar well diffusion technique to identify the zone of inhibition. The minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) of the most effective extracts were then evaluated using the broth micro dilution method, as recommended by the Clinical and Laboratory Standards Institute (CLSI). All studies were carried out in triplicate, and the results were statistically evaluated to determine the correlation between phytochemical presence and reported antibacterial activity, resulting in a thorough bioactivity profile for each solvent extract (Nagori, Rajput, Choudhary, & Khabiya, 2025).

Research Settings and Plant Material

The investigation was carried out in the microbiology laboratory at the University of Haripur. Fresh and healthy maize silk (Zea mays L.) was obtained from a local market in Haripur. The plant material was carefully cleaned with tap water before being rinsed with 70% ethanol to remove surface impurities. It was then shade-dried to retain heat-labile chemicals.

Sampling and Sample Preparation

A mechanical grinder was used to grind the dried maize silk into a consistent powder. For every solvent extraction procedure, 50 g of the powder was utilized as a sample. Benzene, chloroform, acetone, methanol, and ethanol were the solvents of increasing polarity used in the extraction, which was carried out using a Soxhlet apparatus. A rotary evaporator was used to concentrate the extracts, and a freeze-dryer set at 60–65°C for 24 hours was used to thoroughly dry them. Until they were needed again, the final dried extracts were kept at 4°C.

Data Collection Instruments

A Soxhlet apparatus for extraction, a freeze-dryer for solvent removal, and normal laboratory glassware were the main tools utilized to gather data. For qualitative testing, phytochemical screening was carried out using well-known chemical reagents (such concentrated H_2SO_4, Fehling's solution, and $FeCl_3$). A sterile cork borer (6–8 mm) was used to create wells and nutrient agar medium to measure antimicrobial activity.

Data Collection Procedure and Analysis

Phytochemical Screening

To determine the presence of different phytoconstituents, the prepared extracts were reconstituted and put through standard qualitative tests. These tests included the following: reducing sugars (Fehling's test), flavonoids (Acidic test), resins, anthraquinones (Borntrager's test), steroids (Salkowski's test), glycosides (Keller-Killani test), saponins (Froth test), tannins and phenols (Ferric Chloride test), phlobatannins, and steroids (Salkowski's test) [4].

Antimicrobial Assay

Five bacterial pathogens—Klebsiella pneumoniae, Escherichia coli, Pseudomonas aeruginosa, Proteus mirabilis, and Staphylococcus aureus—were used to test the antibiotic activity. Fresh bacterial cultures were swabbed onto nutrient agar plates using the agar well diffusion technique. 25 µL, 50 µL, and 75 µL of each extract were placed into wells that had been drilled. Following a 24-hour incubation period at 37°C, the zones of inhibition (ZOI) on the plates were measured in millimeters.

Every experiment, including antimicrobial testing, phytochemical analyses, and extractions, was carried out in triplicate. Using Microsoft Excel 2016, the quantitative antimicrobial data (zone of inhibition measures) were examined. The mean ± standard deviation (SD) is used to display the findings.

Results and Findings

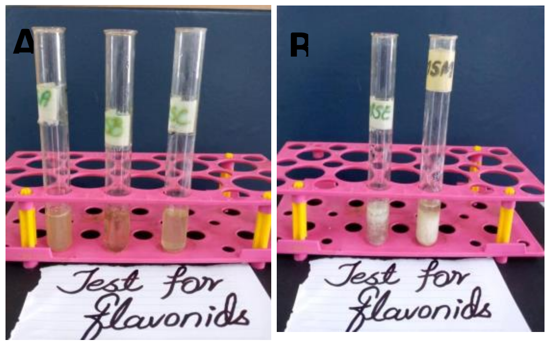
Phytochemical Analysis of Corn Silk

Flavonoids Detection

The plant extract had a strong yellow color that turned colorless after adding a few drops of magnesium powder, indicating the presence of flavonoids. Higher flavonoids contents were detected in methanol and ethanol extracts of corn silk as compared to chloroform extracts, hence ethanol and methanol proved better solvents for the identification of corn silk compounds. The low flavonoids contents of corn silk extracts in benzene showed that it might not be better to use benzene for the detection of flavonoids while the solvent acetone was not found suitable for the detection of flavonoids, so it is concluded that methanol and ethanol were better solvents for detection of flavonoids. Figure-1 showed flavonoids in the extract of corn silk in all five solvents i.e., acetone, benzene, chloroform, ethanol and methanol.

Figure 1

Flavonoids Detection

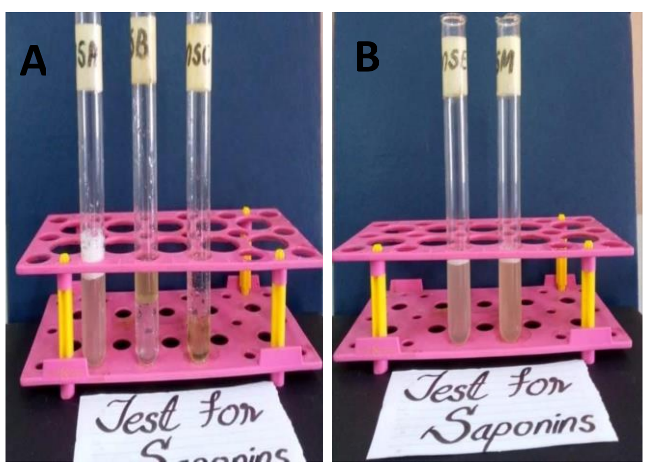


Identification of Saponins

The presence of saponins was suggested by the development of stable foam. Saponins were found highly expressed in the analyzed acetone extracts of corn silk while Methanolic and ethanolic extracts of corn silk were also revealed to contain moderate content of saponins while benzene and chloroform extracts of corn silk did not contain saponins. Figure-2 showed saponins in the extract of corn silk in all five solvents i.e., acetone (A), benzene (B), chloroform (C), ethanol (E), and methanol (M).

Figure 2

Saponins Detection

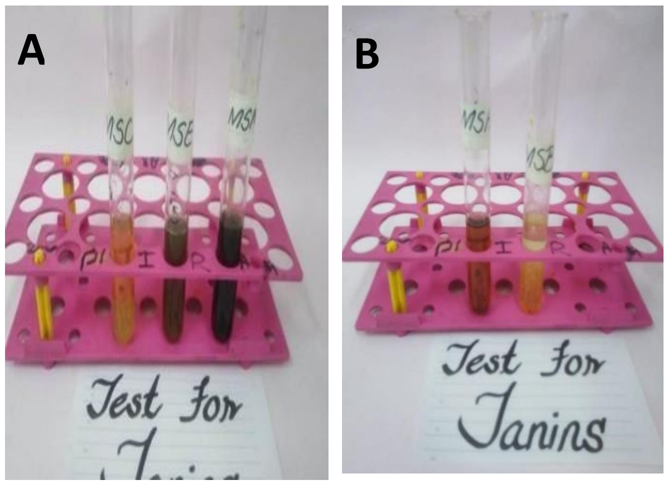


Recognition of Tannins

The presence of tannins was shown by the formation of a greenish precipitate. A portion of the extracts were also diluted with distilled water, and a few drops of ferric chloride solution were added. The presence of tannins is indicated by a blue or green tint. When ferric chloride was added to the filtered sample, the color changed to brownish green or blue, indicating the presence of tannins. Methanolic and ethanolic extracts of corn silk showed maximum contents of tannins while low content of tannins was detected in extracts of Corn silk in acetone and chloroform solvents and showed no detection of tannins content in benzene solvent. Figure-3 shows tannins in the extract of Corn silk in five solvents i.e., acetone, benzene, chloroform, ethanol and methanol.

Figure 3

Tannin Detection

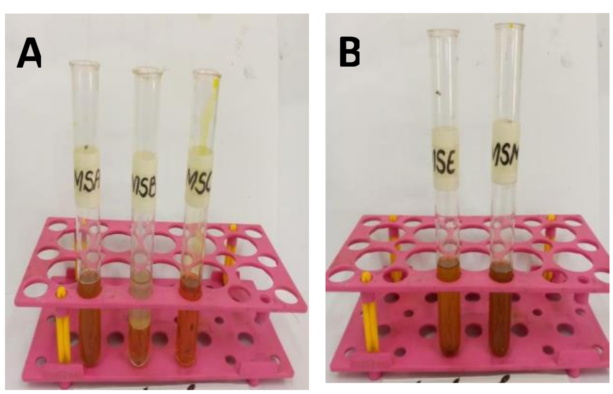


Presence of Resins

A few drops of copper acetate were added to one ml of various solvent extracts, followed by one ml of conc. H_2SO_4. After adding the solution resins produced different colors, from light green to dark green. Resins are highly observed in extracts of Corn silk in methanol, ethanol while the solvent acetone was not found suitable for the detection of resins, so it is concluded that methanol and ethanol were better solvents for detection of resins while low contents of resins were found in benzene and chloroform. Figure 4 showed resin in the extract of corn silk in five solvents of acetone, benzene, chloroform, ethanol and methanol.

Figure 4

Resin Detection

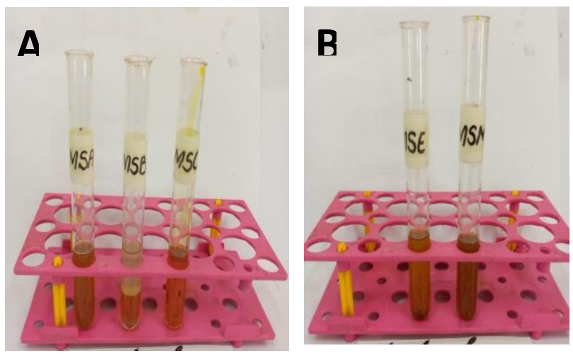


Detection of Phenols

In a test tube, plant extracts were mixed with 1 ml of water and 1 to 2 drops of Iron III chloride (FeCl3). A positive test results in a blue, green, red, or purple color precipitate were observed in a few minutes. Higher phenolic contents were detected in methanol and ethanol extracts of corn silk as compared to chloroform extract of corn silk, hence ethanol and methanol proved better solvents for identification of corn silk compounds the low phenolic content of corn silk extract in benzene showed that it might not be better to use benzene for detection of phenols while the solvent acetone was not found suitable for detection of phenols so it is concluded that methanol and ethanol were better solvents for detection of phenols. Figure -5 showed phenol in the extract of corn silk in acetone, benzene, chloroform, ethanol and methanol solvents.

Figure 5

Phenols Detection



Identification of Steroid

Plant extracts (2 ml) were dissolved in chloroform (10 ml), then strong sulfuric acid was added to the test tube. The appearance of red color indicates the presence of steroids. Extracts of Corn silk in methanol and ethanol manifested higher steroid contents while low content of steroid was detected in extracts of Corn silk in chloroform and showed no detection of steroid content in acetone and benzene solvent was observed, hence ethanol and methanol proved better solvents for identification of corn silk compound the low steroid content of corn silk extract in benzene showed that it might not be better to use benzene for detection of steroid while the solvent acetone was not found suitable for detection of steroid so it is concluded that methanol and ethanol were better solvents for detection of steroid. Results showed steroids in the extract of corn silk in solvents of acetone, benzene, chloroform, ethanol and methanol.

Determination of Phlobatannins

2 ml of the corn silks extracts were added to dilute HCl, and the presence of brown precipitate indicated the existence of Phlobatannins. Higher content of Phlobatannins was detected in extract of Corn silk in methanol, ethanol and acetone solvent showed low phlobatannins content and no detection of phenol content was observed in benzene and chloroform, hence ethanol and methanol proved better solvents for identification of corn silk compound as compared to acetone, benzene and chloroform. Results showed phlobatannins in the extract of corn silk in acetone, benzene, chloroform, ethanol and methanol solvents.

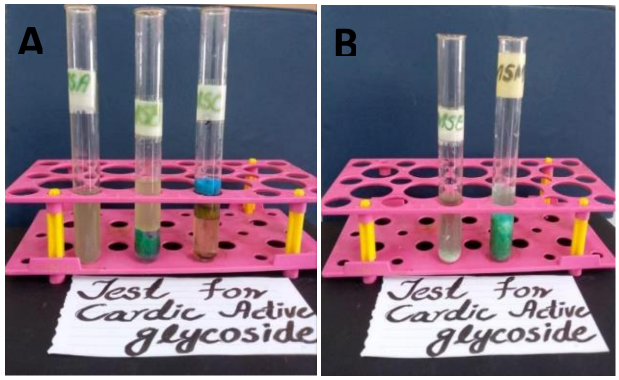
Cardiac Active Glycoside

A few drops of NaOH were added to 1ml of various solvent extracts, followed by 1ml of Fehling solution A and B, formation of a ring indicating the presence of glycoside. Extracts of corn silk in acetone, methanol and ethanol observed higher cardiac active glycoside content while moderate content of cardiac active glycoside was detected in extracts of corn silk in chloroform, also very low content of cardiac active glycoside in benzene was observed.

Figure-6 showed cardiac active glycoside in l extract of corn silk in five solvents of acetone, benzene, chloroform, ethanol and methanol.

Figure 6

Glycoside Detection



Anthraquinones Identification

The presence of anthraquinones was shown by the appearance of red color. The extracts were also be diluted with distilled water and a few drops of concentrated H_2SO_4 were added. When concentrated H_2SO_4 were added to the filtered sample, the color changed to red, indicating the presence of anthraquinones. Anthraquinones are highly identified in extracts of Corn silk in acetone, in ethanol and methanol showed moderate anthraquinones content while low contents of anthraquinones were detected in chloroform and showed no anthraquinones content in the solvent of benzene. Results showed anthraquinones in the extract of Corn silk in five solvents of acetone, benzene, chloroform, ethanol and methanol.

Presence of Reducing Sugar

2 ml of the extract's aqueous solution were added to Fehling solutions A and B. The presence of dark green rings indicated the existence of sugar. Higher sugar contents were detected in methanol and ethanol extracts of corn silk as compared to chloroform extracts, hence ethanol and methanol proved better solvents for the identification of corn silk compounds. The low reducing sugar contents of corn silk extracts in benzene showed that it might not be better to use benzene for the detection of sugar while the solvent acetone was not found suitable for the detection of reducing sugar, so it is concluded that methanol and ethanol were better solvents for detection of reducing sugar. Investigations show the reducing sugar present in the extract of corn silk in five solvents of acetone, benzene, chloroform, ethanol and methanol.

Antibacterial Activities of Corn Silk Extracts against Selected Pathogens

The maximum antibacterial activities were observed in the Methanolic and ethanolic extracts of maize silk against *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa, Klebsiella* and *Proteus mirabilis* (Figure-7). This shows that methanol and ethanol are the best solvents for the preparation of corn silk extract to test antibacterial activities. Nutrient agar was used to test antibacterial activity.

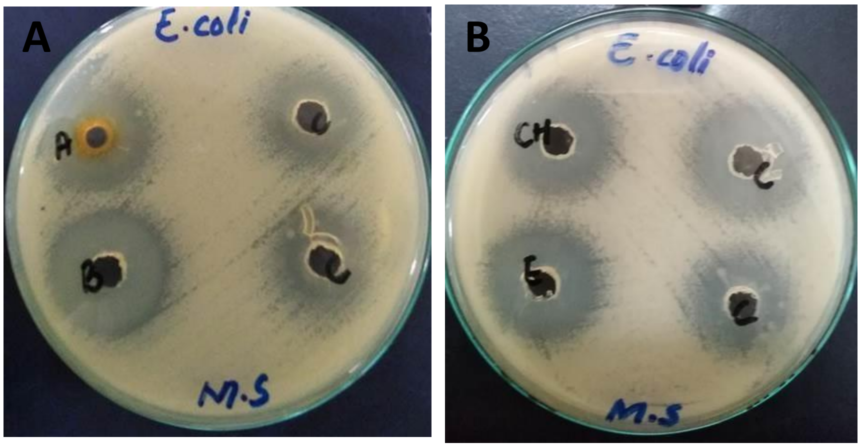
Statistical Analysis

Antibacterial Activity of Corn Silk against Escherichia Coli

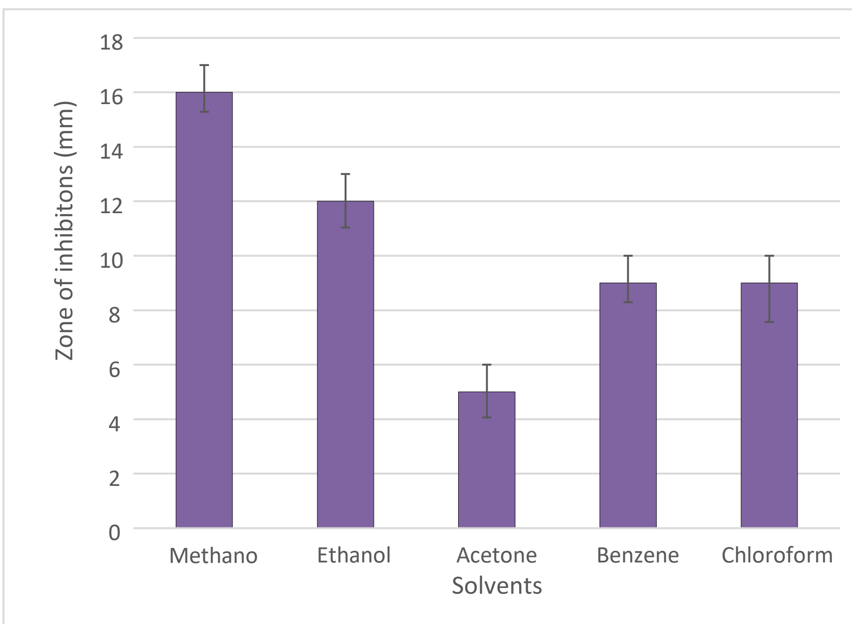
Methanol and ethanol extract of Corn silk observed higher antibacterial activity potential against *Escherichia coli* i.e., 16mm and 12mm zone of inhibition, while chloroform, benzene and acetone extract of Corn silk showed moderate and less antibacterial activity against *Escherichia coli* i.e., 5mm, 9mm and 9mm zone of inhibition. (Fig; 7), (Table-1).

Figure 7

Activity against E. coli



Graph 1
Activity against E. coli

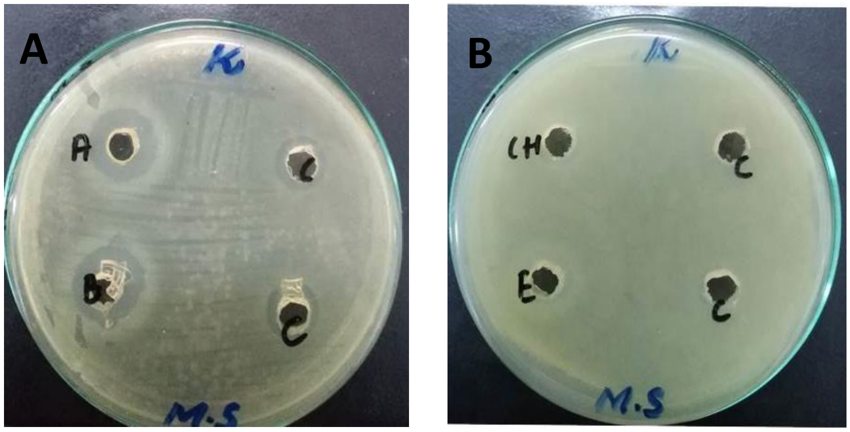


Antibacterial Activity of Corn Silk against *Klebsiella*

Methanol and ethanol extract of Corn silk detected higher antibacterial activity potential against *Klebsiella* i.e., 11mm and 15mm zone of inhibition, while chloroform, benzene and acetone extract of corn silk showed moderate and less antibacterial activity against *Klebsiella* i.e., 4mm, 10mm and 11mm zone of inhibition (Figure-8) (Table-1).

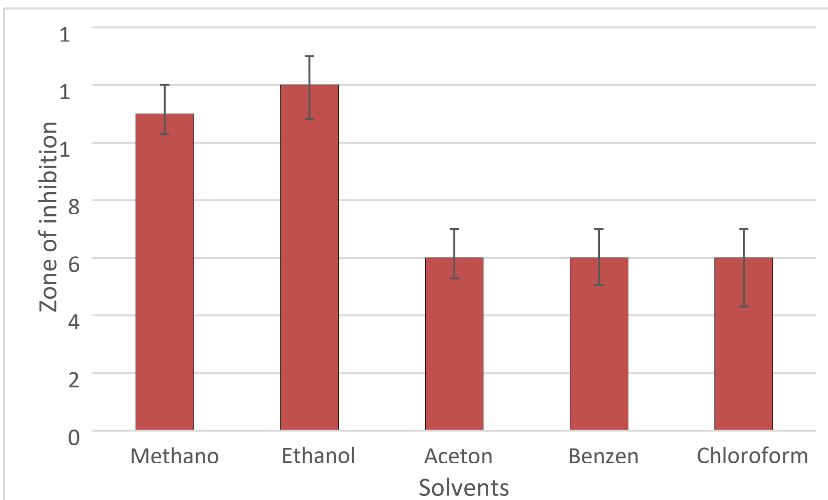
Figure 8

Activity against Klebsiella



Graph 2

Activity against Klebsiella



Antibacterial Activity of Corn Silk against *Staphylococcus Aureus*

Methanol and ethanol extract of Corn silk indicated higher antibacterial activity potential against *Staphylococcus aureus* i.e., 13mm and 19mm zone of inhibition, while chloroform, benzene and acetone extract of Corn silk observed moderate and less antibacterial activity against *Staphylococcus aureus* i.e., 2mm, 10mm and 11mm zone of inhibition (Table-1).

Antibacterial Activity of Corn Silk against *Pseudomonas Aeruginosa*

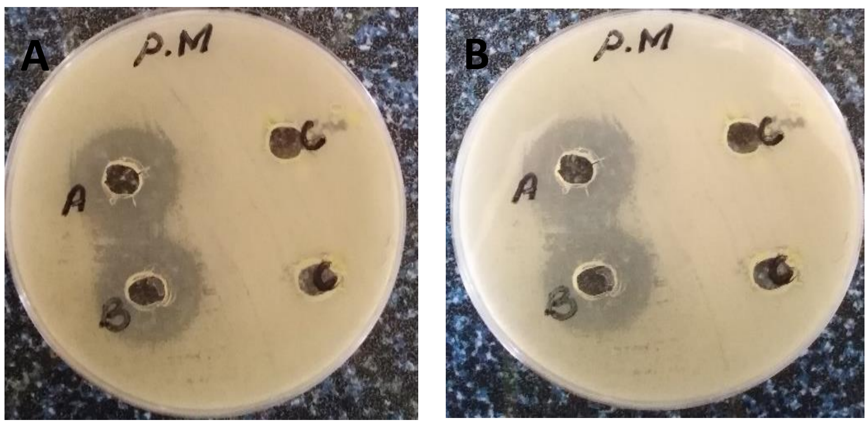
Methanol and ethanol extract of Corn silk determined higher antibacterial activity potential against *Pseudomonas aeruginosa* i.e., 12mm and 13mm zone of inhibition, while chloroform, benzene and acetone extract of Corn silk indicated moderate and less antibacterial activity against *Pseudomonas aeruginosa* i.e., 4mm, 10mm and 9mm zone of inhibition (Table-1).

Antibacterial Activity of Corn Silk against *Proteus Mirabilis*

Methanol and ethanol extract of Corn silk showed higher antibacterial activity potential against *Proteus mirabilis* i.e., 11mm and 16mm zone of inhibition, while chloroform, benzene and acetone extract of Corn silk observed moderate and less antibacterial activity against *Proteus mirabilis* i.e., 4mm, 10mm and 9mm zone of inhibition. (Figure-9), (Table-1).

Figure 8

Activity against Proteus Mirabillis



Graph 3

Activity against Proteus Mirabillis

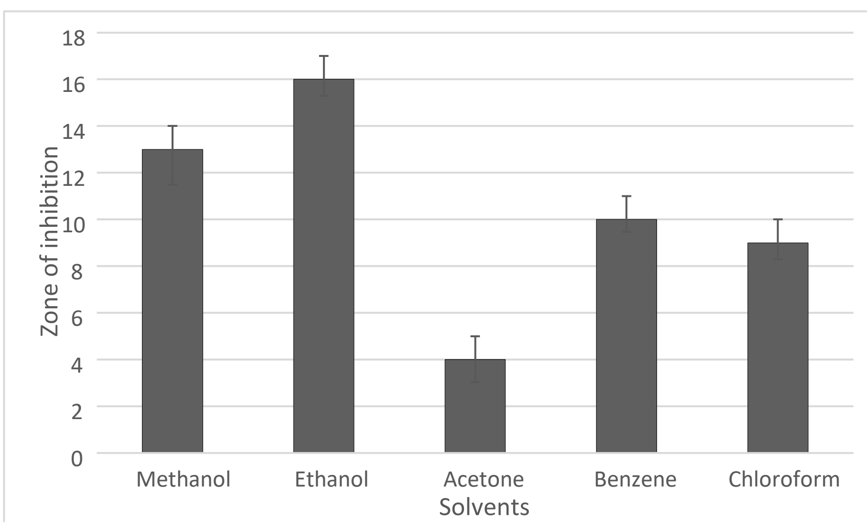


Table 1

Zone of inhibition of corn silk against pathogens in various solvents

Organic solvents	*S. aureus*	*E. coli*	*Klebsiella*	*Aeruginosa*	*P. mirabilis*
Methanol	11mm	16mm	11mm	12mm	13mm
Ethanol	15mm	12mm	12mm	13mm	16mm
Acetone	4mm	5mm	6mm	4mm	4mm
Benzene	10mm	9mm	6mm	10mm	10mm
Chloroform	11mm	9mm	6mm	9mm	9mm

Discussion

Medicinal plants have been studied for their therapeutic efficacy in the treatment of a variety of diseases, particularly in developing nations. The plants have many medicinal characteristics, and they are nature's gift for us to cure infections and free our life from several harmful diseases. It also plays a fundamental role in saving the health of humans. We know that our country Pakistan is a developing country and there we largely depend on the plants for fodder, agriculture, food and for herbal medicines. In many countries like Pakistan, plant extracts are still used for making herbal medicines. The idea that plant-based medications are not often linked to certain adverse effects associated with synthetic drugs is boosting the use of such plants. Plant active molecules are currently being analyzed to reveal limitless possibilities because of their hostile nature against a variety of disease-causing microbes, making them ideal therapeutic targets. Furthermore, this supports the notion made in folklore that indigenous herbs are used in traditional African therapeutic practices (Mann *et al*., 2008). In many developing countries, the therapeutic and dietary demands that specific local plant species meet have been highlighted (Conteh *et al*., 2025).

The discovery of phytocompounds would enhance the plant's therapeutic capacity against a variety of diseases in this investigation (Muhammad, Usman, & Zauro, 2023).Corn silk was put to the test against a variety of bacteria to determine their activity spectrum. Furthermore, because phenolic are antiseptic, this plant extract should have good antibacterial efficacy against a limited number of species. The antibacterial properties of alkaloids, polyphenols, saponins, and steroids may be responsible for the efficacy in treating diarrhea and stomach upsets caused by *Staphylococcus aureus* infections (Adebiyi, Ore, & Ojile, 2022).

Methanol and ethanol showed sensitive reactions to the various organic solvents and concentrations utilized for screening antibacterial activity and determining phytochemical characteristics of corn silk extract. Among the corn silk extracts, the ethanol extract performed best, with the largest zone of inhibition compared to the methanol and chloroform extracts (Fatema *et al*., 2024) has described such impacts. The inhibitory zones for bacteria suggested that the ethanol-based extract of corn silk had more antimicrobial activity potential in our research. Different corn silk extracts were used to create an inhibition zone between Gram-positive and Gram-negative bacteria. With the examined extracts, Gram-positive bacteria produced a larger inhibitory zone than Gram-negative bacteria in this investigation. Li, Chen, Liu, Zheng, & Hou (2024) hypothesized that the varying susceptibility could be explained by changes in cell wall composition between Gram-positive and Gram-negative bacteria. Examples of organic compounds include tannins, phenols, alkaloids, flavonoids, terpenoids, glycosides, and steroids. (Tordzagla *et al*., 2024) examined fatty acid mixtures (dodecanoic acid, tetra decanoic acid, hexadecenoic acid, and octadecanoic acid) and phytosterols (stigma sterol and sitosterol) in various corn silk varieties. They discovered that methanol extract contained a number of flavonoids, including maysin, quercetin, and maysin-3 (Wang *et al*., 2024). Our results showed that sugar and steroids were exclusively present in ethanol and methanol-based extracts, but flavonoids and glycosides were present in ethanol, methanol, and chloroform-based extracts. Methanol-based extracts of Catharanthus roseus leaves included flavonoids, alkaloids, anthraquinones, steroids, glycosides, tannins, saponins, and phenolic substances (Wang *et al*., 2024).

Pseudomonas aeruginosa and *Staphylococcus aureus* are two of the most opportunistic infections commonly associated with respiratory diseases, urinary tract infections, and gastrointestinal infections, among others that have gotten a lot of attention due to their rising prevalence among community-acquired infections (Lord, Gikonyo, & Miwa, 2021). Another opportunistic infection contender is, which has been identified as one of the causal agents for acute diarrhea and other urinary tract infections around the world (Georgiou & Kotze, 2023; Peinado-Guevara, Mejía-Sánchez, Clark-Tapia, Alfonso-Corrado, & Campista-León, 2024).

Conclusion

Methanolic and ethanolic extract of maize silk showed maximum detection of phytochemical compounds. These extracts showed antibacterial activities against certain pathogens causing urinary tract infection (*Escherichia coli* and *Proteus mirabilis*) which was depicted by getting zones of inhibition against selected pathogens. Different phytochemicals like flavonoids, alkaloids, phenols, steroids etc. were detected from maize silk extracts.

Declarations

Ethical Approval and Consent to Participate: This study strictly adhered to the Declaration of Helsinki and relevant national and institutional ethical guidelines. Informed consent was obtained. All procedures performed in this study were consistent to the ethical standards of the Helsinki Declaration.

Consent for Publication: The authors give their consent for publication.

Availability of Data and Materials: Upon a request, the corresponding author will make the datasets used and/or analyzed during the current investigation available.

Competing Interest: There is no conflict of interest among the authors.

Funding: It is institutional study, and it has not received any funding from any source.

Authors' Contribution: JM., AH., AB: Conceived the idea, literature. AA., AW., SAB: methodology, data analysis and writeup. All authors have reviewed and approved the final version of the paper.

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