



Antimicrobial Effect of Aqueous Banana Peel Extract, Iraq

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ABSTRACT

Fruit peels have been a valuable source for maintaining human health. The use of fruit peels extracts for antimicrobial properties can be of great significance in therapeutic treatments. This study aimed to evaluate the antibacterial activity of banana's peel. The antibacterial effect of aqueous extracts of fresh yellow banana peels against 2 Gram-positive and 4 Gram-negative bacterial and one yeast isolates, including *S. aureus*, *S. pyogenes*, *E. aerogenes*, *K. pneumoniae*, *E. coli*, *M. catarrhalis* and *candida albicans*, was carried out by the well-agar diffusion method. The water extract of fresh banana peel showed a various inhibitory effect against various microbial isolates. Highest inhibitory effect against both *M. catarrhalis* and *S. aureus* with 30 mm inhibition zone, followed by *S. pyogenes*, *E. aerogenes* and *K. pneumoniae* with no effect against *E. coli* and *candida albicans*. Aqueous extracts of fresh yellow banana peels could be considered as a good antibacterial agent against both Gram positive and negative bacteria to replace the synthetic medicines in treatment of diseases caused by these bacteria.

Introduction

The increasing failure of chemotherapeutics and antibiotic resistance exhibited by pathogenic microbial infectious agents has led to the screening of several medicinal plants for potential antimicrobial activity. They have a long evolution of resistance against microbial agents, which has led to alternative directions in drug development. Extracts of plants are getting more importance as they have the great potential sources for microbial and viral inhibitors. Plant parts used for this purposes are bulb, gel, leaves, roots, barks, peels etc ¹. Different class of plant family and their respective parts has been used to treat threat throughout human culture ².

The reason for extensive use of plants as drugs may be the fact that plants are available everywhere, wide range of medicinal plants and their distinct form and thus are procured without any trouble. Medicinal plants have a long history of use and their use is widespread in both developing and under developed countries ¹.

Musa is genus from Zingiberales and family Musaceae; it includes bananas and plantains. There are around 70 species of *Musa* with a broad variety of uses. The common was banana scientifically known as *Musa sapientum* ³.

There are many composition of banana skin like enzymes such as polyphenoloxidase, pectin as gelling agent and that the banana peel extract is used alone or combined with a cream or ointment, medicinal benefits of the extract include relief of pain, swelling and itching ^{4,5}. Additionally,

Flavonoids, tannins, phlobatannins, alkaloids, glycosides and terpenoids were found to be present in the peels of genus *Musa*. These phytochemicals have been reported to exert multiple biological and pharmacological effects (antibacterial, antihypertensive, antidiabetic and anti-inflammatory activities). The presence of these bioactive substances in banana peels therefore suggests that the peels possess valuable medicinal potential yet to be explored. As the bioactive compounds contained in plants are majorly responsible for their medicinal properties ⁶.

Moreover, Banana peel contains Vitamin A, Vitamin C, Gallocatechin, dopamine, Vitamin E, Vitamin B6, â-sitosterol, malic acid, succinic Acid, palmatic acid, Magnesium, phosphorus, potassium, fiber, Iron. Fatty acids present in the Banana peel are responsible for their antimicrobial activity ⁷.

Different studies have been done on the various parts of banana plant in which performed the inhibitory effect towards the food borne pathogens, hence banana plant should be considered to be a potential natural source of antimicrobial as well as antioxidant agent ⁸. The aim of this study was to assess the antimicrobial capacity of the aqueous extracts of fresh banana peels against different microbial isolates. Banana peel was selected because of its cheap edible source.

Materials and Methods

Microbial isolates

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Different seven clinical microbial isolates 2 Gram positive (*Staphylococcus aureus*, *Streptococcus pyogenes*), 4 Gram negative (*Enterobacter aerogenes*, *Klebsiella pneumoniae*, *E. coli* and *Moraxella catarrhalis*) and yeast (*Candida albicans*) were collected and identified by using conventional biochemical tests and cultivated in pure culture, at microbiological laboratory/college of Medicine/ Babylon university.

Plants collection

Fresh bananas were obtained from the local market at Hilla City, Iraq, 2013. Bananas were washed in running tap water in laboratory, surface sterilized with 70% alcohol, rinsed with sterile distilled water, then peels were taken. Distilled water was boiled, peels were added to the water and left to cool. Later on, these contents were mixed by the blender and filtered to remove the large, UN homogenized particles to get clear aqueous extract. The extract was kept at 4°C until to be use.

In vitro antimicrobial activity testing using Agar well diffusion assay NCCLS¹⁰

Loopfull growths from bacterial isolates were inoculated into nutrient broth incubated at 37 °C for 18 hours. The bacterial suspensions were diluted with normal saline. Adjust the turbidity and compare with standard tube (McFarland number 0.5) to yield a uniform suspension containing 1.5×10^8 CFU / ml. Dip cotton swab into adjustment suspension and streak the entire Mueller-Hinton agar surface of plates and the plates were left for one 5-15 minutes at room temperature to dry. Media were cut into well (5mm diameter) by cork borer and add 0.1ml of the banana extract. The plates were incubated at 37 °C for overnight. The size of zone of inhibition was measured from edge of well to the edge of inhibition of growth.

Results

The antibacterial prosperities of the aqueous extract of banana peel were initially evaluated by well diffusion assay against different microbial isolates. The results are presented in (Figure-1) show that the aqueous extract of banana peel exhibited a variable antimicrobial effect. These results showed that this extract give a good inhibition effect against Gram-positive bacteria including *S. aureus* and *S. pyogenes* with inhibition zone 30 and 18 mm respectively, with no effect against *C. albicans*.

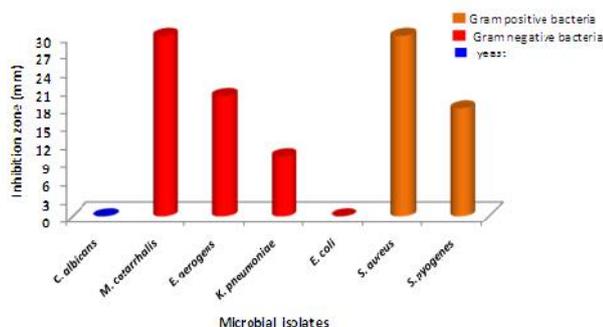


Figure 1: Inhibition zone (mm) of microbial isolates by aqueous banana extract

Result showed inhibitory effect against Gram-negative bacteria with inhibition zone ranging from 10-30 mm,

with high susceptibility of *M. catarrhalis* followed by *E. aerogenes* and *K. pneumoniae* except *E. coli* which showed no susceptibility to banana peel extract.

Discussion

Several works have been done to evaluate the phytochemical compositions and antimicrobial activities of different parts of diverse plants, with the aim of using these plants for the treatment of microbial infection as possible alternatives to synthetic drugs to which many infectious microorganisms have developed resistance¹¹. Effect of plant constituents can combat human and plant pathogenic bacteria, fungi and viruses without toxic side effects and environmental hazards¹².

Lino *et al.*,¹³ results indicated that the tannins are present but the flavanoids are absent in the extract of *Musa sapientum* L., Musaceae, epicarp, it is probable that the antimicrobial activity of the gel prepared from banana peel is related to tannins and not to flavanoids. In addition, it has astringent action, with ability to precipitate proteins, which may affect the bacterial peptidoglycan.

The inhibitory effect of aqueous banana extracts to Gram-positive bacteria in our study was agreed with different studies. Ighodaro¹¹ demonstrated that the aqueous extract of *M. paradisiaca* (one of banana types) gave an antibacterial effect (against *Staphylococcus aureus*, *Escherichia coli* and *Proteus mirabilis*) more than antifungal. Banana skin can be applied directly to burn or boil for a good healing effect¹⁴.

The consumption of this fruit is great because of their nutritional value; its shell has been studied for treatment of gastrointestinal disorders (diarrhea, gastritis and gastric ulcers)¹⁵ and commonly is used to treat wounds, especially in nipple fissures that arise during breastfeeding that mainly caused by *Staphylococcus aureus*¹⁶. Additionally, Lino *et al.*,¹³ banana peel gel inhibited the growth of enterobacteria and pyogenic bacteria. Aldean *et al.*,¹⁷ showed that aqueous extraction of banana skin exhibited a variable degree of antibacterial activity against Gram positive and negative bacterial isolates causing gingivitis including streptococcus species.

Sumathy⁷ studied the antifungal and antimicrobial properties of yellow banana fruit peel and found that it is effective against different Gram positive and negative bacteria. As well as it can be of great significance in therapeutic treatments. Thus, more studies can be taken up in the future pertaining to the use of plant extracts as therapeutic agents especially those related to the control of antibiotic resistant microbes.

High susceptibility of *K. pneumoniae*, *E. aerogenes* and resistance of *E. coli* to banana peel extract were agreed with the results of Fapohunda *et al.*,¹⁸ and Bankar *et al.*,¹⁹ respectively. Some workers said that banana should be considered to be a good source of natural antioxidant and antibacterial and these criteria can be used to produce natural dyes extracted from banana peel to color cotton fabrics and protect them from bacterial effects²⁰. In addition to that banana peel extract not only inhibit the non-spore forming bacteria but also certain studies

conclude that unidentified substance extracted from banana skin has been shown to inhibit *Closteridium sporangium* and other gram negative spore forming bacteria by using plate biological assay, the unknown substance demonstrate inhibitory effects at pH values as high as 7.5¹⁷.

Conclusion

Aqueous extracts of fresh yellow banana peels could be considered as a good antibacterial agent against both Gram positive and negative bacteria to replace the synthetic medicines in treatment of diseases caused by these bacteria.

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