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Antibacterial Efficacy of *Moringa oleifera* Leaf against Medically Important Clinical Pathogens

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A B S T R A C T

Moringa oleifera Leaf (Moringaceae) is a very useful tree in tropical countries. The antimicrobial activity of Acetone, Chloroform, Methanol and Petroleum ether extract of *Moringa oleifera* leaf against ten microorganisms *Escherichia coli*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Streptococcus pyogens*, *Bacillus Sp*, *Proteus Sp Salmonella Sp Streptococcus mutants*, *Shigella sp* along with positive controls. It was observed that methanol extract of *Moringa oleifera* showed highest antimicrobial activity against while petroleum their extract exhibited greater antimicrobial activity against all the tested bacteria. So this plant extracts having good healing properties without side effects when compared with synthetic antibiotics.

Introduction

Medicinal plants have been used for centuries as remedies for human diseases because they contain components of therapeutic value. The plants have always been vital for mankind irrespective of the era and area all over the globe since the beginning of life. (Bukar, 2009).

Medicinal plants contain numerous biologically active compounds, many of which have been shown to have antimicrobial properties. Plant-derived medicines have been part of traditional healthcare in most parts of the world for thousands of years and there is increasing interest in plants as sources of agents to fight microbial diseases (Thilza *et al.*, 2010).

Moringa oleifera is a well-documented world renowned plant for its extraordinary nutritional and medicinal properties. It is a natural antihelmintic, antibiotic, detoxifier, outstanding immune builder and is used in many countries to treat malnutrition and malaria. It is also used in water purification and therefore helps in reducing the incidence of water borne diseases (Marcu, 2004).

Phytochemicals are chemical compounds that are naturally found in plant. They are responsible for the colour and organoleptic properties of the plant. It is also referred to as those chemicals that may have biological significance but are not established as essential nutrients in plant. (Ugwu Okechukwu *et al.,* 2013). They are used Phytochemicals are dietary supplements, but the potential health benefits of Phytochemicals are derived from consumption of the whole plant (Riad *et al.*, 2014).

Materials and Methods

Collection and Processing of Plant Materials

The fresh leaves of *Moring oleifera* were collected from Pokkam Palayam, Namakkal District, and Tamilnadu, India.

Preparation of Extracts

The dried plant material was crushed in to fine particles (powder) using a mixer. About 25 grams of each plant powdered material was separately extracted with 100 ml of solvents (Acetone, Chloroform, Methanol and Petroleum ether) respectively. All the solvents were kept at room temperature, for 7days to allow the extraction of the compounds from plants. Each mixture was stirred every 24 hours using sterile glass rod. The greenish extracts obtained were passed through the whattman filter paper No: 1 and the respective solvents were evaporated with the help of heating mantel. The sticky black substances obtained was stored in the refrigerator and dissolved in Dimethyl Sulphoxide(DMSO) prior to use.

Phytochemical Screening of the Plant Extract

The extracts were subjected to phytochemical screening for identification of its active chemical constituents. Phytochemical analysis of extract for qualitative detection of Alkaloids, Flavonoids, Saponins, Tannins, Terpenoids, Phyto steroids, Carbohydrates was performed by the extracts.

Antibacterial Screening of Plant Extract

The antibacterial activities of the plant were tested against the selected bacterial strain by following the method of the sterilized Mueller Hinton agar medium was poured in to each sterile petri plate and allowed to solidify. Using sterile cotton swabs the test bacterial cultures were evenly spread over the media. The sterile discs were individually loaded with different concentrations of organic solvent extracts (Acetone, Chloroform, Methanol, and Petroleum Ether) of the plant. Then the discs were placed on the top layer of the Petri dishes pertaining to the test cultures. All the plates were incubated at 37°C for 24 hours. After the incubation period the results were observed and measured the diameter to demarcate inhibition zone around each disc/ organism.

Results and Discussion

Screening of Antibacterial Activity

Four different organic solvents (Acetone, Chloroform, Methanol, Petroleum Ether) at various concentrations (25µl, 50 µl, 75 µl, 100 µl) of *Moringa oleifera* was evaluated for its antimicrobial activity. Both Gram positive and Gram negative organisms were screened in this study. The results were tabulated in Table 1.

The results of the present study shoes that most of the organic solvent extracts of *Moringa oleifera* Leaf showed significant activity against the tested bacterial strains.

The disc containing lest amount of solvent extract, 25µl/ disc had similar antibacterial activity of the tested microorganisms, *Escherichia coli* (8 mm), *Staphylococcus aureus* (11 mm), *Klebsiella* sp (11-17 mm), *Pseudomonas aeruginosa* (9-15 mm), *Streptococcus pyogens* (11-15 mm), *Proteus* sp (15 mm), *Salmonella* sp (8-12mm), *Shigella* sp (8-12mm), *Streptococcus mutants* (11 mm), *Bacillus*sp (10-20 mm).

In case of 50 µl shows a fair antibacterial activity against the bacterial tested, *Escherichia coli* (9 mm), *Staphylococcus aureus* (11-14 mm), *Klebsiella sp* (9-17 mm), *Pseudomonas aeruginosa* (9-10 mm), *Streptococcus pyogens* (7-18 mm), *Proteus* sp (10-17mm), *Salmonella* sp (817mm), *Shigella* sp (8-17mm),*Streptococcus mutants* (12mm), *Bacillus* sp (12-21mm).

The disc containing 75 µl/ disc extracts showed a better result, *Escherichia coli* (9-13 mm), *Staphylococcus aureus* (10-17 mm), *Klebsiella* sp (11-15 mm), Pseudomonas aeruginosa (11-13 mm), Streptococcus pyogens (820 mm), *Proteus* sp (11-21mm), *Salmonella* sp (9-17mm), *Shigella* sp (917mm), *Streptococcus mutants* (9-12mm), *Bacillus* sp (12-24mm).

The higher concentration of the extract 100 µl/ disc shows a good activity the tested organisms, *Escherichia coli*(10-18 mm), *Staphylococcus aureus* (12-20 mm), *Klebsiella* sp (10-17 mm),*Pseudomonas aeruginosa* (12-16 mm), *Streptococcus pyogens* (8-28mm), *Proteus* sp (11-31mm), *Salmonella* sp (10-20mm), *Shigella* sp (13-27mm), *Streptococcus mutants* (10-15mm), *Bacillus* sp (12-28mm). (Table.1)

Phytochemical Analysis of *Moringa oleifera*

The presence of Phytochemicals in the plant under study was evaluated. It is reported to predominantly contain a wide range of chemicals in different extracts. The acetone extract contains the following constituents, Terpenoids, Tannins, Saponins, Flavanoids and Alkaloids. The chloroform extract contains Carbohydrates, Terpenoids, Tannins, Saponins, Flavanoids and Alkaloids. The methanol extract contains Terpenoids and Phyto Steroids. The petroleum ether extract contains Alkaloids, Flavanoids, Saponins, Terpenoids, Phyto Steroids and Tannins (Table.2).

In the present study, the plant *Moringa oleifera* was evaluated for its antibacterial properties against both gram positive and gram negative organisms. Various organic solvent extracts with different concentrations were analyzed for the current investigation. From the screening results it was observed that most of the extracts were found to inhibit the growth of the organisms. The results indicated that some of the secondary metabolites present in the plant part may be responsible for this activity.

Plant based antimicrobial represents the vast untapped source for medicine. Plant based antimicrobials have enormous therapeutic potential as they can solve the purpose without any side effects, that are often associated with synthetic antimicrobials, continued further research and exploration of plant derived antimicrobials needed today.

Table.1 Antibacterial activity of *Moringa oleifera*

SI.NO	NAME OF THE ORGANISMS	SOLVENT	Diameter Zone of inhibition (mm) at different concentration of the extracts.			
			25µl	50µl	75µl	100 µl
1.	*Escherichia coli*	Acetone	-	9	10	11
		Chloroform	-	9	9	10
		Methanol	-	-	-	-
		Petroleum ether	8	9	13	18
2.	*Staphylococcus aureus*	Acetone	11	14	17	20
		Chloroform	-	-	10	12
		Methanol	-	11	13	16
		Petroleum ether	-	11	15	19
3.	*Klebsiella sp*	Acetone	-	-	12	9
		Chloroform	9	10	10	10
		Methanol	-	-	13	-
		Petroleum ether	7	9	12	9
4..	*Pseudomonas aeruginosa*	Acetone	10	-	12	10
		Chloroform	13	-	12	-
		Methanol	-	-	-	-
		Petroleum ether	10	11	11	9
5.	*Streptococcus pyogens*	Acetone	11	12	17	20
		Chloroform	-	7	8	8
		Methanol	14	16	20	20
		Petroleum ether	15	18	20	30
6.	*Bacillus sp*	Acetone	20	21	24	28
		Chloroform	12	15	18	20
		Methanol	13	15	17	18
		Petroleum ether	10	10	12	12
7.	*Proteus sp*	Acetone	-	10	10	13
		Chloroform	-	10	10	11
		Methanol	-	10	11	13
		Petroleum ether	15	17	21	31
8.	*Salmonella sp*	Acetone	12	17	17	20
		Chloroform	8	8	9	10
		Methanol	10	11	12	16
		Petroleum ether	-	10	10	12
9.	*Streptococcus mutants*	Acetone	11	12	12	14
		Chloroform	11	12	13	15
		Methanol	-	-	11	12
		Petroleum ether	-	-	9	10
10.	*Shigella sp*	Acetone	12	17	17	20
		Chloroform	8	8	9	10
		Methanol	10	11	12	16
		Petroleum ether	-	10	10	12

Table.2 Phytochemical Screening of *Moringa oleifera*

SI.NO	Constituents	Acetone	Chloroform	Methanol	Petroleum Ether
1	Alkaloids	+	+	-	+
2	Flavonoids	+	+	-	+
3	Saponins	+	+	-	+
4	Tannins	+	+	-	+
5	Terpenoids	+	+	+	+
6	Phyto Steroids	-	-	+	+
7	Carbohydrates	-	+	-	+

Medicinal plants are important source for the development of potential new chemotherapeutic drugs and the in *vitro* antibacterial test from basis. Many of the studies were useful in identifying the active principle responsible for such potentials and to develop clinically important therapeutic drugs for mankind.

The present study focused on the medicinal plant *Moringa oleifera* for its antibacterial activity, Phytochemical analysis.

In conclusion, plants used in traditional are assumed to be safe due to the long-term use by traditional healers. Herbal medicinal preparations and their proprietary products are being used more and more widely throughout the world for treating various ailments. Hence evaluating and ensuring their quality becomes increasingly urgent. Many medicinal plants have been found effective in the cure of bacterial diseases. Due to increasing antibiotic resistance in microorganisms and side effects of synthetic medicinal plants are now gaining popularity in the treatment of bacterial infections. Medicinal plants are considered as clinically effective and safer alternatives to the synthetic antibiotics.

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