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## MORINGA OLEIFERA: A PLANT WITH MULTIPLE MEDICINAL USES AND FOOD PRESERVATIVE

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### ABSTRACT

*Moringa oleifera* Lam (Moringaceae) is a highly valued plant, distributed in tropic and subtropical countries. It has wide range of medicinal uses with high nutritional value. Different parts of *Moringa* are rich in minerals, protein, vitamins,  $\beta$ -carotene, amino acids and phenolics. The present work focuses on crude extract of *Moringa* seed and leaf in combination with *Citrus aurantifolia* and *Zingiber officinale* extract at different concentrations on antibacterial activity in sugarcane juice against 11 pathogens and 5 food strains. It was found that combination of *Moringa* seed extract with lime and ginger showed highest antimicrobial activity compared to sodium benzoate and sodium metabisulphate.

**Keywords:** *Moringa oleifera*, Antibacterial Activity, Pathogens, Nutrition.

### INTRODUCTION

Over the years, a vast range of chemical preservatives have been used to preserve many of the foods from spoilage due to oxidation or bacterial contamination. Many consumers preferred natural products that can be used as preservatives. In most of the developing countries, *Moringa* has the potential to improve nutrition, food security, foster rural development, and support sustainable land care. India is the largest producer of *Moringa*, with an annual production of 1.1 to 1.3 million tones. A large number of researches on the nutritional qualities of *Moringa* leaf report that it is rich in  $\beta$ -carotene, calcium, iron, vitamin C and potassium. The protein quality of *Moringa* leaves rivals that of milk and eggs (Jed, 2005). The antibacterial activity of *Moringa oleifera* leaf extracts against four microorganisms, such as *Escherichia Coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Salmonella typhi* and on both Gram positive and Gram negative micro-organisms has been studied. The phytochemical screening indicated the presence of phenolics, flavonoids, tannins, glycosides etc., in the extracts (Vinoth et.al., 2012). Further study showed that *Moringa oleifera* leaves possess inhibitory properties and thus can serve as an alternative preservative in foods like and also a good source of nutrient supplements (Anthonia, 2012) The antibacterial effects of aqueous and ethanolic extracts of seeds of *Moringa oleifera* and pods of (*Annona muricata*) against *Staphylococcus aureus*, *Vibrio cholerae*, *Escherichia coli* and *Salmonella enteritidis* (Gustavo et.al., 2010). Lemon (*Citrus aurantifolia*) is a poly-embryonic species with greenish yellow, smooth surfaced, thin-skinned

fruit, and solid core at maturity with highly acidic juice. It is cultivated in many countries all over the world. Inhibitory effect of garlic (*Allium sativum* Linn.) and lemon (*Citrus aurantifolia* Linn.) on *Streptococcus mutans*, *Lactobacillus acidophilus*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* isolated from 240 extracted, carious teeth was studied. The result of this investigation suggests that a paste made by blending garlic and lemon could be used as a mouth wash in the treatment of dental caries, mouth-sore, sore-throat and also can be incorporated into toothpaste (Owhe et.al., 2010). Ginger or ginger root is the rhizome of the plant *Zingiber officinale*, consumed as delicacy, medicine, or spice. Ginger is a rhizomatous plant grown throughout South-eastern Asia, China and in parts of Japan, Austria, Latin America, Jamaica and Africa. Ginger containing component such as thymol, eugenol, 1,8-cineole,  $\alpha$ - and  $\beta$ -pinenes, linalool,  $\alpha$ -terpineol while exhibit antimicrobial activity against *Aspergillus niger*, *Saccharomyces cerevisiae*, *Mycoderma sp.*, *Lactobacillus acidophilus* and *Bacillus cereus*. Among fifteen medicinal herbs examined for antimicrobial activity namely *Zingiber officinale*, showed good antimicrobial activity (Tageo, 2010). A study on acceptable quality beverage of sugarcane juice with satisfactory storage stability for 90 days at room as well as refrigeration temperature could be activated by addition of crude extract (Chauhan et.al., 2007). The objective of the study is to find the Antimicrobial activity of *Moringa (Moringa oleifera)*, Lemon (*Citrus aurantifolia*), Ginger (*Zingiber officinale*) against pathogens, Comparison of combination effect of natural preservatives vs chemical preservatives.

## MATERIALS AND METHODS

### SAMPLE COLLECTION

### PLANT MATERIALS

#### MORINGA (*MORINGA OLEIFERA*)

*Moringa* leaves were collected from various parts of Tamil Nadu. *Moringa* seeds from Madurai were used. Seeds were separated from the dried pods and leaves were air dried.

#### LEMON (*CITRUS AURANTIFOLIA*), GINGER (*ZINGIBER OFFICINALE*)

Commercially available lemon and ginger were bought from local market. Lemon juice, fresh ginger was cut into very small pieces taken and extracted by juice extractor.

### BACTERIAL STRAINS

Total 17 types of bacterial strains were used in the study namely clinical strains *Escherichia coli*, *Micrococcus luteus*, *Shigella flexneri*, *Staphylococcus aureus*, *Shigella dysentery*, *Salmonella paratyphi A*, *Salmonella paratyphi B*, *Klebsiella species*, *Enterobacter species*, food strains such as *Bacillus cereus*, *Lactobacillus casei*, *Lactobacillus fermentus*, *Lactococcus lactis*, *Lactobacillus acidophilus*, *Lactobacillus rhamnosus*, *Listeria monocytogenes* and *Streptococcus thermophilus*. They were isolated from clinical cases and provided by Sri Ramachandra Medical Centre in Porur, Chennai. Bacteria were grown in nutrient broth and maintained on nutrient agar slants at 4°C. They were cultured on nutrient broth (Himedia) at 37°C for 24 h.

### PREPARATION OF EXTRACT

#### AQUEOUS CRUDE EXTRACTION

*Moringa* leaves, seeds and ginger pieces were taken and ground into fine powder using mortar and pestle. 1.5g in 20ml distilled water was taken and stirred in a magnetic stirrer at room temperature for 30min at 200rpm and then centrifuged at 3500rpm for 20min. Supernatant was taken, filtered and stored at 4°C.

#### ETHANOL CRUDE EXTRACTION

Dried *Moringa* leaves or seeds or ginger pieces were taken and ground into fine powder using mortar and pestle. 1.5g in 20ml ethanol was taken and stirred in a magnetic stirrer at room temperature for 30min at 200rpm and then poured on a glass plate and left for 24hours. The extract was collected and the normal ethanol crude extraction was done.

#### CHLOROFORM CRUDE EXTRACTION

Dried *Moringa* leaves or seeds or ginger pieces were taken and ground into fine powder using mortar and pestle. 1.5g in 20ml chloroform was taken and stirred in a magnetic stirrer at room temperature for 30min at 200rpm and then poured on a glass plate and left for 24hours. The extract was collected and the normal chloroform crude

extraction was done (Atieno et.al., 2010). Extract from fresh ginger paste were obtained as described above for *moringa* seeds and leaves.

### DETERMINATION OF ANTIBACTERIAL ACTIVITY

#### WELL DIFFUSION METHOD

The antibacterial activity of the leaf extracts was determined using agar well diffusion method. Nutrient agar was inoculated with the given microorganisms by spread plate method. Wells were punched using punch borer (4 mm) in the agar and loaded with plant extracts. Control wells containing neat solvents were also run parallel in the same plate. The plates were incubated at 37°C for 24 hours and the antibacterial activity was assessed by measuring the diameter of the zone of inhibition (Gerhard).

### RESULTS AND DISCUSSION

On comparing antimicrobial activity of the 3 extract was tested *Moringa* crude seed extract were best followed *Moringa* leave extract, lemon juice. In contract ginger showed very little antimicrobial activity although many studies have reported good antimicrobial activity (Table 1 and 2). Extract from different solvents were similar in aqueous antimicrobial activity. The effect on combining the extract was evident on some pathogens and other non-pathogenic microbe as seen in the (Table 1, 2 and 3). Crude extract of *Moringa* seeds were inhibitory while *Moringa* leave extracts were inactive against the pathogens.

Addition of lemon and ginger antimicrobial activity of *Moringa* seed extract. Surprisingly their addition to *Moringa* leaf extract enhanced the antimicrobial activity of the leaf extract. This indicates that the compounds in the *Moringa* seed extract are different from those of *Moringa* leaf extract. Secondly presence of lemon and ginger antagonism for antimicrobial activity of *Moringa* crude seed extracts.

The ethanol and chloroform crude extracts of *Moringa* seeds showed sensitivity against *Streptococcus thermophilus*, *Shigella dysentery* and *Staphylococcus aureus*. But the combination of extracts with Lemon juice had better effect on all the organisms except *Escherichia coli*, on which it had only partial effect (Table 1, 2).

The ethanol and chloroform crude extracts of *Moringa* leaves did not give any zone of inhibition. But the combination of extracts with Lemon had better effect. However the activity of *Moringa* leaves is less compared to the *Moringa* seeds. For the other bacterial strains only combination effect was studied. The chemicals such as sodium benzoate and sodium meta-bisulphite (0.1%) were used to compare their activity with the extracts. The extracts gave the better activity compared to the chemicals. The *Moringa* seeds combined with Lemon had better activity on most of the organisms studied than other combinations. The antibacterial activity was tested for 15 isolated bacterial strains from sugarcane juice samples. The same *Moringa* seeds aqueous crude extract and Lemon juice combination gave the better zone of

**Table 1. Combination Antibacterial Activity of Moringa Seeds (Zone Formation – mm) on Clinical Pathogens**

S.No.	Samples - Crude extract (%)		ZONE OF INHIBITION (mm)					
			<i>Escherichia coli</i>	<i>Streptococcus thermophilus</i>	<i>Staphylococcus aureus</i>	<i>Shigella dysentery</i>	<i>Salmonella paratyphi A</i>	<i>Salmonella paratyphi B</i>
1	Moringa seed ethanol (ME)	100	0	16	18	11	0	0
2	Moringa seed chloroform (MC)	100	0	22	23	12	0	0
3	Lime (L)	100	11	22	20	11	20	12
4	Ginger (G)	100	0	14	0	0	0	9
5	ME+MC	50:50:00	0	18	25	11	0	9
6	ME+L	50:50:00	14	10	18	0	11	10
7	MC+L	50:50:00	0	0	13	0	0	11
8	MC+G	50:50:00	10	17	21	8	12	12
9	L+G	50:50:00	0	18	20	9	0	0
10	ME+MC+L	25:25:25	0	17	17	7	10	9
11	ME+MC+G	25:25:25	0	14	19	10	13	9
12	ME+MC+G	25:25:25	0	14	20	10	0	0
13	ME+L+G	25:25:25	0	15	14	8	9	9
14	MC+L+G	50:50:50	0	13	18	8	10	11
15	ME+MC+L+G	50:50:50:50	8	12	18	9	10	11

**Table 2- Combination Antibacterial Activity of Moringa Leaves (Zone Formation – mm) on Clinical Pathogens**

S.No.	Samples - Crude extract (%)		ZONE OF INHIBITION (mm)					
			<i>Escherichia coli</i>	<i>Streptococcus thermophilus</i>	<i>Staphylococcus aureus</i>	<i>Shigella dysentery</i>	<i>Salmonella paratyphi A</i>	<i>Salmonella paratyphi B</i>
1	Moringa leaves ethanol (ME)	100	0	0	0	0	0	0
2	Moringa leaves chloroform (MC)	100	0	0	0	0	0	0
3	Lime (L)	100	11	12	18	9	20	15
4	Ginger (G)	100	0	8	0	0	0	0
5	ME+MC	50:50:00	0	0	0	0	0	0
6	ME+L	50:50:00	14	10	15	14	12	11
7	MC+L	50:50:00	0	7	6	0	0	9
8	MC+G	50:50:00	10	10	15	10	11	13
9	L+G	50:50:00	0	7	8	0	0	7
10	ME+MC+L	25:25:25	0	13	15	9	12	10
11	ME+MC+G	25:25:25	0	10	12	8	8	13
12	ME+MC+G	25:25:25	0	9	0	0	0	8
13	ME+L+G	25:25:25	0	9	11	8	9	15
14	MC+L+G	50:50:50	0	10	12	8	9	12
15	ME+MC+L+G	50:50:50:50	8	9	14	9	9	10

**Table 3- Combination Antibacterial Activity of Moringa seeds, Leaves (Zone Formation – mm) on Food Pathogens**

s.no	Samples crude extract (%)	Zone of inhibition (mm)				
		Sodium benzoate	Sodium metabisulphate	Moringa seed (A+E+C) +Lemon	Moringa seeds (A+E+C)+Lemon	Moringa seeds (A)+Lemon
1.	Lactobacillus Acidophiles	10	8	22	20	26
2.	Lactobacillus Fermentum	11	0	20	20	20
3.	Lactobacillus Rhamnosus	0	0	20	10	22
4.	Lactobacillus Casei	0	0	18	16	24
5.	Lactobacillus Lactis	0	0	25	20	0
<b>List of Pathogens</b>						
6.	Micrococcus Luteus	0	0	25	20	0
7.	Bacillus Cereus	0	0	20	19	18
8.	Listeria Monocytogens	0	0	24	20	23
9.	Enterobacter Aerogenes	0	0	7	0	15
10.	Shigella Flexeneri	7	0	9	0	10
11.	Klebsiella Pneumoniae	0	0	8	0	8

A – Aqueous Crude Extract, C – Chloroform Crude Extract, E – Ethanol Crude Extract

inhibition. This antibacterial activity study showed that the aqueous crude extract of Moringa seeds combined with Lemon gave better activity. So this combination was used for the shelf life analysis of sugarcane juice. The potency of Citrus aurantifolia (Lemon fruit), against pathogens, in the different forms is used locally. Antimicrobial activity was carried out by the agar well diffusion. The clinical isolates used included anaerobic facultative bacteria for crude extracts of all solvents used varied in zones of inhibition (Ibukun et.al., 2010).

### CONCLUSION

It is concluded that the combination effect of Moringa, Citrus aurantifolia have been optimized as natural preservative and Moringa extract showed inhibition against most of the food, human dysentery and wound pathogens. In future aspects these will be used as a natural edible food preservatives which are safe to use and it will be a replacement of the chemical preservatives which is available in market. Likewise it will be effective against most of the infectious disease.

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**REFERENCES**

- Jed W. Fahey and Lewis B. Moringa oleifera: A Review of the Medical Evidence for Its Nutritional, Therapeutic, and Prophylactic Properties. 2005; 1:5.
- B.Vinoth, R.Manivasagaperumal and S.Balamuruga. Phytochemical Analysis and Antibacterial Activity of Moringa Oleifera Lam. 2012.
- Anthonia Olufunke Oluduro. Evaluation of Antimicrobial properties and nutritional potentials of Moringa oleifera Lam. leaf in South Western Nigeria. Malaysian Journal of Microbiology, 2012; 8(2): 59-67.
- Gustavo Hitzschky Fernandes Vieira, Jozeanne Alves Mouro, Nngela Maria Ngelo, Renata Albuquerque Costa and Regine Helena Silva dos Fernandes Vieira. Antibacterial effect (in vitro) of Moringa oleifera and Annona muricata against Gram positive and Gram negative bacteria, 2010.
- U.B Owhe-Ureghe, D.A. Ehwarieme and D.O.Eboh. Antibacterial activity of garlic and lime on the isolates of extracted carious teeth. African Journal of Biotechnology. 2010; 2(21): 3163-3166.
- D.Tagoe, F.Gbadago. A Comparison of the Antimicrobial Effectiveness of Aqueous Extracts of Garlic, Ginger and Lime and Two Conventional Antibiotics on Escherichia coli, Salmonella spp., Shigella spp. and Bacillus cereus. The Internet Journal of Microbiology. 2009; 8(2).
- O. P. Chauhan, Dheer Singh, S. M. Tyagi and D. K. Balyan. Studies on preservation of sugarcane juice. 2007; 217-229
- Atieno Walter, Wagai Samuel, Arama Peter and Ogur Joseph. Antibacterial activity of Moringa oleifera and Moringa stenopetala methanol and n-hexane seed extracts on bacteria implicated in water borne diseases. 2010.
- Gerhard Gottschalk Methods in Microbiology (18).
- Ibukun Aibinu, Tayo Adenipekun, Toyin Adelowot an, ToluOgunsanya and Tolu Odugbem. Evaluation of the Antimicrobial Properties of Different Parts of Citrus aurantifolia (Lime Fruit). Afr. J Tradit. Complement Altern. Med. 2007; 4(2): 185-190.