

Short Communication

Studies on the antimicrobial effects of garlic (*Allium sativum* Linn), ginger (*Zingiber officinale* Roscoe) and lime (*Citrus aurantifolia* Linn)

Onyeagba R.A.^{1*}, Ugboogu O.C.², Okeke C.U. and Iroakasi .O.¹

¹Department of Microbiology, Abia State University, PMB 2000 Uturu, Nigeria

²Department of Botany, Abia state University, PMB 2000 Uturu, Nigeria.

Accepted 15 August, 2019

The antimicrobial effect *in vitro* of aqueous and ethanolic extracts of garlic (*Allium sativum* Linn.), ginger (*Zingiber officinale* Roscoe) and lime (*Citrus aurantifolia* Linn.) juice were assayed against *Staphylococcus aureus*; *Bacillus* spp., *Escherichia coli* and *Salmonella* spp. All the test organisms were susceptible to undiluted lime-juice. The aqueous and ethanolic extracts of garlic and ginger singly did not inhibit any of the test organisms. The highest inhibition zone of 19 mm was observed with a combination of extracts on *Staphylococcus aureus*. *Salmonella* spp were resistant to almost all the extracts except lime.

Key words: Antimicrobial, ginger, garlic, lime, concoctions.

INTRODUCTION

The use of higher plants and their extracts to treat infections is an age old practice in traditional African medicine. Traditional medical practice has been known for centuries in many parts of the world (Sofowora, 1984). It is, however, observed that these practices vary from one country to another. Numerous plants and herbs are used all over Nigeria by traditional medicine practitioners. The use of herbs is the most ancient approach to healing known. The herbal medicines may be in form of powders, liquids, or mixtures, which may be raw or boiled, ointments, liniments, and incisions. (Apata, 1979). Roots, barks, and leaves of various plants are employed in ethnomedicine. Plant extracts are given singly or as concoctions for various ailments. More than 70% of the people living in Nigeria depend on these various form of concoctions and herbal decoctions for the treatment of some diseases (Kimbi and Fagbenro-Beyioku, 1996).

Many investigators have demonstrated the antimicrobial activity of the constituents of some higher plants (Akobundu and Agyakara, 1987; Rocio and Rion, 1982; Almagboul et al., 1988; Misra et al., 1992; Hablemariam et al., 1993) and quite a number of chemical compounds of plant origin have been shown to possess antimicrobial activities (Corthout et al., 1992). In diseases of microbial origin, the plants function as a result of antimicrobial activity against the causative agents (Sofowora, 1993).

This work reports the antimicrobial effect of garlic (*Allium sativum* Linn.), ginger (*Zingiber officinale* Roscoe) and lime (*Citrus aurantifolia* Linn.) juice and their various combinations on some bacterial species. This is in pursuance of the efforts to search for drugs from plants and the verification of the scientific basis of some known practices in traditional medicine

MATERIALS AND METHODS

Source of organisms

The cultures were obtained from the Microbiology laboratory of Abia state University, Uturu, and were preserved in agar slants.

*Corresponding author. E-Mail: osychin@yahoo.com.

Table 1. Combination of Extracts.

S/N	Extract /Combination
1	Lime
2	Ginger (ethanolic extracts)
3	Ginger (Aqueous extracts)
4	Garlic (Ethanolic extract)
5	Garlic (Aqueous extracts)
6	Lime + Ginger(Ethanolic extracts)
7	Lime + Ginger (Aqueous extracts)
8	Lime +Garlic (Ethanolic extracts)
9	Lime +Garlic (Aqueous extracts)
10	Ginger + Garlic (Ethanolic extracts)
11	Ginger + Garlic (Aqueous extracts)
12	Lime + Ginger + Garlic(Ethanolic extracts)
13	Lime +Ginger+Garlic (Aqueous extracts)
14	Control (Primpex)

Table 2. Diameter (mm) of zone of inhibition produced by various extracts.

Bacterial species	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>Bacillus spp.</i>	17	-	-	-	-	15	11	13	17	13	-	13	13	15
<i>Staphylococcus aureus</i>	17	-	-	-	-	15	13	19	17	9	-	13	17	35
<i>Escherichia coli</i>	11	-	-	-	-	15	11	11	9	-	-	-	9	9
<i>Salmonella spp.</i>	13	-	-	-	-	-	-	-	-	-	-	-	9	45

- = No inhibition

The bacterial species used are *Staphylococcus aureus*, *Bacillus spp* *Escherichia coli* and *Salmonella spp.*

The plants were bought from Eke Okigwe market in Imo state. The ginger was washed and peeled, cut into pieces and sun dried for one week. The dried ginger was ground using an electric blender. The garlic was peeled, cut into pieces and sundried for one week. It was then ground using an electric blender. 20 g of the ground material (garlic and ginger) were soaked in 100 ml of hot sterile water and allowed to stand for 72 h. The crude extracts were obtained by filtration. Similarly, 20 g of the ground samples were soaked in 100 ml of the 90% ethanol in conical flasks sealed with foil and allowed to stand for 72 h. They were filtered to obtain crude ethanolic extracts. The lime fruits were washed with sterilized water then cut open with a sterile knife and the juice pressed out. All extracts were stored at 4⁰C when not in use.

Susceptibility testing

Agar plates were inoculated with 0.1 ml broth culture of test organisms and spread with an L-shaped rod. Sterile paper disks (What man No 1 filter paper) of 5 mm diameter were impregnated with different crude extracts and mixtures and dried in a hot air oven at 60⁰C for 5 min. The antimicrobial Trimethoprin sulphamethazole (primpex) was used as control for the susceptibility tests. The combination of extracts is summarized in Table 1.

RESULTS AND DISCUSSION

The crude extracts of garlic and ginger applied singly and in combination did not exhibit any *in vitro* inhibition on the growth of test organisms. However with lime they inhibited *Bacillus spp*, *Staphylococcus spp.* *Salmonella* was resistant to most of the decoctions. It was only slightly inhibited by lime (singly) and a mixture of aqueous extracts of garlic, ginger, and lime-juices. All the test organisms were susceptible to lime juice and control drug (Primpex). The results of the zones of inhibition (mm) are summarized in Table 2.

C. aurantifolia Linn. (Lime) juice has the highest effect on the test organisms, although its effect on the gram-positive organisms was found to be higher than that of the gram-negative organisms. This finding agrees with that of other authors (Oboh et al., 1992; Oboh and Abulu 1997) who reported the antibacterial effect of lime leaves on some bacterial isolates. When combined with the crude aqueous and ethanolic extracts of ginger and garlic an inhibitory effect was also observed whereas there was none with the crude aqueous and ethanolic extracts of these plants when used singly. The combination of aqueous crude extracts of ginger and garlic yielded no inhibition, whereas the combination of their ethanolic

extracts inhibited both *S. aureus* and *Bacillus* spp. This could be as a result of better extraction with alcohol. *Salmonella* spp was resistant to most of the decoctions. The effect of lime on these organisms *in vivo* cannot be predicted from this study. Further *in vivo* studies are necessary. More importantly there is need for detailed scientific study of traditional medical practices to ensure that valuable therapeutic knowledge of some plants are preserved and also to provide scientific evidence for their efficacies.

REFERENCES

- Apata L (1979). Practice of Herbalism in Nigeria. University of Ife Press.
- Akobundu IO, Agyakwa CN (1987). A handbook of West African Weeds. International Institute of tropical Agriculture: 240, 272 and 348.
- Almagboul AZ, Basho AK, Karim A, Salibm TA, Khalid SA (1988). Antimicrobial activity of certain Sudanese plants used in folklore medicine. Screening for antifungal activity VI, *Fitoterapia* 59: 393-396.
- Corthout B, Piefers L, Cleays M (1992). Antiviral caffeoyl ester from *Spondias mombin*. *Phytochemistry*. 31: 1979-1981.
- Hablemariam S, Gray AI, Waterman PG (1993). A new antibacterial sesquiterpene from *Premna oligotrichia*. *J. Nat. Prod.* 56: 140-143.
- Kimbi HK, Fagbenro-Beyioku AF (1996). Efficacy of *Cymbopogon giganteus* and *Enantia*, against chloroquine resistant plasmodia. *East Afr. Med. J.* 12: 636-638.
- Misra TN, Sigh RS, Pandey NS, Prasal C, Singh BP (1992). Antifungal essential oil and a long chain alcohol from *Achyranthis aspera*. *Phytochemistry*. 31:1811-1812.
- Oboh PA, Abula EO (1997). The antimicrobial activities of extracts of *Sidium guajava* and *Citrus aurantifolia*. *Niger. J. Biotechnol.* 8 (1): 25-29
- Oboh PA, Agbonlahor DE, Ekundayo AO, Owen-Ureghe B (1992). Antibacterial activity of *Citrus aurantifolia* (lime) juice against some Gram positive and Gram negative bacteria. *Ann. Nat. Sci.* 2:1-6.
- Rocio MC, Rion JL (1989). A review of some antimicrobial substances isolated from medicinal plants reported in the literature 1978-1972. *Phytother. Rev.* 3: 117-125.
- Sofowora A (1984) . *Medicine plants and traditional medicine in Africa*. John Wiley and Chichester.
- Sofowora A (1993). *Introduction to medicinal plants and traditional medicine*. Spectrum books limited, 2: 8-76.