Studies On In-Vitro Antimicrobial Activity of Ethanol And Aqueous Ginger (Zingiber Officinale) Extract On Selected Bacterial Isolates

Mbata C. A., Aleru C. P., Azike C. A., Adewoye M. O., Ugwueze V

Department of Medical Laboratory Science, Rivers State University of Science and Technology, Nkpolu-Oroworukwo, Port Harcourt, Rivers State, Nigeria.

Abstract - The study was carried out to screen in-vitro antibacterial activity of ethanol and aqueous (aq) ginger extract against selected bacterial isolates namely: Staphylococcus aureus, Escherichia coli and Pseudomonas species (Sp). The disc diffusion method was used to determine the inhibitory effects of ethanol, ethanol extract and aqueous ginger extract on the bacterial isolates. The ethanol and aqueous extract of ginger were used at concentrations of 2g/20ml and 20g/40ml. They were each diluted at the concentrations of $0.1gml^{-1}$, $0.2gml^{-1}$, $0.4g/gml^{-1}$, $0.6gml^{-1}$ and $0.8gml^{-1}$. 0.02ml of each dilutions were impregnated into sterile filter paper disc and ready for use. Ethanol was also diluted and used as control. The 3 test organisms were spread on nutrient agar plates and the disc placed on them, incubated at 37^0C for 24hours. The zones of inhibition for ethanol extract (2g/20ml) of gingers ranged between 2mm – 10mm. The zone of inhibition obtained for diluted ethanol extract (2g/20ml) of ginger at concentrations of $0.1ml^{-1}$ - $0.8ml^{-1}$ ranged from 4mm – 10mm. Also the zone of inhibition obtained for ethanol extract (20g/40ml) of ginger ranged between 6mm – 12mm, also the zone of inhibition obtained for ethanol extract (20g/40ml) of ginger ranged between 6mm-12mm, the zone of inhibition for diluted ethanol extract (20g/40ml) of ginger at concentration of $0.1gml^{-1}$ – $0.8gml^{-1}$ ranged from 7mm – 13mm. The aqueous, extract 2g/20ml and 20g/40ml of ginger and diluted aq. extract were all resistant to staphylococcus aureus, Escherichia coli and Pseudomonas sp. The zone of inhibition of Staph. aureus, E. coli and Pseudomonas sp at concentrations of 2g/20ml, 20g/40ml $0.1ml^{-1}0.2ml^{-1}$, $0.4ml^{-1}$, $0.6ml^{-1}$and $0.8ml^{-1}$ ranged from 6mm – 12mm, 4mm – 10mm and 8mm-6mm respectively. The zone of inhibition of ethanol alone ranged between 6mm-10mm. Statistically there is significant inhibition rate at various concentrations of ginger ($P<0.05$). This investigation has revealed that ginger is effective only when used in organic solvent at higher concentration.

Keywords: Concentration, Ginger, Antibacterial, Zingiberaceae, Gastritis, Constipation.

I. INTRODUCTION

Medical plants are any plant that can be put to culinary or medical use and include those we associate with, orthodox drugs such as fox glove and opium poppy as well as everyday plant such as garlic (Serrentino, 1991). All drugs of the past were substances with a particular therapeutic action extracted from plants. Ginger is extracted from the rhizomes of a perennial herb *Zingiber officinale* that belongs to the family zingiberaceae which is indigenous to the Southern coast of India and the Malabar Coast of the state of Kerala. Ginger was described as a medicinal plant and a spice in India and China long ago. It is cultivated in Jamaica, China, Nigeria, Italy, Asia, America, Sierra Leone on the West African Coast. In the West Indies it is used for the treatment of urinary tract infections while it is used for treatment of malaria and yellow fever in Nigeria (Zest, 2010).

Ginger is cultivated in areas of many rainfalls. Its pungency is as a result of oleoresin, which may be extracted with a volatile oil, by either alcohol or acetone (Idries, 1998). Ginger is used for the treatment of stomach problems like gastritis, since the plant is able to neutralize the excess of gastric acid. It has the capacity to eliminate harmful bacteria, such as *Escherichia coli*, which is responsible for most of the diarrhea, especially in children (Wood, 1988). Ginger eases both diarrhea and constipation; hence it should have impact on the growth of *Bacillus cereus* which mainly causes diarrhea and nausea. Ginger has been shown to reduce stickiness of blood platelets, hence may help to reduce the risk of atherosclerosis (Wood, 1988). Before the 2nd world war, Nigeria was a major exporter of dried ginger and the potentials of the crop as a foreign exchange earner for the country are still high. However, there is a small but growing market for fresh or green ginger in many European countries.

Ginger is an essential component of traditional Chinese medicines, Africans and West Indians also use it as spice (Govindarjan, 1982). Chinese take ginger for stomach ache, diarrhea, nausea cholera, asthma, heat conditions, respiratory disorders, foot ache and rheumatic complaints. Ginger is also a component of curry powder, sauces and gingered carbonated drinks. It is used for making biscuits, pickles and confectioneries. Dry ginger is used in the manufacture of oil, oleoresin, and processed meat (Bakhrus 1999).

Ginger has strong antibacterial and antifungal properties. Ginger inhibits the growth of *Escherichia coli*, *Proteus sp.*, *Staphylococcus aureus*, *Streptococcus* and *Salmonella* (Gugnami and Ezewanze, 1985).

The aim of the study is to determine the antimicrobial effects of ginger extract on *Staphylococcus aureus*, *Escherichia coli* and *Pseudomonas sp.* at different concentrations and also to determine the antimicrobial effects of ethanol on the mentioned organisms.

II. MATERIAL AND METHOD

Study Area

Fresh ginger rhizomes (Zingiber officinale) was purchased from Fimie market Abuloma road and Mile III market, Diobu Port Harcourt. Fimie is one of the villages that make up ward 20 in Port Harcourt City Local Government Area with an estimated population of about 30,000 persons. The market is situated along the road about 6km from Abuloma Town.

Test Organisms

The pathogenic bacteria used were *Staphylococcus aureus*, *Pseudomonas sp* and *Escherichia coli*, all gotten and identified from wound culture collections of patients in Braithwaite Memorial Hospital (BMH), Port Harcourt. Pure cultures of the organisms were sub cultured on nutrient agar plates and incubated overnight at 37^0C and preserved in the refrigerator at 4^0C until ready for use.

Antibacterial screening test

The sensitivity test was done by weighing 2g of ginger and crushing in 20ml of ethanol and water. Similarly 20g of ginger was weighed and crushed in 40ml of ethanol and water. A serial dilutions of both 2g/20ml and 20/40ml of ginger and ethanol and water to give concentration of $0.1gm^{-1}$ $2gml^{-1}$, $4gml^{-1}$, $6gml^{-1}$ and $8gml^{-1}$. 0.02ml of all the dilutions were impregnated into sterile filter paper disc.

The organisms were spread on the plates and the filter paper discs were placed on them and incubated over night at 37^0C. The zones of inhibition and resistance were read and recorded. From all the concentrations those that showed growth and inhibited were examined. They were gram stained, biochemical test were also done for proper identification and recorded.

III. RESULT

When ethanol alone was used as control, the inhibition for *Staph aureus* was 10mm, *Escherichia coli* was 8mm and *Pseudomonas sp.* Was 6mm. Ethanol extract showed inhibition of *Staph aureus* as 10mm, *E. coli* 8mm, *Pseudomonas* 6mm. The rate of inhibition of varying concentrations of $0.1gml^{-1}$ - $0.8gml^{-1}$ differed for *Staph aureus*, *E. coli* and *Pseudomonas* sp. as 6mm, 8mm, 7mm, 8mm, 9mm 10mm then 4mm, 5mm, 7mm 8mm 10mm and 6mm, 6mm 6mm 7mm, 7mm respectively. This are shown in figure 1.

The in-vitro antibacterial sensitivity of aqueous extract 2g/20ml of ginger on test organisms showed no zone of inhibition at varying diluted concentrations as shown in table 1.

In-vitro antibacterial sensitivity of ethanol extract (20g/40ml) of ginger showed zone of inhibition as follows; ethanol extract showed *Staph aureus has* 12mm, *Escherichia coli* had 12mm and *Pseudomonas* had 10mm: At different diluted concentrations of $0.1ml^{-1}$ to $0.8ml^{-1}$, *Staph. aureus* showed 9mm, 10mm, 11mm, 11mm and 12mm, *E. coli* showed inhibition of 4mm, 6mm, 8mm, 9mm and 10mm while *Pseudomonas* had inhibition of 6mm, 7mm, 7mm, 8mm and 8mm respectively as shown in table 2.

Table 1: In-vitro antibacterial sensitivity of aqueous extract (2/20ml) of ginger on test organism

Test organism	Size of inhibition (mm)					
Dilution (g/ml)	EA	0.1	0.2	0.4	0.6	0.8
Staph. aureus	R	R	R	R	R	R
E. coli	R	R	R	R	R	R
Pseudomonas sp.	R	R	R	R	R	R

Key: EA = Ethanol alone

Table 2: In-vitro antibacterial sensitivity of ethanol extract (2g/20ml) of ginger on test organism.

Test organism		size of inhibition of zone (mm)					
Dilution g/ml	EE	EA	0.1	0.2	0.4	06	.08
Staph aureus	10	10	6	7	8	9	10
Escherichia coli	10	8	4	5	7	8	10
Pseudomonas sp	8	6	6	6	6	7	7

Key: EE = Ethanol Extract, EA = Ethanol alone

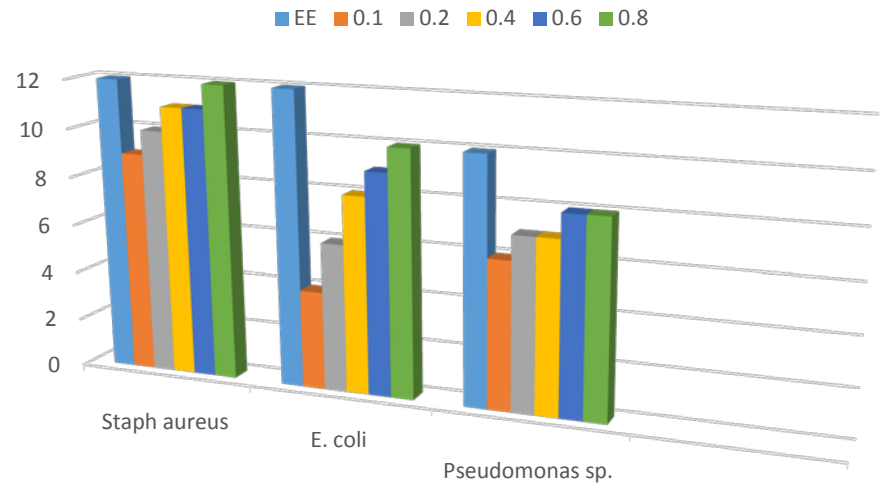

Figure 1: In–vitro antibacterial sensitive of ethanol extract 20g/40ml of ginger.

IV. DISCUSSION

The study has revealed that ginger extract has In-vitro antibacterial activity at different concentrations against some selected bacterial isolates with *Staph aureus* having the widest zone of inhibition followed by *E. coli* while *Pseudomonas sp.* had the least zone of inhibition. Aqueous extract at different concentrations were resistant to all the isolates. This finding is in line with the report by Ogueke *et al* (2006) that ethanol is the best solvent for the rapid extraction of most plant active part of mechanical properties. This study further agrees with Ekwenye and Elegalam (2005) which states that ethanol is an organic solvent that dissolves organic compound better at a high concentration, hence liberate the active compound of ginger when required for antibacterial activity.

Ethanoic extract of ginger showed more zones of inhibition than ethanol alone was used as control this further showed that ginger possess many medicinal properties which include anti-inflammatory, antibacterial, antidiabetic and antihepatotoxic as reported by Angbeh *et al;* (2006).

The antibacterial activities of ginger at varying concentration showed clear zone of inhibition with neat showing the widest zone of inhibition followed by 0.8g/ml, 0.6g/ml to 0.1g/ml. This clearly shows that ginger extract is more effective at higher concentration. The isolates tested were both gram positive and gram negative organism. This clearly shows that ginger can be used in the treatment of gram positive and gram negative as such seen as broad spectrum in nature.

V. CONCLUSION

Ginger is being sold commercially to people. This study has proven that the high demand of ginger is as a result of its medicinal properties. It has also proven that it has the ability to kill the most recalcitrant organism (*Pseudomonas sp.*). Ginger, when mixed with other plants is used traditionally to treat infectious diseases. It therefore becomes imperative to conclude that it is important to note the correlation between the shown antimicrobial activity and claims of traditional healers. Pharmaceutical companies are therefore advised to take advantage of this to further modify them into capsules and tablets for treatment of diseases.

REFERENCES

[1] Serrentino, J. (1991). How natural remedies work point. Robert, W. A, Harley and Marks publishers p20-22

[2] Fawett, W. (1994). History and description of ginger. *American journal of Pharmacology*, 24, 533-593

[3] Zest, (2010). All about ginger and role it can play in treating certain diseases p 1-5

[4] Idries, T. H. (1998). Chemical composition of ginger. *American Journal of Pharmacology*, 26, 466-468

[5] Wood, C. D. (1988). Comparison of efficiency of ginger with various antimicrobial sickness drugs. *Clinical research practices and drug regulatory affairs*, 6(2)129-136

[6] Govindarajin, V. (1982). Ginger chemistry, technology and quality evaluation critical review. *Journal of food Science and Nutrition*, 17, 1-10

[7] Bakhrus, H. K. (1999). Herbs that heal in natural remedies for good health oriented paper backs. A division of vision books PVT LTD, Delhi, p 97-200.

[8] Gugnami, H. C. and Ezenwanze, E. C. (1985). Antibacterial activity of extracts of ginger (zingiber officinale) and African oil bean seed (Pentaclethoira macrophylla) *Journal of Communicable Diseases* 17, 233-25

[9] Ogueke, C. C, Ogbuile, J. N and Nsoku, H. O (2006). Antimicrobial properties and prelimnary phytochemical analysis of ethanoic extracts of Aistonia bonnie, *Nigerian Science Microbiology*, 20 (2), 896-899

[10] Ekwenye, U. N and Elegalam, N. N (2005). Antibacterial activity of ginger (zingiber officinale) and garlic (alluium sativum) extracts on *Escherichia coli* and *Salmonella typhi*. *Journal of Molecular Medicine and Advanced Science*, 1(4), 411-416