EVALUATION OF ANTIBACTERIAL ACTIVITY OF TURMERIC (*Curcuma longa*) EXTRACT AND ITS SYNERGY WITH ANTIBIOTICS AGAINST *Staphylococcus aureus* AND *Escherichia coli.*

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Abstract

The aim of this work was to evaluate the antibacterial activity of turmeric (*Curcumalonga*) seed extract and its synergy with antibiotics against *Staphylococcusaureus* and *Escherichiacoli*.Antibacterial assay was carried out against the test organisms using disc diffusion method. The results showed zone of inhibition in diameter. For ethanol extract 25mm and 15mm on *Staphylococcusaureus* and *Escherichiacoli* respectively, water extract 20mm and 10mm on *S. aureus* and *E. coli* respectively, Ciprofloxacin 24mm and 23mm on *S. aureus* and *E. coli* respectively, Ampicillin 16mm and 10mm on *S. aureus* and *E. coli* respectively. Synergy of the extracts and antibiotics on test organisms; ethanol extract and Ciprofloxacin 30mm and 20mm on *Staphylococcusaureus* and *Escherichiacoli* respectively, water extract and Ciprofloxacin 22mm and 19mm on *Staphylococcusaureus* and *Escherichiacoli* respectively. Water extract and Ampicillin 18mm and 17mm on *S. aureus* and *E. coli* respectively, Ampicillin and ethanol extract 21mm and 16mm on *S. aureus* and *E. coli*respectively. This result showed that turmeric seed extract and named antibiotics are good antibacterial agent against *Staphylococcusaureus* and *Escherichiacoli.* Although the combination of tumeric seed extracts and the antibiotics used showed an effect, it was not synergistic.

Key words: Turmeric, Antibacterial, Microorganisms, Synergy, Antibiotics.

Introduction

Natural materials extracted from plants are being used for pharmaceutical and agricultural purposes. Plants act generally to stimulate and supplement the body's healing force, they are natural foods for human beings (Fabiola *et al*., 2003). Many infectious diseases are known to be treated with herbal remedies throughout the history of mankind. Infectious diseases are the number one cause of the death accounting for approximately one half of all deaths in tropical countries (Akinnibosun and Itedjere, 2013). Today, plant materials continue to play a major role in primary healthcare as therapeutic remedies in many developing countries (Jonathan *et al*., 2007)**.**

The widespread use of antibiotics both inside and outside of medicines is playing a significant role in the emergence of resistant bacteria, serving as a growing threat to public health throughout the world (Goossens *et al*.,

2005). Hence, the call for urgent need for alternative antibacterial strategies because the effectiveness of synthetic antibiotics has been diminishing. Some plants have been discovered to be rich in the secondary metabolites such as tannins, terperoid, alkaloids, flavonoid, phenols, steroids and volatile oil. These compounds are responsible for their therapeutic activities.

Turmeric (*Curcumalonga*) is a perennial herb which belongs to the *Zingiberaceae* family and it is widely used around the world as spice, a coloring material and food preservatives. Its rhizome has been reported to possess a variety of medical properties such as anticancer, antimicrobial, antioxidant, anti-inflammatory and anti-parasitic properties (Sarker and Narher, 2007). Powdered turmeric when taken with boiled milk is helpful in curing cough and related respiratory ailments and roasted turmeric is an ingredient used as anti-dysenteric for children (Abhishek and Dahn, 2008). A poultice of turmeric is also applied to the perineum to aid in the healing of any lacerations in the birth canal (Pandeya, 2005). External application of turmeric could stop swelling and pain, heal wounds rapidly and treat many kinds of skin diseases like acne and leprosy (Biswas *et al*., 2003). The natural bioactive substances have shown prospective in treating these infections.

Curcumin, a phytochemical derived from the rhizome of *Curcumalonga*, has antibacterial as well as anti-biofilm activity. Recently, its antibacterial action is found to be synergistic with several antibiotics (Sasidharan *et al*., 2014).

The aim of this study is to evaluate the antibacterial activity of turmeric (*Curcumalonga*) extract and its synergistic effects with antibiotics against *Staphylococcusaureus* and *Escherichiacoli*.

Materials and Methods

Sample Collection

The turmeric (*Curcumalonga*) seeds were purchased from Eke Oko market in Orumba North Local Government Area, Anambra State, Nigeria. It was packaged in a sterile polythene bag transported to Microbiology Laboratory Federal Polytechnic Oko for preparation and further analysis.

Preparation of the Plant Extract.

Water Extraction

Exactly 50g portion of the powdered sample was weighed out and dissolved in 200ml of water in a sterile beaker and allowed to stand for 24 hours. The mixture was filtered using whatman No.1 filter paper and the filtrates were stored in a sterile sample container until it was ready for use.

Ethanol Extraction

Exactly 50g of the powdered sample were weighed out and dissolved in 200ml of ethanol solvent in a sterile beaker and was allowed to stand for 24 hours. The filtrates were evaporated to dryness, stored in a clean bottle until ready for use.

Bacteriological Analysis

Media and Media Preparation

The media that were used for this study were Mannitol Salt agar, Eosin Methylene Blueagar, Mueller Hinton agar, Nutrient agar and Nutrient broth. All were prepared according to the manufacturer's instructions.

Test Organisms

The microorganisms used for this analysis were *Staphylococcusaureus* and *Escherichiacoli*. They were obtained from Microbiology Laboratory of Science Laboratory Technology, Federal Polytechnic Oko, Anambra State, Nigeria.

Determination of Antibacterial Activity Assessment using Turmeric Extracts

The paper disc diffusion method was adopted to evaluate the antibacterial activity of the plant extracts. Muller Hinton agar was prepared and distributed into different sterile petri dish. The organisms were grown in a nutrient broth which was used for the bacterial susceptibility test. The broth culture were grown for 24 hours and serially diluted in the same broth (sterilized at 121^{o}C for 15 minutes). Sterile swab stick was used to inoculate the standardized organisms using macfarland standard method which contain approximately $3.2x10^{5}$Cfu/ml and $4.0x10^{5}$Cfu/ml, for *Staphylococcusaureus* and *Escherichiacoli* respectively by dipping it in the diluted culture and streaking on all the surface of the agar plates. Different sterile paper disc about 6mm diameter were soaked with the plant extracts and were allowed to dry for some minutes. They were placed on the surface of inoculated agar plates using sterile forceps. The plates were then incubated for 24 hours at 37^{o}C. After incubation, the diameter zones of the inhibition were measured using millimeter rule.

Also, 50µg/ml of the antibiotics (Ciprofloxacin and Ampicillin) was used for the test. Different sterile paper disc about 6mm diameter were soaked with different antibiotics and were allowed to dry for some minutes. The plates were then incubated for 24 hours at 37^{o}C. After incubation, the zones of inhibition were measured using millimeter rule.

Assessment of the Synergy of Turmeric and Antibiotics

The different turmeric seed extracts and the commercial antibiotics (Ciproflaxacin and Ampicillin) were mixed differently in the ratio 1:1 to check the synergism. Different sterile paper disc of about 6mm diameter were soaked with the sample. They were placed aseptically on the surface of inoculated plates. The plates were incubated at 37^{o}C for 24hours. After incubation, the zones of inhibition were measured using millimeter rule.

Results

Table 1: Antibacterial Activity of turmeric seed extracts on *Staphylococcusaureus* and *Escherichiacoli*

	Zones of inhibition in millimeter (mm)	
Microorganisms	**water extract**	**Ethanol extract**
Staphylococcusaureus	20	25
Escherichiacoli	10	15

Table 2: Antibacterial Activity of Ampicillin and Ciprofloxacin on *Staphylococcus Escherichiacoli*

Zones of inhibition in millimeter (mm)		
Microorganisms	**Ampicillin**	**Ciprofloxacin**
Staphylococcusaureus	16	24
Escherichiacoli	10	23

Table 3: Synergy of turmeric extracts and Ciprofloxacin on *Staphylococcusaureus* and *Escherichiacoli*

	Zones of inhibition in millimeter (mm)	
Microorganisms	**Ethanol extract & Ciprofloxacin**	**water extract & Ciprofloxacin**
Staphylococcusaureus	30	22
Escherichiacoli	20	19

Table 4: Synergy of turmeric seed extracts and Ampicillin on *Staphylococcusaureus Escherichiacoli*

	Zones of inhibition in millimeter (mm)	
Microorganisms	**Ethanol extract & Ampicillin**	**Water extract & Ampicillin**
Staphylococcusaureus	21	16
*Escherichiacoli*1	8	17

Discussion

The results of antibacterial activity as shown in table 1 above, showed that both turmeric seed extracts (ethanol and water) were effective against the test organisms but with different zones of inhibition. Ethanol extract had 25mm and 15mm zones of inhibition on *Staphylococcusaureus* and *Escherichiacoli* respectively. Water extract had 20mm and 10mm zones of inhibition on *S. aureus* and *E.*

coli respectively. Though both extracts were active on the test organisms, ethanol extract showed highest zones of inhibition. The ethanol and water extracts were active on both Gram-positive (*Staphylococcusaureus*) and Gram-negative (*Escherichiacoli*) used and this might indicate a broad spectrum activity. The antibacterial activity shown by turmeric seed extracts in this study agrees with the findings of Niama and Suitinft (2009) who recorded the antibacterial activity of turmeric seed water extract against *Escherichiacoli* and *Staphylococcusaureus*. Also, this result is in contrast with the report of Khattak *et al.*, (2005) who reported the antifungal, antibacterial activity of ethanol extract of turmeric seed.

The antibiotics used inthis study as shown in table 2 above, showed antibacterial activity against the test organisms. Ciprofloxacin had 24mm and 23mm zones of inhibition on *S. aureus* and *E. coli* respectively. Ampicillin had 16mm and 10mm zones of inhibition on *S. aureus* and *E. coli* respectively with Ciprofloxacin showing highest antibacterial activity on both test organisms.

Recently, turmeric antibacterial action was found to be synergistic with several antibiotics (Sasidharan *etal*., 2014). In this study as shown in table 3 and 4, the synergies of plant extracts were checked with the antibiotics. Ethanol extract and Ciprofloxacin had 30mm and 20mm zones of inhibition on *Staphylococcusaureus* and *Escherichiacoli* respectively. Water extract and Ciprofloxacin had 22mm and 29mm zones of inhibition on *Staphylococcusaureus* and *Escherichiacoli* respectively. Ethanol extract and Ampicillin had 21mm and 18mm zones of inhibition on *Staphylococcusaureus* and *Escherichiacoli* respectively. Water extract and Ampicillin had 16mm and 17mm zones of inhibition on *Staphylococcusaureus* and *Escherichiacoli* respectively. This result agrees with the findings of Elin *etal.*, (2018) who researched on antibacterial activity of turmeric in combination with antibiotics against *Staphylococcusaureus*and *Escherichiacoli*. They foundt that combination of turmeric with the antibiotics had a synergistic interaction against *S. aureus* and *E. coli*.

According to Aukur *etal* (2015), the combination effect of turmeric extracts with antibiotics has an antagonistic effect and this study gives clear evidence that their antibacterial activity reduced when the extracts and antibiotics were combined together. Their findings agree with the findings of this study because their zones of inhibition were expected to be much higher when combined than when used separately but it was not so.

Conclusion

This study has shown that extracts of turmeric possesses antibacterial activities and these results provide valuable information that turmeric holds great promise as highly effective antibacterial agent and should be used in the health care delivery system.

Recommendation

In view of the resultsobtained, the traditional medicinal use of turmeric should continueand also tumeric should be incorporated into some of our daily diet because of its health benefits.

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