

ANTIBACTERIAL ACTIVITY OF A HERBAL DRUG (OMEGA ROOTS) AGAINST SOME PATHOGENIC BACTERIA

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ABSTRACT: A retailed herbal drug (Omega roots) was investigated for antibacterial activity against some pathogenic bacteria (*Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi*, *Pseudomonas aeruginosa* and *Bacillus cereus*). Aqueous, ethanolic, and tonic-water extracts of the herbal drug were prepared. They were screened for antibacterial activity using the ditch method of media diffusion technique. The nature of antibacterial activity, the Minimum Inhibitory Concentrations (MICs) and the Minimum Bactericidal Concentrations (MBCs) were determined using the media dilution technique. The activities of the extracts were compared with those of some standard antibiotics. The extracts showed varying degree of activity against the test organisms. The ethanolic extract showed the highest activity while the tonic-water extract was the least active. The extracts were active against all the pathogens tested including *Pseudomonas aeruginosa* and *Bacillus cereus* which were resistant to all antibiotics tested. Phytochemical screening of the herbal drug revealed the presence of glycosides and saponins. The antibacterial activities of the herbal drug as well as its possible use in therapy are discussed.

INTRODUCTION

The failure of common broad spectrum antibiotics in combating ailment has been attributed to development of resistance by pathogens. This has partly resulted from misuse, abuse and overuse of antimicrobial drugs (Ibeawuchi and Mbata, 2002). The increasing incidence of such drug resistance has encouraged the patronage of herbal preparations as remedies for ailments. Traditional medicine practitioners in Nigeria use a variety of herbal preparations to treat ailments, some of which are associated with drug resistance (Akipulu *et al.*, 1994; Awe and Omojasola, 2003)

The herbal preparations consist largely of plants whose organs contain substances that can be used for therapeutic purpose or for the synthesis of useful drugs (Sofowora, 1982). Traditional medicine has existed for ages and predates the introduction of antibiotics and other modern drugs into the African continent (Haslam *et al.*, 1989; Akipulu *et al.*, 1994). Accessibility and affordability have been identified as part of the reasons for increased patronage of herbal medicine (Omojasola and Awe, 2004). Olukoya *et al.* (1993) and Akipulu *et al.* (1994) pointed out that the uneven distribution of health personnel between rural and urban areas has also encouraged the use of herbal medicine by rural populations. The proportion of rural populations in Nigeria that depend on herbal medicine as their primary health care is put at between 60% and 80% (Ilori *et al.*, 1996, Omojasola and Awe, 2004).

Studies by Wariso and Ebong (1996), Mann *et al.* (1997), Oyegade *et al.* (1999) and Xavier *et al.* (2003) have examined the efficacy of some medicinal plants. Olukoya *et al.* (1993) reported some correlation between results of antibacterial activity testing and some claims of efficacy by traditional healers. The use of herbs has also been on the increase and is fast gaining acceptance generally. This study investigates the antibacterial activity of an herbal drug: Omega roots, retailed in parts of Abuja, Nigeria. It is said to be effective against a vast array of diseases including typhoid, STDs, malaria, amoebic dysentery, pile, and rheumatism. This study examines the potency of omega roots against some common pathogens using the media diffusion and media dilution techniques. Preliminary phytochemical screening was also carried out.

MATERIALS AND METHODS

Aqueous, ethanolic, and tonic-water extracts of the herbal drug were prepared as described by Awe and Omojasola (2004). They were dried in a rotary evaporator and reconstituted in distilled water. Pure cultures of the test organisms were collected from the Microbiology and Parasitology Laboratory of the University of Ilorin Teaching Hospital (UITH), Ilorin, Kwara State. All inocula were standardized before use as described by Bauer *et al.* (1966). The extracts were screened for antibacterial activities

using the ditch method of the media diffusion technique. The susceptibilities of the test organisms to standard antibiotics were determined using the ditch method of the media diffusion technique. The minimum inhibitory concentrations (MICs) and the minimum bactericidal concentrations (MBCs) were determined using the media dilution technique. The natures of the antibacterial activities were determined by sub-culturing from positive MIC and MBC tubes unto extract-free Muller-Hinton agar. All plates and tubes were incubated at 37°C for 24 hours. Phytochemical analysis of the herbal drug was carried as described by Odebiyi and Sofowara (1978).

RESULTS

The extracts and antibiotics showed varying degrees of activity against the test organisms (Table 1). The zones of inhibition were generally wider for the ethanolic extract than for the same concentration of any of the other extracts. *Bacillus cereus* and *Pseudomonas aeruginosa* were sensitive to different concentrations of the extracts but were resistant to all the antibiotics. The extracts exhibited bacteriostatic and bactericidal activity against different organisms (Table 2). The aqueous and tonic-water extracts had bacteriostatic effect on *Escherichia coli* and *Pseudomonas aeruginosa*. However, they were bactericidal on *Staphylococcus aureus*, *Salmonella typhi* and *Bacillus cereus*. On the other hand, the ethanolic extract had bactericidal effect on all the test organisms. The minimum inhibitory concentrations and the minimum bactericidal concentrations of the extracts are shown in Tables 3 and 4 respectively. The ethanolic extract had the lowest MIC values and was the only extract that exhibited bactericidal action. The drug was found to contain tannins and glycosides (Table 5).

Table 1: Antibacterial activities of extracts of Omega roots and Some Standard Antibiotics

Extracts and Concentration		Zones of Inhibition of test organisms (mm)				
		<i>Staphylococcus aureus</i>	<i>Escherichia coli</i>	<i>Salmonella typhi</i>	<i>Pseudomonas aeruginosa</i>	<i>Bacillus cereus</i>
Aqueous Extract (mg/ml)	250.00	26.0	25.0	29.0	25.2	27.2
	125.00	22.0	22.5	22.0	19.5	21.0
	62.50	18.5	19.0	18.0	18.5	18.0
	31.25	16.0	16.0	16.4	15.0	17.0
	15.63	14.0	15.0	0.0	10.0	0.0
Ethanolic extract (mg/ml)	250.00	31.0	26.5	35.0	30.0	31.0
	125.00	22.5	24.5	22.5	23.0	22.5
	62.50	21.0	22.5	20.0	22.0	21.0
	31.25	20.0	20.0	20.0	20.0	20.0
	15.63	18.0	0.0	0.0	0.0	0.0
Tonic-water extract (mg/ml)	250.00	25.0	24.0	23.5	21.5	23.0
	125.00	22.0	20.0	21.0	16.0	19.0
	62.50	16.3	15.5	15.5	16.0	16.5
	31.25	15.0	13.5	0.0	11.0	15.0
	15.63	0.0	12.5	0.0	0.0	0.0
Antibiotics						
Amoxycillin	25µg	24.0	0.0	18.0	0.0	0.0
Ofloxacin	30 µg	29.0	26.5	22.5	0.0	0.0
Tetracycline	30 µg	22.0	0.0	0.0	0.0	0.0
Gentamycin	10 µg	20.0	0.0	13.5	0.0	0.0
Augmentin	30 µg	15.0	0.0	19.5	0.0	0.0

Table 2: Nature of Antibacterial Activities of the Herbal Drug

Organisms	Nature of Antibacterial Activities		
	Aqueous Extract	Ethanollic Extract	Tonic-water Extract
<i>Staphylococcus aureus</i>	Bactericidal	Bactericidal	Bactericidal
<i>Escherichia coli</i>	Bacteriostatic	Bactericidal	Bacteriostatic
<i>Salmonella typhi</i>	Bactericidal	Bactericidal	Bactericidal
<i>Pseudomonas aeruginosa</i>	Bacteriostatic	Bactericidal	Bacteriostatic
<i>Bacillus cereus</i>	Bactericidal	Bactericidal	Bactericidal

Table 3: Minimum Inhibitory Concentrations (MICs) of Extracts of the Herbal Drug

Organisms	Minimum Inhibitory Concentrations (MICs) mg/ml		
	Aqueous Extract	Ethanollic Extract	Tonic-water Extract
<i>Staphylococcus aureus</i>	62.5	62.5	125
<i>Escherichia coli</i>	250	125	250
<i>Salmonella typhi</i>	125	62.5	250
<i>Pseudomonas aeruginosa</i>	250	250	*
<i>Bacillus cereus</i>	250	125	250

*: Not inhibited by the range of concentrations used in this study.

Table 4: Minimum Bactericidal Concentration of Extracts of Omega Herbal Drug

Organisms	Minimum Bactericidal Concentration of Extract (mg/ml)		
	Aqueous	Ethanol	Tonic-water
<i>Staphylococcus aureus</i>	250	250	250
<i>Escherichia coli</i>	*	250	*
<i>Salmonella typhi</i>	125	125	125
<i>Pseudomonas aeruginosa</i>	*	250	*
<i>Bacillus cereus</i>	125	250	250

*: Not killed by the range of concentrations used in the study

Table 5: Phytochemical properties of Ethanollic Extract of Omega Herbal Drug

Chemical Constituent	Ethanollic extract of Omega Herbal Drug
Alkaloids	Absent
Tannins	Present
Glycosides	Present
Saponins	Absent
Steroids	Absent
Phenolics	Absent

DISCUSSION

The antibacterial activity testing showed that the extracts of the Omega roots were active against the test organisms. The ethanollic extract was the most potent similar to results obtained by Oyagade *et al.* (1999), Awe and Omojasola (2003) and Xavier *et al.* (2003) who also reported higher activity with ethanollic extracts. The higher activity is suggested to be due to the ability of ethanol to extract more of the metabolites which possess antibacterial activity (Awe and Omojasola, 2003). The antibiotic resistance exhibited by *Pseudomonas aeruginosa* is similar to the report of Jensen *et al.* (1997). The

organism is reported to show high level of resistance to broad spectrum antibiotics. It was also resistant to all concentrations of the tonic water extract used in this study. It was however susceptible to the aqueous and ethanolic extracts of the herbal drug used in this study.

The likelihood of greater potency of the ethanolic extract is shown by the low MIC values obtained against all the test organisms (Table 3). An inverse relationship exists between MIC values and potency of antibacterial agent. The most potent antibacterial agents have low MIC values (Brock *et al.*, 1994). Although the aqueous extract had the same MIC values as the ethanolic extract for *Staphylococcus aureus*, and *Pseudomonas aeruginosa*. The MBCs values obtained further strengthens the position that the ethanolic extract was more potent. The aqueous extract however, appeared to be more potent in killing *Bacillus cereus* as seen in the lower MBC. Its MBC value was also the same as that of the ethanolic extract in the case of *Staphylococcus aureus*.

The susceptibility of *Staphylococcus aureus* and *Bacillus cereus* to microcidal action of the extracts is consistent with the observation that Gram positive bacteria are usually more sensitive to antibiotics than Gram negative bacteria (Brock *et al.*, 1994). The herbal drug showed activity against both Gram positive and Gram negative organisms and can thus be regarded as a broad-spectrum antibiotic.

Antibiotics resistant *Staphylococcus aureus* has been associated with systemic infections like pneumonia, osteomyelitis, arthritis, endocarditis and meningitis. Staphylococcal colitis can also result when there is an overgrowth of the antibiotic resistant strains (Jensen *et al.*, 1997). Due to the upsurge of drug abuse, antibiotic-resistant strains of *Salmonella typhi* have also emerged (Jensen *et al.*, 1997). That the extracts showed bacteriocidal activity against *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Salmonella typhi* is noteworthy. This is particularly important in view of the antibiotic resistance associated with these organisms.

Phytochemical screening of the extracts revealed the presence of glycosides and tannins. These have been identified as active principles that play a part in antibacterial activity (Awe and Omojasola, 2003). Omojasola and Awe (2004) reported the presence of glycosides in ethanolic extract of *Anacardium occidentale* which was more potent than the extract of *Gossypium hirsutum* in which it was absent. Although the glycosides and tannins appear to be active component, the extract is currently being subjected to detailed phytochemical analysis in another research laboratory.

CONCLUSION

All the extracts exhibited antibacterial activity against the pathogens in the order: tonic water extract < aqueous extract < ethanolic extract (increasing activity). The exhibition of antibacterial activity by the extracts gives some credence to the claim of efficacy of the drug by the producers. This study suggests that the Omega roots could serve effectively in therapy of some ailments. However, further research is recommended to assess the toxicity of the extracts to humans. It is also necessary to identify, isolate and purify the active principles for large scale production.

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