

## A Preliminary comparative study on the Antimicrobial properties of *Cassia alata*, *Jatropha curcas*, *Aloe barbadensis* and *Allium sativum*

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**Abstract:** Anti-microbial properties of ethanol and aqueous extracts of locally available plants: *Cassia alata*; *Jatropha curcas*, *Allium sativum* and *Aloe barbadensis* on *Staphylococcus aureus*, *Candida albicans*, *Streptococcus pyogenes* and *Escherichia coli* were studied. Paper disc diffusion method was used to determine the inhibitory effects of both the leaf and seed extracts of test plants on the micro-organisms. The plant extract produced inhibitory zones ranging from 0 to 4.0mm against test organisms. The water extracts of the test plant proved effective more than the ethanol extracts, water extracts of *Allium sativum* were effective only on *Candida albicans* and *Escherichia coli* while the extracts of *Aloe vera* were only effective on *E.coli* and *Streptococcus pyogenes*. Extracts of *Jatropha curcas* were effective against all the test organisms except *Candida albicans* while extracts of *Cassia alata* were effective against all except *Streptococcus pyogenes* and *Candida albicans*.

**Keywords:** Anti-microbial, *Cassia alata*, *Jatropha curcas*, *Allium sativum* and *Aloe barbadensis*.

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### I. Introduction

In Nigeria the climate favours a great array of plant species, many of which have varied medical and anti-microbial potentials [1, 2, 3 and 4]. Earlier studies have shown that plants that have medicinal and anti-microbial values have either alkaloid; steroids, tannins, glycosides and various oils and they tend to be sites for the active medicinal ingredient of such plants [5, 6, 7 and 8]. Three compounds may be found in a particular part of the plant or all over its body and they are often localized in glands [9, 10 and 11]. Plants that have medicinal and anti-microbial properties in Nigeria have been identified and documented [12 and 13]. Some of the active ingredient of the extract of some of these plants have been isolated, tested and documented [14 and 15]. The development and spread of resistance to the existing antibiotics by micro-organism cells has increased efforts in the development of new antibiotics for the treatment of microbial infection and disease [16, 17 and 18]. Although a number of plants with anti-microbial activities have been identified, a great number still remain unidentified [19, 20 and 22].

Recently, great expectations have been aroused by natural substances, especially biologically active compounds produced by higher plants due to their own multi directional, biological activity and few side effects [23, 24 and 24]. In addition to having anti-mycotic properties many substances of natural origin stimulate natural and potential immunity. A substrate problem is the appearance of drug resistance strains. However, this phenomenon is less common in the case of media derived from plants than from those of chemotherapeutical and anti-mycotic antibiotics. Historically, many bioactive substances have been natural products. Therefore, it is logical that the search for new prototype anti-fungal products should also include natural products. The major advantage of this approach over chemical synthesis or modification of existing agents is the likelihood of similar intoxication, cross-resistance or even mechanism of action. Over the past several decades the search for anti-fungal has been limited primarily to micro-organisms particularly Actinomycetes and some fungi [25 and 26]. The search for new anti-fungal agents or modifications of those already known is not easy and producing an effective anti-mycotic drug is even more difficult than finding an antibacterial preparation. Higher plants are a valuable source of many biologically active substances.

The purpose of this research was to evaluate the anti-microbial activities of *Jatropha curcas*, *Allium sativum*, *Aloe vera* and *Cassia alata* on *Staphylococcus aureus*, *Escherichia coli*, *Streptococcus pyogenes* and *Candida albicans*.

### II. Materials And Methods

**Collection of Samples:** The leaves and seeds of *Jatropha curcas*, *Aloe vera*, *Cassia alata* and *Allium sativum* used were bought from Ogbete Main Market, Enugu, they were dried for five days. The back of the garlic was removed and air dried.

**Extraction of Active Ingredients:** The extraction was done using the method described by Asuzu (1986) [3]. 15g of the ground plant were soaked in 50ml of distilled water for each sample in separate conical flasks for 6 days. The extracts were filtered using Whatman No 1 filter paper after which the filtrates were stored in the refrigerator until required.

**Ethanol Extraction:** The ethanol extraction of the active ingredient of the plant parts were carried out using the method of Harbone (1973) [15]. In this method 1 gram of each of the ground plant part was extracted using 10ml of ethanol. The extraction of each of the plants lasted for 3 days and the active ingredients were collected and stored in the refrigerator until required.

**Media Used:** Media used were Nutrient Agar (Lab. m) and Sabourand Dextrose Agar (Lab. m). The media were prepared according to the manufacturer's instructions.

**Test Organisms:** The bacteria and fungi species used in this study were kindly donated by Atlas and ASO laboratories 118 Agbani Road, Enugu. The bacteria were cultured and maintained as described by Cruickshank et al (1980) [8]. The isolates were identified using biochemical methods as described by [19 and 20]. The fungus by the wet preparation method described by Fawole and Oso (1996) [13]. The bacteria species are coagulase positive *Staphylococcus aureus*, *Streptococcus pyrogenes* and *Escherichia coli*, while the species is *Candida albicans*.

**Ant-microbial Test:** The method adopted was the agar disk diffusion method. In this method the paper disc diffusion tests as described by Opera and Anasa (1993) [21]. Sterile paper discs were soaked in the different plant extracts for 24 h. The surface of the well-labeled agar was inoculated with the various bacterial and fungi suspensions. The paper discs containing different extracts were placed at different areas on the surface of each plate. The plates were incubated at 37<sup>0</sup>c for 24h. Anti-microbial activity of each extract against the test bacteria was indicated by growth –free zone of inhibition near the respective discs. This save method used to test for anti-fungal activity but the fungus was grown on sabourand dextrose agar plates at 28<sup>0</sup>C for 48 h before the paper disc dipped in the plants extracts were planted on the plates. A disc soaked in the extracting solvent for 24 h was used as the control. This procedure was also used for the plant soaked in ethanol.

### III. Results

The aqueous extract of the plants showed various levels of anti-microbial activity when tested by disc diffusion method, where as the ethanol extract showed no anti-microbial activity when tested by the paper disc diffusion method.

Generally, all four plants: *Cassia alata* and *Jatropha curcas* showed high inhibitory zones of between 1.0 to 2.5m against *Staphylococcus aureus*, while *Aloe vera* and *Allium sativum* had no anti-microbial activity against the same organism.

However, all four plants had anti-microbial effect on *Escherichia coli*. Both *Cassia alata* and *Jatropha curcas* had more effect than *Allium sativum* and *Aloe vera* on *E.coli*. Only *Jatropha curcas* and *Aloe vera* had inhibition zones of between 1.8 to 2.0mm while *Aloe vera* had 2.0mm. It also shows that *Cassia alata* and *Allium sativum* had no anti-microbial effect on the other organism.

Furthermore, *Allium sativum* remarkably high anti-microbial effect on *Candida albicans*, with inhibitory zones of between 1.2 to 3.4mm, while the extracts of *Cassia alata*, *Jatropha curcas*, and *Aloe vera* had no anti-microbial effect against the same organisms. Similarly the ethanol extracts of the test plants showed nothing.

**TABLE 1: Inhibitory properties of plant extract towards bacteria and fungi (incubation zone diameter in mm) (aqueous extraction result).**

Organism	PLANT EXTRACTS			
	Cassia Alata	Jatropha Curcas	Allium Sativum	Aloe Vera
Staphylococcus Aureus	2.5	1.2	-	-
	1.8	1.1	-	-
	-	1.0	-	-
	-	-	-	-
Escherischia Coli	1.2	2.0	-	-
	2.6	1.0	-	-
	2.3	0.7	0.1	1.8
	-	-	-	-
Streptococcus pyrogenes	-	1.8	-	2.0
	-	1.2	-	-
	-	2.0	-	-
	-	-	-	-
Candida Albacians	-	-	1.2	-
	-	-	1.1	-

-	-	3.4	-
-	-	-	-

#### IV. Discussion

Thomas Jefferson wrote that ‘‘ the greatest service which can be rendered any country is to add a useful plant to this culture’’ Plants have forever been a catalyst for our healing. In order to halt the trend of increased emerging and resistant infection diseases, it will require a multi-pronged approach that included the development of new drugs. Using plant as the inspiration for new drugs provides an infusion of novel compounds or substances for healing diseases. Evaluating plants from the traditional African system of medicine provide wonderful idea used in the treatment of disease (Boakye *et al.*, 1977) [5].

The results of this study showed that the leaf and seed extracts of the test plants : *Cassia alata*, *Jatropha curcas*, *Allium sativum* and *Aloe vera* have good inhibitory effects against *Staphylococcus aureus*, *Escherichia coli*, *Streptococcus pyrogenes* and *Candida albicans*.

The water extract of the plant parts showed more inhibitory effects than the ethanol extracts which did not have any inhibitory effect at all. This tends to show that the active ingredients of the plants parts were better extracted with water than ethanol. Also that all the plants that had their leaves extracted tend to have effect more on bacteria than on fungi (Asuzu, 1986) [3]. The seed of *Allium sativum* also tends to show a clear effect on fungi (*Candida albicans*). Even though *Aloe vera* showed a minimal effect on *Escherichia coli* and *Streptococcus pyrogenes* that it does not make it to be graded with both *Cassia alata* and *Jatropha curcas* in the same class as having a higher effect on bacteria. Akunyili *et al.*, (1991) [1] observed a similar result when they worked with stem bark of *Kigelia pinnata*. The failure of ethanol to extract maximally the active ingredients in those plants parts may be responsible for the no inhibitory effects the ethanol extracts had both on the bacterial and fungi organisms; whereas the water extracts of the same plants parts had good inhibitory effects against the same organisms. In case of leaves of *Cassia alata* and *Jatropha curcas* and the seed of Garlic, here it has shown more inhibitory effects against the bacterial species than the fungus *Candida albicans* (Harbone, 1973) [15]. The extracts of Garlic showed wider zones of incubation against *Candida albicans* than other plant extracts. Since the extracts of the plant produced good inhibitory zones against the test organisms, it is expected that they could be used to treat infection and diseases caused by these organisms and if the active ingredients of extracts are isolated and possibly crystallized, therapeutic antibiotics could be produced from them.

#### V. Conclusion

In conclusion, the plants presented here showed a very promising activity in the area of anti-microbial agents, warranting further investigations. The need for economic, rapid, sensitive and accurate bioassays for fungi toxic compounds is apparent from the problem caused by them. Recent development with anti-fungal and bacterial; drugs have pointed once more to the plant kingdom. Large numbers of plants continue to be used in traditional medicine for anti-fungal and bacteria diseases, and such plants need to be tested for their efficacy.

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