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A Comparative Study of Phytochemical and Antimicrobial Activity of *Enancia Chlorantha* and *Tamarindus Indica*

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ABSTRACT

One of the main sources of organic chemicals is medicinal plants. The purpose of the project research is to examine the antibacterial qualities and phytochemical compositions of *Tamarindus indica* and *Enancia chlorantha*. Qualitative phytochemical analyses of *Tamarindus indica* and *Enancia chlorantha* reveal that both plants have alkaloids, phenols, flavanoids, and saponins; however, glycosides are absent in the former but present in the latter, and tannins are present in the former but absent in the latter, and reducing sugar is not found in any of the plants. This study also looked at the plants' ability to inhibit the growth of *aspergillus niger*, *Escherichia coli*, *candida albican*, and *streptococcus aureus*. The results showed that the plant extracts were more effective at low concentrations than high concentrations, and that they showed moderate inhibitions against the growth of these bacteria. The study advances our knowledge of these plants' medicinal potential, which may have important ramifications for the creation of natural products and medication.

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INTRODUCTION

Medicinal plants are valuable sources of organic compounds, and many people, especially in rural areas, rely on herbal medicine to treat various illnesses (Uchechukwu et al., 2011; Abdallah and Muhammad, 2018). Phytochemicals are naturally occurring biologically active compounds in plants, including carotenoids, flavonoids, and polyphenols. The most significant bioactive constituents of plants are alkaloids, phenols, terpenoids, flavonoids, glycosides, tannins, proteins, steroids, lipids, and amino acids.

Many indigenous medicinal plants are also used as spices and food plants (Ghumare et al., 2021). The biological properties of these medicinal plants can vary based on altitude, climate changes, and geographical location (Asfere et al., 2020). Due to the increasing resistance of microbes to synthetic drugs, there is a global search for safe, affordable, effective, and widely available therapeutic agents (Abdulnabi et al., 2019). The extraction of components from medicinal plants is considered an alternative to reduce the impact of infectious diseases (Sadiku et al., 2020). Bacterial pathogens and other microbes that develop resistance to synthetic drugs can be destroyed or inhibited by applying either crude or refined extracts of medicinal plants (Sadiku et al., 2020).

Enancia chlorantha, belonging to the Annonaceae family, is locally known by various names such as Awogba, Awopa, Osun pupa (Yoruba), Osomolu (Ikale), dokita (Igbo), Erumeru (Southeastern Nigeria), Kakerim (Boki in Cross River State, Nigeria), and Erenga-Vbogo (Bini). It is widely distributed along the coasts of West and Central Africa and is common in the forest regions of Nigeria (Adesokan et al., 2008). The plant's outer bark is thin and dark brown with geometric fissures, while the inner bark is brown above and pale cream beneath. The stem is fluted and aromatic, and the elliptic leaves are approximately 0.14-0.15m long and 0.05-0.14m wide (Adesokan et al., 2008; Iwu, 1993). *Enancia chlorantha* is particularly sought after by rural communities in Nigeria for treating various ailments, with the stem bark being the most preferred part, although the roots and leaves may also be used. Preparations such as decoctions, tinctures, or infusions are commonly made (Sotade

et al., 2022). In Nigeria, *E. chlorantha* preparations can be made in the form of a drink called 'Agbo' or a powder referred to as 'Agunmu' (Ishola et al., 2014). The plant is traditionally believed to possess numerous therapeutic functions but has received little scientific research (Sotade et al., 2022). Studies have reported its potential use in conditions such as Rickettsia fever, cough, wounds, typhoid fever, and infective hepatitis or jaundice (Gills, 1992).

Tamarindus indica, commonly known as Tamarind, is widely cultivated as an ornamental tree and is native to fertile areas throughout Africa and Southern Asia. In Northern Nigeria, it is known as Samiya in Hausa and Jatame in Fulfulde. The plant is a slow-growing, long-lived, and massive fruit tree of the tropics, growing wild throughout Sudan and long ago introduced and adopted in India. It is grown in all tropical and near-tropical areas as a shade and fruit tree along roadsides, in yards, and in parks.

Tamarindus indica is an important medicinal plant useful for alleviating pain and inflammation in joints. The leaves and pulp, when crushed and applied to swollen joints, provide significant relief and reduce inflammation (Ghumare et al., 2021). The plant is also gargled or drunk as tamarind juice to relieve throat pain and discomfort (Vyas et al., 2009; Asase et al., 2005). In Nigeria, the fresh stem bark and leaves are used as a decoction mixed with potash to treat various ailments (Komutarin et al., 2004). *Tamarindus indica* is traditionally applied for wound healing, snake bites, abdominal pain, colds, inflammation, diarrhea, helminthes, infection, and fever (Ghumare et al., 2021). These effects are likely due to the presence of polyphenols. *Tamarindus indica* contains a variety of bioactive compounds in its leaves, bark, seeds, pulp, and flowers, offering beneficial effects for human health and potential applications in the pharmaceutical industry

2.0. MATERIALS AND METHODS

2.1 Sample Collection

The sample (*Enancia chlorantha*) and (*Tamarindus indica*) were collected from the herbal merchants. The pure Form of the Microorganisms comprises of two Fungi (*Candida Albican*, *Aspergillus niga*) and

two Bacteria (*Escherichia Coli* and *Streptococcus aureus*) were collected from the Microbiology Laboratory, Department of Microbiology Abubakar Tafawa Balewa University Bauchi.

2.2 Identification and preparation of samples

The Plants Samples were identified by a botanist in the Department of Botany, Abubakar Tafawa Balewa University Bauchi. The Plants Samples were cleaned to remove dirt and was open dried in the sun for two weeks.

2.3. Homogenization and aqueous extraction

The dried barks were homogenized or grinded to powdered form in preparation for extraction in order to expose the cellular components of the samples. 50g of Homogenate were weighted using electrical weighing balance and dissolved in 250ml of distilled water. The dissolved sample was boiled in a boiling water bath for 15mins and shook using electrical Shaker for further extraction for 30mins. After shaken, the extract was allowed to cool for 15mins and was filtered using Whatman filter paper. After filtration, the filtrate was evaporated on a boiling water bath for 24hours and a pure dried crude extract of the sample is obtained.

2.4 Phytochemicals Screening

After extraction 5g of the pure extract is weighted using electrical weighing balance and dissolved in 30ml of Distilled water in order to conduct solvent recovery for Phytochemicals Screening. Test for Reducing Sugar, Alkaloids, Glycosides, Phenols, Tannins, Flavanoids, and Saponins were carried out. Benedict reagent was added to a solution of the test sample and the appearance a red precipitate indicates the presence of reducing sugar. The test for alkaloids was carried out with 5ml of the extract, 2ml of HCl and 1ml of Dragendroff's reagents, an orange precipitate or red precipitate shows a positive result for Alkaloids. Borntragers test was used to test glycosides. Appearance of pink colour indicates its presence. The production of bulky white precipitate indicates positive for Phenols when lead acetate was added to 5ml of the sample. The production of dark green colour indicates the presence of tannins when drops ferric chloride was added to the sample.

The production of florescent yellow precipitate indicates positive results for flavonoids when 10% ammonia solution was added to the sample

and heated. The formation of frothing indicates positive for Saponins when shaken vigorously with distilled water.).

2.5 Anti-microbial test Procedure

Powdered extract obtained from the plant, solvent recovery of the pure extract was conducted and then prepared into different Concentrations A, B, C and D in test tubes at 50g/ml, 100g/ml, 200g/ml and 400g/ml respectively.

The antimicrobial activity of *Enancia chlorantha* and *Tamarindus indica* was determined by applying the Agar well diffusion method. Sterilized petri dishes were filled with prepared Nutrient agar and allowed to solidify, pure isolates of each Bacterium and Fungi in a normal saline were applied on the solidified agar in different petri dishes. A sterilized cork borer was used to create wells in the dried nutrient agar containing the microorganisms. Moreover, the wells were topped up with 0.5ml of different concentrations of extracts (50,100,200 and 400ml). The plates were allowed to stand for 30mins for diffusion to occur and then incubated (Upright position) at 37 °C for 24hours. The inhibition zones were measured using ruler and recorded in millimeter.

3.0 RESULT AND DISCUSSION

In Rural Areas, people use plants extract to treat numerous ailments which mostly occur due to due to pathogenic organisms. In southern and western part of Nigeria, people use *Enancia chlorantha* to treat numerous ailments such as cough, and wounds (Gills and Akinwumi, 1986). Also use to cure Malaria, hepatitis disorders, turberculosis and ulcers (Sotade *et al*, 2022). Similarly, *Tamarindus indica* is used in Northern Nigeria to treat ailments associated with ulcers, fevers, wounds and jaundice (Muhammad *et al*, 2013). However, medicinal plant is on high interest throughout the world due to their high therapeutic features and the presence of numerous bioactive compounds and search for plants with effective, cheap and less harmful on microorganisms that possess resistance to drugs is concern for researchers throughout the world.

RESULTS OF PHYTOCHEMICAL SCREENING

Table 1: Results of Phytochemicals Screening of *Enancia chlorantha* and *Tamarindus indica* .

PHYTOCHEMICALS	TESTS	<i>Enancia chlorantha</i>	<i>Tamarindus indica</i>
Alkaloids	Dragendroffs test	+ (Positive)	+ (Positive)
Glycosides	Bornstragers test	+ (Positive)	+ (Negative)
Phenols	Lead acetate test	+ (Positive)	+ (Positive)
Tannins	Ferric chloride test	- (Negative)	+ (Positive)
Flavanoids	Ammonia Solution	+ (Positive)	+ (Positive)
Saponins	Foam test	+ (Positive)	+ (Positive)
Reducing Sugar	Benedicts test	- (Negative)	- (Negative)

Phytochemical screening results of *Enancia chlorantha* revealed that, the aqueous extract possess bioactive compounds which include: alkaloids, glycosides, phenols, flavanoids and saponins as presented in Table 1 above. However, tannins and reducing sugar is undetected which is either due to solvent used for extraction or geographical location of the plant. Similarly,

phytochemical screening results of *Tamarindus indica* revealed that the aqueous extract of the bark of the plant possess alkaloids, phenols, tannins, flavanoids and saponins. However, glycosides and reducing sugar are not detected could which also due to solvent used for extraction or geographical location of the plant.

RESULT OF INOCULATION AND INCUBATION

Table 2: Results of Inhibition zones of *Enancia chlorantha*

Concentrations	E. coli (mm)	A. niga (mm)	S. aureus (mm)	C. albican (mm)
50g/ml	8	6	10	14
100g/ml	7	5	6	10
200g/ml	5	3	7	8
400g/ml	6	1	5	6

Mm= Millimeter.

Table 3: Result of Inhibitions zones of *Tamarindus indica*

Concentrations	E. coli (mm)	A. niger (mm)	A. niger (mm)	C. albican (mm)
50g/ml	10	4	12	14
100g/ml	7	1	6	3
200g/ml	6	2	3	2
400g/ml	1	0	1	3

Mm= Millimeter.

3. 2 Antimicrobial Properties of *Enancia chlorantha* and *Tamarindus indica*

3.2.1 *Enancia chlorantha*:

The aqueous bark extract of *Enancia chlorantha* demonstrated antimicrobial effectiveness against *Candida albicans* and *Streptococcus aureus*, with inhibition zones of 14mm and 10mm respectively at a 50g concentration. It also showed inhibition zones of 8mm and 6mm against *Escherichia coli* and *Aspergillus niger*,

respectively. At a concentration of 100g, the inhibition zones were 7mm for *E. coli*, 5mm for *A. niger*, 6mm for *S. aureus*, and 10mm for *C. albicans*. At 200g, the inhibition zones were 5mm for *E. coli*, 3mm for *A. niger*, 7mm for *S. aureus*, and 8mm for *C. albicans*. At 400g, the inhibition zones were 6mm for *E. coli*, 1mm for *A. niger*, 5mm for *S. aureus*, and 6mm for *C. albicans* (Table 2).

3.2.2 *Tamarindus indica*:

The antimicrobial properties of *Tamarindus indica* were also assessed. At a 50g concentration, the inhibition zones were 10mm for *E. coli*, 4mm for *A. niger*, 12mm for *S. aureus*, and 14mm for *C. albicans*. At 100g, the inhibition zones were 7mm for *E. coli*, 1mm for *A. niger*, 6mm for *S. aureus*, and 3mm for *C. albicans*. At 200g, the inhibition zones were 6mm for *E. coli*, 2mm for *A. niger*, 3mm for *S. aureus*, and 3mm for *C. albicans*. At 400g, the inhibition zones were 1mm for *E. coli*, 0mm for *A. niger*, 1mm for *S. aureus*, and 3mm for *C. albicans* (Table 3).

3.3 Discussion

Phytochemical Screening:

Phytochemical analysis of *Enancia chlorantha* revealed that the aqueous extract contains bioactive compounds such as alkaloids, glycosides, phenols, flavonoids, and saponins (Table 1). However, tannins and reducing sugars were not detected, possibly due to the solvent used for extraction or the plant's geographical location. In contrast, studies by Dawodu et al. (2014) and Olanlokun et al. (2013) found that *E. chlorantha* is rich in alkaloids, phenolics, flavonoids, glycosides, and reducing sugars in both aqueous and ethanolic bark extracts.

Similarly, the aqueous extract of *Tamarindus indica* bark was found to contain alkaloids, phenols, tannins, flavonoids, and saponins, but not glycosides and reducing sugars. This may also be due to the extraction solvent or the plant's geographical location. Research by Ghumare et al. (2021) and Gupto et al. (2014) identified similar bioactive compounds in *T. indica*.

Mechanisms of Antimicrobial Activity:

The significant antimicrobial activity observed in both plants is likely due to the presence of alkaloids, which disrupt microbial cell membranes, inhibit enzyme activity, interfere with DNA and RNA, alter pH and ion balance, and modulate cellular signaling pathways.

Concentration-Dependent Activity:

Both plants exhibited greater antimicrobial activity at lower concentrations (50g and 100g) compared to higher concentrations (200g and 400g), with notable effectiveness against

Candida albicans. This aligns with findings by Nyong et al. (2015) and Vaghasiyya and Chandi (2009), who reported significant antimicrobial activities in similar studies. Sotade et al. (2022) also noted that inhibition sites were proportional to the concentration of plant extracts, supporting these findings.

4.0. SUMMARY

1. The research project focused on investigating phytoconstituents and antimicrobial activity potentials of *Enancia chlorantha* and *Tamarindus indica* to determine the related anti therapeutic significance. The research centered on collection, identification, preparation and tests running for phytochemical analysis and antimicrobial activity evaluations.
2. Qualitative phytochemical analysis was conducted on the plants extracts which shows that both plants possess alkaloids, phenols, flavanoids, and saponins while reducing sugar is absence in both plants and tannins is present in *Tamarindus indica* but absent in *Enancia chlorantha*. Similarly, Glycosides is detected in *Enancia chlorantha* but undetected in *Tamarindus indica*.
3. The research project indicates significant antimicrobial activity of *Enancia chlorantha* and *Tamarindus indica* against *Candida albicans* and *Streptococcus aureus* with moderate inhibition against *Escherichia coli* and *Aspergillus niger*. The research project shows the significant of *Enancia chlorantha* and *Tamarindus indica* as a source of natural Antimicrobial agent and suggest further investigations of the plants to determine more of their medicinal importance.

5.0 CONCLUSION

Based on the findings, the research project successfully achieved its goal of investigating and comparing the phytochemicals and antimicrobial activities of *Enancia chlorantha* and *Tamarindus indica*. Both plants were found to possess similar phytochemicals, differing only in glycosides and tannins, highlighting their importance as medicinal

plants. Their varying levels of inhibition against different microorganisms at various concentrations demonstrate their significant antimicrobial properties. Consequently, *Tamarindus indica*, which is abundant in Northern Nigeria, could potentially substitute *Enancia chlorantha*, predominantly found in Southern and Western Nigeria, if combined with other plants that contain glycosides and tannins. However, further quantitative investigations are recommended to isolate the necessary compounds to facilitate this substitution effectively.

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