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# ETHNOBOTANICAL SURVEY OF PLANTS USED IN THE TREATMENT OF MYCOBACTERIUM TUBERCULOSIS IN GWAGWALADA AND KUJE AREA COUNCILS

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## Abstract

*An ethnobotanical survey on medicinal plants used by traditional medicinal practitioners for treating tuberculosis was carried out at Gwagwalada and Kuje area Councils, with specific objectives aimed at identifying, documenting and collecting the various diversity of plant species used. A well-structured questionnaire was used to obtained the required information on demographics and the ethnobotanical data Data was analyzed using SPSS. Descriptive statistics were used to present results. The dominant sex of respondent was female. 17 plant species belonging to 12 plant families were discovered in Gwagwalada and a total 12 plant species belonging to 11 plant families were discovered in Kuje with the seeds and the leaves being the most commonly used part. The most frequently cited plant species were Garcinia kola, Allium sativum, Zingiber officinale, Afromomum melegueta, Abrus precatorius and Bryophyllum pinnatum. Phytochemical screening of the ethanolic extracts were carried out on the frequently cited plants. Of the 12 parameters tested, all were present except anthraquinone and glycoside. The result of the quantitative analysis records the presence of saponins, tannins, flavonoids, alkaloids and phenols in all the plant samples with Abrus precatorius recording the highest alkaloid, flavonoid and phenol content. Antioxidant activity was carried out using DPPH as the radical scavenger. The highest antioxidant activity was seen in Garcinia kola, followed by Afromomum melegueta. These findings not only validate traditional knowledge but ethnomedicinal application of the plant in the management of TB and further highlight the potentials of these plants as a valuable raw material in the pharmaceutical industries.*

***Keywords****: Antioxidants, Ethnobotany, Medicinal Plants, Phytochemicals, Tuberculosis.*

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## 1. INTRODUCTION

Tuberculosis (TB) is a communicable disease present for over the past millennia and remains a major global public health burden, with one-third of the world's population currently infected and more than 1.3 million deaths per year (Micheni *et al.,* 2021). According to WHO global tuberculosis report for 2020, It is a contagious disease caused by *Mycobacterium tuberculosis* (WHO, 2020). It usually attacks the lungs, although it can also spread to other parts of the body, and is transmitted through coughing and sneezing. Nigeria with a population of over 200 million people (National Bureau of Statistics) is ranked sixth nation with the highest number of TB cases globally. The country in 2021, contributed to 4.4 percent to the total TB cases globally. In Nigeria, efforts to control and prevent Tuberculosis encounters several challenges which include the impact of HIV/AIDS and the emergence of multi-drug-resistant tuberculosis (MDR-TB) (Adebisi *et al*., 2019).

In a study on the prevalence of drug resistance tuberculosis in Nigeria by Onyedum *et al* (2017) it was found that the burden of MDR-TB is high, occurring in 6.0% of new and 32% in previously treated, which is above the current WHO estimates of 4.3% (3.2 – 5.2 %) for Nigeria (WHO, 2016). These statistics highlight the increasing prevalence of tuberculosis in Nigeria. In absence of effective therapeutic drugs for TB, hope is built on plant based natural products due to their chemical diversity and and significant role as phyto-drugs. (Gemechu *et al.,* 2013).

In Nigeria large percentage of the population, particularly in the rural areas, depend on traditional medicines for their primary health care (Ibekwe *et al.,* 2014).

Several ethnobotanical studies have documented medicinal plants being used to treat tuberculosis (Ibekwe *et al.,* 2014 and Oryema *et al*., 2021). According to Adeniran *et al*., 2020, ethnobotanical knowledge is traditionally passed on verbally from generation to generation within the FCT and as practitioners rely solely on memory for their practice. This mode of knowledge transfer may lead to interrupted knowledge transmission; intergenerational knowledge erosion and its effect are discrepancies between knowledge and actual use of medicinal plants (Adeniran *et al.,* 2020).

**Aim and Objectives**

The aim of this study is to identify the diversity of ethnobotanical plants used in treatment of Tuberculosis symptoms by traditional medicine practitioners in Gwagwalada and Kuje area council of Abuja.

**Objectives**

1.To identify, collect and document the diverse ethnobotanical plants used in traditional medicine for the treatment of tuberculosis in Abuja.

2. To determine the phytochemical composition of the crude ethanolic extract of most commonly used ethnobotanical plants.

3. To ascertain the antioxidant properties of the most commonly identified ethnobotanical plants.

**Purpose of Research**

Tuberculosis (TB) remains a significant public health concern in Nigeria. According to the World Health Organization Nigeria has one of the highest burdens of TB in the world, with over 361 000 cases were reported in 2023 (WHO, 2024). The spread of TB is exacerbated by factors such as poverty, malnutrition, and weak health systems. The socio-economic impact of TB is also significant, as the disease can lead to disability and death, resulting in loss of productivity and income.

Despite the availability of conventional treatments for tuberculosis (TB), the disease remains a significant public health burden in Nigeria, with high morbidity and mortality rates as a result of limited access to diagnostic center, cost of treatment, treatment side effects, low awareness, stigma surrounding the disease, and poor infection control measures in health facilities (Adejumo *et al.,* 2016). Due to this limitation, there has been a shift towards traditional plants as an alternative source of treatment for tuberculosis.

However, there is a lack of comprehensive documentation and scientific validation of the diverse ethnobotanical plants used in TB treatment, which poses a significant knowledge gap and potential safety risks for patients. Therefore, it is essential to investigate the diversity of ethnobotanical plants used in the treatment of TB in Abuja, with a focus on identifying the

most commonly used plants, their phytochemical composition, and their antioxidant properties, in order to provide a scientific basis for their use and potential development into effective and safe alternative treatments for TB.

**Research Justification**

Nigeria struggles with the scourge of Tuberculosis (TB), with a high prevalence rate of 322 cases per 100,000 populations (WHO, 2020). Ethnobotanical plants have been used for centuries in traditional medicine, but their diversity, efficacy, and safety have not been comprehensively documented or scientifically validated.

These area's (Gwagwalada and Kuje) unique cultural and geographical context, with a mix of urban and rural populations, provide an ideal setting to investigate the diversity of ethnobotanical plants used in TB treatment by generating valuable knowledge on these plants, identifying potential drug leads from the ethnobotanical plants for further development into effective and safe alternative treatments for TB and promoting integration of traditional medicine into conventional healthcare systems while ultimately improving healthcare outcomes for TB patients in this region and beyond.

## 2. MATERIALS AND METHODS

**Study Area**

This study is conducted in Gwagwalada and Kuje Area Councils of Federal Capital Territory (FCT) Abuja. Gwagwalada is located along Abuja Lokoja Road, about 55km southwest of Abuja city center. Gwagwalada, has a population of 157,770 according to the 2006 national population census and a total area of 1,043 km². Kuje has a population of 97,367 people at the 2006 census and a total area of 1,644 $km^2$.

**Collection of Data**

A Survey was conducted among traditional medicinal practitioners and herbal sellers both those of member association and various herbal traders within Gwagwalada and Kuje area councils between August to November to ensure adequate survey coverage among these two areas. A concise questionnaire was designed and prepared to obtain the most precise ethnobotanical data. A total number of 110 questionnaires was distributed within Gwagwalada and Kuje (against the 124 questionnaires as determined by the sample size due ethical concerns

as some of the respondents were scared of others stealing their knowledge). Informed consent was obtained orally from all participants comprising traditional medical practitioners (TMP) and herbal sellers. The questionnaires were prepared in English. However, to facilitate efficient communication, informal discussion with herb sellers and traditional medicinal practitioners was done in the local language in some areas. The questionnaires were focused on the use of medicinal plants or plant parts to treat common TB -symptoms (cough longer than 2 weeks, fever, night sweats, weight loss and bloody sputum). Local plant names, utilized organs (leaf, stem, root, seed) and traditional formulations of the plants were recorded.

Participants were interviewed individually to maintain confidentiality. Data collected were divided into two sections: Section (A) comprises of the demographic information such as age, gender, occupation, educational background, residence, marital status and working experience while Section (B) comprises of the professional experience of plants used such as local names of the plants used in treating tuberculosis and related ailments, plant part used, method of preparation/extraction, and administration method. The most frequently mentioned plants species were collected from the local market, identified by using specific taxonomic keys and additionally their scientific names were determined through consultation with botanists. The Voucher specimens was prepared and deposited at the herbarium of Botany department University of Abuja.

**Table 1: Demographic Data of the Respondents in Gwagwalada Area Council.**

| Variables | Frequency | Percentage |
|---|---|---|
| **Sex** | | |
| Male | 15 | 27.3 |
| Female | 40 | 72.7 |
| Total | 55 | 100.0 |
| **Age** | | |
| 31-40 | 5 | 9.1 |
| 41-50 | 17 | 30.9 |
| 51-60 | 21 | 38.2 |
| 61 and above | 12 | 21.8 |
| Total | 55 | 100.0 |
| **Educational background** | | |
| Primary | 19 | 34.5 |
| Secondary | 15 | 27.3 |
| Tertiary | 6 | 10.9 |
| None | 15 | 27.3 |
| Total | 55 | 100.0 |
| **Marital status** | | |
| Single | 6 | 10.9 |

| | | |
|---|---|---|
| Married | 45 | 81.8 |
| Divorced | 4 | 7.3 |
| Total | 55 | 100.0 |
| **Religion** | | |
| Christianity | 20 | 36.4 |
| Islam | 30 | 54.5 |
| Traditional | 5 | 9.1 |
| Total | 55 | 100.0 |
| **Tribe** | | |
| Yoruba | 28 | 50.9 |
| Hausa | 17 | 30.9 |
| Igbo | 5 | 9.1 |
| Others | 5 | 9.1 |
| Total | 55 | 100.0 |
| **Occupation** | | |
| Traditional medicine practitioner | 45 | 81.80 |
| Herbal seller | 10 | 18.20 |
| Total | 55 | 100.0 |
| **Work Experience** | | |
| 1-5 | 3 | 5.5 |
| 6-10 | 2 | 3.6 |
| 11-15 | 0 | 0.0 |
| 16-20 | 22 | 40.0 |
| 21 and above | 28 | 50.9 |
| Total | 55 | 100.0 |

**Table 2: Demographic Data of the Respondents in Kuje Area Council.**

| Variables | Frequency | Percentage |
|---|---|---|
| **Sex** | | |
| Male | 23 | 41.8 |
| Female | 32 | 58.2 |
| Total | 55 | 100.0 |
| **Age** | | |
| 21-30 | 1 | 1.8 |
| 31-40 | 11 | 20.0 |
| 41-50 | 15 | 27.3 |
| 51-60 | 19 | 34.5 |
| 61 and above | 9 | 16.4 |
| Total | 55 | 100.0 |
| **Educational background** | | |
| Primary | 28 | 50.9 |

| | | |
|---|---|---|
| Secondary | 9 | 16.4 |
| None | 18 | 32.7 |
| Total | 55 | 100.0 |
| **Marital status** | | |
| Married | 55 | 100.0 |
| Total | 55 | 100.0 |
| Religion | | |
| Christianity | 19 | 34.5 |
| Islam | 36 | 65.5 |
| Total | 55 | 100.0 |
| **Tribe** | | |
| Yoruba | 35 | 63.6 |
| Hausa | 12 | 21.8 |
| Others | 8 | 14.5 |
| Total | 55 | 100.0 |
| **Occupation** | | |
| Traditional medicine practitioner | 38 | 69.1 |
| Herbal seller | 17 | 30.9 |
| Total | 55 | 100.0 |
| **Work Experience** | | |
| 11-15 | 11 | 20.0 |
| 16-20 | 30 | 54.5 |
| 21 and above | 14 | 25.5 |
| Total | 55 | 100.0 |

**TABLE 3: List of Plants (Botanical Name, Common Name and Local Name) used in Gwagwalada Area Council of Abuja.**

| | Family | Botanical name | Common name | Local name | Frequency | Percent (%) | Plant part used |
|---|---|---|---|---|---|---|---|
| 1 | Acanthaceae | *Acanthus montams T. Anders* | Mountain thistle | Mafowokan omo mi (Y) | 1 | 1.8 | Leaf, Stem |
| 2 | Amaryllidaceae | *Allium sativum L.* | Garlic | Ayu (Y) | 8 | 14.5 | Seed |
| 3 | Anacardiaceae | *Anacardium occidentale L.* | Cashew | Kashu(H) | 3 | 5.5 | Stem/bark |
| 4 | Apocynaceae | *Calotropis procera, W.T Aiton* | Milk weed | Ewe bomubomu (Y) | 1 | 1.8 | Leaf |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5 | Caricaceae | *Carica papaya, L.* | Paw paw | Gwanda (H) | 3 | 5.5 | Leaf, seed |
| 6 | Crassulaceae | *Bryophyllum pinnatum, Lam.(Oken)* | Miracle leaf | Abamoda (Y) | 4 | 7.3 | Leaf |
| 7 | Clusiaceae | *Garcinia kola, Heckel* | Bitter kola | Orogbo (Y) | 9 | 16.4 | Seed |
| 8 | Fabaceae | *Abrus precatorius, L.* | Rosary pea | Omisinmisin pelebe (Y) | 4 | 7.3 | Leaf |
| | | *Tetrapleura tetraptera, (Schumach. & Thonn.) Taub.* | Aidan fruit | Obogolo | 2 | 3.6 | Seed |
| 9 | Myrtaceae | *Psidium guajava, L.* | Guava | Gwaaba (H) | 2 | 3.6 | Leaf, stem |
| | | *Syzygium aromaticum, (L.) Merr. & L.M. Perry* | Clove | Kanafuru(Y) | 2 | 3.6 | Seed |
| 10 | Piperaceae | *Peperomia pellucida, Kunth* | Crab claw herb | Ewe rin rin (Y) | 1 | 1.8 | Leaf |
| | | *Piper nigrum, L.* | Black pepper seed | | 2 | 3.6 | Seed |
| 11 | Ruthaceae | *Citrus aurantifolia (Christm.) Swingle* | Lime | Epe nkirisi (I) | 2 | 3.6 | Leaf, fruit |
| | | *Citrus limon, (L.) Osbeck* | Lemon | | 2 | 3.6 | Leaf, fruit |
| 12 | Zingiberaceae | *Aframomum meleguueta, K.Schum* | Alligator pepper | Ose oji (I) | 5 | 9.1 | Seed |
| | | *Zingiber Officinale, Roscoe* | Ginger | Jinja (H) | 4 | 7.3 | Seed |
| | Total | | | | 55 | 100 | |

KEY: H denotes Hausa,Y denotes Yoruba and I denotes Igbo

**TABLE 4: List of Plants (Botanical Name, Common Name and Local Name) Used In Kuje Area Council Of Abuja.**

| | **Family** | **Botanical name** | **Common name** | **Local name** | **Frequency** | **Percentage (%)** | **Plant part Used** |
|---|---|---|---|---|---|---|---|
| **1** | Anonaceae | *Xylopia aethiopia,(Dunal) A. Rich.* | Plegro Pepper | Uda(I) | 3 | 5.5 | Seed |
| **2** | Amaryllidaceae | Allium sativum, L. | Garlic | Ayu (Y) | 4 | 7.3 | Seed |
| **3** | Arecaceae | *Borassus aethiopum, Mart.* | African Fan Palm | | 1 | 1.8 | Seed |
| **4** | Caricaceae | *Carica papaya, L.* | Paw paw | Ibepe | 3 | 5.5 | Leaf, Seed |
| **5** | Clusiaceae | *Garcinia kola, Heckel* | Bitter kola | Orogbo (Y) | 13 | 23.6 | Seed |
| **6** | Lamiaceae | *Ocimum gratissimum, L.* | Scent leaf | Efinrin nla (Y) | 2 | 3.6 | Leaf |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **7** | Euphorbiaceae | *Jatropha curcas, L.* | Physic Nut | Ewe Lapalapa (Y) | 2 | 3.6 | Leaf, Seed |
| **8** | Menispermaceae | *Sphenocentrum Jollyanum, P.* | Moonseed | Akerejupon (Y) | 2 | 3.6 | Seed, Leaf |
| **9** | Ruthaceae | *Citrus aurantifolia, (Christm.) Swingle* | Lime | Epe nkirisi (I) | 3 | 5.5 | Seed |
| **10** | Sapotaceae | *Vitellaria Paradoxa, C.F.Gaertn* | Shea tree | | 2 | 3.6 | Seed, Stem |
| **11** | Zingiberaceae | *Aframomum meleguueta, K.Schum* | Alligator pepper | Ose oji (I) | 13 | 23.6 | Seed |
| | Zingiberaceae | *Zingiber officinale, Roscoe* | Ginger | Ata ile (Y) | 7 | 12.7 | Ginger |
| | **Total** | | | | 55 | 100.0 | |

KEY: Y denotes Yoruba, H for Hausa and I for Igbo

**Preparation of Plant Material and Extraction**

Plant species identified through the use of questionnaire was washed, air dried at room temperature. The plant material was grounded into a homogenous powder. One hundred grams of the sample was measured and weighed in a beaker, 120ml of ethanol used to soak the dried plant material at room temperature for two days, extract was filtered using Whatman filter paper. The extract was evaporated into dryness using a hot water bath for 72 hours and stored in the refrigerator for future use (Ajuru *et al*., 2017).

**Phytochemical Analysis**

Phytochemical analysis of the various plant species was carried out to determine the secondary metabolite presents in the identified plants. Using the standard method of Sofowora 1993 with little modification, 1ml to 2ml of the ethanolic extract was used to carry out the analysis for each parameter.

**Table 5: Qualitative Phytochemical Composition of the ethanolic extract of six different plant species**

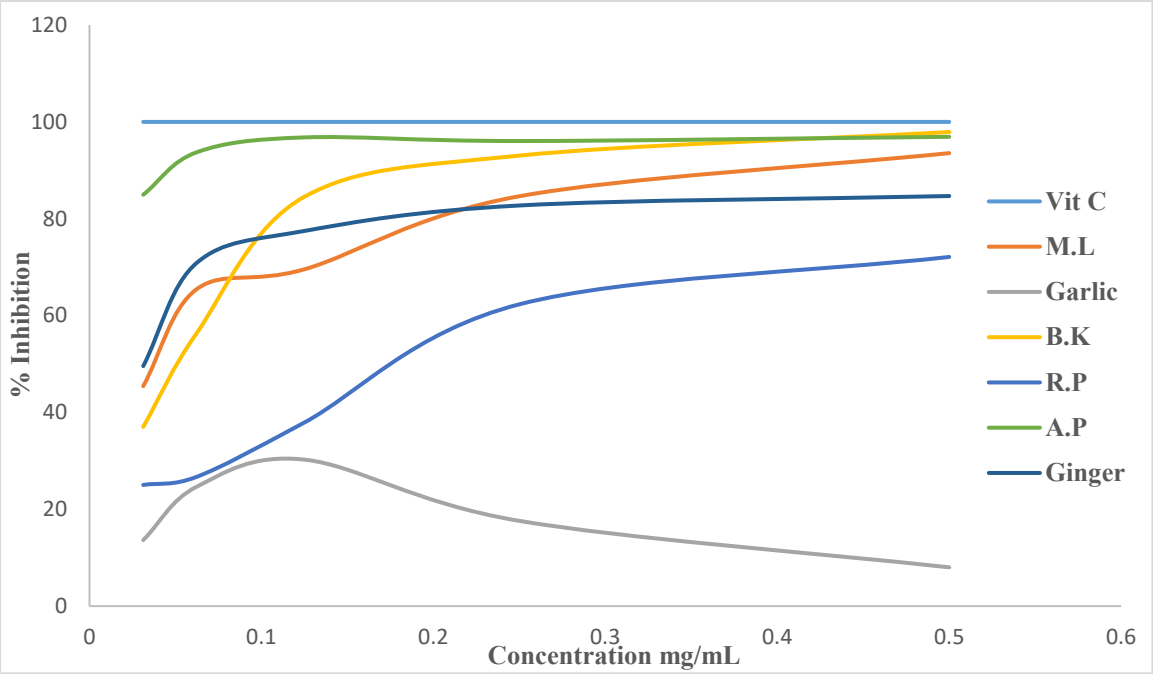
| S/NO | Parameter | *Bryophyllum pinnatum* | *Afromomum melegueta* | *Abrus precatorrius* | *Zingiber officinale* | *Gracinia kola* | *Allium sativum* |
|---|---|---|---|---|---|---|---|
| 1 | Anthraquinones | - | - | - | - | - | - |
| 2 | Resins | + | - | + | + | + | - |
| 3 | Alkaloids | + | + | + | + | + | + |
| 4 | Glycosides | - | - | - | - | - | - |
| 5 | Coumarin | + | + | + | + | + | + |
| 6 | Phenol | + | + | + | + | + | + |
| 7 | Tannins | + | + | + | + | + | + |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8 | Flavonoids | + | + | + | + | + | + |
| 9 | Saponins | + | + | + | + | + | + |
| 10 | Steroids | + | + | - | + | + | + |
| 11 | Terpenoids | + | - | - | - | - | - |
| 12 | Triterpenoids | + | + | - | - | + | + |

+ =presence and - =absent

**Table 6: Quantitative Phytochemical Composition of the Ethanolic Extract of Plant Species**

| S/NO | Parameter (mg/g) | *Bryophyllum pinnatum* | *Afromomum melegueta* | *Abrus precatorrius* | *Zingiber officinale* | *Gracinia kola* | *Allium sativum* |
|---|---|---|---|---|---|---|---|
| 1 | Phenol (@ 505nm) | 0.0656 | 0.0240 | 0.0826 | 0.0804 | 0.0668 | 0.2363 |
| 2 | Tannins (@ 395nm) | 1.3250 | 1.2684 | 1.9997 | 1.3463 | 1.3360 | 1.2720 |
| 3 | Flavonoid (@ 505nm) | 0.0975 | 0.0477 | 0.6306 | 0.0510 | 0.2462 | 0.0496 |
| 4 | Saponin (@ 490nm) | 0.0360 | 0.0341 | 0.0350 | 0.0366 | 0.0392 | 0.0370 |
| 5 | Alkaloids (@ 5665nm) | 0.0608 | 0.1176 | 0.1661 | 0.1019 | 0.1614 | 0.0706 |



## 3. RESULTS

In this survey, 17 species of plants belonging to 12 plant families were Identified in Gwagwalada Area Council with the highest frequency occurring *in Garcinia kola* 16.4%, *Allium sativum* 14.5%, Afromomum *melegueta* 9.1%, *Abrus precatorius* 7.3% and *Bryophyllum pinnatum* 7.3% respectively as shown in table 3. While in Kuje Area council 12 species of plants belonging to 11 families were identified. The most frequently cited plant in Kuje are *Afromomum melegueta* 23.6%, *Garcinia kola* 23.6%, *Zingiber officinale* 12.7%, *Allium sativum* 7.3% and *Citrus aurantifolia* 5.5% as shown in table 4.

### Discussion

Results from the demographic data recorded more female respondents than male respondents in both areas, as majority of the respondents were females. Also 50.9% to 54.5% of the respondents possesses a work experience of 16years and above indicating a strong foundation in herbal medicine. The majority of the respondents had a primary education.

The result of the ethnobotanical survey shows that *Gracinia kola* has the highest frequency of citation (16.4%) in Gwagwalada and (23.6%) in kuje followed by *Afromomum melegueta, Allium sativum, Zingiber officinale, Abrus precatorius* and *Bryophyllum pinnatum.* This observation corresponds with the work reported by Ogbole *et al.,* 2010 on ethnobotanical plants used in treatment of tuberculosis in Ogun state in which *Afromomum melegueta, Garcinia kola* was among the most cited plants used in the treatment of tuberculosis. Also, research by Ibekwe *et al (*2014) on the efficacy of some Nigerian anti-tuberculosis ethnomedicines mentioned *Abrus precatorius* as one of the ethnobotanical plants. The most commonly used plant parts were seeds and leaves. The similarity in the usage of the same plant species from these areas implies that these plants may be potential sources of anti-tuberculosis drugs. This calls for modern scientific validation to verify their efficacy and safety.

The presences of the most important phytochemicals were observed in all the plant extract. Results of similar evaluations on other medicinal plants have shown that medicinal plants with these secondary metabolites have been studied to be biologically active possessing antimicrobial potency which may contribute to their potential health benefit.

From the quantitative analysis, the highest concentration of phenol was recorded in *Allium sativum* (0.2363) while *Abrus precatorius* has the highest concentration of tannins, alkaloids

and flavonoids. However, the highest amount of saponins is observed in *Gracinia kola.* Saponins have biological effects such as anti-inflammatory and antimicrobial properties. These phytochemicals can act as antioxidant that protects cells against free radical damage (Omoregie and Osagie, 2021).

The antioxidant assays carried out on the six plant samples using DPPH as the free radical scavenger which measures the ability of a substance to scavenge free radicals, shows that all of the plant extracts tested exhibited some degree of antioxidant activity. However, the degree of antioxidant activity varied considerably between the different plant extracts. The higher the percentage inhibition, the greater the antioxidant activity of the plant extract.

The plant extracts with the highest antioxidant activity were *Garcinia kola* followed by *Afromomum melegueta*, respectively. While the plant extract with the lowest antioxidant activity was *Allium sativum*. However, in *Bryophyllum pinnatum, Abrus precatorius* and *Zingiber officinale* the higher the concentration of extract, the higher the inhibition percentage, the greater the antioxidant activity. The results of this study revealed that some of the plants frequently used by traditional medicine practitioners in treating tuberculosis have significant antioxidant activity. This suggests that these plants may contain compounds with therapeutic potential in the treatment of tuberculosis.

## 4. CONCLUSION

The study demonstrates the existence of medicinal plant knowledge and ethnobotanical plants used in the treatment of symptoms of tuberculosis. For most of the plants mentioned the seed and the leaf were the most used plants for therapeutic purpose and this threatens the conservation of these plant species. However, despite the small numbers of plants mentioned, the results of the current study could form the basis for the development of a new class of drugs for the treatment of TB.

## Conflict of interest

There was no conflict of interest during the course of this work.

## Acknowledgement

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