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# Antibacterial activity and phytochemical screening of some medicinal plant extracts against bacteria isolated from food materials sold in Keffi, Nasarawa State, Nigeria

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## Abstract

Phytochemical analysis of ethanol and aqueous extracts of the leaves and bark of *Bidens plasa* and *Brilliantasia patula* plant were carried out using standard technique. The plants parts were extracted through cold maceration technique. Bacteria were isolated using standard microbiology methods. Antibacterial activity of the extracts was carried out using agar well diffusion technique. Results of the phytochemical analysis revealed flavonoids, phenols, alkaloid, tannins, steroids, saponins, anthraquinone, reducing sugar, terpenes and glycosides were present in the plant extracts. The extracts were tested against *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella spp*, *Salmonella spp* and *P. aeruginosa* isolated from tomato, vegetables and dry fish. The aqueous leaves extract of *Bidens plasa* inhibited all the test isolates at 50.0 mg and 25.0 mg. The ethanol leaves extracts of *Bidens plasa* had more antibacterial activity against the test bacteria. The ranges of inhibition zone of the test bacteria were *E. coli* had 14.0±0.42 mm at 50.0 mg, 11.00±2.00 mm at 25.0mg and 7.00±0.10 mm at 12.5 mg; *Klebsiella spp* with 13.03±0.32 mm at 50.0 mg and 10.0±3.00 mm at 25.0mg respectively. The bark of extract of *Brilliantasia patula* had more antibacterial activity in various amount of the extract ranging from 50mg – 12.5mg against the test bacteria. The range of inhibition zone of the test bacteria were E. coli had 13.0±0.21 mm at 50.0 mg, 7.0±1.00 mm at 25.0mg and 5.00±0.11 mm at 12.5 mg and *Klebsiella spp* with 10.00±1.00 at 50.0 mg and 6.00±0.01 mm at 25.0 mg. The antimicrobial activity demonstrated by these plant extracts on food borne pathogens indicated the preservative potentials these extracts possess in controlling the bacteria growth.

**Keywords:** Phytochemical analysis; Antibacterial activity; Food materials; Leaves extracts; Bark extracts

## 1. Introduction

Diarrhoea is one of the causes of morbidity and mortality in developing countries. It is most commonly caused by gastrointestinal bacteria and kills around 4.6 million people; including 2.5 million children every year [1]. Many plant extracts owe their potency to the presence of substances such as tannins, phenolic compounds and so on [2]. These substances are usually found in various parts of the plants like roots, leaves, shoots and bark. Many plants have therefore become sources of important drugs and the pharmaceutical industries have come to consider traditional medicine as a source of bioactive agents that can be used in the preparation of synthetic medicine [1]. In recent times, emphasis is placed on the use of natural materials in the control and treatment of various infections and diseases as some chemically synthesized drugs have undesirable side effects. Alternative approach to drug discovery is through the medicinal plants. Many people seeking remedies and health approaches free from side effects caused by synthetic chemicals, Recently, attention has been paid to utilize eco-friendly and bio-friendly plant-based products for the prevention and cure of different human diseases. Most of the people have faith in traditional medicine, particularly plant drugs for their primary healthcare [3]. In India, 6000 plants are in use in traditional, folk and herbal medicine, representing about 75% of the medicinal needs of the third world countries [3]. Natural products serve as lead molecules for the development of many popular drugs. Herbal drugs are having lesser side effects than the other classes of synthetic drugs. Herbs had

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been used by all cultures throughout history. It was an integral part of the development of modern civilization. Primitive man observed and appreciated the great diversity of plants available to him. The plants provided food, clothing, shelter and medicine. Much of the medicinal uses of plants seem to have been developed through observations of wild animals and by trial and error. As time went on, each tribe added the medicinal power of herbs in their area to its knowledge base. They methodically collected information on herbs and developed well defined herbal pharmacopoeias. Indeed, well into the 20th century much of the pharmacopoeia of scientific medicine was derived from the herbal tradition of native peoples. Many drugs commonly used today are of herbal origin. Indeed, about 25% of the prescription drugs dispensed in the United States (US) contain at least one active ingredient derived from plant material and some are made from plant extracts; others are synthesized to mimic as natural plant compound. The same follows for plant therapeutic agents. Thorough biological evaluation of plant extracts is vital to ensure their efficacy and safety. These factors are of importance if plant extracts are to be accepted as valid medicinal agents. Ethno-pharmacologists, botanists, microbiologists and natural-product chemists are searching the earth for phytochemicals which could be developed for the treatment of infectious diseases [4]. This study focus on isolation, characterization and antibacterial activity of *Bidens pilosa* and *Brilliantasia patula* against bacterial isolated from food materials sold in Keffi, Nigeria.

## 2. Material and methods

### 2.1. Collection and preparation of plant materials

*Bosqueia anglosensis* Fresh and healthy leaves, bark and root of *Bidens pilosa, Brilliantasia patula, Ageratum conyzoides* and *Bosqueia anglosensis* were collected from farms in Abeokuta, Ogun state, Nigeria; and transported to Plant Science and Biotechnology Department, Nasarawa State University, Keffi for identification purposes. The collected leaves were washed thoroughly in tap water, followed by successive washing in distilled water. The washed leaves of these plants were air-dried at room temperature under shade. Finally, dried material were ground to coarse powder using a manual grain mill and stored in plastic containers for further analysis.

### 2.2. Extraction of the crude extracts

Plant active components were extracted using the cold extraction method. Two (2) different extraction solvents namely ethanol and ethyl acetate were used. Extract was prepared following the methodology proposed by Orhue *et al.,* [5] with minor modifications. One hundred grams (100 g) of milled powdered sample of each of the plant parts (leaves and root) were separately soaked in 500 mL beaker containing 100ml of ethanol for 24 h at room temperature, under occasional shaking, followed by ethyl acetate. Extraction was repeated three times, and the extracts obtained were filtered through Whatman filter paper number 1. After that, they were concentrated to dryness under reduced pressure using a rotary evaporator at 45 °C.

### 2.3. Phytochemical analysis

Qualitative phytochemical test involved the simple chemical test to detect the secondary metabolites using standard method of Okoli *et al.,* [6]. For each of the ethanol, and ethyl acetate extracts of the pants, qualitative screening was carried out to determine the phytochemical present. One gram (1 g) of the powder was subjected to qualitative phytochemical tests for Alkaloid **(**Mayer reagent); Tannins **(**$FeCl_3$**)**; Saponins (chloroform and $H_2SO_4$.**);** Cardiac glycosides **(**glacial acetic acid + $FeCl_3$ + $H_2SO_4$.**);** Steroid **(**chloroform + acetic anhydride + Conc. $H_2SO_4$**)**; and Flavonoid **(**5 ml of Ammonia solution + $H_2O$). Total phenolic content was estimated spectrophotometrically using Folin Ciocalteu reagent, as described by Ekeleme, *et al.,* [7], using Gallic acid as a standard.

### 2.4. Test for steroids (Salwoski's test)

Dry extracts (100 mg) were dissolved in 2 ml of chloroform. A few drops of concentrated sulphuric acid were added to form a lower layer. A reddish brown colour at the interface was indicative of the presence of steroidal ring [8].

### 2.5. Test for Alkaloids

The extracts (20 $\mu$L) were applied on TLC plates (Silica Gel 60G, 5 × 10 cm) and eluted using toluene-ethyl acetate-diethylamine (70: 20 : 10) as solvent system. Alkaloids were detected after spraying Dragendorff's reagent as orange-brown spots on TLC plates [7].

### 2.6. Test for Phenol

The extracts were spotted on a filter paper and a drop of phosphomolybdic acid reagent was added. This was then exposed to ammonia vapors. Blue coloration of the spot, showed a positive result [9].

### 2.7. Test for Glycosides

Dry extract (50 mg) dissolved in 1ml ethanol was mixed with 1 ml of water and then aqueous sodium hydroxide was added. A yellow colour observed indicated the presence of glycosides, [8].

### 2.8. Test for Anthraquinone

The dry extract (200 mg) was placed in a dry test tube and 2 ml of chloroform added for 5 minutes. The extract was filtered and the filtrate was shaken with 2 ml of 10% ammonia solution. A pink violet or red colour shows the presence of anthraquinone [8].

### 2.9. Test for Terpenes (Liebrmann-Burchard Test)

Chloroform (2 ml and 1 ml) of concentrated sulphuric acid were added to 1mg of the dry extract. A reddish-brown colour indicated the presence of terpenes [7].

### 2.10. Test for Tannins

Extracts were treated with 1mL of 5% ferric chloride which was added. The presence of tannins was indicated by the formation of bluish black or greenish black precipitate [7].

### 2.11. Test for Flavonoids

Few fragments of magnesium metal ribbon (3-4 pieces) were added to 1mL of ethanolic extract, followed by drop wise addition of concentrated hydrochloric acid. Formation of pink or red color indicated the presence of flavonoids [7].

### 2.12. Saponin

Two (2) mL of distilled water was added to extracts suspended in ethanol and was shaken vigorously. The formation of copious foam layer indicated the presence of saponins [7].

### 2.13. Test for Reducing Sugars

Distilled water (10 ml) was added to 1 g of each of the samples in the test tube and the mixture boiled for 5 mins. The mixture was filtered while hot and then cooled. 5 ml of mixture of Fehling's solution was added to 2 ml of the filtrate in a test tube and the resultant mixture boiled for 2 mins. Appearance of brick red precipitate at the bottom of the test tube indicated the presence of reducing sugar.

### 2.14. Food Sample collection

Food sample such as tomato, vegetable and dry fish were collected from Keffi market using disposable black polythene bags and transported immediately to the microbiology laboratory, Nasarawa State University, Keffi for analysis.

### 2.15. Isolation and identification of bacterial species from food items

The food samples were processed according to Obiekezie *et al*. [10]. Ten (10) milligrams of each of the food samples was mixed with 90ml distilled water and homogenized in a stomacher. Serial dilution was carried out to $10^{-5}$ dilution by transferring 1ml of the homogenized sample into another test tube containing 9ml sterile distilled water, 1ml was picked from the first test tube using pipette and transferred to second test tube containing 9ml sterile distilled water. The steps were repeated till $10^{-7}$. aliquot of $x10^{-5}$ diluted 0.5ml sample was inoculated onto already prepared and solidified Nutrient agar for viable count, MacConkey agar, Mannitol salt agar, Eosine, Methylene Blue using spread plate method and incubated for 18 hours at 37 °C.

### 2.16. Identification of bacteria isolates

The bacteria growths were identified using cultural, morphological and biochemical characteristics.

### 2.17. Gram staining examination

The Gram staining technique was carried out as described [11]. A small portion of cultural organism was transferred onto a clean grease-free glass slide, and emulsified in a drop of distilled water until a thin homogeneous film is obtained, then the wire loop was re-sterilized and the thin homogeneous film was allowed to air-dry, and heat-fixed by passing through the flame. The slide was then flooded with crystal violet for 1 minute, and then rinsed with distilled water. The stain was again flooded with Lugol's iodine for 1 minute, and rinsed with distilled water. It was then decolourised,

rapidly with acetone alcohol until no more colour appeared to flow from preparation, then rinsed appropriately with distilled water. The stain was then counter-stained with neutral red for 1 minute, and rinsed with distilled water and allowed to air dry and viewed microscopically using x100 oil immersion objective. Gram positive organism retains the dark blue colour inferred by the iodine/crystal violet complex, while Gram negative organisms appears red; maintaining the colour of the secondary dye.

### 2.18. Biochemical Tests

The following biochemical tests that were carried out on the suspected bacteria isolates include: Catalase test, Indole, Methyl red, Vorges-Proskauer tests, Nitrate reduction, Urease production, Citrate utilisation, and glucose fermentation tests.

### 2.19. Determination of Antibacterial Activity of *Bidens pilosa* and *Brilliantasia patula*, Extracts

Antimicrobial activities of ethanol and ethyl acetate extracts of *Bidens pilosa* and *Brilliantasia patula,* extracts were evaluated using cup-plate agar diffusion assay as earlier described by [12]. Fresh culture 100 $\mu$l (approximately $10^6$ cfu/ml) were spread uniformly on a sterile Mueller-Hinton agar (MHA) plates and allowed to air-dry. The culture was standardized by comparing with 0.5 McFarland turbidity standard after that, 6-mm wells were made in the MHA plates using a sterilized corn borer and the base were sealed with melted Mueller-Hinton agar (MHA). Exactly 100 $\mu$l of 0.78-500 mg/ml concentrations of the extract prepared in 10% (w/v) DMSO corresponding to 50 mg, 25 mg, 12.5 mg, 6.25 mg and 3.125 mg of the extract were dispensed into the wells and the plates were allowed to stand for 1 h at room temperature for pre-diffusion and further incubated at 37$^o$C for 24 h. The diameter of zones of inhibition against the test strains were measured and recorded.

## 3. Results

The results of phytochemical analysis of ethanol and aqueous extracts of leaves and bark of *Bidens pilosa, Brilliantasia patula* are as given in Table 1. Phenols, tannin, phenols and reducing sugar were found to be common to ethanol and aqueous, root and leaves extracts of the two (2) plants except in the in the leaves. Glycosides and anthraquinone were discovered to be absent in the *Brilliantasia patula,* while Flavonoid was only present in both Ethanol and aqueous bark extracts of *Bidens pilosa* plant respectively.

Table 2 shows the cultural, morphological and biochemical characteristics of bacteria isolated from food items sold in Keffi market in Nasarawa State, Nigeria.

**Table 1** Phytochemicals present in leaves and root of *Bidens pilosa and Brilliantasia patula*

| Phytochemicals | Leaves | | Bark | |
|---|---|---|---|---|
| | aqueous | ethanol | ethanol | aqueous |
| Flavonoids | + | + | - | - |
| Phenols | + | + | + | + |
| Alkaloids | + | + | + | - |
| Tannins | + | + | + | + |
| Steroids | + | - | + | + |
| Saponins | + | + | - | + |
| Anthraquinone | - | - | + | + |
| Reducing sugar | + | + | + | + |
| Terpenes | + | - | + | + |
| Glycosides | - | - | - | + |

+ = present; - = absent

**Table 2** Cultural, Morphological and Biochemical Characteristics of bacteria isolated from food items

| Cultural characteristics | | Morphological characteristics | | | Biochemical Characteristics | | | | | | | Suspected organism |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Shape** | **Surface** | **Pigment** | **shape** | **Gram Stain** | **CAT** | **COA** | **IN** | **V.P** | **MR** | **OX** | **CT** | |
| Circular | smooth | Greenish metallic sheen on EMB, Pinkish on MAC | rod | - | + | - | + | | + | - | - | *Escherichia coli* |
| Circular | smooth | Pinkish on MAC, purple on EMB | rod | - | + | - | - | + | - | - | + | *Klebsiella* spp |
| Circular Cluster | smooth | Yellowish on MSA | Cocci | + | + | + | - | | + | - | - | *Staphylococcus aureus* |
| Irregular | rough | greenish on NA, brown on MAC | rod | - | + | - | - | + | - | - | + | *P. aeruginosa* |
| Irregular | rough | Black deposit on SSA | rod | - | + | - | + | + | - | - | + | *Salmonella* spp |

Keys: G.S – Gram staining, CAT - Catalase, COA - Coagulase, IN- Indole, V.P - Voges proskauer, MR - Methyl red, OX - Oxidase, CT - Citrate, NA - Nutrient agar, MAC - MacConkey agar, EMB - Eosine Methylene blue agar, (-) – negative, (+) – positive

The percentage occurrence of bacterial from food items is as given in Table 3. The highest bacteria isolated was from tomato with 60.0 % followed by vegetable which had 40.0 %, dry fish with 20.0 % and the total percentage occurrence was 60.0 %.

**Table 3** Percentage occurrence of bacteria from different sample of food items

| Sample | No sample | No (%) |
|---|---|---|
| Tomato | 5 | 3(60.0) |
| Vegetable | 5 | 2(40.0) |
| Dry fish | 5 | 1(20.0) |
| Total | 15 | 6 (40.0) |

**Table 4** Antibacterial activities of aqueous leave extract of *Bidens pilosa*

| Isolates | Diameter of zone of inhibition (mm)(mean+SD) at various amount of extract | | | | |
|---|---|---|---|---|---|
| | **50.0 mg** | **25.0 mg** | **12.5 mg** | **6.25 mg** | **3.125 mg** |
| *E. coli* | 11.0±0.00 | 9.0±1.03 | 0.00 | 0.00 | 0.00 |
| *Salmonella sp* | 13.00±1.00 | 8.0±1.00 | 0.00 | 0.00 | 0.00 |
| *P. aeruginosa* | 9.00+0.01 | 8.0±2.01 | 0.00 | 0.00 | 0.00 |
| *Klebsiella* | 11.03±.02 | 10.0±1.00 | 0.00 | 0.00 | 0.00 |
| *S . aureous* | 12.00±2.00 | 8.0±1.00 | 0.00 | 0.00 | 0.00 |

The antibacterial activities of the leave extract of *Bidens pilosa* plant against bacteria isolated from some selected food items is as given in Table 4. The aqueous leaves extract inhibited all the test isolates at 50.0 mg and 25.0 mg: were *E. coli* had 11.0± 1.00 mm inhibition zone at 50.0 mg, 9.0±1.03 mm inhibition zone at 25.0 mg and did not show any inhibition at others various amount of extract. *Salmonella* spp were inhibited at 50.0 mg with 13.00±1.00 mm inhibition zone and at 25.0 mg with 8.0±1.00 mm inhibition zone. *P. aeruginosa* was inhibited at 50-25.0 mg with 9.00+0.01 mm and 8.0±2.01 mm inhibition zone; *Klebsiella* spp had 11.03±.02mm at 50.0mg, 10.0±1.00mm inhibition zone at 25.0mg. *Staphylococcus aureus* had 12.00±2.00 mm inhibition zone at 50.0mg and 8.0±1.00 mm inhibition zone at 25.0mg.

The ethanol leaves extract of *Bidens pilosa* did not inhibited *Salmonella* spp, and *P. aeruginosa* were not inhibited at any amount of extract. The extract inhibited *E. coli* with 14.0±0.42 mm at 50.0 mg, 11.00±2.00 mm at 25.0mg and 7.00±0.10 mm at 12.5 mg. *Klebsiella* spp with 13.03±0.32mm at 50.0 mg and 10.0±3.00 mm at 25.0 mg only; *Staphylococcus aureus* was inhibited from 50-25.0 mg only, *Staphylococcus aureus* with 10.00±0 .00 mm at 50.0 mg and 5.00±1.00 mm at 25.0 mg is as given in Table 5 respectively.

**Table 5** Antibacterial activities of ethanol leave of *Bidens pilosa*

| **Isolates** | **Diameter of zone of inhibition (mm)(mean+SD) at various amount of extract** | | | | |
|---|---|---|---|---|---|
| | **50.0 mg** | **25.0 mg** | **12.5 mg** | **6.25 mg** | **3.125 mg** |
| *E. coli* | 14.0±0.42 | 11.00±2.00 | 7.00±0.10 | 0.00 | 0.00 |
| *Salmonella* sp | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *P. aeruginosa* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Klebsiella* | 13.03±0.32 | 10.0±3.00 | 0.00 | 0.00 | 0.00 |
| *S . aureous* | 10.00±0 .00 | 5.00±1.00 | 0.00 | 0.00 | 0.00 |

The antibacterial activities bark extract of *Brilliantasia patula* plant against bacterial isolated from some selected food items is as given in Table 6. The aqueous bark extract inhibited *P. aeruginosa* isolates at any amount of extract from 50-25.0 mg: *E. coli* was inhibited from 50-12.5 mg only; *E. coli* had 13.0±0.21 mm at 50.0 mg, 7.0±1.00 mm at 25.0 mg and 5.00±0.11 mm at 12.5mg, *Salmonella* spp were inhibited only at 50 mg with 8.00+1.00 mm; *Klebsiella* spp with 10.00±1.00 mm at 50.0 mg and 6.00±0.01 mm at 25.0 mg. *S. aureus* was inhibited only at 50.0mg with 9.00±2.00 mm as shown in Table 6.

**Table 6** Antibacterial activities of aqueous bark of extract of *Brilliantasia patula*

| **Isolates** | **Diameter of zone of inhibition (mm)(mean+SD) at various amount of extract** | | | | |
|---|---|---|---|---|---|
| | **50.0mg** | **25.0mg** | **12.5mg** | **6.25mg** | **3.125mg** |
| E. coli | 13.0±0.21 | 7.0±1.00 | 5.00±0.11 | 0.00 | 0.00 |
| Salmonella sp | 8.00+1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| P. aeruginosa | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Klebsiella | 10.00±1.00 | 6.00±0.01 | 0.00 | 0.00 | 0.00 |
| S . aureous | 9.00±2.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**Table 7** Antibacterial activities of ethanol bark extract of *Brilliantasia patula*

| **Isolates** | **Diameter of zone of inhibition (mm)(mean+SD) at various amount of extract** | | | | |
|---|---|---|---|---|---|
| | **50.0mg** | **25.0mg** | **12.5mg** | **6.25mg** | **3.125mg** |
| *E. coli* | 11.0±0.08 | 4.0±0.00 | 0.00 | 0.00 | 0.00 |
| *Salmonella* sp | 7.00±1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *P. aeruginosa* | 5.00±0.42 | 3.00±1.01 | 0.00 | 0.00 | 0.00 |
| *Klebsiella* | 6.00±1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *S . aureous* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

The antibacterial activities bark of extract of *Brilliantasia patula* plant against bacterial isolated from some selected food items is as given in Table 7. The ethanol bark extract did not inhibited *S. aureus* at any amount of the extract. *E. coli and*

*P. aeruginosa* isolates were inhibited at 50-25.0 mg amount of extract; *E. coli* had 11.0±0.08 mm at 50.0mg and 4.0±0.00 mm at 25.0 mg, *P. aeruginosa* was inhibited at 50 mg with 5.00±0.42 mm and 3.00±1.01 mm at 25.0 mg. *Klebsiella* spp with 6.00±1.00 mm at 50.0 mg only.

## 4. Discussion

Many infectious diseases have been known to be treated with herbal remedies throughout the history of mankind. Natural products, either as pure compounds or as standardized plant extracts, provide unlimited opportunities for new drug leads because of the unmatched availability of chemical diversity. There is a continuous and urgent need to discover new antimicrobial compounds with diverse chemical structures and novel mechanisms of action for new and remerging infectious diseases [13]. The search for antimicrobials from natural sources has received much attention and efforts have been put into identifying compounds that can act as suitable antimicrobial agent to replace synthetic ones. Phytochemicals derived from plant products serve as a prototype to develop less toxic and more effective medicines in controlling the growth of microorganisms [14].

Phytochemicals exert antimicrobial activity through different mechanisms, for example, tannins act by iron deprivation, hydrogen bonding or specific interaction with proteins such as enzymes, cell envelopes and complex formation with polysaccharides [15]. Herbs that have tannins as their component are astringent in nature and are used for treating intestinal disorders such as diarrhoea and dysentery, thus exhibiting antimicrobial activity. *Bidens pilosa* and *Brilliantasia patula* extracts inhibited the growth of bacteria thus supports the usefulness of this plant in treating diarrhea and dysentery among Yoruba tribes of Southwestern Nigeria. Saponins are considered a key ingredient in Traditional Chinese Medicine and are responsible for most of the observed biological effects [16]. Saponins are known to produce inhibitory effects on inflammation [17]. Saponins have also been reported to possess antibacterial property with their mode of action attributed to their ability to cause leakage of proteins and certain enzymes from bacterial cells [18]. Cardiac glycoside is an important class of naturally occurring drug whose actions help in the treatment of congestive health failure [19]. This class of phytochemical compound was detected in *Bidens pilosa, Brilliantasia patula* thus supports the usefulness of this plant for the treatment of infections along with other ailments such as dental caries and cough among the Yoruba tribe of southwestern Nigeria. Steroid compounds also present in *Bidens pilosa,* and *Brilliantasia patula,* extract are of importance and interest due to their relationship with such compounds as the sex hormones [19]. Some kinds of steroids have been reported to have immune-enhancing benefits [20].

The antibacterial activity of crude ethanol and aqueous extracts of leave and root of *Bidens pilosa* and *Brilliantasia patula* against bacteria isolates from some selected food items observed in this study was as expected and this finding is in agreement with the study earlier described by Oyero *et al.* (2021); Olasehinde, *et al*., (2018). The antibacterial activity of crude of *Bidens pilosa, Brilliantasia patula* against bacteria species isolated from some selected food items observed in this study was higher than the study earlier described by Ayepola and Ajayi, (2018), Kubmarawa, *et al*., (2007); Siti *et al.*, (2018). Also, the crude aqueous and ethanol extracts of leaves of *Bidens pilosa* observed in this study had more activity against Gram positive than the Gram negative bacteria and this finding seems to agree with study earlier described by Mushore *and* Matuvhunye, (2018), that the crude organic solvent acetate extract *Brilliantasia patula* had more activity against Gram negative bacteria than the Gram positive bacteria. The high activity of the extracts against Gram negative than the Gram positive bacteria may be due to the complexity of the cell wall. Our finding in this study also shows that, extract of the plant may be useful traditionally for treatment of foodborne infections caused by *E. coli*, *Klebsiella* spp, *Salmonella* spp and *P. aeruginosa*. In addition, the antibacterial activity of the extracts against the bacteria isolated from some selected food items observed in this study justified the fact that natural products from plant source may be useful as antimicrobial which can as well be used as food preservatives in food industries.

## 5. Conclusion

The Ethanol and aqueous leaves extracts of *Bidens pilosa* had more antibacterial activity against bacteria isolated from some selected food items than the Ethanol and aqueous extracts of and *Brilliantasia patula*. The common phytochemical in all the extracts such as tannins, phenols and reducing sugar indicates the possibility that they were responsible for the observed antibacterial activity and can be used for preservation of food. This research has confirmed and justified the use of the plants as herbal preparations amongst the people especially those in the rural communities in south-west Nigeria where the practice become prevalent owing to easy accessibility to the plants and relatively low cost of the herbal preparation treatment of Diarrhoea caused by foodborne infection.

## Compliance with ethical standards

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*Disclosure of conflict of interest*

No conflict of interest among the authors.

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