# Antibacterial Effects of Lalley Leaves (*Lawsomia inermis*) against Isolates from Vaginal Infections

**Enwa Felix Oghenemaro[1]*, Osuya Innocent Oyemaechi[2], Ladu Exalt Erhomosele[1], Michael Oghenejobo[1]**

*[1]Department of Pharmaceutical Microbiology and Biotechnology, Delta State University, Abraka, Nigeria.*
*[2]Department of Animal and Environmental Biology, Delta State University, Abraka, Nigeria.*

## ABSTRACT

This investigation looked at the effects of *Lawsonia inermis* (*L. inermis*) extracts on vaginal isolates in terms of their antibacterial activity. Cold maceration was used to extract *L. inermis* leaf powder, and the resultant ethanol, aqueous, and chloroform fractions were separated. To produce residues that could be kept at 4 °C, the resulting extracts were dried in an oven and then concentrated to a dry state. Saponin, tannin, alkaloids, terpenoids, and steroids were found in the residues after a phytochemical screening. Following accepted microbiological procedures, filthy HVS samples were randomly obtained from students, staff members, and inhabitants of hostels. They were then cultured. The samples showed the presence of *Proteus* spp., *E. coli*, *Pseudomonas* spp., *Klebsiella* spp., and *Staph* spp. The antibacterial activity that was concentration-dependent and varied with the organisms found was assessed using the agar diffusion technique on a broth culture, and it produced a result of 9.46%. For Proteus species and *Staphylococcus* species, the MIC of the crude extract and aqueous extract was 50 mg/ml, whereas it was 25 mg/ml for *Klebsiella* and *Pseudomonas*. For all of the isolated species, the aqueous extract showed a high MIC of 100 mg/ml. The chloroform extract (12.5 mg/ml) was shown to have the optimum minimal inhibitory concentration profile for *Proteus* species (8.0 ± 1 mm), *Staphylococcus* species (12.0 mm), *Klebsiella* species (8.5 ± 1.5 mm), and *E. coli* species (7.5 ± 1.5 mm), as well as 6.25 mg/ml for *Pseudomonas* species (6.0 mm). This study demonstrated that the leaves of *Lawsomia inermis* contain phytoconstituents that might cause an antibacterial response.

**Key Words:** *Lawsomia inermis, Antimicrobial, Inhibition zone diameter, Phytoconstituents, MIC*

**eIJPPR 2023; 13(4):40-47**

**HOW TO CITE THIS ARTICLE:** Oghenemaro EF, Oyemaechi OI, Erhomosele LE, Oghenejobo M. Antibacterial Effects of Lalley Leaves (*Lawsomia inermis*) against Isolates from Vaginal Infections. Int J Pharm Phytopharmacol Res. 2023;13(4):40-7. https://doi.org/10.51847/bvx5enhTZy

## INTRODUCTION

For ages, man has relied on nature to provide for his fundamental necessities, including food, clothes, shelter, and medicine [1, 2]. Many people consider plants to be a natural remedy for treating and preventing a variety of ailments [3, 4]. Plants have been employed in traditional herbal medicine for a long time [5, 6] because they are now recognized as natural sources of powerful and novel antibacterial agents [7, 8]. Because of the wide variety of medicines that are easily available, these plants are sources of natural compounds that are utilized as ethnomedicine in several nations across the world [9] and provide limitless prospects for developing novel pharmaceuticals [10, 11].

Traditional medicine is thought to be used by 80% of people in underdeveloped nations for their primary healthcare, and it is becoming more and more popular as a result of the high toxicity and negative side effects of orthodox medication [10, 12]. Herbal medicine has long been characterized as a course of care that entails a coordinated pharmacological intervention of several distinct substances interacting with numerous targets, as opposed to a single medicament engaging with a single target [13, 14]. Natural active compounds found in plants may be utilized to cure ailments and improve health, which is the basis for herbal treatments. Utilizing plants and plant extracts to treat a variety of illnesses [15].

**Corresponding author:** Enwa Felix Oghenemaro
**Address**: Department of Pharmaceutical Microbiology and Biotechnology, Delta State University, Abraka, Nigeria.
**E-mail:** ✉ felixenwa@delsu.edu.ng
**Received:** 23 May 2023; **Revised:** 01 August 2023; **Accepted:** 08 August 2023

This is an **open access** journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Henna, mehndi, and mignonette trees are all common names for the tall shrub plant *Lawsonia inermis* (*L. inermis*), which is a member of the Kingdom: Plantae, Division: Angiospermae, Class: Dicotyledoneae, Order: Myrtales, Family: Lythraceae, Genus: *Lawsonia*, and Species: *L. inermis*. A blooming plant with a height of 2–7 meters, henna is found in subtropical and tropical climates throughout the world, including South Asia, Africa, Oasis in the Sahara Desert, and even northern Australia. The elliptic, obovate to oblanceolate, acute at the apex, sometimes mucronulate, constricted into a short petiole, pinnately nerved, and submembranous leaves of henna plants [16] have these characteristics. Lawsone (2-hydroxynaphthoquinone), mucilage, mannitol, gallic acid, and tannic acid make up the majority of henna's chemical components [17]. According to reports, henna has antibacterial [18], immunostimulant [17], and hypoglycemic effects. The goal of the current study is to ascertain if *L. inermis* leaves have any antibacterial properties against isolates of vaginal infections.

## MATERIALS AND METHODS

*Reagents and equipment*

Ethanol (99.9%) (Loba Chemie PVT Ltd, Mumbai, India), *L. inermis* leaves, Petri dishes, test tubes, swap stick, cork-borer, spatula, precision balance, agar medium (Loba Chemie PVT Ltd, Mumbai, India), autoclave, flame, incubator, rotary evaporator, wire loop, meter rule, and agar broth. The different chemicals and tools needed for this project were acquired from the laboratories of the Pharmaceutical Microbiology Department of the Faculty of Pharmacy at Delta State University, Abraka (DELSU).

*Extraction of L. inermis leaves*

The pulverized leaves of *L. inermis* were collected from a local outlet in Kaduna, Nigeria. The leaves were then divided into ethanol, aqueous, and chloroform fractions after being extracted using cold maceration. The fractions obtained were filtered and concentrated in an oven to 101.2 g dryness, and the residues recovered were refrigerated at 4 °C [19].

*Phytochemical screening*

*L. inermis* leaf extract was prepared for phytochemical analysis using the techniques described by Enwa *et al*. (2016) and Okafor *et al*. (2021), with a little modification.

*Fractionation of L. inermis extract*

About 45.04 g of the extract was weighed and transferred into a separating funnel. The aqueous phase was prepared with 100 ml of methanol and 75 ml of distilled water. About 200 ml of chloroform was measured and transferred into the separating funnel which was shaken vigorously for 5 minutes. The upper layer was decanted and a bottom layer containing the chloroform fraction was carefully transferred into a beaker. This process was repeated four times and the fractions were allowed to concentrate at room temperature for 72 hrs. Furthermore, the fractions were packaged and stored in separate beakers for further microbiological studies.

*Identification of bacteria isolate*

Biochemical tests such as indole, catalase test, citrate utilization test, H2S test, urease, oxidase, MOT, coagulase, and gram staining were carried out. Glucose, lactose, and sucrose tests were carried out to determine the presence of these sugars [20].

*Preparation of broth culture*

15 g of the nutritional broth powder was dissolved in 1 L of distilled water to create the nutritional broth. After thoroughly blending the solution for 5 minutes to achieve total dissolution, the mixture was placed into test tubes. The solution was then autoclaved for 15 minutes at 121 °C. A sterile wire loop was used to inoculate the preparation with the microorganisms, and it was then left for 24 hours.

*Evaluation of antimicrobial activity*

Molten Mueller Hilton Agar (MHA) was allowed to solidify. 15 test tubes were sterilized and labeled crude (CR 100-6.25 mg/ml), Aqueous (Aq 100-6.25 mg/ml), and Chloroform (Chl 100-6.25 mg/ml). Thereafter 0.4 g of the extracts were dissolved in non-concentrated ethanol. Two-fold serial dilution was carried out for the crude, aqueous, and chloroform extracts inside the test tubes from a range of 100, 50, 25, 12.5, 6.25, and 3.125 mg/ml. The broth was streaked on the plates and a cork borer 6 mm diameter was used to punch the sides of the plate which was labeled according to the various concentrations used. The holes were sealed with molten agar to close up cracks. The various concentrations of the extract and the control (ciprofloxacin) were introduced into the holes and the plates were incubated for 24 hours. The zone of inhibition was read in duplicate and the average was taken.

*Evaluation of the minimum inhibitory concentration (MIC)*

Determination of MIC was done using the method described by Enwa *et al*. (2023) with minimal adjustment.

*Data analysis*

To describe the data, graphs, frequency tables, means, and standard deviations were used. The data were examined using SPSS (the statistical package for the social sciences) version 22. With a P-value of 0.05, an

independent t-test was used for inferential statistics.

## RESULTS AND DISCUSSION

*Yield*

The initial weight of the powdered leaves collected was 1100 g. The weight obtained after concentrating was 104.04 g. The yield was calculated using the formula below:

Yield = Weight of concentrated extract/Initial weight collected × 100%

$$\text{Yield} = 104.04\text{ g} / 1100\text{ g} = 0.09458 \times 100\ \% \quad (1)$$

Yield = 9.46 %

*Phytochemical screening*

The results of the phytochemical screening revealed that saponins, tannins, alkaloids, terpenoids, and steroids were present while flavonoids and reducing sugars were absent **(Table 1)**.

**Table 1.** Phytochemical screening

| Phytochemicals | Inference |
|---|---|
| Saponin | + |
| Tannin | + |
| Alkaloid | + |
| Terpenoids | + |
| Steroids | + |
| Flavonoids | - |
| Reducing sugars | - |

+ means Present
- means Absent

*Identification of bacteria isolates*

The bacteria isolate was identified using various biochemical tests. The result is presented in **Table 2**. *Klebsiellas* pp., *Proteus* spp., *Staphylococcus* spp., and *E. coli* were mostly encountered.

**Table 2.** Bacteria isolate identified

| S/N | CODE | Catalase | Indole | $H_2S$ | Citrate | Urease | Oxidase | M.R | MOT | Coagulase | Gram Stain | Glucose | Lactose | Sucrose | Inference |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FSC | + | - | - | + | + | - | - | - | - | -Rods | A | AG | AG | *Kleb* spp. |
| | FC6 | + | - | - | + | + | - | - | - | + | +cocci | A | A | AG | *Staph* spp. |
| | F7C | + | + | + | + | + | - | + | + | - | -Rods | A | A | A | *Proteus* spp. |
| | RS | + | + | + | + | + | - | + | + | - | -Rods | AG | A | AG | *Proteus* spp. |
| | $FW_1$ | + | + | - | + | + | - | - | - | - | -Rods | AG | AG | AG | *Kleb* spp. |
| | $FW_2$ | + | + | + | + | + | - | + | + | - | -Rods | A | AG | A | *Proteus* spp. |
| | $FW_3$ | + | - | + | + | + | - | + | + | - | -Rods | AG | AG | A | *Proteus* spp. |
| | $FW_4$ | + | + | - | + | + | - | + | - | - | -Rods | AG | AG | AG | *Kleb* spp. |
| | $FW_5$ | + | + | - | - | - | - | + | + | - | -Rods | AG | A | A | *E. coli* |
| | $FW_6$ | + | - | - | + | + | - | - | - | - | -Rods | A | AG | A | *Kleb* spp. |
| | $FW_7$ | + | + | - | + | + | - | - | - | - | -Rods | AG | AG | A | *Kleb* spp. |
| | $FW_8$ | + | + | - | + | + | - | - | - | - | -Long rods | AG | A | AG | *Kleb* spp. |
| | $FH_2$ | + | - | - | + | + | + | + | + | - | -Rods | AG | - | - | *Pseudomonas* spp. |
| | $FH_{20}$ | + | + | - | + | + | - | - | - | - | -Rods | A | AG | A | *Kleb* spp. |
| | $FH_3$ | + | + | + | + | + | - | + | + | - | -Rods | AG | AG | AG | *Proteus* spp. |
| | $FH_5$ | + | + | - | + | + | - | - | - | - | -Rods | A | AG | A | *Kleb* spp. |
| | $FH_7$ | + | + | - | - | - | - | + | + | - | -Rods | AG | A | A | *E. coli* |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $FH_9$ | + | + | - | + | + | - | - | - | - | -Rods | AG | A | AG | *Kleb* spp. |
| $FH_{10}$ | + | + | - | + | + | - | - | - | - | -Rods | AG | AG | AG | *Kleb* spp. |
| $FH_{11}$ | + | + | - | + | + | - | - | - | - | -Rods | AG | AG | AG | *Kleb* spp. |
| $FH_{12}$ | + | + | - | + | + | - | - | - | - | -Rods | | | | *Kleb* spp. |
| $FH_{13}$ | + | + | - | + | + | - | - | - | - | -Rods | A | AG | AG | *Kleb* spp. |
| $FH_{14}$ | + | + | - | + | + | - | - | - | - | -Rods | AG | A | AG | *Kleb* spp. |
| $FH_{15}$ | + | + | + | + | + | - | + | + | - | -Rods | AG | AG | AG | *Proteus* spp. |
| $FH_{17}$ | + | + | + | + | + | - | + | + | - | -Rods | AG | A | AG | *Proteus* spp. |
| $FH_{18}$ | + | + | + | + | + | - | + | + | - | -Rods | AG | A | AG | *Proteus* spp. |
| $FH_{21}$ | + | - | - | + | + | + | + | + | - | -Rods | AG | | | *Pseudomonas* spp. |
| $FH_{22}$ | + | + | - | - | - | - | + | + | - | -Rods | AG | A | A | *E. coli* |

KEY:C: Coursemates; H: Hosteller; W: University workers

*Inhibition zone diameter of the extracts*

**Table 3** displays the diameter of the inhibition zone for each extract. The width of the inhibitory zone varies depending on the microorganism detected **(Table 3)**.

**Table 3.** Inhibition zone diameter of the extracts

| S/N | CODE | Concentration (mg/ml) / Inhibition Zone Diameter (IZD in mm) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 100 | | | 50 | | | 25 | | | 12.5 | | | 6.25 | | | Control | | |
| | | 1 | 2 | AV | 1 | 2 | AV | 1 | 2 | AV | 1 | 2 | AV | 1 | 2 | AV | 1 | 2 | AV |
| | F7C-Crude (mm) | 16 | 16 | 16 | 14 | 13 | 13.5 | 12 | 12 | 12 | 10 | 12 | 11 | 5 | 6 | 5.5 | 26 | 25 | 25.5 |
| | F7C-Chloroform (mm) | 16 | 18 | 17 | 13 | 12 | 12.5 | 11 | 9 | 10 | 7 | 9 | 8 | 6 | 7 | 6.5 | 29 | 27 | 28 |
| | F7C-Aqueous (mm) | 16 | 14 | 15 | 10 | 9 | 9.5 | - | 4 | 2 | - | 4 | 2 | - | 2 | 1 | 26 | 27 | 26.5 |
| | FC6-Crude (mm) | 19 | 18 | 18.5 | 15 | 15 | 15 | 11 | 10 | 10.5 | 9 | 8 | 8.5 | 6 | 6 | 6 | 15 | 15 | 15 |
| | FC6-Cloroform (mm) | 15 | 14 | 14.5 | 12 | 12 | 12 | 12 | 10 | 11 | 11 | 10 | 10.5 | 7 | 6 | 6.5 | 15 | 18 | 16.5 |
| | FC6-Aqueous (mm) | 12 | 14 | 13 | 9 | 9 | 9 | 6 | 7 | 6.5 | - | 5 | 2.5 | - | - | - | 21 | 24 | 22.5 |
| | FSC-Crude (mm) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 29 | 27 | 28 |
| | FSC-Chloroform (mm) | 7 | 10 | 8.5 | 6 | 8 | 7 | 4 | 6 | 5 | | 4 | .5 | - | - | - | 30 | 28 | 29 |
| | FSC-Aqueous (mm) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 31 | 31 | 31 |
| | $FW_1$-Crude (mm) | 14 | 15 | 14.5 | 12 | 12 | 12 | 10 | 11 | 10.5 | 7 | 8 | 7.5 | 4 | 6 | 5 | 26 | 27 | 26.5 |
| | FW1-Chloroform (mm) | 11 | 14 | 12.5 | 10 | 10 | 10 | 11 | 10 | 10.5 | 9 | 12 | 10.5 | 7 | 7 | 7 | 29 | 29 | 29 |
| | FW1-Aqueous (mm) | 11 | 11 | 11 | 8 | 8 | 8 | 5 | 4 | 4.5 | - | 4 | 2 | - | -;8 | - | 24 | 26 | 25 |
| | $FH_2$-Crude (mm) | 14 | 14.5 | 14.3 | 15 | 14 | 14.5 | 10 | 9 | 9.5 | 7 | 7 | 7 | 4 | 4 | 4 | 28 | 29 | 28.5 |
| | $FH_2$-Chloroform (mm) | 13 | 12 | 12.5 | 11 | 11 | 11 | 9 | 10 | 9.5 | 9 | 9 | 9 | 6 | 6 | 6 | 27 | 26 | 26.5 |
| | $FH_2$-Aqueous (mm) | 11 | 12 | 11.5 | 6 | 6 | 6 | 6 | 5 | 5.5 | - | 4 | 2 | - | 3 | 1.5 | 26 | 24 | 25 |
| | $FW_5$-Crude (mm) | 15 | 16 | 15.5 | 12 | 12 | 12 | 10 | 11 | 10.5 | 9 | 6 | 7.5 | 6 | 6 | 6 | 27 | 27 | 27 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $FW_5$-Chloroform (mm) | 15 | 13 | 14 | 11 | 12 | 11.5 | 11.5 | 11 | 11. | 8 | 12 | 10 | 6 | 6 | 6 | 25 | 27 | 26 |
| $FW_5$-Aqueous (mm) | 11 | 12 | 11.5 | 7 | 9 | 8 | 5 | 5 | 5 | 3 | 3 | 3 | 2 | - | 1 | 24 | 26 | 25 |

Control: Ciprofloxacin 2 mg/ml

F7C: Proteus spp; FC6: Staphylococcus spp; FSC: Klebsiella spp, $FW_1$: Klebsiella spp, $FH_2$: Pseudomonas spp, $FW_5$: Escherichia coli; AV: Average

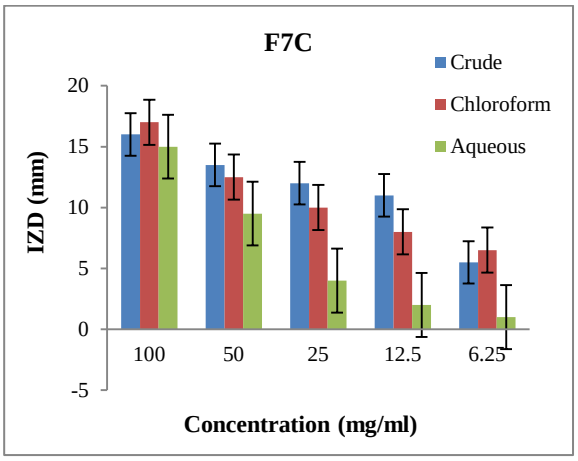


**Figure 1.** Graphical representation of the zone of inhibition of all extract on isolate F7C

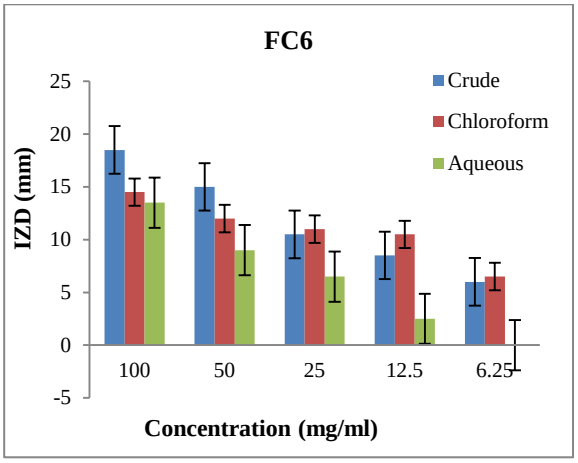


**Figure 2.** Graphical representation of the zone of inhibition of all extract on isolate FC6

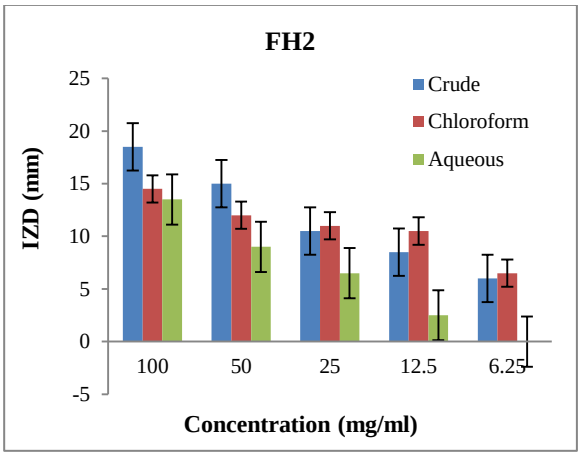


**Figure 3.** Graphical representation of the zone of inhibition of all extract on isolate FH2

**Figures 1-3** show the inhibition zone diameter of the extracts.

*MIC of L. inermis extract*

The MIC of the extracts is shown in **Table 4**. The chloroform extract produced the best minimal inhibitory concentration profile (12.5 mg/ml for *Proteus* species, *Staphylococcus* species, *Klebsiella* species, and *E. coli*, and 6.25 mg/ml for *Pseudomonas* species) **(Table 4)**.

**Table 4.** MIC of the extracts

| Code | Sample | Organism | MIC (mg/ml) |
|---|---|---|---|
| F7C | Crude | *Proteus* | 50 |
| | Chloroform | | 12.5 |
| | Aqueous | | 100 |
| FC6 | Crude | *Staphylococcus* | 50 |
| | Chloroform | | 12.5 |
| | Aqueous | | 100 |
| FSC | Crude | *Klebsiella* spp. | - |
| | Chloroform | | 12.5 |
| | Aqueous | | - |
| $FW_1$ | Crude | *Klebsiella* spp. | 25 |
| | Chloroform | | 12.5 |
| | Aqueous | | 100 |
| $FH_2$ | Crude | *Pseudomonas* spp. | 25 |
| | Chloroform | | 6.25 |
| | Aqueous | | 100 |
| $FW_5$ | Crude | *E. coli* | 25 |
| | Chloroform | | 12.5 |
| | Aqueous | | 100 |

The secondary metabolites are mostly blamed for plants' antibacterial activities [21]. Steroids, tannins, and phenolic chemicals may be the active components of these secondary metabolites [22]. It was discovered that the sample contains saponins, tannins, terpenoids, flavonoids, alkaloids, steroids, and flavonoids, but reducing sugars were not present after a phytochemical examination was conducted to detect these metabolites present in various plant samples. This is in tandem with the previous work of Khawia and Wahiba [23] who identified terpenoids, phenols, and tannins in their samples. However, it was shown that the presence of

these metabolites strongly depends on the extraction of the solvent. Cardio glycosides, terpenoids, polysaccharides, phenols, quinones, and tannins were present in the *L. inermis* methanol, acetone, and aqueous extracts but not in the chloroform extract [23]. This is because metabolites are soluble in solvents based on their polarity. Starch, tannins, saponins, polypeptides, terpenoids, lectins, and other ions make up the majority of plant materials' water-soluble components, whereas flavonoids, alkaloids, tannins, sterols, polyphenols, and other substances are present in alcoholic extracts [24, 25]. Lawsone (2-hydroxynaphthoquinone), mucilage, mannitol, gallic acid, and tannic acid are the principal chemical components of henna [26]. The findings showed that every extract has antibacterial activity against every bacterial strain found in the current investigation. Only one gram-positive bacterium strain (*Staphylococcus* spp.) was identified from the three populations of coursemates, hostel guests, and university employees. This supports previous findings that identified *Staphylococcus* species from clinical isolates [27], but most of the organisms in their study were gram-negative bacteria. The reason for this trend has been attributed to the protective mechanisms and prevalence of gram-negative organism infection across populations, especially in extreme conditions and tropical regions [23]. Similarly, a study conducted on the antimicrobial evaluation of propolis ointment posited that the activity of a plant depends on the constituents present, the time of collection, the polarity of the extraction solvent as well as period of exposure to such solvent [28]. Furthermore, the phytochemical components of *L. inermis* are exclusively efficient against gram-positive bacteria and inactive against gram-negative bacteria [29]. In each instance, the chloroform extract outperformed the aqueous extract in terms of antibacterial inhibition. Additionally, it is important to highlight that *L. inermis* demonstrated antibiotic action against gram-positive (*S. aureus*) and gram-negative (*E. coli*, *Proteus* spp., *Klebsiella* spp., and *Pseudomonas* spp.) bacteria, which is consistent with Habbal's findings [30].

The inhibition zone diameter was concentration-dependent, hence higher concentrations of the crude, aqueous, and chloroform extract had higher inhibition zone diameter. Several studies have established that the inhibition zone diameter of plant extracts was concentration-dependent. **Figure 1** displays the MIC values for each bacterial strain that was put to the test. **Figure 1** findings demonstrated that every tested bacterial isolate displayed the smallest MIC for the crude, chloroform, and aqueous extracts. The chloroform extract had the lowest MIC (6.25 mg/ml) for all organisms isolated. This is consistent with prior research by Iram [27], who found that *L. inermis* chloroform extract was a more effective antibacterial agent against *Shigella* spp., *Klebsiella* spp., *S. aureus*, and *S. epidermidis*. This explains why the aqueous extract was the least effective and the chloroform extract was more powerful. The polarity of the extraction solvent was the cause of the extract's variable antibacterial activity. **Figures 2 and 3** also indicated the efficacy of the extract on both isolates FC6 and FH2 with the crude extract being very active as compared to the chloroform and aqueous.

## CONCLUSION

There is no question about *L. inermis* antibacterial abilities, but a toxicological evaluation is also essential. Public health issues caused by multi-resistance bacteria always prompt researchers to turn to the natural resources of the plant kingdom, a crucial source for the creation of novel treatments. The herb *L. inermis*, known for its numerous medicinal benefits, was the subject of the current study. Its potential for application as an antibiotic is shown by the phytochemical analysis and the evaluation of the antibacterial activity of its crude, aqueous, and chloroform extracts. The utilization of *L. inermis* extracts as a therapeutic alternative to antibacterial agents is extremely important as researched by this study in addressing issues related to virginal infections. Furthermore, efforts should be made towards isolating, characterizing, and identifying new active compounds from *L. inermis*, that could lead to the discovery of more efficacious compounds with therapeutic action. It is also pertinent to consider the toxicity profiles and potential side effects of *L. inermis*, extracts to also determine their safe use. Finally, this research study showed that *L. inermis* Leaves has a phytochemical constituent that can elicit antimicrobial activity against isolates from vaginal infections.

**Acknowledgments:** Faculty of Pharmacy, Delta State University.

**Conflict of interest:** None

**Financial support:** None

**Ethics statement:** Ethical approver was obtained from the ethical committee of the Faculty of Pharmacy, Delsu with Ref No. PHC/05/2002/2

## REFERENCES

[1] Lalthanpuii K, Kaur J, Saini S, Bhatti K, Nain P. Strengthen the monitoring and reporting of adverse drug reaction at a tertiary teaching hospital. Arch Pharm Pract. 2022;13(1):61-7.

[2] Shahid I, Khan KM, Khan TM, *i*mran MS, Shahid N, Alnafoosi FN, et al. Clinical efficacy of LivPro ® herbal medicine among hepatitis C patients Pakistan: longitudinal interventional study. Arch Pharm Pract. 2021;12(4):54-7.

[3] Das N, Kalita PP, Sarma MP, Bhattacharjee M. Molecular modeling of HEV core protein and active compounds from northeast folk medicine. J Biochem Technol. 2021;12(2):12-8.

[4] Chit SJ, Jonathan SH, Hani EN. Herbal medicine: toxicity and recent trends in assessing their potential toxic effects. Adv Bot Res. 2016;79(8):365-84.

[5] Ushimaru PI, Mariama TN, Luiz C, Di Luciano B, Ary FJ. Antibacterial activity of medicinal plant extract. Braz J Microbiol. 2007;38:717-9.

[6] Ebrahimi S, Shohrati M, Najafian B. Drug use evaluation of intravenous immunoglobulin (IVIG) in a hospital in Iran. Entomol Appl Sci Lett. 2021;8(2):57-61.

[7] Taher SS, Al-Kinani KK, Hammoudi ZM, Ghareeb MM. Co-surfactant effect of polyethylene glycol 400 on microemulsion using BCS class II model drug. J Adv Pharm Educ Res. 2022;12(1):63-9.

[8] Blanks T, Brown S, Cosgrave B, Woody J, Bentley V, O'Sullivan N. The body shop book of wellbeing mind, body, and soul. London: Ebury Press; 1998. p. 173-92.

[9] Srivastava J, Lambert J, Vietmeyer N. Medicinal plants: an expanding role in development. World Bank Publications; 1996.

[10] Cos PJ, Arnold V, Dirk VB, Louis M. Anti-infective potential of natural products: How to develop a stronger in vitro proof-of-concept. J. Ethnopharmacol. 2006;106(3):290-2.

[11] Nakagawa N, Odanaka K, Ohara H, Kisara S. Evaluation of drug information literacy gained through e-learning to prepare students for practical pharmacy experience. J Adv Pharm Educ Res. 2021;11(4):111-5.

[12] AlMogbel MS. First report of escherichia coli sequence type 1193 a multidrug-resistant clone isolated in Ha'il, Saudi Arabia. Int J Pharm Res Allied Sci. 2022;11(2):24-8.

[13] Noor SKM, Bushara MOE, Taha ZI, Salah M, Anwar T, Osman AA, et al. Prevalence of multidrug resistance mycobacterium tuberculosis (MDR-TB) using genexpert; how serious is the situation? Int J Pharm Res Allied Sci. 2021;10(2):116-21.

[14] Sharma RK, Goel A. Identification of phytoconstituents in *Lawsonia inermis* Linn. leaves extract by GC-MS and their antibacterial potential. Pharmacogn J. 2018;10(6):1101-8.

[15] Zhang F, Zhai J, Weng N, Gao J, Yin J, Chen W. A comprehensive review of the main lignan components of *Schisandra chinensis* (North Wu Wei Zi) and *Schisandra sphenanthera* (South Wu Wei Zi) and the lignan-induced drug-drug interactions based on the inhibition of cytochrome P450 and P-glycoprotein activities. Front Pharmacol. 2022;13:816036. doi:10.3389/fphar.2022.816036

[16] Sarkar N, Farheen S, Chakraborty M, Mukherjee S, Haldar PK. Exploration of phytochemical and in-vitro antioxidant and antidiabetic properties of *Aerva sanguinolenta* (L.) Blume. Res J Pharm Technol. 2022;15(11):5267-72. doi:10.52711/0974-360X.2022.00887

[17] Al-Snafi AE. Chemical constituents and pharmacological effects of *Lepidium sativum*. Int J Curr Pharm Res. 2019;11(6):1-10. Available from: https://journals.innovareacademics.in/index.php/ijcpr/article/view/36338.

[18] Al-Rubiay KK, Jaber NN, Al-Mhaawe BH, Alrubaiy LK. Antimicrobial efficiency of Henna extract. Oman Med J. 2008;8(23):253-56.

[19] Syamsudin I, Winarno H. The effect of Inai (*Lawsonia inermis*) leaves extract on blood sugar level: an experimental study. Res J Pharmacol. 2008;2:20-3.

[20] Mikhail BR, Badria FA, Maatooq GT, Amer MMA. Antioxidant and immunomodulatory constituents of henna leaves. Z Naturforsch Sec C J Biosci. 2004;59(7-8):468-76.

[21] Al-Saimary I. Antistaphylococcal activity of henna extracts *Lawsonia inermis* L (Lythraceae). J Microb. 2015;1(2):8-11.

[22] Al-Edany AA, Khudaier BY, Jaber NN. Antibacterial activity of *Lawsonia inermis* L. leaves extracts on Staphylococcus aureus isolates. Basrah J Vet Res. 2013;12(2):256-66.

[23] Franco-Duarte R, Černáková L, Kadam S, S. Kaushik K, Salehi B, Bevilacqua A, et al. Advances in chemical and biological methods to identify microorganisms—from past to present. Microorganisms. 2019;7(5):130. doi:10.3390/microorganisms7050130

[24] Romero CD, Chopin SF, Buck G, Martinez E, Garcia M, Bixby L. Antibacterial properties of common herbal remedies of the southwest. J Ethnopharmacol. 2005;99(2):253-7.

[25] Gonzalez-Lamothe R, Mitchell G, Gattuso M, Moussa S, Malouin DF, Bouarab K. Plant antimicrobial agents and their effects on plant and human pathogens. Int J Mol Sci. 2009;10(8):3400-19.

[26] Al-Snafi AE. A review on *Lawsonia inermis*: a potential medicinal plant. Int J Curr Pharm Res. 2019;11(5):1-13. doi:10.22159/ijcpr.2019v11i5.35695

[27] Khawla ZH, Wahiba B. Antimicrobial activity of *Lawsonia inermis* leaf extract collected from south of algeria touat (Adrar) and Tidikelt (In Salah). J Plant Sci. 2020;15:9-16.

[28] Iram G, Maria S, Muhammad SA, Muhammad AA. Phytochemical, toxicological, and antimicrobial evaluation of *Lawsonia inermis* extracts against clinical isolates of pathogenic bacteria. Ann Clin Microbiol Antimicrob. 2013;12(1):36-42.

[29] Tafese BT, Colin RM, Hans MO, Tobias W, Tamara N, Sileshi A, et al. Prevalence and characterization of antimicrobial resistance among gram-negative bacteria isolated from febrile hospitalized patients in central Ethiopia. Antimicrob Resist Infect Control. 2022;11(1):8. doi:10.1186/s13756-022-01053-7

[30] Arhewoh MI, Agbamu E, Agare GI, Enwa FO, Aduba P, Atamenwan OJ. Evaluation of the antimicrobial activity of propolis ointment. Nig J Pharm Res. 2022;18(1):16-21.