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Comparative assessment of *Solanum melongena* (Eggplant) against multi-drug-resistant *Staphylococcus aureus* and *Pseudomonas aeruginosa*

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Abstract: *Solanum melongena* (Eggplant) is a medicinal plant belonging to the family *Solanaceae*. This study aimed to perform a comparative assessment of the methanol extracts of the fruit and the leaf of *Solanum melongena* against multi-drug-resistant *Staphylococcus aureus* and *Pseudomonas aeruginosa.* The crude extracts were obtained from the leaves and fruits of the plant using methanol. The plant extracts were tested for the presence of various phytochemical constituents qualitatively. The antibacterial assay and minimum inhibitory concentration for the crude extracts were carried out using the agar well diffusion and agar dilution methods, respectively. Phytochemical analysis of methanol extracts of *Solanum melongena* revealed the presence of various phytoconstituents. Antibacterial assay of methanol extracts of *Staphylococcus melongena* against multi-drug-resistant *Staphylococcus aureus* isolates with ciprofloxacin as a reference control revealed inhibition zone diameter ranging from 04.0±0.0 to 11.0±0.0 mm; in contrast that of multi-drug-resistant *Pseudomonas aeruginosa* isolates revealed inhibition zone diameter, with ciprofloxacin showing no inhibition. The minimum inhibitory concentration of the methanol extracts on *Pseudomonas aeruginosa* isolates ranges from 25.0 to 50.0 mg/ml and 25.0->50.0 mg/ml, respectively, in comparison, the minimum inhibitory concentration of the methanol extracts on *Staphylococcus aureus* isolates ranges from 6.25 to 50.0 mg/ml and 6.25->50.0 mg/ml respectively. Thus, the fruit extract had better activity against test multi-drug-resistant *Pseudomonas aeruginosa* and *Staphylococcus aureus* than the leaf extract of *Solanum melongena*.

Introduction

Resistant bacteria are expeditiously emerging and that endangers the remarkable health satisfactions that have been attained with antibiotics [1]. This emergence causes a considerable health and economic burden on the world healthcare system. The population requires urgent attention [2], which may be achieved by seeking natural alternatives. *Solanum melongena*, commonly known as Eggplant is a delicate, tropical perennial plant often cultivated in temperate climates. Eggplant belongs to the family: Solanaceae, order: *Solanales*, genus: *Solanum*, and species: *melongena* [3]. *Solanum melongena* possesses certain biological activities such as

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spasmogenic activity, lowering of intraocular pressure, antiplatelet and calcium blocking activities, hypo-lipidemic action, cardiac activity, antipyretic activity, antidiabetic activity, and is useful in some lung problems [4], ulcers of nose, cholera, bronchitis, and asthma [5]. The presence of a wide variety of siloxanes which retards the growth of wound-infecting organisms makes it possible for the leaf extract of eggplant to be used as an alternative disinfectant for the first-aid dressing of minor wounds and bruises [6]. By ongoing research for new therapeutic compounds from Nigerian medicinal plants, the current study seeks to compare and assess the methanol extract of the fruit and the leaf of *Solanum melongena* against multi-drug-resistant (MDR) *Staphylococcus aureus and Pseudomonas aeruginosa.*

Materials and methods

Test organisms: Ten isolates of multi-drug-resistant *Staphylococcus aureus* and *Pseudomonas aeruginosa* collected from the Department of Pharmaceutical Microbiology and Biotechnology were the microorganisms used, respectively.

Plant collection: Fresh and healthy fruits and leaves of *Solanum melongena* (**Figure 1**) were harvested in April 2023 in the early hours of the morning from the botanical garden of the Faculty of Pharmaceutical Sciences, Nnamdi Azikiwe University, Agulu campus, Anambra State, South-Eastern Nigeria. The plant material was identified as *Solanum melongena* and authenticated by Chinenye H. Nedum at the Department of Pharmacognosy and Traditional Medicine, Nnamdi Azikiwe University, Awka, Agulu Campus, Anambra State, Nigeria.

A B

Figure 1: Fruits of *Solanum melongena* (**A**) Leaves of *Solanum melongena* (**B**)

Extraction methods: The pulverized leaves weighing 200 g were macerated in 1000 ml of methanol for 48 hours. The resulting mixture obtained was filtered using a muslin cloth and further filtered with no 1 Wattman filter paper. After that, the filtrate was concentrated using a rotary evaporator at a reduced temperature (40^{o}C) and pressure. It was further concentrated using a water bath at 40^{o}C and the crude extract after evaporation weighed 4.0 g and 5.0 g for the leaves and fruits, respectively. The percentage yields were 2.0% and 2.5% per 200 g for leaves and fruits, respectively.

Phytochemical testing: The crude extracts were tested for the presence of various phytoconstituents like alkaloids, flavonoids, reducing sugars, saponins, proteins, tannins, amino acids, steroids, triterpenoids and glycosides using the following tests: Dragendoff's and Wagner's tests for alkaloids; lead acetate and alkaline reagent test for flavonoids, Fehling's test for reducing sugar; Frothing test for saponins; Precipitation test for protein; ferric chloride test for tannins; ninhydrin test for amino acid; Liebermann-Burchard test for steroid; Salkowski test for triterpenoid and general test for glycosides [7-10].

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Confirmation of test organisms: The bacteria isolates were confirmed using their morphological appearance (macroscopy) of the colonies, Gram stain reaction (microscopy), and selected confirmatory biochemical tests [11, 12].

Gram staining technique: Smears of the isolates were made on clean grease-free slides, air dried, and heat fixed. These were covered with Giemsa stain for 30 sec and washed off with water. After which Lugol's iodine was added for one minute and washed off with water. Thereafter, they were rapidly decolorized for a few seconds with alcohol and immediately washed off with water. They were counter-stained with Safranin red for three minutes and washed off with water. The back of the slides was wiped dry and examined under the oil immersion microscope for Gram characteristics of the microorganisms [11].

Catalase test (slide drop method): Using a wooden applicator stick, a small amount of organism from a well-isolated 18 hours to 24 hours culture plate was collected and placed on a grease-free slide. Using a dropper, a drop of 3.0% H_2O_2 was placed onto the organism on the microscope slide. Positive reactions are evident by immediate effervescence (bubble formation) [12].

Oxidase test: A piece of filter paper was placed in a clean Petri dish and two or three drops of freshly prepared oxidase reagent were added. Using a piece of stick or glass rod, a colony of the test organism was removed from the culture plate and smeared on the filter paper. The development of a blue-purple color within 10 sec was looked out for [11].

Antibiotic susceptibility: This was done using the Kirby-Bauer method [13]. Multiple antibiotic discs containing ofloxacin (5.0 µg) ciprofloxacin (5.0 µg), amoxicillin-clavulanic acid (20/10 µg), gentamicin (10 µg), ceftazidime (30.0 µg), cefotaxime (30.0 µg), trimethoprim-sulfamethoxazole (1.25/23.75 µg), ampicillin (10.0 µg), tetracycline (30.0 µg) and ceftriaxone (30.0 µg) were placed onto a sterile agar plate (Muëller-Hinton agar) upon which the test isolates, standardized to 0.5 McFarland were inoculated. The plates were left on the work table for 30 minute to allow for pre-diffusion of antibiotics into the agar. The plates were incubated at 37°C for 18 hours to 24 hours. The susceptibility of each isolate to each antibiotic was shown by a clear zone of growth inhibition and the diameter of the zones of inhibition was then interpreted using a standard chart [14].

Preparation of extract: Stock concentrations of each of the extracts were made by weighing 400 mg of each crude extract into sterile beakers. Then 4.0 ml of dimethyl sulfoxide (DMSO) was added to each of the samples and reconstituted properly. Thereafter, a two-fold serial dilution was made from the stock concentrations to get (50.0, 25.0, 12.5, and 6.25 mg/ml) concentrations of the crude extracts.

Determination of antimicrobial activity: The antibacterial assay for the crude extracts was carried out against the test organisms using agar well diffusion assay as described by [15, 16] with slight modifications. The bacterial suspensions were adjusted to 0.5 McFarland turbidity standards and inoculated onto previously sterilized Mueller-Hinton Agar (MHA) plates. A sterile cork borer was used to make five wells (8.0 mm in diameter) on each of the MHA plates. Aliquots of 80.0 µl of each extract dilution were put in each of the wells. Ciprofloxacin (8.0 µg/ml) served as the positive control. The plates were then incubated at 37ºC for 24 hours. The antimicrobial potential for each extract was determined by measuring the zone of inhibition around each well. The procedure was conducted in triplicate for each of the test organisms and the mean of IZDs was calculated.

Determination of minimum inhibitory concentration (MIC): The MIC was determined by the agar dilution method previously described [16, 17]. Different concentrations (80.0 µl) of the crude extracts were seeded with the test isolates and inoculated unto Mueller Hinton agar. The inoculated plates were allowed to stand for some minutes to allow for pre-diffusion and incubated at 37ºC for 24 hours. The MIC was obtained as the least concentration that inhibited the growth of the test microorganisms divided by the dilution factor.

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Results

Phytochemical analysis: Phytochemical analysis of methanol extract of fruits and leaves of *Solanum melanum* revealed the presence of alkaloids, flavonoids, reducing sugars, proteins, amino acids, steroids, and glycosides, with only the extract from the leaves of *Solanum melongena* having saponins, while both plant parts showed no tannins and triterpenoids (**Table 1**).

Table 1: Phytochemical analysis of *Solanum melongena* extracts

Phytoconstituents	Test	Fruit	Leaf
Alkaloids	Dragendorf's	+	+
	Wagner's	+	+
Flavonoids	Lead acetate	+	+
Reducing sugar	Fehling's	+	+
Saponins	Frothing	-	+
Protein	Precipitation	+	+
Tannins	Ferric chloride	-	-
Amino acids	Ninhydrin	+	+
Steroids	Liebermann-Burchard	+	+
Triterpenoids	Salkowski	-	-
Glycosides	General	+	+

Confirmation of test organisms: The finding of the macroscopy, microscopy, and biochemical tests as shown in **Tables 2** and **3** confirm that they are isolates of *Staphylococcus aureus* and *Pseudomonas aeruginosa*.

Table 2: Identification of *Staphylococcus aureus* isolates

Isolate code	Colonial morphology/characteristics	Gram character	Microscopic feature	Biochemical/ confirmatory tests		Probable organism
				Oxidase	Catalase	
S1	Milky, opaque colonies	**+ve**	Cocci clusters	**+ve**	**+ve**	*S. aureus*
S2	Milky, opaque colonies	**+ve**	Cocci clusters	**+ve**	**+ve**	*S. aureus*
S3	Milky, opaque colonies	**+ve**	Cocci clusters	**+ve**	**+ve**	*S. aureus*
S4	Milky, opaque colonies	**+ve**	Cocci clusters	**+ve**	**+ve**	*S. aureus*
S5	Milky, opaque colonies	**+ve**	Cocci clusters	**+ve**	**+ve**	*S. aureus*
S6	Milky, opaque colonies	**+ve**	Cocci clusters	**+ve**	**+ve**	*S. aureus*
S7	Milky, opaque colonies	**+ve**	Cocci clusters	**+ve**	**+ve**	*S. aureus*
S8	Milky, opaque colonies	**+ve**	Cocci clusters	**+ve**	**+ve**	*S. aureus*
S9	Milky, opaque colonies	**+ve**	Cocci clusters	**+ve**	**+ve**	*S.aureus*
S10	Milky, opaque colonies	**+ve**	Cocci clusters	**+ve**	**+ve**	*S. aureus*

+ve = positive and -ve = negative

Table 3: Identification of *Pseudomonas aeruginosa* isolates

Isolate code	Colonial morphology/characteristics	Gram character	Microscopic feature	Biochemical/ confirmatory tests		Probable organism
				Oxidase	Catalase	
P1	Translucent colonies	**-ve**	Rod-like (slender)	**+ve**	**+ve**	*P. aeruginosa*
P2	Large translucent colonies	**-ve**	Rod shape (slender)	**+ve**	**+ve**	*P. aeruginosa*
P3	Large translucent colonies	**-ve**	Rod shape (slender)	**+ve**	**+ve**	*P. aeruginosa*
P4	Large translucent colonies	**-ve**	Rod shape (slender)	**+ve**	**+ve**	*P. aeruginosa*
P5	Large translucent colonies	**-ve**	Rod shape (slender)	**+ve**	**+ve**	*P. aeruginosa*
P6	Large translucent colonies	**-ve**	Rod shape (slender)	**+ve**	**+ve**	*P. aeruginosa*
P7	Large translucent colonies	**-ve**	Rod shape (slender)	**+ve**	**+ve**	*P. aeruginosa*
P8	Large translucent colonies	**-ve**	Rod shape (slender)	**+ve**	**+ve**	*P. aeruginosa*
P9	Large translucent colonies	**-ve**	Rod shape (slender)	**+ve**	**+ve**	*P. aeruginosa*
P10	Large translucent colonies	**-ve**	Rod shape (slender)	**+ve**	**+ve**	*P. aeruginosa*

+ve = positive and -ve = negative

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Antibiotic susceptibility: The susceptibility test as shown in **Tables 4** and **5** revealed their resistance against the most commonly used antibiotics.

Table 4: Susceptibility of test *Pseudomonas aeruginosa* isolates

Isolate code	Antibiotic disc concentration (µg) / Inhibition zone diameter (mm)								Status
	CAZ	CRX	GEN	CTR	ERY	CXC	OFL	AUG	
P1	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	MDR
P2	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	22.0	0.0±0.0	MDR
P3	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	24.0	0.0±0.0	MDR
P4	0.0±0.0	0.0±0.0	14.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	MDR
P5	0.0±0.0	0.0±0.0	30.0	24.0	0.0±0.0	0.0±0.0	24.0	0.0±0.0	MDR
P6	0.0±0.0	11.0	30.0	22.0	25.0	0.0±0.0	30.0	28.0	SEN
P7	0.0±0.0	0.0±0.0	0.0±0.0	30.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	MDR
P8	0.0±0.0	14.0	30.0	24.0	24.0	0.0±0.0	22.0	32.0	SEN
P9	0.0±0.0	0.0±0.0	40.0	0.0±0.0	0.0±0.0	0.0±0.0	40.0	11.0	MDR
P10	0.0±0.0	0.0±0.0	0.0±0.0	26.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	MDR

P: *Pseudomonas aeruginosa*, CAZ: ceftazidime (30 µg), CRX: cefuroxime (30 µg), GEN: gentamicin (10 µg), CTR: ceftriaxone (30 µg), ERY: erythromycin (5 µg), CXC: cloxacillin (5 µg), OFL: ofloxacin (5 µg), AUG: Augmentin, (30 µg), SEN: Sensitive/ susceptible, and MDR: Multi-drug resistance (resistance to three or more different classes of antibiotics tested).

Table 5: Susceptibility of test *Staphylococcus aureus* isolates

Isolate code	Antibiotic disc concentration (µg) / Inhibition zone diameter (mm)								Status
	CAZ	CRX	GEN	CTR	ERY	CXC	OFL	AUG	
S1	28±0.0	22±0.0	18±0.0	0.0±0.0	0.0±0.0	0.0±0.0	24±0.0	26±0.0	MDR
S2	20±0.7	0.0±0.0	26±0.0	40±0.0	0.0±0.0	0.0±0.0	26±0.0	0.0±0.0	MDR
S3	22±0.0	0.0±0.0	28±0.0	40±0.0	0.0±0.0	0.0±0.0	26±0.0	22±0.0	MDR
S4	0.0±0.0	0.0±0.0	30±1.4	0.0±0.0	20±0.0	0.0±0.0	26±0.0	0.0±0.0	MDR
S5	24±0.0	10±0.7	30±0.0	0.0±0.0	0.0±0.0	0.0±0.0	30±0.0	32±0.0	MDR
S6	0.0±0.0	0.0±0.0	22±0.0	0.0±0.0	0.0±0.0	0.0±0.0	26±0.0	0.0±0.0	MDR
S7	18±0.7	0.0±0.0	26±0.0	0.0±0.0	0.0±0.0	0.0±0.0	26±0.0	0.0±0.0	MDR
S8	26±0.0	22±0.0	30±0.0	0.0±0.0	0.0±0.0	0.0±0.0	28±0.0	24±0.0	MDR
S9	0.0±0.0	16±0.0	40±0.0	0.0±0.0	28±0.0	0.0±0.0	26±0.0	0.0±0.0	MDR
S10	0.0±0.0	0.0±0.0	26±0.0	0.0±0.0	0.0±0.0	0.0±0.0	26±0.0	0.0±0.0	MDR

S: *S. aureus*, CAZ: ceftazidime (30 µg), CRX: cefuroxime (30 µg), GEN: gentamicin (10 µg), CTR: ceftriaxone (30 µg), ERY: erythromycin (5 µg), CXC: cloxacillin (5 µg), OFL: ofloxacin (5 µg), AUG: Augmentin, (30 µg), and MDR: Multi-drug resistance (resistance to three or more different classes of antibiotics tested).

Antibacterial screening: **Tables 6, 7, 8,** and **9** showed the antibacterial activity of the extracts against multi-drug-resistant *Pseudomonas aeruginosa* and *Staphylococcus aureus*.

Table 6: Antibacterial activity of fruit extract against MDR-*Pseudomonas aeruginosa* (P) isolates

Extract concentration (mg/mL)	Test organism/inhibition zone diameter (mm)			
	P1	P4	P5	P9
100	5.0±0.0	7.0±0.0	5.0±0.0	7.0±0.0
50	3.0±0.7	3.0±0.0	0.0±0.0	2.0±0.0
25	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
12.5	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
6.25	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
Ciprofloxacin (8.0 µg/ml)	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0

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Table 7: Antibacterial activity of leaf extract against MDR-*Pseudomonas aeruginosa* (P) isolates

Extract concentration (mg/mL)	Test organism/inhibition zone diameter (mm)			
	P1	P4	P5	P9
100	3.0±0.7	4.0±0.0	4.0±0.0	0.0±0.0
50	3.0±0.7	3.0±0.0	3.0±0.0	0.0±0.0
25	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
12.5	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
6.25	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
Ciprofloxacin (8.0 µg/ml)	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0

Table 8: Antibacterial activity of fruit extract against MDR-*Staphylococcus aureus* (S) isolates

Extract concentration (mg/mL)	Test organism/inhibition zone diameter (mm)				
	S2	S3	S5	S7	S9
100	2.0±0.7	5.0±0.0	3.0±0.0	5.0±0.0	5.0±0.0
50	2.0±0.7	4.0±0.7	0.0±0.0	4.0±0.7	5.0±0.7
25	0.0±0.0	4.0±0.7	0.0±0.0	3.0±0.7	4.0±0.0
12.5	0.0±0.0	3.0±0.0	0.0±0.0	0.0±0.0	3.0±0.0
6.25	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
Ciprofloxacin (8.0 µg/ml)	0.0±0.0	7.0±0.0	0.0±0.0	4.0±0.0	11.0±0.0

Table 9: Antibacterial activity of leaf extract against MDR-*Staphylococcus aureus* (S) isolates

Extract concentration (mg/mL)	Test organism/inhibition zone diameter (mm)				
	S2	S3	S5	S7	S9
100	0.0±0.0	0.0±0.0	4.0±0.0	0.0±0.0	5.0±0.0
50	0.0±0.0	0.0±0.0	3.0±0.0	0.0±0.0	4.0±0.0
25	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	3.0±0.7
12.5	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	2.0±0.0
6.25	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
Ciprofloxacin (8.0 µg/ml)	0.0±0.0	7.0±0.0	0.0±0.0	4.0±0.0	11.0±0.0

Minimum inhibitory concentration (MIC) of the extract: **Tables 10** and **11** showed the MIC of the extracts against isolates of *Pseudomonas aeruginosa* and *Staphylococcus aureus*.

Table 10: Minimum inhibitory concentration of extracts on *Pseudomonas aeruginosa* isolates

Extract	Test organisms/minimum inhibitory concentration (mg/mL)			
	P1	***P4***	***P5***	***P9***
	MIC	**MIC**	**MIC**	**MIC**
Fruit	25	25	50	25
Leaf	25	25	25	>50
DMSO	NA	NA	NA	NA

P: *Pseudomonas aeruginosa*, DMSO: Dimethylsulfoxide (negative control), NA: No activity

Table 11: Minimum inhibitory concentration of extracts on *Staphylococcus aureus* isolates

Extract	Test organisms/minimum inhibitory concentration (mg/mL)				
	S2	***S3***	***S5***	***S7***	***S9***
	MIC	MIC	MIC	MIC	MIC
Fruit	25	6.25	50	25	6.25
Leaf	>50	>50	25	>50	6.25
DMSO	NA	NA	NA	NA	NA

S: Staphylococcus aureus, DMSO - Dimethylsulfoxide (negative control), NA: No activity

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Discussion

Several previous studies have shown the establishment of the antimicrobial properties of medicinal plant extracts such as *Staphylococcus melongena* [18, 19]. The current study confirms the natural occurrence of diverse phytoconstituents with various pharmacological properties. It was deduced that the presence of phytoconstituents may be responsible for the antimicrobial activities observed in most of the multi-drug-resistant test isolates. The phytochemical result of the leaf extract supports the phytochemical reports of *Solanum melongena* [20, 21], which revealed the presence of saponins, alkaloids, flavonoids, and protein in the leaf and fruit extracts. All the *Staphylococcus aureus* and *Pseudomonas aeruginosa* isolates were observed to appear as cocci in clusters and long rods using a light microscope. These agree with the previous study of Cheesbrough [11]. Their identities were further confirmed by their positive reactions to oxidase and catalase tests. The susceptibility test on *Pseudomonas aeruginosa* and *Staphylococcus aureus* isolates revealed that all the isolates were multi-drug resistant against the selected antibiotics except *P6 and P8* (**Table 2**). The results confirm the rule for multi-drug resistance organisms [22]. Antibacterial screening results are an indication that the fruits and leaves extracts of *Solanum melongena* may be a better treatment option against multi-drug resistant-*Pseudomonas aeruginosa* than ciprofloxacin. The methanol fruit extract against multi-drug resistance *Staphylococcus aureus* isolates revealed that the extract had varied and slight inhibition against the test isolates at different concentrations except for isolate *S5*, with a zone of inhibition observed at 100 mg/ml (**Table 8**). The same was the case with the methanol leaf extract (**Table 9**). This report is similar to the report of the study by [20]. The difference in the inhibitory effects of these test isolates is an indication that they are species-strain dependent which may be attributed to the strain specificity of the multidrug-resistant test organisms. Comparatively, the fruit extract had a better activity against the two isolates than the leaf extract. The minimum inhibitory concentrations of methanol fruit and leaf extracts of *Staphylococcus melongena* on Pseu*domonas aeruginosa* range from 25.0-50.0 mg/ml and 25.0->50.0 mg/ml, respectively (**Table 10**). Similarly, the minimum inhibitory concentrations of fruits and leaf extracts of *Staphylococcus melongena* on *Staphylococcus aureus* range from 6.25-50 mg/ml and 6.25->0.0 mg/ml, respectively (**Table 11**). These extracts showed good antibacterial activities against the resistant isolates. A previous work reported a minimum inhibitory concentration of 5.5 mg/ml of the ethanol extract against *Micrococcus* and *E. coli in-vitro* [6]. It is recommended that a comprehensive chemical analysis should be carried out in other to identify and isolate the active phytoconstituents for development into antibacterial therapy. In addition, molecular detection of the genes responsible for the degree of resistance expressed by all the pathogenic test organisms should be done with a comparative analysis should be done to compare different solvent extraction capacities.

Conclusion: This study confirms the presence of bioactive phytoconstituents in the methanol fruit and leaf extracts of *Solanum melongena* with activities against disease-causing multidrug-resistant *Staphylococcus aureus and Pseudomonas aeruginosa.* The findings showed that the fruit extract has better activity against test organisms than the leaf extract.

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