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A Comparative Assessment of the Phytochemical Composition of *Ximenia Caffra* (Sour Plum) Leaf

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Abstract

The phytochemical analysis of Ximenia caffra (sour plum) leaves was evaluated; extracts of the leaves of the plants from n-hexane, methanol and chloroform were subjected to photochemical screening which was done using standard methods. The phytochemical screening of the test plant revealed the presence of saponins, alkaloids, glycosides, phenols, tannins and amino acids and flavonoids and it also detects the presence of Carbohydrate, Protein/, Amino acids, Fats and oil, Alkaloids, Glycosides, Flavonoids, Tannins, Saponins, Phenolics compounds, Steroids and Triterpenoids. The result of qualitative and quantitative analysis shows that methanolic extract has more effect on all the parameters tested than chloroform extract and n-hexane extract. The findings of this study support the use of sour plum leaves as alternative system of medicine.

Keywords: sour plum leaf, phytochemical screening, methanol, n-hexane, chloroform.

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1. Introduction

Natural products are chemical compounds or substances isolated from living organism [1] The chemistry of the natural product includes their biosynthesis, extraction, identification, quantification, structural elucidation, physical and chemical properties and reactions They are produced by the pathway of primary or secondary metabolism [2] Metabolism is defined as series of enzyme catalyzed biochemical

reaction or transformation occurring within the cells of an organism which are mainly required for its growth, development and for proper response to its environment [3]

Medicinal plants have been used for centuries as remedies for human diseases because they contain components of therapeutic value. The curative properties of medicinal plants are attributable to the presence of various bioactive phytochemicals which may explain their traditional uses against various ailments [4].

Plants have been used as a source of medicine from ancient to contemporary age. Initially, these were the main part of folk or ethno-medicine, practiced in India and other parts of the world like China, Middle East Africa and South America. Later, substantial part of such indigenous knowledge was organized, documented and eventually passed into the organize systems of medicines such as Ayurveda, Chinese, Yunani, Sidha, Tibetan or other systems [5].

The use of plants as medicinal agents to the treat of many diseases has been investigated for a long time since the antique civilizations. Several plants are used in traditional medicine against inflammatory diseases as well as various types of tumours on the base the potential of their chemical constituents. Although many compounds are extremely toxic, when we have the relation between the toxicity of a compound and its chemical pattern of substitution, that can result in a more in-depth understanding of these compounds [6].

Despite significant development of rural health services, village people still use herbal folk medicines to a good extent for treatment of common ailments like cough, cold and fever, headache and body-ache, constipation and dysentery, burns, cuts and scalds, boils, ulcers, skin diseases and respiratory troubles and others [7]. Nevertheless, a growing world-wide interest in the use of phytopharmaceuticals as complementary or alternative medicine, either for prevention or amelioration of many diseases has been noted in recent years [8].

Phytochemicals are biologically active, naturally occurring chemical compounds found in plants, which provide health benefits for humans further than those attributed to macronutrients and micronutrients [9]. They protect plants from disease and damage and contribute to the plant's colour, aroma and flavour. In general, the plant chemicals that protect plant cells from environmental hazards such as pollution, stress, drought, UV exposure and pathogenic attack are called as phytochemicals [10, 11]. Recently, it is clearly known that they have roles in the protection of human health, when their dietary intake is significant. Phytochemicals are classified by protective function, physical characteristics and chemical characteristics [12]. Phytochemicals accumulate in different parts of the plants, such as in the roots, stems, leaves, flowers, fruits or seeds. Many phytochemicals, particularly the pigment molecules, are often concentrated in the outer layers of the various plant tissues. Levels vary from plant to plant

depending upon the variety, processing, cooking and growing conditions [13]. *Ximenia caffra,* also known as large sour plum, is a member of a genus of flowering plants in the Olacaceae family, which grows in the southern African region [14, 15]. Ximenia caffra is a deciduous tree up to 6m tall with an untidy open crown. The bark is dark grey and rough, but pale green or brown on younger branches. The flowers are small, sweet-scented and creamy-green. The skin is smooth and starts green, and then ripens to a yellow colour, and when ripe has a juicy pulp. The sour plum is 3.5cm in length and 2.5 cm in diameter. The seed is smooth, ellipsoidal and yellow-brown to red in colour. The seed is hard and around 2.5 cm in length. It will generally flower in September to October during the dry season to the onset of the rains. The fruits from this flowering are produced in December to January during the rains; this varies from region to region with the fruit being produced generally in October and January. The sour plum can tolerate altitudes of up to 2000m and requires annual rainfall of 250-1270mm. It generally requires clay or loamy soils for effective growth. Once planted, the seeds will germinate after 14-30 days. The seeds have no special requirements for storage. The tree can be used as a natural fence to designate tracts of land or set a perimeter. [16]. *Ximenia caffra* has been used in foods and traditional medicine. Its fruit is considered to be rich in vitamin C, potassium, and protein [17]. The dried seed of *Ximenia caffra* contains a substantial quantity of unsaturated fatty acids; the most abundant is oleic acid [18]. As such, the extracted seed oil would be used as a feed ingredient and domestic biofuel [19]. As a traditional medicine, local herbalists have been using the leaves and root of *Ximenia caffra* for treatment of wounds, infections, fever, infertility, and diarrhoea [20]. The roots are used to treat abscesses, stomach aches, colic, malaria, and cough. They can also be pounded, turned into porridge and eaten to reportedly prevent sterility in women [16]. It is thought that powdered roots can also be added to beer to act as an aphrodisiac [21]. The tree's bark is used as a remedy for syphilis, hookworm, chest pains, and body pain. The seeds are generally roasted and then pounded for their oils to be used for wounds as ointment [16]. The leaves can be used to soothe inflamed eyes and as a reported cure for tonsillitis. [21], they have also been reported to show antimicrobial activities [22].

2. Materials and methods

2.1. Collection and identification of plant

The plant *Ximenia caffra* (PT-001) was collected from Anyigba and identified by a botanist, Mr. Ayegba Sule, in biological sciences Department (Plant Science and Biotechnology), Kogi State University, Anyigba, Kogi State.

2.2. Preparation of extract

The leaves were separated from plant, washed well to remove altering matter, air-dried and powdered

using mortar and pestle. The extraction was done using cold maceration method. The powdered sour plum leaves (50 g) were subjected to maceration for 72h at room temperature using methanol (300 mL). The extract was filtered and the solvent was evaporated using water bath at 45^0C. A brownish pasty residue was obtained. The same procedure was followed, using n-hexane and chloroform respectively as solvents

2.3. Percentage Yield

For Methanol:

Mass of sample + mass of beaker - mass of sample (beaker + extracted sample)

$$102 + 50 - 127$$

$$152 - 127$$

$$\frac{25 \times 50}{100}$$

$$= 12.5\%$$

For n-hexane:

Mass of sample + mass of beaker - mass of sample (beaker + extracted sample)

$$102 + 50 - 129$$

$$152 - 129$$

$$\frac{23 \times 50}{100}$$

$$= 11.5\%$$

For Chloroform:

Mass of sample + mass of beaker - mass of sample (beaker (102) + extracted sample (25))

$$102 + 50 - 131$$

$$152 - 131$$

$$\frac{21 \times 50}{100}$$

$$= 10.5\%$$

2.4. Phytochemical Analysis

2.4.1 Determination of total phenolic content

Folin-Ciocaltou assay method was used for the determination of the total phenol content. The reaction mixture containing the extract (1mL) and distilled water (5mL) was taken in a volumetric flask (25 mL)). One milliliter of Folin-Ciocaltou phenol reagent was treated to the mixture and shaken well. After some minutes, 7 % Sodium Carbonate (Na_2CO_3) solution (10mL) was treated to the mixture. The volume was made up to 25 mL. A set of standard solution of gallic acid (20, 40, 40, 60, 80 and 100 µg/mL) were prepared in the same manner as described earlier. Incubation was done for 90 minutes at room temperature and then absorbance for test and standard solutions were determined against the reagent blank at 550 nm with an Ultraviolet (UV)/Visible spectrometer. Total phenol content was expressed as mg of GAE/g of extract.

2.4.2. Determination of total flavonoid content

Total flavonoid content was measured by the aluminium colorimetric assay. The reaction mixture consists of extract (1mL) and distilled water (4mL) was taken in a 10 mL volumetric flask. To the flask, 5% sodium nitrite (0.30mL) was treated and after 5 minutes, 10% aluminium chloride (0.30mL) was mixed. After 5 minutes, 1 M sodium hydroxide (2mL) was treated and diluted to 10 mL with distilled water. A set of reference standard solutions of quercetin (20, 40, 60, 80, 100 µg/mL) were prepared in the same manner as described earlier. The absorbance for test and standard solutions were determined against the reagent blank at 510 nm with an UV/Visible spectrometer. The total flavonoid content was expressed as mg of QE/g of extract.

2.4.3. Determination of tannin content

The tannins were determined by Folin-Ciocaltou method. About 0.1 mL of the sample extract was added to a volumetric flask (10 mL) containing distilled water (7.5mL) and Folin-Ciocaltou reagent (0.5mL), 35% Na_2CO_3 solution (1mL) and diluted to 10 mL with distilled water. The mixture was shaken well and kept at room temperature for 30 minutes. A set of reference standard solutions of Gallic acid (20, 40, 60, 80 and 100µg/mL) were prepared in the same manner as described earlier. Absorbance for test and standard solutions were measured against the blank at 725 nm with an UV/Visible spectrometer. The tannin content was expressed in terms of mg of GAE/g of extract.

2.4.4. Determination of alkaloid

The alkaline precipitation gravimetric method as reported by. Inuwa *et al.* [23] was used. A measured weight (1 g) of the processed sample was dispersed in 10% acetic acid (30mL) in ethanol solution. The mixture was shaken well and allowed to stand for 4h at room temperature. The mixture was shaken periodically at 30 minutes interval. At the end of the period, the mixture was filtered through whatman N0.42 grade of filter paper. The filtrate (extract) was concentrated by evaporation to a quarter of its original volume. The extract was treated with drop-wise addition of concentrated NH_3 solution to precipitate the alkaloid. The dilution was done until the NH_3 was in excess. The alkaloid precipitate was removed by filteration using weighed whatman No.42 filter paper. After washing with 1% NH_4OH solution, the precipitate in the filter paper was dried at 60°C in an oven and weighed after cooling in a desiccator. The alkaloid content was calculated as shown below:

$$\% \text{ Alkaloid} = \frac{W_2 - W_1}{\text{Weight of sample}} \times 100$$

Where W_1 = weight of empty filter paper

W_2 = weight of filter paper + alkaloid precipitate.

2.4.5. Determination of saponins

Crude saponin extracts (10mg) were dissolved in 50% aqueous methanol (5mL). 250 µl of aliquot was transferred to the test tubes into which an equal volume of vanillin reagent (8%) was added followed by 72% (v/v) sulphuric acid. The mixture was mixed and placed in a water bath adjusted at 60^{o}C for 10 minutes. The tubes were cooled on an ice-cold water bath for 3-4 minutes and absorbance of yellow colour reaction mixture was measured at 544 nm using a UV-Vis spectrometer against a blank containing 50% aqueous methanol instead of sample extract.

2.4.6. Determination of cardiac glycosides

Cardiac glycosides of each generation of suspension culture were quantitatively determined, 10% extract of each generation and total extract of seeds were mixed with freshly prepared Baljet's reagent (10mL) (95 mL of 1% picric acid + 5 mL of 10% NaOH). After an hour, the mixture was diluted with distilled water (20mL) and the absorbance was measured at 495 nm by a UV-Vis spectrometer.

2.5. Qualitative Chemical Test for Phytochemicals

2.5.1. Test for carbohydrates/sugars

The extract was dissolved in water and then filtered

2.5.1.1. Fehling's solution test: The Fehling's solutions are prepared as follows:

Solution A:

Copper sulphate	34.64gm
Sulphuric acid	0.5m
Distilled water to	500Ml

Solution B:

Sodium potassium tartrate	176gm
Sodium hydroxide	77gm
Distilled water to	500mL

The two solutions are mixed in equal volumes immediately before use. A little of the test residue is dissolved in water, and a few mL of the Fehling's solution is added. This mixture is then warmed. If red precipitate of cuprous Oxide was obtained, reducing sugar is present.

2.5.1.2. Benedict's test

The test solution mixed with Benedict's reagent in equal quantity and heat in boiling water bath for five minutes. Formation of green, yellow or red colour indicates the presence/absence of reducing sugars.

2.5.2. Test for proteins and amino acids

The extract is dissolved in water and then filtered

2.5.2.1. Biuret test

To the test solution, Sodium hydroxide (4%) and few drops of copper sulphate solution (1%) was added, development of violet or pink colour indicates the presence/absence of proteins and free amino acids.

2.5.2.2. Million's test

To a few mL of alcoholic extract, distilled water (5mL is added and filtered; to this 2mL of filtrate, of Million's reagent (5-6 drops) is added. Formation of red colour/precipitate indicates the presence/absence of protein and free amino acids.

2.5.3. Test for fats and oils

2.5.3.1. Spot test

Press the extracts in small quantity in between two filter papers. The presence or absence of fixed oil and fats was confirmed by the stains of oil observed with petroleum ether, benzene and methanolic extracts.

2.5.3.2. Saponification test

To the extracts add few drops of alcoholic potassium hydroxide (0.5N) along with few drops of phenolphthalein then heat the mixture on a water bath for about one hour. The presence or absence of fixed oil and fat was confirmed by the formation of soap/partial neutralization of alkali with petroleum ether, benzene and methanolic extracts.

2.5.4 Test for alkaloids

The extract is dissolved in dil. HCl and then filtered

2.5.4.1. Wagner's test

Iodine (1.27g) and potassium iodide (2g) were dissolved in water (5mL) and the solution is diluted to 100mL with distilled water. Few drops of this reagent are added to the residue. Formation of reddish-brown precipitate indicates the presence of alkaloids.

2.5.4.2. Hager's test

A saturated aqueous solution of picric acid (1g) dissolved in 95 distilled water (95mL) is used for this test. Few drops of this reagent are added to the test residue. Formation of a yellow ppt or precipitate indicates the presence of alkaloids.

2.5.5 Test for glycosides

The extract is dissolved in water and alcohol

2.5.5.1. Killer-killani test

Glacial acetic acid (1mL) containing traces of ferric chloride and concentrated sulphuric acid (1mL) are added to the test residue. Formation of reddish-brown colour at the junction of two layers and the upper layer turned bluish green. This indicates the presence of glycosides.

2.5.5.2. Legal test (cardiac glycosides)

A few drops of pyridine and sodium nitroprusside solution are added to the test residue, it is made alkaline with few drops of NaOH solution. Formation of a pink or red colour indicates the presence of glycoside.

2.5.6 Test for flavonoids

The extract is dissolved in alcohol

2.5.6.1. Shinoda test

A small quantity of the test residue is dissolved in 5mL ethanol (95% v/v} and reacted with few drops of concentrated hydrochloric acid and magnesium turnings (0.5g) and observed. Formation of pink or magenta colour indicates the presence of flavonoids.

2.5.6.2. Alkaline Reagent test

To the test solution, few drops of sodium hydroxide solution are added. Formation of intense yellow colour which turns colourless on addition of few drops of dilute HCI indicates the presence/absence of flavonoids.

2.5.7 Test for tannins

The extract is dissolved in alcohol and water

2.5.7.1. Gelatine Solution test

Gelatin (1% w/v) solution in water, containing sodium chloride (10%) is prepared. A little of this solution was added to the test residue. Formation of white precipitate indicates the presence of tannins.

2.5.7.2. Catechin Test (Matchstick test)

A matchstick is dipped in aqueous plant extract, dried near burner and moistened with concentrated hydrochloric acid. On warming near a flame, the matchstick turned pink or red. This indicates the presence of tannins.

2.5.8 Test for saponins

2.5.8.1. Froth/Foam test

A few mg of test residue is taken in a test tube and shaken vigorously with a small amount of sodium bicarbonate and water. Formation of a stable froth indicates the presence of saponins.

2.5.9 Test for phenolic compounds

The extract is dissolved in alcohol and water

2.5.9.1. Ferric chloride test

The test residue is taken in water, warmed and filtered; to the filtrate, ferric chloride solution (2mL) is added and observed. Formation of green and blue colour indicates the presence of phenolic compounds.

2.5.9.2. Lead acetate test

To the test residue, lead acetate solution is added and observed. Formation of precipitate indicates the presence of phenolic compounds.

2.5.10 Test for Steroids

The extract is dissolved in chloroform.

2.5.10.1. Salkowski test

To the test solution chloroform (2mL) is added and filtered. Few drops of concentrated sulphuric acid is added to the filtrate and shaken. The mixture is allowed to stand for some time. Formation of red colour in the lower layer indicates the presence of steroids and formation of yellow coloured in the lower layer indicates the presence/absence of triterpenoids.

2.5.10.2. Libermann-Burchard's test

To the test solution few drops of acetic anhydride is added, boiled and cooled. Then concentrated sulphuric acid was added from the side of the test tube. Formation of brown ring at the junction of two layers and the upper layer turns green which indicates the presence of steroids and formation of deep red color indicates the presence of triterpenoids.

2.5.11. Test for acidic compounds

2.5.11.1. Sodium bicarbonate test

To the alcoholic extract, sodium bicarbonate solution is added and observed. Formation of effervescence indicates presence of acidic compounds.

2.5.11.2. Litmus test

A small amount of alcoholic extract is taken in warm water and filtered. The filtrate is tested with litmus paper and methyl orange to observe blue colour.

3.0. Results and discussion

After the extraction and concentration, the colour and texture of the extract was oily, deep greenish-black sticky resin with a dull odour. It had a very good yield. The analysis of the methanolic, n-hexane and chloroform extracts of ximenia caffra leaf revealed that it contains the following phytochemical constituents, which includes, Tanins, Flavonoids, Saponins, Steroids, Alkaloids, Terpenoids, Cardiac glycosides, total phenol, carbohydrate test, protein test fats and oil, triterpenoids, as shown in table 1.

3.1. Qualitative analysis of *Ximenia caffra*

The results of the phytochemical screening of *Ximenia Caffra* leaf extract indicated the presence of medicinally active constituents; alkaloids, flavonoids, cardiac glycosides, tannins, saponins, carbohydrates, Amino acids and phenols while steroids and fats and oil were absent in the leave extract. The results also indicated that methanolic extract shows the highest presence of the phytochemicals (Table 1).

4.0 Discussion

The results summarized in Table 1, revealed the presence of phytoconstituents in the extracts of *Ximenia caffra* leaves; the methanol extract reveal the presence of carbohydrates, proteins, alkaloids, tannins, saponins, glycosides, phenol, triterpenoids and flavonoids. On the other hand, the chloroform extract revealed the presence of carbohydrates, proteins, alkaloids, flavonoids, saponins, and phenol. The n-hexane extract revealed the presence of fats and oil, saponins and triterpenoids only. This is in agreement with the work of Geyid *et al*. (2005) [24]. and Tedong *et al*. (2006) [25]. who reported that plants generally have variety of secondary metabolites. The results summarized in Table 8 revealed the concentration of some selected phytochemicals in the leaf-extracts of *Ximenia caffra*.

Quantitative analyses of some selected phytochemicals in the plant (*Ximenia caffra*), revealed that the extracts contained these phytochemicals in varying amount in the leaves. It was observed that the concentration of the phytochemicals was particularly high in methanol, followed by chloroform and n-hexane extracts respectively. The phytochemical with the highest concentration was flavonoid, followed by total phenol, saponins, alkaloid and tannins respectively as shown in (Table 8).

Table 1. Results of qualitative analysis of *Ximenia caffra*

S/N	Tests	Methanol Extract	Chloroform Extract	n-hexane Extract
1	**Carbohydrate test**			
	Fehling's test	+ +	+	---
	Benedict's test	+ +	+ +	---
2	**Protein/ Amino acids test**			
	Biuret test	+ + +	+ +	---
	Million's test	+ + +	+ +	---
3	**Fats and oils test**			
	Spot test	---	---	+
	Saponification test	---	---	+
4	**Alkaloids test**			
	Wagner's test	+ +	+	---
	Hager's test	+ +	+	---
5	**Glycosides test**			
	Killer-Killani test	+ + +	---	---
	Legal test	+ + +	---	---
6	**Flavonoids test**			
	Shinoda test	+ + +	+ +	---
	Alkaline reagent test	+ +	+ +	---
7	**Tanins test**			
	Gelatin solution test	+ + +	---	---
	Catechin test	+ +	---	---
8	**Saponins test**			
	Froths/foam test	+ +	+ + +	+
9	**Phenolics compounds test**			
	Ferric chloride test	+ + +	+ +	---
	Lead acetate test	+ + +	+ +	---
10	**Steroids test**			
	Salkowski test	---	---	---
	Libermann-Burchard's test	---	---	---
11	**Triterpenoids test**			
	Salkowski test	+ +	---	+ +
	Libermann-Burchard's test	+	---	+ +

+ = slightly present
+ + = moderately present
+ + + = highly present
-- = not present

The Flavonoid concentration in the extracts is in the order methanol > chloroform > n-hexane. This is an indication that different solvents of extraction have varying abilities to liberate these compounds and each liberated at varying quantities as ascertained by vaghasiya *et al.,* (2011) [26]. It has been reported that flavonoids are essential secondary metabolites with anti-oxidant property but relatively slightly

toxic when ingested and have inherent ability to modify body's reaction to allergens, virus and carcinogens [27].

3.2. Quantitative analysis of *Ximenia caffra*

Table 2 Tanin contents of *Ximenia caffra* leaf extract

GAE = Gallic Acid Equivalent

Sample code	Sample absorbance at 725nm	Mg of GAE/g of extract
Methanolic extract	0.167	4.18
	0.166	4.16
n-hexane extract	0.110	3.18
	0.109	3.16
Chloroform extract	0.133	3.58
	0.134	3.60

Tannins standard calibration curve equation

Y = 0.057x - 0.071 where y = absorbance and x = concentration

Table 3: Total Phenol contents of *Ximenia caffra* leaf extract

Sample code	Sample absorbance at 550nm	mg of GAE/g of extract
Methanolic	1.149	191.83
extract	1.147	191.50
n-hexane extract	0.629	105.17
	0.628	105.00
Chloroform	0.895	149.50
extract	0.898	150.00

Total phenol standard calibration curve equation

y = 0.006x - 0.002 where y = absorbance and x = concentration

Table 4: Flavonoid contents of *Ximenia caffra* leaf extract

QE = Quaicertin

Sample code	Sample absorbance at 510 nm	mg of QE/g of extract
Methanolic	1.361	303.78
extract	1.363	304.22
n-hexane extract	1.138	127.11
	1.137	127.00
Chloroform	1.278	142.67
extract	1.279	142.78

Flavonoid standard calibration curve equation

y = 0.009x - 0.006 where y = absorbance and x = concentration

Table 5: Alkaloid contents of *Ximenia caffra* leaf extract

AE = Atropine Equivalent

Sample code	Weight of paper (g) W_1	Weight of paper + alkaloid W_2	% Alkaloid
Methanolic	2.640	2.653	13.00
extract	2.630	2.643	13.00
n-hexane	3.120	3.125	3.50
extract	3.000	3.003	3.00
Chloroform	2.670	2.678	8.00
extract	2.600	2.668	8.00

$$\% \text{ Alkaloid} = \frac{W_2 - W_1}{\text{Weight of sample}} \times 100$$

Where, weight of sample = 0.1g

Table 6: Cardiac Glycoside contents of *Ximenia caffra* leaf extract

Sample code	Sample absorbance at 495nm	mg of SECURIDA SIDE/g of extract
Methanolic	0.238	1.09
extract	0.240	1.10
n-hexane	0.123	0.59
extract	0.122	0.59
Chloroform	0.176	0.82
extract	0.174	0.81

Cardiac Glycoside calibration curve equation

y = 2.285x - 0.012 where y = absorbance; x = concentration and Df = Dilution fraction

Table 7: Saponin contents of *Ximenia caffra* leaf extract

DE = Diospenin Equivalent

Sample code	Sample absorbance at 550nm	mg of GAE/g of extract
Methanolic	1.913	38.36
extract	1.915	38.40
n-hexane	1.723	34.56
extract	1.723	34.56
Chloroform	1.791	35.92
extract	1.793	35.96

Saponin standard calibration curve equation

y = 0.0005x - 0.0052

y = absorbance

x = concentration

Table 8: Summary of the quantitative analysis of *Ximenia caffra*

Phytochemical	Extract	Wavelenght (nm)	Absorbance	Concentration
Tannin	Methanolic extract	725	0.1665	4.17
	n-hexane extract	725	0.1095	3.17
	Chloroform extract	725	0.1335	3.59
Total phenol	Methanolic extract	550	1.148	191.665
	n-hexane extract	550	0.6285	105.085
	Chloroform extract	550	0.8965	149.75
Flavonoid	Methanolic extract	510	1.362	304
	n-hexane extract	510	1.1375	127.055
	Chloroform extract	510	1.2785	142.725
Cardiac glycoside	Methanolic extract	459	0.239	1.095
	n-hexane extract	459	0.1225	0.59
	Chloroform extract	459	0.175	0.815
Saponin	Methanolic extract	544	1.914	38.38
	n-hexane extract	544	1.723	34.56
	Chloroform extract	544	1.792	35.94
Phytochemical	Extract	Weight of paper	Weight of paper + alkaloid	Concentration
Alkaloid	Methanolic extract	2.635	2.648	13
	n-hexane extract	3.06	3.0635	3.5
	Chloroform extract	2.665	2.673	8

Total phenol compounds play an important role in regulating the various metabolite functions including structure and growth, pigmentation and are resistant to different pathogens in plants [28]. Saponins also play an important role in the reduction of blood cholesterol level. They lower the risk of human cancers by preventing cancer cells from growing and also help in boosting our immune system [29]. Tannins

and glycosides have been reported to have anti-bacteria potentials [30]. Alkaloids are basic essential medicinal agents, known for their analgesic, antispasmodic and bactericidal effects [31]. The high concentration of flavonoids and phenols in the extracts makes the plant a potent antioxidant and antibiotic.

5.0 Conclusion

The phytochemical analysis of *Ximenia caffra* (sour plum) leaf was evaluated; extracts of the leaves of the plants from n-hexane, methanol and chloroform were subjected to photochemical screening which was done using standard methods. The phytochemical screening of the test plant revealed the presence of saponins, alkaloids, glycosides, phenols, tannins and amino acids and flavonoids and it also detects the presence of Carbohydrate, Protein/, Amino acids, Fats and oil, Alkaloids, Glycosides, Flavonoids, Tannins, Saponins, Phenolics compounds, Steroids and Triterpenoids. The result of qualitative and quantitative analysis shows that methanolic extract has more effect on all the parameters tested than chloroform extract and n-hexane extract. The findings of this study support the use of sour plum leaves as alternative system of medicine, and that, using methanol as a solvent for extraction if preferred.

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