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PHYTOCHEMICAL PROFILING OF *ASTERACANTHA LONGIFOLIA* AND *MORINGA OLEIFERA*: A COMPARATIVE ANALYSIS OF SOXHLET AND MICROWAVE-ASSISTED EXTRACTION METHOD

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Keywords:

Asteracantha longifolia, *Moringa oleifera*, Phytochemical, Soxhlet Extraction, and Microwave-assisted extraction

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ABSTRACT: Plants have rich deposits of phytochemical constituents, which are responsible for their medicinal uses. Different extraction methods like Soxhlet and microwave-assisted extractions are used to isolate these phytochemicals from plant materials. However, there is a lack of studies on a comprehensive comparison of phytochemical profiles obtained from different plant materials using Soxhlet and microwave-assisted extraction methods. Therefore, this research is carried out to investigate the presence and quantification of phytochemicals in *Asteracantha longifolia* and *Moringa oleifera* using Soxhlet extraction and Microwave-assistedextraction methods. The extraction process is carried out using solvents like ethanol, hydro-alcoholic solution, and distilled water. In both extraction methods, the highest yield is obtained for the stem and leaves of *Moringa oleifera* with distilled water. Soxhlet extraction with distilled water exhibited the highest extract yield potential i.e., 12.68% for *Moringa oleifera* (Stem and leaves) and 9.62% for *Asteracantha longifolia* (Root). In the microwave-assisted extraction method, *Moringa oleifera* (Stem and leaves) obtained the highest yield of 19.2%, 28.7%, and 33.2% with the solvent's ethanol, hydro-alcoholic solution, and distilled water, respectively. *Asteracantha longifolia* (Root) exhibits a low yield of 0.91% with ethanol and 1.06% with distilled water. The phytochemical screening shows the presence of phytochemical compounds. Furthermore, the result shows that the highest total phenol content is obtained using microwave-assisted extraction, and the highest total flavonoid content is obtained using the Soxhlet extraction methods.

INTRODUCTION: The world is enriched with varieties of medicinal plants. Their medicinal and pharmacological properties are attributed to bioactive components that exert specific physiological effects on the human body [1]. *Asteracantha longifolia* and *Moringa oleifera* are plants with significant medicinal properties and are used for different medicinal purposes.

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Asteracantha longifolia is traditionally used for diuretic and hepatoprotective properties, while *Moringa oleifera* is known for its rich nutritional and antioxidant profile. Both the plants are rich in phytochemicals [2,3]. Phytochemicals are biologically active, naturally occurring chemical compounds found in plants that provide health benefits for humans as medicinal ingredients and nutrients [4].

The major phytochemicals include carbohydrates, proteins, amino acids, chlorophylls, alkaloids, saponins, steroids, flavonoids, and tannins. Plants are a rich source of polyphenols and flavonoids, which protect the body against oxidative stress and maintain the balance between oxidants and antioxidants [5, 6].

Various extraction techniques have been used to obtain the phytochemicals from different plant parts. These extraction techniques include the conventional solvent-based (Soxhlet extraction method) and the more robust modern and green extraction techniques (Microwave-assisted extraction method) [7, 8]. Soxhlet and microwave-assisted extraction are automated techniques that enhance extraction efficiency. While Soxhlet is a continuous solvent-based process, microwave-assisted extraction provides reduced solvent usage and shorter extraction time. Both extraction methods are considered as commonly used methods for phytochemical extraction from plants [9, 10].

The extraction methods and employed solvents significantly effect on extraction of phytochemicals. The results revealed that the extraction efficiency for the maceration with methanol showed significant residue yield and the content of Betulin. Also, ultrasound-assisted extraction with ethanol demonstrated better selectivity for phytochemicals of *Asteracantha longifolia (L.) Nees* collected from the western ghat of Maharashtra [11]. The yield obtained by the Soxhlet extraction method using ethanol, hexane, and petroleum ether was 42%, 38.9%, and 38%, respectively, in *Moringa oleifera* seeds of Brazil. Microwave-assisted extraction with hexane and petroleum ether showed oil yields of 35.9% and 35.8%, respectively [12].

The optimum formulation was obtained with an optimal extraction time of 2.119 minutes, ethanol concentration of 57.618%, and solid-solvent ratio of 1:15 g/mL using microwave-assisted extraction [13]. *Moringa oleifera* oil from microwave-assisted and Soxhlet extraction methods had good yields of 34.25% and 28.75%, respectively, and a low moisture content of 0.008% and 0.011%, respectively [14]. Existing studies focused on various conventional and modern methods of phytochemical extraction from plants. Many studies expressed these views, particularly on the extraction of bioactive compounds from plant materials. However, limited studies have directly compared the efficiency of Soxhlet extraction and microwave-assisted extraction in isolating phytochemicals from specific medicinal plants. Therefore, this research is carried out to investigate the presence and quantification of phytochemicals in *Asteracantha longifolia* and *Moringa oleifera* using Soxhlet extraction and microwave-assisted methods.

MATERIALS AND METHODS:

Sample Collection: The plant parts, such as the aerial parts and roots of *Asteracantha longifolia* and the stem and leaves of *Moringa oleifera* were collected from nearby areas of Sambalpur. Dust particles were removed by washing with tap water followed by distilled water and then the plant materials were air-dried. The dried plant material was ground to a fine powder using a mechanical grinder and kept in airtight polybags.

Soxhlet Extraction: The powder samples were taken for Soxlet extraction. 60g powder of aerial parts and 54g of *Asteracantha longifolia* root; 54g of *Moringa oleifera* stem and leaves were used for Soxhlet extraction. Ethanol, distilled water, and a hydro-alcoholic solution (ethanol: distilled water, 70:30) were used as solvent. To guarantee the highest phytochemical output, the extraction procedure was conducted for 48 hours and included continuous cycles of solvent reflux and condensation. After passing through the Whatman filter paper, the extracts were concentrated at 50°C in a rotary evaporator. Extraction of different plant material is shown in **Fig. 1**.

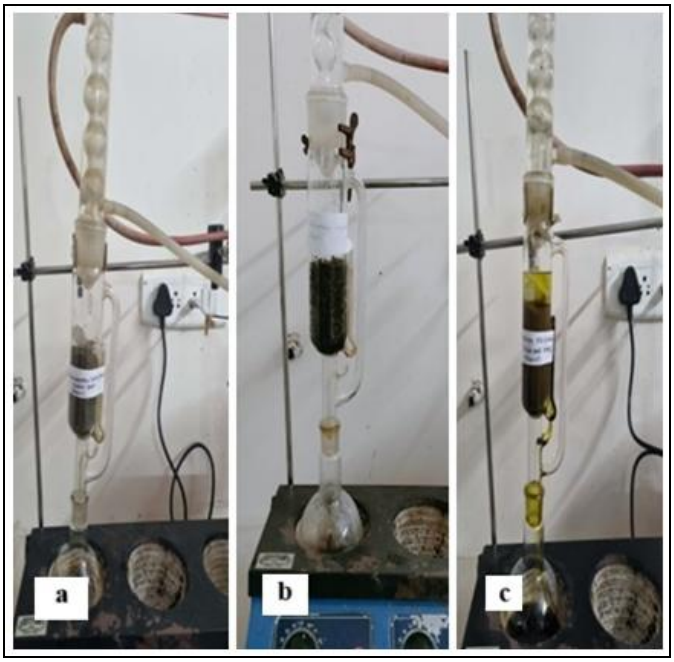

FIG. 1: SOXHLET EXTRACTION OF PLANT SAMPLES (a) AERIAL PART, (b) ROOT, (c) STEM AND LEAVES

Microwave-assisted Extraction: For microwave-assisted extraction, 25g powder sample of aerial parts and 15g of root of *Asteracantha longifolia* and 30g powder sample of stem and leaves of *Moringa oleifera*, were taken and extracted using ethanol, hydro-alcoholic solution, and distilled water. The extraction was performed at 500W microwave power for 5 minutes per cycle, followed by centrifugation at 7000 rpm for 10 minutes. The supernatant was collected, and the solvent was evaporated at room temperature. The dried extracts were scraped from Petri plates for further analysis, as shown in **Fig. 2**.

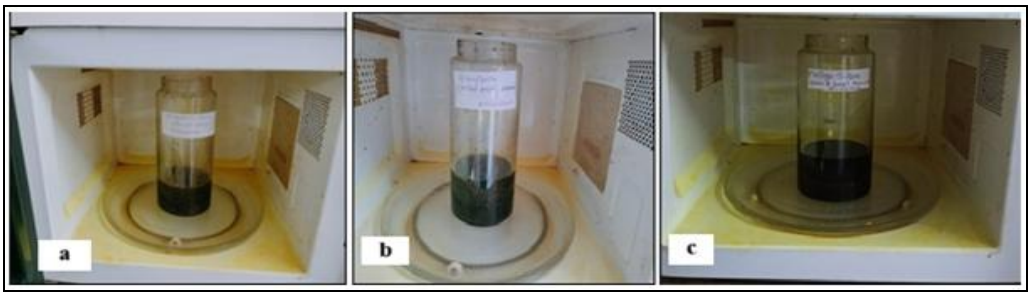

FIG. 2: MICROWAVE-ASSISTED EXTRACTION OF PLANT SAMPLES (a) AERIAL PART, (b) ROOT, (c) STEM AND LEAVES

Determination of Percentage Yield: Percentage yield measures the effectiveness of the entire extraction process. % yield was calculated using the formula given below:

Percentage yield = (Weight of extract) / (Weight of powder sample taken) × 100

Qualitative Phytochemical Screening: Qualitative phytochemical screening is a method used to identify the presence or absence of various classes of natural compounds, such as alkaloids, glycosides, flavonoids, diterpenes, phenols, proteins, carbohydrates, saponins, tannins, and sterols. Qualitative phytochemical screening was done by using various standard methods, such as Wagner's Test, Hager's Test, Concentrated H_2SO_4 Test, Alkaline Reagent Test, Lead acetate Test, Copper acetate Test, Ferric Chloride Test, Folin Ciocalteu Test, Biuret test, Fehling's Test, Benedict's test, Froth Test, Gelatin Test, and Salkowski Test, which is shown in **Table 1**.

TABLE 1: METHODS TO IDENTIFY PHYTOCHEMICAL CONSTITUENTS

Phytochemicals	Test	Observation (presence of phytochemicals)
Alkaloids	**Wagner's Test:** 1ml of extract in a test tube was mixed with 3 drops of Wagner's reagent [15].	Reddish-brown precipitate
	Hager's Test: 2ml of the extract was mixed with a few drops of Hager's reagent [15].	Yellow precipitate
Glycoside	**Concentrated H_2SO_4 Test:** The extract was dissolved in distilled water and treated with a few drops of conc. H_2SO_4 [16].	Red precipitate
Flavonoids	**Alkaline Reagent Test:** Extracts were treated with a few drops of sodium hydroxide solution [15].	Intense yellow colour, which becomes colourless with the addition of dilute acid
	Lead acetate Test: Extracts were treated with a few drops of lead acetate solution [15].	Yellow precipitate
Diterpenes	**Copper acetate Test:** Extracts were dissolved in water and treated with 3-4 drops of copper acetate solution [15].	Emerald green precipitate
Phenols	**Ferric Chloride Test:** Extract was treated with 3-4 drops of ferric chloride solution [15].	Bluish black precipitate
	Folin Ciocalteu Test: 1 ml extract was added to 1 ml Folin Ciocalteu reagent [17].	Blue-green precipitate
Proteins	**Biuret Test:** 40% NaOH solution and two drops of 1% copper sulphate solution were added to 0.5 mg of the extract [18].	A pink solution in the ethanolic layer
Carbohydrates	**Fehling's Test:** Extracts were dissolved individually in 5 ml of distilled water and filtered. This filtrate was hydrolyzed with dil. HCl, neutralized with alkali, and heated with Fehling's A & B solutions [15].	Red precipitate

	Benedict's Test: Extracts were dissolved individually in 5 ml of distilled water and filtered. This filtrate was treated with Benedict's reagent and heated gently [15].	Orange-red precipitate
Saponins	**Froth Test:** Extracts were diluted with distilled water to 20ml and this was shaken in a graduated cylinder for 15 minutes [15].	1 cm layer of foam
Tannins	**Gelatin Test:** 1% gelatin solution containing sodium chloride was added to the extract [15].	White precipitate
Sterols	**Salkowski Test:** 3-4 drops of Conc. Sulphuric acid were added to the extract in chloroform [16].	Red colour appears at the lower layer

Quantitative Analysis of Phytoconstituents:

Estimation of Total Phenol Content: The total phenolic content was determined using the modified Folin-Ciocalteu technique [19]. A standard calibration curve was prepared using gallic acid (10–50 µg/mL). The plant extracts (10 mg/mL) were reacted with 1 mL of Folin-Ciocalteu reagent (diluted 1:10 v/v) and 1 mL of 7.5% sodium carbonate solution. After incubation at room temperature for 15 minutes, the absorbance was measured at 765 nm using a UV-Vis spectrophotometer (Shimadzu UV-1800). The results were expressed as mg of gallic acid equivalents (GAE) per gram of extract.

Estimation of Total Flavonoid Content: Total flavonoid content was determined using the aluminium chloride colorimetric assay [19]. A standard quercetin curve (5–25 µg/mL) was prepared. 3 mL of plant extract (10 mg/mL) was mixed with 1 mL of 2% $AlCl_3$ solution and allowed to incubate at room temperature for 15 minutes. The absorbance was measured at 420 nm, and flavonoid concentration was expressed as mg quercetin equivalents (QE) per gram of extract.

RESULTS:

Yield Potential of Extract: Extracts from various parts of the *Asteracantha longifolia* and *Moringa oleifera* were obtained using a variety of solvents, thus resulting in significant differences in the yield for each solvent. **Table 2** illustrates the extract yield obtained in different solvents using the Soxhlet method and microwave-assisted method.

TABLE 2: YIELD POTENTIAL OF PLANT EXTRACT

Plant material	Extract	Weight of plant material (g)		Weight of extract (g)		% Yield (W/W)	
		Soxhlet extraction	Microwave assisted extraction	Soxhlet extraction	Microwave assisted extraction	Soxhlet extraction	Microwave assisted extraction
Asteracantha longifolia (Aerial parts)	Ethanol	60	25	1.83	0.30	3.05%	1.2%
	Hydro-alcoholic	60	25	2.70	1.20	4.5%	4.8%
	Distilled water	60	25	3.39	2.13	5.65%	8.52%
Asteracantha longifolia (Root)	Ethanol	54	15	1.87	0.14	3.46%	0.91%
	Hydro-alcoholic	54	15	1.17	1.09	2.16%	7.3%
	Distilled water	54	15	5.20	0.16	9.62%	1.06%
Moringa oleifera (Stem and leaves)	Ethanol	54	30	1.63	5.78	3.01%	19.2%
	Hydro-alcoholic	54	30	5.11	8.61	9.46%	28.7%
	Distilled water	54	30	6.85	9.9	12.68%	33.2%

Phytochemical Screening using Soxhlet and Microwave-assisted Method: All the extracts were evaluated for the occurrence of the phytochemical constituents. The results of the qualitative phytochemical analysis are given in **Table 3**, where the '✓' sign indicates the presence of that constituent or the '×' sign indicates the absence.

TABLE 3: PHYTOCHEMICAL SCREENING

Constituents		Plant material	Ethanolic extract		Hydroalcoholic extract		Aqueous extract	
			Soxhlet	Microwave assisted	Soxhlet	Microwave assisted	Soxhlet	Microwave assisted
Alkaloids	Wagner's Test	Aerial parts	✓	✓	×	✓	×	×
		Root	✓	×	×	×	✓	×
		Stem and leaves	×	✓	×	✓	×	✓
	Hager's Test	Aerial parts	✓	✓	×	✓	×	×
		Root	×	×	×	×	×	×

		Stem and leaves	×	×	×	✓	×	✓
Glycosides	Conc.	Aerial parts	×	×	×	×	×	×
	H_2SO_4	Root	×	✓	×	×	×	×
	Test	Stem and leaves	✓	×	×	×	×	×
Flavonoids	Lead	Aerial parts	✓	×	✓	✓	✓	✓
	acetate	Root	✓	✓	✓	×	×	×
	Test	Stem and leaves	✓	✓	✓	✓	✓	✓
	Alkaline	Aerial parts	×	✓	✓	✓	✓	×
	test	Root	×	×	✓	×	✓	×
		Stem and leaves	×	×	×	×	×	×
Diterpenes	Copper	Aerial parts	×	×	×	✓	✓	×
	acetate	Root	✓	×	✓	✓	×	✓
	Test	Stem and leaves	×	✓	×	×	×	×
Phenol	Ferric	Aerial parts	×	×	×	✓	×	×
	Chloride	Root	×	✓	×	×	×	×
	Test	Stem and leaves	✓	×	✓	×	×	✓
	Folin	Aerial parts	×	✓	×	✓	×	×
	Ciocalteu	Root	✓	✓	✓	✓	✓	✓
	Test	Stem and leaves	✓	✓	✓	×	✓	×
Proteins	Biuret test	Aerial parts	×	×	×	×	×	×
		Root	×	×	×	✓	×	×
		Stem and leaves	✓	×	×	×	×	×
Carbohydrate	Fehling's	Aerial parts	×	×	×	×	×	×
	Test	Root	×	×	×	×	×	×
		Stem and leaves	✓	×	×	×	×	×
	Benedict's	Aerial parts	×	×	×	×	×	×
	Test	Root	×	×	×	×	×	×
		Stem and leaves	×	×	×	×	×	×
Saponins	Froth Test	Aerial parts	×	×	×	✓	×	×
		Root	×	×	×	×	×	✓
		Stem and leaves	✓	×	✓	×	✓	✓
Tannins	Gelatin	Aerial parts	×	✓	×	✓	×	×
	test	Root	×	×	×	×	✓	✓
		Stem and leaves	×	×	×	×	✓	×
Sterols	Salkowski	Aerial parts	✓	✓	×	×	×	×
	Test	Root	×	×	×	×	✓	×
		Stem and leaves	×	×	×	×	×	×

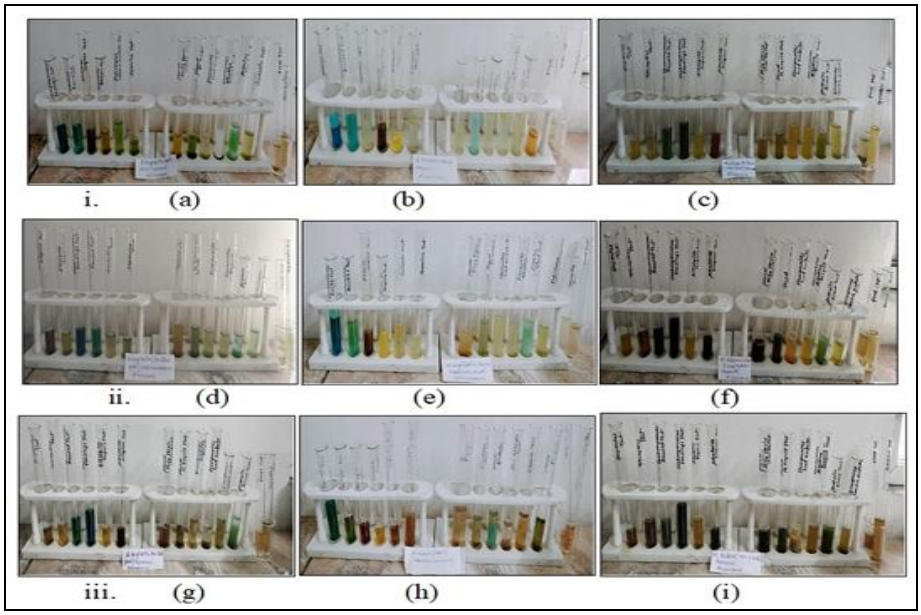

FIG. 3: MICROWAVE-ASSISTED EXTRACTION USING (i) ETHANOLIC EXTRACT FOR (a) AERIAL PART, (b) ROOT, (c) STEM AND LEAVES, (ii) HYDRO-ALCOHOLIC EXTRACT FOR (d) AERIAL PART, (e) ROOT, (f) STEM AND LEAVES, (iii) AQUEOUS EXTRACT FOR (g) AERIAL PART, (h) ROOT, (i) STEM AND LEAVES

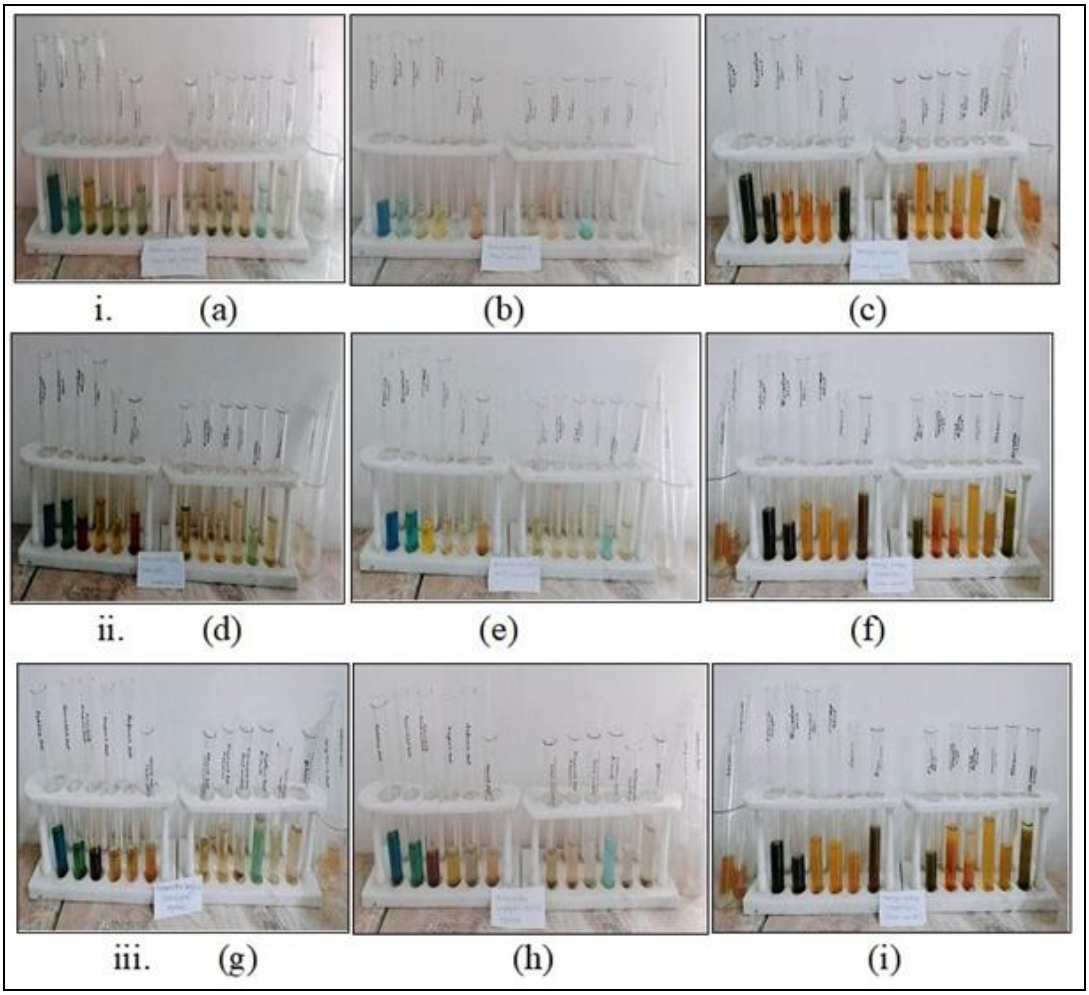

FIG. 4: SOXHLET EXTRACTION USING (i) ETHANOLIC EXTRACT FOR (a) AERIAL PART, (b) ROOT, (c) STEM AND LEAVES, (ii) HYDRO-ALCOHOLIC EXTRACT FOR (d) AERIAL PART, (e) ROOT, (f) STEM AND LEAVES, (iii) AQUEOUS EXTRACT FOR (g) AERIAL PART, (h) ROOT, (i) STEM AND LEAVES

Estimation of Total Phenolic Content and Total Flavonoid Content: The total phenolic and flavonoid contents of ethanol, hydro-alcoholic solution, and distilled water extracts from the aerial part and root of *Asteracantha longifolia* and stem and leaves of *Moringa oleifera* were tested. The result of the total phenolic contents was expressed as mg/100mg of the gallic acid equivalent of dry extract sample using the equation of a calibration curve $\gamma = 0.019x+0.021$, $R^2 = 0.998$ as shown in **Fig. 5(A)**, where x is the gallic acid equivalent and y is the absorbance. Total flavonoid contents were expressed as quercetin equivalent using the equation $\gamma = 0.047x+0.016$, $R^2 = 0.998$ as shown in **Fig. 5(B)**, where x is the quercetin equivalent.

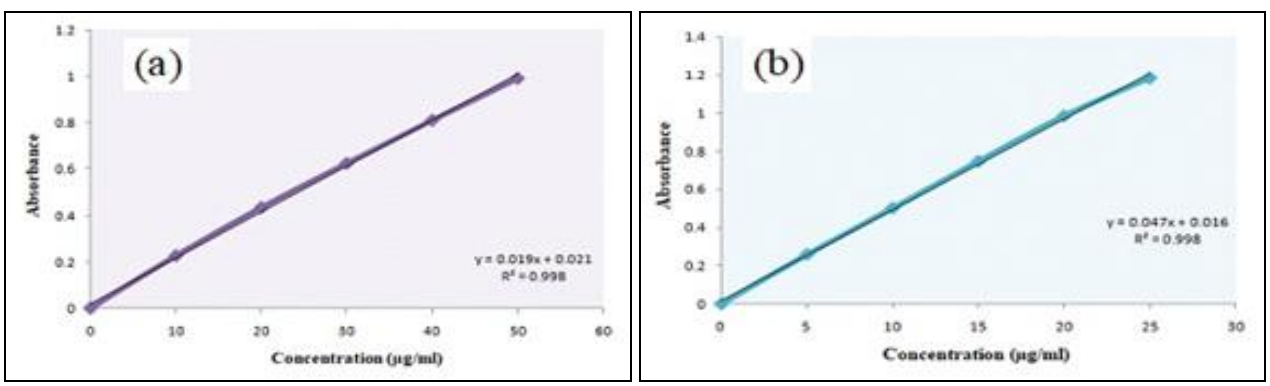

FIG. 5: CALIBRATION CURVES FOR (a) GALLIC ACID, (b) QUERCETIN

The folin-Ciocalteu technique and aluminium chloride colorimetric assay were used to determine the total phenol and flavonoid content. **Table 4** shows the total phenol and flavonoid content obtained using the Soxhlet and microwave-assisted extraction methods.

TABLE 4: TOTAL PHENOL AND FLAVONOID CONTENT

Plant Material	Extract	Total phenol content (mg/100mg)		Total flavonoids content (mg/100mg)	
		Soxhlet extraction	Microwave-assisted extraction	Soxhlet extraction	Microwave-assisted extraction
Asteracantha longifolia (Aerial parts)	Ethanolic	-	1.14	1.10	1.11
	Hydro-alcoholic	-	0.49	0.82	0.85
	Distilled water	-	-	0.52	0.46
Asteracantha longifolia (Root)	Ethanolic	0.66	1.03	0.92	1.27
	Hydro-alcoholic	0.8	0.11	0.89	-
	Distilled water	0.56	0.32	0.86	-
Moringa oleifera (Stem and leaves)	Ethanolic	1.04	1.14	1.28	1.25
	Hydro-alcoholic	0.66	-	0.96	0.63
	Distilled water	0.40	0.27	0.35	0.28

The result showed that the highest total phenol content was obtained for ethanolic extract of *Moringa oleifera* (Stem and leaves) using Soxhlet extraction and *Asteracantha longifolia* (Aerial part) and *Moringa oleifera* (Stem and leaves) using microwave-assisted extraction. Also, the highest total flavonoid content was obtained for the ethanolic extract of *Moringa oleifera* (Stem and leaves) using Soxhlet extraction and *Asteracantha longifolia* (root) using microwave-assisted extraction. However, the root extract of *Asteracantha longifolia* using the soxhlet extraction method with solvents, such as ethyl acetate, ethanolic, and aqueous extracts was examined [25]. The study found that the total phenol content and total flavonoid content with ethanolic extract were 0.529 mg/100mg and 0.608 mg/100mg, respectively, and with aqueous extract were 0 and 0.251 mg/100mg, respectively.

DISCUSSION: In the present work an attempt has been made to study the presence and quantification of phytochemicals in *Asteracantha longifolia* and *Moringa oleifera* using Soxhlet extraction and microwave-assisted methods. Soxhlet extraction with distilled water exhibited the highest extract yield potential i.e., 12.68% for *Moringa oleifera* (Stem and leaves) and 9.62% for *Asteracantha longifolia* (Root). In the microwave-assisted extraction method, *Moringa oleifera* (Stem and leaves) obtained the highest yield of 19.2%, 28.7%, and 33.2% with the solvent's ethanol, hydro-alcoholic solution, and distilled water, respectively. *Asteracantha longifolia* (Root) exhibits a low yield of 0.91% with ethanol and 1.06% with distilled water. In both extraction methods, distilled water solvent extract had the maximum yield. Further, the microwave-assisted extraction method obtained the highest yield (33.2%) in stem and leaves of *M. oleifera*. In contrast to the present study, [20] found that the highest yield of 28.40% was obtained by *Moringa oleifera* using the Soxhlet extraction method with n-hexane as the solvent. Also, the yield obtained through the microwave-assisted extraction method was 6.90%. In another study, [21] examined the aerial parts, leaves, and seeds of *Hygrophila auriculata* (*Asteracantha longifolia*) using conventional extraction techniques. They found the plant extract yield of 4.15 % for aerial parts with the ethanolic extract and a high yield of 22.8 % and 35.64 % for seeds with ethanolic and hexane extracts, respectively, using the Soxhlet extraction method.

Another researcher [27] analyzed the leaves of *Moringa oleifera* using a microwave-assisted extraction method and showed an extraction yield of 14.64 to 17.65% with a hydroethanolic extract, which is less than the present study (28.7%). As the distilled water and ethanol are polar solvent that exhibit much plant extract yield potential in both extraction techniques. The polar solvents have the potentialities to extract polar compounds like flavonoids and polyphenols. Also, solvent-to-solid ratio is responsible for extract yield potential. The present study found that there were no sterols in the stem and leaves of *Moringa oleifera* with ethanolic, hydroalcoholic, and aqueous extracts. Carbohydrates were only present in the stem and leaves of *Asteracantha longifolia* with ethanolic

extract using the Soxhlet extraction method. Also, Saponins were present in the steam and leaves of *Moringa oleifera*. Similar to the present study, a separate study [22] found that there was a presence of saponins in the leaf extracts of *Moringa oleifera* [23]. tested in the methanolic extract from the leaves of *Asteracantha longifolia* for the availability of phytochemicals and confirmed the presence of terpenoids, alkaloids, flavonoids, phenols, steroids, glycosides, saponins, tannins, carbohydrates, and proteins. The study of [28] revealed that the presence or absence of particular phytochemicals is determined by the polarity of the solvents used for extraction. Also, justified that *M. oleifera* contain rich phytochemicals, including alkaloids, flavonoids, phenolics, terpenoids, tannins, and saponins, that are known to have pharmacological properties. In the present study, the Folin Ciocalteu Test showed that phenols are present on the root of *Asteracantha longifolia with* ethanolic, hydroalcoholic, and aqueous extract using both Soxhlet and microwave-assisted extraction methods. Also, the study showed that glycosides are only presented in the roots of *Asteracantha longifolia* using the microwave-assisted method and stem and leaves of *Moringa oleifera* using the soxhlet method with the ethanolic extract.

Alkaloids are absent in root extract of *Asteracantha longifolia*. Compared to the current study, another author [24] stated that there were no glycosides present in the leaves of *Hygrophila auriculata* (*Asteracantha longifolia*) with the ethanolic extract. In the present study, the total phenol and flavonoid content with ethanolic extract for the root of *Asteracantha longifolia* were 0.66 mg/100mg and 0.92 mg/100mg, respectively. Researchers [26] examined the seeds of *Moringa oleifera* for the total phenol and flavonoid content using the Soxhlet extraction method and found a high value for methanolic extract. Similar to the present study, [27]analyzed the leaves of *Moringa oleifera* using a microwave-assisted extraction method and revealed a total phenol content of 63.36 to 76.40 mg GA/gram. Phenolic compounds act as a potent antioxidant and for instance, medicinal plants are rich reservoirs of phenolic compounds [29].

CONCLUSION: The present study examined the phytochemicals in *Asteracantha longifolia* and *Moringa oleifera* using two extraction methods: microwave-assistedand Soxhlet extraction. The study further investigated the yield obtained from various parts of *Asteracantha Longifolia* and *Moringa Oleifera* using solvents, such as ethanol, hydro-alcoholic solution, and distilled water. Among them, *Moringa oleifera* (Stem and leaves) obtained the highest yield of 33.2% with distilled water using the microwave-assisted extraction method and 12.68% using the soxhlet extraction method. The phytochemical screening showed the presence of phytochemical compounds, such as alkaloids, glycosides, flavonoids, diterpenes, phenol, proteins, carbohydrates, saponins, tannins, and sterols. The research showed that microwave-assisted extraction obtained a higher total phenol content of 1.14 mg/100mg with ethanolic extract for the aerial parts of *Asteracantha longifolia* and stem and leaves of *Moringa oleifera.* Further, soxhlet extraction obtained a higher total flavonoid content of 1.28 mg/100mg for the stem and leaves of *Moringa oleifera* with ethanolic extract. Using distilled water for both the microwave-assisted extraction method and the Soxhlet extract method could provide a high extraction yield for plant materials. Also, the microwave-assisted extraction method could be efficient for obtaining higher total phenol content. Furthermore, the Soxhlet extract method could be efficient for obtaining higher total flavonoid content. There is need of further study on antioxidant, anti-inflammatory, antimicrobial and anti-cancer activity of this plant extract.

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CONFLICT OF INTEREST: No conflicts of interest to declare.

REFERENCES:

1. Koche DE, Shirsat RU and Kawale MA: An overview of major classes of phytochemicals: their types and role in disease prevention. Hislopia Journal 2016; 9(1/2): 1-11.
2. Dash AK, Dutta GK, Sahoo G, Sardar KK and Mishra SK: Nutri-biochemical composition of *Asteracantha longifolia*. Medicinal Plants-International Journal of Phytomedicines and Related Industries 2015; 7(3): 233-6.
3. Bhattacharya A, Tiwari P, Sahu PK and Kumar S: A review of the phytochemical and pharmacological characteristics of *Moringa oleifera*. Journal of Pharmacy and Bioallied Sciences 2018; 10(4): 181-91.

4. Alara OR, Abdurahman NH, Ukaegbu CI and Kabbashi NA: Extraction and characterization of bioactive compounds in *Vernonia amygdalina* leaf ethanolic extract comparing Soxhlet and microwave-assisted extraction techniques. Journal of Taibah University for Science 2019; 13(1): 414-22.
5. Nigam V, Mishra RK, Gupta A and Kumar M: Pharmacognostic study, characterization of marker compounds and pharmacological review of aerial parts of *Hygrophila auriculata* (Schumach.) Heine. World J Pharm Pharmaceutic Science 2015; 4(12): 1127-1143.
6. Alias NH and Abbas Z: Microwave-assisted extraction of phenolic compound from pineapple skins: The optimum operating condition and comparison with Soxhlet extraction. Malaysian Journal of Analytical Sciences 2017; 21(3): 690-699.
7. Baig FK and Sangvikar RV: Conventional and novel techniques of phytochemical extraction. International Journal of Botany Studies 2024; 9(10): 27-33.
8. Bitwell C, Indra SS, Luke C and Kakoma MK: A review of modern and conventional extraction techniques and their applications for extracting phytochemicals from plants. Scientific African 2023; 19: 01585.
9. Mosić M, Dramićanin A, Ristivojević P and Milojković-Opsenica D: Extraction as a critical step in phytochemical analysis. Journal of AOAC International 2020; 103(2): 365-372.
10. Mustapa AN, Martin Á, Mato RB and Cocero MJ: Extraction of phytocompounds from the medicinal plant *Clinacanthus nutans* Lindau by microwave-assisted extraction and supercritical carbon dioxide extraction. Industrial Crops and Products 2015; 74: 83-94.
11. Raval SE, Saple SR and Vaidya VV: Methods for phytochemical extraction from *Asteracantha longifolia* (L.) Nees, a comparative analysis. Journal of Pharmacognosy and Phytochemistry 2024; 13(6): 1-5.
12. Souza DE, Melo JJ, Santos FF, Vasconcelos AL, Jesus AD, Freitas LD, Souza RL and Soares CM: Microwave-assisted vs. Conventional extraction of *Moringa oleifera* seed oil: process optimization and efficiency comparison. Foods 2024; 13(19): 3141.
13. Makkiyah FA, Pradana DL, Putra RP and Nurcholis W: Optimization microwave-assisted extraction of *Moringa oleifera* leaves using response surface methodology focused on extracting phenolic and flavonoid with antioxidant activity. Tropical Journal of Natural Product Research 2024; 8(6): 7474-7482.
14. Nebolisa NM, Umeyor CE, Ekpunobi UE, Umeyor IC and Okoye FB: Profiling the effects of microwave-assisted and Soxhlet extraction techniques on the physicochemical attributes of *Moringa oleifera* seed oil and proteins. Oil Crop Science 2023; 8(1): 16-26.
15. Patil DK and Jain AP: Extraction, Qualitative and Quantitative Determination of Secondary Metabolites of *Corchorus Olitorius*: Journal of Drug Delivery and Therapeutics 2019; 9(1): 252-255.
16. Vishwakarma A and Shrivastava K: Isolation and structural characterization of bioactive compound from *Phyllanthus niruri*. Cuestiones de Fisioterapia 2025; 54(3): 699-709.
17. Godlewska K, Pacyga P, Najda A and Michalak I: Investigation of chemical constituents and antioxidant activity of biologically active plant-derived natural products. Molecules 2023; 28(14): 5572.
18. Matlala T, Maseko RB and Kgosana KG: Antioxidant properties, anti-nutritive and toxic factors of *Terminalia sericea* in Onderstepoort. The Onderstepoort Journal of Veterinary Research 2024; 91(1): 2172.
19. Darshana IG and Hemant S: Quantitative analysis of phytoconstituents and *in-vitro* antioxidant activity of *Pyrostegia venusta*leaves. Journal of Chemical Health Risks 2024; 14(2): 1-6.
20. Mohd SBY: Comparison study on the extraction of *Moringa oleifera*seeds oil by Soxhlet and Microwave methods. Thesis. Universiti Malaysia Pahang 2015.
21. Malpotra M, Garg M, Singh N, Sadhu SD, Chopra R and Sharma B: An overview of bioactive components and phytopharmaceutical potentials of *Hygrophila auriculata*-A herbaceous medicinal plant. Phytomedicine Plus 2025; 100737.
22. Oladeji OS, Odelade KA and Oloke JK: Phytochemical screening and antimicrobial investigation of *Moringa oleifera* leaf extracts. African Journal of Science Technology. Innovation and Development 2020; 12(1): 79-84.
23. Veerakumar D and Muthulingam M: Preliminary phytochemical analysis and spectroscopic analysis of methanolic extract of *Asteracantha longifolia* (Nees.). Journal of Pharmaceutical Research International 2021; 33(19): 80-87.
24. Prasanna M and Sridhar S: Studies on phytochemical screening, tannin content and their antibacterial activity of *Hygrophila auriculata* leaf extracts. Int J Curr Science 2016; 19(4): 140-148.
25. Shukla AK, Malviya RK and Mishra JN: Analysis of phytoconstituents and antioxidant activity of root extract of *Asteracantha longifolia*. Journal of Pharmaceutical Negative Results 2022; 13(8): 1-5.
26. Ghafar F, Tengku Nazrin TN, Mohd Salleh MR, Nor Hadi N, Ahmad N and Azahari A: Total phenolic content and total flavonoid content in *Moringa oleifera* seed. Science Heritage Journal/Galeri Waris. Sains 2017; 1(1): 23-35.
27. Gunalan S, Thangaiah A, Janaki JG, Thiyagarajan A, Kuppusamy S and Arunachalam L: Optimization of microwave-assisted extraction method for increased extraction yield and total phenol content from moringa leaves (*Moringa oleifera* Lam.) var. PKM 1. Advances in Agriculture 2022; 2022(1): 1-9.
28. Sivapragasam G, Devi GT, Ragavan ND, Suryadevara N, Sridewi N, Al Obaid Sami, Ali Alharbi S and Arulselvan P: A comparative phytochemical characterization of *Moringa oleifera* plant parts by different solvent extraction Ind. J Pharm Edu.Res 2024; 58(2): 648-s659.
29. Jyotsna J Shodhganga: a reservoir of Indian theses @ INFLIBNET, 2023. http://hdl.handle.net/10603/532869

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