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EVALUATION OF ANTIMICROBIAL, ANTIOXIDANT ACTIVITIES AND TOTAL PHENOLIC CONTENTS OF *CORCHORUS TRIDENS.,* CRUDE EXTRACTS

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ABSTRACT

This study was carried out in Khartoum State, Sudan, during March, 2023. The plant of *Corchorus tridens.,* locally known Malokheya, it was chosen for this plant because it is being used traditionally in treatment of many diseases. The objective of the present study was to evaluate the *in vitro* antibacterial and antioxidant activity of n-hexane, chloroform, ethyl acetate and methanolic extracts of aerial parts from *Corchorus tridens.,*. In addition, total phenol, flavonoids, tannins of these extracts were determined. Extracts from the plant was prepared by sequential maceration of dried aerial parts powder in solvents of increasing polarity. The antibacterial activity was evaluated against Gram-positive and Gram-negative bacteria. Antioxidant activity were assessed based on the scavenging activity of the stable 2,2-Diphenyl- 1-picrylhydrazyl free radical (DPPH). Total polyphenolic, flavonoids and tannins contents were determined by spectrophotometric assays. Generally, the results of antimicrobial activity showed that extracts of the plant exhibited better antifungal activity than antibacterial. The results of antibacterial activity showed the highest in ethyl acetate and methanol extracts against *Bacillus sabtilis* and *Escherichia coli* (12±1.53 and 12±00mm respectively) flowed the methanol extract against *Pseudomonas aeruginosa* (11±2.52mm). While the highest antifungal activity showed the best value in methanolic extract against *Candida albicans* (19±1.00) and ethyl acetate against *Aspergillus niger,* (18±1.00mm). The highest scavenging radical activity was obtained from the methanol extract of aerial parts of *Corchorus tridens.,* (64±0.02%) while the n-hexane extract gave lowest than the methanol extract (44±0.01). Quantitative analysis revealed that the total polyphenolic content was in the range of 88.79±0.04 to 50.21±0.04mg gallic acid equivalents/g with highest value shown in ethyl acetate extract. The total flavonoids content was in the range of 1034.19±0.03 to 128.23±0.00mg quercetin equivalents/g with highest value recorded from the ethyl acetate extract, while total tannins content was the range of 136.87±0.08 to 0.091±0.03mg tannic acid equivalents/g with highest value found in the methanol extract. In conclusion, the studied of plant was rich in bioactive agents with antioxidant, antifungal activities and total phenolic, flavonoids and tannins contents potential and could have interesting pharmaceutical and cosmetic applications.

KEYWORDS: *Corchorus tridens.;* Antimicrobial activity; Antioxidant activity; Total phenolic.

1 INTRODUCTION

Medicinal plants are plants which contain substances that could be used for therapeutic purposes or which are precursors for the system of useful drugs.[1] Sudan is located in tropical Africa and has high plant diversity and a multinational population. In Sudan

and other developing countries traditional medicine plays a major role particularly in rural regions due to both economic and cultural reasons.[2]

Corchorus tridens (Jute) L. in Malvaceae family is a Annul herb plant.[3] Jute leaves are found to possess demulcent, diuretic, lactagogue, purgative, and tonic effects.[4] Different extracts showed potent antidiabetic, anticancer, antioxidant, antiinflammatory, antimicrobial, cardioprotective, hepatoprotective, neuroprotective, analgesic, and wound healing effects.[5] Seed also contained 2.25% raffinose, 11.3-14.8% oil (16.9% palmitic acid, 3.7% stearic acid, 62.5% linoleic acid, 0.9% linolenic acids,1.8% behenic acid, 1.1% lignoceiic acid, 9.1% oleic acid) and large portions of B, Mn, Mo, and Zn.[6] ß-sitosterol, scopoletin and fusidic acid were also isolated from the leaves.[7] Cardiac glycosides, triterpenes, ionones, phenolics, sterols, coumarins, steroids and fatty acids.[8]

Traditionally jute is cultivated for bast (phloem) fibre production. But in rural belts of Asian, African and European countries, tender leaves from young jute plants are consumed as green leafy vegetable.[9] The purpose of this research is to ascertain the antimicrobial, antioxidant activities and total phenolic contents of *Corchorus tridens.,* crude extracts.

2 MATERIAL AND METHODS

2.1 Plant Material

The Plants of aerial parts *Corchorus tridens., was* collected in March, 2023 from Obeid, North Kordofan State, Sudan. The plants species was taxonomically identified by Dr.Mubarak Siddig Hamad, herbarium Department of Taxonomy and Phytochemistry, Medicinal, Aromatic and Tradition Medicine Research Institute, National Center for Research, Khartoum, Sudan. The plant was washed thoroughly under running water to remove contamination and was shade dried with active ventilation at ambient temperature for 5 days; the dried aerial parts were to fine powder using pistil and mortar.

2.2 Preparation of extracts

Separately, 20 g of dried powdered aerial parts *Corchorus tridens.,* was extracted consecutively by maceration in hexane, chloroform, ethyl acetate and methanol (400 mL each) using a shaker apparatus, for about 24 h at room temperature, filtered and then solvents were evaporated under vacuum using a rotary evaporator. The resultant dry extracts from each sample were weighted and stored at 4°C until used.

2.3 Antimicrobial activity

The bacterial cultures used were *Bacillus subtilis* NCTC 8236, *Staphylococcus aureus* ATCC 25923, *Escherichia coli* ATCC 25922 and *Pseudomonas aeruginosa* ATCC 10145. The used fungi cultures were *Aspergillus niger* ATCC 9763 and *Candida albicans* ATCC 7596. Each extract (10 mg/disc) was tested using the disc diffusion method as described by Mbavenge and coworkers.[10]

2.4 Antioxidant activity

The antioxidant activity of the extracts was evaluated using the *in vitro* 2,2-Diphenyl-1-picrylhydrazyl (DPPH) radical scavenging method.[11]

2.5 Quantitative determination of total polyphenol, flavonoids and tannins contents

2.5.1 Determination of total polyphenols content

The total polyphenolic content was determined by adopting the method described by Wolfe *et al.*[12]

2.5.2 Determination of total flavonoids content

The total flavonoid content was determined by adopting the method described by Ordonez *et al.*[13]

2.5.3 Determination of total tannins content

Total tannins content was determined according to the procedure reported by Sun *et al.*[14]

2.6 Statistical analysis

All the procedures for extraction, antimicrobial, antioxidant activity and total phenolic content studies were repeated in triplicate. The descriptive analysis (mean and standard deviation) was used to discuss the results, assuming the normal distribution of the studied variables.

3 RESULT AND DISCUSSION

3.1 Antimicrobial activity

Hexane, chloroform, ethyl acetate and methanol extracts of *C.tridens* was evaluated for their antimicrobial activity. Results are depicted in Table 1. Inhibition zone value<14 mm is considered as resistance, 14-18 mm is intermediate and >18 mm is sensitive.[15] Extracts from the was studied plant displayed variable antimicrobial activity. The highest antibacterial activity was recorded against *B. sabtilis* and *Escherichia coli,* exerted by n-hexane and methanolic extracts of *Corchorus tridens.,* (12±1.53 and12±000mm).

The highest antifungal activity against *C. albicans* was recorded from the methanolic extract of *C. tridens* (19mm) flowed the *Aspergillus niger, against* ethyl acetate (18±1.00). Generally, extracts of the plant exhibited better antifungal activity than antibacterial activity. Variation in results from different methods could be attribute to to different factors like genetics,

ages and organs of the plant as well as environmental conditions by Dinnage *et al.,* (2019).[16]

Table 1: Antimicrobial activity of *Corchorus tridens.*

Botanical name	Organ	Extract	Inhibition zones diameter (IZD) in mm					
			B. s	*S. a*	*E. c*	*P. a*	*A. n*	*C. a*
C. tridens	Aerial parts	n- hexane	12±1.53	11±1.00	10±1.74	10±1.53	16±3.22	15±3.22
		Chloroform	11±1.16	NA	9±0.58	NA	NA	12±2.09
		Ethyl acetate	NA	NA	9±0.58	9±1.55	18±1.00	13±1.53
		Methanol	11±1.16	9±0.58	12±00	11±2.52	17±1.00	19±1.00
Nystatin*	SD	10µg/disc	15±0.02	13±0.03	17±0.03	14±0.76	NA	NA
Gentamicin*		10µg/disc	NA	NA	NA	NA	22±0.02	20±0.04

NA: not active, positive control (10µg/disc) B.s = *Bacillus subtiles.* S.a = *Staphylococcus aureus,* E.c = *Escherichia coli,* P.a = *Pseudomonas aeruginosa,* A.n = *Aspergillus niger,* C.a = *Candida albicans.* IZD (mm): > 18mm: Sensitive: 14-18mm: intermediate: < 14mm: Resistant.

3.2 Antioxidant activity

Antioxidant activity of extracts from the plants was determined by evaluating their capacity to scavenge the DPPH free radicals and results are presented in Table 2. The highest scavenging radical activity was exerted by the *Corchorus tridens.,* with the methanol extract gave highest activity (64±0.02%) followed by the n-hexane extract (44±0.01%).

Table 2: Antioxidant activity of *Corchorus tridens.*

Plant name	Organ	Extract	%RSA±SD (DPPH)
Corchorus tridens	Aerial parts	N- hexane	44±0.01
		Chloroform	15±0.04
		Ethyl acetate	24±0.05
		Methanol	64±0.02
Standard	SD	Propyl gallate	94±0.01

RSA=Radicals scavenging; DPPH= 2,2, Diphenyl-1- Picrylhydrazzyl.

3.3 Total polyphenolic, flavonoids and tannins contents

Results of total polyphenolic, flavonoids and tannins contents of different extracts from the two studied plants are presented in Table 3. Phenolic compounds are known as powerful chain breaking antioxidant[32] and they are very important plant constituents because of their scavenging ability, which is due to their hydroxyl group.[33] The highest total polyphenolic content showed in Ethyl acetate extract (88.79±0.04mg GAE/g) flowed methanol extract (65.52±0.04mg GAE/g).

The highest total flavonoids content was obtained from the ethyl acetate extract (1034.19±0.03mg QE/g), followed by chloroform extract (627.99±0.01mgQE/g). It was reported that the concentration of flavonoids in plant extracts and nature of extracted flavonoids depends on the polarity of solvents used in the extract preparation.[34] While the total tannins content in high abundance methanolic extract(136.87±0.08mgTAE/g), flowed by ethyl acetate (110.56±0.01mgTAE/g). Variation in polyphenolic and falvonoids contents of the studied species from values reported for the same studied species in the literature could be attributed to different factors like geographical areas and climatic conditions for the growth of the plant.[35]

Several researchers reported significant correlation between the phenolic content and antioxidant activity of extracts.[36,37] Thus the highest content of polyphenolic and flavonoids in the polar extracts of *Corchorus tridens.,* supported their contribution in their antiradical activity.

Table 3: Total phenol content, total flavonoids and total tannine of *Corchorus tridens.*

Botanical name	Extract	Total phenol content (Y=0.005X+0.000)R_2= 0.998	Total flavonoids content (Y=0.0012X+0.0958) R_2=0.09915	Total tannin content (Y=0.002X+0.591) R_2=0.997
C. tridens	N- hexane	50.21±0.04	128.23±0.00	0
	Chloroform	64.91±0.09	627.99±0.01	0.091±0.03
	Ethyl acetate	88.79±0.04	1034.19±0.03	110.56±0.01
	Methanol	65.52±0.04	187.75±0.00	136.87±0.08

GAE: Gallic acid equivalent; QE: Quercitin equivalent; TAA: Tannic acid equivalent. Figure 1. Correlation analysis between scavenging activity and the total polyphenolics, flavonoids and tannins contents. Red line =

total polyphenolic content / scavenging activity Green line = total flavonoids content / scavenging activity. Violet line = total tannins content / scavenging activity.

4 CONCLUSIONS

The inhibitory zones of different extracts varied with the type of microorganism tested. Generally, extracts of the plants exhibited better antifungal activity than antibacterial. The highest scavenging radical activity was exerted by the the plant. The majority of extracts were rich in flavonoids while the polyphenols were mainly accumulated in the two polar extracts. Therefore, these plants could a very beneficial source of natural bioactive agents. Further studies should be undertaken to elucidate the particular phytochemicals and their pharmacological mechanism.

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