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Research Article

Pharmacognostical and Biological Evaluation of Cultivated *Syzygium cumini* (L.) Skeels (Jambolan) in Libya

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Abstract

Several studies have been focused on natural products of medicinal plants as a substitute for some pharmaceutical drugs in certain diseases in developing countries. *Syzygium cumini* L. skeels (*S. cumini*) belongs to the family Myrthaceae. It is a native plant to subtropical and tropical areas (e.g., India, South China, East Africa and Eastern Australia) but invasive plant to South America and Malaysia. Earlier studies have indicated that the plant has gastro-protective, antiulcer, antibacterial and anti-malarial and anti-diabetic activities. The plant leaves contain an essential oil with a pleasant odor of the oil contains terpenes. Thus, this study was aimed to isolate, characterize and screen the most active compounds of *S. cumini* leaves. The plant material was cultivated and collected from a private farm in South of Tripoli in 2018 and was identified. Column chromatography, NMR and IR were all used to isolate and identified the compounds from the plant extracts. Antioxidant activity was assessed by DPPH assay. Standard microbiological testings for identification of gram positive and gram negative bacteria was used. The findings of phytochemical screening of methanol and ethyl acetate extracts of *S. cumini* have revealed presence of flavonoids, anthocyanin, triterpenes, glycosides, tannins, saponins, alkaloids, steroids and cumarins. In addition, 1-phenyl nonan-1-OH was isolated by column chromatography from methanol extract of *S. cumini*. The compound isolated from small column chromatography was expected by using NMR and IR which was 1-phenylnonnan 1-OH compound. The present findings showed a significant level of free radical scavenging (antioxidant) activity. A significant effect against *Staphylococcus aureus* as gram positive bacteria and *Pseudomonas aeruginosa* and *Escherichia coli* as gram negative bacteria which belongs to an aerobic bacterium was observed as well as an effect on the candida strains. These results indicated that *S. cumini* possesses a high quantity of different chemical compounds which can be of a great value for therapeutic effects in certain human diseases.

Keywords: *Medicinal Plants; Phytochemical Profile; Jambolin; Antimicrobial Activity; Antioxidant; Libya*

Introduction

Medicinal plants are popular plants and are the main source of useful drugs for a large proportion, particularly in developing countries. Over the last centuries, 80% of China and India people were using herbal medicines [1] and in many instance they found positive solutions and therapeutic responses. Thus, in the early 19th century, scientists began to extract and modify the active ingredients from the plants as in fast developing countries [2]. These herbal medicines are less expensive than pure pharmaceutical drugs. Crude drugs may be prepared from wild or cultivated plants. However, the pharmacological and toxicological effects of these crude drugs have not been well

documented. The plant is a good sources of anti-oxidant and anti-inflammatory like green vegetable [3]. Some of the useful plant drugs included digoxin and digoxigenin, artemisinin sinning, curcumin, hesperidin's, atropine, capsaicin, allicin and some of them edible and medicinal plants in the same time like basil, caraway, garlic, cumin, nut mug, rosemary, sage, thyme. These plants possess anti-microbial effect and antioxidant effect like phenolic groups, flavonoids, tannins, coumarins, terpenes, alkaloids and polypeptides [4]. On the other hand, acute use, chronic use and overuse have to be biological investigated in experimental animals and humans to characterize the pharmacological properties. Thus, further research studies have supported certain biological activities of some medicinal plants. Diabetes mellitus is a major disease where a lot at research going to found a treatment to help patients from their illness like ginseng, avocados, licorice and green tea [1]. *Syzygium cumini* (L) skeels (*S. cumini*) or Jambolan is native commonly medicinal plant in Serlianka which possesses anti-diabetic, antioxidants and antimicrobial activities as well as for treatment of other diseases [5,6]. *S. cumini* belongs to Myrthaceae family and for the first time mentioned as cultivated plant in family Myrtaceae in Libya. It is new record in Libya however, it is not included in flora of Libya.

Figure 1: *Syzygium cumini (L.) skeels tree cultivated in Libya.*

Several previous physiochemical studies carried on *S. cumini* fruit contain high quantity of malic acids, small quantities of oxalic acid, gallic acid, tannins, cyaniding, glycosides and sugar [7]. Seeds contain phenolic substance, essential oil, albumin, tannins, gallic acid, resorcinol and rich in protein, calcium β-pinene, terpene, eugenol and flavonoids as rutin, quercetin, β-sitosterol [7,8]. Thus, Sah and Verma [9] have reported therapeutic value and traditional use of the plant but without any pharmacological and toxicological effect of the active constituents. Various pharmacological activities like gastro-protective, antiulcer organic, antibacterial, anti-infective and anti-malarial have been studied [10]. Essential oil present in the leaves of *S. cumini* showed a better antibacterial activity due to limonene and dipentene (20%), sesquiterpenes of cadalane type (40%) and sesquiterpenes of azulene (10%) [11,12]. The leaf extract showed activity against *Escherichia coli* and *Staphylococcus aurous* [12]. Alcoholic extract of seeds lowered lipid serum and tissue in alloxan induced diabetic rats [13]. Moreover, defatted seeds and water-soluble fibers from seed showed hypoglycemic activity in alloxan induced diabetic rats [14,15]. Thus, observed glucose concentration in mice reduced by administration of *S. cumini* extract [16]. Leaf extract *S. cumini* delayed the onset of mortality and reduced symptoms radiation sickness [17]. According, *S. cumini* showed anti-allergic effect due to

inhibition of mast cell [18]. Anti-diarrheal activity evaluated ethanol extract of *S. cumini* [19]. However, all these studies have dealt with systemic pharmacological study without pharmacokinetic and pharmacodynamic studies as well as without toxicity studies. Despite the wide uses of *S. cumini* in medicine in several regions in the world, there is a lack of data about active compounds and use of *S. cumini* in Libya. Thus, the aim of this work was to isolate, characterize and evaluate the cultivated *S. cumini* in Libya.

Materials and Methods

Plant materials

Leaves *of S. cumini* (L.) skeels were collected from southern area of Tripoli (Gaseer ben Gasher Region) in April 2018. The leaves of the plant have been authenticated by a professional botanist (Abuhadra M) in the herbarium of department of Botany, Faculty of Science, University of Tripoli, Libya. Voucher specimens of the identified plant were deposited in herbarium of Botany department, Faculty of Science, UoT (Voucher number: D6812200).

Figure 2: *Syzygium cumini fruit.*

Microbes strains

Escherichia coli (ATCC -35150), *Pseudomonas aeruginosa* (ATCC - 27.893), *Staphylococcus aureus* (ATCC-43300), *Candida albicans* (ATCC10331) were all obtained from department of Microbiology, Faculty of Pharmacy, University of Tripoli, Libya.

Phytochemical methods: The collected leaves were cleaned from soil and other impurities by tap water and dried in shade for a month. 300 gm of the dried ground leaves of *S. cumini* (L.) were successfully extracted in soxhlet apparatus with different solvents of increasing polarity petroleum ether (40 - 60), chloroform, ethyl acetate and finally with methanol. The other 100 gm of ground leaves were extracted by decoction with only methanol. The extract was concentrated by using rotary evaporator under reduced pressure using vacuum pump at 60°C.

Thin layer chromatography (TLC) is used for screening of different constituents in various extracts [20]. For purification, detection, authentic of the compounds, five fractions of petroleum ether, CH_3CL, ethyl acetate, methanol and methanol of decoction extracts were

used. Individually spotted on TLC plate and development procedure were performed with various mobile phases representing gradient development [21]. The separated compounds were detected by UV light at 254 and 366 nm and the migration distance of each compound is generally fixed as R_f values [21]. The crude methanol extract was subjected to fractionation by CLC, the preparation of the column was carried out by sephadex LH 20. Using hexane, dichloromethane and methanol with increasing polarity of various proportions as a mobile phase (gradient elution method) until 50 : 50 dichloromethane : methanol increased to 100% methanol. Different fractions were then observed by TLC plate by development in saturated tank and detected under UV light. Other fraction was collected using same Rf values and subjected to a small column using hexane 25% ethyl acetate 75% with increasing polarity using ethyl acetate : methanol (75% : 25%).

Phytochemical screening: Main constituents of the methanolic leaf extract of *S. cumini* leaves were screened by phytochemical testing. The extract was treated with few drops of sodium hydroxide solution which indicating the presence of flavonoids. Then, extract was treated with dragendorff's reagent (solution of potassium bismuth iodide) indicating presence of alkaloids. 0.5g of the extract was shaken with 2 ml of water, foam produced and persist for ten minutes indicates presence of saponins. 0.5g of the extract was dissolved in 5 ml of distilled water and filtered. Few drops of 5% ferric chloride solution were added to the filtrate indicating presence of tannins. Spot of extract put on filter paper moistened with sodium hydroxide then examined under U.V. light blue florescent at 366 nm indicting presence of coumarins. Concentrated extract was mixed with 2 ml of glacial acetic acid, then one drop of concentrated sulfuric acid indicating presence of steroids. The plant extract was mixed with 2 ml of chloroform and concentrated H_2SO_4 indicating presence of terpenoid.

Thin layer chromatography: It is used as a preliminary screening for the plant extract to identity the methanolic and ethyl acetate for pure compound isolation. They spotted and developed in a suitable mobile phase, chloroform : methanol : acetone in ratio of 5 : 4 : 1. The plate is dried sprayed with anisaldehyde reagent and left in an oven at 150°C for 10 seconds until the color is observed. TLC was used to identify the content of the fraction of column chromatography. The methanolic and ethyl acetate fraction where each of the fraction was spotted on TLC firstly, from the beginning until to the end of about 95 fraction were identify from column chromatography. Further investigations using small column and identify the fraction on the TLC and developed in suitable mobile phase, butanol : acetic acid : water in a ratio of 4 : 1 : 1 was used. The plate is dried, then sprayed with anisaldehyde reagent and dryad until the color is observed and screened by UV light.

Isolation of pure compound from *S. cumini* by column chromatography: Open column chromatography (CC) was commonly used in a dimension of length 80 cm and diameter of 2.5 cm. The column was packed with sephadex (LH20) in least polar system by soaking the sephadex overnight in a mixture using a mobile phase (hexane : dichloromethane : methanol in a ratio of 2 : 5 : 1, respectively) for swelling [22]. Then, the slurry added into the column and the plant extract was added on the slurry of sephadex. The column was eluted with the same solvent mixture and finally washed with dichloromethane and methanol mixture with an increasing polarity.

Nuclear magnetic resonance spectroscopy: It is a powerful technique to identify the plant exact structure of pure compound and it provides more information about the structure of the compound [23]. NMR spectra of the isolated compound was measured in broker Avance 400 MHZ AM referenced to the residual non-deturated solvent ($CDCl_3$) signals. H^1NMR is an experiment presenting information about the nature of protons in the molecular number, chemical shifts and multiplicity, coupling constant and intensity of the isolated compound.

Identification by infrared spectroscopy (IR): It is one of the most common spectroscopic techniques used to determine the chemical function groups in sample [24]. The IR spectrum of fractionated sample of *S. cumini* has determined on brucker infrared spectrometer using KBr disc. The structured assignments have been correlated for the characteristic bands as mentioned in results. KBr used with the sample to determine facilitate identifying functional groups decrease the possibility of interaction solvent with extracts and to get a clear graph.

Qualitative DPPH radical scavenging in assay: This assay is a qualitative indicator for free radical scavenging activity. DPPH is reduced from a stable free radical that is purple in color which changes and became yellow [25]. This technique shows antioxidant compounds on TLC and given yellow color in presence of antioxidant compound like lupeol and sitosterol.

Anti-bacterial activity: The antimicrobial activity of the crude extract was estimated by fine extract using agar cup cut diffusion method [26]. For minimum inhibitory concentration (MIC) which is the lowest concentration of the extract, expressed in mg/l, that under defined *in vitro* conditions, prevents the growth of bacteria within a specified period of time [27]. Minimum bactericidal concentration (MBC) is the lowest concentration of the extract, expressed in mg/l, that under defined in vitro conditions, reduced by 99.9% (Logarithmic cycle). Thus, the number of organisms in a medium containing a defined in colonies of bacteria with in a defined period of time [27]. Determination of MIC and MBC were done by cup cut dilution method. For serial dilution of leaves extract of *S. cumini*, the system was incubated for 24 hr at 36 ± 1°C under aerobic conditions, after incubation, confluent bacterial growth was observed. Inhibition of the bacterial growth was measured in mm as previously described by Vijay and Pritio [28].

Anticandidal activity: The activity of *S. cumini* was estimated by agar diffusion method assay. The screening of the plant extract on candida effect was carried out by determining the zone of inhibition using modified agar infusion method. The candida strain used in this study were *Candida albicans* which was first grown on nutrient sabouraud dextrose agar plates and adjusted to turbidity of 0.5 McFarland standard. The suspension was used to inoculate 90 mm diameter petri dishes with sterile cotton swab. The extracts were dissolved in DMSO 50 in a concentration of 3 mg/ml and finally sterilized by filtration using 0.45 μ milli-pore filter. The disc fill with 50 ml of plant extract, isolated fraction, 20% of DMSO 50 and sterile water were used as a negative control; Nystatin (NY 100 IU) was used as a positive control. The controls were prepared using only solvent without the plant extract. Controls were inoculated at 37°C for 24 hours and all experiments were performed in duplicate [29].

Results

Plant Extraction: In table 1, data for the dried powder of *S. cumini* leaves (300 gm) was extracted in soxhlet apparatus by different solvents by increasing the polarity namely, petroleum ether, chloroform, ethyl acetate and methanol and methanol solvent by decoction to comparing yielding a residue is shown. Petroleum ether extraction was found to be the highest yielding in percentage (about 35%) but other extractions were found to be low (about 5%).

Solvent	Weight of extract in gm	Weight in %
Petroleum ether	101.4	33.8
Chloroform	12.6	04.2
Ethyl acetate	09.9	03.3
Methanol (Soxhlet)	04.3	01.4
Methanol (Decoction)	22.8	07.5

Table 1: *Percentage of yield for each extract by weight.*

Phytochemical screening: The preliminary phytochemical tests were carried out on ethanolic extract of *S. cumini*. Thus, the extract was used by emersion the macerate of powder overnight and then filtration. This is indicating the presence of flavonoids, alkaloids, tannins, coumarins, saponins, terpenoids but no anthraquinone (Table 2).

Macroscopic investigations: As shown in figure 3, the leaves of *S. cumini* is petiole which known to be petiolate and symmetrical. Their apex acuminates to acute with leaf blade lanceolate to oblong with smooth margin.

Test	Observations	Findings
Flavonoids	Yellow color	++
Alkaloids	Formation of precipitate	++
Saponins	Formation of foam	++
Tannins	Blue/Black color hydrolysable tannin	++
Coumarins	Presence of florescent spots	++
Terpenoids	Colour changed	+
Steroids	Colour changed	++

Table 2: *Phytochemical screening of S. cumini.*

Fairly present (++) and slightly present (+)

Figure 3: *Dried leaf of S. cumini.*

Microscopic examination: Crystals like druses (star shape): crystal and a stomata arrangement of surrounding cells by subsidiary cells (paracytic) as seen under the microscopic: fibers and stomata (paracytic stomata) two subsidiary cell parallel to the ground cell (Fibers and stomata were studied using light microscope). Fresh leaves immersed in KOH overnight to remove the excess unwanted and destroyed the other unwanted cells have shown stomata, trichomes, calcium oxalate as cluster, trichomes clavate type (Figure 4).

Thin Layer Chromatography (TLC) was applied to the different crude extracts and comparing with the TLC of fractions of the column chromatography. They were spotted to isolate pure compound by using butanol: acetic acid: water. The results of the changing in the color of the spots after spraying with anisaldehyde reagent as shown in figures 5 and 6.

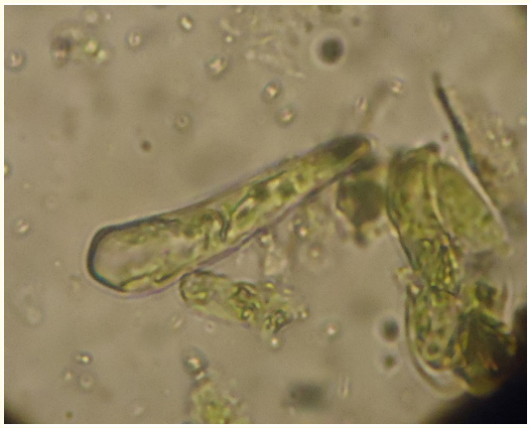

Figure 4: *Unicellular Trichomes non-glandular-clavate type.*

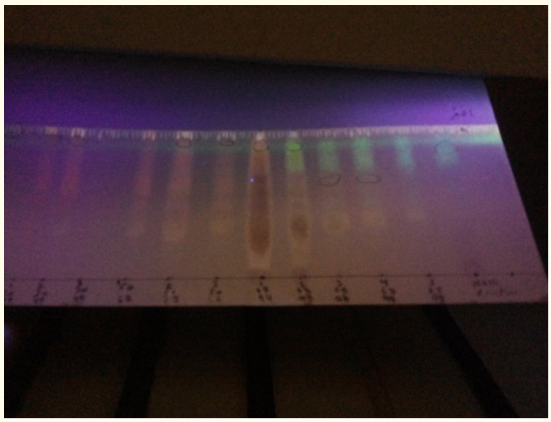

Figure 5: *Change in color after sprayed with anisaldehyde reagent.*

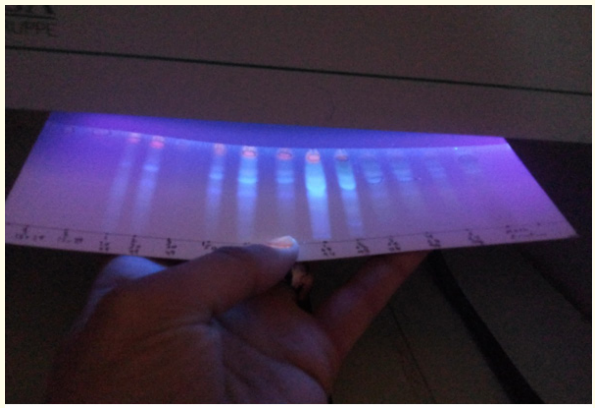

Figure 6: *Detection by UV.*

Extract	Fraction no.	Appearance of separated spot		R_f	hRf %
		366 nm	254 nm		
Ethyl acetate extract	15 - 29	Fluorescent	Fluorescence	0.12	12
	30 - 49	Fluorescent	Fluorescence	0.27	27
	50 - 67	Fluorescent	Fluorescence	0.55	55
	68 - 94	Fluorescent	Fluorescence	0.88	88
Metha-nol extract	15 - 29	Redish-brown	Not visible	0.38	38
	30 - 49	Yellow-green	Slightly	0.62	62
	50 - 67	Yellow-white	Slightly	0.78	78
	68 - 94	Violet	Violet	0.87	87

Table 3: *Measuring RF Value for each fraction.*

R_f = 0.87 near R_f of lupeol and R_f = 0.88 near of R_f of gallic acid.

With regard to the detection of compounds, TLC plate for two the extracts was investigated under UV light. The chromatoplate exhibited different colored compounds (Figure 7) and the stronger intensity of the color was found to be present in the methanol extract (Sistosterol and lupeol).

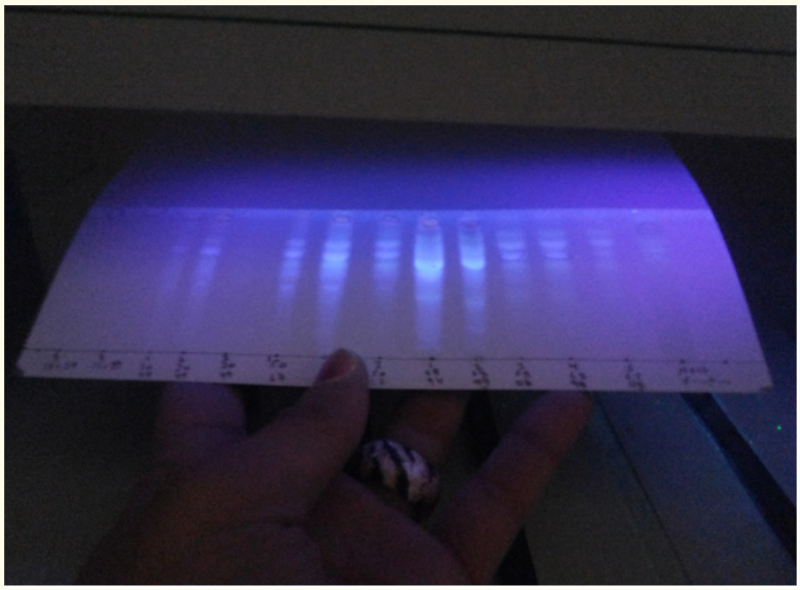

Figure 7: *Shows pure compound under UV.*

Figures 8-10 show the different compounds isolated from *S. cumini* fraction value by using IR spectroscopy technique as following: 3390 OH (bonded), 3402 O - H, 2927 CH stretch, 1589 aromatic structure, 1720 C = O, 1350 C - O - C, 1627 C = C aromatic.

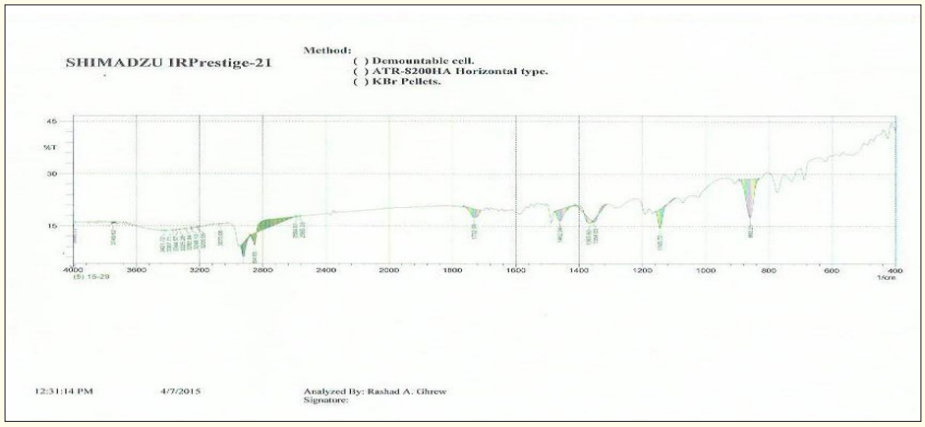

Figure 8: *IR Spectrum shown carboxylic group pand phenolic and hydroxylic group from 2800-3200.*

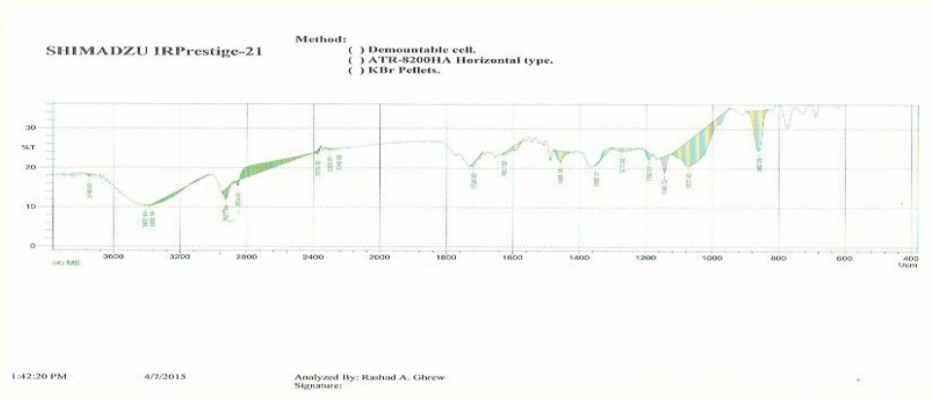

Figure 9: *IR Spectrum of lupeol compound.*

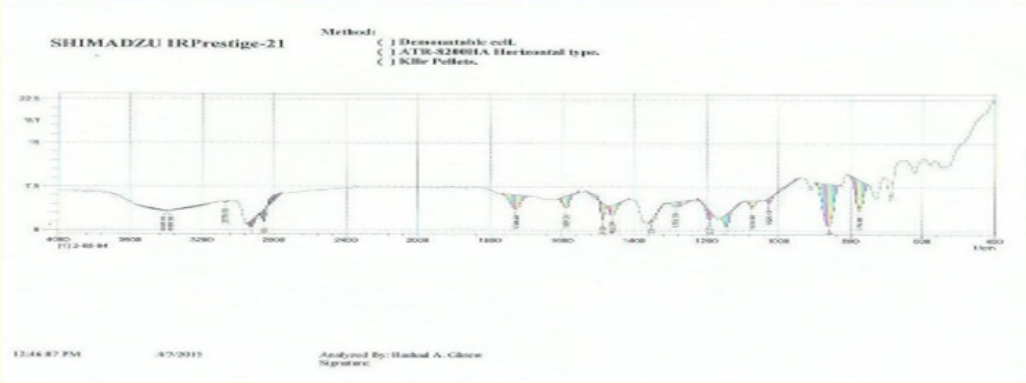

Figure 10: *IR Spectrum of sitosterol.*

The identification of compounds isolated from *S. cumini* fraction by NMR spectroscopy is shown in table 4. TL chromatogram of the compounds revealed violet color in case of triterpene and blue fluorescence color in case of tannins under U.V light at 366 nm. For H^1NMR data of expected compound A verified the presence of signals at 0.971; 0.97; 1.01; 1.01 attributed to H_{11}, H_{12}, H_{13}, H_{14} respectively, the DE shielded proton at (3.21, 3.8) attributed to H-15 while at (2.01, 1.91), (1.73,1.49) and at (1.70, 1.45) attributed to H-9, H-1, H-2, H-3, H-8, and at (2.01) attributed to H-6. C^{13}NMR data for the compound added further support revealed the presence of 10 - 12 distinct signals. Quaternary c at 25.9, 28.7, 28.9, 129.2, the CH at 61.5, the CH_2 at 22.1, CH_3 at 28.7, 28.9 (Table 4).

Proton position	Lupeol	Proton position	Lupeol comparisons
2	1.70	2	3.21 dd
3	3.1	3	3.8
6		6	2.01
18		18	1.91
19	2.1	19	1.73
21		21	1.49
22		22	2.38 m
23	0.98	23	1.01
24	0.89	24	0.95 s
25	0.94	25	0.79 s
26	0.99	26	0.89 s
27	1.012	27	0.799 s
28		28	1.02
29	3.97	29	4.68
30	3.2	30	3.23

Table 4: *H^1NMR spectral data of lupeol.*

The compounds as shown below revealed to the presence lupeol and B- sitosterol compounds as terpenes and steroid compound. Thus, as seen in figures 11-13. This was compared with others to identify putative anti-diabetic constituents from *S. cumini* from NMR SP data. Two different compound are lupeol, B-sitosterol were identified from n-hexane fraction of the plant extract.

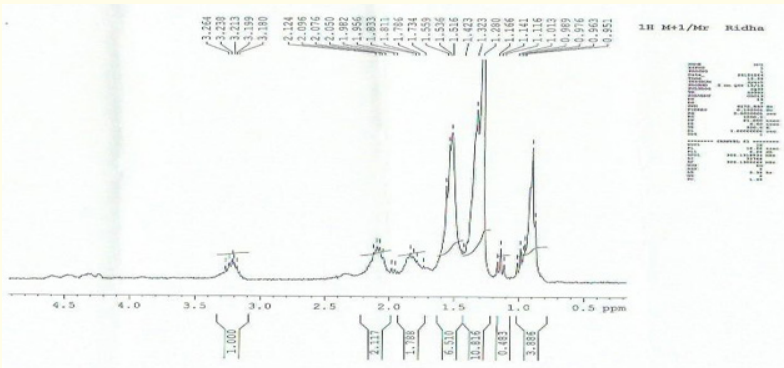

Figure 11: *H^1NMR spectroscopy compound.*

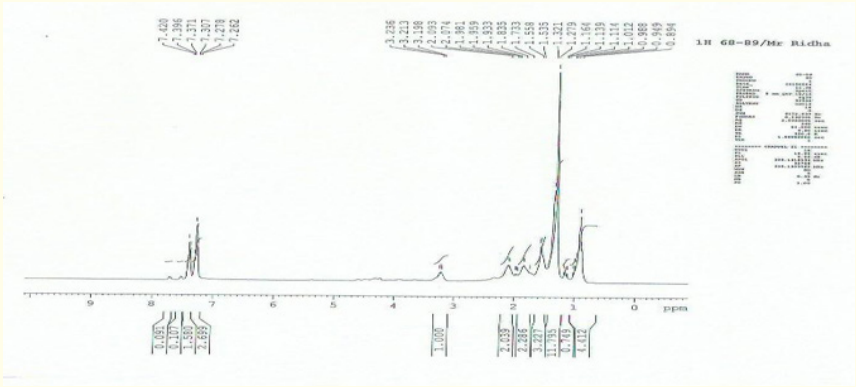

Figure 12: *H^1NMR spectroscopy of lupeol compound.*

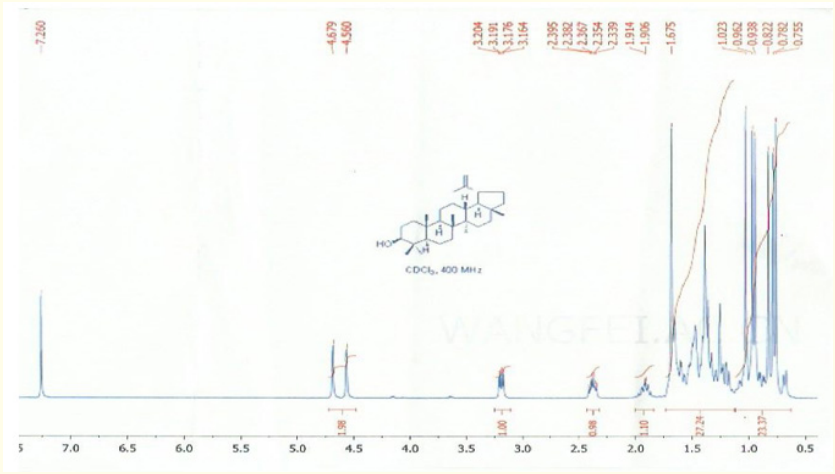

Figure 13: *NMR spectroscopy of lupeol compound (standard graph).*

With regard to the antioxidant activity, the crude extract and fraction extract were carried out by using TLC technique and by using DPPH spray. The visual color changed on chromatogram from blue purple and other color or to yellow color indicated the presence of antioxidant compound(s). The methanolic extract by decoction has a stronger antioxidant than the other extracts as observed. In methanolic extract by soxhelt, ethyl acetate, petroleum ether and chloroform extract, as observed fractions from 15 to 95 which may have antioxidant effect by DPPH spraying. This is shown on the methanolic extract has a polar compound that gives powerful antioxidant product like tannins (phenolic), triterpenes and flavonoids.

With regard to the antibacterial activity, the assay of antimicrobial activity is based on the use of wells as reservoirs containing solutions of substances to be examined. On the basis of the result obtained, it is found that the methanolic extract by decoction has a significant *in vitro* antibacterial activity against certain bacteria sp (*Staphylococcus aureus, E. coli, pseudomonas aeruginosa*) and methanolic extract by soxhlet and ethyl acetate were also profound effective but petroleum ether chloroform did not give any positive result, and no inhibition zone. The extract was effective on two kinds of gram-negative and gram-positive bacteria species. The fraction did not show any effect on bacteria but it may show some action in synergism with other constituents (Tables 5 and 6).

Code	Bacterial strains	Meth (Deco)	Meth (Soxh)	Ethyl acetate	Chloroform	P. ether	Control +ve
ATCC 43300	*St. aureus*	18 mm	15 mm	13 mm	- ve	- ve	28 mm
ATCC 35150	*E. Coli*	15 mm	8 mm	10 mm	- ve	- ve	30 mm
ATCC 27,893	*P. aeruginosa*	13 mm	14 mm	10 mm	- ve	- ve	20 mm

Table 5: *Effect of extracts of S. cumini on bacterial strains.*

Extract	Organism	IC50mg/ml	MIC	Total activity	Average total
Methanol Extract	*P. aeruginosa*	400	656	250	404.67
	E. Coli	724	-	-	
	St. aureus	200	271	605.16	
Ethyl Acetate extract	*P. aeruginosa*	303	399	726	350.6
	E. Coli	104	-	-	
	St. aureus	140	154	200	

Table 6: *Minimum inhibitory concentration of extract.*

With regard to the Anti-candida assay (*Candida albicans*), the fungi assay of anti-candida activity was carried out by using agar cup cut diffusion method; the results are shown in table 7.

Code	Candida St	Methanolic extract	Control +ve	Control -ve
ATCC 10231	*Candida albicans*	10 mm	20 mm	-ve

Table 7: *Effect of extract on fungi strain.*

Discussion

In this study, the dried powder of *S. cumini* leaves was extracted by different solvents in an increasing polarity and with methanol solvent by decoction to compare and identify the yielding residue of the different percentage of weights with petroleum ether of about 30%. Preliminary phytochemical tests were done on ethanolic extract of *S. cumini* the ethanolic extract which showed different chemical structures that may have potential therapeutic effects upon purification and further analysis. These compounds are flavonoids, alkaloids, tannins, coumarins, saponins, terpenoids but no anthraquinone.

Different TLC methods were applied to the crude extracts and comparing with the TLC of fractions of column chromatography were spotted to isolate pure. TLC plate for two extracts was investigated under U.V light. The chromatoplate exhibited different colored compounds and the stronger intensity of the color was found in methanol extract indicating sitosterol and lupeol. Spectroscopy technique, value of IR as following: 3390 OH (bonded), 3402 O - H, 2927 CH stretch, 1589 aromatic structure, 1720 C = O, 1350, C - O - C, 1627 C = C aromatic. For H^1NMR data of expected compound verified the presence of signals at 0.971; 0.97; 1.01; 1.01 attributed to H_{11}, H_{12}, H_{13}, H_{14} respectively, the DE shielded proton at (3.21, 3.8) attributed to H-15 while at (2.01, 1.91), (1.73,1.49) and at (1.70, 1.45) attributed to H-9, H-1, H-2, H-3, H-8, and at (2.01) attributed to H-6. C^{13}NMR data for the compound added further support revealed the presence of 10-12 distinct signals. Quaternary c at 25.9, 28.7, 28.9, 129.2, the CH at 61.5, the CH_2 at 22.1, CH_3 at 28.7, 28.9. The compounds as found revealed to presence lupeol and B- sitosterol compounds as terpenes and steroid compound. Thus, the present study compared with other studies in other country was carried out to identify putative anti-diabetic constituents from *S. cumini* from NMR SP data were two different compound are lupeol, B-sitosterol were identified from n-hexane fraction of the plant extract. These compounds may have a

potential anti-diabetic activity which support the traditional use of a leaves as being remedy for treating diabetes [22]. Interestingly, all these identified chemical active compounds have to be biological studied individually, in animals and humans. A detail study is needed for pharmacokinetic properties including absorption, distribution, metabolism and excretion in order to gain further knowledge about the therapeutic and clinical responses. One important issue is the toxicity and misuse of the plant (any adverse effects and side effects). This should be considered in toxicology investigations in animal including acute and chronic intake of the compounds without forgetting the interaction of these active compounds with drugs.

The crude extract and fraction extract were carried out using TLC technique by using DPPH indicated the presence of antioxidant compound(s) as found in the present study. The methanolic extract by decoction has a stronger antioxidant than other extracts as observed. In methanolic extract and ethyl acetate extract, less than it and less result with petroleum ether and chloroform extract as shown fractions from 15 to 95. This has antioxidant effect by DPPH spraying of methanolic extract that has a polar compound and gives a powerful antioxidant product like tannins (phenolic), triterpenes and flavonoids.

The assay of antibacterial activity is based on the use of wells as reservoirs containing solutions of substances to be seen. On the basis of the result obtained, it is found that the methanolic extract by decoction has significant *in vitro* antibacterial activity against some bacteria spp (*Staphylococcus aureus, E. coli, pseudomonas aeruginosa*) and methanolic extract by soxhlet and ethyl acetate. This is also effective but petroleum ether chloroform did not give result, and no inhibition zone. The extract is effective on the two kinds of gram-negative and gram-positive bacteria species. The fraction did not give any effect on bacteria but it may show an interaction action in synergism with other constituents.

Conclusion

In conclusion, *S. cumini* has a high quantity of different active chemical compounds that can be of a great value for therapeutic uses in diseases: such as phenolic compound (phenyl nonnan-1 ol) and (Sitosterol, lupeol) which exert their therapeutic effects as antioxidant and antibacterial actions. More pharmacological and toxicological studies is needed to confirm its therapeutic efficacy.

Conflict of Interest

The authors have no financial interest or any conflict of interest related to this article.

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