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Research Article

Medicinal Properties of Local Plants

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Abstract: The wild plants and herbs were an important part in health care in Sudan and still. This project is intention to study the actual of some Sudanese medicinal plants to proof its medicinal benefits in a scientific approach. Mesquite is one of the most spread plants in Sudan; it grows everywhere, in any climate and needs no specific conditions to grow. Until now this plant was not used in the advantage of human beings. In this study a sample of mesquite where screened for its content of active medicinal ingredients. The investigation of mesquite samples gave indications that the extract can be used as anti-HIV, anti-tumor, anti-hypertension, anti-arrhythmia, anti-inflammatory, anti-osteoporosis, antiseptic, analgesic, use in the treatment of asthma and lymphedema.
Keywords: Wild plants, Mesquite, Medicinal ingredient.

INTRODUCTION

Many of the modern medicines are produced indirectly from medicinal plants, for example aspirin. Also some plants are directly used as medicines by a majority of cultures around the world, for example Chinese medicine and Indian medicine. Medicinal plants are resources of new drugs and it is estimated there are more than 250, 000 flower plant species. Studying medicinal plants helps to understand plant toxicity and protect human and animals from natural poisons. Herbs are staging a comeback and herbal 'renaissance' is happening all over the globe. The herbal products today symbolize safety in contrast to the synthetics that are regarded as unsafe to human and environment. Although herbs had been priced for their medicinal, flavoring and aromatic qualities for centuries, the synthetic products of the modern age surpassed their importance, for a while. However, the blind dependence on synthetics is over and people are returning to the naturals with hope of safety and security.

Sudan is the largest country in Africa with a diverse flora. Most of the Sudanese people in rural areas rely on traditional medicine for the treatment of many infectious diseases. Sudanese traditional medicine is characterized by a unique combination of knowledge and practices of Arabic, Islamic and African culture (El-Hamidi, A. 1970; El Kamali, H.M., & El Khalifa, K.F. 1997). Infectious diseases are the world's leading cause of premature deaths (Emori, T.G., & Gaynes, R.P. 1993). Therefore, there is a continuous and urgent need to discover new antimicrobial compounds with diverse chemical structures and novel mechanisms of action. On the other hand, viral infections are very common and responsible for a variety of infectious diseases ranging from the common cold to uniformly fatal rabies and AIDS. In contrast to the enormous amount of antimicrobial drugs, very few effective antiviral drugs are available (Vlietinck, A. J. *et al.*, 1997; Farouk, A., & Abdelrazek, 2018).

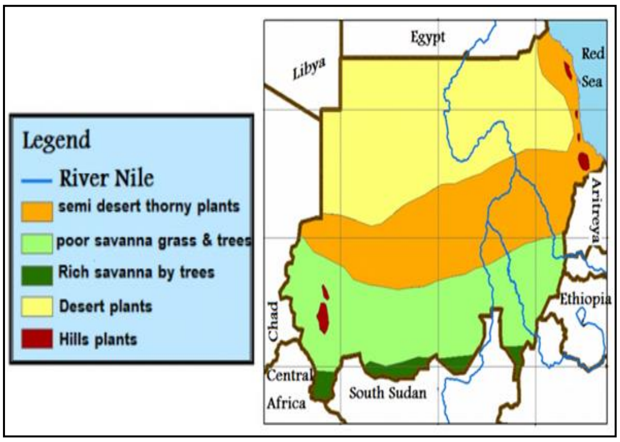

Fig.1: Vegetation and forest cover in Sudan

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One of the most important reasons for the lack of success in developing antiviral drugs is due to the nature of the infectious viral agents, which totally depend upon the cell they infect for their multiplication and survival (Vanden Berghe, D. A. *et al.*, 1986). Since many of the existing disinfectants and antiseptics fail to kill all pathogenic viruses, the demand for new antiviral agents is great and needs all possible approaches towards the development of new antiviral drugs (Munro, M.H.G. *et al.*, 1987). One of the possible methodologies that can be used for the discovery of antibacterial and antiviral principals is the screening of selected plant extracts for the activity followed by bioassay-guided fractionation of active extracts leading to the isolation of the pure constituents.

Mesquite (Prosopis juliflora) in Sudan is a perennial woody plant. Characterized by a strong root system, and with the ability to grow under a wide range of environmental conditions. These trees can reach a height of 6 to 9 m (20 to 30 ft) although in most of their range they are shrub size. Twigs have a characteristic zigzag form. Some common species of mesquite are honey mesquite, velvet mesquite creeping mesquite. Mesquite was introduced into Sudan in 1917 from South Africa and Egypt and planted in Khartoum. The success attained in establishment of the tree and its abilities to tolerate drought and fix sand dunes provided the impetus for introduction of the tree into various agro ecologies with emphasis on dry areas (El Kamali, H.M., & El Khalifa, K.F. 1999). In the 1970s and 1980s it was widely disseminated in Sudan for the purpose of addressing the problems of Sudan's -arid arid and semi areas, summarized as: fuel wood production: pods for fodder: soil stabilization: and as a means for stopping the desertification process. In 1938 the plant was introduced into Sinar, Fwar, ELfoung (central Sudan), Elghaba, Lietti basin (northern Sudan), Sinkat, ELgalabat, Portsudan (eastern Sudan), Kordofan and Darfur (western Sudan) (El Kamali, H.M., & Khalid, S.A. 1996).

Fig.2: Mesquite Plant and Leave

The Forestry Service was particularly committed to restrict Prosopis to desert and semi desert regions. By 1948 plantations were established in Kassala, Gash Delta and Northern Regions. It was thus planted along the Red Sea Coast near Port Sudan and the sandy unstable edges of the Gezira irrigated scheme. Late in 1947and subsequently in 1965 mesquite was reintroduced into eastern Sudan, where it was planted in a green belt around Kassala. The prevailing drought in the 1970 s rejuvenated the interest in mesquite and further introductions, into eastern Sudan, were made to protect residential and cultivated areas. In 1974 mesquite seeds were broadcast by airplanes in around Kassala and further planted in protected forests. In the period 1978-1981 the tree was planted as shelterbelts at Portsudan and Tokar. The tree was planted in shelterbelts around farms, irrigated schemes and along the Nile. Several species of mesquite (P. chilensis, P. valutina, P. glandulosa var. terreyona, P.alba, P. pallida and P. articulata) were introduced, in the period 1978-1986, with the objective of selecting suitable species for the different ecological zones. Some of the species selected, had their seeds multiplied and distributed in western Sudan around El Obeid, and various other locations (EL-Kamali, H.H. 2009; El Khalifa, K.F. *et al.*, 2006). Mesquite seedlings failed to establish on sand dunes, but were well established within oases leading to lowering of water tables and suppression of native vegetation. At present mesquite has become a noxious weed in Sudan. It has invaded both natural and managed habitats, including watercourses, floodplains, highways, degraded abandoned land and irrigated areas. The weed is more of a problem within central, northern and eastern Sudan. The most prominent benefit of mesquite to the communities, in addition to sand dune fixation, is provision of wood fuel for the households, charcoal making and other traditional industries. Selling mesquite firewood and charcoal is an important economic activity. Records of commercial production of charcoal and firewood in 1996/97 from Gash and Atbara rivers were 600,000 sacks and 135,000 m3, respectively. Animal rearing constitutes the main livelihood of land and resource less farmers in many of the mesquite endemic areas. Prosopis leaves and pods may offer a cheap source of feed. However mesquite species including P. juliflora and P. chilensis have unpalatable leaves (El Kamali, H.M., & Khalid, S.A. 1996). Mesquite leaves fed to Nubian goats were reported to suppress rumen microbes and increase levels of rumen ammonia and blood urea (EL-Kamali, H.H. 2009). Research on medicinal and aromatic plants in Sudan began a long time ago, but this was carried out in a scattered and unstructured fashion until the establishment of the Medicinal and Aromatic Plants Research Institute (MAPRI) in 1972. The objectives of this work are summarizing as follows:

- The best methods to extract the active ingredient from mesquite plant.
- Identification of the medicinal properties of mesquite plants and herbs in Sudan and their active ingredients.
- Investigation of the antibacterial and antiviral activity of extracts from mesquite plants.

MATERIALS AND METHODS

In order to identify the antimicrobial and antibacterial activities of the mesquite plant, number of laboratory experiments was done to specify the active components, which the plant consists of. The mesquite samples were taken from the bank of the Nile in Khartoum city in Sudan. The mesquite pod was crashed and the seeds were eliminated.

Fig.3: The dry extract of mesquite pod

Preparation of Extracts

Extraction was carried out according to method described by Harborne (Harborne, J.B. 1984). 20g of the crashed plant was extracted with 80% ethanol using soxhlet extractor (Fig.4) apparatus. Extraction carried out till the color of the solvent in the siphoning time returned colorless. Solvent was evaporated under reduced pressure using rotary evaporator (Fig.4) apparatus. Extracts were allowed to air till complete dryness (Fig.4) and the yield percentages were calculated.

Phytochemical Screening

General phytochemical screening for the active constituents was carried out for the extract using the methods described by Martinez & Valencia (2003), Sofowora (1993), Harborne (1984) and Wall *et al.*, (1952) with many few modifications. To prepare the sample, 50 g of the plant extract was soaked in 500 ml of 80% ethanol for about twenty four hours at room temperature. Extract was filtered through filter paper and solvent was evaporated under reduced pressure using rotary evaporator apparatus.

Identification of Tannins

0.2 g of each fraction was dissolved in 10 ml of hot saline solution and divided in two tests tubes. To one tube 2-3 drops of ferric chloride added and to the other one 2 – 3 drops of gelatin salts reagent added. The occurrence of a blackish blue color in the first test tube and turbidity in the second one denotes the presence of tannins.

Test of Sterols and Triterpenes

0.2 g of each fraction was dissolved in 10 of chloroform. To 50 of the solution 0.5 ml acetic anhydride was added and then 3 drops of conc. Sulphuric acid at the bottom of the test tube. At the contact zone of the two liquids a gradual appearance of green, blue pink to purple color was taken as an evidence of the presence of sterols (green to blue) and or triterpenses (pink to purple) in the sample.

Test of Alkaloids

0.5 g of each fraction was dissolved in 2 ml of 2N HCl in water bath and stirred while heating 10minutes, cooled filtered and divided into tow test tubes. To one test tube few drops of Mayer's reagent was added while to the other tube few drops of Valser's reagent was added. A slight turbidity or heavy precipitate in either of the two test tubes was taken as presumptive evidence for the presence of alkaloids.

Fig.4: Soxhlet extractor and rotary evaporator

Test of Flavonoids

0.5 g of each fraction was dissolved in 30 ml of 80% ethanol and filtered. The filtrate was used for three tests. First one consists of, 3ml of the filtrate in a test tube, and 1ml of 1% aluminum chloride solution was in methanol was added. Formation of a yellow color indicated the presence of Flavonoids. Flavones or and chalcone. The second test performed with 3ml of the filtrate in a test tube, and 1ml of 1% potassium hydroxide solution was added. A dark yellow color indicated the presence of Flavonoids compounds (flavones or flavonenes), chalcone and or flavonols. The third test performed with 2ml of the filtrate, and 0.5ml of magnesium turnings were added. Producing of defiant color to pink or red was taken as presumptive evidence that flavonenes were present in the plant sample.

Test for Saponins

0.3 g of each fraction was placed in a clean test tube. 10 ml of distilled water was added, the tube stoppered and vigorously shaken for about 30 seconds. The tube was then allowed to stand and observed for the formation of foam, which persisted for least an hour, was taken as evidence for presence of saponins.

Test for Coumarins

0.2 g of each fraction dissolved in 10 ml distilled water in test tube and filter paper attached to the test tube to be saturated with the vapor after a spot of 0.5N KOH put on it. Then the filter paper was inspected under UV light, the presence of coumarins was indicated if the spot have found to be adsorbed the UV light.

Test for Anthraquinone Glycoside

0.2 g of each fraction was boiled with 10 ml of 0.5N KOH containing 1ml of 3% hydrogen peroxide solution. The mixture was extracted by shaking with 10 ml of benzene. 5ml of the benzene solution was shacked with 3ml of 10% ammonium hydroxide solution and the two layers were allowed to separate. The presence of anthraquinones was indicated if the alkaline layer was found to have assumed pink or red color.

Test for Cyanogenic Glycoside:

0.2 g of each fraction was placed in Erlenmeyer flask and sufficient amount of water was added to moisten the sample, followed by 1ml of chloroform (to enhance every activity). A piece of freshly prepared sodium picrate paper was carefully inserted between a split crock which was used to stopper the flask, a change in color of the sodium picrate paper from yellow to various shades of red was taken as an indication of the presence of cyanogenic glycoside.

TLC Test

TLC (Thin Layer Chromatography) is a technique used to separate the pure components present in a mixture. This separation is possible due to the difference on the adhesion force of the molecules that are present in the mixture to a mobile phase (normally a solvent) and to a stationary phase (called thin layer, silica gel). This difference translates into more or less movement of each individual component, which allows its separation and identification (Sofowora, A. 1982). The test product was analyzed by using a Visible Spectrophotometer. For mesquite extract two different types of tests were used. In the first test, the stationary phase used Silica gel $H_2F_{54,}$ prepared by mixing 30g of Silica powder with 60g of water. The mobile phase were Toluene, Formic acid and Ethyl acetate (with percentages 40:10:50 respectively). At the daylight and UV the TLC plate gives no observation (Fig.5a), so it was sprayed by vanillin-sulphuric acid and was heated in the oven at 105 ^{o}C for 10 minutes (Fig.5b). Then the retention factor (R_f) value was measured.

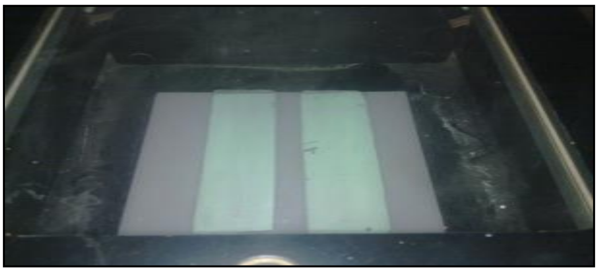

Fig.5a: TLC test result under U.V (no observation).

Fig.5b: TLC test result after spraying and heating.

In the second test, the stationary phase used Silica gel H_2F_{54}. The mobile phase were Butanol, Acetic acid, Water (with percentages 40:10:50 respectively). At the daylight and UV the TLC plate gives no observation so the same procedure was repeated again.

RESULTS AND DISCUSSION

The phytochemical screening shows that the mesquite pod contains alkaloid, which is used in the structural modifications of many synthetic and semisynthetic drugs to enhance or change the primary effect of the drug and reduce unwanted side effects. Also alkaloids are used as psychoactive substances. Also the screening emphasizes the strong presence of flavonoid in mesquite (fig 4.2), and flavonoid is most commonly known for its antioxidant activity.

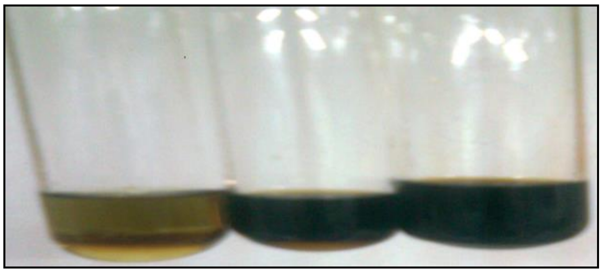

Fig.6a: Green and purple color, which took as positive result for the presence of sterols and triterpenes.

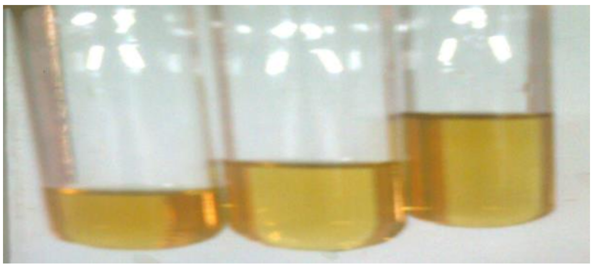

Fig.6b: Yellow color, which took as positive result for the presence of Flavonoids.

In addition, it could also induce mechanisms that may kill cancer cells and inhibit tumor invasion. Furthermore research works have suggested that flavonoid can inhibit the development of fluids that result in diarrhea.

Table.1

Test	Observation	Result
Alkaloids	Turbidity	++
Sterols	Green-blue color	-
Triterpenes	Pink-purple color (Fig.6a)	++
Flavonoids	Yellow color (Fig.6b)	++
Coumarins	UV florescence (Fig.7)	+
Saponins	Foam (Fig.8a)	+
Tannins	Green-blue color (Fig.8b)	++
Anthraquinones	No Observation	-
Cyanogenic	No Observation	-

+= Trace, ++ = Moderate, +++= High, - = Negative

There are significant amount of tannin in mesquite sample (Fig.8b), which is effective in protecting the kidneys and have shown potential antiviral, antibacterial and antiparasitic effects.

Fig.7: Fluorescence under UV254, which took as positive result for the presence of Coumarins.

The presence of coumarins (Fig.7) indicates that the mesquite can be used as anti-HIV, anti-tumor, anti-hypertension, anti-arrhythmia, anti-inflammatory, anti-osteoporosis, antiseptic, analgesic , and use in the treatment of asthma. Coumarins has been used in the treatment of lymphedema.

Fig.8a: Appearances of foam, which took as positive result for the presence of Saponins.

Fig.8b: Appearances of green color, which took as positive result for the presence of Tannins.

There is tremendous, commercially driven promotion of saponins as dietary supplements and nutriceuticals, so mesquite can be used there because it contains saponins in considerable amounts. As indicated in table (2), the retention factors for each spot were measured and recorded as the ratio between distance travelled by the spot, and distance travelled by the mobile phase for each solvent used. It is clearly resulted that, every solvent has its own characteristic strength (which used to be known as its polarity). The higher the strength, the stronger the solvent and the quicker substances are transported through the chromatographic system. Rapid transport through the column does however mean that there is less interaction,

Table (2): TLC test results for the first and second solvents

TLC first test				***TLC second test***		
Spot	*R_f*	*Color*		*Spot*	*R_f*	*Color*
1	1.1/15.6	Gray		***1***	0.9/15.4	Black
2	4.7/15.6	Gray		***2***	3.8/15.4	Gray
3	7.7/15.6	Gray		***3***	8.5/15.4	Yellow
4	12.5/15.6	Gray		***4***	14.5/15.4	Violet
5	14.5/15.6	Violet				
6	15/15.6	Violet				

between the stationary and the mobile phase, and that the separation is therefore not as effective. It is thus very important to have the correct solvent strength so as to achieve optimum separation results.

CONCLUSIONS

The various traditional uses, and medicinal properties of the mesquite plants correlate well through rigorous experimental methods. The results concluded the following points.

- Sudan is a rich country of medicinal herbs and plants.
- The herbs and plants were used variously in health care by the population.
- The investigation of mesquite samples gave indications that the extract can be used as anti-HIV, anti-tumor, anti-hypertension, anti-arrhythmia, anti-inflammatory, anti-osteoporosis, antiseptic, analgesic , use in the treatment of asthma and lymphedema.
- The results of this preliminary evaluation give evidence that some of the ethnobotanically selected and traditionally used Sudanese plant species can be regarded as promising resources for antibacterial and/or antiviral drugs. It seems that further investigations are necessary in order to draw solid conclusions.

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