

“Medicinal Value of ziziphus Spina Christi ”

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ABSTRACT

Ziziphus spina-Christi is a plant rich in saponin, and this compound is used to treat malignant melanoma in the present study. Saponins are plant glycosides with different structures and biological activities, such as anticancer effects. Nanophytosomes can be used as an advantageous nanodrug delivery system for plant extracts. The aim of this work is to use the saponin-rich fraction (SRF) from *Z. spina-Christi* and prepare SRF-loaded Nanophytosomes (saponinosomes) and observe the in vitro and in vivo effects of these carriers. First, the SRF was obtained from *Z. spina-Christi* by a solvent-solvent fractionation method. Results indicate that the SRF from *Z. spina-Christi* has anticancer activity, and the saponinosomes prepared in this work can control tumour growth, improve therapeutic efficacy, and reduce the side effects of saponins. The methanolic extract of leaves showed the highest phenolic concentration and largest antioxidant activity. *Z. spina-Christi* leaves could have potential source of antioxidants for pharmaceutical drug preparations. The tropical tree *Ziziphus spina* belongs to the Rhamnaceae family. Biological reports and traditional applications including management of diabetes and treatment of malaria, digestive issues, typhoid, liver complaints, weakness, skin infections, urinary disorders, obesity, diarrhoea, and sleeplessness have all been treated with different parts of *Ziziphus spina-Christi*. *Z. spina-Christi* is a wild tree today found in Jordan, Israel, Egypt, and some parts of Africa, which was already in use as a medicinal plant in Ancient Egypt. In ancient Egyptian prescriptions, it was used in remedies against swellings, pain, and heat, and thus should have anti-inflammatory effects.

KEYWORDS: *Ziziphus spina-Christi, Rhamnaceae, Pharmacology, Phytochemistry, Shrub.*

I. INTRODUCTION

Ziziphus spina-Christi is also known as Christ's thorn jujube. Tree grows in northern and tropical Africa, as well as in North and West Asia [1]. *Ziziphus spina-Christi* is an edible plant, known also as Christ's thorn, Jujube, Nabka, and Sidr. *Z. spina-Christi* is a species in the family Rhamnaceae and grows mainly in hot and dry regions [2]. The seeds comprise 18.6% protein and 28.5% lipids, whereas the flesh comprises 80.6% carbohydrates. The leaves are rich in calcium and magnesium, and a high ascorbic acid content has been recorded in the mesocarp [2]. It has great medical importance that the ancient people knew, as it was used as food, as well as a medicine for many diseases [3]. *Ziziphus spina-Christi* is a deciduous shrub belong to the family Rhamnaceae and grow throughout Middle Eastern region including Jordan. It is commonly called as "Sedr" and also known as 'Nabak' [4]. There are many ways to name *Z. spina-Christi*, which is known as Christ's thorn; Syrian Christ-thorn in English, on behalf of epine du Christ; jujube in French, on behalf of epine du Christ; jujube [5]. *Ziziphus spina-Christi* leaf extract contains numerous phytochemical constituents, such as flavonoids, alkaloids, tannins, triterpenoid, phytosterols, saponins, and essential oils [6]. Several medicinal characteristics of the genus *Ziziphus* have been recorded, including antioxidant, anti-inflammatory, hepatoprotective, hypoglycaemic, antitumor, hypotensive, antidiarrheal, antimalarial, ant plasmodium, and immunomodulatory activities [7]. The medicinal properties of this plant depend on the part of the plant and the extract used. For instance, fruits are applied on cuts and ulcers. They are also used to treat pulmonary ailments and fevers and to promote the healing of fresh wounds, for dysentery [8]. Interestingly, the flowers are important source for honey bee. The winter honey collected from the flowers of the Sedr is in high demand by citizens for its medicinal qualities in

addition to its excellent taste and fragrant smell [9]. *Z. spina-Christi* is a shrub, sometimes a tall tree, reaching a height of 20 m and a diameter of 60 cm; its bark is light-grey, very cracked, scaly; trunk twisted; very branched, crown thick; shoots whitish, flexible, drooping; thorns in pairs, one straight, the other curved. Its leaves are glabrous on upper surface, finely pubescent below, ovate-lanceolate or ellipsoid, apex acute or obtuse, margins almost entire, lateral veins conspicuous. Flowers in cymes, subsessile, peduncle 1 to 3 mm. Fruit about 1 cm in diameter [10]. *Z. vulgaris* has been used for the treatment of some diseases, such digestive disorders, weakness, liver complaints, obesity, urinary troubles, diabetes, skin infections, loss of appetite, fever, pharyngitis, bronchitis, anaemia, diarrhoea, and insomnia [10].

Z. spina-Christi has been used in folk medicine as a demulcent, depurative, anodyne, emollient, and astringent against stomach and toothaches, and as a mouth wash. The leaves are applied locally to sores, and the roots are used to cure and prevent skin diseases [11]. Arabs used it to maintain a healthy lifestyle and for its soothing properties. *Z. spina-Christi* has very nutritious fruits that are usually eaten fresh. Its flowers are an important source for honey in Yemen and Eritrea. *Z. spina-Christi* has been used in folk medicine as a demulcent, depurative, anodyne, emollient, and astringent against stomach and toothaches, and as a mouth wash [11]. extract of the plant is used in the management of dandruff, wounds, and hair loss in Bahrain [12]. Cough medicine in Nigeria is typically made from the roots [13]. Fruits are used in Sudan to treat diarrhoea, rheumatism, scorpion stings, malaria, and antispasmodics [14]. All parts of the plants are traditionally used in the treatment and management of various ailments in different parts of the world [15]. Decoction is made by boiling leaves and fruits in water for half an hour, and then it should be taken three times a day as an oral supplement to lower cholesterol and cancer risk [16]. In the Sahel region the roots are reported as a treatment against headaches, while spines and ashes are applied to heal snake bites [17].

PLANT PROFILE

Scientific name: *Ziziphus spina Christi*

Kingdom: Plantae

Family: Rhamnaceae

Genus: *Ziziphus*

Species: *Ziziphus spina-Christi*

Common name: Christ's thorn jujube, Christ's-thorn, Nabk tree, Syrian Christ-thorn

Synonyms: *Rhamnus nabeca* Forssk, *Rhamnus spina-Christi* L, *Ziziphus Africana* Mill., *Ziziphus ironies* A. Crav, *Ziziphus nabeca* Lam, *Ziziphus sphaerocarpa* Tul.

Uses: *Ziziphus* contains chemicals that might lower sugar and fat levels in the blood, and also cause sleepiness. People use *ziziphus* for constipation, diabetes, aging skin, high cholesterol, insomnia, and many other conditions, but there is no good scientific evidence to support these uses. Saponins are plant glycosides with different structures and biological activities, such as anticancer effects. *Ziziphus spina-Christi* is a plant rich in saponin, and this compound is used to treat malignant melanoma in the present study [18].



Fig.no.1.1 SpinaChristi flower

PHYTOCONSTITUENT OF ZIZIPHUS SPINA-CHRISTI

Z. spina-Christi is an important food source because it contains many nutrients, as 100 grams of *Z. spina-Christi* contains 314 calories. Fresh fruits contain 80% carbohydrates, 3mg% iron, 0.9gfat, 140mg calcium, 0.04 mg of thiamine, 0.13 mg riboflavin, 3.7 mg niacin and 30 mg ascorbic acid, and the concentration of ascorbic acid changes according to the degree of ripeness with respect to the fruit. The seeds contain 28.5% fat, 18.6% protein, and these proteins are characterized by being rich in sulphur amino acids. The leaves contain many minerals such as calcium 1,270 mg%, iron 7.2 mg%, magnesium 169mg % [5].

ECOLOGY AND DISTRIBUTION

The genus *Ziziphus* is known to be drought tolerant and very resistant to heat [19]. It can be found in desert areas with very low rainfall [20]. An indication of the importance of the root is the high root-to-shoot ratio measured on *Z. mauritiana* Lam. and the characteristic deep rooting nature of both *Z. nummularia* Burm. f. and *Z. mauritiana* [21]. The large carbohydrate reserves in the roots contribute to

the strong regeneration potential of *Ziziphus* plants. *Z. mauritiana* is reported as having a great capacity of recovering from injury of any kind, including fire [22]. Some species like *Z. mauritiana* and *Z. jujuba* Mill are found on almost every continent, whereas other species like *Z. spina Christi*, *Z. nummularia* and *Z. mucronata* are restricted to specific areas. *Z. spina-Christi* is found over the whole Sahelian area from Senegal to Sudan and across a large area in North Africa, Middle East, east Afghanistan and North West India [23]. The species is native to Sudan where it grows extensively in the north and centre of the country and along the Nile banks in Khartoum [24]. *Ziziphus spina-Christi* can generally be found at altitudes up to 600 m. However, in the United Arab Emirates it has been reported to grow at elevations of around 1,500 m [25]. The species can tolerate high temperatures. It grows in desert areas with an annual rainfall of 50–300 mm but is often also found in wadis where underground water is available. In Egypt apart from spontaneous growth, the tree is cultivated in the Nile valley in villages and parks [26].



Fig.no.1.2 *Ziziphus spina Christi* plant

PROPAGATION

Ziziphus is commonly propagated by seeds and therefore exhibits a wide genetic heterogeneity. This genetic variability may benefit *Ziziphus* in harsh environments by allowing rapid adaptation to changing climatic conditions. The tree is cross-pollinated and highly out bred. Germination is epigeal and seedling growth rate is medium, reaching a suitable size (40–50 cm in length) for planting after 4–5 months in the nursery [27].

CHEMICAL COMPOSITION OF THE FRUIT

The flesh of *Z. spina-Christi* fruits is rich in carbohydrates (80.6% in dry matter) notably starch (21.8%), sucrose (21.8%), glucose (9.6%) and fructose (16%) and in iron (3 mg 100 g) [28]. One-hundred-gram dried fruit pulp contains 314 calories,

4.8 g protein, 0.9 g fat, 140 mg calcium, 0.04 mg of thiamine, 0.13 mg riboflavin, 3.7 mg niacin and 30 mg ascorbic acid [29]. In another study, Eromosele et al. found 98 mg of ascorbic acid in the mesocarp of *Z. spina-Christi*. This is a rather high value if compared with those of orange (50 mg), grapes (38 mg) and strawberry (59 mg). On the other hand, it is well known that the level of ascorbic acid depends on the stage of maturity and ripeness of the fruits and such factors might explain the range reported in the above-mentioned study [30]. The seed contains 28.5% lipid and 18.6% protein. Its proteins contain high levels of sulphur-rich amino acids. Analysis of fatty acids revealed the presence of 13 fatty acids, linoleic acid predominates in its lipids (45%) followed by linolenic acid (20%), which showed high activity against *Escherichia coli* and *Bacillus subtilis* [31]. The leaves are rich in calcium (1,270 mg), iron (7.2 mg) and magnesium (169 mg) [32].



Fig.no.1.3 Fruits of *Ziziphus spina Christi*

POTENTIALS OF ZIZIPHUS SPINA CHRISTI

A tropical evergreen tree of many parts of Iran, it is cultivated mainly as a dry crop for its mucilage nutritious fruits, honey production and landscaping purposes. It serves the ecosystem by controlling erosion, acting as wind break and it improves soil quality by increasing available phosphorus. Traditionally, it is used in Iran as a medicinal plant; the fruits are used for the treatment of fever, pain, dandruff, wounds and ulcers, in inflammatory conditions, asthma and to cure eye diseases, while the seeds are used as a tonic. Extracts from the plant could be useful in the treatment of nosocomial infections, opportunistic infection of the urinary tract, infantile gastroenteritis, traveller's diarrhoea, wound infection, meningitis, and wounds infection which are diseases caused by some of these organisms [33]. Additionally, *Z. spina-Christi* fruit extract causes neurotransmitters release, which is probably related to presence of ascorbic acid and the leaves may potentially be safe

for use as sedative drug[34]. A variable activity of the plant extract is against *Staphylococcus aureus* which highly infects various burns [35]. Moreover, the methanol extract of Sidir could be used not only as a safe potential natural functional food ingredient or as therapeutic drug in the treatment of diabetes, but also it is effective in reducing both hyperlipidaemia and oxidative stress accompanying diabetes. It easily domesticated and can be grown commercially for the benefit of pharmaceutical industry and vegetation purposes [36].

BIOLOGICAL EVALUATION

Antifungal activity-Ziziphus spina-Christi has antimicrobial properties because of the presence of biologically active compounds. The methanolic extracts of *Z. spina-Christi* leaves and fruits demonstrated significant antifungal activity against the growth of *Alternaria alternata*, *A. citri*, and *A. radicina* with variable inhibition percentages at different concentrations. Pathogenicity was increased when the skin was injured, as expected [37].

Antidiarrheal Effects- Diarrhoea can be described as an adult's daily bowel movement that surpasses 200 g and contains between 60 and 95% of water. Diarrhoea caused by an infectious agent is the leading cause of new born mortality in underdeveloped countries [38]. Children under the age of two have been found to have the greatest mortality rates, with a mortality rate of 20 fatalities per 1000 people [38]. Diarrhoea is responsible for more illnesses and deaths in children than any other disease combined in some regions of the world [39]. 'World Health Organization has established a Diarrhoeal Disease Control (DDC) program to address the issues of diarrhoea in poor countries. 'Is program involving investigations of traditional medicinal practices. According to the findings, the extract of *Z. spina* protected rats from castor oil-induced diarrhoea and reduced intraluminal fluid collection and gastrointestinal transit. The findings revealed that the extract may include physiologically active components that are antidiarrheal, which could explain its traditional use for gastrointestinal disorders [39].

Anticancer activity- Cancer is a disease in which cells divide improperly and uncontrolled. In 2012, around 14 million new cancer cases were reported worldwide, with 8.2 million cancer-related deaths. The development and spread of the contemporary healthcare system has been supported by medicinal plants. As their acceptability and acknowledgment spread over the world, medicinal

plants remain the only path ahead. According to the findings of this investigation, the leaf extract contains compounds that have anticancer properties, making it a promising target for future research to create novel anticancer medications. If extensive scientific research is conducted, the leaf extract of *Z. spina* will aid in the development of novel anticancer drugs [40].



Fig.no.1.4. Leaves, spines, seeds and fruits of SpinaChristi

Antibacterial activity- Aqueous extracts of the fruits, leaves, seeds and stems of *Ziziphus spina-Christi* were screened for their antimicrobial activity against six standard bacteria: two Gram positive (*Bacillus subtilis*, *Staphylococcus aureus*), four Gram negative (*Escherichia coli*, *Klebsiella pneumoniae*, *Proteus vulgaris* and *Pseudomonas aeruginosa*) and two fungi (*Aspergillus Niger* and *Candida albicans*). The methanol extracts of all parts showed the highest activity against the bacteria tested followed by chloroform then petroleum ether. The aqueous extracts of all parts were inactive against all bacterial organisms. *Z. spina-Christi* has been used in alternative medicine for the treatment of fever, pain, dandruff, wounds and ulcers, inflammatory conditions, asthma and to cure eye diseases. *Z. spina-Christi* has recently been shown to have antibacterial activity [41].

Antidiabetics- Diabetes mellitus, a metabolic disorder, causes damage to the heart, blood vessels, nerves. As the current effective oral therapy for the treatment of diabetes causes side effects, new alternatives are required. In modern world, medicinal plants are used to treat many diseases, every year, large numbers of novel natural products are isolated with efficacy against various diseases. plants we assessed the potential of *Ziziphus spina-Christi* which belong to Genus *Ziziphus* and family *Rhamnaceae*. *Ziziphus* species are a group of small trees that grow in many

regions of the world. It is used for various medicinal purposes. Species of this genus are used traditionally for the treatment of various diseases such as fever, insomnia, skin infections, urinary problems, digestive disorders, obesity, liver complaints and diabetes [42].

Anti-Inflammatory-Physical trauma, noxious chemicals, and microbial infections may all produce inflammation, which is the body's natural reaction to protecting itself from further damage. A host of infections, irritants, and damaged tissues are dealt with during this procedure. Many medications are available to combat inflammation, but long-term usage may result in side effects such as nausea, vomiting, bone marrow depression, and fluid or salt retention [43]. A new supply of structurally essential compounds from plants has been discovered by traditional medicine, which means that it is always expanding its horizons [40]. It is well known that plants are rich in chemical compounds. Compositional diversity in plants has gone largely unexploited, and novel lead chemicals for the treatment and management of inflammation might be found. The crude extract was tested in a variety of solvents and shown to be efficient in treating a variety of inflammation-related diseases [44].

MULTIPURPOSE OF ZIZIPHUS SPINA-CHRISTI

There are many forms of benefiting of *Ziziphus spina-Christi*, the fruits of which are eaten either fresh or dry and may be in the form of flour used in baked goods, where they are made in the form of small balls, as the fruit pulp may be eaten or stored for the future.

a) Animal feed- Leaves are used as food for animals, especially in the dry season, where small branches are rubbed and used as feed for camels and goats [45].

b) Environmental uses-

It has great environmental importance as it is grown around villages and works as a safety belt and windbreaks because of its deep and extended roots. In addition, it works to raise soil fertility rates because it contains a large amount of phosphorous [45].

c) Human food-

There are many ways to take advantage of the plant, it may be eaten fruits, which are characterized by the sweetness of taste or may be ground, then mixed with water and made from it baked goods such as ginger bread. Recent studies have proven that honey resulting from bees that feed on dam trees is a strong bacterial antibody compared to other types of honey [46].

d) Fuel sources-

Wood is used as a source of fuel and access to high-quality coal, in addition to being used in the manufacture of doors and windows, door handles and furniture [47].

e) pharmaceutical uses

The medicinal uses of *Ziziphus spina-Christi* are versatile as hypoglycaemic. This plant has hypoglycaemic effect; researches indicated that induced diabetic rats by aqueous extract of plant decrease the level of blood glucose by two mechanisms by acting on glucose homeostasis in an extra-pancreatic way or by improvement of liver action and take glucose to synthesis glycogen act as fuel of energy. Saponin glycoside is known as natural product present in this plant which responsible for lowering level of glucagon which is hormone responsible for mobilization of glucose in to blood stream and hence lowering level of blood glucose in indirect pathway, hypotension, anticancer, anti-inflammation is used [48]. Due to the fact that the plant contains tannins, it has an antibacterial effect. This is due to the fact that the tannins are associated with the protein, especially proline-rich proteins. Where tannins are bound to the iron, which contributes to the inhibition of metabolism inside the microbe and helps to eliminate it [49]. The presence of saponins contributes to increasing the surface tension of the membranes, which contributes to increasing the permeability of cells and helps in destroying the microbe [50]. Alkaloids are bound to DNA, which affects the process of cell division, Flavonoids bind to DNA and R N A, thereby inhibiting protein and fat formation, causing energy metabolism to be impaired, thereby affecting the growth of the microbe [51]. The plant is used as a treatment for diarrhoea and colon cramps. It is also used as a twig powder in the treatment of rheumatism, scorpion sting, strengthening the immune system and regulating its mechanism of action [52]. The leaves are also used to treat headache, bone pain, abscess treatment, and superficial wound dressing, and are sometimes used as an analgesic [53]. Small branches are used in the treatment of eye infections, its leaves are boiled in water and used as a face wash and mixed with lemon and used as a shampoo to maintain the softness of hair and the purity of the skin [54]. Fruit tea is used to treat measles. Fruits are used to treat chest pain, respiratory system, and blood purification from impurities. Its leaves are used to get rid of the undesirable taste in oral medications and to keep the gums clean [55].

MEDICINAL USES

The vast majority of rural people in Sudan has no access to modern medicine and relies heavily on traditional cures, mostly prepared from plants. The genus *Ziziphus* is known for its medicinal properties as a hypoglycaemic, hypotensive, anti-inflammatory, antimicrobial, antioxidant, antitumour, and liver protective agent and as an immune system stimulant [56]. In central Sudan, *Z. spina-Christi* fruits are eaten to treat diarrhoea and malaria and as an antispasmodic. The powder of the twigs is used externally to treat rheumatism and scorpion sting [57]. In northern Kordofan the poultice of the powdered leaves is used to heal swellings and macerated roots are used as an antipurgative [58]. In the White Nile states the decoctions of the bark are used to treat intestinal spasms [59]. In the Sahel region the roots are reported as a treatment against headaches, while spines and ashes are applied to heal snake bites. Boiled leaves are applied to various surface wounds and against diarrhoea. In Egypt a beverage made from fruits is considered to be a sedative. In Palestine leaves and young branches are used as an anti-inflammatory for eye wash, treat toothache and stomach-ache and as an antirheumatic [60]. In the United Arab Emirates leaves are boiled in water and used as a shampoo or mixed with lemon and applied to the face and hair to soften or to soothe it. Ash of wood mixed with vinegar is applied to heal snake bites and a tea made of fruit is used to treat measles. Fruits and crashed kernels are eaten to treat chest pains, respiratory problems and as a tonic [61]. Moreover, in Oman fruits are regarded as having purifying properties such as cleansing the stomach, removing impurities from blood as well as being a restorative for the whole system. The water in which crushed leaves had been boiled is given to women in prolonged labour or with a retained placenta for its oxytocic properties [62]. In India, a preparation from bark is used to clean wounds and sores, while the gum that exudes from the tree in hot weather is used in Cyc remedies. The chewed leaves are said to numb the taste buds, which provides a method of suppressing the unpleasant flavour of some oral medicines.

a) Fruits-

Fruits of *Z. spina-Christi* are used as food especially for people in western and central Sudan and other Saharan regions. Fruits are collected by women and children and sold on local markets. This provides an additional source of income for local people, who may use the revenue to buy important

non-food items. Similarly, in Oman fruits are collected from wild and cultivated plants and sold on local markets. Fruits are consumed either fresh or dried and the sweet pulp of fruit is dried to produce fine flour. Typically, this flour is placed in small metal cups and cooked under steam. This process solidifies the flour to the shape of the container. The dried pulp flour and water are also mixed with sesame and formed into small balls. The fruit pulp prepared in these two ways can be consumed either immediately or stored for future use. In Oman fruits including kernels are ground to produce an edible mealy substance which is either eaten raw or cooked in water, milk or buttermilk. *Ziziphus* is a shrub or small tree. The fruit is used to make medicine. *Ziziphus* is used for improving muscular strength and weight, for preventing liver diseases and stress ulcers, and as a sedative [63].

b) Leaves-

The leaves provide valuable animal forage and fodder under open grazing conditions. This is especially important during the dry season when grazing is limited. Small branches are often lopped as dry season fodder for camels and goats and later used to make thorn fences. Biological reports and traditional applications including management of diabetes and treatment of malaria, digestive issues, typhoid, liver complaints, weakness, skin infections, urinary disorders, obesity, diarrhoea, and sleeplessness have all been treated with different parts of *Z. spina* all over the globe [63].

c) Bark-

The results of studies have exhibited that it is effective in anti-cancer and liver damage treatment. *Ziziphus spina-Christi* was found in ancient Egyptian prescriptions to treat pain, swellings, and heat to have anti-inflammatory effects. The wood is used as a source of fuel and it produces an excellent charcoal. The timber is used for tool handles, fence posts, bedstead legs, walking sticks, furniture, bent wood chairs, roofing beams, doors, windows and turned items. It is hard and heavy and is known to resist termites [64].

d) Seed-

Ziziphus spina-Christi had anti-apoptotic, anti-fibrotic, antioxidant, and protective effects on *S. mansoni* induced liver wounds. It has significant anti-inflammatory and moderate antipyretic activities. Safe alternative to lower blood glucose [65].

e) Flower-

The honey collected from the flowers of *Z. spina-Christi* is of excellent flavour and is normally sold at a price higher than that derived from the flowers of other trees [64].

II. CONCLUSION

The study found traditionally the plant parts especially the leaves were used for the treatment of diabetes, malaria, digestive issues, typhoid, liver complaints, weakness, skin infections, urinary disorders, obesity, diarrhoea, and sleeplessness. Preclinical investigations have already been conducted on a variety of biological activities. The leaves were found to have significant biological activity, and this is due to the presence of high contents of polyphenol compounds. *Z. spina-Christi* has pharmacological functions, including antihyperglycemic, antibacterial, antifungal, antioxidant and antinociceptive activities, among others. As the current information shows, it is also possible that various flavonoids and saponin glycosides such as Christin in-A might be useful in the development of new drugs to treat various diseases. It must be kept in mind that clinicians should remain cautious until more definitive studies demonstrate the safety, quality and efficacy of *Z. spina-Christi*.

REFERENCES

- [1]. Rushforth K. "Trees of Britain and Europe". Collins (1999).
- [2]. A. S. Saied, J. Gebauer, K. Hammer, and A. Burkert, "Ziziphus spina-Christi (L.) Wild.: a multipurpose fruit tree," Genetic Resources and Crop Evolution, vol. 55, no. 7, pp. 929–937.
- [3]. Wilkins J. "Food in Antiquity". University of Exeter Press (1995): 345
- [4]. Lev E, Amar Z. Ethnopharmacological survey of traditional drugs sold in the Kingdom of Jordan. J. Ethnopharmacology. 2002; 82:131-145.
- [5]. Amina S., et al. "Ziziphus spina-Christi (L.) Wild.: A multipurpose fruit tree". Genetic Resources and Crop Evolution 55.7 (2007): 929-937.
- [6]. O. Kadioglu, S. Jacob, S. Bohnert et al., "Evaluating ancient Egyptian prescriptions today: anti-inflammatory activity of Ziziphus spina-Christi," Phytomedicine, vol. 23, no. 3, pp. 293–306, 2016.
- [7]. M. A. Dkhil, R. B. Kasab, S. Al-Quraishy, M. M. Abdel-Daim, R. Zriecq, and A. E. Abdel Moneim, "Ziziphus spina-christi (L.) leaf extract alleviates myocardial and renal dysfunction associated with sepsis in mice," Biomedicine & Pharmacotherapy, vol. 102, pp. 64–75, 2018.
- [8]. Abalaka ME, Daniyan SY, Mann A. Evaluation of the antimicrobial activities of two Ziziphus species (*Ziziphus mauritiana* L. and *Ziziphus spina-christi* L.) on some microbial pathogens. Afr. J. Pharm. Pharmacol. 2010;4(4):135-139.
- [9]. Adzu B, Haruna AK. Studied on the use of *Ziziphus spina-christi* L. against pain in rats and mice. African Journal of Biotechnology. 2007; 6:1317-1324.
- [10]. Phytochemistry and pharmacologic properties of *Ziziphus spina christi* (L.) Wild.
- [11]. Chemical composition, antioxidant capacity and antibacterial activity against some potato bacterial pathogens of fruit extracts from *Phytolacca dioica* and *Ziziphus spina-christi* grown in Egypt.
- [12]. T. A. Alalwan, J. A. Alkhuzai, Z. Jameel, and Q. A. Mandeel, "Quantitative ethnobotanical study of some medicinal plants used by herbalists in Bahrain," Journal of Herbal Medicine, vol. 17-18, Article ID 100278, 2019.
- [13]. H. M. Adamu, O. Abayeh, M. Agho et al., "An ethnobotanical survey of Bauchi State herbal plants and their antimicrobial activity," Journal of Ethnopharmacology, vol. 99, no. 1, pp. 1–4, 2005.
- [14]. H. El-Kamali and K. El-Khalifa, "Folk medicinal plants of riverside forests of the Southern Blue Nile district, Sudan," Fitoterapia, vol. 70, no. 5, pp. 493–497, 1999.
- [15]. Madani, D. A. A. Ibrahim, and H. M. Hamdeen, "Abundance and ethnomedicinal use of tree and shrub species in Azaza and Mokla forests in the Blue Nile state, Sudan," EPRA International Journal of Multidisciplinary Research (IJMR), vol. 7, no. 7, pp. 167–173, 2021.
- [16]. O. Said, K. Khalil, S. Fulder, and H. Azaizeh, "Ethnopharmacological survey of medicinal herbs in Israel, the Golan heights and the west bank region," Journal of Ethnopharmacology, vol. 83, no. 3, pp. 251–265, 2002.
- [17]. MA (1998) Antimicrobial activity of 20 plants used in folkloric medicine in the Palestinian area. J Ethnopharmacol 60:265–271.

- [18]. https://en.m.wikipedia.org/wiki/Ziziphus_spina-christi
- [19]. Cherfas J (1989) Nuts to the desert. *New Sci* 19:44-47.
- [20]. Jawanda JS, Bal JS (1978) The Ber, highly paying and rich in food value. *Indian Hortic* Oct-Dec:19-21.
- [21]. Depommier D (1988) *Ziziphus mauritiana* Lam. *Bois Forests Trop* 218:57-62.
- [22]. Grice AC (1996) Seed production, dispersal and germination in *Cryptostegia grandiflora* and *Ziziphus mauritiana*, two invasive shrubs in tropical woodlands of northern Australia. *Austral Ecol* 21:324-331.
- [23]. Kirkbride JH Jr, Wiersema JH, Turland NJ (2006) Proposal to conserve the name *Ziziphus jujuba* against *Z. ziziphus* (Rhamnaceae). *Taxon* 55:1049-1050.
- [24]. Vogt K (1995) A field worker's guide to the identification, propagation and uses of common trees and shrubs of dryland Sudan. SOS Sahel International, London
- [25]. Jongbloed M (2003) The comprehensive guide to the wild flowers of the United Arab Emirates. Environmental research and wildlife development agency (ERWDA), Abu Dhabi.
- [26]. Grivetti LE, Ogle BM (2000) Value of traditional food in meeting macro- and micronutrients needs: the wild plant connection. *Nutr Res Rev* 13:31-46.
- [27]. Jongbloed M (2003) The comprehensive guide to the wild flowers of the United Arab Emirates. Environmental research and wildlife development agency (ERWDA), Abu Dhabi.
- [28]. Maxwell S (1991) To cure all hunger: food policy and food security in Sudan. Short Run Press, London.
- [29]. El Amin HM (1990) Trees and shrubs of the Sudan. Ithaca Press Exeter, Ithaca.
- [30]. Abdelmuti OMS (1991) Biochemical and nutritional evaluation of famine foods of the Sudan. Doctoral dissertation in Biochemistry and Nutrition, University of Khartoum, Sudan.
- [31]. Gebauer J, El-Siddig K, Ebert G (2002) Baobab (*Adansonia digitata* L.): a review on a multipurpose tree with promising future in the Sudan. *Eur J Hortic Sci* 4:155-160.
- [32]. Anonymous (1992) Nutritional study on *Ziziphus spina-christi*. Eden Foundation, Sweden.
- [33]. Adzu B, Haruna AK (2007). Studied on the use of *Ziziphus spina-christi* against pain in rats and mice. *Afr. J. Biotechnol.*
- [34]. Waggas AM, Al-Hasani RH (2010). Neurophysiological study on possible protective and therapeutic effects of Sidr (*Ziziphus spinachristi* L.) leaf extract in male albino rats treated with pentylenetetrazol. *Saudi J. Biol. Sci.* 5(3):1-6.
- [35]. El-Kamali HH, Mahjoub SA (2009). Antibacterial activity of *Francoeuria crispata*, *Pulicaria undulate*, *Ziziphus spina-Christi* and *Cucurbita pepo* against seven standard pathogenic bacteria. *Ethnobot. Leaflets* 13:722-733
- [36]. Aruoma OI (2003). Methodological considerations for characterizing potential antioxidant actions of bioactive components in plant foods. *Mutat. Res.* 523-524:9-20.
- [37]. Bioactive Compounds and Antifungal Activity of Leaves and Fruits Methanolic Extracts of *Ziziphus spina-Christi* L.
- [38]. F. G. Shoba and M. 'Om Borlaug NE (2002) Feeding a world of 10 billion people: the miracle ahead. *In Vitro Cell Dev Biol-Plant* 38:221-228a's, "Study of antidiarrheal activity of four medicinal plants in castor-oil induced diarrhoea," *Journal of Ethnopharmacology*, vol. 76, no. 1, pp. 73-76, 2001.
- [39]. A. L. Abdullahi, M. O. Agho, S. Amos, K. S. Gamaniel, and C. Wambebe, "Antidiarrheal activity of the aqueous extract of *Terminalia avicennoides* roots," *Phytotherapy Research*, Vol. 15, no. 5, pp. 431-434, 2001.
- [40]. A. Dogra, I. Labaran, S. W. Hamad, A. A. Lema, and B. H. Jakada, "Traditional medicinal plants used for the treatment of cancer in Mubi, Adamawa State, Nigeria," *AlQadisiyah Journal of Pure Science*, vol. 26, no. 4, pp. 258-268, 2021.
- [41]. N. S. Macedo, C. R. B. dos Santos, R. L. S. Pereira et al., "Phytochemical prospection, evaluation of antibacterial activity and toxicity of extracts of *Libidibia ferrea* (Mart. Ex Tul.) LP Queiroz," *Arabian Journal of Chemistry*, vol. 15, no. 2, pp. 103632-103639, 2022
- [42]. U. S. Abubakar, S. Abdullahi, V. Ayuba, S. Kaigama, U. S. Halidu, and M. K. Ayuba, "Medicinal plants used for the management of diabetes mellitus in Zaria, Kaduna state, Nigeria," *Journal of Pharmacy &*

- Pharmacognosy Research, vol. 5, no. 3, pp. 156–164, 2017.
- [43]. A. D. Mahmoud, A. M. Dogara, and A. Abba, “Ethnomedicinal survey of plants used for management of in-inflammatory diseases in Ringim local government, Jigawa state, Nigeria,” *Ethnobotany Research and Applications*, vol. 22, pp. 1–27, 2021.
- [44]. M. O. Ugwah, E. U. Etuk, S. O. Bello, A. A. Aliero, and C. J. Ugwah-Oguejiofor, “Comparative studies of anti-ulcerogenic activities of three Nigerian medicinal plants: a preliminary evaluation,” *Research Journal of Medicinal Plant*, vol. 7, no. 9, pp. 490–495, 2013.
- [45]. Amots D Shay L and Efraim L. “The ethnobotany of Christ’s Thorn Jujube”. *Journal of Ethnobiology and Ethnomedicine* 1.1 (2005).
- [46]. Jinous A and Elaheh H. “Phytochemistry and pharmacologic properties of *Ziziphus spina Christi* (L.) Willd”. *African Journal of Pharmacy and Pharmacology* 6.31 (2012).
- [47]. Vandita S., et al. "In vitro Antioxidant Activities of *Ziziphus spina-christi* Fruits (Red Date) Grown in Oman" 11.4 (2012): 209-216.
- [48]. Onat K., et al. "Evaluating ancient Egyptian prescriptions to- day: Anti-inflammatory activity of *Ziziphus spina-christi*". *Phytomedicine* 23.3 (2016)
- [49]. Michel C., et al. "Anti-diabetic activity and stability study of the formulated leaf extract of *Zizyphus spina-christi* (L.) Willd with the influence of seasonal variation". *Journal of Ethno- pharmacology* 133.1 (2011)
- [50]. Qianqian H., et al. "Potential and challenges of tannins as an alternative to in-feed antibiotics for farm animal production". *Animal Nutrition* 4.2 (2018): 137-150.
- [51]. Michał A., et al. "Effects of Saponins against Clinical *E. coli* Strains and Eukaryotic Cell Line". *Journal of Biomedicine and Biotechnology* (2012): 286216.
- [52]. Panche A., et al. "Flavonoids: an overview". *Journal of Nutri- tional Science* 5 (2016): e47.
- [53]. Teshager Y., et al. "BMC Complement". *Altern Medinces* 16.1 (2016): 303.
- [54]. Dkhil M., et al. “*Ziziphus spina-christi* leaf extract pre-treatment inhibits liver and spleen injury in a mouse model of sepsis via anti-oxidant and anti-inflammatory effects”. *Inflammopharmacology* 26.3 (2018): 779-791.
- [55]. Riham O., et al. “A Completely Polyherbal Conditioning and Antioxidant Shampoo: A Phytochemical Study and Pharmaceutical Evaluation”. *Journal of Pharmacy and Bioallied Sciences* 11.2 (2019): 105-115.
- [56]. Harami MA, Abayeh OJ, Ibok NNE, Kafu SE (2006) Antifungal activity of extracts of some *Cassia*, *Detarium* and *Ziziphus* species against dermatopytes. *Nat Prod Rad* 5:361–365.
- [57]. El-Siddig K, Ebert G, Luˆdders P (1999) Tamarind (*Tamarindus indica* L.): a review on a multipurpose tree with promising future in the Sudan. *J Appl Bot* 73:202–205
- [58]. FAO (1997) Non-wood goods and services in Sudan. In: *Forestry statistics and data collection*. FAO, Rome, Italy.
- [59]. El Ghazali GEB, El Tohami MS, El Egami AAB (1994) Medicinal plants of the Sudan: medicinal plants of the White Nile provinces. Khartoum University Press, Khartoum.
- [60]. Ali-Shtayeh MS, Yaghmour MR, Faidi YR, Salem K, Al-Nuri MA (1998) Antimicrobial activity of 20 plants used in folkloric medicine in the Palestinian area. *J Ethnopharmacol* 60:265–27
- [61]. Jongbloed M (2003) The comprehensive guide to the wild flowers of the United Arab Emirates. Environmental research and wildlife development agency (ERWDA), Abu Dhabi
- [62]. Miller AG, Morris M (1988) Plants of Dhofar, the southern region of Oman traditional, economic and medicinal uses. Adviser for Conservation of the Environment, Diwan of Royal Court Sultanate of Oman, Musca.
- [63]. Verinumbe I (1993) Soil and *Leucaena leucocephala* L. growth variability under *Faidherbia albida* Del. and *Ziziphus spina-christi* (L.) Desf. *Agrofor Syst* 21:287–292
- [64]. Sudhersan C, Hussain J (2003) In vitro propagation of a multipurpose tree, *Ziziphus spina-christi* (L.) Desf. *Turk J Bot* 27:167–171
- [65]. Borlaug NE (2002) Feeding a world of 10 billion people: the miracle ahead. *In Vitro Cell Dev Biol-Plant* 38:221–228