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Review Article

Medicinal Plants of Saudi Arabia

A Review of Commonly Used Medicinal Plants in The Western Region of Saudi Arabia

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Abstract: Writing a review on the use of medicinal plants involves evaluating their effectiveness and safety in treating various health conditions. To comprehensively assess their therapeutic value, it is crucial to consider scientific evidence, traditional knowledge, and potential side effects.This review aims to summarize and analyze the scientific research on the medical benefits of plants commonly used in western Saudi Arabia. These plants are frequently utilized as food additives, flavorings, traditional drink ingredients, and various skin-related applications. By examining the existing literature, this review provides an overview of the potential therapeutic properties associated with these plants. The plants presented in the research are *Citrullus colocynthis* (Bitter apple), *Zingiber officinale* (Ginger), *Hibiscus sabdariffa* (Roselle), *Mentha piperita* (Mint), *Pimpinella anisum* (Anise), *Salvia rosmarinus* (Rosemary), *Senna italic* (Senna), *Ziziphus SpinaChristi* (Sidr). Firstly, when discussing plants, it begins by providing a general introduction. Subsequently, it shows the various medicinal advantages associated with each plant. Finally, conclude by summarizing the specific medicinal benefits offered by each plant. Our review has determined that the following plants - Bitter apple, Ginger, Roselle, Mint, Anise, Rosemary, Senna, and Sidr - possess beneficial properties for diabetes. Except for Senna, all these plants positively affect cancer and inflammation. Similarly, all plants except Roselle demonstrate positive effects on microbes, while Anise and Roselle lack positive effects on oxidants. Additionally, Ginger, Anise, and Senna positively impact gastrointestinal health. Furthermore, Anise is known for its relaxant effects.

Keywords: Medicinal plants, Anti-cancer, Antidiabetic, Antimicrobial, Bitter apple, Ginger, Roselle, Mint, Anise, Rosemary, Senna, Sidr.

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1. INTRODUCTION

Medicinal plants are one of the oldest forms of medicine[1], found by humans through the trial and error technique, in which different species are tried until helpful species are discovered, eventually becoming an essential element of human societies' traditional medicine.[2]Despite the discovery of medicinal plants since ancient times, the active ingredients and mechanisms of action remained unknown for a long time until scientific research made it possible to learn about the active chemicals and mechanisms of action[2]. Sumerian clay from 5,000 years ago contains the oldest evidence of plant use for medical purposes. The second oldest evidence is a Chinese book from 4523 years ago. Furthermore, in particular religious' texts, various medicinal plants are referenced. For instance, the Quran and hadith mention at least 12 medicinal plants in Islam [3]. Similarly, the Bible mentions 45 medicinal plants[4], while the Hindu scripture Veda references a staggering 437 medicinal plants.[5, 6] It is estimated that one-tenth of vascular plants are medicinal plants.[2]Its count is between 50,000 and 80,000 around the world, including 15,000 that are threatened with extinction. [7] Women are the most knowledgeable about medicinal plants.[8] More than 90% of traditional medicine depends on plant origin, and up to 80% of the people in the least developed countries (equivalent to more than 3.3 billion people) depend on medicinal plants[7,9]. Morphine was the first drug from a plant source known to be put on the market in 1826 by Merck,[2, 10] and Aspirin is one of the most common drugs from plants derived from the bark of the willow tree, which was used for pain relief for more than 3500 years ago[11]. 115 of the 150 most prescription drugs in the United States are derived from plants. More than a quarter of prescription medicines in developed countries are derived from plants[7]. Sales of medicinal plants between 2008 and 2013 increased in China twofold and threefold in India[2]. Sales of medicinal plants in Europe have grown by 25%, and more than 1,300 medicinal plants are used[7, 12]. Patients' confidence in plant-based medicines is high 10 The world's usage of medicinal plants is expanding quickly[7], and The trade in medicinal plants exceeds $100 billion annually[12]Scientific research on medicinal plants is divided into three types: Research on plants in an area. Second, research on a specific plant. Third, research focuses on the plant's effectiveness toward a goal, such as eliminating bacteria or its effectiveness toward a disease. More than 110,000 studies on medicinal plants have been published between 1960 and 2019 in 159 countries, with China and India being the top countries for research, followed by the United States and Brazil. Studies peaked in 2010, with more than 5,000 papers published globally yearly[2] This review article falls within type I, where we focus on some plants in western Saudi Arabia and summarize what was mentioned in the scientific articles.

2. METHODOLOGY

2.1. *Data collection*

To achieve the aim of collecting data published about some different medicinal plants in Western Saudi Arabia region and summarize what was mentioned about these plants in the scientific research, some keywords were used for a search, such medicinal plants, Anti-cancer, Antidiabetic, Antimicrobial, Bitter apple, Ginger, Roselle, Mint, Anise, Rosemary, Senna, Sidr). This review tried to cover different scientific research from 1982 until now, from research articles, review articles, book chapters, and conference abstracts related to the medicinal effects of the plants chosen (Table 1) traditionally used in the Western Saudi Arabia region.

2.2. *Study area*

The Eastern Province, also known as the Eastern Region, is the easternmost of the 13 provinces of Saudi Arabia. Area: 672,522 km², Area code: 1234. Its coordinates are 23.5681° N, 50.6794° E. Fig (1).

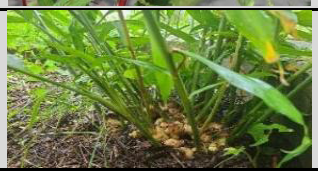
Fig 1: Political Map of Saudi Arabia - Nations Online Project

Table 1: Ethnobotanical plants used as medicinal plants in the study area.

No	The scientific name	Common name	family	Part used	Mode of application with literature citation	Reference
1	*Citrullus colocynthis*	Hanzal	*Cucurbitaceae*	Whole plant	The fruit is used to treat tumors and diabetics 300 mm/ day, The oil extract is used to treat constipation, and plant leaves are used for skin infections.	13-15
2	*Zingiber officinale*	Zanjabil	*Zingiberaceae*	Whole plant	Ginger is a spice for eating, a hot drink to treat sore throat, blood thinners, cough treatment, and a natural antibiotic for infections.	16-19
3	*Hibiscus sabdariffa*	karikadia	*Malvaceae*	Dried leaves and cup	Hibiscus is used as a drink to lower blood pressure by boiling the flower	20
4	*Mentha piperita*	Naenae	*Lamiaceae*	plant leaves	Mint leaves are used in tea to soothe a sore throat, lower blood pressure, and regulate the pulse rate.	21
5	*Pimpinella anisum*	Yansun	*Apiales*	anise seeds	The seeds are crushed and used as a cough suppressant and anti-bacterial and anti-fungal syrup in the mouth. Anise seed syrup is used as a cradle for abdominal pain.	22
6	Rosmarinus officinalis	Aklil Aljabal	*Lamiaceae*	whole plant	The seeds, leaves, and roots are used as a spice, and the plant is used to strengthen hair and relieve skin infections by boiling and using the plant.	23, 24
7	*Seena italica*	Seenamaki	*Fabaceae*	Whole plant	Leaves, flowers, and bark treat various infections and skin diseases. Aqueous leaf extracts significantly lower glucose levels	18, 19
8	*Ziziphus Spina* christi	Sidr	*Rhamnaceae*	Sidr leaves, Fruit	Dry and grind the leaves to use on hair like henna. Also, make Sidr oil by squeezing it, then use it to eliminate dandruff, promote hair growth, and moisturize it. Sidr fruit, called Nabq, has health benefits like treating dry eyes, aiding digestion, and reducing joint infections.	25

In this table, we indicate the different information about the plants studied (plant species, common name, scientific name, parts used from the plants, and mode of application).

Table 2: Plant species and habits

Plant species	Habit	Photograph
Citrullus colocynthis	Creeping plant	
Zingiber officinale	Shrub	
Hibiscus sabdariffa	Shrub	
Mentha piperita	Herb	

Pimpinella anisum	Shrub	
Salvia rosmarinus	Shrub	
Senna italica	Shrub	
Ziziphus Spina Christi	Tree	

This table showed the scientific names of the plants, the habits of these plants, and a photograph of these plants.

3. PLANTS USED

3.1. *Citrullus colocynthis (Bitter apple)*

The desert plant is found in areas such as the Arabian Peninsula, west of Asia [26], and it has other common names, such as Bitter gourd, Bitter apple, and Bitter cucumber[27], used for physical therapy and to resist diseases of microorganisms such as bacteria and fungi and uses insecticide for defence[28, 29]. Its composition contains approximate proportions of Protein 25.73b, Carbohydrate 13.70b, Fat 46.24c, Fiber 5.00b, Ash 4.48b, Moisture 4.85a[30]. The seeds contain many fatty acids, such as linoleic, the most significant proportion of palmitic and oleic[31]. Specialists can benefit from this plant by producing curatives that can help combat many diseases that affect humans and can benefit from all parts of the plant, such as fruit and roots [32, 33] The fruit is used for the common cold; the root is used for urinary tract disorders [34]. The seeds act as antibacterial positive and negative grams[35]. It also has some activities in organs such as the liver, which helps stabilize cells[36, 37]It also protects nerve cells[38]. and reduce[39]. Furthermore, if treatment is used without health advice, it may cause many diseases. Many studies have been carried out on a group of organisms. A study was conducted to measure plant toxicity using an extract from a mature plant, which gave unsatisfactory results as some organs, such as the liver and kidneys, were affected. It also causes intestinal damage. The mice were examined after consuming 10% of the plant extract, which led to low body weight diarrhea and damage to blood cells[42]. High doses caused rabbits to die from dehydration and heart failure[43] It has also been used in humans with constipation and liver damage[44]

3.1.1. Medical effects

3.1.1.1. Anti-inflammatory effect

Using unripe bitter apple fruit and seeds[28] gave strong anti-inflammatory results[45]. A study proved that the plant's alcoholic water extract, such as metformin, plays the role of follicle formation to relieve inflammation[46]. A cream was made from the plant and showed its activity against inflammation and pain in mice[47]

3.1.1.2. Anti-cancer effect

The treatment of tumors can be used in several parts of the plant where the leaf extract contains chloroform and ethyl acetate. The results showed an increase in the number of treated cells. In the presence of inhibitors, we conclude it can inhibit cancer cells. Also, the methanol leaf extract gave activity in response to breast cancer[48]. Fruit pulp extract inhibits cancer cell transmission and activates apoptosis [49]. The leaf extract is more effective against cancer, and the fruit extract is effective against tumors leading to cancer cells[50]. A study was conducted on leaf extracts causing thrombosis[51]. An experiment on Bitter apple plant oil proved its effectiveness in killing cancer cells in the skin. In the future, it might be relied upon as a natural treatment drug[52].

3.1.1.3. Antidiabetic effect

A study was conducted on rabbits where the plant peels were extracted from saponins and given to diabetic rabbits whose sugar level was low[53,54]. The same study was carried out on rats using roots, leading to the same results [55]. The plant was used from pulp extract and seeds with acetate and fat content, which helps enhance insulin[56]. The ratios of each extract were clarified, starting from 10 – 500 mg /kg body weight. The fruit pulp is also used to reduce the effects of diabetes[58], where the plant works to maintain and regenerate beta cells[57, 59] A study extracted 4% of the oil from the plant and gave it to mice to gain weight, as the results of the extract showed that it is an aid for weight loss and controls the level of glucose [60]

3.1.1.4. Antimicrobial effect

A study on "Acetone aqueous" and dry extract of the plant was done, and it showed a reaction towards Gram-positive and Gram-negative bacteria[28]. Extracted Ethanol was also found to be effective against positive and harmful bacteria, and pulp extract was more effective than the plant's seed[61]. Ethyl

acetate extracted from leaves was effective against positive and negative bacteria and was shown to obtain a lower inhibitory concentration. The activity against bacteria depends on the type of strain, different parts of the plant, plant maturity, and method of extraction[28] So far; studies are still being carried out to fight bacteria by using extracts[29]. All plant organs were used to find out their effectiveness. It was found that mature plants affect the Candida, while immature plants needed the extracted acetone to affect the strains[28]. Studies show that plant-based Ethanol is a good substitute for chemical pesticides against fungi that affect plants[62]. A study on a parasite called *Trichomonas vaginalis* showed that nanocomposites extracted from the plant were more effective than traditional chemical drugs in combating the parasite, even though the parasite showed more robust resistance. It was also safer and less toxic than traditional drugs in patients with hemolysis[63]

3.1.1.5. Anti-oxidant effect

Chemical examination shows that the plant contains natural compounds [64]. Among them, methanol extracted from the plant is effective against oxidation, and the concentration of the extract in the crust was observed to be higher than phenolic compounds to protect the internal organs[65, 66]. The distribution of phenolic compounds depends genetically and on external influencing factors in general[67]. A study was carried out on the highest percentage of the phenolic content of the plant, as it was found that the percentage is higher in winter than in summer in the average year. However, the total percentage is higher in summers [68 & 69]. It was studied on oil extracted from the seeds of the plant, where fatty acids are more active against oxidation; it serves as, for example, can be used for liver protection[70, 71]Since it is a good anti-oxidant, it can be used with manufactured medicines[72]Several studies have been conducted on bitter apples. It has been found to have high nutritional values that can be used to treat many diseases, including anti-oxidant, anti-cancer, antidiabetic, and antibacterial ones. For example, because it contains a large percentage of fatty acids, specifically in its seeds, it can be used as a food supplement that uses anti-oxidants in the future. Studies have been done so far to adopt and trust them instead of chemical compounds.

3.2. *Zingiber officinale (Ginger)*

For more than 25 years, traditional Chinese and Indian medicine has used ginger, a well-known herbal plant[73] Ginger is a significant plant with numerous therapeutic and dietary benefits. 8.9% moisture, 2.3% protein, 0.9% fat, 1.2% minerals, 2.4% fiber, and 12.3% carbs are all present in fresh ginger. It has been used for a long time as an herbal medication to treat various ailments, such as headaches, nausea, discomfort, and cold symptoms. In addition, accumulating studies have demonstrated that ginger possesses the potential to prevent and manage several diseases, such as neurodegenerative diseases, cardiovascular diseases, obesity, and diabetes mellitus, and it has been shown to have anti-inflammatory, anti-tumor activities, anti-tumourigenic, anti-apoptotic, antimicrobial, anti-hyperglycaemic, antioxidant antidiabetic, anti-clotting and analgesic properties, cardiotonic, cytotoxic[74]

3.2.1. Medical effects

3.2.1.1. Anti-inflammatory effect

A series of studies showed that ginger and its active ingredients possessed anti-inflammatory activity, such as 6-shogaol ,6-gingerol,6-dehydroshogaol, and GDNPs (ginger-derived nanoparticles) 2, which could protect against inflammation-related such as colitis[75]An experimental experiment was conducted on male Swiss rats and male Wistar rats to evaluate the anti-inflammatory and anti-inflammatory effects, respectively, by Vendruscolo *et al.* (2006). In this study, they found that Ginger essential oil (GEO) showed significant anti-keratolytic and anti-inflammatory activity[76]

3.2.1.2. Anti-cancer effect

Ginger's biological effects on tumor development include altering a tumor suppressor gene, promoting apoptosis, and deactivating VEGF pathways. As a result, ginger has the power to inhibit the growth of tumors. VEGF (vascular endothelial growth factor) and FGF (Fibroblast growth factors), two angiogenic factors, are critical regulators of the emergence and growth of tumors[77]. According to numerous studies, ginger's pharmacological mechanisms and myriad constituents potentially impact several malignancies, including breast, prostate, and colorectal cancer [78]. The active component 6-gingerol plays a significant part in suppressing the growth of cancer, uncontrolled cell growth, metastasis, and inflammatory processes involving various carcinogenesis, angiogenesis, and malignancy stages. Ginger stops them[79]Ginger contains active substances like 6-gingerol and 6-school that can combat cancers, including gastrointestinal cancer. Since many forms of cancers, including those that affect the digestive tract, such as the liver, colon, stomach, pancreatic, and bile duct, are effectively treated by ginger [80], this is significant. Compared to chemotherapy, which might have side effects like hair loss, ginger is one of the most potent cancer treatments, with outcomes a thousand times greater than chemotherapy. A natural cancer preventative, ginger also has antioxidant properties [81].

3.2.1.3. Antidiabetic effect

According to studies, ginger can help people with diabetes lower blood sugar levels and control how their bodies react to insulin, particularly for those with type 2 diabetes. The ability of ginger to stimulate blood glucose absorption into muscle cells without using insulin has also been demonstrated in studies[82]. Studies have demonstrated the antidiabetic properties and activity of ginger. Treatment with ginger helps treat hypo-insulinemia and lower blood sugar levels [83]. Additionally, animal models have demonstrated that ginger juice significantly lowers blood sugar levels in people with diabetes and non-diabetics [84]obesity because of its association with several chronic diseases, including diabetes, high blood pressure, and cardiovascular disease; obesity is a hazardous condition [85]. Ginger is used to lose weight since research has shown that it effectively controls and prevents obesity [86]. Ginger contains anti-obesity bioactive substances, primarily through the ability to block lipogenesis and enhance fatty acid catabolism. Examples of these substances include gingerenone A, 6-shogaol, and 6-gingerol[87] Other research has shown that male Sprague-Dawley rats administered 95% ethanolic ginger can reduce adipocyte size and enhance energy expenditure, activating the thermoregulatory system in adipose tissue by increasing the degree of heat generation[88]

3.2.1.4. Antimicrobial effect

The ginger plant has many properties, and one of those properties is that it is antimicrobial. Ginger effectively eliminates fungus and bacteria in the colon and flatulence in the stomach [89]. When the components of ginger gingerol and shogaols were isolated, they showed antiviral activity; many studies in the laboratory showed that ginger has components, which are active ingredients that prevent the reproduction of bacteria that are in the stomach of the stomach; for example, *Helicobacter pylori*, as the more ginger extract, the greater the antimicrobial properties[90].

3.2.1.5. Antioxidant effect

Ginger has an antioxidant effect on the cell culture system[91]. Many studies state that ginger has antioxidant properties. Ginger contains antioxidants that improve body functions and help it eliminate "free radicals" and prevent them from damaging cells that can lead to many diseases[92]. Ginger has oxidative properties, as about 40 antioxidant compounds have been discovered; due to these ingredients, ginger can be an antioxidant drug Protective against toxicity and lethality, such as carbon tetrachloride. DNA enables oxidative damage caused by many fatty steroids in mice[93].

3.2.1.6. Gastrointestinal effect

Ginger is most frequently used to treat nausea and vomiting symptoms. Pregnant women frequently use it to lessen their symptoms of nausea and vomiting[94].Studies have shown that ginger can empty the stomach and eliminate intestinal cramps. Ginger has an antiemetic and flatulent effect that helps relieve intestinal gas. Ginger has been proven more effective than treatments and medications for symptoms and motion sickness since it has a habit of curing seasickness. It is, therefore, advised to take ginger to prevent seasickness. One gram of ginger effectively lowers the subjective severity of seasickness in marine students, according to a follow-up study [95]. One of the most significant known medicinal herbs, ginger, is employed in contemporary medical treatments and by traditional healers. Fever, sore throat, and nausea are conditions brought on by the common cold that can be treated with fresh ginger. It is utilized as an anti-inflammatory, antioxidant, anticoagulant, antibacterial, and hypoglycemic agent to treat numerous disorders.

3.3. *Hibiscus sabdariffa (Roselle)*

Roselle is a plant that belongs to the *Malvaceae* family. It often grows in the wild in tropical climates. It has a high percentage of pharmacologically active compounds, is suitable for treatment, and has been used in broad areas of folk medicine for thousands of years. Bacterial, parasitic, and cancerous diseases have also severely threatened human and animal health for decades. It is often used in forensic medicine because it is rich in carbohydrates, dietary fiber, protein, vitamins, calcium, magnesium, and iron[96]. The main biological components of Roselle of medical importance are polysaccharides, organic acid, and flavonoids, mainly anthocyanins[97]. Thus, it has enormous capabilities in modern therapeutic uses. The study aimed to consolidate, review, and document all available evidence and information about Roselle, focusing on its nutritional composition, bioactive ingredients, therapeutic uses, and chemical components. Journals, books, and conference proceedings were also searched. The review provides valuable information about the nutritional component of Roselle. Moreover, it is used in treating various degenerative diseases such as high blood pressure, cancer, and other inflammatory diseases of the liver and kidneys and high blood lipids. Their toxicological effects are also discussed from a safety point of view. Most studies have confirmed and provided the scientific basis for saying that Roselle and its active ingredients are essential in protecting against chronic and degenerative diseases associated with oxidative stress[20, 98]

3.3.1. Medical effects

Research has stated that all its parts (seeds, stems, flowers, leaves) have beneficial uses. The most beneficial part of the Roselle plant is the sepals[96]. Dried cobs of Roselle are a source of effective anti-oxidant, anti-aging, anti-inflammatory, anti-obesity, Anti-hyperlipidemia, anti-hypertensive, inhibition of platelet aggregation, diuretic, anti-ureolytic, antimicrobial, anti-cancer[97], heart diseases, stomach pains, as well as kidney and skin diseases. It has been documented that the plant is rich in phytochemical compounds such as polyphenols, which have shown a strong effect in lowering the fat content in the liver and enhancing the absorption density of LDL lipoprotein in liver cells[99]

3.3.1.1. Anti-inflammatory effect

The seed oil of Roselle revealed the presence of cholesterol, campasterol, stigmasterol, ß-sitosterol, α spinasterol, and ergosterol. In addition, some seed oils contain steroids and tocopherols such as linoleic acid, cellulose, pentosan, and starch. Showed high. Antipyretics, Anti-Inflammatories, Essential Medicines, Extracts[100]

3.3.1.2. Anti-cancer effect

Roselle. It belongs to the Mallow family. It is considered native to Africa, although it can be found in many parts of the world. It is cultivated for its medicinal and economic value. Roselle tea or juice is famous worldwide for its anti-oxidant properties and many other health benefits. It has uses in Indian herbal medicine and *Ayurveda* to treat diseases. However, investigations into the cancer-fighting potential of plants had begun around the past decade and had shown promising results. This plant's crude extracts and purified compounds have been reported to induce chemo-preventive, selective cytotoxicity, cell cycle arrest, apoptosis, autophagy, and metastatic effects in various human cancer cells. The plant contains high amounts of polyphenols, at least two of which have been shown to have potent cancer-fighting properties. However, several studies have roughly elucidated the molecular mechanism of anti-cancer activity. This study shows that Roselle is an ideal candidate to study its role as an herbal dietary supplement in the prevention and treatment of cancer because plant polyphenols have an excellent safety and tolerability record, and better-designed clinical trials are needed[101]. Roselle leaves have been shown to have hypoglycemic, hypo-lipidemic, and anti-oxidant effects and induce cancer cell death and apoptosis. However, the molecular mechanisms involved in the anti-cancer effects of anti-invasive leaf extracts are unclear. First, HLE needs to be better understood. The study aimed to investigate the potential of rosella to inhibit the migration and invasion of polyphenolic cells in a dose-dependent manner[102].

3.3.1.3. Antidiabetic effect

Herbal medicines are becoming more popular. Roselle. It had been used in folk medicine for thousands of years. Due to its multiple active components, including polyphenols, polysaccharides, organic acids, or pectin, it is said to have hypoglycemic, anti-oxidant, anti-hypertensive, and lipid-protective activities and many indirect effects[96]. It has a positive role in type 2 diabetes[103] as it lowers blood sugar, increases insulin secretion, and improves resistance[104]. Plants rich in polyphenols may help inhibit alpha-glucosidase and alpha-amylase but with less potential for side effects. Aqueous extracts of red and white Roselle showed inhibitory activity against α-amylase and α-glucosidase, the compounds responsible for the inhibition. These enzymes are gallic acid and protocatechuic acid. Roselle extract had biofilm-killing properties against all bacteria tested. The antibacterial effects of Roselle are also enhanced by combining the extract with apple cider vinegar. Some research also shows that using an aqueous extract or infusion of Roselle can affect insulin levels. Some authors believe that Roselle gallic acid increases insulin secretion by regenerating islets in the pancreas, improving insulin sensitivity, and reducing insulin resistance[96]. Recently, the efficacy of natural bioactive compounds such as flavonoids and phenols in treating obesity has been reported. Bioactive compounds in edible plants such as Roselle have been reported for their ability to combat obesity, and available toxicology information on the consumption of Roselle was revealed. Roselle compounds and other PPARγ transcription factors. The derived bioactive compounds effectively treat obesity with an apparent reduction in body weight, inhibiting lipid accumulation and suppressing lipogenesis through the Roselle pathway of time[105]. Obesity can be prevented by inhibiting the enzymes that interfere with the absorption of dietary fats, α-amylase and α-glucosidase, and carbohydrates in the intestine. Notably, the main enzymes are responsible for the hydrolysis of starch into simple sugars. At the same time, the lipases are responsible for the breakdown of fats into absorbable monoacylglycerols and free fatty acids. Inhibition of these enzymes impairs the digestion of dietary fats and carbohydrates, reducing caloric intake[106].

3.3.1.4. Anti-oxidants effect

Little information is available on the anti-oxidant effects of extracts from other parts of the hibiscus plant[107]. It has a positive role in type 2 diabetes, as it lowers blood sugar, increases insulin secretion, and improves its resistance. The anti-cancer potential of the plant has been proven, which showed encouraging results. The plant contains a high amount of polyphenols, and it has been proven that at least two stimulate anti-cancer solid effects. Obesity can be prevented by inhibiting enzymes that interfere with the absorption of dietary fats, α-amylase and α-glucosidase, and carbohydrates in the intestine.

3.4. *Mentha piperita* (Mint)

Mint has a long history of use in safe[108] for its therapeutic essential oils and is widely distributed. The genus Mentha belongs to the *Lamiaceae* family and has 18 species besides others[109]. Famous Greek herbalist and physician Pedanius Dioscorides first attempted to classify the Mint. After that, in his book "Plant Species," Karl Linnaeus classified Mint. Additionally, the taxonomy of Mint was enhanced in the 20th and 21st centuries based on the genetic links between species[110]. Mint, found in various consumer products, can trigger allergic symptoms such as anaphylaxis, heartburn, stinging, diarrhea, headaches, and abdominal cramps [111]. L-carvone, a component found in many mouth sanitizers, can cause sensitivity in some people, especially in Mint-flavored mouthwashes[112]. Inhaling the smell of Mint might cause allergic asthma[113].

3.4.1. Medical effects

3.4.1.1. Anti-inflammatory effect

Mint oil was discovered to have anti-inflammatory properties by inhibiting macrophage production of pro-inflammatory cytokines. This suggests their therapeutic potential against inflammation and infection[114]. Mint has both calming and detoxifying effects. It can aid digestion, smooth inflammation, and alleviate bronchitis, lungs, nose, throat, and congestion. It can be consumed as tea or chewing gum[115].

3.4.1.2. Anti-cancer effect

The mint extract has anti-proliferative effects on breast cancer cells and strong antimicrobial and antioxidant properties. It can be studied to isolate novel anti-cancer chemicals[116]. The Mint essential oils showed varying levels of potency. A549, HepG-2, and MCF-7 human tumor cell lines exhibit anti-cancer activity at 100 g/mL doses[117].

3.4.1.3. Antidiabetic effect

Mint juice treatment improved lipid profile and glycemia in the offspring of diabetic rats. This information suggests its potential as a culturally appropriate therapy for preventing diabetes and related complications[118]. To ascertain there in vitro antidiabetic effects, Mint Eosinophils (EOs) were evaluated for their capacity to inhibit -amylase and -glucosidase enzymatic activity[119]. It is helpful as a substitution for salty, sweet, or calorific flavors[120].

3.4.1.4. Antimicrobial effect

Mint oil extracts have anti-bacterial properties mainly due to Menthol. Their Minimum Inhibitory Concentration MICs range from 0.4% to 0.7% v/v for bacterial strains[121]. Mint has anti-bacterial properties against various bacterial types, with similar efficacy against Gram-negative bacteria[122]. However, their anti-biotic action against Gram-positive bacteria varies. Mint's essential oils demonstrated extremely potent anti-bacterial activity, especially against Escherichia coli strains[123].

3.4.1.5. Antioxidant effect

When compared to other plants, the largest concentration of antioxidants can be found in mint leaves[115], such as flavonoids, polysaccharides, terpenoids, polyphenol compounds, vitamin E, vitamin C, beta-carotene, and other protein molecules with enzymatic activity, confer antioxidant characteristics on Mint[108].To sum up, Mint is an essential plant for therapy. It has been utilized for a very long time. It has significant ramifications for human beings. This plant has been proven to have anti-bacterial, anti-fungal, antioxidant, anti-cancer, and antidiabetic effects. As a result, it is thought to be among the most significant plants for medical research.

3.5. *Pimpinella anisum* (Anise)

Anise is a well-known traditional medicinal plant used as a muscle relaxant, anti-cancer agent, anti-bacterial agent, and anti-ulcer in folk medicine [124]. Since they have developed through generations to encode biological tests, natural substances produced from plants continue to represent the first generation of pharmaceuticals. Most researchers have focused on naturally occurring substances from regularly used *Pimpinella* species, including Anise, to evaluate their anti-oxidant, anti-bacterial, and anti-inflammatory effects.[125], Aniseeds offer a variety of medicinal properties, including anti-bacterial, anti-fungal, anti-viral, anti-oxidant, muscle relaxant, analgesic, and anti-convulsant action, in addition to multiple effects on the gastrointestinal system[126].

3.5.1. Medical effects

3.5.1.1. Anti-inflammatory effect

To support the assertions made by Unani and Arabian traditional medicine practitioners regarding the putative gastro-protective effects of Anise on experimentally induced stomach ulceration and secretion in rats, Anise significantly reduced the damage to the stomach mucosa brought on by indomethacin and necrotizing agents. Histological analysis further supported the anti-ulcer efficacy[127, 128]. Anise suspension considerably decreased the acidity and rumenal ulceration in pylorus-ligated Shay rats and the basal stomach acid output. However, the solution considerably restored the levels of gastric mucosal non-protein thiols(NP-SH) and stomach wall mucus, and the effects of ethanol significantly decreased. Screening of many Iraqi medicinal plants for analgesic action revealed that Anise extracts had a significant analgesic effect against benzoquinone-induced writing and thermal tests[129].

3.5.1.2. Anti-cancer effect

The current study concentrated on a straightforward, environmentally friendly method for creating silver nanoparticles (AgNPs) with multiple anti-cancer and anti-bacterial uses. Overall, our findings demonstrated the potential of AgNPs produced by Anise as novel, affordable bio-reducing agents for green nano-synthetic pathways. The data support that plant-borne reducing and stabilizing agents have multiple uses in nanotechnology. India has a far lower incidence of cancer than Western countries. Although the exact cause is unknown, the increased spice consumption may play a significant role. People in our region believe that anise seeds effectively prevent and treat cancer. *Anise* is a plant that is grown in India. The potential anti-cancer properties of anise seed extract were investigated in this work[130].

3.5.1.3. Antidiabetic effect

On type 2 diabetes patients, the anti-diabetic, hypo-lipidemic, and anti-oxidant effects of aniseed and coriander seeds were compared. The seed powders (5 g/day) were administered to two groups of type 2 diabetes individuals for 60 days. Fasting blood sugar levels increased by 11% in controls, by 36% in people with type 2 diabetes receiving aniseed treatment, and by 13% in those receiving coriander treatment, according to the findings. Additionally, patients who received either coriander or aniseed medication saw a significant decrease in their blood lipids and cholesterol. Both treatment groups demonstrated decreased erythrocyte and plasma lipid peroxidation and protein oxidation in serum compared to baseline values[131, 132.]

3.5.1.4. Antimicrobial effect

Combining two extracts of Anise and Oregano, vulgare demonstrated the highest anti-bacterial activities against bacteria[133]. Fluid extract and essential oil from anise fruits (*Apiaceae*) were tested in vitro on clinical isolates of seven species of yeasts and four dermatophytes. Three anti-viral and immune-stimulating chemicals (LC1, LC2, and LC3) were isolated from a hot water extract of anise seeds, significantly decreased the plasma concentrations of kidney function indicators and reduced the tubule damage brought on by gentamicin[134].

3.5.1.5. Relaxant effect

Boskabady and Ramazani-Assari studied Anise's soothing effects on isolated guinea pig tracheal chains. Results showed that essential oil had less impact, while theophylline's calming effects were not statistically different from those of aqueous or ethanol extracts[135]. Three hydroalcoholic extracts of aerial portions of Anise reduced the contraction induced by acetylcholine, suggesting that the NO-cGMP pathway is principally responsible for this activity[130]. Anise has anti-convulsant properties against clonic and tonic seizures caused by PTZ and MES.127 Heidari, and Ayeli found that anise extract delayed the onset of seizures in mice, with 200 mg/kg being the most efficacious dose[129]. Arab medicinal plants' leaves and stems also delayed seizures and reduced mortality[135].

3.5.1.6. Gastrointestinal effect

The effectiveness of Anise in aqueous solution against gastric ulcers, alleviation of nausea, and laxative efficacy of a phytotherapeutic compound was investigated in a randomized clinical trial with 20 patients with chronic constipation[136]. The results showed that phytotherapeutic material had significant anti-inflammatory effects compared to a placebo, with decreased colonic transit time and increased daily evacuations. This substance can still be regarded as a safe alternative for treating constipation[137]. Anise is a significant plant for therapy, to sum up. It has been in use for a very long period. On human bodies, it has significant consequences. This plant's anti-bacterial, anti-fungal, anti-viral, anti-convulsant, anti-oxidant, anti-cancer, anti-diabetic, muscle relaxant and other properties have been demonstrated. It is, therefore, regarded as one of the most important plants for study and medicinal investigation.

3.6. *Salvia Rosmarinus (Rosemary)*

Rosemary plants have long been used for medicinal purposes. Moreover, *Rosmarinus angustifolius Mill* is another name for *Rosmarinus officinalis Linnaeus*[138]. Rosemary can be found in the Mediterranean region from Spain to the North African country of Morocco. It grows best in hot climates, needs heat and light, and can tolerate drought to a moderate extent. It is cultivated in parched, sub-humid areas[139]. It is a fragrant, long-lived plant that reaches 2 meters tall. It has shrub-like branches covered in leaves and green leaves with a distinctive scent[140]. Rosemary, an aromatic shrub with leaves that look like thorns, has been used to treat muscle spasms.,

dysmenorrhea, and renal colic. It also has anti-fungal, anti-viral, and anti-bacterial properties[23]. The main industrial product made from this plant is the essential oil (EO) that gives it its pleasant scent[141] is a perennial sclerophyllous shrub[142]

3.6.1. Medical effects

3.6.1.1. Anti-inflammatory effect

The transcription element NF-B influences the inducible nitric oxide complex (iNOS), which is required for signal transduction and facilitates the enzyme's expression and NO generation. NF-B is ordinarily present in the cytoplasm, but it is translocated to the nucleus during inflammatory responses, where it binds to the promoter regions of multiple pro-inflammatory genes, including iNOS. An exploration was made of rosemary extracts' potential to prevent NF-B activation by monitoring NF-B translocation into the nucleus after inhibiting NO generation in LPS-stimulated RAW 264.7 cells. Achieved outcomes[143]. A previous study has related the anti-inflammatory activities of rosemary extracts to the reduction of multiple stages of the inflammatory reaction-histamine release, demonstrating that activity correlates with the number of triterpene components[144]. This herb has demonstrated topical anti-inflammatory activity in mouse wound healing[145].

3.6.1.2. Anti-cancer effect

Because of its antioxidant properties, Rosemary has been identified as a potential anti-cancer drug. It can fight and eliminate free radicals and prevent the potential oxidative damage they cause to fats, proteins, and DNA [146]. Recent research has shown that Rosemary extracts and the polyphenols CA and RA have powerful anti-cancer effects[147]. Treatment of MDA-MB-231 breast cancer cells with rosemary extract (50 µg/mL) for 24 or 48 h resulted in a significant decrease in Akt phosphorylation/activation (25.62% ± 2.56% of control, $p < 0.0001$) and (11.05% ± 0.62% of control, $p < 0.0001$)[148]. It has recently been shown that carnosic acid, a primary polyphenolic antioxidant in Rosemary, significantly improves 1,25D3-induced differentiation and reduces myeloid cell proliferation in liquid cultures[149].

3.6.1.3. Anti-obesity effect

After extracting the bioactive components of Rosemary, the most abundant molecules were discovered to be rosmarinic, carnosol, and carnosic acids; furthermore, the leaf extract can impact human adipocytes and impair adipogenesis and fat metabolism[150]. CA, carnosol, and rosemary acid were investigated for anti-obesity properties in HFD-produced obese mice to examine the action of Rosemary against obesity. While carnosol and rosmarinic acid did not affect the body weight of the mice, CA had a significant effect on weight gain after ten weeks of feeding the mice[151]. Rosemary leaf extracts and CA increased fat mass, reduced body weight, and increased blood lipid levels in male rats fed a high-fat diet[139, 152].

3.6.1.4. Antimicrobial effect

The samples for the third period (May 2018), The highest concentration of *S. Rosmarinus* essential oil and 1,8-cineole present during the summer, were averaged to create the tested essential oils. To identify the most potent EOs among those tested, the disc diffusion mechanism was used to conduct an initial qualitative analysis of the antimicrobial activity[139]. Guidelines from the Clinical Laboratory Standards Institute (CLSI) were used to evaluate antimicrobial activity[153] against MRSA USA300 LAC strain AH1263, a methicillin-resistant Staphylococcus aureus strain. Mueller-Hinton (MHB) cultures were generated from a single colony and diluted to 1.0 105 CFU/ml based on absorbance at 600 nm (OD600). The disc-diffusion technique and bacteria retrieved from hospital samples were used in an experiment to test the anti-biotic activity of rosemary extracts, which have also been shown to have antimicrobial activity. The extract was prepared with 100% ethanol and did not interfere with bacterial activity. On the other hand, Pen-strep, used as a positive control, was more efficient than rosemary extracts[154]. Each year, billions of infections with microorganisms significantly threaten human health, resulting in more than 1.5 million fatalities[155]. A Brazilian business generated a 20% (200 mg/mL) Rosemary glycolic extract using Rosemary leaves as the raw material. The extracts are not denatured in the lab; instead, they are bought in a commercially available form that contains terpenic derivatives found in essential oils such as sesquiterpenes, oleanolic acid, tannin, bitter substances, saponin acid, and glucoside compounds (pinene, camphene, free borneol, acetate, cineole, and camphor)[156]. They are shown alongside some essential oils from Lamiaceae that have anti-bacterial capabilities. More than half of essential oils are effective against bacteria (1000g/ml) [157].

3.6.1.5. Antioxidant effect

Various compounds containing double carbon and hydroxyl groups are bonded, which can donate hydrogen, inhibit free radicals, and reduce oxidative stress[24]. The antioxidant capacity and efficacy of Rosemary and its bioactive constituents were investigated in both laboratory tests[158]. If focused on extracting antioxidants and phenolic constituents, microwave-assisted extraction) MAE (extract is already beginning to be used in food formulations, providing good final organoleptic properties to products and additional health benefits. When rosemary extract is added to fresh cheese, the extraction process by MAE provides the product with acceptable flavors and antioxidant properties[159].Rosemary is an essential plant for treatment, to summarize. It has been in use for a very long time. It has significant effects on human bodies. Antimicrobial, anti-fungal, antioxidant, anti-cancer, anti-obesity, and other activities have been shown in this plant. Therefore, it is considered one of the most essential plants in research and medical examinations.

3.7. *Senna italica (Senna)*

One of the family *Fabaceae* members is Senna, and the height of the plant reaches (1meter); it is found in tropical and subtropical regions[18]. Some of these types are found in areas where temperatures are high and were first seen in the city of Mecca in the middle of the Hijaz region growing abundantly. It was seen as a medicine for the digestive system and is immune and anti-inflammatory. It has been widely used in modern epidemiological medicine systems [160]. The Senna plant has several vitamins, such as E, C, and β-Carotene. In the Senna, there are fatty acids[161]. The safety and side effects of Senna are generally sound. However, when used excessively, it causes mild to moderate side effects and tears quickly when discontinued. Side effects include increased irritation of the intestinal mucosa, causing abdominal pain and intensifying

menstrual bleeding[162] dark urine and diarrhea [163], as well as hepatic toxicity. In rare cases, nausea and vomiting may occur[162]. Medicinal properties of Senna are a treatment for various skin diseases and is used in all parts of the plant and is considered one of 54 other types of plants that treat scabies, itching, and other skin diseases. Senna strengthens the defense of the liver and kidneys against oxidative stress and reduces blood glucose levels during fasting, which is also antidiabetic. The extract of water Senna leaves performs excellent activity at a concentration of less than (1 microgram/ 1ml) as a treatment for malaria and fever[18].

3.7.1. Medical effects

3.7.1.1. Antidiabetic effect

Senna leaf extract is considered to decrease blood sugar levels and has an inhibitory effect a-glucosidase A decoction of the leaves of the Senna plant. It is used to regulate the sugar level, decrease fasting in the blood, improve metabolism, and decrease the oxidative stress that causes diabetes. The research presented the activity of the Senna plant as an antidiabetic, which is relatively few. More research is being done in this field[18].

3.7.1.2. Antimicrobial effect

Senna leaves are an antibiotic that treats urinary tracts and pneumonia, as well as gonorrhea and some fungal infections. Senna leaves have an enormous range of efficacy contra Gram-positive and Gram-negative bacteria[19]; leaf decoction displayed substantial discouragement activities against many microbes[18]. All parts of the plant, especially antimicrobial and antifungal activities in the Senna plant, are acquired from the leaves. The concentration of the inhibitory action is measured by minimum inhibitory concentration, which is the lowest concentration of the sample that prevents the formation of microbes. A result of 200-100 µg/mL minimum inhibitory concentration is acceptable for the plant leaves, but in extracts from other parts of the Senna plant, it cannot reach such values. The best antimicrobial properties of Senna ethanolic extract were seen in *Aspergillus niger* with a 25.2 mm zone of suppression, and the least was *Salmonella typhimurium* with a 12.1 mm suppression zone. *Escherichia coli* and *Candida albicans* had similar suppression zones with 17.2 mm and 18.2 mm[162]Antifungal activity of Senna plan. Senna is an antifungal plant and works against the DNA of E. colon bacteria. Sennosides affect the intestines, and Senna produces DNA lesions in E. coli cultures and acts as an antifungal[164].

3.7.1.3. Antioxidant effect

Compounds of the Senna plant: quercetin 3-O-α-L-rhamnopyranosyl- (1→6) -β-D-glucopyranoside(rutin)[162]. Senna contains many antioxidants, and β-Carotene is considered one of the main anti-oxidants[19]. Senna plant has high amounts of antioxidants, which reduce diseases caused by oxidative stress and show anti-tumor activity. They contain phenols and flavonoids such as epicatechin rutin and dimeric[162]. The evaluation of carotenoids contributed to the scavenging activities. Various parts of Senna. Markedly discouragement The action of free radicals that cause stress[18].

3.7.1.4. Gastrointestinal effect

Senna has a pungent taste, and it is used as a laxative to treat constipation and bowel emptying before diagnosis in the colon and rectum, as well as bulges and colic[164]. Tea made from Senna leaves helps to lose weight in essential steps. First, it prevents accidental constipation due to food that lacks fiber; second, it stimulates the body to eat liquids because its calories are few; third, it helps in the elimination of toxins and und undigested food[19].The Senna plant has many vitamins and stimulants biologically and in all parts of the plant. Many antioxidants show anti-tumor activity and anti-bacterial and fungal treatment of many skin diseases. It strengthens the defense of the kidneys against oxidative stress, is antidiabetic, and treats urinary tract and pneumonia. It is generally used; it is good, but excessive use causes side effects.

3.8. *Ziziphus Spina Christi (Sidr)*

Sidr is a drought-tolerant tree located in the Middle East and Africa. It has various uses, including traditional medicine, edible fruits, and livestock feed. The tree can grow into dense, thorny thickets that outcompete local plants and have been spread through cultivation[165]. The wood is used for instrument parts, fencing, and tool handles due to its resistance to termites. However, its slow growth and poor condition make it unsuitable for charcoal[166, 167]. The fruit is occasionally edible but less flavorful than other domesticated species. The fruit contains a large seed and low nutritional content. The leaves are suitable for animal feed but have low nutritional value[168-171]. Sidr leaves contain various alkaloids with potential medical uses, including hypoglycemic properties. Its roots relieve headaches, and its leaves can treat skin wounds and diarrhea and have anti-helminthic effects. The fruit is used to reduce boils and abscesses and as a rodent pesticide [165, 172-175].

3.8.1. Medical effects

3.8.1.1. Anti-inflammatory effect

Sidr has anti-inflammatory properties and treats various inflammation-related illnesses, such as swelling and discomfort. Studies have shown that it contains substances that can help reduce inflammation[176]. A root's bark of Sidr exhibits significant central analgesic action. In addition, it has been used to relieve intestinal cramps and diarrhea [177]. Sidr shows potential for treating inflammation and accelerating the healing of burn wounds. An ointment made from the plant's leaves demonstrated effectiveness in animal studies[178].

3.8.1.2. Anti-cancer effect

Sidr leaves were used to create a saponin-rich fraction (SRF) enclosed in a novel carrier called a saponinosome, which has not been used before in cancer treatment. As cytotoxicity tests show, the controlled release of saponin from the carrier reduces toxicity to healthy cells. This action makes saponinosomes a promising cancer treatment[179]. Sidr leaf extract has potential anti-cancer substances that can aid in creating new medications. However, natural remedies must be chosen and prepared carefully to avoid toxicity, a disadvantage compared to prescription drugs[178]. We, therefore, suggest that the newly discovered betulin derivative is responsible for the historical and widespread usage of *Ziziphus spp*. as an alternative anti-cancer in the United Arab Emirates[180].

3.8.1.3. Antidiabetic effect

Sidr leaves were tested for their relaxing effects on aortic strips and their impact on the central nervous system in rats.

The leaves were discovered to be effective and safe in reducing blood sugar levels and function similarly to sulfonylureas[181]. Preliminary research shows that Sidr extract has promising antidiabetic qualities in vivo and in vitro experiments, inhibiting alpha-glucosidase and alpha-amylase[178]. Sidr leaf extract increased insulin secretion and enhanced glucose utilization in diabetic mice, perhaps due to the saponin and polyphenol concentrations. Due to its overall polyphenol content, it also reduced the absorption of glucose from meals, which helped regulate hyperglycemia[182]. Fortified (GT+ZT) tea can help control and avoid NAFLD and obesity by boosting the health-promoting properties of green tea. Its advantages result from controlling the Notch-1 signaling system, lipolysis, inflammation, oxidative stress, and apoptosis[183]. The Sidr extract reduced lipid peroxidation, enhanced liver and kidney function, and demonstrated benefits against hyperlipidemia in male rats with high cholesterol. These effects may be due to the suppression and decrease in oxidative stress linked to its high phenolic compound content [178]. Sidr helped diabetic rats lose weight and gain muscle by reducing high blood sugar levels caused by streptozotocin-induced diabetes[184].

3.8.1.4. Antimicrobial effect

Honey bees gather plant nectar to make natural, sweet honey with a complex chemical makeup. In Saudi Arabia, Sidr (*Ziziphus spina-christi L.*) and Talh (*Acacia Gerrard Benth.*) tree-produced honey significantly inhibited the growth of pathogenic gram-positive (*Bacillus cereus, Staphylococcus aureus*), gram-negative (*Escherichia coli, Salmonella enteritidis*), and dermatophytes (*Trichophyton mentagrophytes*) bacteria[185]. Sidr acts as a detoxifying agent by inhibiting the formation of coronavirus spike proteins, which weakens their ability to block protein synthesis and produce fat [177]. Sidr extract has the potential for identifying and developing novel anti-bacterial chemicals, which can produce effective antibiotics against bacterial illnesses[178].

3.8.1.5. Antioxidant effect

The study analyzed the antioxidant and allelopathic effects of five provenances of Sidr on two plants. The results showed high antioxidant activity and suggested using extracts for food, pharmaceuticals, and as a natural herbicide[186]. Antioxidants in Sidr extract may be used to make nutraceuticals that can reduce oxidative stress. The extract shows strong antioxidant potential by protecting against radicals [178]. Sidr fruit from Oman has potential antioxidant activity and can be a natural source of nutraceuticals or antioxidants. It may reduce oxidative stress and offer health benefits[187]. Sidr's high concentration of phytochemical components, including phenols, flavonoids, and saponins, gives it antioxidant properties. This effect supports its traditional medicinal use and the potential use of its ethanolic extract in primary healthcare[188]. In conclusion, the Sidr tree provides numerous health benefits through its herb, which has anti-obesity, anti-inflammatory, antioxidant, antidiabetic, anti-cancer, and antimicrobial properties. It is a valuable plant for medical research.

4. CONCLUSION AND RECOMMENDATION

Our review indicates that all the plants, such as bitter apple, Ginger, Roselle, Mint, Anise, Rosemary, Senna, and Sidr, have favorable properties towards diabetes. All plants except Senna have a positive effect on cancer and inflammation, all plants except Roselle have a positive effect on microbes, and all plants except Anise and Roselle have a positive effect on oxidants. Ginger Anise and Senna positively affect Gastrointestinal; Anise has Relaxant effects. We propose research on the effect of the Bitter apple on eye infections, the effect of Ginger as an anti-inflammatory and antimicrobial, the effect of the Roselle as an antioxidant, the effect of the Senna on cancer resistance, and the effect of the Rosemary on blood sugar level.

5. AUTHORS CONTRIBUTIONS STATEMENT

Ali H. Amin and Ahmed H. Ismail contributed to the conception, design, writing, and revision of collected data, while Muhammad Al-Harbi, Amjed Rmani, and Hattan. z.Jawa, Faris Mohammed Qari, Merai M. Manqari, Naif A. ALSHMRANI, Abdullah.T.Alghamdi, Abdullah Almalki, and Saleh H. AL-Qarni contributed in collecting, formatting, writing, and revision of data in the article.

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7. CONFLICT OF INTEREST

Conflict of interest declared none.

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