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Potential Health Promoting Attributes of Indian Seed Spices

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Abstract

The primary purpose of seasoning with spices and herbs is to impart flavor, pungency, aroma, and color to the food being prepared. In addition, spices extend the shelf life so that food can be stored without becoming spoiled by inhibiting and delaying the process of putrefaction and maintaining the sensory qualities of food products. Spices have a number of important phytochemicals, such as aromatic compounds, essential oils, phenolic compounds and pigments. These phytochemicals give distinctive flavor and aroma to foods and beverages, as well as a more herbal appearance, which in turn increases consumer acceptance of these products. As a result, these herbs and spices have a variety of health benefits and various medicinal properties as well as tremendous functional properties. In the era of Covid-19, there has been an increase in the consumption of health drinks and concoctions that are based on spices and herbs in order to provide the health benefits and immunity boosting properties.

Keywords: Putrefaction, Phytochemicals, Concoctions, Beverages, Spices

1. Introduction

Since the beginning of recorded history, spices have played an important role in India's culture, traditions, and efforts to preserve its heritage. Because of this, India is known throughout the world as the "land of spices." 70 varieties of spices are grown all over the world (Paswan *et al.* 2021). The production of seed spices is an important part of the agricultural industry in our country and plays an important role in the overall functioning of

our economy. More than 80 percent of the seed spices produced in India come from the Indian states of Rajasthan and Gujarat together. It was estimated that India's total spice production in the year 2021 would be approximately 10.4 million metric tonnes (Statista research department). Coriander, cumin, cardamom, fennel, and fenugreek are covered as major seed spices and the minor seeds spices includes ajowain, caraway (siah jeera), celery, dill (sowa), nigella (kalonji). These seed spices are mostly used to make cuisines aromatic, fiery, pungent, and delectable. Seed spices not only add the aroma to the food products but also come with notable nutritional values and provide a lot of health benefits (Dubey *et al.* 2017).

Seed spices are responsible for the production of a wide variety of secondary metabolites and phytochemicals. Apart from this, the phenolic compounds, flavonoids, and terpenoids make up the majority as primary components in all seed spices. These components are the foundation of all of the properties and uses of seed spices. Examples of antimicrobial and antioxidant compounds found in seed spices include thymoquinone and cumin aldehyde. In this way, Indian seed spices are a treasure of numerous medicinal and health benefits. During this recent pandemic of COVID-19, seed spices have caught the attention as immunity booster due to having antimicrobial and antioxidant potential properties. There has been a lot of research done on seed spices all over the world. One survey found that 71.8% of people are currently using *kadha* to treat infections and strengthen their immune systems, and that 93% of people believe that spices are helpful in curing coronavirus or other viral infections and also in strengthening the immune system (Zaharan *et al.* 2021). The Ministry of Ayurveda, Yoga, and Naturopathy (AYUSH) in India has put out advice on how to use Ayurveda to boost your immune system and promoted the methods of self-care during pandemic. This advisory recommends the use of certain seed spices for cooking, including cumin, coriander, and nigella. These seed spices are also recommended to be consumed in the form of a decoction once or twice daily (Singh *et al.* 2020).

This review presents a consolidated report on current research on the possible human health benefits of major Indian seed spices and explores their traditional therapeutic uses.

Cumin seeds (*Cuminum cyminum* Linn.)

Cumin is a member of the Umbelliferae family. In India, cumin is also commonly referred to as the spice *Jeerak* or *Jeera*. It is an annual herb that does not have any hair and is very slender. Its leaves are compound and are shaped like long lines. The fruits have a cylindrical shape and the seeds are packed tightly against the dorsal surface. The Punjab and southern India are its primary areas of cultivation (Gupta *et al.* 2010).

Cumin seeds have been a staple in the cuisine of India for thousands of years, and they can be found in a wide variety of dishes, such as korma and soups. Cumin seeds are also included in a variety of other spices blends due to their versatility (Chaudhari *et al.* 2021).

Cumin seeds have a history of use in folk medicine for the treatment of a wide variety of medical conditions, including asthma, diabetes, colic pain, abdominal discomfort, inflammation, flatulence, inadequate lactation, piles, and worm infection. It is one of the major seed spice which contain cuminaldehyde, pinene, limonene, cymene, terpinene as the principle bioactive components. It contains 3.5% of crucial oil content which is responsible for the distinctive flavor of cumin (Singh *et al.* 2017). Cumin is an excellent source of a variety of minerals, including iron, calcium, potassium, and zinc, and it also has a significant quantity of the B complex vitamin. It is also used to help people who have trouble sleeping, and it possesses a number of antiseptic properties (Kannan *et al.* 2018).

Coriander seeds (*Coriandrum sativum* Linn.)

Coriander is a member of the Umbelliferae family, which also includes dhaniya, a spice commonly known and used in India. It is a small annual herb that is glabrous and has decompound and ovate leaves, compound umbel flowers, and small round seeds. It is originated native to Western Asia and Europe. Coriander contains a number of active chemical components, such as coriandrol and linalool. Other components include pinene, terpinene, limonene, cymene, and so on. As a result of the presence of these active compounds, it has been discovered that coriander possesses pharmacological properties that include antifertility, antihyperglycemic, antihyperlipidemic, antioxidant, antiproliferative, and hypotensive effects. These characteristics are brought about by the presence of bioactive compounds in seed spices (Chawla *et al.* 2013).

In most cases, it is prescribed for the treatment of digestive tract, including anorexia, dyspepsia, flatulence, diarrhea, gripping pain, and vomiting. Coriander's seeds and stems, which include the anti-diabetic acids, caffeic, chlorogenic, ferulic, and gallic, have anti-diabetic qualities. The coriander leaves also contain ferulic acid. It is commonly believed that coriander seeds are beneficial to one's health and are high on the list of spices that have curative properties. In some regions of Europe, coriander has a long history of uses, as a medicinal plant in the treatment of diabetes. Because of its ability to reduce inflammation, it has long been utilized as a traditional medicine in certain regions of India (Lal and Meena, 2018).

Cardamom (*Elettaria cardamomum*)

Elaichi is the name given to the spice that comes from the *Eletteria cardamomum* plant, which is a member of the Zingibaraceae family and is primarily located in southern India. Due to the fact that both its flavour and aroma are quite enticing, cardamom is frequently referred to as the "Queen of spices." It is one of the rarest and most expensive spices that can be found anywhere in the world. The primary active chemical constituents of cardamom seeds are volatile oil, cineol, terpene, and terpenol. Cardamom seeds also contain trace amounts of terpene. These constituents are responsible for the anti-inflammatory, antipyretic, carminative, diuretic, stimulative, aromatic, and tonic for the liver and digestive pharmacological properties of cardamom (Ashok *et al.* 2020). It is common practice in both the Middle East and India to use it for imparting flavour to hot beverages such as tea and coffee, in addition to various types of sweets. However, the most common application of cardamom in India has been used as an effective mouthwash and mouth-freshener (Arjun *et al.* 2019).

In traditional Indian medicine, large cardamom was frequently used as a flavouring and fragrance component. Cardamom seeds have traditionally been employed in the treatment of venomous snake and scorpion bites. Additionally helpful in lowering cholesterol and hyperlipidemia can be prevented by eating cardamom fruits and seeds. Essential oil, oleoresin, encapsulated flavour, flavoured biscuits, and other flavoured products were developed in order to broaden the range of applications for large cardamom (Kurup *et al.* 2020).

Fenugreek seeds (*Trigonella foenum graecum* L.)

Fenugreek is a type of seed that is commonly known as maithray (in Bangla and Gujarati), methi or mithi (in Hindi, Nepali, Marathi, Urdu, and Sanskrit), and fenugreek. In India, fenugreek is used as a culinary spice (Sachan *et al.* 2018). It is a member of the Leguminosae family and is an annual herb that stands erect. It is fragrant. In India, it is grown primarily in the states of Punjab and Kashmir, as well as the upper Gangetic plains. The fenugreek plant has trifoliate, round leaves, flowers that are white or yellowish in color, and fruit pods which contain various seeds which are rectangular in shape and yellow in color. In traditional medicines, fenugreek seeds were used to treat diabetes as well as bodyaches, insufficient lactation, abdominal pain, and anorexia. Fenugreek contains a variety of chemical components, the most important of which are volatile oils, sitosterol, tigogenine, vitexin, trigonalin, calcium, and phosphorus. Iron is also present. In addition, it has been discovered that fenugreek seeds possess pharmacological properties such as hypoglycaemic, antipyretic, analgesic, hypolipidemic, anti-inflammatory, and anti-tumor activities (Singletary *et al.* 2017).

Fenugreek seeds have a long history of use in conventional remedies, including applications for the treatment of wounds, abscesses, arthritis, bronchitis ulcers, and digestive issues. Raw or cooked fenugreek seeds can be consumed for their aroma, bitterness, carminative and antibacterial properties. The majority of the seed is composed of inedible fiber (which accounts for fifty percent) and tasteless protein, which accounts for thirty percent. Additionally, the seeds contain mucilage and bitter fixed oil. The presence of oil, steroidal saponins, and alkaloids are the primary contributors to bitterness (Srinivasan *et al.* 2005).

Fenugreek leaves contain significant amount of beta-carotene, iron, calcium, magnesium, potassium, and vitamin C, while the seeds are an abundant source of protein, fibre, and omega-3 fatty acids (Krishnaswamy *et al.* 2008).

Mustard seeds (*Brassica compestris* Linn.)

Mustard, also known as *sarson* in India, is a member of the Cruciferae family. The North-western regions of India are the typical locations for its cultivation. It is a highly branched annual herb with yellow flowers, and its seeds are small, round, and smooth. These seeds

have a long history of uses as a remedy for wide range of conditions, related to skin and teeth, as well as worm infestations, obesity, dry skin, and eating disorders. Some of the active chemical constituents that can be found in mustard include sinigrin, fixed oils, sinalbin, and myrosin. Lecithin and sinalbin (Names *et al.* 2013).

There are three aspects of mustard that contribute to its effectiveness as a condiment. The ability to stimulate salivation and appetite, which speeds up the first stage of digestion, the ability to break down indigestible fats and meat fibres, and the ability to stimulate digestive juices, which brings the digestive process to a successful conclusion. Mustard essential oil has ally isothiocyanate, which is helpful in speeds up circulation when applied to the skin, and, as a result, aids in the process of eliminating toxins from the body. Mustard powder in two or three tablespoons can be added to a warm bath to relieve chills, relax tired muscles, and make it easier to fall asleep (Rathore *et al.* 2013).

Black cumin seeds (*Nigella sativa* L.)

In different regions of the world, black cumin seed is also referred to as black caraway, kalonji, kalajeera, or roman coriander. Its scientific name is *Nigella sativa* L. and it is an annual flowering plant that belongs to the family Ranunculaceae. It is cultivated and distributed across the India, but mainly in the states of Punjab, Himachal Pradesh, Madhya Pradesh, Bihar, Bengal, Rajasthan, Assam, and Maharashtra. A few of its constituents are volatile oil (0.40-0.45 percent), non-volatile oil (3,240 percent), protein (16.00-20.85 percent), carbohydrates (31.0-33.9 percent), fibre (5.50-7.94 percent), alkaloids, tannins, saponins, iron, calcium, potassium, magnesium, zinc, and copper (1.79-3.44 percent), and vitamins A, C, thiamine, and niacin (Dubey *et al.* 2016).

The black cumin seeds have a variety of therapeutic uses, including bronchodilatory, hypotensive, antibacterial, antifungal, analgesic, anti-inflammatory, and immune potentiating effects (Sharma *et al.* 2017). Black cumin seeds and its oil, both are excellent food components that can be used in the diet as a seasoning and as a method of preserving food. In addition, it has been found that black cumin seeds and the oil possess a wide range of biological activities, including antioxidant, an antimicrobial, antihypertensive, anticancer, antiinflammatory, diuretic, antidiarrheal, appetite stimulant, analgesic and a treatment for

skin disorders. As a result, nigella seeds can be considered to be functional food components (Sachdeva *et al.* 2022).

2. General description of seed spices

The word "spice" was originally derived from the word "species," which was used to refer a group of unusual foodstuffs in the middle ages. Seed spices, on the other hand, are a group that denotes all of those annuals whose dried fruits or seeds are used as spices. In ancient times, spices were called species, which referred to unusual foods. The Geneva International Organization for standardisation explains the definition of spices as "vegetable products or mixtures, free from extraneous matter, used for flavouring, seasoning, and imparting aroma to foods" (ISO, 1995).

Spices are derived from various parts of plants, including flowers (saffron), fruits (nutmeg), leaves (bay leaves), seeds (cumin), roots (ginger), buds (clove), bark (cinnamon), berries (peppercorns), and secretory products; however, seed spices consist of cumin, coriander, cardamom, fennel, fenugreek, mustard, and nigella seeds. Due to the fact that all spices originate from plants, it is generally accepted that they are safe to consume. Indian seed spices have been renowned ever since ancient times for their unique flavour, taste, and aroma, as well as for their ability to impart flavour, pungency, medicinal values, and also for their use in the seasoning of foods. The seed spices also have non-food applications in industries such as functional foods, perfumery products, and the nutraceutical industry. All seed spices contain a number of important phytochemicals, including aromatic compounds, essential oils, phenolics, flavonoids, alkaloids, saponins, tannins, steroids, and anthocyanins. These phytochemicals give foods and beverages their distinctive flavours and aromas, as well as herbal appearance, which in turn increases the customers' acceptance (Paswan *et al.* 2021).

Seed spices are a gold mine of opportunities for research into the discovery of beneficial bioactive compounds. These molecules have an influence on several human systems, including the digestive, circulatory, reproductive, and neurological systems, resulting in a vast array of metabolic and physiological processes. Seed spices contain phytochemicals that have overlapping and complementary effects. These include anticancer, antidiabetic, antimicrobial, hypolipidemic, insecticidal, anticancer, antiinflammatory, antimicrobial, can

lower the blood pressure, help digestion, reduce inflammation, modulate steroid metabolism, and boost immunity (Das *et al*. 2015).

3. Classification of spices

The plant parts that are used to classify the Indian spices; leaf, root, bulb, fruit, rhizome, bark, seed, pod, kernel, bud, floral parts, latex, berry, and the aril are all the components of plant. The classification is given in the table below.

Plant parts used	**Spices**
Seeds	Cumin, Black cumin, Fenugreek, Coriander, Fennel, Ajwain, Poppy
Bulb	Onion, Garlic, Leek and Shallot
Bark	Cinnamon, Cassia
Fruit	Chilli, Cardamom, Allspice, Kokum
Leaf	Mint, Curry-leaf, Bay-leaf, Chive, Rosemary, Savory
Rhizome	Turmeric, Ginger, Galangal
Pod	Vanilla, Tamarind
Kernel	Nutmeg
Floral part	Saffron, Savory, Caper, marjoram
Bud	Clove and Caper
Latex	Asafoetida
Aril	Mace and Anardana
Berry	Black pepper, juniper, Allspice

4. Chemical Composition of Seed Spices

There are many characteristics that give seed spices their individuality, such as their aroma; however, the chemical properties of seed spices make them suitable to use as preservatives in food. Seed spices have antioxidant and antimicrobial activity as a result of the presence of a number of different chemical compounds (Peter and Shylaja, 2012).

The primary components, which are present in seed spices are primarily phenolic compounds, flavonoids, and terpenes. These substances are considered to be the basis of the properties and uses of spices; for instance, cumin aldehyde and allylisothiocynate are related to the

antimicrobial and antibacterial properties. Due to the presence of chemical compounds in seed spices, a number of research have been carried out to establish which spices have a greater inhibiting effect for specific bacteria that typically invades food. The findings that were derived from these studies: The research studies has been done in order to describe the antibacterial properties of the spices and to ensure that they are suitable for using as a food preservative (Fatima *et al.* 2018).

Seed Spices	**Important Chemical Constituents**
Black cumin	α-Thujene, p-Cymene, Limonene, Terpinen-4-ol, Thymoquinone, Carvacrol, dithymoquinone, thymohydroquinone, thymol
Cardamom	Limonene, 1,8-cineole, terpinolene, myrcene, caffeic acid, quercetin, kaempferol, luteolin, pelargonidin
Coriander	Linalool, terpineol, cumene, pinene, terpinene, quercetin, kaempferol, caffeic, ferulic, n-coumaric and vanillic acids, rutin, tocopherols
Cumin	Terpenes, phenols and flavonoids
Fenugreek	Sequesterpenes, aromatic aldehydes and terpenes
Mustard	Allyl isothiocyanate, carotene, isorhamnetin, kaempferol glucoside

Table 1. Chemical composition of seed spices

Seed Spices	Uses	Health Benefits
Coriander	Both the leaves and the seeds of the coriander plant are utilized in culinary preparation. In addition to that, it has applications in medicine.	It can be applied topically to sore joints and rheumatism to provide relief. In addition to this, it can help alleviate symptoms of a sore throat, allergies, digestive issues, hay fever, and other related conditions.
Cumin	In addition to being put to use in the kitchen, it is recognized for its value in medicinal applications.	It is an excellent source of iron and helps to maintain a healthy immune system. In cases of dysentery, drinking water that has been boiled with cumin seeds can be beneficial.
Fenugreek	The seeds are used as a seasoning and for the preparation of Masalas, but the majority of the plant is consumed as a green leafy vegetable. It is also used in the medical field.	Tea and fudge made from fenugreek seeds, both are beneficial for increasing breast milk production. It is also useful in the treatment of diabetes and in the reduction of cholesterol.
Black cumin	A small amount of black seed oil has many anti-oxidative and disinfectant properties, which is able to fight efficiently against allergies and respiratory or fungal infections.	Increase an individual intellectual level, memorizing ability, focus and treats brain associated diseases. Treatment of diabetes Regulates normal sugar levels in the blood. Promotes cardiac health Control bad cholesterol level in the body to prevent arterial blockage to reduce the chances of heart stroke.
Bishop's weed	In addition to its use in culinary applications, it finds application in the medical field.	It is utilized in the treatment of gastrointestinal conditions such as diarrhea, dyspepsia, flatulence, indigestion, and cholera. Antiseptic, preservative, and treatment for respiratory and gastrointestinal disorders are its Ayurvedic medical applications.
Mustard	In addition to being consumed as a green leafy vegetable, it is also used as a seasoning. In India, the use of mustard oil is widespread, whereas in other parts of the world it is prohibited.	The use of mustard oil in body massages and even in hair care can yield positive results. Omega-3 fatty acids make up its constituent parts. It is a very good source of a variety of nutrients, including iron, zinc, manganese, calcium, and protein, among others.

Cardamom	It is utilized in the majority of Indian kitchens as well as other kinds of sweet dishes to impart a pleasant flavour and aroma.	Assists in the treatment of digestive disorder as well as bad breath. Consuming a whole cardamom and chewing it is beneficial for managing diabetes.

Table 2. Seeds spices, their uses and health benefits on human health

5. Medicinal Role of Seed Spices

In our society, if we have a stomach, muscle, or brain discomfort, we don't wait long to use medication to relieve it. Rather than all of this, we should seek natural comfort. We have all we need in our kitchen to calm, soothe, and ease any little ailment that may emerge.

- **Fenugreek (Methi):** Tea and fudge made from fenugreek seeds are beneficial for increasing breast milk production. It is also useful in the treatment of diabetes and in reuction of cholesterol (Singletary, 2017).
- **Bishop's weed (Ajwain):** It is utilized in the treatment of gastrointestinal conditions such as diarrhoea, dyspepsia, flatulence, indigestion, and cholera. Antiseptic, preservative, and treatment for respiratory and gastrointestinal disorders are among its Ayurvedic medical applications. The Unani medical system aids in the enhancement of the body's natural resistance (Singh *et al.* 2017).
- **Cumin:** In addition to a significant quantity of the B complex, cumin is rich in a variety of minerals, including iron, copper, calcium, potassium, and zinc. Cumin has been shown to be effective in treating insomnia and also possesses many antiseptic properties (Derakshan *et al.* 2007).
- **Cardamom (Elaichi):** Cardamom assists in the treatment of digestive disorder as well as bad breath. Consuming a whole cardamom and chewing it is beneficial for managing diabetes (Ashok *et al.* 2020).

6. Impact of Seed Spices on Human Health

It has been found that Indian seed spices have a variety of beneficial effects on human health, such as anti-inflammatory, anti-carcinogenic, anti-sclerotic, anti-thrombotic, antidiabetic, gastro-protective, and lipid-lowering action, along with cholesterol-lowering effects. In addition, the use of seed spices helps to inhibit the oxidation of low density lipoprotein as

well as the glycation of proteins. Since ancient times, spices have been used for a variety of purposes. Their essential oils have been used in aromatherapy, in addition to being used for the treatment of mental health conditions including as stress, anxiety, and depression (Peter and Shylaja, 2012).

Due to the presence of antimicrobial properties in many seed spices, including antibacterial, antiviral, and antifungal properties, these spices have a great potential for possessing antiseptic qualities. In spite of this, the seeds of certain spices do play an important role in the management of cardiovascular diseases and heart diseases. This is due to the fact that certain spices inhibit enzymes that are involved in the synthesis of lipids, decrease platelet aggregation, lower LDL levels, prevent lipid peroxidation, and increase coronary blood flow. The past three decades have seen a lot of research done on the beneficial effects that seeds and spices have on one's health. This research has suggested that the use of these food adjuncts goes beyond just taste and flavour (Srinivasan, 2005).

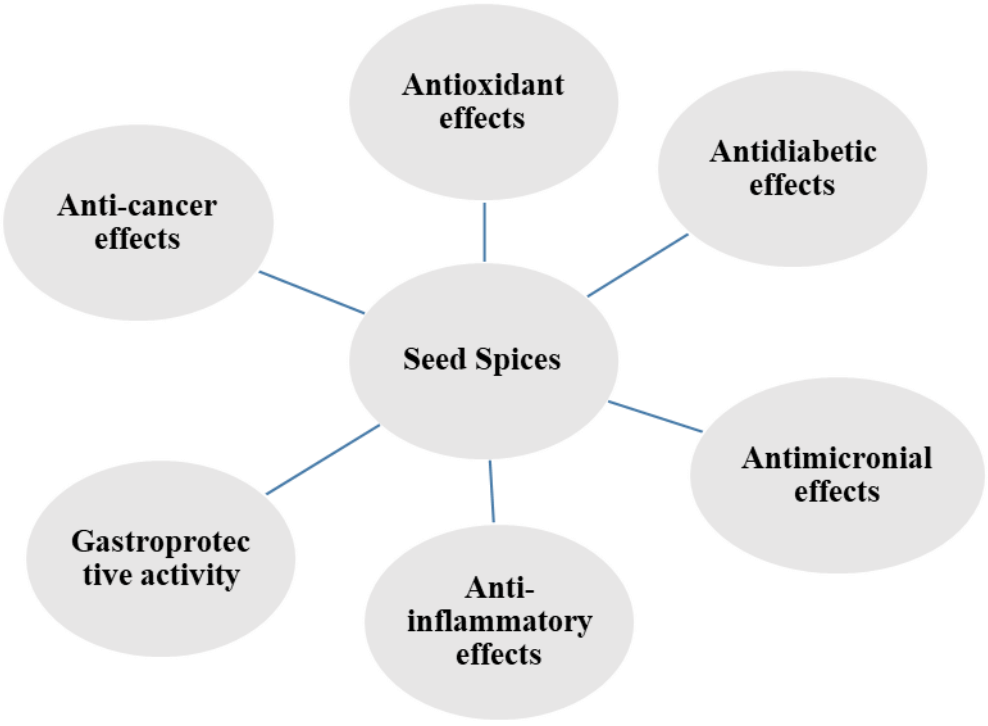

Fig. 1 Multiple Health benefits of Seed spices

6.1 Gastro protective Activity

The seeds of Ajwain (Trachyspermum ammi) have been shown to have anti-ulcer properties. This study tested an aqueous suspension of black cumin seeds as an anti-ulcer drug in rats with experimentally produced stomach ulcers and basal gastric secretion. The rats were given gastric ulcers by means of an experimentally induced gastric ulcer model. *Nigella sativa* has the ability to prevent a rise in alcohol-induced lipid peroxidation (i.e. thiobarbituric acid reactive chemicals), as well as a reduction in the amount of GSH found in the stomach and the enzyme activities of gastric Transferees. As a result of these findings, the idea that thymoquinone has the potential to operate as a therapeutic agent in the management of inflammatory bowel disease in patients (Saxena *et al.* 2013).

6.2 Anti-inflammatory Power

A wide variety of inflammatory mediators and pathways are involved in the development of chronic inflammatory disorders like asthma and arthritis. It is a common practice to apply spices and extracts topically in order to alleviate a variety of aches and pains, including backache, rheumatism, skin rashes, and inflammatory processes in general (Ramadan, 2007). It is likely that allergic rhinitis can be related to the anti-allergic actions of components that are contained in Nigella seeds. In addition, when it is required to avoid the adverse effects of other anti-allergic medications, nigella should be considered for the treatment of allergic rhinitis. This is because nigella consists anti-inflammatory properties (Shobana *et al.* 2000).

6.3 Antimicrobial Influence

The potent antimicrobial activity that ajwain possesses is one of the reasons why it is so widely used. It prevents the food stuffs from becoming spoiled by microorganisms. Carvacol and thymol are two of the active compounds found in ajwain, and it is believed that these compounds are responsible for the antibacterial capabilities of the plant. Cumin has been demonstrated to possess antimicrobial effects against a strain of *Klebsiella pneumoniae* that is resistant to ceftazidime ATCC 13883. This activity was observed in both cumin essential oil and cumin alcoholic extract. It has been reported that both cumin oil and cuminaldehyde possess powerful larvicidal and antibacterial activity. Cumin seed's essential oil and alcoholic extract both have potential uses in the pharmaceutical industries. Cumin seed's essential oil has anti-inflammatory properties (Derakhshan *et al.* 2007).

6.4 Antioxidant Activity

Antioxidants that occur naturally are becoming a popular choice for protecting humans from the harmful effects of oxidative stress. Seed spices are often thought of as natural antioxidants for food; antioxidants are required in food in order to prevent the lipid components from degrading. According to the findings of a number of studies, the antioxidants that are found in seed spices may act as a defense mechanism in the body against conditions such as cardiovascular disease, cancer, asthma, and diabetes (Sachdeva *et al.* 2022). Cumin seeds have been found to contain two types of flavonoids, apigenin and luteolin, both of which are known for their ability to act as antioxidants. It has been demonstrated that the fraction of cumin that is soluble in petroleum ether possesses antioxidant activity. It has been demonstrated that cumin aldehyde is capable of scavenging the superoxide anion. However, the importance of antioxidants in preventing oxidative damage to biological systems has become more widely recognized in recent years. Damage caused by oxidative stress at the cellular or subcellular level plays a significant role in the pathogenesis of many diseases, including coronary artery disease, inflammatory diseases, carcinogenesis, and the ageing process. During the course of normal metabolism, reactive oxygen species and various other free radicals are produced. This is a natural process that should ideally be balanced out by an endogenous antioxidant defense system. The chemical make-up of spices, particularly the presence of polyphenolic and other physiologically active chemicals, has been linked to their ability to act as antioxidants. This is the primary factor in determining the antioxidant activity of spices (Embuscado *et al.* 2015).

Researchers have discovered that cumin has pharmacological properties which include antioxidants, an anticancer agent, a stimulant, and a carminative. Cumin seeds have been found to contain two types of flavonoids, apigenin and luteolin, both of which are known for their ability to act as antioxidants. It has been demonstrated that the fraction of cumin that is soluble in petroleum ether possesses antioxidant activity. It has been demonstrated that cumin aldehyde is capable of scavenging the superoxide anion. Seed spices contain a number of naturally occurring antioxidant biomolecules. If they possess water-soluble molecules, then they can scavenge reactive oxygen species, and if they possess lipid-soluble molecules, then they are able to prevent the production of lipid peroxidation peroxides. Both of these

properties would be desirable (Shobana *et al.* 2000). The antioxidant activity of seed spice compounds is caused by one or more of the following processes: the scavenging of free radicals, the suppression of lipid peroxidation, the enhancement of the antioxidant molecules in tissues, the stimulation of the activities of endogenous antioxidant enzymes, the inhibition of the activity of inducible nitric oxide synthase, the inhibition of LDL oxidation, and the inhibition of enzymes. As a result of the antioxidant activity they possess, seed spices have been shown to be effective in wound healing, as well as anti-inflammatory, anti-mutagenic, and cancer preventative, cardiovascularly protective, hepatically protective, neurologically protective, and all of these combined (Srinivasan, 2008).

6.5 Antidiabetic Activity

There is a long history of people using seed spices for the treatment and prevention of diseases, and it has been demonstrated in a great number of studies that seed spices have antidiabetic potential, which makes them potentially useful. Seed spices like fenugreek seeds, cumin seeds, dill seeds, coriander, and nigella seeds have been found to be effective in improving glycemic status and glucose tolerance in type-2 diabetics. This led to an ongoing search for novel anti-diabetic drugs derived from seeds (Kannan *et al.* 2018).

Cumin in the diet was found to be effective in preventing metabolic disorders, as evidenced by a reduced level of urea in the blood and decreased excretions of urea and creatinine. Additionally containing anti-diabetic properties, dill seed aids in the regulation of insulin levels in the body. It also decreases the volatility of blood lipids and insulin levels that are generated by corticosteroid medication in diabetic patients. These variations are caused by diabetes treatment. An increased blood glucose level can be prevented by the alkaloidal extract of fenugreek, which also results in a reduced lipid profile (Wani *et al.* 2016). Patients with mild non-insulin-dependent diabetes were also able to reduce their total cholesterol, serum triglycerides, and blood sugar levels significantly when they used fenugreek powder to treat their condition. This was the result of a reduction in the amount of fenugreek powder used in the treatment (Lal and Meena, 2018).

Conclusion

In many countries, spices have long been used as essential components in cuisine's preparation, particularly in India. Spices have been used to flavor and taste the food for ages. Seed spices are employed in traditional medicines because of their health benefits. Food based techniques of increasing the spices and phytochemicals intake can have a significant impact on the beginning and progression on the chronic diseases, oxidative stress and ageing. Natural sources of vitamins and minerals include spices and herbs. Seed spices have a comprehensive effect on human health when consumed as a part of diet on regular basis. However, many Indian seed spices have been thoroughly researched using modern scientific methods in order to understand their nature, the chemical constituents that make up their bodies, and the pharmacological qualities that they possess. Research on such a comprehensive scale has provided conclusive evidence that particular chemical components are present in seed spices. Spices have some of the most diverse nutritional and pharmacological properties of any other food ingredient. They can be used as an appetizer, a digestive aid, a carminative, an analgesic, a blood purifier, a hepato-protective, an antidiabetic, an anti-microbial, an anti-oxidant, an anti-inflammatory, and they even have hypo-lipidemic activity. In addition, seeds and spices should be included in the diet so that they can reach their full therapeutic potential, which would increase their ability to both improve overall health and treat particular health conditions. The development of new methods and potential products for the extraction and utilization of these active ingredients in a variety of processed food products has led to advancements in the technologies used in the food industry.

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