A META ANALYSIS: DETECTION OF ANTIULCER AND ANTIOXIDANT ACTIVITY OF CINNAMON OIL IN ANIMAL MODEL

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Abstract

Ulcer, a disorder that affects the digestive tract, is experienced by a great number of people. In the digestive tract, an ulcer is nothing more than a damaged skin or mucus membrane that has become inflamed. Ulceration can develop when the natural balance is upset, which can be caused either by an increase in mucosal aggression or a decrease in mucosal resistance. Abuse of drugs, poor diet, high levels of chronic stress, and other conditions that are comparable may all play a part. Peptic ulcers are so-called because they can occur anywhere along the digestive tract, including the duodenum and the stomach. In order for peptic ulcers to occur, the mucosal defenses of the stomach must first become compromised. Peptic ulcers also require acid and peptic activity to be present in the gastric juice. There is a wide range of synthetic medication that can be used to treat ulcers. On the other hand, in comparison to more conventional treatments, these medications are not only more expensive but also more likely to have unintended consequences. According to the findings of the research, many different ayurvedic physicians and practitioners of traditional medicine make use of a wide variety of medicinal

plants and polyherbal combinations in order to heal ulcers. When treating peptic ulcer illness, the primary goals of treatment should be symptom relief, ulcer healing, and the prevention of further ulcer attacks. In this article, we will go over some of the medicinal plants that have been explored for their possible use in ayurveda and Western medicine in the treatment and prevention of peptic ulcers. These plants have been studied because of their potential application in both of these medical systems.

Keywords: Ulcer, Cinnamon, essential oil, Antioxidant Properties.

Introduction

It is well knowledge that germs that are resistant to several drugs provide a significant danger to the health of humans in the 21st century[1]. In a report that was published in 2017, the World Health Organization listed the most harmful multidrug-resistant bacteria for which new antibiotics need to be developed as quickly as possible[2]. The research also stated that new medicines need to be discovered as soon as possible. Plants, bacteria, algae, fungus, and animals all contribute to the development of new antibacterial agents; nevertheless, there has been a rise in interest in bioactive chemicals given by plants as prospective alternatives for traditional antibiotics[3]. This is due to the fact that bioactive compounds have the potential to be more effective than conventional antibiotics. Essential oils (EOs) are a rich source of naturally occurring compounds that have demonstrated excellent potential for application in the creation of new antibacterial medications. In a number of investigations [4,5], it was discovered that several EOs possessed a potent antibacterial effect. One essential oil (EO) that has been investigated in great depth for its potential antibacterial benefits is cinnamon.[6,7,8] In addition, the use of EOs in conjunction with one another or with other purified primary components would increase the possibility that the bacteria being targeted would be exposed to a wide variety of chemical compounds, which would ultimately result in increased activity [9]. An ulcer is an open sore on the skin or a mucous membrane that is inflamed and contains dead tissue that is sloughing off [10]. Ulcers are lesions that can occur in the skin or a mucous membrane, but they only result in the loss of superficial tissue. Ulcers can present themselves everywhere on the skin of the body; however, they are most commonly found on the stomach and lower legs. Ulcers are able to manifest themselves in a variety of locations throughout the body, including the mouth, the esophagus, the stomach, and the genitalia. Peptic ulcer illness affects a significant number of people. Erosion of the lining of the stomach or duodenum is what leads to the development of peptic ulcers [11]. The two types of peptic ulcers that occur most frequently are those that affect the stomach and the duodenum. The condition was originally referred to as ulceration. Both the stomach and the duodenum are capable of developing ulcers at the same time. Gastric ulcers are a painful condition that occurs when open sores grow in the stomach, and the aged population has an increased risk of developing this condition. In certain circumstances, eating could make the existing discomfort feel even worse. There is a possibility that you will also experience decreased appetite, nausea, and vomiting. Patients who suffer from stomach ulcers may have normal or decreased acid production, but ulcers can develop even when there is no acid present in the stomach [12]. Patients are frequently jolted up from their sleep by the agonizing pain and a

burning sensation in the upper abdomen that is caused by duodenal ulcers. The duodenum is the first part of the small intestine. There is a correlation between having an empty stomach and experiencing discomfort, but eating can alleviate the issue. Ulcers of the duodenum are more common in adults under the age of 40, particularly in men. Ulcers can appear on the walls of the duodenum at any point, including the anterior and the posterior regions [13]. Peptic ulcers are a potentially life-threatening condition, and in certain cases, they can even be deadly [14]. In addition to blood in the stools, other symptoms include extreme stomach ache, cramps, and vomiting blood.

Antioxidants are absolutely necessary in order to get rid of free radicals, which are unstable chemicals that can cause damage to a variety of biomolecules in the human body, including DNA, proteins, and lipids. There is a possibility that our body does not produce a sufficient amount of antioxidant enzymes on its own. Because synthetic antioxidants could have adverse effects on the endogenous enzymes found in humans, the majority of research efforts have been concentrated on the putative natural antioxidants that are produced from natural sources [15].

Food is sometimes preserved by a process called fermentation, which utilizes the help of microbes. It is believed that fermentation has a role in the production of more aglycone isoflavone and malonylglycoside isoflavone. As a result, fermented soybean paste in Korea possesses higher total phenolic contents (TPC) and a greater antioxidant activity when compared to unfermented soybean [16]. However, it has been demonstrated that the DPPH radical scavenging effect of peanut flour is significantly improved through the fermentation process with lactic acid [17]. Both soybeans and cowpeas whose DPPH activity had been fermented with lactic acid bacteria exhibited an increase in their level of activity [18,19]. A rise in DPPH capacity after the fermentation process is evidence that fermentation may have enormous potential for the creation of some metabolites with superior radical scavenging activity [20]. This is indicated by the rise in DPPH capacity that occurs after fermentation. According to a second study [21], the antioxidant potential of an extract of Coffee arabica pulp was demonstrated to increase from 36% to 42% following fermentation. This was shown to be the case. Natural antioxidants, such as hydroxycinnamic acids, are found in coffee pulp and may be liberated during the fermentation or enzymatic process that occurs during the production of coffee. This page provides a summary of the research that has been published in English regarding the anti-ulcer capabilities of components found in essential oils. Bioactive substances are characterized, and the chemical structures of such bioactive molecules are provided. The chemicals that were considered for inclusion in this review were selected on the basis of their shown pharmacological effect in experimental models developed to evaluate the efficacy of anti-ulcer treatments, and/or on the basis of the findings of additional research aiming to give insight on the underlying mechanisms at work[22]. To select essential oil constituents from the database, essential oils, monoterpenes, sesquiterpenes, and phenylpropanoids, as well as the names of representative compounds from these groups, were used. The results were then refined using terms related to anti-ulcer activity, anti-ulcerogenic activity, and ulcers. An ulcer is an open sore on the skin or a mucous membrane that is inflamed and contains dead tissue that is sloughing off [23]. Ulcers are

lesions that can occur in the skin or a mucous membrane, but they only result in the loss of superficial tissue. Ulcers can present themselves everywhere on the skin of the body; however, they are most commonly found on the stomach and lower legs. Ulcers are able to manifest themselves in a variety of locations throughout the body, including the mouth, the esophagus, the stomach, and the genitalia. Peptic ulcer illness affects a significant number of people. Erosion of the lining of the stomach or duodenum is what leads to the development of peptic ulcers [24]. The two types of peptic ulcers that occur most frequently are those that affect the stomach and the duodenum. The condition was originally referred to as ulceration. Both the stomach and the duodenum are capable of developing ulcers at the same time. Gastric ulcers are a painful condition that occurs when open sores grow in the stomach, and the aged population has an increased risk of developing this condition. In certain circumstances, eating could make the existing discomfort feel even worse. There is a possibility that you will also experience decreased appetite, nausea, and vomiting. Patients who suffer from stomach ulcers may have normal or decreased acid production, but ulcers can develop even when there is no acid present in the stomach [25]. Patients are frequently jolted up from their sleep by the agonizing pain and a burning sensation in the upper abdomen that is caused by duodenal ulcers. The duodenum is the first part of the small intestine. There is a correlation between having an empty stomach and experiencing discomfort, but eating can alleviate the issue. Ulcers of the duodenum are more common in adults under the age of 40, particularly in men. Ulcers can appear on the walls of the duodenum at any point, including the anterior and the posterior regions [26]. People who have peptic ulcers may present with symptoms such as bloody stools, severe stomach discomfort and cramps, and vomiting blood [27]. Peptic ulcers can be exceedingly harmful and even fatal in some individuals. Despite the fact that over 70% of patients with peptic ulcer disease may initially be asymptomatic, perforated peptic ulcers are the most prevalent cause of patient presentation. This is due to the fact that perforated peptic ulcers are more likely to result in bleeding. It may be more challenging to obtain an accurate history from specific groups of people, such as those who are immunocompromised, very young or very old, or who have an altered level of consciousness. When an honest narrative is collected, a comprehensive history will assist in determining whether or not any symptoms were present prior to the ulcer perforation. Patients who suffer from peptic ulcer disease often exhibit symptoms of dyspepsia, which is also referred to as upper abdominal pain. Pain in the upper abdomen may be generalized, in which case it will impact the entire region, or it may be localized, in which case it will just affect one side of the abdomen, the other side, or even the epigastrium. However, the discomfort associated with duodenal ulcers typically does not begin until two to five hours after a meal has been had. Food has the potential to worsen stomach ulcers. Patients who are suffering from peptic ulcer hemorrhage frequently have symptoms such as nausea, hematemesis, and melanotic feces. Some individuals may observe bright red blood per rectum or feces that are a maroon color if the bleeding from the upper gastrointestinal tract is significant.

Patients who are suffering from a ruptured peptic ulcer frequently report sudden and intense pain in the epigastric region. Despite the fact that it starts off localized, the painful feeling quickly

spreads across the entire body. Blood loss, SIRS (systemic inflammatory response syndrome), or sepsis can all lower a patient's blood pressure, which can cause symptoms such as dizziness or even fainting in some cases. After a few hours, there is a chance that the discomfort in your abdomen will temporarily ease, although it may still be brought on by movement. If the patient delays seeking medical treatment and the perforation is not walled up, they may develop clinical signs of SIRS or sepsis, including increased abdominal distension. This can happen if the perforation is not walled off[28].

Every patient who complains of stomach pain ought to have a comprehensive medical examination performed on them. There is a correlation between having perforated peptic ulcers and having progressive and extensive abdominal pain, as well as guarding and rigidity. It is possible to find guaiac in the stool sample taken during a rectal examination. Patients could have low blood pressure or rapid heart rates. In the event that the patient does not show themselves immediately, they may be experiencing symptoms such as fever and a change in their mental status[29].

The final step, which is the secretion of hydrogen ions by parietal cells, is the culmination of a complicated and drawn-out process in which a wide variety of factors, both internal and external, play a part. A number of neurotransmitters and hormones (acetylcholine, often known as ACh; histamine; gastrin; see figure) are responsible for regulating acid generation. Their respective receptors (M3, H2, and CCK2, respectively) can be found in the basolateral membrane of parietal cells in the body and fundus of the stomach. These receptors can also be discovered on enterochromaffin-like cells (ECL), where they perform the role of controlling the production of histamine. Because the H2 receptor is a G protein-coupled receptor, the cyclic AMP-protein kinase A (PKA) pathway is activated when it is activated by this receptor. In response to acetylcholine and gastrin, parietal cells transmit signals via the Gq-PLC-IP3-Ca2+ pathway that is mediated by GPCRs. Hydrogen and potassium ions are transferred across the parietal cell membrane by H+, K+-ATPase (the proton pump), which is activated by the cyclic AMP and the Ca2+-dependent pathways. This pump generates the largest ion gradient that has been seen in vertebrates. It has an internal pH of 7.3, whereas the pH of the canalicular fluid is just 0.8[30].

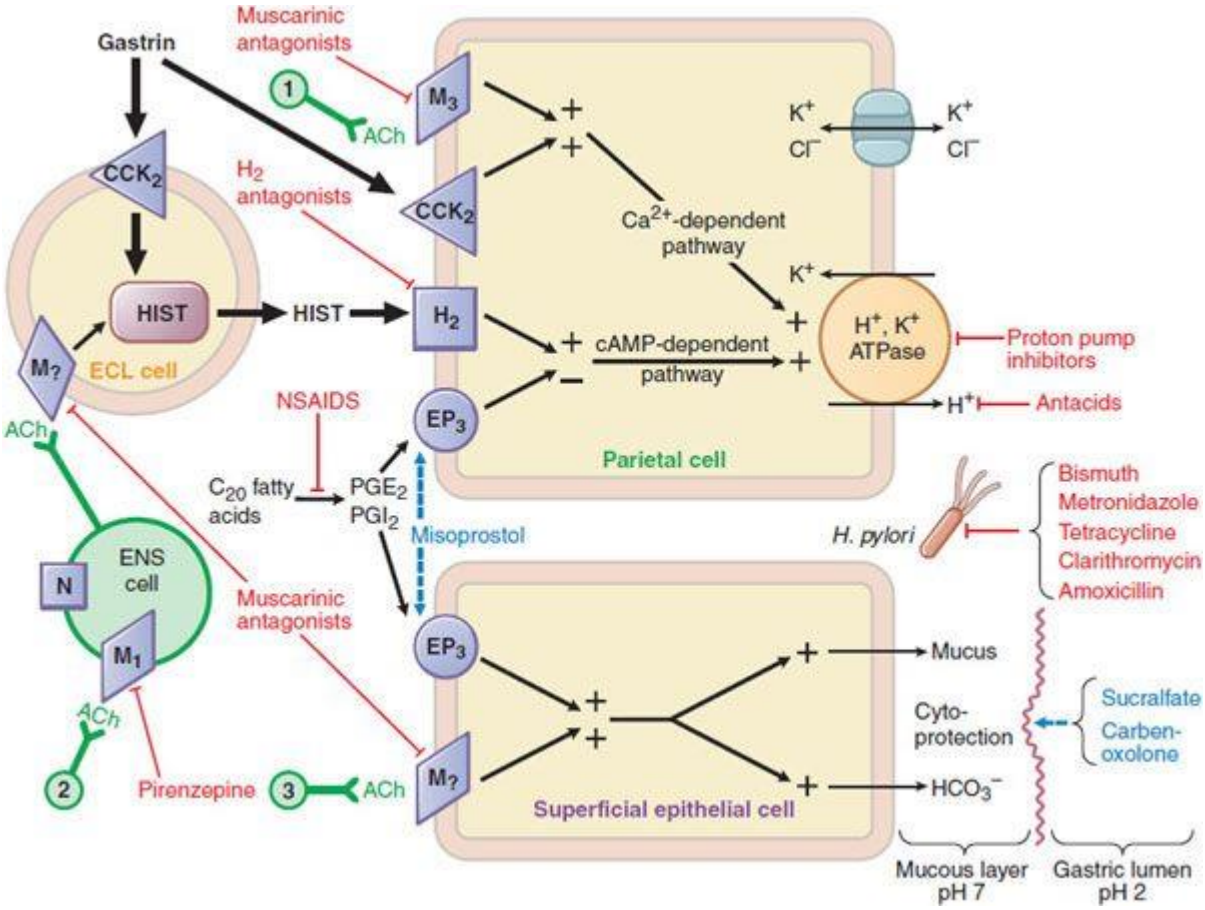

Fig: 1 Understanding stomach secretion and how to control it is the first step in treating acid-peptic disorders. Pharmacologists are the experts in this area. It depicts the interactions that take place between mucus- and bicarbonate-secreting superficial epithelial cells, acid-secreting parietal cells, histamine-secreting enterochromaffin-like (ECL) cells, and ganglion cells of the enteric nervous system (ENS). These cells all produce histamine. Both excitatory (+) and inhibitory (-) physiological pathways are possible inside the solid black physiological network. The input from the vagus nerve is depicted at the number 2, and the postganglionic cholinergic fibers are displayed at the numbers 1 and 3. In physiology, the membrane receptors for the various agonists include acetylcholine (ACh), muscarinic (M), and nicotinic (N) receptors; gastrin (CCK2), histamine (HIST), and prostaglandin E2 (PGE2) receptors; and H2 and EP3 receptors, respectively. The antagonized targets of pharmaceuticals are shown in red in this diagram. The capability of a medicine to reproduce or augment a physiological pathway is represented by a light blue dashed arrow in the figure. The treatment for acid-peptic disorders is denoted by the color red. Because they suppress the enzyme cyclooxygenase, NSAIDs have been linked to the development of ulcers.[6]

Peptic ulcers are the most frequent type of ulcer, but there are many more. They are classified according to where they develop in the human body[2, 10]

Ulcers come in a variety of forms, including:

- Pressure sores
- Genital herpes
- Ulcerative colitis
- Vein erosions
- Canker sores (aphthous ulcers)1

Typical ulcers include: Abdominal ulcer: It's a break in the mucosal lining that allows acid and pepsin to enter.

The condition is called a peptic ulcer because of its association with pepsin secretion.9

Peptic ulcers can affect either the stomach or the duodenum. Peptic ulcer classification by location: Type I gastric ulcers are characterized by normal or reduced gastric acid output and ulceration along the stomach's minor curvature.

Type II encompasses both stomach and duodenal ulcers. Gastric acid secretion is either typical or elevated in these cases.

Material & Methods

This review was structured by doing a search for pertinent papers in both online and offline databases, including PubMed, Scopus, the Scientific Information Database, Springer Link, and African Journals Online, as well as Google Scholar. The results of these searches were compiled and used to organize the information. In addition to that, we looked at reports from the Centre for Plant Medicine Research in Mampong-Akuapem, Ghana, as well as monographs on medicinal plants, information from product labels, student theses, and reports from institutions. Helicobacter pylori, those who suffer from peptic ulcer disease, herbal treatments, and the presence of anti-ulcer activity.

Results & Discussion

Fig: 2 Cinnamon essential oil Chemical Constituents heal gastric mucosa

Antiulcer activity of Cinnamon oil

Harada *et al.*, (1975) The effects of cinnamon (CA) on both the heart and the digestive system were looked into. It would appear that the hypotensive effect that CA exhibited in sedated dogs and guinea pigs was predominantly induced by the peripheral vasodilatation that was caused by CA. CA induced a temporary dilatation of the dogs' blood vessels, which persisted long after their blood pressure returned to normal after it had fallen. This happened when the pups' blood pressure plummeted. CA displayed a papaverine-like musculotropic activity in the isolated ileum of the guinea pig and the mouse, which suggests its involvement in the vasodilation. The application of CA resulted in an increase in the cardiac contractile force and beating rate of the isolated guinea pig heart preparations (isolated atria and perfusing heart). The positive inotropic and chronotropic effects came after a delay, distinguishing them from the rapid affects of the adrenaline. On the other hand, repeated CA doses resulted in attenuation of those effects and cardiac inhibition. The blood flow to the coronary arteries was increased. The digestive activity of rats and mice was slightly slowed down by the presence of CA, as was the movement of food through their intestines. The stomach erosions that stress generated in mice were avoided by CA when it was given to the mice in oral form and delivered. In the rat, CA caused an increase in the amount of biliary secretion. The pharmacological activities of cinnamon from China were discussed, along with their possible connection to the medicinal benefits of cinnamon from China[6].

Oho*no et al.*, (2003) Helicobacter pylori is a major infection because it frequently has a role in the development of gastroduodenal diseases in humans. In spite of the fact that eradicating H. pylori through the use of antibiotics often results in improvements in gastroduodenal disorders, antibiotic resistance is increasing at an alarming rate. The concentration of 0.1% (v/v) of each of these 13 essential oils that was used in this experiment was sufficient to completely inhibit the growth of H. pylori in vitro. Both lemongrass (Cymbopogon citratus) and lemon verbena (Lippia citriodora) were found to have bactericidal effects against H. pylori at a concentration of 0.01% when the environment was pH 4.0 or 5.0. However, the variables that contributed to the development of resistance to clarithromycin were the same as those that led to resistance to lemongrass. There was no evidence of resistance to lemongrass after ten consecutive passages. The number of H. pylori found in the stomachs of mice that were treated with lemongrass was shown to be much lower when compared to the number of H. pylori found in mice that were not treated[13].

Ali *et al.*, (2005) In time course viability assays, we found that eugenol and cinnamaldehyde, each at a concentration of 2 g/ml, were able to inhibit the growth of H. pylori ATCC26695 after 9 and 12 hours of incubation, respectively. It has been demonstrated that certain essential oils extracted from lemon grass have exceptionally potent antimicrobial properties, particularly in relation to H. pylori. On the other hand, the fact that we used active principles as opposed to extracts or oils might make our findings more trustworthy. Because of the possible existence of unidentified chemicals, the actions of these essential oils could be additive or inhibitory. In contrast to the essential oils that Ohno and his colleagues used, our study found that eugenol was

a more efficient antibacterial than cinnamaldehyde was. Eugenol was also found to have antifungal properties. Additionally, our compounds were more efficient than the commonly used antibiotic amoxycillin. Cinnamaldehyde and eugenol both stopped the growth of H. pylori ATCC26695 at the 12th hour, whereas eugenol inhibited microbiological growth at its minimal inhibitory concentration at the 9th hour of incubation itself. The minimum inhibitory concentration (MIC) of amoxycillin is 0.016 g/ml; however, it was found to be completely effective against bacteria at a concentration of 1 g/ml. Due to the fact that H. pylori thrives in the stomach, which has a pH of less than 3.0, it is essential to assess a compound's effect as well as its stability at an acidic pH. However, in our research, H. pylori isolates were able to survive at a pH of 4.0 despite the fact that the bactericidal effects of the bioactive compounds were demonstrated to be stronger even at low pH. According to the findings of other investigations, H. pylori can survive at a pH of 3.0. Against H. pylori, different bactericidal medicines are activated by pH levels of varying values. For example, ecabet sodium is most effective at an acidic pH, but tea catechin is most effective at an alkaline pH[5].

A, razq *et al*., (2010) Peptic ulcer disease is a problem that can occur in the digestive tract. The medications that are utilized to treat illnesses of any kind in today's world are both expensive and loaded with unintended side effects. In light of this, the objectives of this study were to investigate the effectiveness of aqueous extracts of cinnamon and chamomile against ulcers and to evaluate the efficacy of these extracts in comparison to the antiulcer medication ranitidine contained in Zantac TM. Fifty male rats weighing 1605g each were divided up into 10 different groups. The individuals who make up Group I are considered to be the "good guys." Group II is the control group that does not use any drugs. After oral administration of CIAE or CHAE, there was a considerable reduction in the volume of gastric juice, as compared to both the positive group and the control group. When compared to rats treated with Zantac, those given CIAE or CHAE had a much better rate of complete recovery from stomach ulcers. Healing rates for stomach ulcers caused by CHAE were likewise significantly higher than those caused by CIAE. An infected rat's stomach underwent histological investigation, which indicated necrosis of the gastric mucosa, as well as submucosal edema and bleeding brought on by congestion of the submucosal blood vessels. In the stomachs of those who were administered Zantac, a necrosis of the mucosa lining the stomach was noted, along with hemorrhage. However, higher dosages of CIAE (300 or 400 mg/kg of b. wt.) and CHAE (200, 300, or 400 mg/kg of b. wt.) were required to prevent histological changes from occurring in the stomachs of the animals. In summary, CHAE and CHAE showed promise as ulcer therapies, and their outcomes were superior to those produced by Zantac. The stomach was better protected by chamomile extracts than it was by cinnamon, according to a study that compared the two[10].

Alqasoumi S *et al*., (2012) Cinnamomum zeylanicum, more popularly known as cinnamon, was the subject of investigation in this study with the intention of determining whether or not it possesses stomach antisecretory and antiulcer actions in rats. Cinnamon aqueous suspension, at doses of 250 and 500 mg/kg, was investigated in a rat model of pylorus ligation (Shay), as well as in animals treated with necrotizing drugs and those that had indomethacin-induced ulceration.

Histopathological analysis was performed on stomach tissue obtained from rats. In addition to protein sulfhydryls, mucus and nonprotein sulfhydryls were determined to be present in the stomach wall. Cinnamon, when administered in the form of a suspension, prevented pylorus-ligated rats from developing rumenal ulcers and decreased the volume of basal stomach acid output. In a study where stomach hemorrhagic lesions were created using ethanol (80%), sodium hydroxide (0.2 M), and sodium chloride (25%), the suspension was found to dramatically reduce the amount of bleeding that occurred. Inhibition of basal gastric secretion (attenuation of aggressive factors), stimulation of mucus secretion (potentiation of defensive factors), and increase in nonprotein-sulfhydryl concentration (likely due to prostaglandin-inducing abilities mediated through its antioxidant property) all contribute to cinnamon's gastroprotection, as seen in the present study. Cinnamon's antioxidant property also plays a role in the gastroprotection it provides[14].

Tankam *et al*., (2013) This study investigated the preventative effects of a cinnamon-based diet using many mouse models of gastric ulcer. We investigated the dose dependence of a cinnamon powder diet and the optimal time of delivery using a water immersion stress gastric ulcer model. Cinnamon powder in their meal reduced the risk of ulcers in mice exposed to stress, ethanol, HCl, or aspirin orally, but did not prevent ulceration in mice administered indomethacin orally or aspirin subcutaneously. A diet containing 100 mg of cinnamon powder per gram of food protected against stomach ulcers after 4 weeks of treatment, and cinnamaldehyde was identified as the active component in cinnamon powder for gastroprotective action. Despite its poor efficacy against NSAID-induced stomach ulcers, the data here suggest that regular usage of cinnamon powder provides gastroprotection, likely via a cytoprotective mechanism[3].

Abdel *et al*., (2022) Cinnamon comes from a plant in the Lauraceae family and has been used for both culinary and medicinal purposes for centuries. It can prevent inflammation and free radical damage to cells. The goal of this research was to examine how effective omeprazole and cinnamon were at reducing the risk of ethanol-induced stomach ulcers. An oral dose of 70% ethanol (five milliliters per kilogram of body weight) caused stomach ulcers in Wistar rats. For seven days prior to ulcer induction, the patients were given a combination of 20 mg/kg of omeprazole (a reference drug) and 2.5 ml of cinnamon oil per kilogram of body weight orally. A substantial uptick in VEGF immunoreactivity was seen following pretreatment with cinnamon oil, with a concomitant reduction in COX-II immunoreactivity. The microscopic abnormalities brought on by ethanol poisoning were reversed by cinnamon oil, as shown by histological findings, which corroborated the clinical observations. Studying the effects of cinnamon oil on rats with an ethanol-induced gastric ulcer discovered that it had a gastroprotective effect similar to that of omeprazole. This benefit may arise from the oil's ability to boost angiogenesis while simultaneously reducing oxidative stress and gastrointestinal inflammation. It's possible that this is how the oil accomplishes its positive benefits[16].

Seyed ahmadi *et al*., (2019) Cinnamon essential oil's antimicrobial and antioxidant qualities may help wounds heal more quickly. The purpose of this research was to assess the efficacy of a

topical ointment containing essential oil from Cinnamomum verum (C verum) in the treatment of an infected wound model. In this experiment, mice were given wounds and allowed to develop infections on purpose; the infections were then surgically removed. Two bacterial strains, Staphylococcus aureus and Pseudomonas aeruginosa, were introduced into a 5 mm in diameter circular excisional wound model produced surgically. The model was contaminated with both of these bacterial strains. The inflammatory phase was substantially shortened after topical C verum therapy, and fibroblast distribution, collagen deposition, cell proliferation, re epithelialization, and keratin synthesis were accelerated. The mRNA levels of IGF-1, FGF-2, and VEGF in the C verum-treated groups (particularly the 2% group) were significantly greater than in the group that received no treatment. After getting topical C verum therapy, antioxidant capacity rose and MDA content decreased, in contrast to the controls. It has been shown that C verum has the ability to hasten the healing of wounds. Boosts in cellular proliferation, collagen production, and the re epithelialization ratio all contribute to this goal[19].

Antioxidant properties of cinnamon oil

Paupuleti *et al*., (2014) Cinnamon, also known as Cinnamomum zeylanicum and Cinnamon cassia, is native to the Lauraceae family of plants. Cinnamon is also known by these other names. In tropical areas, people have been harvesting therapeutic goods from this tree for ages. Cinnamon, which is widely considered to be one of the most important spices, is routinely incorporated into the meals that are consumed by people all over the world. Its volatile oils and a number of secondary byproducts, such as cinnamaldehyde, cinnamic acid, and cinnamate, are the major components of cinnamon. Other secondary components include cinnamate. Cinnamon has been found to have actions against neurological illnesses such as Parkinson's disease and Alzheimer's disease. In addition to its properties as an antioxidant, an anti-inflammatory agent, an antidiabetic, an antibacterial, an anticancer, a lipid-lowering, and a substance that lowers the risk of cardiovascular disease, cinnamon also has been found to have these actions[6].

Pallavi *et al*.,(2015) Because cinnamon has such a unique flavor and aroma, it is an indispensable ingredient in the kitchen of every single house. The fact that our predecessors used it as far back as 2800 BC for things like anointing, embalming, and treating a wide spectrum of ailments has piqued the interest of many researchers. In recent years, a great number of research have been carried out to investigate the possible health advantages of cinnamon with regard to Parkinson's disease, diabetes, blood, and the brain. After doing an exhaustive search in both PubMed and Google scholar, we were able to compile information regarding its antioxidant, anti-inflammatory, anti-lipemic, anti-diabetic, antibacterial, and anticancer activities. This systematic review draws attention to the need for more research into the possible positive effects that this covert component may have on health[23].

Azam *et al*., (2018) Women with polycystic ovarian syndrome (PCOS) were studied to determine if cinnamon supplementation improved their antioxidant status and serum lipids. Serum total antioxidant capacity was found to be considerably elevated by cinnamon ($P = 0.005$).

When compared to the placebo group, there was a substantial reduction in malondialdehyde (P = 0.014). All three types of cholesterol in the blood were considerably reduced by taking cinnamon supplements: total, low-density lipoprotein, and high-density lipoprotein (all P 0.05). Serum triglyceride levels were not significantly altered. Women with polycystic ovary syndrome (PCOS) who took a cinnamon supplement saw improvements in their antioxidant status and blood lipid profile[24].

Mohmed E. abd *et al*.,(2019) Scientists are working feverishly to develop viable alternatives to the use of antibiotic growth promoters (AGPs) in chicken feed as a result of the bans imposed on their usage by a number of countries. Probiotics, prebiotics, enzymes, organic acids, herbs, immune-stimulants, and essential oils (EO) have all been investigated as potential additions to chicken feed. Some of these additions have shown promise. Cinnamomum zeylanicum, also known as cinnamon, was one of the first plants to be utilized for medical purposes. It can be used to poultry dishes either as a powder or as essential oil. The possibility that essential oils extracted from aromatic plants can act as hypocholesterolemic agents, antioxidants, antimicrobials, antifungals, and stimulants of digestive enzymes has contributed to an increase in the oils' popularity. Cinnamon oil contains a high concentration of volatile components, the majority of which are cinnamaldehyde, eugenol, and carvacrol. It is possible that these components are responsible for cinnamon oil's potential insecticidal and antibacterial activity against pathogens that cause rotting in agricultural products and human diseases[21]

Mohamad *et al*., (2020) The purpose of this study was to determine whether or not an extract of cinnamon possesses any antioxidant properties. Cinnamon sticks were purchased from a grocery store in the area, while palm oil was acquired from a business that specialized in the production of oil in the area. The ferric reducing antioxidant power (FRAP) test was used to determine the overall antioxidant activity of the resulting extract after it was tested for its antioxidant activity using the total phenolic content (TPC), free radical scavenging activity (DPPH assay), and ferric reducing antioxidant power (FRAP). Cinnamon extract was added to palm oil at varying concentrations (0.05, 0.10, 0.15, 0.20, and 0.25% respectively) in order to evaluate the antioxidant capacity of the extract. To serve as a reference, tocopherol was employed in the oil samples, while TBHA at a concentration of 0.1% served as a synthetic antioxidant. The shelf life of palm oil was evaluated as a result. The oil samples were tested for rancidity at regular intervals (once every seven days throughout the course of a four-week storage period) while they were being stored[20].

Behrooz *et al*., (2020) An investigation of the chemical components, antioxidant capacity, antibacterial mechanism, and antiproliferative activity of the essential oil extracted from Cinnamomum zeylanicum bark is presented here. Using GC-MS, the components of the oil's composition were broken down, and the results revealed that the oil's primary components were (E)-cinnamaldehyde (71.50%), linalool (7.00%), -caryophyllene (6.40%), eucalyptol (5.40%),

and eugenol (4.60%). The essential oil of C. zeylanicum had an impressively high concentration of phenolic and bioactive components, which gave it an exceptional capacity to quench the activity of free radicals and prevent the oxidation of beta-carotene. The growth of dangerous and spoilage bacteria, notably Gram-positive ones (such as Listeria innocua, Staphylococcus aureus, and Bacillus cereus), was greatly suppressed by the oil, especially when compared to the growth of Gram-negative species (such as Escherichia coli, Pseudomonas aeruginosa, and Salmonella typhi). By using scanning electron microscopy, structural alterations in the cells of L. innocua and E. coli that had been treated with essential oil extracted from C. zeylanicum were analyzed. These strains were chosen because they were the most susceptible and the most resistant to the oil, respectively. It was seen that the essential oil soon exerted its antibacterial activity by rupturing the cell envelope and making it easier for intracellular chemicals to seep out. The essential oil exhibited a dose-dependent antiproliferative effect on adipose-derived mesenchymal stem cells (AT-MSCs), and the cell proliferation could be increased by low doses of the oil. However, the antiproliferative action of the oil was dose-dependent[18].

Kanita *et al*., (2022) The amount of 2,2-diphenyl-1-picrylhydrazyl-radical scavenging activity and reducing power that was displayed by the cinnamon ethanol (80%) extract was found to be the highest (p 0.05). The ability of cinnamon water extract (CWE) to chelate iron was found to be the highest (p 0.05), while the quantity of total phenolic component was found to be the highest in CP 100% ethanol extract. After that, CP and OMP were added to chicken patties at several concentrations, ranging from 0.1% to 0.2%. After the addition of CPs, the values for a* (redness), b* (yellowness), pH, and L* (lightness) all reduced, while the values for 2-thiobarbituric acid reactive substance and volatile basic nitrogen increased. Because of the addition of CP 0.2%, microbial counts of both total bacteria and Enterobacteriaceace were reduced, and this was the case regardless of the OMP level[24].

Conclusion

People in more and more parts of the world are developing an interest in herbal medicine and other forms of alternative medicine. However, there is evidence that cannot definitively say that they have succeeded in entirely removing H. pylori from the body. In general, as well as for every additional intervention or application in H. pylori eradication regimens, there is a need for more high-quality randomized clinical trials. According to our interpretation, these findings constitute a new benchmark for future research aimed at determining whether or not nutritional therapy is effective in treating H. pylori. Cinnamon leaf oil was subjected to a number of different in vitro bioanalytical tests in order to evaluate its potential antioxidant and enzyme-inhibiting properties. Isosakuranetin, hispidulin, and chlorogenic acid were found to be the most abundant of the phenolic compounds that were found in the plant oil. In addition, the GC-FID investigation found that E-Cinnamaldehyde was responsible for 72.98 percent of the oil that was previously present in cinnamon leaves. According to these studies, cinnamon leaf oil is a potential treasure trove of biomolecules that are advantageous to the body. Furthermore,

cinnamon oil contains a significant amount of phenolic compounds, such as E-cinnamaldehyde, benzyl benzoate, -caryophyllene, and trans-cinnamylacetate. These molecules are all found in abundance. Researchers found that cinnamon leaf oil includes a number of phenolic compounds, including ellagic acid, naringenin, and luteo-lin-7-glycoside, by using LC-HR/MS to analyze the chemical composition of the oil.

References

1. W. A. Hoogerwerf and P. J. Pasricha, *Agents Used for Control of Gastric Acidity and Treatment of Peptic Ulcers and Gastro Esophageal Reflux Diseaseedition*, pp. 1005–19, McGraw-Hill, New York, NY, USA, 10th edition, 2001.
2. Saha, P., Kumar, R., Nyarko, R. O., Kahwa, I., & Owusu, P. (2021). Herbal Secondary Metabolite For Gastro-Protective Ulcer Activity With Api Structures.
3. Tankam, J.M., Sawada, Y. & Ito, M. Regular ingestion of cinnamomi cortex pulveratus offers gastroprotective activity in mice. *J Nat Med* **67**, 289–295 (2013). https://doi.org/10.1007/s11418-012-0680-9
4. Daharia, A., Jaiswal, V. K., Royal, K. P., Sharma, H., Joginath, A. K., Kumar, R., & Saha, P. (2022). A Comparative review on ginger and garlic with their pharmacological Action. *Asian Journal of Pharmaceutical Research and Development*, *10*(3), 65-69.
5. Bind, A., Das, S., Singh, V. D., Kumar, R., Chourasia, A., & Saha, P. (2020). Natural Bioactives For The Potential Management Of Gastric Ulceration. *Turkish Journal of Physiotherapy and Rehabilitation*, *32*(3), 221-226.
6. Rao, P. V., & Gan, S. H. (2014). Cinnamon: a multifaceted medicinal plant. *Evidence-based complementary and alternative medicine : eCAM*, *2014*, 642942. https://doi.org/10.1155/2014/642942
7. Kumar, R., Saha, P., Lokare, P., Datta, K., Selvakumar, P., & Chourasia, A. (2022). A Systemic Review of Ocimum sanctum (Tulsi): Morphological Characteristics, Phytoconstituents and Therapeutic Applications. *International Journal for Research in Applied Sciences and Biotechnology*, *9*(2), 221-226.
8. HARADA, M., & YANO, S. (1975). Pharmacological studies on Chinese cinnamon. II. Effects of cinnamaldehyde on the cardiovascular and digestive systems. *Chemical and pharmaceutical bulletin*, *23*(5), 941-947.
9. Nyarko, R. O., Kumar, R., Sharma, S., Chourasia, A., Roy, A., & Saha, P. (2022). Antibacterial Activity of Herbal Plant-Tinospora Cordifolia And Catharnthus Roseus.
10. Amr, A. R., & Maysa, M. E. (2010). Anti-ulcer effect of cinnamon and chamomile aqueous extracts in rat models. *J. Am. Sci*, *6*, 209-216.
11. Ali, S.M., Khan, A.A., Ahmed, I. *et al.* Antimicrobial activities of Eugenol and Cinnamaldehyde against the human gastric pathogen *Helicobacter pylori*. *Ann Clin Microbiol Antimicrob* **4**, 20 (2005). https://doi.org/10.1186/1476-0711-4-20

12. Kumar, R., Singh, A., & Painuly, N. (2022). Investigation of in-vitro anti-oxidant & anti-ulcer activity of polyherbal medicinal plants. *Journal of Pharmaceutical Negative Results*, 2077-2088.
13. Ohno, T., Kita, M., Yamaoka, Y., Imamura, S., Yamamoto, T., Mitsufuji, S., ... & Imanishi, J. (2003). Antimicrobial activity of essential oils against Helicobacter pylori. *Helicobacter*, *8*(3), 207-215.
14. Alqasoumi, S. (2012). Anti-secretagogue and antiulcer effects of 'cinnamon'cinnamomum zeylanicum in rats. *J Pharmacog Phytother*, *4*, 53-61.
15. Mishra, A., Singh, Y., Singh, R., Kumar, R., Shukla, S., Kumar, R., ... & Pol, S. L. (2022). Ethano-pharmacology activity & Antioxidant activity of Centella asiatica Plant Parts. *NEUROQUANTOLOGY*, *20*(11), 7562-2.
16. Abdel-Kawi, S.H., Hashem, K.S., Saad, M.K. *et al.* The ameliorative effects of cinnamon oil against ethanol-induced gastric ulcer in rats by regulating oxidative stress and promoting angiogenesis. *J Mol Histol* **53**, 573–587 (2022). https://doi.org/10.1007/s10735-022-10072-y
17. Borzoei, A., Rafraf, M., Niromanesh, S., Farzadi, L., Narimani, F., & Doostan, F. (2017). Effects of cinnamon supplementation on antioxidant status and serum lipids in women with polycystic ovary syndrome. *Journal of traditional and complementary medicine*, *8*(1), 128–133. https://doi.org/10.1016/j.jtcme.2017.04.00
18. Abd El-Hack, M. E., Alagawany, M., Abdel-Moneim, A. E., Mohammed, N. G., Khafaga, A. F., Bin-Jumah, M., Othman, S. I., Allam, A. A., & Elnesr, S. S. (2020). Cinnamon (*Cinnamomum zeylanicum*) Oil as a Potential Alternative to Antibiotics in Poultry. *Antibiotics (Basel, Switzerland)*, *9*(5), 210. https://doi.org/10.3390/antibiotics9050210
19. Singhal, A. K. V., Giri, S., & Kumar, R. (2022). INVESTIGATION OF IN-VITRO ANTI-OXIDANT & ANTI-ULCER ACTIVITY OF ANGIOGENESIS LATIFOLIA ROXB (DHAVA). *NeuroQuantology*, *20*(11), 5680-5686.
20. Alizadeh Behbahani, B., Falah, F., Lavi Arab, F., Vasiee, M., & Tabatabaee Yazdi, F. (2020). Chemical Composition and Antioxidant, Antimicrobial, and Antiproliferative Activities of *Cinnamomum zeylanicum* Bark Essential Oil. *Evidence-based complementary and alternative medicine : eCAM*, *2020*, 5190603. https://doi.org/10.1155/2020/5190603
21. Seyed Ahmadi, S. G., Farahpour, M. R., & Hamishehkar, H. (2019). Topical application of Cinnamon verum essential oil accelerates infected wound healing process by increasing tissue antioxidant capacity and keratin biosynthesis. *The Kaohsiung journal of medical sciences*, *35*(11), 686-694
22. Chaudhary, H., Sagar, S., Kumar, R., Bisht, V., & Butola, K. (2022). Herbal Essential Oil use as Ulcer Protective Activity: A Systematic Review. *Journal for Research in Applied Sciences and Biotechnology*, *1*(5), 86-101.
23. Kawatra, P., & Rajagopalan, R. (2015). Cinnamon: Mystic powers of a minute ingredient. *Pharmacognosy research*, *7*(Suppl 1), S1–S6. https://doi.org/10.4103/0974-8490.157990

24. Rakasivi, K. G. J., & Chin, K. B. (2022). Antioxidant activity of Cinnamomum cassia extract and quality of raw chicken patties added with C. cassia powder and Pleurotus sajor-caju powder as functional ingredients during storage. *Animal bioscience*, *35*(8), 1279–1288. https://doi.org/10.5713/ab.21.0444
25. Awuchi, C. G., Saha, P., Amle, V. S., Nyarko, R. O., Kumar, R., Boateng, E. A., ... & Asum, C. (2023). A Study of Various Medicinal Plants used in Ulcer Treatment: A Review. *Journal for Research in Applied Sciences and Biotechnology*, *2*(1), 234-246.
26. Das, S., Singh, V. D., Bind, A., Gupta, S. P., & Kumar, R. Evaluation of antiulcer, antioxidant potency of manuka honey and cinnamon powder mixture in Wistar rats using experimental rat models.
27. PASWAN, S. K., DHARMENDRA AHUJA, D. L., KUMAR, S., MUZTABA, M., AHMAD, A., SELVAKUMAR, P., ... & KUMAR, R. (2023). Volatile Alkaloids And Brain Disorder Investigation Of The Cognitive And Mood Effects Of Zingiber Officinale Essential Oil With In Vitro Properties Relevant To Central Nervous System Function. *Journal of Pharmaceutical Negative Results*, 574-589.
28. Paik, S. Y., Koh, K. H., Beak, S. M., Paek, S. H., & Kim, J. A. (2005). The essential oils from Zanthoxylum schinifolium pericarp induce apoptosis of HepG2 human hepatoma cells through increased production of reactive oxygen species. *Biological and Pharmaceutical Bulletin*, *28*(5), 802-807.
29. Redasani, V. K., & Bari, S. B. (2012). Synthesis and evaluation of mutual prodrugs of ibuprofen with menthol, thymol and eugenol. *European journal of medicinal chemistry*, *56*, 134-138.
30. Sehajpal, S., Prasad, D. N., & Singh, R. K. (2018). Prodrugs of non-steroidal anti-inflammatory drugs (NSAIDs): a long march towards synthesis of safer NSAIDs. *Mini reviews in medicinal chemistry*, *18*(14), 1199-1219.