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| [**Index**](http://docs.google.com/index.html) [**ABSTRACT**](http://docs.google.com/abstract.html) | |  | | --- | | **Introduction**  **Why ginger?**  I would always question my mothers cooking because most of her specialty dishes contained ginger. The penetrating and aromatic smell of ginger complemented the hot and biting taste of all her soups and casseroles. Upon asking her why she would always include this root in her cooking, she would simply tell me that ginger promotes good health and would keep me from catching a cold.  My initial idea to research the antibacterial effects of ginger stem from my motherís comment. However, previous research done during previous years on the antibacterial affects of garlic made me want to try the same experiment to determine weather ginger can be used as an antibiotic, similar to garlic. However, from research, it was stated that no actual ginger antibacterial tests have been conducted, other than administering ginger to patients and recording patients relief from their symptoms. However, many such experiments have a problem of a placebo effect, meaning the patient simply believes they are cured from taking the herb. Through my research I would determine and prove for myself that this root commonly used in many recipes and remedies throughout the world had more to it than just a pungent taste and did in fact have antibacterial properties.  **Ginger: History**  Ginger was first believed to be cultivated for nearly a millennium in both China and India, it reached the West at least two thousands years ago, as a subject of Roman tax in the second century after being imported via the Red Sea to Alexandria. Itís citations in ancient tests go as far back as to the 4th century B.C. Tariff duties appear in the records of Marseilles in 1228 and in Paris by 1296. It became naturalized in America at the discovery of that country by the Spaniards. The value of ginger is written about in early literature of ancient Asia, Europe and the Middle East. And during that time ginger cultivators were considered prosperous in trade. Today, ginger is known as one of the worldís favorite spices having so many varieties with an estimated 50 in India alone.  Traditional oriental medicine acknowledges four different forms of ginger. These forms include fresh, dried, roasted, and steamed; each with their own unique purpose. When ginger is fresh, itís rhizome is good for hot compresses, a culinary spice and medicinal tea. Fresh ginger can also be added to juices, soups and stews. Likewise, a honey-based syrup acts synergistically by broadening gingerís antibacterial, anti-fungal properties. In China ginger is mentioned in the earliest of herbals. Ancient China mentions the fresh root to be called Sheng-jiang and the dried root as Gan-jiang. The fresh root was used to dispel pathogens via itís ability to induce sweating. It expels cold, relieves nausea and ìclears awayî toxic matter as believed by the Chinese. Moreover, the dried root removes cold and is useful for cold pain of the stomach and abdomen and was also useful for diarrhea in the culture. Chinese scientist through experimentation verified the dried roots ability to help the stomach while acting as a mild stomach and intestinal stimulant. Ginger was so popular in Chinese culture that Chinese fisherman have known for centuries that ginger can stave off seasickness.  Other countries throughout time have likewise known of the benefits of ginger. In ancient Greece, Greeks would ward off the effects of gluttoness by eating ginger wrapped in bread, which eventually turned into ginger bread. Similarly, in India, like the ancient Chinese, the fresh and dried roots were considered distinct medicinal products. Fresh ginger has been used for cold-induced disease, nausea, asthma, cough, colic, heart palpitation, swellings, dyspepsia, loss of appetite, and rheumatism. Furthermore, in nineteenth century India, one English writer observed that a popular remedy for cough and asthma consisted of the juice of fresh ginger with a little juice of fresh garlic, mixed with honey. This is a recipe similar to those in early oriental medicine. Another Indian remedy was a paste of powdered dried ginger was applied to the temples to relieve headache. To allay nausea, fresh ginger was mixed with a little honey, topped off with a pinch of burnt peacock feathers.  Ginger continues to be as popular health remedy in India and in many parts of the world. In Europe, traditions value ginger for digestive disturbances. Also, indigenous groups of the Caribbean islands quickly adopted ginger as a remedy after it was introduced to America by Francisco de Mendoca. In 1585 it was an export form Santa Domingo. In Jamaica ginger fumes or hot ginger tea are used as an inhalant to relive head colds. It is with no surprise that today ginger is commonly used as a household remedy.  **Ginger: From a Scientific Viewpoint**  The ginger plant family has about 50 genera and 1300 species. It is pantropical in distribution. Ginger has complicated flowers, one fertile stamen and a showy labellum, formed from two of the sterile staminodes. It is a perennial herb which grows from underground rhizomes which are often mistaken for the plants roots. But, it is the rhizome that provides us with its slightly hot, citrus like taste and pungent aroma. Furthermore, the rhizome has thick lobes colored form tan to white. The rhizome contains large amounts of starch and other useful substances. Leaves of the Ginger plant consist of a broad blade with parallel veins running perpendicular to a thick midrib, which extends into a stalk and sheathing base.  There are four classifications of gingerís anatomy: pungency of taste, fragrance (essential oil), nutrients (macro/micro) and synergis. Gingerís pugnency is a result of oily-resinos substances called ìgingerol.î It has been broken down into about 30 elements, the most noted by the gingerols and shogaols. Fresh ginger contains the gingerols, but when exposed to air it changes to the shogaols, which is more pugnent. Gingerís oil is thus, highly volatile, meaning it vaporizes when exposed to air. This chemical change is an important aspect of gingerís aroma and therapeutic value. Likewise, gingerís fragrance is a mixture of opposites, citrusy to sweets and also warm and spicy. The smell comes from the oil of ginger which makes up about 1.0 to 2.5% of its rhizome. Furthermore, ginger has nutritional value which includes lipids, proteins, carbohydrates, nutrients and minerals. It also contains potassium, phosphorus, vitamin C and riboflavin. Lastly, Synergis makes up the last class with hundreds of ingredients interacting to produce gingerís ultimate effect. In this category is a protein-digesting enzyme called ìzigibvinî one of natureís richest protolytic enzymes.  Ginger has been proved to have a wide variety of uses and remedies. Norman Farnswory, Ph. D, senior University scholar of pharmacognosy and director of the World Health Organization Collaborating Center for Traditional Medicine at the University of Illinois Chicago college of Pharmacy calls ginger ìone of the most thoroughly investigated plants in the history of the world.î It helps arthritis much like other anti-inflammatory drugs like NSAIDS without the side effects. Furthermore, it helps Heart and circulatory problems. This was proved by a group in Cornell Medicinal School when researchers found ginger to as effective as aspirin to remedy clogged arteries. . Thrombxams are a major cause of clogged arteries. Working similar to aspirin, ginger reduces inflammatory eicosanoids like PGE, TXA, and LTB without the side effects of other anti-inflammatory drugs and NSAIDS. Many doctors today recommend a daily intake of aspirin to remedy this build up. Numerous studies have supported this finding since 1980. Ginger has also been known as a fever reducer because of itís thermoregulatory properties. Also, ginger can be used to alleviate ulcers. When researchers compared ginger to Cimetidine, a popular anti-ulcer drug on the market, they found that both equally reduced the total volume of gastric juices and both had ulcer-protectant components by reducing irritation to the digestive tract. More research has also proven ginger to be an anti-nauseant. Because of this, ginger is frequently used in the travel industry and in chemotherapy, pregnancy, and root operative conditions to combat nausea and vomiting caused by these procedures. A similar experiment was conducted where ginger (administered in capsules of 940mg), Dramamine(100mg), and a placebo(chickweed) were compared for their ability to keep susceptible subjects from becoming nauseated while seated on a spinning chair. The study showed that one gram of ginger was better than 100mg of Dramine for reducing motion sickness. In the early 1980s researchers at Brigham Young University in Provo, Utah conducted studies of powdered gingerroot in capsule form and found it to be more effective in curing motion sickness and nausea than many popular over-the-counter medications. Similarly again, another study took place on a passenger cruise ship on rough seas. In this double-blind study, ginger (500mg every four hours) was equally effective as Dramamine (100mg every four hours). In a similar case ginger proved significantly better than placebo for a group of naval cadets on a sailing ship in heavy seas. Because of this the board of German herbal experts known as Commission E has ruled that ginger is effective in preventing motion-sickness. But, unlike most common motion-sickness remedies, including antihistamines and scopolamine patches, ginger acts directly on the stomach instead of the nervous system. As a result, there are no side effects such as drowsiness or dry mouth. Regarding ginger Dr. Varro E. Tyler, Ph.D.,professor of pharmacognosy at the Purdue School of Pharmacy in Indiana, says ìCarefully done research suggests it may be quite effective for treating motion-sickness, particularly seasicknessî  Ginger has also been found to treat arthritis. It was found that gingerís antioxidant constituents strengthened the cardiac muscle, while studies in Japan and India have shown that ginger lowers serum cholesterol levels by interfering with cholesterol biosynthesis. Ginger can also treat ulcers. The root has a balancing ability which allows it to protect while it stimulates and inhibits toxic bacteria while allowing beneficial bacteria to grow. Ginger is also known to be a carrier herb, meaning it can enhance the absorption of other herbs, allowing the presence of another herb to be made more effective. An example of this is that it may assist digestive absorption by up to 200 percent.  Ginger also can treat a cough. For example, if someone is experiencing a dry scratchy cough, ginger tea will stimulate the secretion of mucus to help alleviate the cough, and the hot liquid will soothe the scratchiness. Ginger also aids in digestion. The herb is an effective carminative, meaning it helps gas and the pain caused by it. Ginger may even prevent cancer. There has been some preliminary evidence hinting that ginger may play a role in preventing or treating cancer. A study conducted in 1997 showed that mice treated with ginger extract developed significantly fewer skin tumors than mice who received no treatment. However, it is uncertain if ginger can help humans in a similar fashion. Lastly, most relevant to my experiment, as least four studies from China and Japan have demonstrated that ginger regulates pristalsis, the warlike movement of muscles in the digestive tract that pushes food and waste through the digestive system. This effect enables ginger to ease both diarrhea and constipation, whether a result of illness or simply bad eating habits. If ginger does truly combat the symptoms described above , then it should have significant impact on the growth of bacillus cereus which mainly causes diarrhea and nausea.  **Bacillus Cereus: A closer look**  Foodborne illness of this bacteria are similar to that caused by Clostirdium perfringens and Staphylococcus aureus. In 1980 there were 9 outbreaks reported to the Centers for Disease Control and in 1981, there were 8 reported outbreaks.  Bacillus cereus is a bacterium that is common in the natural environment and in a variety of foods. It is so widespread it is almost impossible to keep it from contaminating certain foods. Making it even more effective, Bacillus Cereus is able to form spores that can survive long periods of dryness and mild heat.  Bacillus Cereus causes two types of foodlike illness. The diarrhea type illness is caused by strains of Bacillus Cereus that produces a high molecular weight diarrhea genic toxin. A vomiting type illness is caused by strains that produce a low molecular weight emetic toxin. The diarrheal illness occurs 6 to 15 hours after eating contaminated food (contaminated with more than one million organisms per gram of food) of a toxigenic strain. Symptoms of Bacillus Cereus includn is an antibiotic used to treat a wide variety of bacterial infections such as respiratory tract infections, middle ear infections and skin infections. The antimicrobial spectrum of erythromycin is broad, with activity against gram positive and gram negative bacteria, including actinomycetes, mycobacteria, treponemes, mycoplasma, chlamydia and ricettsiae. Erythromycin may act as bacteriostatic or bactericidal depending on drug concentration, bacterial species, density of inoculum and phase of growth. The antibiotic basically acts by inhibiting RNA dependent protein synthesis as the site of chain elongation by binding to the 50 S ribosomal subunit, resulting in blockage of transpeptidation and translocation reactions.  The structure of erythromycin consist of a 14-member macrocyclic lactone ring attached to 2 sugar moieties. It was originally derived in 1952 from a strain of Streptomyces erythreus. It is a water insoluble, weak base (pK8.8), is subject to destruction by gastric acid and therefore is inconsistently absorbed after oral administration.  **Antimicrobial Susceptibility Test**  To test if ginger does have an antibacterial effect the antimicrobial susceptibility test must be used. The antimicrobial susceptibility test is mainly used to test the effectiveness of an antibiotic. Small disks of chromatography paper are soaked in the antibiotic and then are placed directly onto a bacteria inoculated nutrient agar petri dish. Overnight, the bacteria will grow and zones of inhibition should be produced. The more susceptible the bacteria is to the antibiotic the larger the zone of inhibition. Therefore, if ginger has an antibacterial effect, a zone of inhibition should be produced  which is consistently changes when the concentration of ginger is altered. | | |
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