

Ayesha Siddiq

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## **“Garlic and Ginger: Two botanicals and their vital roles on the microbiome in animals as well as immunological health”**

Botanicals are the most inexpensive and handy source of remedy which is practiced for initial health care in many cultures and communities. Plants contain some beneficial active ingredients which work against infectious and systemic diseases in animals and humans. As synthetic drugs have some side effects including withdrawal period issues, it is high time we should use herbal medicine to alleviate the outrageous practice of antibiotics as well as their antimicrobial resistance.

In my personal experienced, I grew up with my family in a rural area in Bangladesh where most families including my family rear some food animals like cattle, goats as well as pet animals. Since my childhood, I have been seeing that they are broadly applied to several types of medicinal plants, their leaves, root, extract, or whole plant in various types of health problems. And I also use some botanicals when suffering from skin problems, coughing and digestive system problems like neem and turmeric are the best remedies for skin problems also in inflammation, basil is used when suffering from coughing, and garlic, ginger juice & onion juice are the most useful herbal treatment for indigestion and ruminal tympany in cattle.

Among lots of mostly useable herbal plants, I would like to choose two herbal plants that are garlic and ginger which have a great impact on the microbiome as well as immunological health.

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**Garlic (*Allium sativum* family Liliaceae):** For a very long time, people of the Indian subcontinent have used garlic in their daily meals. Different cultures used garlic as a prophylactic as well as a curative remedy. As well as treating numerous infectious disorders, it has been used to treat gastrointestinal issues, parasitic infestations, breathing difficulties, arthritis, toothaches, chronic cough, constipation, and many other conditions.

Garlic includes fructan, a carbohydrate that acts as a prebiotic for gut bacteria (López, 2015). In both humans and animals, the OSCs of garlic have a favorable impact on immunity and have a positive effect on the microbiomes and gut health. Allicin, thiosulfates, and ajoene, three garlic OSCs have biological traits that are advantageous for health, such as antibacterial, antiviral, antifungal, antiprotozoal, antioxidant, anti-inflammatory, antimutagenic, antidiabetic, neuroprotective or hepatoprotective activities (Antonio Sorlozano-Puerto, 2018) (Enrique Guillamon, 2021).

The phytochemicals of *Allium sativum* can alter the composition of gut microbiota by reducing the number of harmful bacteria and raising the population of beneficial ones. Gram-positive and Gram-negative bacteria, including species from the genera *Escherichia*, *Salmonella*, *Bacteroidetes*, *Klebsiella*, *Streptococcus*, *Neisseria*, *Proteus*, *Clostridium*,

Mycobacterium, Staphylococcus, Micrococcus, and Bacillus, have been demonstrated to be sensitive to OSCs from Allium (Enrique Guillamon, 2021).

The immune system and gut microbiome have a close relationship. One of the discoveries was that there was a correlation between higher blood levels of immune cells known as neutrophils and the presence of three different species of gut bacteria, namely Faecalibacterium, Ruminococcus, and Akkermansia, which have a greater impact on the immunological health of the animals (Jonas Schluter, 2020). Furthermore, it has immune-boosting properties that include promoting cytokine release, phagocytosis, lymphocyte proliferation, and natural killer cell activity (Kyo E, 1998). The WSGP decreased the damage to colonic tissue, reduced inflammatory factor (interleukin 6, interleukin 1 beta, and tumor necrosis factor-alpha) expression, increased the generation of short-chain fatty acids, and enhanced the composition of the intestinal microbiota which help to maintain diseases free healthy life of the animals (Xin Shao, 2020).

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**Ginger (*Zingiber officinale* family Zingiberaceae):** Ginger is another endemic herb that is the handiest and most usable botanical in Bangladesh. Their rhizomes are used as a spice and remedy. Ginger is indigenous to the moist tropical and subtropical forests of Southeast Asia. Since the time in prehistoric, ginger has been utilized as a natural remedy for a variety of illnesses. Ginger is a crucial dietary component that has a carminative action that relaxes the lower esophageal sphincter, eases cramping in the intestines, and avoids dyspepsia, bloating, and flatulence (Hekmatdoost3, 2018).

Ginger's potency for health is due to at least 100 different chemicals, and it is the most appropriate choice for stomach aches, indigestion, and heartburn. Ginger may maintain a healthy microbiota therefore it and intestinal health may be closely related. A study mentioned earlier also demonstrated that ginger acts somewhat like a prebiotic by promoting the development of advantageous Lactobacillus and Bifidobacterium species (Qing-Yi Lu, 2017). Ginger's active components have potential use in the control of biological processes and the remedy and prevention of diseases. Healthy probiotics may aid the body's defense against gastrointestinal illnesses. Ginger may lessen intestinal viral and bacterial infections, which could subdue diarrheal symptoms (Ratini, 2020). They may help prevent viruses like RSV from spreading and are very effective at stopping the amplification of bacteria like E. coli and shigella (Ratini, 2020). It also may subdue the occurrence of peritonitis. Overall, it seems that ginger helps the body's beneficial bacteria while abating harmful microorganisms.

The immune system is strengthened in many nations by ginger and its derivatives. By inhibiting 5-lipoxygenase or prostaglandin synthetase, gingerol, shogaol, and other structurally similar compounds in ginger prevent the formation of prostaglandins and leukotrienes. They can also stop the production of pro-inflammatory cytokines such as IL-1, TNF-, and IL-8 (Effie Tjendraputra, 2001). By secreting lysozyme, macrophages demonstrate the body's capacity for cellular immunity and infection resistance (Shengying An, 2019). The improvement in lysozyme activity showed that ginger extracts considerably improved the body's general immunological response. Since ancient times, rhizomes have been used in various traditional systems of medicine to treat conditions such as the common cold, fever,

sore throats, infectious diseases, arthritis, rheumatism, sprains, muscular aches, pains, cramps, hypertension, dementia, migraines, nervous diseases, gingivitis, toothache, asthma, stroke, and diabetes (Hekmatdoost3, 2018). They are also used as a home remedy to treat a variety of gastric conditions such as constipation, and diarrhea.

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As synthetic drugs have adverse effects on gut microbiota which may reduce beneficial bacteria as well as gives the chance to grow harmful microorganisms potentially causing gastrointestinal diseases, also resistance to pharmaceuticals remains prevalent. Herbal medicine opens the door toward an exploration of potential microbiota-targeted interventions to improve immunotherapy and treatments for immune-mediated and inflammatory diseases. According to reliable studies, herbs have a significant impact on the microbiota and have immune-supporting characteristics that help to maintain good immunological health and well-being.

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