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# THE POTENTIAL OF GARLIC AND VIRGIN COCONUT OIL AS SARS-CoV-2 ANTIVIRAL: A REVIEW

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**ABSTRACT**

The SAR-CoV-2 virus infection quickly spreads to almost all countries in the world, and the number of sufferers is rapidly increasing. Therefore, it is necessary to prevent its spread by increasing immunity by consuming the right intake. Immunity can be increased by taking a multivitamin or supplementary food derived from nutritious plants. Some plant-based intake has antiviral properties, such as virgin coconut oil (VCO) produced from coconut (*Cocos nucifera*) and white bottom (*Allium sativum* L.). VCO and garlic oil are also known as antiviral oils, which are also expected to against SARS-CoV-2. This paper reveals a review of the potential of VCO and garlic oil against the SARS-CoV-2 virus. VCO contains lauric acid compounds and their derivatives, monolaurin, which can inhibit viral growth. Monolaurin reduced the infectivity of 14 human RNA and DNA-coated viruses in cell culture by > 99.9% and acted by destroying the viral envelope. Additionally, monolaurin can inhibit the final maturation stage in the viral replication cycle and prevent the binding of viral M protein to the host cell membrane. Likewise, garlic has acillin compounds to prevent viral activity in organs by inhibiting human body compounds that interact with the SAR-CoV02 virus, namely, ACE2. The ACE2 protein is a host cell receptor with a similar function that SARS-CoV-2 and SARS have. The highly organosulfur compounds contained in garlic are expected to interact strongly with the amino acids of the ACE2 protein. If the ACE2 protein is inhibited, the coronavirus is prevented and treated.

**Keywords:** ACE2; Antiviral; Garlic; VCO; SARS-CoV-2.

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## INTRODUCTION

Coronavirus is a non-segmented positive single-strand RNA virus with a particle size of 80-220 nm.[1] The majority of these viruses infect animals, with only 6 types of coronaviruses previously known to be infectious to humans, namely 229E and NL63 (from *alphacoronavirus*), OC43 (from *betacoronavirus*), Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV), Middle East Respiratory Syndrome Coronavirus (MERS-CoV), and HKU1.[2] The coronavirus causes flu-like symptoms, including cough, fever, and breathing difficulties. Coronaviruses are composed of four structural proteins: S (spike protein), M (membrane glycoprotein), N (nucleocapsid protein), and E (envelope protein) (Figure-1).[3] These proteins are crucial in the viral replication process.

The World Health Organization (WHO) has termed it 2019-nCoV, while the International Committee on Taxonomy of Viruses (ICTV) knows it as SARS-CoV-2. The resulting disease is called coronavirus disease 2019 (COVID-19). Antivirus is one way in which the spread of this epidemic can be reduced, as the antivirus can inhibit virus replication for influenza, colds, and other infection types.[4,5] Recent research has shown that garlic essential oil is an excellent source of organosulfur compounds, with powerful antioxidant effects[6], antibacterial[7], antifungal, anticancer[7], and antimicrobial[8] properties. In addition, allicin is a typical reactive sulphur compound found in essential oils.[9] Via modified processing, Virgin Coconut Oil (VCO) is derived from coconut fruit; the obtained oil has low water content, is transparent, fragrant, and contains free fatty acids.

This paper reviews the potential chemical compounds of Virgin Coconut Oil (VCO) and garlic essential oil and how they interact with viruses to inhibit the replication of SARS-CoV-2.[10,11]


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**The Potential of Garlic as an Antiviral**

Garlic (*Allium sativum* L.) has been consumed as a natural supplement for many years across the world, even to increase the stamina of athletes. Garlic's active compounds can increase immunity by increasing the immune cells responsible for killing pathogens when inflammation occurs.[12] Garlic contains biologically and chemically active substances, such as sulphur compounds, acillin, diallyl thiosulfate, pectin, fructans, adenosine, fatty acids, carbohydrates, nicotinic acid, essential amino acids, phospholipids, prostaglandins, lectins, enzymes, minerals (P, Zn, Se, K, Fe, Mg, Ca, Na), and vitamins (C, E, B1, B2, B6). The active compounds in garlic can also have antilipidemic, antithrombotic, antihypertensive, antiatherogenic, and anti-glycaemic effects.[10]

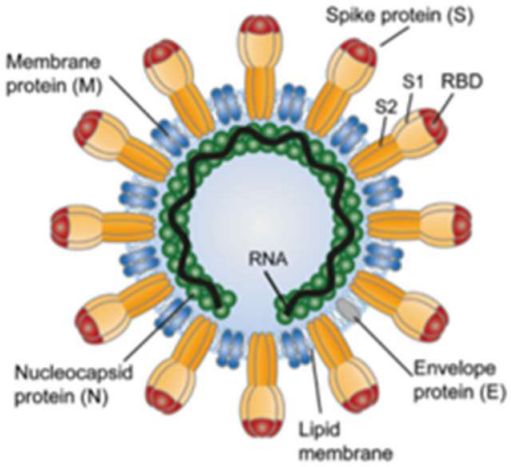


Fig.-1: Structural of Coronavirus Particle and The Spike Protein S.[3]

Garlic and its OSCs (Organo-sulphur compounds) potentially have antiviral effects which prevent the virus from entering the host cell to resist the activity of other viruses in humans and animals; they also inhibit viral RNA polymerase, DNA synthesis, reverse transcriptase, and immediate early gene 1 transcription. They also down-regulate activated extracellular signal-regulated kinase/mitogen Organo-sulphur compounds (OSCs) in garlic by entering the viral host cell and inhibiting the viral RNA polymerase, DNA synthesis, reverse transcriptase, and gene transcription processes. In addition, it downregulates the protein kinase/mitogen signaling pathway which is responsible for regulating extracellular signalling. Further laboratory clinical tests have proven that OSC significantly enhances immune responses. Thus, this review emphasizes that garlic functions well as an antiviral.[13] Organosulfur compounds, the main active compounds in garlic, work by inhibiting cancer cell proliferation and inducing apoptosis in tumor cell tissue. Alliin (S-allyl-L-cysteine sulfoxide) is the most common sulphur compound found in fresh and dried garlic (10-30 mg/g). Alliin can be rapidly converted to allicin (diallyl thiosulfinate) using the enzyme alliinase when fresh garlic is chewed into a fine powder. Allicin is a powerful biologically active organosulfur compound found in garlic. The best known derivative compound is allicin [S-(2-propenyl)2-propene-1-sulfinothioate].[14,15] The enzymatic reaction of alliin is shown in Figure-2. The study on the "Antimicrobial Properties of Garlic Allicin" found that alliin was first discovered as a stable precursor as a result of allicin conversion via the alliinase enzyme. Transforming alliin into the biologically active molecule allicin is performed by rapidly crushing garlic. Alliinase can be found in high concentrations in garlic cloves: a minimum of 10% of the total protein content (10 mg/g fresh weight). Allicin is the main active ingredient and has antiviral activity *in vitro* and *in vivo*. Viruses sensitive to garlic extract include influenza B, human cytomegalovirus, herpes simplex virus types 1 and 2, vaccinia virus, parainfluenza virus type 3, stomatitis virus vesicles, and human rhinovirus type 2.[16] Condensation of ajoene, the allicin product, has greater antiviral activity than allicin. Ajoene blocks integrally independent processes in cells infected with human immunodeficiency virus.

Antibacterial effects have been shown in Tunisian garlic essential oil (*Allium sativum*), the ethanol extract of garlic in the form of essential oil (EO), and garlic with ethanol (EE). Thiosulfates, including allicin present in (EE), inhibit microorganisms as a result of their -S(O)-S groups, which normally react with the SH group of cellular proteins to produce mixed disulphide.

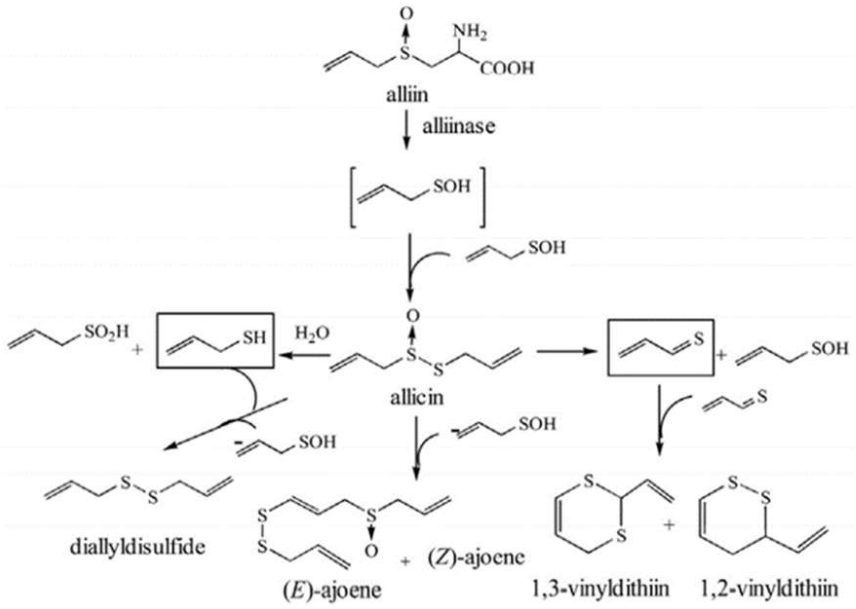


Fig.-2: Enzymatic Reaction of Alliin[15]

The antimicrobial activity of thiosulfate is negated by sulfhydryl compounds including cysteine, which, in addition to allicin and other thiosulfates, reacts with sulfhydryl (SH) groups of cellular proteins and with non-SH amino acids. Garlic ethanol extract's effectiveness as an antimicrobial agent stems from the molecule easily crossing cell membranes and bio-reacting with low levels of thiol bonds in amino acids. Computational resistance research into SARS-CoV-2 garlic essential oil compounds was performed using molecular docking techniques to determine the interaction of ligands in garlic essential oil with ACE2 and PDB6LU7 proteins.[17] Figure-3 illustrates the schemes of (A) the human angiotensin-converting enzyme 1 (ACE2) and (B) the PDB6LU7 protein, which is the major protease of SARS-CoV. The result shows that natural garlic essential oil can prevent SARS-CoV-2 in humans.

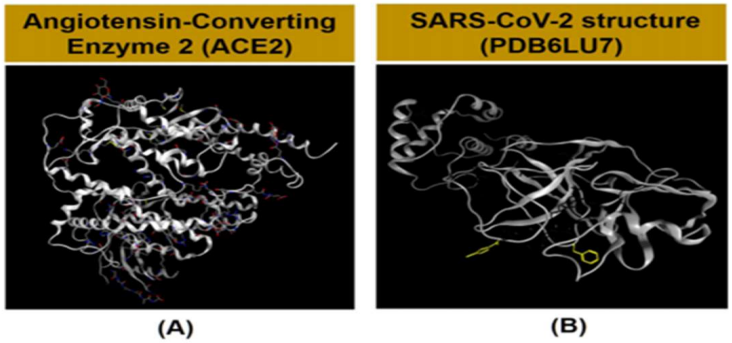


Fig.-3: The Scheme of (A) Angiotensin-Converting Enzyme 1 (ACE2) in the Human Body and (B) PDB6LU7 Protein in SARS-CoV Main Protase.[17]

**The Potential of VCO as an Antiviral**

VCO is a relatively new healthy nutritious oil product because of its high antipathogenic monoacylglycerol content. Compared to coconut and palm oils, virgin coconut oil is higher in lauric and lactic acid. Lauric

acid levels in VCO were higher than coconut oil and palm oil, at 54.06%, 0.45%, and 0%, respectively. A high acid number, saponification number, and high iodine number are indicative of VCO characteristics because of lauric acid's small molecular content, namely medium-chain triglycerides (MCT).[18] VCO is beneficial to health and can prevent the oxidation of low-density lipoproteins and increase antioxidant enzymes.[19] Lauric acid has higher antiviral activity than coconut oil, and the high concentration of lauric acid in the form of monoglycerides makes VCO effective against pathogenic microorganisms. Medium-chain free fatty acids, such as lauric acid, have a wide range of microbicidal activity. Although the mechanism by which lipids kill bacteria is unknown, electron microscopy research reveals that they disrupt cell membranes. Electron microscopy studies have demonstrated that the antiviral effect is the result of the disintegration of the viral envelope by fatty acids.[20] Fatty acids and monoglycerides can also destroy bacteria or viruses via cell membrane fusion. Monolaurin is a monoglyceride derived from lauric acid which, via a membrane fusion mechanism, inhibits antibacterial and antiviral activity.[21] Monolaurin has been shown to destroy HIV-1 viruses and reduce viral transmission. Additionally, monolaurin has a role in membrane damage, causing leakage of intracellular proteins and nucleic acids, thus reducing enzymatic metabolic activity. Monolaurin, known as glycerol monolaurate, is a lauric acid monoester form. It has much higher antibacterial activity than lauric acid.[22] Monolaurin reduces > 99.9% infectivity of 14 human RNA and DNA coated viruses in cell culture by viral membrane disruption and inhibition of the virus replication cycle maturation; viruses prevent proteins from binding to host cell membranes.[11, 23] Lauric acid does not affect viral membrane M protein synthesis but instead inhibits the viral M protein from binding to the host cell membrane. Monolaurin is found in human milk and coconut oil. Fatty acid and monoglyceride chain lengths provide different biological activities against bacteria or viruses. Medium-chain monoglycerides are more active than long chains, and medium-chain fatty acids (C8 to C14), fatty acids, and lauric acid (C12) have higher antimicrobial activity than other fatty acids including caprylic acid (C8), capric acid (C10), and myristic acid (C14). From several literature reviews, VCO and its derivatives have been shown to have compounds that are effective as antivirals for humans and animals. Consequently, VCO can be used as a daily supplement or alternative treatment for microbial and viral infections such as SARS-CoV-2.[24]

## CONCLUSION

VCO and garlic can prevent and inhibit the growth of viruses that attack humans or animals, including the nCoV-209 virus, a virus currently affecting humans globally. VCO contains lauric acid and monolaurin, while garlic contains allicin. These compounds play a role in destroying the virus membrane, inhibiting the growth of the virus, and preventing the virus from binding to the host cell membrane. The potential of VCO and Garlic as an antiviral should be utilized as well as possible, as an alternative way to deal with the current pandemic problem. Using these two preparations as supplements can be a preventive measure against this virus.

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