Let's Pick the Oldest Fighter as a Weapon against Corona Virus: Bacteria

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The patho physiology, behavior, mechanism of action as well as interaction with human immune system of Corona virus (COVID-19) still remains a puzzle despite an elaborate armamentarium to tackle microorganisms. To date there is no licensed vaccine or specific antiviral medicine to prevent or treat the new COVID-19 infection. This viral infection is powerfully deadly in some but mild enough in others. Except few good health practices, no single recommendation is perfect. For most of the drugs, currently used for the treatment of COVID-19 infection have least desired therapeutic effect as compared to undesirable secondary effect/s. For the last few months, at break neck speed research is being carried out and most of the information on COVID-19 infection has already been published [1, 2]. The alarming issue is that within a short time period we need to reduce the scale of outbreak throughout the globe. Although, the affected countries are following the WHO (World Health Organization) recommended guidelines to combat the disease, climatic, environmental, socio-economic and socio-cultural factors also have tremendous impact on viral outbreak in a variety of ways.

Battling bacteria with viruses as their natural enemy has already been reported [3]. Now it's the turn for the virus i.e. COVID-19. Bacteria are well known for their role in driving away viral infection such as flu by influencing our immune system apart from their role in digestion and other metabolic processes [4]. Changes in gut bacteria lead to various diseases such as diabetes, cardiovascular, inflammatory bowel disease [5]. Hence, we can support our gut bacteria by products that contain live microbes or probiotics. Yes, probiotics are naturally occurring 'good' or 'beneficial' bacteria that could prevent infection and improve health such as large species of Lactobacillus, Enterococococcus, Streptococcus, Leuconostoc and Bifidobacterium [6]. They have shown to be beneficial at various locations of the body such as respiratory, gastrointestinal and urogenital tract apart from oral cavity. The concept of probiotics was introduced by Nobel laureate, Elie Metchnikoff in the early 20th century. Antibiotics may not help in clearance of viral infection but against the harmful bacteria that are also associated with infection. Further, due to antibiotic looming probiotic microbes will be preferred in future to replace or augment antibiotic action. Similarly, the effectiveness of antiviral drugs is also hindered by the large number of viral species and their high mutation rate.

Respiratory viruses first tend to infect and replicate in nose and throat and later in lungs where they spread slowly but more deadly. Similarly, corona viruses invade the respiratory tract via the nose. The concept behind the above statement is that ingestion of probiotic bacteria in the form of nasal spray might reduce the harmful pathogens including viruses. Limited research has been conducted with probiotic nasal spray and their use. Sore throat which is also viral in origin can also be reduced by consuming probiotics lozenges. Recent clinical evidence showed the effectiveness of a novel probiotic, *Streptococcus salivarius* K12 in reducing the risk of sore throat of both bacterial and viral in origin by producing lantibiotics as well as antiviral compound interferon –gamma [7]. Though, no strong evidence is detected against corona virus, probiotics supplements can reduce the severity and duration of respiratory infections. Hence our overarching research goal is to select and manipulate beneficial bacterial flora in nose, throat, and respiratory passage as well as in gut to induce immune responses. Chai et al. 2012 studied the protective effect of probiotic *Enterococcus faecium* strain against transmissible gastroenteritis corona virus via a dose dependent viability assay that resulted in reduction of all viral structural proteins via interleukin 6and 8 stimulated cellular defense mechanism [8]. Similarly, a new peptide P18, produced by a probiotic stain, *Bacillus subtilis* showed antiviral activity against influenza virus both in vitro and in vivo [9].

Apart from immunomodulatory activity, the credibility of bacteria can also be exploited in sanification procedures as they suppress the growth of various pathogens including viruses that are chemical resistant.Caselli et al. 2016 explained the impact of probiotic based cleaning using Bacilli spores on reducing the surface microbial contamination including drug resistant species [10]. Various reports suggest that corona virus may linger on surfaces for several hours to days[2]. Hence, proper surface sanitation is highly recommended as first line prevention procedure against viral infection. Good bacteria in probiotic disinfectant will compete with various pathogenic microbes without disturbing the general ecology. This principal of 'competitive exclusion' involving bacterial disinfectant may be tested further to evaluate the long term effect of regulating the viral replication and infection establishment.

Though, further comprehensive research is needed, probiotic bacteria either in the form of pills, nasal spray, lozenges, disinfectant or as natural supplements are expected to be safe, economic and easy to use in the elimination of pathogenic viruses including corona virus.

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