PANDEMIC TIMES- TO EAT AND WHAT TO EAT

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Abstract: *In the current troubling situation when a virus has completely taken the world by storm, the most important question in everyone's minds is the thought of food and proper nutrition. A lot of revenue is being diverted towards the food distribution all over the globe, especially so for India. Emerging trends are showing that food may be a weapon against the novel Corona virus. Extensive research has cast light on several antiviral foods which may be extremely beneficial for the human kind during the tumultuous times. A lot of scientific evidence has been obtained which support the fact that colostrum, the first milk produced by mammals, is beneficial to ward off infections. Moreover, Lactoferrin present in milk also has antiviral properties. Vitamin C is a potent antioxidant which can help in preventing several types of infections. Spirulina, an algae is also being investigated. Selenium and Zinc, both trace elements have shown huge potentials as infectious disease preventing agents. Flavonoids and its various types can be a used as supplements that can act as antiviral agents as well. A novel concept has also emerged where α-Lipoic acid is being used for prophylaxis against infections, especially so for virus.*

Keywords: *Colostrum, Lactoferrin, Vitamin C, Selenium, Zinc, Spirulina, Flavonoids, α-Lipoic acid*

Introduction:

"Crisis and deadlock when they occur at least have this advantage that they force us to think" the quote by Jawaharlal Nehru rightly reflects the condition the world is in today. The pandemic that has spread out in all the corners of the globe has made people stop and think - think about the present, think about the future.

The *Corona Crisis* has highlighted certain loop holes in the current scenario and this has especially been true for the food system of the world, more so for India. The COVID-19 health crisis has brought on an economic crisis, and is rapidly exacerbating an ongoing food security and nutrition crisis. In a matter of weeks, COVID-19 has laid bare the underlying risks, fragilities, and inequities in global food systems, and pushed them close to breaking point. Our food systems have been sitting on a knife-edge for decades. The lockdowns and disruptions triggered by COVID-19 have shown the fragility in people's access to essential goods and services. In health systems and food systems, critical weaknesses, inequalities, and inequities have come to light.

The pandemic has cast light on the community feeling and on how food distribution takes place in times of crisis. The "*economics of food and nutrition"* has now taken a front seat.

Although food is being made available to people, best of efforts should be given to maintain the hygiene and nutritional aspect in the quality and quantity of food, as much as practicable.

This article is not about what and how the Corona pandemic has affected the food supply or the food distribution in different countries but it is about the type

of food which could protect human beings in the future, prevent their susceptibilities to infections in the days to come.

All said and done, the basic understanding is that people who eat a well-balanced diet tend to be healthier with stronger immune systems and lower risk of chronic illnesses and infectious diseases. In this regard some foods as well as some nutrients have emerged which show the potentiality of being capable of boosting the immune system. This article is about those foods and nutrients which have been found to possess properties which make them suitable for preventing any microbial infections, especially those which cause influenza, flu and similar symptoms. Careful read into the article will show the reader how certain food items and some nutrients can actually modify our body physiology and equip us to combat diseases much better.

Reviews:

Starting from where life begins, i.e. from the first food that a human being consumes, it is seen that "*Nature believes in Nurturing"*. Breast milk contains ***Colostrum,*** the yellowish substance that is first secreted after an infant is born, which is turn contains antiviral particles. But most importantly breast milk contains ***Lactoferrin*** which is a proven antiviral substance. ***Lactoferrin*** has been found to be a potentially harmful substance for a variety of DNA and RNA viruses, such as cytomegalovirus, herpes simplex virus, influenza virus, rotavirus and many more such microorganisms. It suppresses viral replication and boosts innate immunity, specifically *Natural Killer Cell* activity. It also stimulates immune cells like neutrophil aggregation and adhesion during SARS-CoV infection. The cytokine release during CoV infection, that leads to hyper-inflammation leading to acute respiratory distress can also be controlled by Lactoferrin, as suggested by some researchers. Thus Lactoferrin can truly be called an immunoceutical and probably is the reason why children are showing

lesser incidence of the infection. Supplemental Lactoferrin may be a possible treatment for the Covid-19 pandemic. (Wakabayashi, H et al)

The most important among our edible friends is ***Vitamin C.*** Much has been said about this vitamin during the present crisis of Corona attack. In the *Journal of Antimicrobial Chemotherapy*, (Peiffer-Smadja, N et al) it has been clearly stated that vitamin C may affect the immune system, for example the function of phagocytes, transformation of T lymphocytes and production of interferon. Several animal control studies have also been carried out, which have clearly shown that vitamin C modifies susceptibility to various bacterial and viral infections (Hemila, H. & Douglas, R.M.). The duration and severity of common cold episodes are reduced when vitamin C is administered. This possibly makes it evident that vitamin C is effective against viral respiratory infections. The lowering of pneumonia incidences have been proved in at least three human control studies with the administration of vitamin C (Leibovitz, B. & Siegel, B.V.). Even the *US National Library of Medicine (Clinical trials.gov.)* shows similar results where vitamin C has been used to treat 2019 nCoV infected pneumonia and the outcome has been fruitful.

Some recent research has also shown the effects of ***spirulina***, an algae in viral infections. Mark McCarty, in his article about nutraceuticals has clearly stated that spirulina may be suitable for combating RNA virus infections including influenza and corona virus (Zhang, L et al).

Selenium is an essential trace element for mammals especially in case of their redox potentials. It has been seen that the nutritional status poses a very important factor in terms of occurrence of infectious diseases. (Zhang et al). It affects not only the host response to a disease pathogen but also modifies the expression of the pathogen itself. It has been seen in various studies that Selenium of the diet can modify the viral genome a thus affect it's virulence. Deficiency in selenium has been found to induce not only impairment of host immune system,

but also rapid mutation of benign variants of RNA viruses to virulence (Guillin, OM et al). Beck et al had reported that selenium deficiency could not only increase the pathology of an influenza virus infection but also drive changes in genome of coxsackievirus, permitting an avirulent virus to acquire virulence due to genetic mutation(Rayman et al). It is because that selenium could assist a group of enzymes that, in concert with vitamin E, work to prevent the formation of free radicals and prevent oxidative damage to cells and tissues.

Another trace element, ***Zinc***, is important for the maintenance and development of immune cells of both the innate and adaptive immune system (Beck MA et al). Zinc has been found to adversely affect both cellular and humoral immunity in mammals (Beck MA et al).

Zinc supplement given to zinc-deficient children could reduce measles- related morbidity and mortality caused by lower respiratory tract infections (Maares, M et al). Increasing the concentration of intracellular zinc with zinc-ionophores like pyrithione can efficiently impair the replication of a variety of RNA viruses (Tuerk MJ et al). In addition, the combination of zinc and pyrithione at low concentrations inhibits the replication of SARS coronavirus (SARS-CoV) Tuerk MJ et al). Therefore, zinc supplement may have effect not only on COVID-19-related symptom like diarrhoea and lower respiratory tract infection, but also on COVID-19 itself.

Flavonoids are an important class of natural products and have several subgroups, which include *chalcones, flavones, flavonols, and isoflavones* (Awotiwon, AA et al). Flavonoids have many functions besides antioxidant effects and they also have antiviral abilities. Shimizu et al had found that flavonoids from Pterogyne Nitens could inhibit the entry of the hepatitis C Virus. Jo et al had suggested that the anti-coronavirus activity of some flavonoids (*Herbacetin, rhoifolin and pectolinarin*) was due to the inhibition of 3C-like protease (3CLpro). Other flavonoids (*Herbacetin, isobavachalcone, quercetin 3-β-d-glucoside,* and *helichrysetin*) were also found to be able to block the

enzymatic activity of MERS-CoV/3CLpro (Shimizu, JF et al). Moreover, Ryu et al had reported that biflavonoids from *Torreya nucifera* also brought inhibition effect of SARS-CoV/3CL (pro). ***α-Lipoic acid*** (ALA), a naturally occurring disulfide compound, acts as a cellular coenzyme and has been applied for the treatment of polyneuropathies and hepatic disorders for years (Table 3) (Tibullo, D et al) ALA, as an antioxidant, has played a pivotal role in scavenging free radicals to protect against oxidative damage in several diseases (Willms, G et al). In addition, ALA also had its capability to enhance intracellular glutathione (GSH) levels (Willms, G et al) and to normalize the oxidative stress induced by Dexamethasone in chicken (El- Senousey, HK et al). Wu et al also reported that the oxidative stress in host cells was an important factor in the infectivity of human coronavirus 229E and the glucose-6-phosphate dehydrogenase (G6PD) deficiency was another factor that enhanced human coronavirus 229E infection. The addition of α-lipoic acid to G6PD-knockdown cells could attenuate the increased susceptibility to human coronavirus 229E infection (Tibullo, D et al & El-Senousey HK et al). Interestingly, Baur et al also found that α-lipoic acid was effective to inhibit the replication of HIV-1.

Scientific evidences show that elderberry (*Sambucus nigra L*.) extracts shorten the duration of influenza by about two to four days and also reduce the severity of infections. Concentrated juice of elderberry was used for the study on influenza A virus (Kinoshita, E et al).

Epigallocatechin-3-gallate, better known as ECGC, present in tea, has also been seen to prevent infections due to influenza virus by binding to the virus. These viral particles are then unable to attach to the receptor sites and thus are incapable of producing disease. It has been found quite effective against viruses like *Retroviridae*, *Orthomyxoviridae* and *Flaviviridae* which include important human pathogens like human immunodeficiency virus, influenza A virus and the hepatitis C virus (Steinmann, J et al)

Nutrients as Supportive Treatments to disease conditions (Zhang, L et al)

Options	Virus targeted and functions related
1.. Nutritional interventions	
1.1. Vitamin A	Measles virus, human immunodeficiency virus, avian coronavirus
1.2. B vitamins	MERS-CoV; ventilator-induced lung injury
1.3. Vitamin C	Avian coronavirus; lower respiratory tract infections
1.4. Vitamin D	Bovine coronavirus
1.5. Vitamin E	Coxsackievirus, bovine coronavirus
1.6. Omega-3 polyunsaturated fatty acids (PUFA)	Influenza virus, human immunodeficiency virus
1.7. Selenium	Influenza virus, avian coronavirus; viral mutations
1.8. Zinc	Measles virus, SARS-CoV
1.9. Iron	Viral mutations
2. Immunoenhancers	
2.1. Interferons	SARS-CoV, MERS-CoV
2.2. Intravenous gammaglobulin	SARS-CoV
2.3. Thymosin α-1	Increase resistance to glucocorticoid-induced death of thymocyte
2.4. Thymopentin	Restore antibody production
2.5. Levamisole	Immunostimulant agent or immunosuppressive agent
2.6. Cyclosporine A	SARS-CoV, avian infectious bronchitis virus
2.7. Chinese medicine	SARS-CoV, avian infectious bronchitis virus

Abbreviations: MERS-CoV, Middle East respiratory syndrome coronavirus; SARS-CoV, severe acute respiratory syndrome coronavirus.

Conclusion:

The Covid crisis has actually opened up areas of much controversy. It has shown us the loop holes which require immediate attention. The most important aspects of this being the diet and food habits of man. In the present days of stress, the human population is markedly shifting it's focus from a traditional *home-based diet* to a modern *fast food diet* and this is probably one of the most important factor that has not only increased their proneness to lifestyle diseases but also has made them much more susceptible to infectious agents. The immune system has been weakened significantly due such illogical consumption of food and thus has paved the way for the present pandemic.

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