

## Immunity is Synchronized by Nutritional Factors

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Diet and lifestyle factors become visible to encompass a crystal-clear influence on innate and adaptive immunity, influencing development of non-communicable diseases (NCDs) [1,2]. Certain derivatives of EFA like oxylipins have been reported to reveal a vital role in the progress of immunity and thus inflammatory responses. Consequent to stimulation led by cytokines, hormones and viral infection, PUFA conjugated to membrane phospholipids are released from cell membranes, followed by acting as substrates for fabrication of dodecanoid, eicosanoid and docosanoids. Western nature diets with deficient PUFA and supplementary micronutrients may decline these eicosanoids consequential to reducing T lymphocyte function and immune resistance, likelihood of certain infection. The Indo-Mediterranean diet with no animal foods (except fish), lower saturated fat and total fat, sugar, and salt, high omega-3 fatty acids and flavonoids concomitant with moderate intake of alcohol, are likely to reveal advantageous possessions and eventually performing as immune-modulators [1,2]. This 'Editorial' aims to highlight the functionally enriched diet to be most significant nutritional modulators of immunological function likely to providing protection from diseases as follows.

Western nature diet, differentiated by elevated energy and low micronutrients has been well identified to create free radical induced oxidative stress resulting in systemic inflammation [1,2]. The consequence of Western nature diet has been mostly blunted by dietary variations, however myeloid cell-induced innate immune responses continue amplified and symbolize to pro-inflammatory NCDs, in case when statutory precautions are not commenced. It assists in bringing about innate immunity, the nucleotide-binding oligomerization (NOD)-like receptors (NLRs), and IFN signaling cycles. It is worthwhile to understand the role of diet and lifestyle factors in view of development of immunity towards pathogenesis and checking COVID-19. It is an emerging new concept highlighting a long term hyperactivation of the innate immune system after exposure to certain antigenic stimulations. However, upon continuation of energy rich, nutrient deficient diet, there may be immunosuppression predisposing to increased susceptibility from free radical induced damage to tissues. Certain inflammatory processes necessitating cells of the innate immune system, principally monocyte-derived macrophages result in the progression of disease. Therefore, it is worth interesting to explore the molecular mechanisms of translating heat shock proteins (Hsps), which connect to the consumption of energy rich diets to increase in inflammation.

Flavonoids have been recognized for definite immunomodulatory effects likely to be of significance in development of various diseases resulting in reduced immunity [3-5]. The protections of the immune system concomitant with pathogenesis of definite autoimmune diseases are regulated by mTOR, predominantly, in T lymphocytes, also functioning as a vital mediator of metabolism. Suppression of certain mTOR activity by polyphenolics and flavonoids is followed by induction of the T regulatory subset. Besides, a number of dietary flavonoids, mainly, catechin, naringin, hesperetin and quercetin, are known to influence virulence and replication of certain viruses like parainfluenza virus type 3, respiratory syncytial virus (RSV), polio-virus type 1 and herpes simplex virus type 1 (HSV-1) [4,5]. Therefore, it can be stated that dietary flavonoids are likely to possess wide spectrum of antiviral activity against certain DNA and RNA viruses, inhibiting replication and/or infectivity, also signifying the flavonoids likely to inhibit the COVID-19 markers.

Polyunsaturated fatty acids are known to a range of immunomodulatory functions that progress. It has been well demarcated that T cell mediated actions lead to a wide range of immunomodulatory functions exhibited by PUFA [3,4], even though absolute molecular mechanisms of these events are still to be explored. A few numbers of these immune functions, partly or completely, are associated to polyunsaturated fatty acid-induced change in the composition of cellular membranes and thus variation in signaling cycles connected to membrane raft-binding proteins. It has also been recommended that noteworthy aspects of the polyunsaturated fatty acid bioactivities are intervened through their conversion to definite lipid mediators, products of lipoxygenase, cytochrome P450 and/or cyclooxygenase complex enzymatic reactions. It probably facilitates the active mode of action of these lipids in view of designing and development of therapeutic strategies aiming at regulation of T cell function, indicating that PUFA are solely involved in T cell biology both as nutrients essential for energy production concomitant with signaling components [3,4].

Apart from decline in inflammation, omega-3 fatty acids persuade immune response [5-7]. It has been well explored that omega-3 as well as omega-6-derived metabolites are vital in terms of intervening immune- functions, and thus recognized as pro-resolving mediators, active in the picogram to nanogram dose range, whereby are able to control inflammation, limit tissue damage, shorten resolution intervals, promote healing and alleviate pain in experimental models of inflammation and resolution [6,7]. Nevertheless, fatty acid-induced transformations in membrane conformation as well as in the accessibility of substrates for eicosanoid biosynthesis are enduring and vital mechanisms [8].

The intake of *n*-6 polyunsaturated fatty acids significantly surpasses that of *n*-3 polyunsaturated fatty acids in the majority of the dietary models [6,7]. Arachidonic acid; a kind of the *n*-6 polyunsaturated fatty acid present in egg, meat, fish and mushroom, arachidonic brings about the eicosanoid family of inflammatory intermediaries such as leukotrienes, prostaglandins and associated metabolites [5,6-8]. It is likely that and from end to end these inflammatory intermediaries standardize the activities of inflammatory cells, thus production of cytokines and diverse balances within the immune system [7-9]. Also, augmented intake of fish oil and oily fish are good quality sources of long chain *n*-3 polyunsaturated fatty acids including arachidonic acid that is in fish meat. Perhaps, these fatty acids might draw out a number of their effects by eicosanoid-independent mechanisms and applied as a therapy for acute and chronic inflammation as well as for disorders accompanied by an inappropriately activated immune response [5-7].

Corona virus infection has turned out to be a public health issue not only in developing countries but in developed ones as well [9]. About fifty percent of the deaths occurs amongst subjects over 60 years and thirty to thirty five percent deaths occur, amongst subjects ranging 34 to 60 years, in India. The death rates are larger amongst subjects with co-morbidities, coronary artery disease, chronic kidney disease, *diabetes mellitus* and heart failure (78%). The death rate is poorer (14%) amongst subjects lowering 45 years. Accordingly, COVID-19 has by now crossed the epidemiological criterion to be stated as Pandemic, having infected more than 213 countries globally [9-11]. While COVID-19 infection is coupled with marked turn down in immunity, it concerns the likelihood of diet and lifestyle factors linked with immune function towards persuade rate of infection, complications and causalities/mortalities.

Escalating evidence enlightens to reasonable amounts of polyphenol-rich alcoholic beverages like wine or beer having advantageous health concerns [9-13]. The influence of alcohol on immune mechanisms, revealing on the one side, that elevated doses of alcohol consumption can straight restrain a broad range of immune responses and that alcohol abuse is linked with an amplified incidence of a number of infectious diseases. On the other side, moderate alcohol use results in improving and maintaining immunity in healthy concerns [9-13]. Thus, the connection between alcohol consumption, immune response as well as infectious and inflammatory processes to is still obscure. With this in concept, it is pertinent to comprehend that further factors, unrelated or indirectly correlated to immune function, like drinking patterns, beverage quality, amount of alcohol, or gender differences, will necessitate that alcohol consumption may have on the immune system. It is likely to moderate amounts of polyphenol-rich beverages like wine or beer having advantageous impacts.

### Conclusion and Future Perspectives

Conclusively, Mediterranean nature diets enriched with polyphenols and flavonoids, omega-3 fatty acids and arachidonic acids and reasonable alcohol consumption, may be vital immune-modulators. It is likely to vitamins; A,E,C,D and beta carotene and minerals, zinc, copper, selenium, chromium and magnesium having advantageous effects on immunity. Nevertheless, Western style foods, tobacco and alcoholism along with short sleep and infections may have undesirable effects on immunity. This editorial provides new insights or clues to develop nutritionally fortified food products likely to be immunity modulators or boosters.

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