# HOW CURCUMIN, IRON, SELENIUM, ZINC, VITAMINS C, B2, B6, AND B9 FROM VEGETAL ORIGIN COULD HELP IN PANDEMIC

The conjuncture of the SARS COV 2 epidemic that has swept the world for over a year now would be one of the most current illustrations of Hippocrates' famous quote: "Let your food be your first medicine".

In general, low levels or intakes of micronutrients such as vitamins and minerals have been associated with adverse clinical outcomes during viral infections. It has been confirmed in a recent review[1] which highlighted that certain vitamins and minerals should be considered in the management of COVID-19 patients. Prevention, diagnosis, and treatment of malnutrition should be therefore included in the management of this epidemic. For that, the European Society for Clinical Nutrition and Metabolism (ESPEN) provided practical recommendations for nutritional management of COVID-19 patients[2].

Vidya Herbs' range of high-quality plant extracts is enriched with a specific essential trace element and a range of vitamins. Extracted from plants using a gentle water-based process, these ingredients are suitable for food supplements and food enrichment.

## Curcuma longa (Turmeric)*

Turmeric is no doubt the most known plant from Ayurveda. Its main component is curcumin, which is well-known for its anti-inflammatory properties and has been shown to be a potent immunomodulatory agent. Curcumin is not only stimulating the immune system, but it also exerts anti-virus activities, demonstrating in vivo activity against Dengue [3], Influenza A [4], Hepatitis B [5] and Herpes Simplex [6] viruses. And now, with the COVID-19 pandemic, curcumin is presenting new and interesting potentials.

## How curcumin helps the immune system modulation

In response to infection, infectious diseases, or biological intrusion, our biological defences may fight by liberating cytokines. Because an uncontrolled cytokine liberation by the immune system

may lead to the development of a lot of auto-inflammatory diseases, it is more appropriate to consider immune system modulation rather than only immune system stimulation.

Known as a strong anti-inflammatory compound, curcumin can reduce the production of various proinflammatory cytokines including TNF, IL-1, IL-2, IL-6, IL-8, IL-12, and chemokines, most likely through inactivation of the transcription factor NF-κB. That is why curcumin anti-inflammatory profile may be useful in both acute and chronic inflammation.

But curcumin can also modulate the activation of innate and adaptative immune cells such as T-cells, B-cells, macrophages, neutrophils, natural killer cells (NK cells), and dendritic cells and can also interact with molecular components involved in the inflammatory processes, such as cytokines and various transcription factors with their downstream signalling pathways, as mentioned above. Interestingly however, curcumin at low doses can also enhance antibody responses[7]. In vitro and in vivo experiments showed that curcumin's anti-inflammatory and immunomodulatory effects are combined to sustain the immune system and all its health properties[8].

## Curcumin and pulmonary damaging viruses

Even if inflammation under physiological conditions is a protective mechanism, when the negative regulatory mechanism is suppressed, a persistent and extensive inflammatory response occurs, which can reach pathological levels causing fatal systemic damages. This triggered over-reaction of the immune systems may cause severe lungs damages and acute respiratory distress syndrome resulting in mortality. The same adverse effects of this type of immune overreaction have been observed in highly pathogenic avian influenza viruses and the novel coronavirus (SARS-CoV2) of the Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV). This cytokine storm which results in acute lungs injuries may be counteracted by curcumin due to its capacities to exert protective effects by regulating the expression of both pro-inflammatory and anti-inflammatory factors and by eliminating the reactive oxygen compounds that exacerbates the inflammatory response[9].

Because of the great impact of the SARS-CoV2 on airways, curcumin has been considered on Nrf2 pathway. This nuclear factor erythroid-2-related factor 2 (Nrf2) has an essential protective role in the lungs against oxidative airway diseases. It has been recently published that curcumin could significantly increase its nuclear expression levels and promote its biological effects. The authors are expecting that curcumin may be considered as a therapeutic candidate against a broad range of oxidative stress-related diseases, including type 2 diabetes, neurodegenerative diseases, cardiovascular diseases, cancers, viral infections, and more recently SARS-CoV-2[10], the COVID-19 disease.

## Curcumin and COVID-19

Since December 2019 and the first cases reported from Wuhan, COVID-19 has not received any treatment, and a lot of pharmaceutical molecules have been tested in vain. Due to its identified clinical effects such as antiviral, antinociceptive, anti-inflammatory, antipyretic, and antifatigue effects, curcumin could be effective to manage the symptoms of the infected patient with COVID-19. Due to its several molecular mechanisms including antioxidant, antiapoptotic, and antifibrotic properties with inhibitory effects on Toll-like receptors, NF-κB, inflammatory cytokines and chemokines, and bradykinin, curcumin could play an important role in the management of the disease[11, 12].

Based on various immunity-boosting steps concerning Ayurveda, and the broad-spectrum of antiviral properties of curcumin, its combination with Zinc is hypothesised by some authors as a therapeutic approach of a nutritional complex with a concerted antiviral action[13]. Zinc in combination with polyphenols like curcumin may form ionophore complex that can boost individual immunity.

According to the hypothesis presented just above, it could be interesting to combine curcumin with natural zinc. But other minerals are also interesting to support or boost our immune system such as Iron and Selenium that could also be combined with curcumin (see below).

Recent research has highlighted the strong potential of curcumin as a complementary therapy or nutritional approach to viral diseases and more particularly today of COVID-19. However, low bioavailability, absorption, permeability, and rapid metabolism still obstruct curcumin's use. To improve curcumin bioavailability, Vidya Herbs developed a naturally enhanced bioavailability curcumin. Vi-Active™ bioavailability is 2.2-times higher than standard curcumin.

Curcumin could be safely consumed at 1,200 mg/day in 3 x 400 mg doses[14], or at higher levels according to clinical trials results[15].

Marketed under the brand name Puremeric™ Vidya Herbs turmeric extracts are characterized by three curcuminoids profiles. HPLC characterisation, isotopic C14 analysis and DNA testing guaranteeing the natural origin and the absence of synthetic substitutions. The botanical variety is guaranteed by a botanist and complete traceability is ensured through the Full iD™ internal quality label. Puremeric™ extracts also benefit of SFT™ natural technology that combines an easier formulation of the product and streamlined production while maintaining clean labelling.

## Vitamin C*

Vitamin C helps to maintain the structural and functional integrity of the cells of our mucosal barriers such as the skin and the respiratory system. This vitamin is essential for the immune system for the differentiation, the proliferation, and the function of the immune cells. In addition, it plays a powerful antioxidant role. Finally, vitamin C participates in the development and production of antibodies.

Vidya Herbs makes an extract containing 15% natural vitamin C from Amla (*Emblica officinalis*). Amla tannins are also recognized for their involvement in the immune response. Just over 530 mg of extract provides the recommended 80 mg / d.

## Vitamin B6

Vitamin B6 is involved in the immunity linked to our intestinal barrier mediated by migration of lymphocyte. It is also involved in their proliferation, their differentiation, and their maturation. It is also involved in maintaining or increasing the cytotoxic activity of NK cells. In terms of inflammation, this vitamin is required to produce cytokines and the regulation of inflammation. Vitamin B6 also participates in the production and metabolism of amino acids necessary for the constitution of antibodies.

Vitamin B6, which is officially recognized to carry a claim relating to the proper functioning of the immune system, can be found at 0.1 to 0.5% in our Vitamin B Complex extract, which also provides vitamins B1, B2, B3, B5, B7 and B9. An herbal blend of guava, lemon and holy basil is used to provide this extract, 200-1,000 mg of which provides the 1.4 mg of vitamin B6 required daily.

## Vitamin B9 (folate)*

Vitamin B9 is involved in the regulation of the immunity of our intestinal barrier by acting for survival and regulation of T lymphocytes in the small intestine. Folate is also involved in the modulation of the cytotoxic activity of NK cells. Folates are also used to support the immune response mediated by T Helper 1. They are necessary for the production and the metabolism of antibodies, ensuring a sufficient response to antigens.

Folic acid is obtained from lemons (*Citrus limon*) and the content of 5% of this extract allows the contribution of RDA in 4 mg only.

## Vitamin B2*

Vitamin B2, for which EFSA has validated many physiological functions, is particularly interesting for its action necessary for iron metabolism. Our extract is obtained from the fruits of the guava tree (*Psidium guajava*). Its 2% riboflavin content allows ingestion of RDA in just 70 mg.

## Iron*

Vitamin C is officially recognized at European level to improve the absorption of iron, which is an important mineral for the immune system.

Like vitamin C, iron is essential for our barrier cells and helps to maintain their integrity as a cofactor of metalloenzymes. Iron is also involved in innate immune cells as a factor involved: in the destruction of bacteria, as a component of enzymes necessary for the functioning of immune cells and in the regulation of cytokines and the inflammatory response.

We have developed an extract from Curry leaves (*Murraya koenigii*) containing 3% Fe that achieves 100% of the recommended daily allowance in less than 500 mg.

## Zinc*

Zinc (Zn) is an essential micronutrient because its deficiency leads to suppress the immune response, both innate and adaptive, leading to an increased susceptibility to many infectious agents and an increase in the duration of the infection. The European Commission officially recognizes the role of Zn in protecting the immune system.

Indeed, Zn also participates in maintaining the integrity of the cells of our

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mucosal barriers since it is a cofactor of the metalloenzymes necessary for their maintenance. Zn is necessary for NK cells and for the growth and differentiation of immune cells. It increases the phagocytic activity of certain macrophages. It is an anti-inflammatory agent which participates in the modulation of the inflammatory response of cytokines.

This Zn-rich extract from guava (Psidium guajava) leaves is standardized at 4% Zn, and achieves the daily dose in less than 300 mg.

### Selenium*

Selenium (Se) is the other micronutrient essential for proper immune function. It is present in the form of selenoproteins important for antioxidant defences, acting at the level of leukocytes and NK cells. Selenium is also involved in the differentiation and proliferation of T lymphocytes and helps to maintain antibody levels. Selenium deficiency is linked to the risk of mortality and severity, especially in cases of serious illness and sepsis.

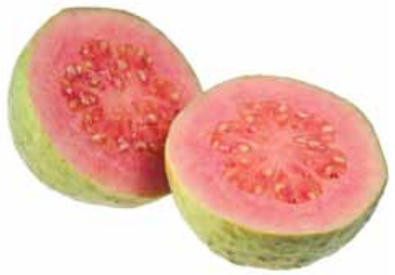
Our extract is obtained from Indian mustard (*Brassica juncea*). By a fine selection of soils for its cultivation, associated with a gentle extraction process, we obtain an extract of 0.5% of Se which allows to obtain the recommended daily dose with less than 20 mg.

### Conclusion

Barrier measures such as hand washing and wearing a mask help to reduce the spread of the virus and the impact of infections. But the burden of this pandemic is heavy and nutritional prophylactic measures may be considered, as necessary.

Indeed, there is no lack of clinical data to show how vitamins and minerals such as those described above participate in the support and functioning of our immune system. Inadequate intakes of these nutrients are unfortunately quite widespread, leading to less resistance to infections, thus increasing the burden of epidemics.

With this 100% natural offer, these vitamins and minerals included in their natural food matrices will allow them to supplement effectively and thus support their immune system, for better prophylaxis against current and future infections. ●



*(Available in organic quality with monitoring of 471 pesticides by third party laboratory)

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