The Physiological Functions of Proline-Rich Polypeptides (PRPs)

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Bovine or ovine colostrum, especially when taken from the first two milkings, is rich in protein subfractions (called immunoglobulins), which provide passive immunity benefits. Properly processed, it also can be rich in proline-rich polypeptides (PRPs), which are nanosized chains of 10 amino acids or less (notably praline) that have a very powerful effect in actively modulating immune responses in mammals.

PRPs enhance the ability of the thymus gland to release factors that help regulate immune functions in the body. Specifically, T-cells called Th1 helper cells are antagonists to the activity of Th2 helper cells. Th2 promotes B-lymphocyte functions. PRP can induce a shift from a predominantly humeral immune response to a more protective cellular response, described as a "Th2 to Th1 shift." This shift may assist the immune system in more effectively fighting chronic viral and bacterial infections, while simultaneously inhibiting the initiation of inappropriate inflammatory cascades associated with allergy, chemical sensitivity and autoimmune responses.

Here is a more detailed list of the physiological functions of PRPs:

- Modulate the immune system. PRPs promote T-lymphocyte function and can stimulate the lymphocytes to become either helper T-cells or suppressor T-cells. Helper T-cells activate B-lymphocytes by presenting an antigen, such as a viral protein, to the B-cell. The B-cell then produces antibodies to that protein. Helper T-cells also help produce memory T-cells, which retain the "memory" of the antigen to shorten the response time in cases of new infection. Suppressor T-cells deactivate other lymphocytes, effectively turning off the immune response to avoid damage to healthy tissue. PRPs also stimulate the production of a whole range of cytokines, particularly the pro-inflammatory cytokines TNF-α and INF-γ, and the anti-inflammatory cytokines IL-6 and IL-10.
- Act as molecular signaling devices, working through specific receptors on cell surfaces.
- Stimulate undifferentiated lymphocytes in thymus to become either helper T-cells or suppressor T-cells. PRPs act as a hormone in the thymus gland by stimulating thymocytes (immature lymphocytes) to differentiate and become either helper T-cells or suppressor T-cells. Helper T-cells are a vital part of the immune response that stimulates the production and differentiation of cytotoxic
T-cells and B-cells, attracts white blood cells, and stimulates macrophages to engulf and destroy pathogens. Suppressor T-cells inhibit the production of cytotoxic T-cells to prevent tissue damage and suppress the immune response, when no longer needed.

- Promote growth and differentiation of B-cells. PRPs promote the growth and differentiation of B-cells, a type of lymphocyte which produces antibodies to antigens, including viral antigens.\(^{10}\)
- Stimulate Natural Killer cell (NK cell) activity. PRPs stimulate the activity of NK cells up to 10 times, far greater than any other known substance. NK cells, along with cytotoxic T-cells, are the cells that actually attack and kill pathogens. NK cells also attack and kill cancerous cells.\(^{11}\)
- Stimulate the production of tumor necrosis factor-alpha (TNF-\(\alpha\)) and interferon-gamma (INF-\(\gamma\)). PRPs stimulate production of the two major pro-inflammatory cytokines, TNF-\(\alpha\) and INF-\(\gamma\), in white blood cells, peritoneal cells, and placental and amniotic membranes.\(^{12,13,14}\)
- Promote the proliferation of leukocytes (white blood cells).\(^{15}\)
- Stimulate production of cytokines by peripheral blood cells. The types of cytokines stimulated by PRPs depend on the antigenic stimulation present or the activity state of the immune system (underproductive or overproductive).
- Induce differentiation and maturation of monocytes and macrophages.\(^{16}\)
- Increase the permeability of blood vessels in the skin. Part of the inflammatory response to infection is an increase in the permeability of blood vessels in the skin, to allow the passage of blood cells and cytokines into the connective tissue to combat the infection. PRPs are known to initiate this inflammatory response.\(^{17}\)
- Produce immunity to certain viruses. PRPs have been experimentally shown to provide immunity to several viruses, including herpes viruses, Epstein-Barr virus, HIV, measles, vesicular stomatitis virus and others.\(^{18,19,20,21,22,23,24}\)
- Inhibit viruses known to be associated with autoimmune diseases. Epstein-Barr virus and human herpes virus-6 (HHV-6) have been associated with chronic fatigue syndrome, an autoimmune disorder. PRPs inhibit the replication of both viruses.\(^{25,26}\)
- Increase T-cell count in AIDS to normal or near-normal levels. In clinical studies conducted in Nigeria, Kenya and Zambia, PRP oral-spray products were shown to boost T-cell (CD4+) levels to normal or near-normal levels in AIDS patients whose T-cell levels were well below normal. Along with the increase in T-cells came a remission of AIDS symptoms (including nausea, vomiting and diarrhea) within two days of start of treatment. In the Nigerian study, weight gains of 5 percent were recorded. Patients taking the PRP
spray fared much better in terms of quality of life than did patients on anti-retroviral drugs. Thus, the ability of PRPs to stimulate insufficient immune response by inducing the production of new helper T-cells may enable the immune systems of AIDS patients to recover sufficiently to fight the HIV on their own.

PRPs are not species-specific. PRPs from bovine milk work on all mammals, including humans, dogs and cats. As PRPs are produced by all mammals and are entirely natural, it is generally thought to be safe for all ages. However, lactose is usually associated with PRP; therefore, those with milk intolerance may need to proceed with caution. The addition of lactase, the milk sugar digesting enzyme, may ameliorate lactose intolerance.

Also, delicate immune system changes occur following conception and during pregnancy. Specifically, there is a shift to Th2 dominance to inhibit the mother’s immune system from over-responding to the different DNA of the new life now inside her. Although there are no known reports of colostrum’s interference with full and normal gestation, until further investigation assures safety, it is suggested that pregnant women should avoid PRP-rich colostrum products unless recommended by their doctor.

Furthermore, PRPs, being such small peptides, can easily be denatured by the digestive acids and enzymes. As such, they are often taken as a sublingual spray. To be taken as a functional food, it is likely best to protect the peptides in liposomes, which are submicron and nanosized lipid spheres, usually made of milk fats or phosphatidyl choline. Using such technologies, extra PRPs also can be added to colostrum to make the colostrum especially high in bioavailable PRPs.

References


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