

Colostrum's Proteins and Peptides: a Brief Overview

Colostrum is mother nature's very first food for all mammals. Colostrum is, gram for gram, the most *zoonutrient* dense of all foods. Zoonutrients in animals, much like *phytonutrients* in plants, are "quasi-nutrients" that when consumed have salubrious effects on the health beyond the provision of energy and structural "raw" materials garnered from fats, proteins, carbohydrates, and vitamins and minerals.

The zoonutrients in colostrum are generally in the form of proteins, glycoproteins and peptides. Their major functions of colostrum are:

- 1) Provide *passive* immunity factors from the mother
- 2) To provide signals to initiate *active* immunity in the neonate.
- 3) To provide growth factors to stimulate growth

Generally, the *protein sub-fractions* of colostrum are most potent in relation to their *passive* immunity effects. These have great import in that the neonate has had neither the time nor the exposure to produce antibodies and related defenses against potential microbial pathogens and opportunists in its environment.

The *peptides* tend rather to be signals and/or bits of information for the production of proteins and glycoproteins related to *active* immunity and growth /repair, and can act as *modulators* to keep the inflammatory cascade and growth / repair activities in balance.

Here is a chart¹ of some of the more important sub-fraction proteins and peptides in colostrum and some of their functions:

Colostrum protein Sub-fraction / peptide	Growth Factor*	PRP	Interferon-gamma	Interleukin -1, 2, 6	Ig	Lacto-ferrin	Lacto-peroxidase	Lyso-zyme
anti-bacterial			+	6	+		+	+
antibody promotion				2, 6		+		
anti-fungal			+	6	+	+	+	+
anti-viral			+	6	+	+		
immune modulation		+		2, 6	+	+		
immune stimulation		+	+	2, 6	+			
macrophage activation			+	1				
phagocytosis promotion					+			
T- cell activation				1				
T + B-cell growth				2, 6				
Tissue repair	+							

peptide	+	+	+	+				
protein sub-fraction					+	+	+	+

*IGF I and II; Platelet Derived, Epidermal, Nerve and Fibroblast Platelet Growth Factors , Transforming GF Alpha and Beta

Colostrum Factors: Active and Passive Immunity

Colostrum has generally been known for its immune globulins (Ig) and their ability to support intestinal health and resistance through the predominantly *passive* immunity they provide. However, when colostrum is processed to achieve higher Ig levels, some other proteins and peptides that promote *active* immunity are diminished, including that peptide which is now quickly becoming the focus of interest, *Proline Rich Polypeptide* AKA PRP.

Proline Rich Polypeptides (PRP)

Proline Rich Polypeptides, PRP, may well be the premier immune factors in colostrum, continually modulating our immune system activity throughout life.² H.S. Lawrence discovered PRP in 1949, when he demonstrated that an immune fraction of a person's white blood cells was able to *transfer* immunity in a non-sensitized individual; hence an AKA for PRP as *transfer factor*.^{3,4}

PRP are very small peptide chains (3,500-6,000 Daltons) of less than a dozen amino acids, with proline predominating. In the past, they were derived from dialyzed white blood cells (WBC), but now can be purified from bovine colostrum. PRP are produced by T-lymphocytes and

- 1) can transfer the ability to recognize a pathogen to cells that have never been in contact with the pathogen (memory function).
- 2) are involved in triggering T- cell recognition of antigen and can heighten the immune system's ability to react to pathogens (Th-1 inducer function).
- 3) can block the response of the T-cells, and signals a down regulation of the immune response (Th-2 suppressor function)^{5,6}

Th-1 and Th-2 Helper Paradigm

The main function of PRP is to modulate the cytokine and antibody production to keep our immune system responses in balance. To best appreciate this function, it is helpful to have a basic understanding of the Th-1 helper/Th-2 helper paradigm.

Th-1 cells, which modulate *cell-mediated* immunity, produce the immune cell signaling peptides called *cytokines*, including for example interleukin-2, interferon-gamma, and tissue necrosis factor-alpha (TNF-a). Cell-mediated Th-1 helper responses are important in the body's ability to defend itself against viruses, fungi, parasites, cancer, and intracellular organisms.⁷

Th-2 cells, which modulate *humoral* immunity, or antibody production, produce IL-4, IL-5, IL-6, IL-10, and IL-13. If one has a Th2-dominated condition, with decreased cellular immunity and heightened humoral immunity, the conditions that tend to prevail are:

- allergies, chronic sinusitis, atopic eczema, asthma and ulcerative colitis;
- systemic autoimmune conditions such as lupus erythematosus and mercury-induced autoimmunity and vaccination-induced states;
- hyper-insulinism and hyper-cortisolism;
- malaria, helminth infection, chronic giardiasis, chronic candidiasis, viral infections (herpes, HIV, hepatitis C) and
- cancer.⁸

Pregnancy is a Th2-dominant state. This is an advantage during pregnancy, since a Th-1 dominant, cell-mediated immune response might induce rejection of the fetus and placenta. Indeed, certain autoimmune diseases, such as multiple sclerosis and rheumatoid arthritis, which are Th-1- dominant states, are ameliorated during pregnancy.^{9, 10} Because it stimulates a Th-1 response in most cases, as a precaution PRP should not be used in pregnancy, though there are no adverse events reported in the literature of which I am aware.¹¹

Bioavailability

Peptides are by definition simple chains of amino acids, and as such, are very susceptible to denaturation (deactivation) by digestive acids and PH. Therefore, PRP as a separate nutraceutical product is often delivered sublingually. Alternately, the use of lecithin and/or milk based phospholipids liposomes are used to enhance alimentary bioavailability.¹²

Conclusion

Immune system functioning is at the heart of the many disorders seen in clinical practice. Whole colostrum¹³ provides unique immune and tissue repair supporting zoonutrients, especially when fortified with PRP and nano-encapsulated in a liposomal delivery system to maximize the bioavailability of the more delicate peptides. Its use as a nutritional adjunctive therapy to support a return to and the maintenance of immune system balance may often be well indicated, especially when it is challenged by tumor growth, chronic fatigue, viral infections, allergies, chronic infections and autoimmune diseases.

- 1.) Other proteins and peptides in whole colostrum include Beta 2-microglobulin, Enzymes, Haemopexin, Haploglobulin, Orotic Acid, Peroxidase, Xanthine Oxidase Enzyme, Gonadotropin-Releasing Hormone (GnRH), Prolactin, Insulin, Sulfur, Glycoproteins. –(Including Protease and Trypsin Inhibitors), Lactalbumin, Multimeric a-Lactalbumin, Gamma Globulin, B Lactoglobulin Complement 3 & 4 (C3 & C4), Kappa Casein, Alpha 2-AP glycoprotein, Alpha 1-antitrypsin, Alpha 2- macroglobulin, Orosomucoids, Prealbumin, Albumin, Oligosaccharides, Non Specific Inhibitors (NSI's), Secretory IgA (SIgA), IgA Specific Helper
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- 7) Bock S. Transfer factor and its clinical applications, *The International Journal of Integrative Medicine*, <http://www.rhinebeckhealth.com/rhc/t-factor.php>
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- 9) Kim S, Lira SM, Dalal MA, Verity MA, Voskuhl RR. Estriol ameliorates autoimmune demyelinating disease. *Neurology* 4:P1230-1237, 1999.
- 10) Formby. Immunologic response in pregnancy. *Endocrine Metabol Clin North Am* 24:187-205, 1995.
- 11) PDRhealth.com, http://www.pdrhealth.com/drug_info/nmdrugprofiles/nutsupdrugs/bov_0082.shtml
- 12) Wong A, Toth I. Lipid, sugar and liposaccharide based delivery systems. *Current medical Chemistry* 8(9): 1123-1136 (2001).
- 13) By whole colostrum, I mean colostrum that has not been processed to heighten passive immune factors at the expense of other proteins and/or peptides. Generally, colostrum is defatted to prevent rancidification.