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## **Bovine Colostrum Emerges as Immunity Modulator**

In the past two years, health care practitioners have been hearing a great deal about bovine colostrum, a relatively new food supplement intended to optimize the immune systems of both healthy and chronically ill individuals. Much of the excitement about colostrum has been generated by testimonials, anecdotal reports as well as the marketing efforts of several new supplement manufacturers and distributors.

The past 20 years has also witnessed the publication of over 2000 research papers strongly supportive of both colostrum and its numerous components. The purpose of this paper is to provide a review of the scientific evidence for the clinical application of a promising immune system modulator.

In <sup>3</sup>Colostrum, Life's First Food<sup>2</sup> (33), Dr. Daniel G. Clark's basic message, as printed on the back cover of his book, is that bovine colostrum <sup>3</sup>Rebuilds the immune system, destroys viruses, bacteria(17,18) and fungi, accelerates healing of all body tissue, helps lose weight, burn fat, increase bone and lean muscle mass and slows down and even reverses aging.<sup>2</sup> According to Clark and the well-known naturopathic physician, Dr. Bernard Jensen(34), colostrum has a therapeutic role to play AIDS, cancer, heart disease, diabetes, autoimmune diseases, allergies, herpes(38), bacterial(15), viral and parasitic(1) infections, gingivitis, colds, the flu and much more. Colostrum has antioxidant properties, is anti-inflammatory and is a source of many vitamins, minerals, enzymes and amino acids.

## **Colostrum Rediscovered**

Historically, Ayurvedic physicians have used bovine colostrum therapeutically in India for thousands of years. In the US and throughout the world, conventional doctors used it for antibiotic purposes prior to the introduction of sulfa drugs and penicillin. In the early 1950's, colostrum was prescribed extensively for the treatment of rheumatoid arthritis. In 1950, Dr. Albert Sabin (12,26), the polio vaccine developer, discovered that colostrum contained antibodies against polio and recommended it for children susceptible to catching polio.

## **What is Colostrum?**

Colostrum is the first mammary secretion that a mammal provides for its newborn for the first 24-48 hours. It contains numerous immune system and growth factors as well as essential nutrients, trypsin and protease inhibitors that protect it from destruction in the GI tract. It is estimated that colostrum triggers at least fifty processes in the newborn. Bovine colostrum is biologically transferable to all mammals, including man and is much higher in immune factors than human mother's colostrum. Laboratory analyses of immune and growth factors from bovine colostrum are identical to those found in human colostrum except for the fact that the levels of these factors are significantly higher in the bovine version. For example, human colostrum contains 2% of IgG while cow colostrum contains 86% of IgG, the most important of the immunoglobulins found in the body. Bovine colostrum contains a blocking hormone to prevent the calf from becoming sensitized to its own mother's immune factors. Studies indicate that all species, including man, benefit from the immune boosting properties of bovine colostrum with no reports of allergic or anaphylactic reactions to date.

It is in a very limited supply because colostrum is only available for a day or two after calving. The needs of the newborn calf must be met first and only high quality colostrum is taken from cows that have been certified free of antibiotics, pesticides and synthetic hormones. Colostrum must be processed at low temperatures so that the immune and growth factors remain biologically viable.

## **Major Colostrum Components**

The most important components of colostrum can basically be broken down into two major categories: immune system factors and growth factors. Drug manufacturers have tried to copy (genetically engineer) and market several of the individual components of colostrum, most notably interferon, gamma globulin (7), growth hormone, IgF-1 and protease inhibitors. Biotechnology companies are currently selling IgF-1 for as much as \$800 per 50 cc vial. Some of the following colostrum components may very well be next on the list of <sup>3</sup>major breakthroughs<sup>2</sup> by the pharmaceutical/nutraceutical industry:

**Immunoglobulins (A, D, E, G and M)** - the most abundant of the immune factors found in colostrum; IgG neutralizes toxins and microbes in the lymph and circulatory system; IgM destroys bacteria while IgE and IgD are highly antiviral (4,23,25).

**Lactoferrin** - an antiviral, anti-bacterial, anti-inflammatory, iron-binding protein with therapeutic effects in cancer, HIV, Cytomegalovirus, herpes (38), Chronic fatigue Syndrome, Candida albicans and other infections. Lactoferrin helps deprive bacteria of the iron they require to reproduce and releases iron into the red blood cells enhancing oxygenation of tissues. Lactoferrin modulates cytokine release and its receptors have been found on most immune cells including lymphocytes, monocytes, macrophages and platelets.

**Proline-Rich Polypeptide (PRP)** - a hormone that regulates the thymus gland, stimulating an underactive immune system or down-regulating an overactive immune system as seen in autoimmune disease (MS, rheumatoid arthritis, lupus, scleroderma, chronic fatigue syndrome, allergies, etc.).

**Growth Factors:**

Epithelial growth factor (EgF)

Insulin-like growth factor-I and II (IGF-1 and IGF-II)

Fibroblast growth factor (FgF)

Platelet-derived growth factor (PDGF)

Transforming growth factors A & B (TgA and B)

Growth hormone (GH)

These all help stimulate cell and tissue growth by stimulating DNA formation (21). Genetically engineered versions of IGF-1 and GH are now marketed as antiaging and AIDS drugs. They are found naturally and in high concentrations in colostrum. Several studies show that these growth factors are capable of increasing T-cell production, accelerate healing, balance blood glucose, reduce insulin need, increase muscle and bone growth and repair while metabolizing fat for fuel (10, 11, 21, 23, 33, 34).

A 1990-study (35) in the New England Journal of Medicine concluded that GH treatment prevented some of the signs of aging. In his study, Dr. Daniel Rudman treated 26 men between the ages of 61-80 with GH. Patients experienced a decrease in overall body fat (of up to 14%), an increase in bone density and lean muscle mass. In addition, their skin was thicker and more elastic. Rudman said the changes were equivalent to those incurred over a 10-20 year period of aging.

**Leukocytes** - stimulate the production of interferon (16), which slows viral reproduction, and penetration of cell walls.

**Enzymes** - lactoperoxidase-thiocyanate, peroxidase and xanthine oxidase oxidize bacteria through their ability to release of hydrogen peroxide.

**Lysozyme** - a hydrolyzing agent and immune system booster capable of destroying bacteria and viruses on contact.

**Cytokines** - interleukins that regulate the duration and intensity of the immune response, are responsible for cell to cell communication, boost T-cell activity and the production of immunoglobulins. Interleukin-10 is strongly anti-inflammatory, especially in arthritic joints.

**Trypsin Inhibitors and Protease Inhibitors** - prevent the destruction of immune and growth factors in colostrum from being broken down in the GI tract; they also prevent H. pylori from attaching to the walls of the stomach and can have a beneficial role in the treatment of peptic ulcers.

**Lymphokines** - hormone-like peptides produced by activated lymphocytes which mediate the immune response.

**Oligo Polysaccharides and Glycoconjugates** - attract and bind to pathogens (Strep., E. Coli (19), Salmonella, Cryptosporidia, Giardia, Entamoeba, Shigella, Clostridium Difficile Toxins A & B and Cholera) preventing them from attaching or entering the mucous membranes.

**Orotic Acid** - stops the formation of pyrimidine nucleotides and prevents hemolytic anemia.

**Other immune Factors** - some of the documented immune factors include secretory IgA, IgA Specific Helper, B Lactoglobulin, Lactalbumin, Albumin, Prealbumin, Alpha 1-Antitripsin, Alpha 1-Fetoprotein, Alpha 2-macroglobulin, Alpha 2-AP Glycoprotein, C3, C4 and Orosomucoids.

**Vitamins** - A, B12 and E are found in small amounts while traces of all others are also present in colostrum.

**Sulfur** - a mineral with multiple uses in metabolism and as part of many structural body proteins.

## **Clinical Applications**

For symptomatic adults, clinicians usually prescribe 1000 – 2000 mgs. twice daily of the dried, encapsulated form of colostrum, best taken on an empty stomach with 8 - 12 ounces of water. Preventive doses have not been established but several authors recommend continuous dosing at levels decided upon primarily by the consumer/patient. For those who show no clinical response to colostrum, the dosage can safely be doubled or even tripled as needed until the desired results are obtained. Children can also take colostrum but require proportionately less. Herxheimer reactions (mainly flu-like symptoms) can occur in up to 40% of the cases but are usually mild and disappear with continued supplementation at the same dosage level. Through hundreds of years of use and over 1000 clinical studies, colostrum has been demonstrated to be completely safe without drug interactions or side effects at any level of ingestion. The following clinical conditions have been well documented to respond favorably to colostrum supplementation:

### **Viral Illnesses**

About 75% of the antibodies in the body are produced by the GI component of the immune system. The ability of AIDS/HIV patients to fight infectious disease is severely compromised by partially due to damage to the gut from chronic inflammation and diarrhea. Several recent studies (1,5,6,8,13,20,24,25,30) report colostrum's role in the reversal of this chronic problem stemming from opportunistic infections like *Candida albicans*, *Cryptosporidia*, rotavirus, herpes simplex, pathogenic strains of *E. Coli* (19) and intestinal flu infections. All gut pathogens are handled well by colostrum without side effects. Colostrum is composed of numerous factors with strong antiviral activity, especially the immunoglobulins, lactoferrin and the cytokines (8,9,23,25,32).

### **Allergies and Autoimmune Diseases**

PRP from colostrum can work as a regulatory substance of the thymus gland (14). It has been demonstrated to improve or eliminate symptomatology of both allergies and autoimmune diseases (MS, rheumatoid arthritis, lupus, and myasthenia gravis). PRP inhibits the overproduction of lymphocytes and T-cells and reduces the major symptoms of allergies and autoimmune disease: pain, swelling and inflammation.

## **Heart Disease**

Altered immunity may be the hidden cause of atherosclerosis and cardiovascular disease. For example, a type of Chlamydia has been associated with arterial plaque formation in over 79% of patients with heart disease. A recent New England Journal of Medicine article (36) concluded that heart disease is the result of immune sensitization to cardiac antigens. Immune system mediated injury results in myocarditis with lymphocytes and macrophage being the predominant infiltrating cells. Colostrum PRP may have a role in reversing heart disease very much like it does with allergies and autoimmune diseases.

Additionally, IgF-1 and GH in colostrum can lower LDL-cholesterol while increasing HDL-cholesterol concentrations. Colostrum growth factors promote the repair and regeneration of heart muscle and the regeneration of new blood vessels for collateral coronary circulation.

## **Cancer**

The benefits of cytokines in the treatment of cancer was first popularized by the 1985 Steven Rosenberg Book, <sup>3</sup>Quiet Strides in the War on Cancer<sup>2</sup>. Since that time, the same cytokines found in colostrum (Interleukins 1, 6, 10, Interferon G and Lymphokines) have been the single most researched protocols in scientific research for the cure for cancer.

Colostrum lactalbumin has been found to be able to cause the selective death (apoptosis) of cancer cells, leaving the surrounding non-cancerous tissues unaffected (37). Lactoferrin has similarly been reported to possess anti-cancer activity.

The mix of immune and growth factors in colostrum can inhibit the spread of cancer cells. If viruses are involved in either the initiation or the spread of cancer, colostrum could prove to be one of the best ways to prevent the disease in the first place.

## **Diabetes**

Juvenile diabetes (Type I, insulin dependent) is thought to be brought about through an autoimmune mechanism, possibly initiated by an allergic reaction to the protein GAD found in cow's milk (2). Colostrum contains several factors, which can offset this and other allergies.

Colostrum IgF-1 can bind to both the insulin and IgF-1 receptors found on all cells. Human trials (39) in 1990 reported that IgF-1 stimulates glucose utilization, effectively treating acute hyperglycemia and lessening a Type II diabetic's dependence on insulin.

### **Weight Loss Programs**

IgF-1 is required by the body to metabolize fat for energy through the Krebs cycle. With aging, less IgF-1 is produced in the body. Inadequate levels are associated with an increased incidence of Type II diabetes and difficulty in losing weight despite a proper nutritional intake and adequate exercise. Colostrum provides a good source of IgF-1 as a complementary therapy for successful weight loss (33).

### **Athletic Stress**

Exhaustive workouts and athletic competition can temporarily depress the immune system, decreasing the number of T-lymphocytes and NK cells. Athletes are therefore more prone to develop infections, including Chronic Fatigue Syndrome. Many of colostrum's immune factors can help significantly reduce the number and severity of infections caused by both physical and emotional stress (33).

### **The Leaky Gut Syndrome**

One of the major benefits of colostrum supplementation is enhanced gut efficiency due to the many immune enhancers that control clinical and subclinical GI infections. Colostral growth factors also play a role by keeping the intestinal mucosa sealed and impermeable to toxins. This is evidenced by colostrum's ability to control chronic diarrhea caused by gut inflammation related to dysbiosis. Healing leaky gut syndrome reduces toxic load and helps in the reversal of many allergic and autoimmune conditions. For the healthy individual or athlete in training, colostrum supplementation enhances the efficiency of amino acid and carbohydrate fuel uptake by the intestine. More nutrients are made available for muscle cells and other vital tissues and organs. One of the reasons for the energy boost seen in most healthy individuals who use colostrum as a food supplement is this ability of colostrum to improve nutrient availability and the correction of subclinical leaky gut syndrome (41).

## **Wound Healing**

Several colostrum components stimulate wound-healing (40). Nucleotides, EgF, TgF and IgF-1 stimulate skin growth, cellular growth and repair by direct action on DNA and RNA. These growth factors facilitate the healing of tissues damaged by ulcers, trauma, burns, surgery or inflammatory disease. The tissues affected beneficially by colostrum's wound healing properties are skin, muscle, cartilage, bone and nerve cells. Powdered colostrum can be applied topically to gingivitis, sensitive teeth, aphthous ulcers, cuts, abrasions and burns after they have been cleaned and disinfected (33,34).

## **Quality Control**

The best quality colostrum is produced organically and is free of pesticides, herbicides, anabolic hormones like rBST, steroids, antibiotics and other chemicals. Not all colostrum products on the market are biologically active due to improper processing through the use of high temperatures and pasteurization or the formation of colostrum into tablets, a method that requires high pressure and generates heat, destroying biological activity. Colostrum in liquid form is also less than ideal. It is not as concentrated as the powdered versions of the product, must be kept refrigerated due to its short shelf life and preservatives must be added that further dilute and destroy its biological capabilities. Low heat processing, the removal of fat, whey and lactose as well as laboratory testing to insure biological integrity and safety are the rigid standards which must be met by high quality supplements.

## REFERENCES

- 1) Acosta-Altamirano, G., et al., Anti-amoebic properties of human colostrum. *Adv. Exp. Med. Biol.* 1987. 216B: p.1347-1352.
- 2) Binz, K. et al. Repopulation of The Atrophied Thymus in Diabetic Rats by Insulin-like Growth Factor I. *Proc. Natl. Acad. Sci. USA.* 87(10):3690-3694. May 1990.
- 3) Boesman-Finkelstein, M., et al., Passive oral immunization of children. *Lancet.* 1989. 49: p. 1336.
- 4) Butler, J. E. Immunoglobulins of the Mammary Secretions. Chapter Five. in: *Lactation: A Comprehensive Treatise.* Vol. 3. Eds. B. L. Larson and V. R. Smith. pp. 217-252. Academic Press. New York. 1974.
- 5) Christopher-Hennings, J., et al., Immunocompromise in gnotobiotic pigs induced by verotoxin-producing *Escherichia coli* (O111:NM). *Infect. Immun.* 1993. 61: p. 2304-2308.
- 6) Doyle, P. S. Anti-Cryptosporidium antibodies inhibit infectivity in vitro and in vivo. *Infection and Immunity* 61(10):4079-4084. Oct. 1993.
- 7) Dwyer, J. M. Manipulating the Immune System with Immune Globulin. *New Engl. J. Med.* 326(2):107-116. Jan. 9, 1992.
- 8) Ebina, T., et al., Prevention of rotavirus infection by cow colostrum containing antibody against human rotavirus. *Lancet.* 1983.29: p. 1029-1030.
- 9) Ebina, T., et al., Passive immunizations of suckling mice and infants with bovine colostrum containing antibodies to human rotavirus. *J. Med. Virol.* 1992. 38: p. 117-123.
- 10) Francis, G. L., et al., Purification and partial sequence analysis of insulin-like growth factor-1 (IGF-1) from bovine colostrum. *Biochem. J.* 1986. 233: p. 207-213.
- 11) Francis, G. L., et al., Insulin-like growth factors-1 (IGF-1) and 2 (IGF-2) in bovine colostrum. *Biochem. J.* 1988. 251:p. 95-103.
- 12) Haynes, B. F. and Fauci, A. S. *Introduction to Clinical Immunology.* Part

Two. Section 2. in: Harrison's Principles of Internal Medicine, Eleventh Edition. Eds. E. Braunwald et al. pp.328-337. McGraw Hill Book Co. New York. 1987.

13) Ho, P.C., and Lawton, J.W.M. Human colostrum cells: Phagocytosis and killing of *E. Coli* and *C. Albicans*. *The Journal of Pediatrics*. Vol. 93, No. 6, pp. 910-915.

14) Janusz, M. et al. Immunoregulatory Properties of Synthetic Peptides: Fragments of a Proline-rich Polypeptide from Bovine Colostrum. *Molecular Immunology*. 24(10): 1029-1031. 1987

15) Kim, K., et al., In vitro and in vivo neutralizing activity of human colostrum and milk against purified toxins A and B of *Clostridium difficile*. *T. Infect. Dis*. 1985. 150: p. 57-61.

16) Lawton, J. W. M., et al., Interferon synthesis by human colostrum leukocytes. *Arch. Dis. Childhood*. 1979. 54: p.127-130.

17) Majumdar, A. S., et al., Protective properties of anti-cholera antibodies in human colostrum. *Infect. Immun*. 1982. 36:p. 962-965.

18) McClead, R., et al., Resistance of bovine anti-cholera toxin IgG to in vitro and in vivo proteolysis. *Pedia. Res*. 1982.6: p. 227-231.

19) Morris, J. A., et al., Passive protection of lambs against enteropathogenic *Escherichia coli*: Role of antibodies in serum and colostrum. *T. Med. Microbiol*. 1980. 13: p. 265-271.

20) Nord, J. et al. Treatment with Bovine Hyperimmune Colostrum of Cryptosporidial Diarrhea in AIDS Patients. *AIDS*. 4(6):581-584. June 1990.

21) Oda, S., et al., Insulin-like growth factor-1 (IGF-1), growth hormone (GH), insulin and glucagon concentrations in bovine colostrum and in plasma of dairy cows and neonatal calves around parturition. *Comp. Biochem. Physiol*. 1989. 94A(4): p. 805-808.

22) Ogra, P. et al. Colostrum Derived Immunity and Maternal Neonatal Interaction. *Annals NY Acad. Sci*. 409:82-92. 1983.

23) Palmer, E.L. et al. Antiviral Activity of Colostrum and Serum Immunoglobulins A and G. *J. Med. Virol*. 5:123-129. 1980.

- 24) Ritchie, D. J., Update on the management of intestinal cryptosporidiosis in AIDS. *Ann. Pharmacother.* 1994. 28: p.767-778.
- 25) Rump, J. A., et al., Treatment of diarrhea in human immunodeficiency virus-infected patients with immunoglobulins from bovine colostrum. *Clin. Invest.* 1992. 70: p. 588-594.
- 26) Sabin, A and Fieldsteel, A.H. Antipoliomyelitic activity of human and bovine colostrum and milk. *Pediatrics*, Jan. 1962. pp.105 - 115.
- 27) Sabir, A. B., Anti-poliomyelitic substance in milk from human beings and certain cows. *T. Dis. Children.* 1950. 80: p.866-870.
- 28) Spik, G., et al., Bacteriostasis of a milk-sensitive strain of *E. coli* by immunoglobulins and iron-binding proteins associated with colostrum. *Immunology.* 1981. 35: p. 663-670.
- 29) Stephan, W., et al., Antibodies from colostrum in oral immunotherapy. *J. Clin. Chem. Clin. Biochem.* 1990. 28: p. 19-23.
- 30) Ungar, B. L. P., et al., Cessation of *Cryptosporidium*-associated diarrhea in AIDS patient after treatment with hyperimmune bovine colostrum. *Gastroenterology* 1990. 98: p. 486-489.
- 31) Wada, N., et al., Neutralizing activity against *Clostridium difficile* toxins in the supernatants of cultured colostrum cells. *Infect. Immun.* 1980.29: p. 545-550.
- 32) Watzl, B., et al., Enhancement of resistance to *Cryptosporidium parvum* by pooled bovine colostrum during murine retroviral infection. *Am. J. Trop. Med. Hyg.* 1993. 48(4): p. 519-523.
- 33) Clark, Daniel G. and Wyatt, Kaye. *Colostrum, Life's First Food.* Salt Lake City:CNR Publications. 1996.
- 34) Jensen, Bernard. *Colostrum: Man's First Food, The White Gold Discovery.* Escondido:Bernard Jensen, 1993.
- 35) Rudman, D.; et al. Effects of Human Growth Hormone in Men over 60 Years Old. *N. Eng. J. Med.* 323:1-6, 1990.

- 36) Lange, Schreiner. Immune mechanisms of cardiac disease. New England Journal of Medicine, April 21, 1994. Vol 330, p1129(7).
- 37) Hakansson et al., Proceedings, Nat. Acad. of Sciences, Vol. 92, pp. 8064-8068, Aug. 1995.
- 38) Kohl, S. et al., Human colostral cytotoxicity: antibody-dependent cellular cytotoxicity against herpes simplex infected cells mediated by colostral cells. Journal of Clinical Laboratory Immunology, 1, pp. 221-224.
- 39) Dohm, Elton, et al. IgF-1 stimulated glucose transport. Diabetes, Sept. 30, 1990, pp. 1028-32.
- 40) Sporn, et al. Polypeptide Transforming Growth Factors (TGF A & B) and Epithelial Growth Factor isolated from bovine colostrum used for wound healing in vivo. Science, 219, pp. 1329-31, 1983.
- 41) Heinerman, John. Dr. Heinerman's Encyclopedia of Anti-Aging Remedies. Paramus:Prentice Hall, 1997; pp.85-86.  
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