

Colostrum:

IMPLICATIONS FOR ACCELERATED RECOVERY IN DAMAGED MUSCLE AND CARTILAGE, PREVENTION OF SOME PATHOGENIC DISEASE.

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Thanks to the advances of biotechnology in the last decade, colostrum has been reintroduced to the world as a potent growth supplement and immune modulator. A substance long known for its cytoactive and curative properties, colostrum was reviewed in the early 1980's as a potential additive for tissue culture media. What was found instead was a high concentration source of growth factors which had characterization for years. The exciting results of those studies led to a flurry of human subject research and recent discovery of the many health benefits available from colostrum as a food supplement.

WHAT IS COLOSTRUM?

Colostrum is not necessarily a “new” product, for it is as old as motherhood. It is the first mammary secretion provided for newborns in the first 24 hours until, at most, 72 hours prior to the onset of genuine lactation. The formulation of colostrum is much more complex than simple milk, and its components are not found in such high

concentrations anywhere else in nature.

There exist four main components to colostrum, three of which are currently undergoing vigorous investigation. These are: the growth factor fraction, the immunoglobulin fraction,

like Growth Factor 1 (IGF-1) and Transforming Growth Factor beta (TGF-B).

Others of lesser interest due to lower concentrations include interleukin-1 (IL-1), Growth Hormone (GH), IGF-2, the FGF's, as well as some EGF

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and a putative permeability fraction. The fourth remaining fraction contains enzymes, proteins, odd peptides and other compounds of lesser interest to athletes, patients, and health care professionals.

THE VARIOUS COMPONENTS

The growth factors present in colostrum are numerous and of a character that provides great hope for bio-technology in the recombinant drug arena. The major factors of intense interest today are “Somatomedin C” which is now popularly called insulin-

and PDGF-like factors which as yet remain uncharacterized. The main theme of many biotechnology companies today involves strategies for cloning and producing large quantities of IGF-1 and TGF-B for very good reasons, which will be discussed.

The immunoglobulin fraction is responsible for instilling passive immunity in the offspring, primarily to infections frequently or recently encountered by the mother. This is an exceptional benefit for the newborn whose immune system may not function adequately for several

months or years, depending on the species.

The various forms of immunoglobulin, which are delivered, consist of IgG, IgA, IgM, and IgE, in descending order of abundance. The affinity mature IgG's furnished to the young are remnants of previous responses to foreign pathogens and confer specific immunity on administration. IgA, IgM, and IgE contribute their respective functions of mucosal and enteric pathogen surveillance, low-affinity antigen binding and contribution to allergic responses. Human studies reveal many other strong positive immunological effects in colostrum, to be discussed.

One might reasonably ask, "How does the body absorb these complex protein macromolecules intact and active, without denaturing and degrading them like steak?" Herein lies the real allure of colostrum. The third colostrum fraction contains a putative permeability factor, which provides wholesale transport of large molecules. Possibly there exists a form of anti-protease activity, which prevents net colostrum degradation.

Though how the large immunoglobulins and enzymes actually enter the bloodstream is yet a mystery, it is well known that the peptide factors are absorbed intact independent of transport assistance. Why,

of course these molecules get in. Would mammals go to the trouble of producing and excreting such precious biochemical's as are found in colostrum for nothing?

THE HISTORY OF COLOSTRUM

That was the rationale of Dr. Hufeland who in 1799 proposed a unique function for colostrum as separate from milk, having to do with the overall health and rapid growth of newborn cattle. Much research was devoted to colostrum at the end of the nineteenth century and continued until just after World War II, stopping with the advent of sulfa drugs and antibiotics such as penicillin, the heyday of chemical medicine. Then, in 1955 "immune milk" was published as a therapy for rheumatoid arthritis, and biological medicine was somewhat revived.

Later, the properties of colostrum were inspected in longitudinal human studies. These revealed that breast-fed babies had fewer infections, particularly common adult bacterial and viral infections, had greater appetites and generally grew faster than non-breast-fed children. It is reasonable to assume that the anti-microbial effect of maternal IgG present in the colostrum accounts for this difference. However, it is the growth factor content of colostrum which is truly exciting for the adult patient.

THE FACTORS

The many regenerative effects of IGF-1, coupled with those of TGF-B, extend to nearly all-structural cells of the body. Without exception, each new published study documents the enhancement of DNA and protein synthesis as well as nutrient uptake mediated by these colostrum growth factors, particularly in muscle and cartilage.

In the somatomedin hypothesis, GH prepares muscle satellite cells for proliferation and differentiation, particularly in conjunction with fibroblasts during the healing process, and brings about strong autocrine IGF-1 production. Terminal differentiation to myotubules complete the healing event, and is directed almost entirely by IGF-1.

TGF-B has also been indicated in the regeneration processes but with specific application in cartilage. This compound, along with IGF-1, has been found to directly stimulate the development of cartilage in vitro. TGF-B is known to be present in colostrum at a concentration 10-fold that of serum. Though its effects have a known capacity to inhibit proliferation but not differentiation of muscle, it is the second best compound available for the synthesis and repair of cartilage. Incidentally, IGF-1 is the best, and was first identified

by its ability to enhance chondroitin synthesis and sulfation of proteoglycans.

More recently, studies have been undertaken to assess the efficacy of colostrum therapy in HIV-associated cryptosporidia and pathogenic colibacter infection, which cause the respective opportunistic infections. The results have been strongly positive for colostrum in the case of the enteric studies, with an overwhelming majority experiencing complete abatement on administration. Studies are still ongoing in the case of cryptosporidia.

The Germans and some Americans have immunized animals with specific pathogens and obtained colostrum for analysis of the prevention of colonization or remediation in immunocompromised patients, with some success in preliminary examinations. Other research has concentrated on the reduction of viral and yeast (*Candida albicans*) activity in the presence of colostrum, which also has been quite effective.

HOW IS COLOSTRUM AVAILABLE?

Colostrum for human consumption is obtained from postparturient cattle during the first 24 hours, the highest concentrations of immune and growth factors being derived in the first 48 hours. With rigid adherence to

sterility GMP's and special care in manufacturing colostrum is typically homogenized and then spray dried. The product is Pasteurized in microdroplets at 140 C for 15 minutes, at which point the soluble compounds become completely dry powder.

One might instantly object to the heat treatment of colostrum; but each of the disulfide cross-linked growth factors is stable indefinitely boiling at pH 1.0, as long as conditions provide no reducing agent. Also, it should be noted that IgG-1, the major bovine secretory immunoglobulin in colostrum, is very thermostable and survives the process intact. Actually, many colostrum proteins associate with each other on the molecular level, thus lowering their specific activity; but these dissociate in processing, actually making them more biologically active.

Colostrum dose has been derived empirically from the response of many subjects. Patients with a desire to enhance their immune system typically take 500 mg every day for 5 days, thereafter tapering to half that dosage. Athletes and individuals with musculoskeletal injuries who wish to capitalize on the anabolic effects of colostrum generally use even greater doses such as 750 mg per day initially. They also taper to half the original dose overtime. There exist no known contraindications and

no overdose have been experienced.

CONCLUSION

Colostrum contains the twin healing properties of IGF-1 and TGF-B, whose muscle and cartilage repair characteristics are biochemically unsurpassed. It is for this reason that biotechnologists are pursuing the recombinant forms so hotly. Since these peptide growth factors will not be available over the counter for a very long time, it is more convenient to obtain them from colostrum today.

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Additional reading about the beneficial effects of colostrum include "Mammary Gland Biology and Lactation" a newsletter published by the University of Colorado School of Medicine, or the book "Biochemistry of Lactation" edited by Dr. T. B. Mephan.

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