

Health Factors in Colostrum

B.R. Thapa

Division of Pediatric Gastroenterology, Department of Gastroenterology, PGIMER, Chandigarh

Abstract. Colostrum is a breast milk produced after the birth of the newborn and lasts for 2-4 days. Colostrum is very important part of breast milk and lays down the immune system and confers growth factors and other protective factors for the young ones in mammals. This is the source of passive immunity achieved by the mother and is transferred to the baby. This is the major source of secretory IgA and gives protection against gastrointestinal infections. In view of so many health factors through colostrum, the use of colostrum has been extended to so many health problems of mankind. Human and bovine colostrums have many similarities barring that bovine colostrum can be obtained in large quantity, so bovine colostrum has been used in various disorders in human beings. This is the nature's gift that is for the young ones to grow as well as for the treatment of many health problems in older age group. [Indian J Pediatr 2005; 72 (7) : 579-581] E-mail : brthapa1@yahoo.co.in

Key words : Colostrum; Bovine colostrum; Immune system; Growth factors

The animals that lactate and produce milk to feed their offspring are called mammals. The word mammal in latin means "breast" to produce milk for the young ones to suckle. All mammals are peculiar in their existence by the fact that they are provided with pre-formed feeds available in their breasts. This is a nature's gift for the newborn. Before the birth, the fetus is absolutely sterile and is lying in the sterile atmosphere. At the time of delivery the newborn is exposed to micro-flora of birth canal and handling by the medical attendants or midwifery or otherwise hits the ground. The newborn from the sterile state is suddenly exposed to the environment full of micro-organisms and other agents. There has to be ready-made immunity to immunize. But at the same time nature provides the breast milk to which baby starts suckling soon after the birth. The first breast milk produced after giving birth is known as colostrum. The colostrum is very important component of breast milk and lays the foundation for every mammals' immune system. This contains protective antibodies to prevent infections in the newborn called PASSIVE immunity. This also provides vital nutrients for tissue development, growth and energy. The mother's lifetime achievements, pass to the baby through colostrum.^{1,2}

WHAT IS COLOSTRUM?

Colostrum is pre-milk substance that is produced immediately after birth. Within few minutes of birth, baby can suckle the breast. Colostrum is thick lemon yellow mammary secretion and is rich in proteins. This lasts for 2-4 days after the lactation has started. This is the

source of fats , proteins , sugars and micronutrients in the form of vitamins and minerals. This is very rich source of secretory IgA to give protection to gastrointestinal tract (GIT) from various infections in the new born. Certain maternal conditions like eclampsia, diabetes and anemia can affect the composition of colostrum.¹

HISTORICAL ASPECTS

Colostrum has been used for various illnesses in India for thousands of years. The medical importance was described in ancient medicine ayurveda. In U.S. colostrum was in use for its anti-bacterial activity before the discovery of antibiotics. In many countries it is used to prepare cake to celebrate the birth of the calf. Colostrum has been used for treatment of rheumatoid arthritis. Sabin, an anti-polio vaccine was prepared from bovine colostrum. Colostrum has been reported to be very safe and effective for its use in repair of tissue as well as for enhancing the immunity.³⁻⁵

HARVESTING OF COLOSTRUM

Human colostrum was not enough for its use at large at the same time mother donors had problems of abuse of alcohol, cigarettes etc. So there was need of alternate colostrum from animal source with safe and stable transfer of immunity and growth factors .These properties are there in bovine colostrum as well .Rather cow colostrum is richer in IgG (20%) as compared to IgG (2%) in human colostrum. The bovine colostrum also contained growth factors, so cow has been accepted as universal donor of colostrum to humans.²

Colostrum is harvested within first few hours of calving from dairy animals. The herds of cows are kept

Correspondence and Reprint requests : Dr. B.R. Thapa, Additional Professor, Pediatric Gastroenterology, PGIMER, Chandigarh-160012. Fax : 0172-2744401.

under close supervision in good state of hygiene, without exposure to antibiotics, pesticides and anthelmintics. They are monitored according to FDA criteria. The colostrum collected within 24 hours contain maximum substances but less in amount, colostrum collected later will be more but contain less immunoglobulins.

IMPORTANT HEALTH FACTORS IN COLOSTRUM

There are ninety known components in the colostrum. There are two primary components of colostrum : immune factors and growth factors. Colostrum also contains vitamins, minerals and aminoacids according to need of neonates.⁵

IMMUNE FACTORS

- (a) Specific Antibodies. The immune factors obtained from the mother have shown to fight against viruses, bacteria, yeast and fungus. There are around 20 specific antibodies in the colostrum to fight microbes like *E.coli*, *Salmonella*, *Rotavirus*, *Candida*, *Streptococcus*, *Styphyllococcus*, *Cryptosporidium*, *H.pylori* etc.^{3,4,6,7} There is adequate transfer of passive immunity against diarrhea.⁸
- (b) Immunoglobulins – Immunoglobulins are superior in defence in both treatment and prevention of viral infections, bacterial infections, allergies, yeast and fungus.⁶ There are five types of immunoglobulins IgA, IgD, IgE, IgG and IgM. Bovine colostrum contains 8%-25%, IgG whereas human colostrum contains 2% IgG. These are protein molecules, saline soluble aminoacids which have important role in the body to fight against infections.
IgA : operates in tears, saliva and blood (secretory IgA in the gut)
IgD : anti-viral
IgE : anti-viral
IgM : anti-bacterial
IgG : abundant in lymph and blood, and neutralizes toxins.
- (c) Prolin Rich Polypeptide (PRP): PRP has been shown to stimulate the thymus to regulate the immune system in the body. PRP stimulates the weakened immune system and also stabilizes hyperactive immune system due to autoimmune diseases and allergies in the body.
- (d) Lactoferrin : This is an iron binding protein that plays important role against cancer cells and also has anti-viral and anti-bacterial properties and anti-inflammatory properties. Lactoferrin can prevent reproduction of bacteria and releases iron for the red blood cells. Lactoferrin receptors have been identified on the immune cells and involved in release of cytokines. Lactoferrin has been implicated in treatment of diseases like cancer, HIV, herpes, chronic fatigue, candidiasis and other infections.⁹

- (e) Cytokines : These are the interleukines. They regulate duration and intensity of immune responses. They boost T cells activity and have antiviral and anti-tumor activity. Interleukine-10 is having the anti-inflammatory activity in arthritis and during injury.¹⁰
- (f) Lymphokines : These are the peptides involved in mediating the immune response.
- (g) Oligopolysaccharides and Glycoconjugate Sugars: They attract and bind to pathogenic bacteria and prevent their entry in the mucosal lining. They block the entry of *Salmonella*, *Cryptosporidium* and *Clostridia* in leaky gut syndrome.^{5,8}
- (h) Glycoproteins and Trypsin Inhibitors: They inhibit the breakdown of colostrum in the gut, hence it can have its effect in the GIT. Colostrum inhibits the *H.pylori* in stomach, so anti-ulcer activity. They protect the immune and growth factors in GIT.⁷
- (i) Lysozyme : This is an acid resistant hydrolyzing agent that is capable of destroying bacteria and viruses on contact. This is being added to commercial baby food.
- (j) Leucocytes : They stimulate interferon production and slow down the viral reproduction. Interferon also inhibits cellular wall penetration.¹¹
- (k) Lactoperoxidase-thiocyanate, Peroxidase and Xanthine Oxidase Enzymes: They oxidize bacteria by generating the release of hydrogen peroxide.
- (l) Lactalbumins: Lactalbumins are active against many forms of cancers and viruses. Lactalbumins also raise the serotonin levels, decrease the cortisol levels and improve the mood under stress.^{4,5}

GROWTH FACTORS

The vital growth factors in the human colostrum are similar to that of bovine colostrum. They stimulate growth, help in regeneration and accelerate the repair of aged original muscle, skin, collagen, bone, cartilage and nerve tissue. Growth factors also stimulate the body to burn fat for fuel instead of the body's muscle tissue in times of fasting and lean built. Growth factors have also been used as an effective topical application for burns, injuries and skin rejuvenation.¹²

VARIOUS GROWTH FACTORS

- (a) Epithelial Growth Factor (EGF): EGF is protective as well as maintains the skin. This can stimulate normal skin growth and repair the cellular tissue. Insulin like growth factors 1 and 2 (IgF1 and IgF-2) are the most abundant. They affect the use of fat, protein and sugar by the body. IgF-1 is known to stimulate the repair and the growth of DNA and RNA, making it most powerful anti-aging substance. IgF-1 also improves the lean muscle mass and may help in regulation of blood pressure and cholesterol levels.^{13,14}
- b) Transforming Growth Factors A and B (TGF A and

Health Factors in Colostrum

B): TGF stimulates the proliferation cells in connective tissue and assists in formation of bone marrow and cartilage. TGF also has therapeutic potential in bone and wound healing. This is helpful in repair of the tissue and supports the lining of the gut.^{14, 15}

c) Platelet Derived Growth Factor (PDGF) : PDGF helps in cell division in connective tissue, smooth muscle and fibroblasts. It also helps neurone survival and regeneration .

d) Vitamins and Minerals : They are most important nutrients essential for the normal metabolism, growth and development. They act as coenzymes throughout the body. They help in maintenance of health as they are naturally balanced and provided in the colostrum depending upon the needs.^{16, 17} There are more than adequate amounts of vitamins like C,E, and A in the colostrum. These vitamins make colostrum to serve as antioxidant in the body.¹⁶⁻¹⁷

e) Aminoacids : They are the building blocks of proteins. They are required for growth and development of the newborn.

CLINICAL APPLICATIONS

Bovine colostrum contains useful ingredients which have been found to be beneficial in various diseases in human beings. In gastrointestinal tract (GIT) bovine colostrum has great role in terms of maintenance of integrity of mucosa, permeability, local immunity (secretory IgA), systemic immunity and antigen handling. There are clinical observations to support that bovine colostrum is effective in the treatment of bacterial and viral diarrhea in adults and children.^{6,8}

This also helps in prevention of diarrhea when given to the children over longer period. Bovine colostrum has also been used in treatment as well as prevention of non-steroidal anti-inflammatory drugs (NSAIDs) induced gut injury. People have used bovine colostrum in various joint disorders like rheumatoid arthritis and has been found to be useful. This acts as an immune modulator, hence, useful in the auto-immune and allergic disorders. This also takes care of upper respiratory tract infections, sinusitis and pneumonia. Due to anti - bacterial and anti-viral activity of bovine colostrum, this product has a great potential to treat various infections in the body in physiological way.¹¹ The growth factors have a lot of scope in the maintenance of growth in children. Due to anti-oxidant and fibroblast activation, the bovine colostrum has been used in various aging disorders and before and after surgical procedures with good results.^{8, 12, 16, 17} However, there is need of double blind placebo-controlled multicentric trials to show scientifically its efficacy in real sense.

To conclude the bovine colostrum has lot of scope in the prevention and treatment of various illnesses in human being. The passive immunity transferred from mother can help in prevention and treatment of various diarrheal disorders in children. The anti-oxidant and anti-aging properties are helpful to deal with various old age problems. The colostrum also helps in growth and healing of various mucosal, skin and muscle injuries. These therapeutic potentials will be covered in separate article.

REFERENCES

1. Kaushik S, Trivedi SS, Jain A, Bhattacharjee J. Unusual changes in colostrum composition in lactating Indian women having medical complications during pregnancy- A pilot study. *Indian J Clin Biochem* 2002; 17 : 68-73.
2. Pakkanen R, Aalto J. Review paper Growth factors and antimicrobial factors of bovine colostrum. *Internat Dairy J* 1997; 7: 285-297.
3. Boesman - Finkelstein M, Finkelstein R. Passive oral immunization of children. *Lancet* 1989; 2 : 1336.
4. Dichtelmuller W, Lissner R. Antibodies from colostrum in oral immunotherapy. *J Clin Bio Chem* 1990; 28 : 19-23.
5. Ogra SS, Ogra P.L. Immunologic aspects of human colostrum and milk. *J Pediatr* 1978; 92 : 546-549.
6. Davidson G, Whyte P, Daniels E *et al.* Passive immunization of children with bovine colostrum containing antibodies to human rotavirus. *Lancet* 1989; 2 : 709-712
7. Bitzan MM, Gold BD, Phil Pott DJ *et al.* Inhibition of *Helicobacter pylori* and *Helicobacter mustelae* binding to lipid receptors by bovine colostrum. *J Infect Dis* 1998; 177 : 955-961.
8. Bogstedt AK, Johansen K, Hatta H. *et al.* Passive immunity against diarrhea. *Acta Pediatr* 1996; 85 : 125-128.
9. Lonnedal B, Iyer S. Lactoferrin molecular structure and biological function. *Ann Review Nutr* 1995; 15 : 93-100.
10. Bocc V, Von Bremen K, Corradeschi F. *et al.* What is the role of cytokines in human colostrum. *J Bio Regulat Homeo Agents* 1991; 3 : 121-124.
11. Lawton JW, Shortstride KF, Wong R Ng Mh. Interferon synthesis by human colostrum leucocytes. *Arch Dis Childhood* 1979; 54 : 127-130.
12. Bhora F, Dinkin B, Batzri S *et al.* Effect of growth factors on cell proliferation and epithelization in human skin. *J Surg Res* 1995; 59 : 236-244.
13. Francis G, Upton F, Ballard J *et al.* Insulin like growth factors 1 and 2 in bovine colostrums. *J Biochem* 1988; 251 : 95-103.
14. Ginjala V, Pakkanen R. Determination of transforming growth factor-b (TGF-B1) and insulin like growth factor IgE in bovine colostrum factors. *J Immuno Assay* 1998; 19 : 195-207.
15. Ballard F, Wallace J, Francis G, Read L, Tomas F. Des (1-3) IgF -1 a truncated form of insulin like growth factor -1. *Internat J Cell Biol* 1996; 28 : 1085-1087.
16. Ahmed L, Nazrul Islam SK, Khan MNI, Hugue s, Ahsan M. Antioxidant micronutrient profile of Vitamin E,C,A, copper, zinc, iron) of colostrum : association with mother characteristics. *J Trop Pediatr* 2004; 50: 357-358.
17. Ahmed L, Nazrul Islam SK, Khan NI, Nahid SN. Vitamin C content in human milk (colostrum, transitional and mature) and serum of a sample of Bangladeshi mothers. *Mal J Nutr* 2004; 10 : 1-4.

SYMPOSIA SCHEDULE FOR 2005

Title	Guest Editor(s)
Growth and its Disorders (<i>Feb</i>)	P.S.N. Menon
Fest-Schrift for Late Dr. P.M. Udani (<i>Apr</i>)	Vrajesh Udani (<i>India</i>)
Common Pediatric Surgical Problems-II (<i>May</i>)	D.K. Mitra (<i>India</i>)
Pediatric Cardiology-I (<i>June</i>)	Anita Saxena (<i>India</i>) and P.S. Rao (<i>USA</i>)
Pediatric Cardiology-II (<i>July</i>)	Anita Saxena (<i>India</i>) and P.S. Rao (<i>USA</i>)
Nephrology	Arvind Bagga (<i>India</i>)
Newer Diagnostics	A. Sibal (<i>India</i>) and I.C. Verma (<i>India</i>)
New Drugs Antibiotics	Arvind Taneja (<i>India</i>) and Ashir Kumar (<i>USA</i>)
Gastroenterology & Hepatology	N.K. Arora (<i>India</i>) and Anil Dhawan (<i>UK</i>)
Developmental and Behavioral Disorders	Nandini Mundkur (<i>India</i>) and D.R. Patel (<i>USA</i>)

ARTICLES APPEARING IN THE FORTHCOMING ISSUES

Benefits of Maternal Participation in Newborn Nurseries : *C.K. Sasidharan, E. Gokul, P. Anoop et al*

Cost of Pediatric Services in Public Sector Setting in India : *A. Krishan, N.K. Arora, C.S. Pandav et al*

Hepatitis B Vaccine in the EPI Schedule : *A.K. Jain, S.K. Mittal, S. Ramji and A. Chakravarthi*

A Study Comparing Intramuscular Midazolam versus Intravenous Diazepam for Treatment of Acute Seizures : *Ira Shah and C.T. Deshmukh*

Rhino-Orbital-Cerebral Mucormycosis in Type 1 Diabetes Mellitus : *S. Bhadada, A. Bhansali, K.S.S. Reddy et al*

Detection of Helicobacter Pylori Infection by Noninvasive Stool Antigen Test in Children with Recurrent Abdominal Pain : *E. Mahir Gulcan, Aydin Varol, Tufan Kutlu, Fugen Cullu, Tulay Erkan et al*

Detection of Subtelomeric Rearrangements in Patients with Sporadic and Non-syndromic Idiopathic Mental Retardation: *Gopalrao V.N. Velagaleti, Sally S. Robinson, Bobbey M. Rouse, Vijay S. Tonk et al*

Familial Combined Hyperlipidemia in a North Indian Kindred: *C.S. Sriram, Sheffali Gulati, Vikas Chopra et al*

Branchio-oculo-facial Syndrome : *M.L. Kulkarni, Shilpa Deshmukh, Ananda Kumar and Preeti M. Kulkarni*

Omens-Plus Syndrome : *Seema Kapoor, S.B. Mukherjee, Ritu Paul and Bhavna Dhingra*

Sleep and Childhood Epilepsy : *S. Aneja and M. Gupta*