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COLOSTRUM: AN ESSENTIAL COMPONENT FOR PHYSICAL AND MENTAL GROWTH AND ITS ROLE IN DISEASE PREVENTION

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ABSTRACT

Colostrum is the first milk of the lactating mother, and it is very important for physical and mental development as well as in prevention of diseases. Colostrum is a complete nutritional food stuff produced in 48 hours of the child birth in all mammals. Colostrum works as a naturally and 100% safe vaccine. Colostrum protect the child from a large number of infections by providing a strong immune system (high concentration of leucocytes and white blood cells that destroy the bacteria and pathogen). New born intestine is very permeable, Colostrum seals the holes by painting the gastro intestinal tract that prevents the penetration of the foreign substance from mother to the new born. Colostrum is a perfect food for the child, It contain all the essential components required for the proper development of the child. Child those does not fed the Colostrum in proper quantity the Colostrum supplements are choice for them. Colostrum supplements are prepared by the use of Colostrum of cows, goats and other animals. The Colostrum obtained from these animals are most commonly similar to human beings in composition so its utility is increases in these days. The following article covers all the components present in the colostrum, importance of colostrum and role of colostrum in disease prevention.

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INTRODUCTION

Colostrum is a form of milk produced by the mammary glands in late pregnancy and the few days after giving birth. It has high concentrations of nutrients and antibodies, but it is small in quantity. Colostrum is high in carbohydrates, high in protein, high in antibodies, and low in fat¹. Colostrum also contain fat soluble vitamins, minerals and immunoglobulins. Immunoglobulins are basically antibodies that provides the passive immunity to the child, which is responsible for prevention of the viral and bacterial infection in the child in future². Colostrum brings eight growth factor that promote normal cell growth, DNA synthesis, fat utilization and increase mental activity³. The formation of the Colostrum is started after two to three month of the pregnancy. The Colostrum is also known as “golden milk” due to its importance. On an average a women make 50 ml of Colostrum in 48 to 72 hours after the child birth⁴. Colostrum is the most concentrated source of biologically active component present in nature. Colostrum is low in volume but it provides a high number of nutrition for the baby. Colostrum has a laxative effect so help in formation of a soft stool and provide the easy passing of the soft stool that is known as “meconium”⁵.

Properties of Colostrum

Color-yellow to orange

Nature-thick and sticky

Quantity-50ml (in human)

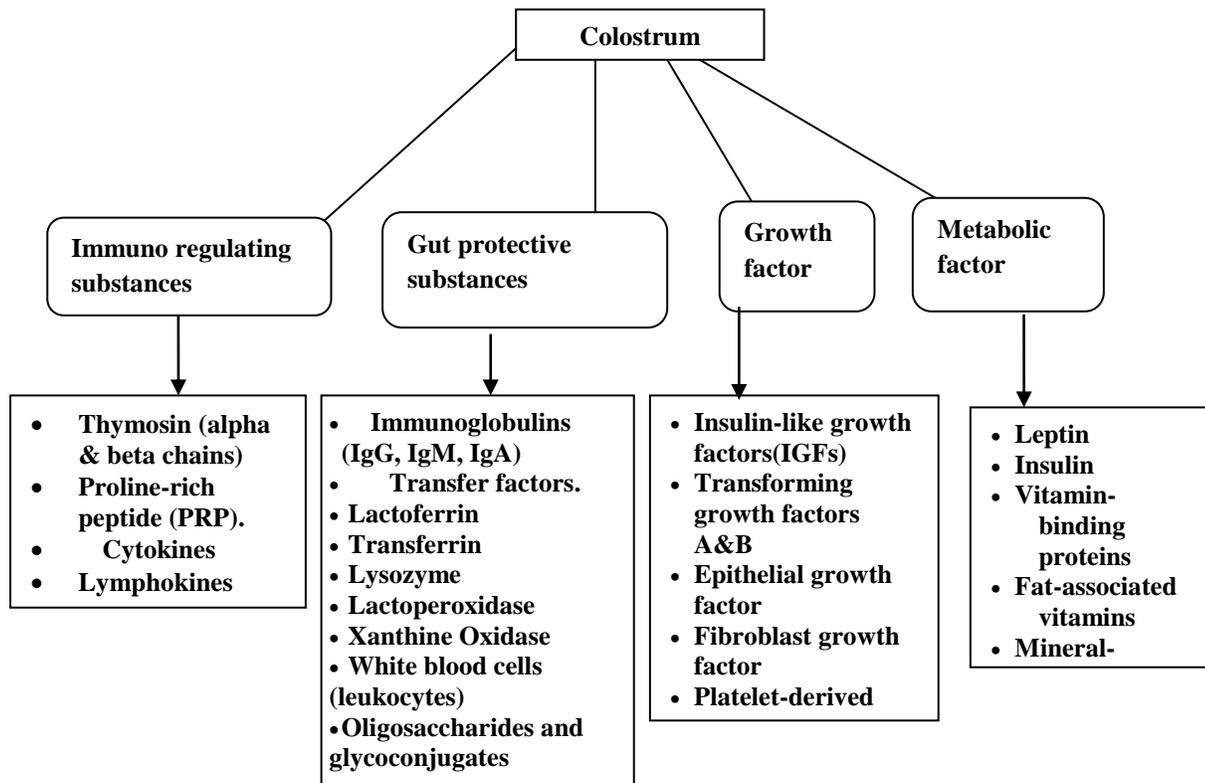
Formation-after 2 to 3 month of pregnancy

Resources of Colostrum

Colostrum is made in mammals but it is in less quantity in human beings than animals. The Colostrum obtained from bovine are very much similar in composition like human Colostrum so the bovine Colostrum can be directly used in artificial preparation of Colostrum. The artificial Colostrum have a large number of uses in prevention and treatment of diseases. The best form of Colostrum is from raw, grass-fed milk cows.

The U.S food and drug administration department has granted the bovine Colostrum in “orphan drug status” under the orphan drug law. The pharmacy companies which invested a large amount in the development of drugs for “Rare condition” are ultimately benefitted due to the permission to sell the drug without market competition for 7 years⁶.

COMPONENTS OF COLOSTRUM AND THEIR UTILITY ⁷



Vitamin and Minerals

All vitamins are organic food substances present in plant and animals, vitamins are necessary for our growth vitality and well being. vitamins are useless without minerals Vitamins cannot be assimilated without the aid of minerals. Minerals are constituents of the bones, teeth, soft tissue, muscle, blood and nerve cells. The vitamins and minerals present in Colostrum are given in following two tables along with their function and deficiency diseases.(according to food products laboratory)^{8,9,10}

TABLE A

Table A: All the Vitamin present in the colostrum function of the vitamin and their deficiency diseases.

Name of vitamin Present in Colostrum	Function of the vitamin	Deficiency diseases
Vitamin A (from beta-carotene)	Necessary for growth and repair, protects the mucous membranes of the mouth, nose, lungs and throat and play a major role in bone and teeth formation	Night blindness, susceptibility to infections, loss of appetite, fatigue, gum disease and retarded growth.
Vitamin C	Essential for healthy teeth, gums and bones and helps in healing of wound tissue. It increases the absorption of iron and prevents the body from different type of infections.	Bleeding gums, swollen joints, slow healing, nosebleeds, tooth decay, and impaired digestion.
Vitamin E	A major antioxidant and used to prevent sterility, muscular dystrophy, calcium deposits in the blood and for numerous heart conditions.	Red blood cells, lack of sexual vitality, degenerative conditions of the heart and other muscles.
Folic Acid (B9)	Necessary for RNA and DNA synthesis, which is essential for the growth and reproduction of all body cells	Gastrointestinal disorders, anemia, vitamin B-12 deficiency and pre-mature grey hair.
Thiamin (Vitamin B1)	Responsible for normal functioning of the nervous system, muscles and heart.	Nervousness and irritability, insomnia, loss of weight, depression and gastrointestinal problems.
Riboflavin (Vitamin B2)	Necessary for carbohydrate metabolism and helps in maintenance of cell respiration, healthy vision, skin, hair and nails.	Itching and burning eyes, sores in the mouth, dermatitis, and oily skin.
Pantothenic Acid (vitamin B5)	Participates in the release of energy from carbohydrates, fats and protein	Dizziness, digestive disturbances, and skin abnormalities.
Pyridoxine (Vitamin B6)	It aids in fat and carbohydrate metabolism, in the formation of antibodies, in the maintenance of the central nervous system and in the maintenance of the sodium and phosphorous balance in the body.	Nervousness, insomnia, anemia, muscular weakness, muscle cramps and water retention.
Vitamin B12	Helps in the formation and regeneration of red blood cells, thus preventing anemia.	Anemia, poor appetite, fatigue, brain damage, nervousness and irritability.

TABLE B

Table B: All the Mineral Present in the colostrum with their Role in disease prevention.

Nutritional minerals	Function of nutritional mineral	Deficiency disease
Calcium	It is essential for bone and teeth growth. It is essential for muscle integrity, nerve function blood clotting	Deficiency results in muscle cramps, softening of the bones (osteoporosis) tooth decay and depression.
Chromium	Responsible for providing energy, and also play a major role in sugar and fat metabolism.	Deficiency may result in glucose intolerance in diabetics, heart disease, obesity and fatigue.
Iron	Iron combines with protein and copper and make haemoglobin which is responsible for transport of oxygen in the blood	Deficiency of iron may cause weakness, anemia, depressed immunity, reduced cognitive function and constipation.
Magnesium	Regulate the neuromuscular activity of heart and responsible for calcium and fat metabolism.	Deficiency may result in muscle spasms, confusion, hypertension and suppressed pancreatic function.
Phosphorus	Maintains the PH of the body and it is present in every cell and play a major role in bone formation.	Deficiency is unknown
Potassium	Works with sodium to regulate the flow of	Deficiency results in poor reflexes, nervous disorders, and muscle

Sodium	water and nutrients, it is also involved in heart, brain and kidney function. It is critical in nerve impulse transmission and in maintaining the acid-base balance within the body.	damage. Deficiency results in a suppression of appetite, cramping and depression.
Zinc	It is necessary for protein synthesis wound healing, reproductive development and the metabolism of phosphorus.	Deficiency results in poor wound healing, reduced immune function, growth failure and delayed reproductive organ development.

COLOSTRUM COLLECTION

Artificial Colostrum can be obtained from various type of animals but the cows are most commonly used to obtain the artificial Colostrum. The artificial Colostrums is most widely used for Colostrum deficiency diseases.

The animals are move to milking area after the 2 hours of calving milking equipments are sanitized before collection. For collection of Colostrum hand milking, using an inverted syringe, or commercial milking device are commonly used. milking the Colostrum directly by hand and collection in the glass cup of 16 to 32 oz make it easy for evaluation. As an alternate Colostrum can be collected from the 60 ml inverted syringe as a simple milking device. For collection the tip of the inverted syringe is cutted and reverse the syringe plunger and place the flared end of the syringe over the mare's teat snug against the udder. A pull on the plunger draw the Colostrum into the syringe. The Colostrum from the cup is then transferred into the large cup and the similar process is repeated until a desired quantity of Colostrum is obtained.

A new device hand-held trigger-operated pump can also uses for collection of Colostrum. In this the device is connected to a plastic bottle in which the Colostrum is collected the Colostrum can be saved for long time if the animal fulfill the following requirements.

- Johnes ELISA test negative
- Healthy
- No mastitis
- Has not leaked milk
- No bloody milk

LABELLING AND STORAGE OF COLOSTRUM

The harvested Colostrum should pass through a gauze filter or new cheese cloth into a storage container. Fresh Colostrum should stored in 2 or 4 quart calf bottles or ziplock containers the Colostrum can also preserved in 8 to 16 oz plastic bottles labelled with the donor mare's name, collection date and Colostrum quality, frozen equine Colostrum can be safely stored for 1 to 2 years in a standard standard -20°C freezer. Frozen Colostrum should be thawed in a water bath at a room temperature, thawing in hot water and in microwave will destroys the antibodies and render the Colostrum useless.

ASSESEMENT OF COLOSTRUM QUALITY

Colostrum quality can be easily assessed quickly and accurately after the birth of foal. the high quality Colostrum indicates the less chances of disease in the foal and the high quality Colostrum can be stored in the Colostrum bank in frozen state, good quality Colostrum is thick yellow in color and sticky in texture. Low quality of Colostrum indicates that there are a major chances of disease in the foal and artificial supplements are required for prevention of disease the low quality Colostrum does not required to stored. Poor quality Colostrum is often watery, white in color and non-viscous in texture, quality of Colostrum can be determined on the basis of presence of antibody IgG.the quality of Colostrum can be determined by 2 methods

Direct measurement tools

In direct measurement tools the Radial Immunodiffusion (RID) assay is most commonly used for the determination of actual level of antibody present in the Colostrum.RID assays are carried out in laboratory scale by using standard protocols. The RID assay provide most accurate and repeatable results. The main drawback of this test is it is costly and take 24 hours to provide results so it is not suitable for day to day quality assesement of Colostrum quality.

Indirect measurement tools

Colostrometer and brix refractometer is commonly used.

Colostrometer

The Colostrometer measures the density and specific gravity of the Colostrum. The specific gravity of the Colostrum can be determined by reading the scale on the glass cylinder at the water line. Colostrum with high antibody level has high specific gravity and high density than the Colostrum has low antibody level. The determination of specific gravity of the Colostrum is totally depends upon the accurate measurement of the Colostrum volume(15ml),small error in the volume determination causes a significant difference in the specific gravity.



Fig: A Colostrometer.

For assessment quality of Colostrum following steps are taken

- After collecting the Colostrum it is allowed to settle for 10-20 minutes to reduce the air bubbles due to froth.
- Stand the Colostrum to cool at the temperature 20-22⁰c
- Remove the froth from the top of the sample if present
- The Colostrometer is allowed to float on the Colostrum and take the reading from the scale.

Brix Refractometer

Refractometer measures the concentration of dissolved solids in the solution. In refractometer light is commonly used for determination of density of the liquid. The instrument measures the amount of light that is refracted from the light path after passing through the sample. In Colostrum the presence of protein causes refraction in the light, high level of IgG causes more bending of light. Refractometer is a pocket size instrument and only required one drop as a sample for the determination of the quality of the Colostrum. This device is most commonly used in dairies^{11,12,13}.



Fig: A Brix Refractometer.

COLOSTRUM MANAGEMENT

A good Colostrum should fulfill following requirements.

- Quality > 50 g/L IgG
- Quantity 4 qts (10% Bwt)
- Quickness < 6 hrs
- Cleanliness < 100,000 cfu/ml TPC¹⁴.

RECOMMENDED DAILY DOSE OF COLOSTRUM

The clinical recommendation for the dosage of Colostrum is said to be 10 gm daily. The normal feeding time is for 5 minutes at least 8 times in a day¹⁵. Colostrum supplements are available in 400-500mg of capsules and in normal the manufacturer recommendation ranging from 1 to 6gm per day. Colostrum supplements which are used to improve athletic performance are recommended to a large dose usually 10-20gm per day, however the results shows that 125mg of Colostrum is sufficient to produce the desired effects.

CONTRAINDICATION AND ADVERSE EFFECT WITH COLOSTRUM

Colostrum is a safest supplement with no adverse effect for prevention and treatment of diseases. Colostrum is not recommended for long term use without any professional guidance however no adverse effects are reported with large doses. Bovine Colostrum supplements are not recommended to pregnant and lactating mothers due to some type of adverse reactions¹⁶ Colostrum is the safest preparation for boosting the immune system some times a mild type reactions are reported with Colostrum on long term use like anxiety, logorrhoea, and insomnia, and subsided spontaneously within a short period of time¹⁷.

Colostrum supplements

Colostrum is a major requirement of child after birth the deficiency of the Colostrum produces a number of diseases and reduces the immune power of the body. So child suffer from Colostrum deficiency diseases Colostrum supplements are miracle for them. Colostrum obtained from different sources are used for preparation of these supplements. Colostrum supplements are available in following dosage forms

- Colostrum capsules
- Colostrum powder
- Colostrum toothpaste
- Colostrum Douche
- Colostrum cream
- Colostrum face mask

Colostrum capsules

Colostrum capsules are most popular dosage form Colostrum capsules should be taken on an empty stomach without any food or other supplements. Colostrum has a half life of 8 hours,so for a maximum benefits it should be taken three times in a day. Colostrum capsules are taken with 8-12 oz of water. Colostrum capsules are generally recommended before breakfast, after several hours of lunch and an hour before dinner.

Colostrum powder

Colostrum is available in powder form. The powder is taken in a form mixed with other foods such as in our shake products. The powder may also be taken or mixed with any food drink and food. For achieve fast action the Colostrum powder is placed under the tongue or around the gums and allow it to absorb. The Colostrum supplements present in powder form are used to promote topical healing¹⁸. Colostrum powder regulates, normalizes, and maintains body functions. Colostrum powder are prepared under expert supervision and does not possess any side effects.

Bovine Colostrum powder is manufactured from Colostrum collected after 48 hours of calving from healthy cows. It is manufactured from first three milking of cows. it is prepared by a very low heat process to retain its nutritional properties¹⁹.

Colostrum toothpaste

It can be prepared by taking one part Colostrum powder to three parts fine ground salts and ten parts baking soda. It is basically used for gingivitis(bleeding gums) and mouth infections.

Colostrum Douche

It can be prepared by mixing water with Colostrum powder, and used for vaginal yeast infection. It is also used in enemas to clean and destroy bowel pathogens.

Colostrum cream

Colostrum cream can be prepared by mixing Colostrum powder with any cream, and keep in a cool place and use within 30 days of the preparation. It is specially used in antiaging night creams, sunburn lotions, dry skin lotions, and burn treatment creams. The growth factor present in Colostrum (IGF-1 and IGF-2) causes regeneration and regrowth of dead and infected cells.

Colostrum face mask

Colostrum face mask is prepared by making a thin paste of Colostrum powder, It helps in rejuvenate and grow new skin cells²⁰.

ROLE OF COLOSTRUM IN TREATMENT OF DISEASE AND THEIR PREVENTION

Colostrum as a complete food

Colostrum is a perfect food for the physical development of child. Colostrum is one of the planet's most beneficial nutritional supplement. Colostrum promotes the balanced growth and provide optimal functioning of all our organs including connective tissues and skeletal muscle²¹. Colostrum helps in digestion of the food in child by acting as a laxative. Colostrum also helps in providing a longer sleep to the child. Colostrum expels the bilirubin from the body of child so it decrease the chances of jaundice in the childrens.

Colostrum in physical development of child

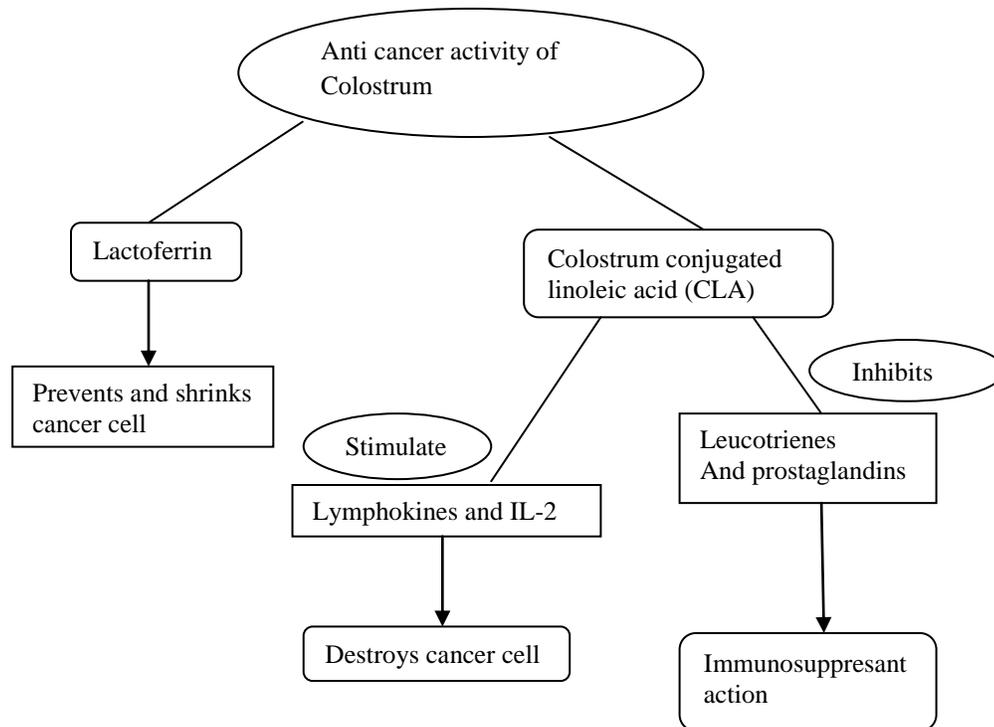
Colostrum contains a large number of nutrients including zinc,calcium,vitamin A, B6, B12 and K and a high content of cholesterol. these nutrients(vitamin A, vitamin B6,vitamin B12 and vitamin K) are essential for the growth and development of child. While the cholesterol helps in growth and development of nervous system of the child²². The supplement of the Colostrum helps in athletes to achieve the desired effects. Colostrum contains the growth factors(insulin-like growth factors (IGF-1 & IGF-2) and growth hormone (GH) that helps in lean muscles. IGF-1 is the naturally occurring hormone capable of promoting natural growth of muscles. growth factor in Colostrum burns the fat which is formed from the carbohydrates and protein and preventing the deposition of fats in the body.

Colostrum in autoimmune disorder

Colostrum contains immune factors which regulates the immune response and growth factors which repairs the damage cells and provide the anti-inflammatory substance to reduce the inflammation. Proline rich peptides (PRP) acts as a regulatory substance for thymus gland. It prevents the allergic reactions related to autoimmune diseases. PRP prevents the over production of "T" cells and lymphocytes so ultimately it reduces the swelling ,redness, and pain. Lactoferrin minimizes the risk associated with bacterial and viral infection and helps in providing the gut permeability and stability. tumour necrosis factor(TNF) stimulates tissue repair.

Colostrum in cancer

Lactoferrin present in Colostrum prevents the colon, bladder, tongue, esophagus, lung cancer. In milk fat of Colostrum Conjugated linolenic acid (CLA) is present that is responsible for its anti carcinogenic property. CLA increases the production of lymphokines and IL-2 and also stimulate the level of immunoglobulins, with decreasing the level of immunosuppressive substance (prostaglandins and leucotrienes) CLA decreases the amount of arachidonic acid which then decrease the eicosanoid and PGE2 synthesis. The eicosanoid receptors controls the release of messengers which are important for cell proliferation, differentiation and apoptosis.



Above mentioned scheme describes the anticancer activity of the colostrum.

Gastro intestinal disorder

A lot of microorganism, antigens and food ingredients are present in GIT. They act on GI tract by direct action or by immunological process. Colostrum contains immunological process that protects the GI tract from microbial infections. The unchanged or undigested Colostrum reaches at the down of the GI tract and maintains the healthy epithelium lining and immune system. ultimately Colostrum prevents the GI disorder²⁴.

Role of Colostrum in mental development of children

Colostrum improves the neuronal development of the children. Children with a breast feeding of Colostrum remains a high level of n-3 and n-6 PUFAs in Colostrum, which is responsible for increase . Maternal education, social class, and intelligence quotient. The long chain poly unsaturated fatty acids (PUFA) present in the Colostrum also play a vital role in the mental development of child²⁵.

Role of Colostrum in heart disease

The study shows that the cardiovascular disease are due to alteration in the immune system of the heart. Studies shows that 79% of patient of heart have the infection from Chlamydia which is responsible for the formation of plaques in the arteries. The proline rich peptide may be able to reverse the heart disease. The growth factor and the growth hormone present in the Colostrum reduces the level of LDL(bad cholesterol).these growth hormones repair the damage heart cells²⁶.

Role of Colostrum in Alzheimer disease

Colostrum helps people in treating Alzheimer disease. Colostrinin, a proline-rich polypeptide complex (PRP) is present in bovine Colostrum and find a most important application in Alzheimer disease. Researchers found that colostrinin found a significant improvement in the health of the patient. The side effects are mild including anxiety, logorrhea, and insomnia.

Colostrum as probiotics

Human Colostrum is also the source of probiotic in infants. Researchers found that several classical group of microorganism mesophylic (68.6%); thermotrophic (38.6%); psychrotrophic (8.6%); proteolytic (15.7%); proteolytic-psychrotrophic (1.4%); lipolytic (4.3%); molds and yeasts (11.4%); Staphylococcus aureus (44.3%); total coliforms (7.2%); and lactic acid bacteria (37.2%), thus characterizing a diversified microbiota²⁷.

Anti aging property of Colostrum

There are 8 essential nutrients which have a major effect on our health. These 8 nutrients causes low level of cholesterol, decrease body fat, accelerate wound healing, ease allergy symptoms and allay autoimmune disease" so ultimately these nutrients are responsible for antiaging property and these nutrients are only present in Colostrum as a natural source²⁸.

Role of Colostrum in autism disorder

Several studies shows that autism spectrum disorder can take place in childrens which involved in late feeding the breast milk or due to deficiency of the Colostrum. the study shows that Colostrum contains omega 3, omega 6 vitamin A and other large fat soluble vitamins. It is discovered that the childrens that feed breast milk for a long time ,there is less chances of autism in them.

According to journal of autism and development disorder the childrens who suffer from autism is treated with the supplement of Colostrum for eight weeks shows significant improvements and in about 50% childrens improvement in their behavior, improvement in GI are observed²⁹.

CONCLUSION

It is concluded from this review article that colostrum plays a major role in the physical and mental growth of the child. A large number of Vitamin and Mineral are present in the colostrum and they play a major role in disease prevention. A lot of research work is required on the colostrum to determine its efficacy and to develop various type dosage form.

Conflict of interest

There is no conflict of interest

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