A Comprehensive Review of General Characteristics of Peptides of Serum Immunoglobulins and Their Health Benefits

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Abstract:
As we know Immunoglobulin or antibodies are kind of protein which is produced by the immune system and fight against microbes or germs. Immunoglobulins are: IgM, IgG and IgA which supply long-term and short-term defense against contamination or infection. Several studies had found that the milk immunoglobulins are able to improve immune defense system response against germs and make available passive immunity, specially, in infants and young animals. The existence of immunologic agents in milk, like lactoferrin and lysozyme, can assist more to its protective effects. And also by incorporation of immunoglobulins and other immune improving materials to the formula milk, we can supply or make ready for the infants the same immunologic benefits like those which got from breastfeeding. We can say that this approach is beneficial for all infants specially it is beneficial for babies that are not able to feed from breast or have compromised Immune Systems.

Keywords: Immunoglobulins, Germ, Cow milk, Breastfeeding, Infant, Serum, Health, Pathogen.

Introduction
Infant mammalians mainly depend on milk for their nutritional completion in contrast with grown up mammalians that feed from different food products. Milk not only is the building block of body tissues but also creates a form of a passive protection. There are different mammals giving breast milk and cow’s milk that are beneficial agents for human infants. This, thus, makes breast milk the best food for an infant. When the breast milk is not available, the
infant formulas can meet all the nutritional needs of the child, but they do demonstrate the immune function. In order to mitigate this, alternative cow milk derived immunological regulators should be incorporated in the formulation (Skolnick et al., 2020). The bovine milk contains immune competent elements, Ig (immunoglobulins), lactoferrin, lactoperoxidase, lysozyme and xanthine oxidase. Cow's milk immunoglobulins are availed in the form of supplements which are essential for artificially boosting the immunity in human beings (Carr et al., 2021, Skolnick et al., 2020).

Reports indicate that the immunoglobulins administration especially immunoglobulin G (IgG) acquired from cow colostrum provides the newborns with protection from rotavirus and enterotoxigenic Escherichia coli (ETEC) infections (Wheeler et al., 2007, Perdijk et al., 2018). Several research has indicated that men have significant defense properties against traveler's diarrhea development in adults. Immune globulin from cow's milk when administered to piglets, calfs, lambs and foals has been demonstrated in animal studies to prevent different infections (Borewicz et al., 2019). Colostrum was used and pregnant cows were inoculated against the particular disease under investigation in many of these investigations. (Brumini et al., 2016, Galzitskaya 2023) demonstrated that rotavirus is active against milk from non-immunized cows. It's possible that milk from cows who aren’t inoculated also works to fight off other infections. While colostrum is scarce, it has a high concentration of Ig. Since milk and whey are readily available in large quantities and suitable for consumption, they would be superior sources of Ig.

Serum immunoglobulins are a special kind of antibodies found in milk that give kids passive immunity. These come from nursing animals, where the mother's blood is mixed with the milk. They can tolerate digestive circumstances since they are stable and members of the immunoglobulin G (IgG) class. Because mothers are exposed to a range of infections, milk immunoglobulins display a variety of antigen specificities (Perdijk et al., 2018, Hurly & Theil 2011).

Nursing newborns have passive immunity from serum immunoglobulins in milk, particularly in the early stages of life. They regulate the gut microbiota, bind to pathogens to preserve gut health, and offer protection against infections and illnesses. Additionally, they are anti-allergic, which is particularly advantageous for babies who are more susceptible to allergies (Murtaza et al., 2022, Gapper et al., 2007).

Certain peptides made of serum immunoglobulins have gained a lot of attention recently due to their potentially beneficial therapeutic effects. The unique characteristics of the mini-protein fragments motivate further research into the potential therapeutic applications of these medicines. In this study, we will summarize the main features of these proteins and emphasize the possible function that they may play in human health (Wang et al., 2022, Lu et al., 2017).

We can gain insight into the functional characteristics and mechanism of action of serum immunoglobulin-derived peptides by examining their structural features, amino acid sequence, and secondary structure. We will also go over the myriad health advantages that these peptides offer, such as their capacity for tissue regeneration and repair, immunomodulatory effects, and antimicrobial activity. This article's primary objectives are to investigate the shared characteristics of these peptides and the potential use of these compounds as medicinal agents (Wang et al., 2022, Lu et al., 2017, Margus et al., 2017).

Characteristics and Structure of Immunoglobulins (Ig)

Immunoglobulins (Ig) contain amino acids, carbohydrates, and other molecules that make them globulins in the serum 7-globulin group (Perdijk 2018, De Sousa-Pereira & Woof, 2019, Ruffolo et al., 2023). These molecules are the smallest building blocks of the proteins, and range from 150 to 900 kilo Daltons in mass. IgG types and many others are subtypes which displayed variety and can be classified into several classifications. In humans, there are five
main categories of immunoglobulins: The following antibodies are produced by a B lymphocyte: IgG, IgM, IgA, IgD, and IgE (7 antibody types). The general kinds of the immunoglobulins are also existing in other types of animals.

The immunoglobulins basically contain two heavy chains and two light chains which are connected by means of covalent cystine bonds and by other non-covalent interactions. The large aggregates account for about 450 amino acid residues with the mass of 50 kDa, monomers of the small chains are constituted of 220 amino acid residues with the mass of 23 kDa. The area on both the light and heavy chain on a molecule referred to as the "constant region" with the N-terminal region being concerned with the variable region. The diversity of amino acids that anchor the sequence of this region is within the scope of specific antigens. The CH region is endowed with biochemical and biophysical characteristics which are essential for the immunoglobulin. (Czosnykowska et al., 2020)

The structural of an immunoglobulin will be obviously drawn as a shape of Y, with flexible arms projecting more than hundred degrees swing degree, providing the protein with flexibility. Our immunoglobulins embody the capacity to find two different spots simultaneously by working with both of their arms. Thus, immunoglobulins may be broken down into 3 fragments by using the enzyme papain. The two identical Fr(ab) fragments consisting of Fragment antigen binding (Fab) region and additionally possessing an Fc fragment, are produced. The Fc fragment is a variable domain of binner crystallization of the immunoglobulin (Fc). Employing the recombinant protein process, Fab portion will attach only to the antigen. Nonspecific pepsin digestion leads to a two-part antibody with F‘ab’ (Fab)2 (Perdijk et al., 2018, De Sousa-Pereira & Woof 2019, Ruffolo et al., 2023).

![Figure 1. Schematic Diagram of Structure IgG, IgA and IgM](image-url)
While the light chain structures of the four Ig classes are similar, each class has its own distinct collection of heavy chains (Galzitskaya 2023, Ruffolo et al., 2023). Certain antibodies are specific to a heavy chain (IgG), a heavy chain (IgA), μ heavy chain (IgM), κ heavy chain (IgD), and ε heavy chain (IgE). IgG is made up of the basic monomeric form and can destroy poisons and viruses in addition to attaching to and opsonizing bacteria. IgG is the most common class in serum. IgA occurs not only as a monomer but also as polymers bound together by inter-monomer disulfide bonds and J (joining) chains. In colostrum and milk, secretory IgA, or sIgA, makes up around 90% of IgA. One J-chain and the secretory component, an additional glycopeptide that is distinct from antigens, make up the dimer known as sIgA. The 70 kDa molecular weight of secretory component (SC) is produced by epithelial cells. sIgA is shielded from pH changes and enzymatic degradation because SC shields the F, a portion of the IgA monomers that is prone to degradation (Miranda et al., 2023, Ogra 1997). sIgA is a specialized antibody for mucosal defense due to its structure. It may stop infections from sticking to the mucosa of the gut. Studies have demonstrated the anti- enterobacterial action of sIgA against E. coli, Vibrio cholera, Shigella, and other pathogens (Czosnykowska 2020, Ulfman et al., 2018). The specificity will be determined if the mother's surroundings contain the germs. IgM is composed of five monomeric units and one J-chain connected by disulfide bonds. Salmonella and other gram-negative bacteria, such as E. coli, are susceptible to the effect of milk's IgM (Nakai 1991). IgD is somewhat larger than IgG and looks similar to it. With a molecular weight of 188 kDa, IgE is heat labile in contrast to IgM and IgG. The immunoglobulins (Ig), in turn, are of notable significance for the immune system, and the heavy chains of the IgG, IgE, and IgD are very specifically classified with respect to each of these molecules (Galzitskaya 2023, De Sousa-Pereira and Woof 2019, Czosnykowska et al., 2020). Despite the common frames of the heavy and light chains motifs in four classes of immunoglobulins, it is the heavy chains that determine the classes. Relating to the class of heavy chain that are attributed to these antibodies, you find IgG, IgA, IgM, IgD, and IgE. IgG (immunoglobulin G), the predominant class of immunoglobulins found in serum, primarily binds to toxins and viruses through its monomeric form, whereas, it can as well opsonize some bacteria.

IgA may obviously function like a monomer or like the polymers that are linked by the disulfide bonds and J (joining) chains. sIgA characteristic in the colostrum and milk takes about 90% of all IgA in general. The dimeric form of sIgA is actually the one segmented into two parts, J-chain and secretory component (SC), standing for the group of glyc determinate which is far away from antigen. The SC molecules, synthesized by epithelial cells, help iodinate the F domains of monomeric sIgA that are prone to degradation, consequently protecting sIgA from acidic changes and enzymatic cleavage. The remarkable structure of sIgA gives a clear explanation on why sIgA behaves as a distinguished antibody for defense of mucosa. It can stand shoulder to shoulder with microbes to avoid affixed infections in the mucous membrane of your gut. The findings obtained from the research showed that the anti-operative effect of sIgA is responsible for killing bacteria such as E. coli, V. cholera, Shigella, and others (Ulfman et al., 2018). The high affinity for the corresponding pathogens compound sIgA has is dependent on the presence of those pathogens in the mothers’ environment.

The glycoprotein IgM is comprised of five monomers linked with one Jol chain disulfide bonds. The antibacterial functions of IgM of milk claims to have a role in a complex of gram-negative bacteria including Salmonella and E. coli (Hurley & Theil 2011, Brumini et al., 2016). IgD, as densely aggregated form of IgG, is a little bigger in size and possesses the same structure. From another perspective, IgE is much larger in comparison to IgM and IgG, being heavier with 188,000 molecular weight and therefore more sensitive to heat damage. antibodies’ structures
are different, and based on heavy chain differences, there exist five main classes, namely IgA, IgD, IgE, IgG, and IgM. IgG does neutralization of toxins and viruses, while delivering bacteria into phagocytic cells for instance. In colostrum and milk one can find two main classes of IgA antibodies, namely IgA, and secretory mainly IgA (sIgA) that got the mucosal surface covered with the aim of its protection given the possibility of infections. IgM exhibits the antimicrobial effect on gram-negative bacteria; another the member–IgD–, is similar to IgG in its activity. IgE on the other hand is LT (short half-life), which determines it outside the stability range occupied by IgM and IgG. Recognizing Ig classes and their roles gives us an insight into details of how the immune system is fighting back and not waiting for the death instrument. In addition, it helps us to gain a knowledge how these systems work.

Making antibodies such as IgA IgG, IgM, and IgD available in breast milk is one. Mata and Wyatt suggest that colostrum indicates the highest concentration of secretory IgA, and this range is between 17 mg/ml initial colostrum and 4-day colostrum (1 mg/ml) (1971). In the 1st colostrum IgG levels were 40 μg/ml what then had decreased to 0.4 μg/ml at the end of 4th colostrum. The IgM levels were 1.6 mg/ml at the initial colostrum stage and later declined to 0.1 mg/ml approximately in the 4-day colostrum period.

This reduction in the level of IgG can be contributed to the effect partially from the increase in the amount of milk. Therefore, the higher levels initially given may give some protection to the newborn until their own immune system develops and will less likely cause some complications. Black magic why IgA appeared in the feces of breastfeeding babies at the very beginning of nursing, whereas the ability to detect IgA was just 30% and 70% in case the child was bottle-fed in three to four weeks and 1.5 months, respectively (Ogra 1997). This implies that a high Ig dose for newborn babies in early introduction would help for their protective mechanism, until their own immune system steps in later during the first month.

Many researches have revealed that the immunoglobulin concentration in colostrum is extraordinarily high and then undergoes a descending trend for the first few weeks of lactation. The first couple of weeks following birth typically produce dynamic fluctuations, which however gradually stabilize over time, remaining stable for up to one year after the initiation of lactation. The evolution of mammalian milk chemo types occurs along with the immunologic composition of milk during the early, mid, and late phases of lactation (Chen & Lu 2020, Gapper et al., 2007), factors that are still unknown.

The specific way based on molecular biology by which Ig maintains immunity against foreign factors is very complicated, but the key clues of how this could be possible can be derived from the structure of immunoglobulin. According to (Mehra et al. 2006, D’Auria et al., 2021, Darand et al., 2022, Hwang et al., 2021), the immunoglobulins present in milk are believed to offer protection through several mechanisms: According to (Mehra et al., 2006, Marshall et al., 2018, Reyneveld et al., 2020), the immunoglobulins present in milk are believed to offer protection through several mechanisms:

1) Agglutination: The cause of bacteria being clumped together is Antibodies which aids their evacuation out of the Intracellular cavity.

2) Interference with adhesion and colonization: Since immunoglobulins prohibit bacteria from getting attached to and settling on the inner membrane of the intestinal tract, it makes it difficult for the bacteria to eventually colonize the intestinal lining.

3) Support for immune agents: Immunoglobulins are fundamentally involved in opsonization process, as a result immune effectors get better chance of eliminating foreign organisms.

4) taking part in complement fixation, a specific antibody action. Complements are a class of about twenty proteins, some of which are progenitors of enzymes. These proteins can be gradually activated by antibody-antigen
interactions, stopping the foreign material from doing harm.

5) neutralizing toxicity.

6) getting rid of infections.

The Importance of Milk in Preventing Infection

Mother's milk not only provides nourishment for infants but also protects them against disease. Mentioned several studies that showed the benefits of human milk for young children. One study that was cited found that bottle-fed infants had greater rates of morbidity for gastrointestinal disorders, respiratory infections, and otitis media than did breastfed infants. Bottle-fed infants also tended to have longer-lasting illnesses and greater death rates. An alternative study found that compared to bottle-fed infants, breastfed infants between the ages of three months and one year experienced a lower incidence of acute infections, otitis media, fever upper respiratory infections, and acute diarrhea. Furthermore, studies on the connection between feeding and infections in newborns have shown that the incidence of diarrheal illnesses decreases during the first few months of exclusive breastfeeding but rises as weaning progresses (Skolnick & Miklavcic 2020, Perdijk et al., 2018, Darand et al., 2022). They highlighted studies showing how feeding newborns raw breast milk quickly stopped an enterocolitis epidemic caused by *Escherichia coli* 0111-B4. They also offered some ancillary evidence in favor of the theory that breast milk can prevent septicemia and meningitis. Infants fed formula who died suddenly and unexpectedly from baby botulism were fed at the time of death. Conversely, breastfed infants constituted a disproportionate number of hospitalized cases of baby botulism. Since all of the aforementioned trials were carried out in populations with adequate sanitation, it is possible that human milk reduced the severity of infant botulism at the beginning and allowed for hospitalization, while infant formula may have allowed for an abrupt onset and unanticipated death (Brumini et al., 2016, Hwanget et al., 2021, Lee & Binns 2020). When malnutrition and poor sanitation are present, the effects of breast milk might not be as great for humans. Studies show that mothers who are malnourished typically make less milk, which decreases the protective properties of the milk. Although the precise mode of action is yet unknown, human milk may offer protection through a number of immunologic components that may promote normal bacterial colonization of the gastrointestinal (GI) tract and limit the invasiveness of some pathogenic microorganisms (Hwang et al., 2021, Alotiby 2023, Lee & Binns 2020).

Health Benefits of Milk Immunoglobulins

One of the main health benefits of bovine immunoglobulin is that it can prevent any gastrointestinal (GI) diseases due to its action. Studies have revealed that components from milk like immunoglobulins provide health benefits. It was determined that mice are protected by immune colostrum antibodies from the bacteria *Helicobacter felis* extracted from immunized cows (Arslan et al., 2021, Ulfman et al., 2018). Scientists have proved that these antibodies act as a barricade within the body of these children and mice, giving an impediment to the multiplication of this bacterium (Ulfman et al., 2018, Mehra et al., 2006). Research reveals that the consumption of the living bacteria can give a chance to decrease *H. Pylori* induced infections (Hurley & Theil 2006). Considering this, the role of the probiotic microorganisms as well as the immunoglobulins is, therefore, coordinating to the process of healing. Recent research showed that *Bifidobacteria spp.* Is present. In a yogurt beverage, the drinking of which can support the balance of intestinal microbiota. Their first attempts with yogurt that contains both *L. acidophilus* and probiotic were somewhat disastrous but not discouraged by this, they persevered and launched a successful business. We would compose this yogurt from blended milk, egg yolks and 1% of special immunoglobulin y molecular compounds isolated from hens that were immunized against the urease enzyme —
one of the potent toxins of Helicobacter pylori. Once introduced to people who are positive for *H. pylori* and those who consume Igy-enriched yogurt, urea breathe test readings showed an alteration in the related process of urease enzyme activity (Hurley & Theil 2006).

The new effect of bone development and bovine colostrum having the similar immunoglobulin have been found out, and the iron chelating bacteria may be prevented from binding to receptor citrate (Mehra et al., 2006, Hurley & Theil., 2006). Studies have revealed that the presence of iron is crucial for the metabolic and survival activities of *E. coli*, as IgG increases the bacteria’s uptake and impairs its growth. In spite of iron citrate receptor inhibited by the injected cows with the receptor antidote, ferric citrate-caused mastitis being sensitive did not change a lot. In experiments with mice, oral administration of an immunoglobulin-enriched colostrum product derived from *enterohaemorrhagic E. coli* O157:H7 infections with reduced the adhesion and growth of bacteria to the intestines by 89% (Kaplan et al., 2022).

To cover neonates in Iraq, a feeding experiment of casein-based baby formula blended with colostrum immunoglobulin concentrate from healthy cows or those vaccinated against *E. coli* were conducted. It turned out that the group which receives the formula containing the immunoglobulin concentration had a pretty lower probability of the patients in this group being diagnosed with the diarrhea during the follow-up period compared to the control group. The control group had 3,5 diarrhea incidences while the immunoglobulin formula level group had only 1,9 incidences of diarrhea. Nevertheless, the other control group survivors had diarrhea lasting 6.5 days on average compared to the immunoglobulin and protein rich formula group which only had diarrhea on average for 4.5 days (Islam et al., 2023, Liu et al., 2023).

It is assumed that relying on colostrum Ig preparations from cows inoculated on a basis of the particular Sh. Is psychologically one factor that may contribute to the case of avoiding *Shigellosis flexneri* antigens (Kaplan et al., 2022, Czosnykowska-Łukacka et al., 2020). As opposed to I, when learning a new language as an adult, for kids who are already have the established language requirement is it quite easy for them to learn. By treating kids of infection with 100 ml colostrum-based hyper immune preparation against *Shigella*. Patients were given oral dysenteriae antigen I of 3 times a day for 3 days, but there was no difference in any parameter of patients treated with the control preparation and bacteria.

After administration of antibiotics, *C. difficile* areas evict and it releases its two forms of exotoxins known as A and B. Hence, colitis and severe infectious diarrhea develops from this. It has been evidenced that experimental diarrhea of *C. difficile* in a hamster model can be effectively handled by the preparation called immunoglobulin made from bovine colostrum, a type of milk produced by cows that were introduced with toxins A and B. A product including serums from immunized-cows against *C. difficile* toxins and *C. difficile* whole cell was given as a support to an antibiotic regime for two weeks in a pilot uncontrolled experiment. Nine of the 16 patients received recurrent diarrhea due to *C. difficile* during more than one session of their disease. Regarding them, the results were impressive; following regimen, all but one patient had no toxins in the stool, while during the 11-month follow-up period, no patient had come back with diarrhea related to *C. difficile*.

Earlier it has been shown that diets which contain milk proteins are associated with lowering cholesterol in people who have hypercholesterolemia, that is, a basal level of increased risk for cardiovascular disease. When 40 tested patients with mild hypercholesterolemia for two months, their serum total cholesterol dropped to 5.98 or 5.97 mmol L⁻¹ from the initial 6.33 mmol L⁻¹, when they received 5 g of blood-derived bovine Ig fraction daily for three or six weeks. The trial conducted with a placebo-controlled experiment. Blood concentration of "bad" cholesterol at the baseline was measured in mmol L⁻¹ and was 4.12 mmol L⁻¹. It decreased
below baseline due to the treatments and was 3.92 and 3.84 mmol L⁻¹. This result certainly looks as good as the mechanism is not yet understandable.

Throughout the additional surgical procedure, one also can experience endotoxemia and an acute phase reaction when intestinal endotoxins that are through bacterial products translocation into the blood. Chong et al., (2022, LeMaster 2023) administered 40 participants with the colonial preparation of Lactobin® or placebo in 52g per day divided in 4 parts before surgery with an abdominal appendix. One day before surgery took 2 shots of the antibiotics mezlocillin and metronidazol. The evidence indicated how the Lactobin® group had less endotoxin levels in the blood and endotoxin neutralizing activity than the placebo group. The authors report that Peritonitisogenic endotoxemia was abolished because of colostral pretreatment which serves as an indicator of stabilizing gut barrier throughout surgery. In a different clinical trial, sixty patients undergoing cardiac bypass felt the benefits of the bovine colostral preparation with 42 grams given daily, starting two days before the surgery (Östertag & Hinrichs 2023, Mollea et al., 2013). The survey results were in accordance with the fact that colostral preparation decreased CRP levels during the postoperative period rather than during the preoperative endotoxemia. It is in question if the former phenomenon (colon-Inaduiggs sequestering membrane-tearing endotoxins the intestine or growth-stimulation of the gut barrier) can be cheered as the main cause.

The new colostrum product named intactTM decreased insignificantly the odds of respiratory tract infections in grown-up males after commencing oral administration. The authors suppose that colostrum-borne native growth factors, instead of intravenous immunoglobulins (IgS), are the ones to be responsible for the effect (Ceniti et al., 2023, Östertag & Hinrichs 2023).

Other Immunoglobulinic Agents in Milk

Milk used to be an essential given for the immune system since it provided non-specific protection through immunoglobulins as well as other substances, the defense of which should not be overlooked (Kaplan et al., 2022, Poonia & Shiva 2022). This group of molecules, namely bifidus growth factor, lysozyme, lactoferrin, oligosaccharides-glycoconjugates, antiviral lipids, neutrophils, and macrophages, are beneficial to the immune system health. The so called bifidus growth factor (hereafter BGF), which is methyl-N-acetyl-D-glucosaminide, is able to promote Lactobacillus bifidus development that is a bacterium that benefits much the gut flora (Pietrzak, & Kamelska 2020). Other pathogens like the Shiggella can mean great losses of bifidobacteria population in the gut (Poonia & Shiva 2022). Antibacterial lipids present in milk interact and impede housed viruses while oligosaccharides-glycoconjugates promote competition among WHO health guidelines promotion, prevention, and control of non-communicable diseases.

In addition to lysozyme is another substance usually called muramidase which acts on β-1,4-glycosidic bonds thus breaking down glucose peptides or peptidoglycans and, consequently, damaging the cell walls of their bacteria. Human and cattle milk lysozyme could fight both Gram positive and Gram negative bacteria but chicken eggs lysozyme works only against Gramm-Positive bacteria (than gram-negative ones). Iron-binding protein gets its name “lactoferrin”, which prevents the proliferation of E. coli, C. albicans, and other organisms requiring iron in a regular life cycle. There is strict oxidation-reduction regulation in Gram-negative bacteria, which requires twice more iron than beneficial lactobacilli. Lactoferrin, by destroying harmful bacteria and promoting bacterial growth of the good ones, during your infantile phase is responsible for your immune development. He curbed how lactoferrin would be active due to high levels of iron in its system because it reduced how effectively they worked when bound (Pietrzak & Kamelska 2020, Erliana & Fly...
This lactoferrin exists in an unsaturated form, therefore, its action to be inhibited through the actions of digestive enzymes such as like pepsin, trypsin, and chymotrypsin. The presence of neutrophils and macrophages in milk has this phagocytic activity, which is utilized to neutralize foreign invaders (Borewicz 2019). Besides milk contains a fatty acid resistance factor which combats staphylococci and leucocytes which provide protection against intestinal and breast infections (Borewicz 2019).

**Conclusion**

The purification and fractionation stages of collecting colostrum and cheese whey have consequently succeeded in producing commercial immunoglobulin (Ig) formulations which boast to have better health potential especially in humans and animals (Ghosh & Iacucci 2021). Strategies, which entail cow immunization programs, targeted at elevating specific antibodies, have been implemented (Chong et al., 2022). This result in producing immunity globulins in milk, which would be useful in human healthcare.

Considering the phenomenon has the low risk of side effects, allergic reactions connected with whey proteins stay the main issue. Countries categorize biologics in different ways: some prefer to place them in drug category, but not all consider them as drugs or well-established (Ghosh & Iacucci 2021). What colostrum and milk Igs do effectively is preventing the infection from sticking on the epithelial mount's integrity, which is essential to ensure diseases' regression. There was the positive effect of drinking the bovine milk or the colonic Igs that proved that mouth infections are prevented from this process. Nonetheless, treatment of existing infections has been associated with positive results only in protracted changes of attachment and reinfection such as probably in GI tract or oral cavity or where particular IgS are responsible of neutralizing inflammatory substances or toxins.

Diarrhea is certainly a critical killer and disabler among children under five years in underdeveloped countries. To fix it, the proactive steps to suppress diarrhea and improve health overall may be needed, the more so when college students are resistant to antibiotics. Technological innovations, like the provision of a fortified feed (containing colostrum or bovine milk) to pigs or chicks with a balanced probiotic mix, can promote piglets' future health and wellbeing. On top of that, colostrum includes also the other bioactive substances such as lactoferrin and growth factors allowing their authors to create pills, which treat gastrointestinal disorders (Ostrom et al., 2002, Pickering et al., 1998).

Recent discoveries in different ways of colostrum and cheese whey concentration, and luckily deduction of commercial Ig formulations that have many potential functions in human health were possible. Although the risk of side effects seems to be low, as the regulatory process continues, the occurrence of negative effects cannot be fully cleared off. Colostrum will be an effective preventive measure for infections and may find application when treating a number of medical conditions. Together with an addition of probiotics and other beneficial compounds already leads to the future healthy lifestyle and treatment of intestinal disorders (Ceniti et al., 2023, Ostertag & Hinrichs 2023).

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