



# Neovite Dairy Colostrum as Functional Food

Colostrum is the milk that is first produced by a mother after giving birth. It plays a key role in the normal early development of mammals by providing substances that are important for nutrition, immunological defence and healthy growth and development.

Commercially available colostrum is usually produced from cattle. The composition of colostrum changes continuously throughout the suckling period. Commercial colostrum is usually obtained within the first 48 hours after birth, when it is particularly rich in immunoglobulins, antimicrobial peptides and growth factors.

There is a body of evidence showing the benefits that colostrum preparations have on exercising adults including but not limited to bolstering immune responses and maintaining gut integrity. Colostrum is receiving an increasing amount of interest in the healthcare community because of the potential benefits it can offer to clinical and/or older populations who may otherwise benefit from the effects of a period of supplementation (e.g. improved immune response).

Several different colostrum products are currently available within the UK. Colostrum (UK) Ltd, the market leaders with the top retail product, Neovite, are also wholesalers to other brands.

This document will discuss the major elements found in colostrum, before highlighting the evidence to support its use in a variety of clinical populations.

# Colostrum principal components

Colostrum contains a range of molecules that influence how cells grow, function and repair themselves. It also contains a number of elements that are part of, or can influence, the immune system. In this section we discuss the key constituents that make colostrum so valuable for patients.

## Protein Growth and Healing Factors

Growth factors are usually small proteins that have been shown to stimulate the growth of cells in the laboratory. However, they have many other actions on gut health and repair, maintaining the Tight Junctions between gut cells. Some of the more important ones found in colostrum are listed below:

- Epidermal Growth Factor (EGF). This group of small proteins are thought to aid gut wall repair.
- Transforming Growth Factors (TGF). These proteins activate tissue and cell growth, maturation and repair. Some are present in high concentrations in colostrum.
- Insulin-like Growth Factors (IGF). These proteins promote cell growth and maturation with potentially wound healing characteristics.
- Platelet-derived growth factor (PDGF). This has been linked to development and growth in the gut.
- Vascular endothelial growth factor (VEGF). This has been linked to the growth of blood vessels around the gut in developing infants or animals.

## Antimicrobial Factors

When a damaging virus, bacteria or other microbial agent enters the body, a series of defence mechanisms come into play. These include non-specific antimicrobial enzymes that ward off microbes, immune modulators that warn the body that microbes are present, and more specific proteins that target these disease causing pathogens. Colostrum contains many of these elements, allowing it to encourage the development and support the immune system of newborn calf but also due to their homology have the potential to influence other species (e.g. humans). The key antimicrobial and immune factors present in colostrum are described below.

### Immune modulators

Colostrum contains a number of different molecules called cytokines. Active at very low concentrations, cytokines are proteins that change (or modulate) how a cell behaves, especially during times of stress. For example, cytokines can affect what a cell does when there is inflammation or an infection. In newborn infants, these factors are likely to influence how the immune system develops, in combination with antibodies from the mother.

### Lactoferrin

Lactoferrin is an antimicrobial protein that binds to iron molecules and can transport them across the gut to the bloodstream. When binding to iron, it prevents bacteria from using it to grow freely. Lactoferrin also binds to bacterial walls causing the cell to break down. Lactoferrin has also been shown to stimulate growth in the laboratory, and it is thought it may regulate gut growth in developing newborns.

### Immunoglobulins

Immunoglobulins, or antibodies, are part of the body's immune system. These are homing proteins that target bacteria, yeasts or viruses. Bovine colostrum is a rich source of the IgG, one the body's most important types of immune response. It also contains high concentrations IgA, which helps protect against a number of viruses and bacteria. Together with other antimicrobial factors, it is thought that these may contribute to colostrum's ability to affect the immune state within the gut.

# Potential uses of colostrum

Recent studies suggest that the peptide growth factors, the immunological factors and antimicrobial proteins contained within colostrum might provide novel therapeutic opportunities for a range of patients.

In many cases the benefits seem to be holistic - the benefits may not be from one individual element of colostrum, but rather the product as a whole. While scientists are continuing to investigate how and why colostrum is so beneficial, there is already a solid body of evidence to support its use in a variety of patient groups. We describe the most exciting research below that has implications for older and patient populations.

## Maintaining intestinal mass and integrity

The cells of the body are constantly turning over and an equilibrium is normally established between cell production, and loss. Some patients have an insufficient length of bowel to digest and absorb food adequately, usually as a result of having undergone major surgery where a large proportion of the bowel has had to be removed. Artificial feeding is very unpleasant and new treatments are therefore being investigated.

There is evidence that growth factors may be useful to stimulate the growth of the remaining bowel. Colostrum supplementation may be of particular value in young children who have undergone intestinal resection, as gut adaptation during early childhood may be more responsive than adults.

## Strengthening the gut barrier

In a healthy gut, the intestinal barrier prevents endotoxins like lipopolysaccharides (from resident gut bacteria) and other factors escaping into the body. However, if gut permeability is allowed to increase, these factors 'leak' into the blood, where they can trigger inflammatory reactions in the body. This can contribute to symptoms like cramping, diarrhoea, nausea, heat-stroke in acute cases or to auto-immune diseases in chronic cases.

Gut permeability is thought to increase in intensive training athletes such as long-distance runners, as well as in other patient groups such as people with Crohn's disease, coeliac disease, diabetes or inflammatory bowel disease. It leads to food intolerances like casein and gluten.

Colostrum contains multiple factors that may be useful in reducing gut permeability, including growth factors and cytokines. There is now increasing evidence suggesting that colostrum can help to stimulate growth and repair in the gut lining, helping to reduce gut permeability and associated symptoms such as autoimmune disorders.

## Countering non-steroidal anti-inflammatory drug (NSAID)-induced gut injury

NSAIDs are the strong painkillers often prescribed for conditions such as arthritis or musculo-skeletal injury. Unfortunately, about 2% of people taking NSAIDs for one year will suffer from gastrointestinal side effects which include bleeding and perforation of the stomach and intestine (1). Acid reducing drugs have been shown to be effective in reducing stomach injury caused by NSAIDs, but, unfortunately, they are less efficacious in preventing the injury in the small intestine where food is absorbed.

How could colostrum help? A recent study has shown that taking a colostrum preparation reduced the amount of small intestinal injury (assessed by following the 'leakiness' or permeability of the bowel) in human volunteers taking standard doses of the NSAID drug indomethacin (2).

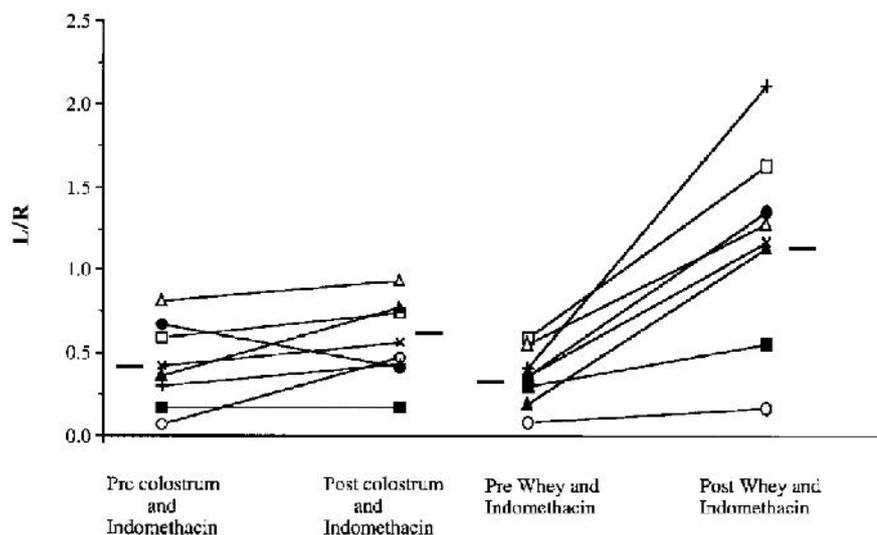


Figure showing that indomethacin makes the bowel leakiness increase by about three-fold, whereas taking colostrum prevents this happening (2).

### Reducing heavy exercise-induced gut permeability

Athletes undertaking high intensity training such as long distance runners are at risk of increasing levels of gut permeability, leading to GI symptoms and 'heat stroke'. However, a recent study showed that colostrum limited the increase in gut permeability after intensive exercise by up to 80% in healthy athletes (3). The research suggests that colostrum can be a valuable tool to limit gut permeability and maintain gut stability in this group, aiding recovery from exercise and cutting the risk of heat stroke.

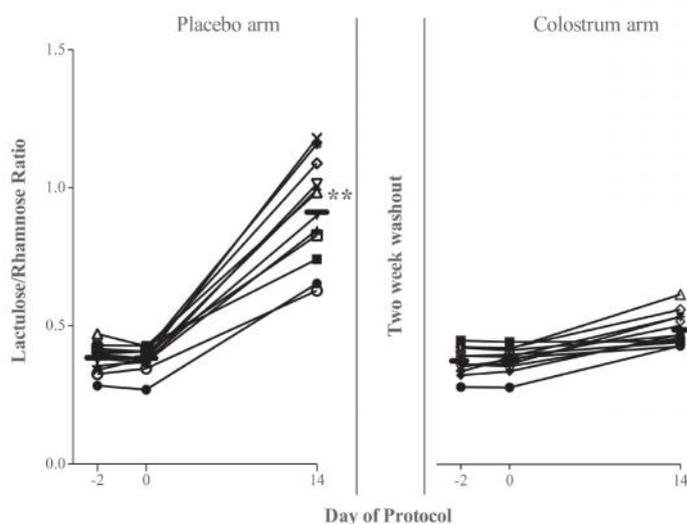


Fig. 3. Gut permeability assessments during trial shown in Fig. 1. Two baseline assessments (no exercise) were performed before each arm and at the end of 14 days ingestion of placebo or colostrum. The third value for each arm of the study was performed immediately after the subject had followed a 20-min 80% maximal oxygen uptake ( $\dot{V}O_{2max}$ ) protocol. Black bars show mean value for each time period. \*\* $P < 0.01$  different from baseline for that arm. \$\$ $P < 0.01$  compared with equivalent period in opposite arm.

Figure showing lactulose/rhamnose ratio - a measure of gut permeability - in participants receiving placebo or colostrum during a physical stress model (3).

### Moderating Inflammatory Bowel Disease

Inflammatory bowel disease causes severe pain, diarrhoea and sometimes weight loss. The two main forms are ulcerative colitis and Crohn's disease. The exact cause of these conditions is unknown and treatment therefore often consist of powerful drugs such as steroids which may, if taken for prolonged periods, cause many side effects.

However, a recent small clinical study (double-blinded placebo controlled randomised trial) has shown a beneficial effect of colostrum when administered via the enema route to patients with distal colitis (4). The improvement in symptoms appears to be due to repair stimulated in the intestinal lining by growth factors, and other molecules, present in colostrum.

## Improving muscle mass and strength

Existing research suggests that colostrum may have a role to play in improving strength and muscle mass in healthy adults.

For example, a recent study investigated the impact colostrum had on the performance of a group of athletes (5). It was found that, compared with a placebo, volunteers who received colostrum showed an improvement in fat free mass (FFM) - that is, the total mass of bone, muscle and any other non-fat element of the body. This is a strong indicator for improved body strength and stamina. The volunteers also showed an improvement in the maximum weight they could lift in one go (1RM).

When combined with creatine, (a supplement used to supply more energy to muscles during intensive training, the results) were even more impressive. The participants showed significant improvements in not only FFM and 1RM, but in reduction of percentage body fat, and improved maximum height jumped and agility over 20 yards. The improvements happened over just six weeks. Along with the benefits that colostrum provides on its own, the authors note that, by improving GI function, colostrum could be valuable tool for increasing the absorption of other nutrients.

Improved strength and muscle mass can be helpful in elderly patients who may also be recovering from surgery or in bed rest. In this group, absorbing nutrients, gaining strength and becoming mobile is vital. Better muscle development is also likely to help reduce the risk of falls, which can be especially serious in the frailer members of this patient group.

## Supporting the immune system

Below we describe some of the evidence to support colostrum for enhancing the body's immune response.

### Infective diarrhoea and other microbial infections

Most cases of diarrhoea caused by bacteria will get better on their own, although occasionally a short course of antibiotics may be appropriate. However, in patients with a weakened or stressed immune system, colostrum may also help.

Colostrum has already been shown to help reduce gut infections in both patients and veterinary practice. For example colostrum has been demonstrated to be an effective treatment in HIV-associated diarrhoea (6, 7). Furthermore, following vaccination of cows with specific viruses or bacteria, researchers have produced 'hyper-immune' colostrum, which helps to prevent and treat gut infections due to *E. coli* (8) and rotavirus (9). In addition, without prior Colostrum has the added value of being able to potentially stimulate the repair process through the presence of growth factors, as well as helping to fight the infection with the other antibacterial factors that are present.

A number of other reports support the potential of colostrum for the prevention and treatment of microbial infections in the gut (10), both by supporting the immune system (11) as well as fighting the microbe itself. For example, researchers found that healthy volunteers given bovine colostrum had a stronger antibody response to a weakened *Salmonella* vaccine (12).

### Upper respiratory illness

Lab studies using both animal and human cells suggest that colostrum may affect cytokine levels, stimulating immune responses (e.g. enhancing the activity of white blood cells) thereby aiding pathogen removal.

In general, if these effects become apparent when humans supplement consume colostrum one would expect a reduction in infection/illness rates, and recent research supports this view. A placebo controlled trial, carried out by the Department of Sport and Exercise Science at Aberystwyth University, showed that, when taken daily, colostrum is able to cut upper respiratory illness (URI) such a coughs and colds in physically active men (13).

The team studied the effect of colostrum in a group of athletes over the winter months, and found a significant reduction in episodes of URI compared with those who received a placebo. They also found that an increase of bacteria in saliva (seen in placebo group) was blunted in those receiving colostrum.

The authors that the colostrum may act as a 'nutritional counter measure' to the stresses placed on the immune system by exercise (i.e. preventing the risk of illness and disturbance to resident bacteria). Previous and more recent human trials by the team at Aberystwyth have shown that colostrum improves white blood cell functions and prevent a reduction in antimicrobial proteins in the saliva (14, 15).

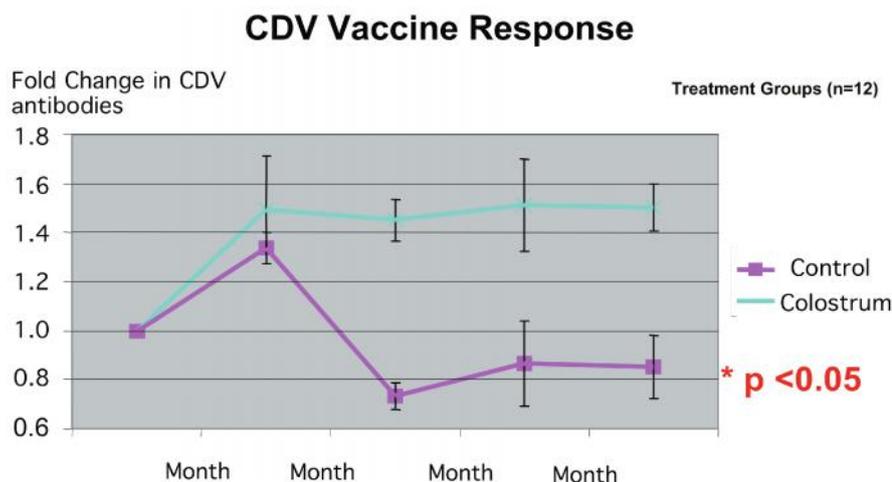
This trial, like many others, uses physical training to stress the immune system and test how well it recovers. URIs are a common condition in other certain patient groups, such as in the elderly who may have weaker immune responses, in those recovering from surgery and/or other at risk groups who may require enhancements in responses to the more conventional preventive measures (e.g. vaccinations). The potential role of colostrum in supporting these patients has already been highlighted by supplementation with colostrum alone or in combination with another immunomodulator being more effective than vaccination in preventing influenza like episodes (16, 17).

## Influencing the gut microflora

A key aspect to any healthy immune system is a vibrant and diverse microflora. The microflora consists of billions of beneficial bacteria that live within the intestine. It is critical to the body's immune system, by competing with and limiting the growth of potential pathogens in the GI tract.

While the gut is initially sterile at birth, colostrum is thought to help promote and balance intestinal microflora. Research suggests that colostrum also actively stimulates immune defences in the intestinal lining, both in newborns and, potentially, in adults.

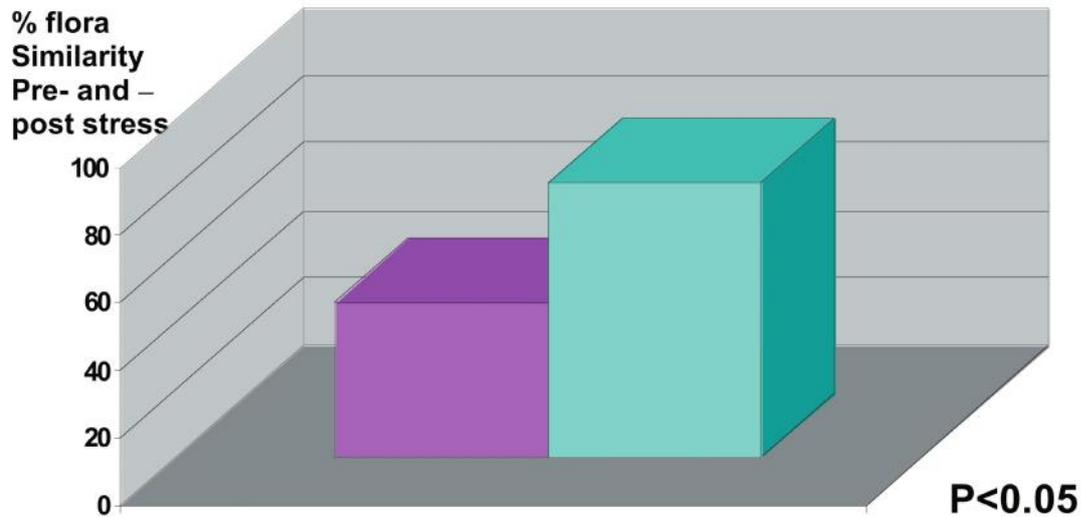
For example, recent animal trials have shown that colostrum boosts the immune system's response to viral exposure (a CDV vaccine), whilst stabilising the microbial population in the microflora. The microbial populations were more stable and consistent after stress in animals who received colostrum (18).



[reproduced from Nestle Purina published study]

In this canine trial a CDV vaccine inoculation was used to test the immune response to antigens (18)

## Dogs fed colostrum had more stable microbial populations



[reproduced from Nestle Purina published study]  
Colostrum was found to stabilise gut microflora (18).

## Conclusion: Neovite for support and recovery

There is now extensive evidence of bovine colostrum's biological activity in a laboratory setting, and increasing data from individuals and clinical trials of its value for immune and gut health.

By boosting the body's immune response, encouraging growth and repair in the gut, stabilising gut microflora and supporting better nutritional absorption and muscle growth, colostrum has the potential to benefit a variety of patient groups. These include:

- Elderly patients during bed rest
- Elderly or patients with a weakened immune system, for example as a result of the decline in immunity with aging, HIV infection or as a result of certain immunosuppressive medicines.
- Patients with inflammatory bowel disorders
- Patients following bowel surgery
- Patients undergoing or recovering from chemotherapy and radiotherapy

As one of the country's leading colostrum products, Neovite has the potential to benefit a wide range of patients. This natural foodstuff has been shown to bolster the immune system, prevent and treat a variety of disorders and recover body strength. Dairy colostrum can play a valuable and cost-effective role across the NHS, for example, in the care of GI disorders and in elderly patients recovering from surgery whose safe return to their own home and prevention of re-admission can save the cost of hospital beds or residential care.

## References

1. MacDonald TM, Morant SV, Robinson GC, et al (1997). Association of upper gastrointestinal toxicity of non-steroidal anti-inflammatory drugs with continued exposure: cohort study. *BMJ*, 315, 1333-7.
2. Playford RJ, MacDonald CE, Calnan DP, Floyd DN, Podas T, Johnson W, Wicks AC, Bashir O, Marchbank T (2001). Co-administration of the health food supplement, bovine colostrum, reduces the acute non-steroidal anti-inflammatory drug-induced increase in intestinal permeability. *Clin Sci (Lond)*, 100, 627-33.
3. Marchbank, T, Davison, G, Oakes, JR, Ghatei, MA, Patterson, M, Moyer MP, Playford RJ (2011). The nutraceutical bovine colostrum truncates the increase in gut permeability caused by heavy exercise in athletes. *Am J Physiol Gastrointest Liver Physiol*, 300, 477-484.
4. Khan Z, Macdonald C, Wicks AC, Holt MP, Floyd D, Ghosh S, Wright NA, Playford RJ (2002). Use of the 'nutraceutical', bovine colostrum, for the treatment of distal colitis: results from an initial study. *Aliment Pharmacol Ther*, 16, 1917-22.
5. Garguilo F, Roberts, J. The Effect of Bovine Colostrum and Creatine Monohydrate Supplementation on Performance Characteristics in Male Athletes.
6. Florén CH, Chinenye S, Elfstrand L, Hagman C, Ihse I (2006). ColoPlus, a new product based on bovine colostrum, alleviates HIV-associated diarrhoea. *Scand J Gastroenterol*. 41, 682-6.
7. Kaducu FO1, Okia SA, Upenyho G, Elfstrand L, Florén CH (2011). Effect of bovine colostrum-based food supplement in the treatment of HIV-associated diarrhea in Northern Uganda: a randomized controlled trial. *Indian J Gastroenterol*, 30, 270-6.
8. Tacket CO, Losonsky G, Link H, et al (1988). Protection by milk immunoglobulin concentrate against oral challenge with enterotoxigenic *Escherichia coli*. *New Engl J Med*, 12, 1240-43.
9. Ebina T, Ohta M, Kanamaru Y, Yamamoto-Osumi Y, Baba KJ. (1992). Passive immunisations of suckling mice and infants with bovine colostrum containing antibodies to human rotavirus. *Med Virol*, 38, 117-123.
10. Seifert J, Molkewehrum M, Desser S, Neberman L, Schulze C (2002). Endotoxin inactivation by enterally applied colostrums of different composition. *Eur Surg Res*, 34, 68-72.
11. Cross ML, Gill HS (1999). Modulation of immune function by a modified bovine whey protein concentrate. *Immunol Cell Biol*, 77, 345-350
12. He F, Tuomola E, Arvilommi H, Salminen S (2001). Modulation of human humoral immune response through orally administered bovine colostrum. *FEMS Immunology Med Microbiol*, 31, 93-96.
13. Jones AW, Cameron SJ, Thatcher R, Beecroft MS, Mur LA, Davison G (2014). Effects of bovine colostrum supplementation on upper respiratory illness in active males. *Brain, Behavior and Immunity*. 39, 194-203.
14. Davison G, Diment BC (2010). Bovine colostrum supplementation attenuates the decrease of salivary lysozyme and enhances the recovery of neutrophil function after prolonged exercise. *British Journal of Nutrition*, 103, 1425-1432.
15. Jones AW, Thatcher R, March DS, Davison G (2015). Influence of 4 weeks of bovine colostrum supplementation on neutrophil and mucosal immune responses to prolonged cycling. *Scandinavian Journal of Medicine and Science in Sports*, DOI: 10.1111/sms.12433.
16. Cesarone MR1, Belcaro G, Di Renzo A, Dugall M, Cacchio M, Ruffini I, Pellegrini L, Del Boccio G, Fano F, Ledda A, Bottari A, Ricci A, Stuard S, Vinciguerra G (2007). Prevention of influenza episodes with colostrum compared with vaccination in healthy and high-risk

cardiovascular subjects: the epidemiologic study in San Valentino. *Clin Appl Thromb Hemost*, 13, 130-6.

17. Belcaro G, Cesarone MR, Cornelli U, Pellegini L, Ledda A, Grossi MG, Dugall M, Ruffini I, Fano F, Ricci A, Stuard S, Luzzi R, Grossi MG, Hosoi M (2010). Prevention of flu episodes with colostrum and Bifivir compared with vaccination: an epidemiological, registry study. *Panminerva Med*, 52, 269-75.

18. Beneficial effects of colostrum supplements in the diet for puppies and kittens. Jean-Philippe C. European Scientific communication manager, Nestlé Purina PetCare