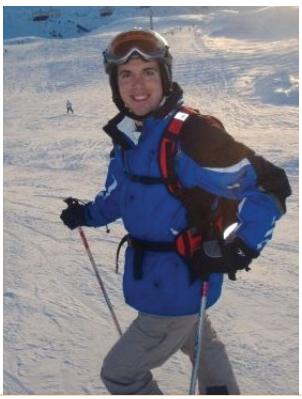
The Use of Probiotics in Children



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Probiotics have been defined as 'live microorganisms which when administered in adequate amounts confer a health benefit on the host'[1]. The probiotic concept is not a new one, and in fact it was early in the last century that Metchnikoff highlighted the possible benefit of fermented milk products. He recognised the possibility of modifying the microflora in our bodies by replacing the harmful microbes by more useful ones[2]. In 1906, Tissier[3] also noted how the administration of probiotic bacteria was protective against the likelihood of diarrhoea in children.

Within the past decade, there has been an increasing amount of interest in the use of probiotics for several paediatric conditions. The main gastrointestinal conditions for which probiotics have been used in children include antibiotic-associated diarrhoea, infectious (viral and bacterial) diarrhoea and necrotising enterocolitis (NE). Probiotics have also been used in several extraintestinal disorders including atopic dermatitis and recurrent urinary tract infections.

The Intestinal Microflora

The human foetus has a sterile gastrointestinal tract at birth. After birth, an infant is exposed to numerous species of microorganisms, which begin to colonise the intestinal tract. The colonising bacteria can originate from the birth canal during delivery, from contact with other humans as the infant grows older, as well as from the surrounding environment. There are many factors[4,5] which can influence the development of an infant's normal intestinal microflora including:

Extrinsic Factors	Intrinsic Factors
Gestation length	Underlying neonatal health
Type of birth (vaginal or surgical)	Immunological status
Source of nutrition (bottle or breast fed)	Gastrointestinal transit time
Dietary intake of mother	Gastrointestinal pH
Probiotic usage of mother	Stress

There is often a predictable pattern to the colonisation of a healthy infant's gastrointestinal tract[6]. Premature infants develop a different pattern of colonisation and they are generally slower to acquire *Lactobacillus*[7] species as well as being more susceptible to the colonisation of the intestinal tract by pathogens. It is also possible that infants who are born via caesarean section may have a delayed microbial colonisation, as they are not exposed to the maternal microflora in the birth canal.

The source of nutrition can influence the infant's microbial balance: those that are fed milk formula generally have higher concentrations of *Enterobacter* species initially, whereas infants receiving breast milk have higher concentrations of *Bifidobacterium* species[8]. Infant formulas which contain probiotics are now available in many countries, reflecting the approach to manipulate the microbial balance.

The two most important species of bifidobacteria are *Bifidobacterium bifidum* and *Bifidobacterium infantis*. While both play a major role in human health, *B. infantis* is the only species of which all known strains are infant specific. In addition to this, the majority of cultivatable microflora in the large intestine of breast fed infants are bifidobacteria.

Coloured scanning electron micrograph of *B. infantis*, which is the main bacterial species found in the large intestine of infants.

Probiotic Applications in Children: The Gastrointestinal System

Probiotics have been used in various gastrointestinal diseases. The non-pathogenic lactic acid bacteria (i.e. Gram-positive bacteria that produce lactic acid) are the most widely used probiotics, with *Lactobacillus* spp. and *Bifidobacterium* spp. being the most researched.

Infectious Diarrhoea:

The use of probiotics in children with infectious diarrhoea is a primary area of research. Infectious gastrointestinal disorders include both viral and bacterial causes.

Viruses can be a cause of acute diarrhoea in children and there are numerous studies looking into the use of probiotics in groups suffering such viral infections. The probiotic species used in these studies included *Lactobacillus casei* ssp. *rhamnosus, Lactobacillus reuteri, Lactobacillus acidophilus* and a combination product of *Streptococcus thermophilus, L. acidophilus* and *Lactobacillus bulgaricus*[9]. The use of probiotics led to a decreased severity and duration of diarrhoea when administered alone or together with oral rehydration therapy. Probiotics have also been shown to decrease the duration of diarrhoea in children with rotaviral infections[10].

Antibiotic-associated Diarrhoea:

Probiotics may also ameliorate the effect of antibiotic-associated diarrhoea (AAD). In paediatric patients bacterial infections are relatively common (conditions include otitis media and sinusitis) and antibiotic treatment is often prescribed. The use of antibiotics in children is probably the single biggest reason for an alteration in their intestinal microflora, with broad-spectrum antibiotics being particularly responsible. For this reason AAD is a frequent issue. During antibiotic therapy, an increased frequency and decreased consistency of stools is often a manifestation of AAD.

Positive effects have been seen when using *L. casei* ssp. *rhamnosus* in children with AAD. In one double-blinded trial[11], 119 children (mean age 4.5 years), demonstrated significantly fewer incidences of diarrhoea with the probiotic (5%) compared to without (16%). In another study, the same probiotic was shown to significantly reduce stool frequency and increase stool consistency in children[12].

The Immune System

There has also been research published looking into the effect of probiotics on the systemic immune system of children. It is the immunomodulatory effect that probiotics may have which has led to their use in the treatment of atopic disorders such as eczema. Studies in infants with eczema have shown that when using probiotics, both a reduction in severity of eczema was seen, as well as a decrease in gastrointestinal symptoms[13]. Other conflicting research, reporting that probiotic supplements did not reduce the incidence of atopic dermatitis, has been published[14]. A recent meta-analysis[15] concluded that probiotics appear to be more effective in preventing atopic dermatitis than treating it. More research is needed in this field before recommendations can be made for the use of probiotics in atopic dermatitis.

Other studies have identified an enhancement in the antibody response to vaccines when probiotics were given to children. In Finland, an enhanced response to rotavirus vaccine was seen in children given *L. casei* ssp. *rhamnosus*[16].

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Other Applications

Necrotising Enterocolitis:

It is thought that the altered intestinal colonisation, which can be seen in premature infants, may contribute to the development of necrotising enterocolitis. *L. acidophilus* and *B. infantis* have both been shown to decrease the incidence of this condition in neonates[17,18]. It has also been suggested that the benefit of using probiotics in infants with necrotising enterocolitis is due to an alteration in the activation of the inflammatory cascade.

Although the use of probiotics for this application appears to be a promising area, more studies are needed to confirm these findings.

Urogenital Infections:

Probiotic bacteria are able to colonise the urogenital tract as well as the intestine. There are a few reports where probiotics have been used to prevent the colonisation of the urinary tract by pathological organisms in children[19].

Conclusion

The use of probiotics in children has been an area of increasing interest over the last decade. The best documented use of probiotics is for the treatment and prevention of infectious and antibiotic-associated diarrhoea. The use of probiotics for urogenital and atopic disease requires further research but these applications hold promise for the future.

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Ian completed his degree in Veterinary Science at The University of Bristol in 2009. He joined Probiotics International as a Technical Advisor the same year and is involved in the veterinary, healthcare and animal health sectors of the Protexin product ranges.

Probiotics International Ltd is one of the largest manufacturers and suppliers of probiotic supplements for the healthcare, veterinary and animal health industry. Products are marketed under the brand name of Protexin.

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