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Probiotics for infants and children

Recent years have seen the rise of probiotic supplementation in our food and the promotion of probiotics as dietary supplements. Probiotics are generally advertised as an aid to gut health and are specifically touted as being of assistance for conditions as varied as diarrhoea, infant colic and allergy. However, the evidence on probiotic effectiveness for a range of infant conditions is mixed.

In 2010, the American Academy of Pediatrics reviewed the use of probiotics and prebiotics as part of an effort to help physicians in their work with parents and families (Thomas, 2010; Armstrong, 2011). The Academy noted the increasing prevalence of probiotic and prebiotic supplements in foods for children and in infant formula.

Introducing these sorts of supplements into children's diets is intended to aid the bacterial colonisation of the infant gut that occurs naturally after birth. Human gut microbiota are thought to play a role in the later life development of conditions such as asthma, eczema and allergic rhinitis, as well as autoimmune conditions such as Type 1 diabetes and multiple sclerosis (Armstrong, 2011).

Probiotics: the basics

The World Health Organization defines probiotics as:

'An oral supplement or food product that contains a sufficient number of viable microorganisms to alter the microflora of the host and has the potential for beneficial health effects.'

Prebiotics, often discussed at the same time as probiotics, are non-digestible food ingredients that selectively stimulate probiotic growth, thus benefitting the host (Gibson and Roberfroid, 1995).

Probiotics have strain-specific effects, which means that different types of probiotics will act in different ways in their hosts. In your work with parents and families, it's important to emphasise that there are different types of probiotics. Probiotics as a term is equivalent to canine for different dog breeds; it gives you a broad idea, but no indication of whether you're faced with a Chihuahua or a Doberman.

The most common groups of probiotics are:

- *Lactobacillus*
- *Bifidobacterium*
- *Streptococcus*
- *Saccharomyces boulardii.*

The strain-specific effects also make reviewing the evidence and drawing conclusions about the role of probiotics quite difficult.

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The role of probiotics in the body

Probiotics are anaerobic organisms and typically produce lactic acid in the host, their role is to alter gut microbiota and colonise the bowel.

More specifically, when they colonise the bowel, they:

- competitively inhibit bacterial adhesion
- stimulate and moderate host immune responses
- decrease inflammation
- increase mucus layers
- enhance epithelial barrier function.

When they alter the gut microbiota of infants, they:

- increase gut microbiota diversity
- reduce pathogenic gut bacteria.

Claims for probiotics

Parents are offered probiotics in a range of products aimed at children and families, whether probiotic-supplemented foods or stand-alone probiotic supplements. Most of those commercially available are made up of mixtures of probiotic strains.

Probiotics for diarrhoea

Probiotics are promoted to both prevent and treat diarrhoea. Acute infectious diarrhoea is the most studied subset type. A 2010 Cochrane review looked at the various studies into probiotics' role in treatment of infant diarrhoea. The review indicated that probiotics may reduce duration of diarrhoea, stool frequency and length of hospital stay. However, there were only a small number of studies, they were conducted in developing countries and a variety of probiotic strains, dosages and lengths of treatment time were used (Gaon, 2003; Basu, 2007).

Probiotics for allergy

One of the other areas where probiotics have been suggested as useful dietary additions is allergies. The hypothesis behind the role of probiotics in allergy is that they shift the balance of Th1 and Th2 immune responses to one that is more balanced and less inclined to inflammation. This has been prompted by observations that indicate that allergic and non-allergic children have different microbiota and that there is reduced microbiota diversity in children with eczema.

A 2010 meta-analysis indicated that there was some evidence of probiotics being effective in the prevention of eczema, when compared to a placebo (Tang et al, 2010). However, when the meta-analysis was restricted to the four studies that looked at dosing infants with probiotics postnatally, probiotics were no longer significantly effective (Tang et al, 2010) and three of the four studies reported no beneficial effects.

A 2012 meta-analysis looked at whether probiotics were effective at preventing eczema when delivered prenatally, without direct infant supplementation (Pelucchi et al, 2012). The study involved both prenatal and postnatal administration and showed a significant reduction in eczema prevalence at 2 years. However, administration of probiotics had no apparent effect for other allergic conditions including food allergy, allergic rhinitis and asthma (Osborne & Sinn, 2007).

In summary, there is evidence for the administration of probiotics prenatally to the mother and postnatally to the infant to prevent eczema and IgE-associated eczema, particularly in infants who are at increased risk. (Read our November 2013 issue of Community Paediatric Review for more information on the characteristics of infants at risk for eczema). Postnatal administration alone does not appear to be effective. The prenatal component of probiotics administration is likely to be more important in terms of beneficial effects and there are some indications that giving the infant probiotics postnatally as well may contribute to maximum effectiveness.

Probiotics for colic

Colic is one of the major areas where probiotic supplementation is thought to potentially be of benefit (Sung et al, 2013). Colic, presenting as constant crying, is a health problem that presents a serious cost burden to health systems. It was estimated to have cost the National Health Service in the UK over US$100 million in 2001 (Miller, 2013). More important than the question of cost, babies that cannot be soothed cause great distress to their parents and caregivers and can put significant pressure on parents' and caregivers' mental health (eg McMahon et al, 2001).

At present, it is unclear what causes infant colic, which impedes the development of effective strategies for prevention and management. However, there is a strong association between food allergy and irritable infants (Hill et al, 2005; Jakobsson et al, 2000; Thompson-Chagoyan, 2011).

There are a number of possible mechanisms by which probiotics are thought to play a role in alleviating colic.

- There are differences in the gut microbiota of infants with and without colic (Savino 2005; Savino 2004; Lehtonen, 1994).
- There is increased faecal calprotectin, a gut inflammatory marker, in infants with colic (Rhoads, 2009).

Based on these observations, a number of randomised controlled trials into the effectiveness of treating infant colic with probiotics have been conducted, three in particular demonstrated that probiotics were effective.

	Savino 2007	Savino 2010	Szajewska 2012
Intervention	*L reuteri* ATCC 55730	*L reuteri* DSM 17938	*L reuteri* DSM 17938
Control	Simethicone	Placebo	Placebo
n	83	46	80
Sample	Colic = >3 hrs crying >3days/week for 7 days *(Wessel's)* Exclusively breast-fed term infants		
	Mothers on cow's milk-free diet		
	3–12 weeks old	2–16 weeks old	<5 months old

(Sung, 2013)

The two Savino trials demonstrated a statistically significant reduction in crying time after seven days. However, the results from the two studies cannot be generalised to all infants as they involved exclusively breast-fed infants whose mothers were on a cows' milk-free diet.

A 2012 trial (Indrio et al, 2014) found that administration of *Lactobacillus reuteri* to infants over a three-month trial resulted in significantly decreased crying time. At the completion of that study, the authors also found that the children who received *L. reuteri* had:

- fewer paediatric emergency department visits
- fewer lost parent working days
- reduced use of agents to promote gastrointestinal comfort.

A double-blind placebo-controlled trial was recently conducted in Melbourne in order to assess the efficacy of the probiotic *Lactobacillus reuteri* in infants under three months old (Sung et al, 2013). Importantly, Sung's trial looked at both breastfed and formula-fed infants. The results of that trial are awaiting publication in the *British Medical Journal*. However, in a recent systematic review and meta-analysis, Sung concluded: *"Although* L reuteri *may be effective as treatment for crying in exclusively breastfed infants with colic, there is still insufficient evidence to support probiotic use to manage colic, especially in formula-fed infants, or to prevent infant crying"*.

Probiotic use for infants

Research indicates that probiotics are safe and well-tolerated in normal, healthy infants and children. Good tolerance has also been observed in premature infants, very low birth weight babies and in HIV-infected children and adults. Probiotics are also safe to use in late pregnancy. There have been some cases of probiotic septicaemia in immunocompromised adults and children, but these have occurred in very unwell individuals with complex medical problems.

The evidence for probiotic use to treat a range of infant conditions is mixed. While there have been quite a number of studies of probiotic use in adults , there have been very few in children.

At present, the evidence indicates that probiotics may help to manage allergies and provide relief from eczema symptoms. Probiotics may also help to reduce the frequency and duration of diarrhoea. For infant colic, evidence indicates that probiotics are of limited use.

More broadly, there has not yet been sufficient research to tell us which particular strains might be most effective, for which conditions, in what doses, and when.

Reflection questions

How do you stay up to date in your work with parents and families when new research appears about infant diet and nutrition?

What methods can you use to communicate clearly and effectively with families about diet and nutrition when they may have encountered unclear or misleading information elsewhere?

What resources do you have available to assist you?

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Deformational plagiocephaly: an update

Deformational plagiocephaly overview

Deformational plagiocephaly is the leading cause of head shape abnormalities in infants (Lee, 2010). This common condition is also known as positional plagiocephaly, and more simply as a misshapen head. In rare instances, and if left untreated, plagiocephaly can lead to asymmetrical growth of the child's face and head.

Common causes of deformational plagiocephaly

Both perinatal and postnatal factors can cause plagiocephaly.

All babies are born with soft skull bones that allow the head to mould to the birth canal. Plagiocephaly occurs more often in premature infants whose skulls are even more pliable than other babies, and newborns from multiple pregnancies are at higher risk through being cramped in utero (Persing et al, 2003).

The soft bones of a newborn's skull make it easy for the skull to develop a flat spot if the infant spends a long time in one position. Risk factors for infants include:

- staying in one position for extended periods of time while asleep or awake, e.g. in a cot, car seat, stroller, carrier, or lying on their back for playtime
- one-sided neck tightness known as torticollis, causing the infant to prefer resting their head to a particular side (Persing et al, 2003).

The recent introduction of multifunction infant carriers, which mean that repositioning between car seat, carrier and stroller is no longer needed, can be a risk as the child is more likely to stay in the same position for longer periods (Lima et al, 2007).

Diagnosis

Children with plagiocephaly have flatness on the back of their head. A child and family health nurse or family doctor can usually diagnose the condition. Tests like X-rays or CT scans are usually not needed.

Treatment options

Many children diagnosed with plagiocephaly do not need any treatment at all, because the condition can improve naturally as the child grows, begins to sit up and to spend more time on their tummy while awake (Persing et al, 2003).

The most common forms of treatment are counter positioning and helmet therapy. There has been a lot of debate and research about which form is most effective, and the most appropriate timing. The general consensus is that positioning is most effective early — around the first 2–4 months of life — and that helmet therapy should be used from around 4 months of age (Grigsby, 2009).

Counter positioning

Counter positioning involves parents making sure their infant does not rest on or develop a flat spot by alternating their baby's head position from the back to the sides.

There are various ways to help infants to alternate points of pressure on their head when sleeping on their back, as recommended by SIDS guidelines. Varying holding and carrying positions, increasing tummy time, and laying the baby on their side to play can also help.

Child and family health nurses can work with parents to help them learn counter positioning techniques to use with their child. Varying the baby's head position during the child's sleep and awake periods is key. The following strategies work for both the treatment and prevention of plagiocephaly.

Sleep

- Alternate the baby's head position between left and right each time they are laid down to sleep.
- Encourage the baby to look at different angles when they are laid down for sleep by placing the baby at alternate ends of the cot, changing the cot position, or placing toys or mobiles in different places.

Holding and carrying

- Vary holding and carrying positions by using a sling, holding the infant upright for cuddles and carrying the baby over the arm on their tummy or side.

Playtime

- Place the baby on their tummy or side to play, starting with short periods of time. This can begin by placing the baby belly-down on the parent's chest while reclining on a chair or propped on some pillows in bed, allowing the baby to see the parent's face and feel more secure. Parents should gradually increase the time as the baby becomes more comfortable in this position.
- Parents can also lay the baby on their lap or thighs and stroke down the baby's back rhythmically, using circular motion between the shoulder blades, or playing finger games on the baby's back, such as 'walking' with fingers. This helps the baby to relax and enjoy their time in this position.
- As babies become more comfortable they can be placed on a blanket or play mat on their tummy or side. A rolled up towel can be placed under the baby's chest to reduce pressure on their abdomen.
- The baby will not be comfortable in tummy time on a full stomach and if they are tired they will not want to work hard to lift up their head.
- Think about ways that parents and caregivers can distract the baby. Could they place a safety mirror or brightly coloured toys in front of them? These also encourage the baby to reach out and shift their weight. Parents can also lie down and get face-to-face with the baby and make noises, sing or just talk.

Corrective helmets

Sometimes when the uneven head shape is more severe or counter positioning has not worked, a cranial remodelling helmet may help.

Helmets are lightweight and made of a thin hard shell with a foam lining for comfort. The helmet helps the skull re-shaping process by removing the pressure over the flat area, allowing the skull to grow into the space provided (The Royal Children's Hospital Department of Plastic and Maxillofacial Surgery, 2010).

Children's heads grow most rapidly during the first 12 months of life, and then continue growth at a much slower rate. This is very important in timing helmet therapy. Children who begin their treatment after 12 months of age take almost double the time to get similar results compared to children who begin their treatment in their first year of life (Grigsby, 2009); it's best to start treatment as early as possible.

Treatment involves an orthotist making a cast of the baby's head to custom make the helmet. The child's hair does not need to be shaved off. The helmet is worn for 23 hours a day and may come off for one hour for bathing or similar. The helmet shape needs to be adjusted by the orthotist every one to two weeks and treatment usually takes between two to six months (The Royal Children's Hospital Department of Plastic and Maxillofacial Surgery, 2010). Parents may be affected emotionally when their child first wears the helmet. It can be helpful to know this is feeling is common and to counsel parents that the treatment is temporary and outcomes are normally very good.

Other considerations

Preschool-aged children with a history of plagiocephaly have been found to receive lower developmental scores than unaffected children. While these findings only imply correlation rather than causation, they may indicate developmental risk (Collet et al, 2013). The development of infants with plagiocephaly should be checked to support early identification and intervention (Collet et al, 2013; Knight et al, 2013).

Reflection questions

If you are concerned about the child's misshapen head, but the parents are not, how do you raise this issue?

What advice do you give to parents about positioning their baby for sleep? How do you balance this advice with reducing the risk of both SIDS and plagiocephaly?

When would you suggest to a parent that they take their child for further investigation for plagiocephaly?

At what age do you discuss 'tummy time' with a parent? Do you use any strategies for specific ages?

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About the Centre for Community Child Health

The Royal Children's Hospital Centre for Community Child Health (CCCH) has been at the forefront of Australian research into early childhood development and behaviour since 1994.

The CCCH conducts research into the many conditions and common problems faced by children that are either preventable or can be improved if recognised and managed early.

Community Paediatric Review

Community Paediatric Review supports child and family health nurses in caring for children and their families through the provision of evidence-based information on current health issues.

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