Resolution of Lactose Intolerance and Colic in Breastfed Babies

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Resolution of Lactose Intolerance and "Colic" in Breastfed Babies

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Abstract

Primary lactose intolerance may arise only as an extremely rare congenital abnormality in babies, since lactose is crucial to normal health and development of human babies.

Secondary lactose intolerance in babies results from damage to the brush border of the gastrointestinal tract and/or an inadequate fat intake during feeds

"Lactose overload" may more correctly describe this secondary lactose intolerance. The resulting cascade of clinical features is often called "colic" by health professionals as well as the general community.

Identification of causative factors followed by appropriate management provides fast resolution of symptoms without interruptions to breastfeeding.

Unfortunately, while practitioners continue to regard lactose overload in breastfed babies as a primary condition, mothers are commonly advised to wean their babies onto lactose-free or lactose-hydrolysed formulae. Ongoing use of lactose-free formulae may pose an unacceptable risk to babies' long term mental and cognitive development.

Accumulating research evidence shows a clear correlation between early weaning onto artificial baby milks and short-and long-term morbidity.

Introduction

Significant research describing the mechanisms of lactose overload in breastfed babies was published nearly ten years ago but has not become widely known amongst practitioners who work with breastfed babies and their mothers (1). Woolridge and Fisher described a type of lactose overload which is due entirely to low fat feeds. This may arise if babies are not permitted to nurse long enough during feeds, such as when feeds are clock-regulated, or if mothers need to shorten feeds because they are painful. Babies may also be inefficient feeders who are unable to milk the breast well enough to extract the fattier milk that comprises the end of feeds (hind milk). Low fat feeds cause fast gastric clearance, thence overloading the small intestine's capacity to metabolise lactose (1,6)

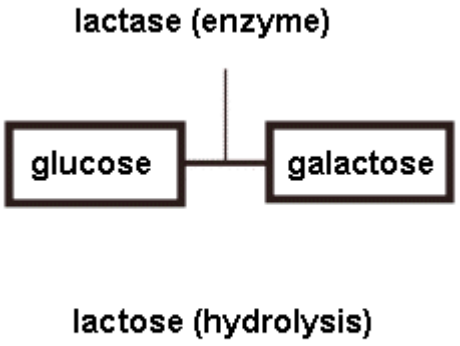
Clinicians have long known that infective agents, infant prematurity and some gastrointestinal conditions cause varying degrees of lactase insufficiency in babies,

but have been less aware that allergens derived from the maternal diet or supplementary formula feeds may also compromise a breastfed baby's lactase sufficiency (2,3,4,5). This occurs when the allergic response targets and damages the brush border of the baby's gastrointestinal tract (7).

Recognition of the likely causes of lactose overload in breastfed babies provides the means by which resolution of symptoms and maintenance of breastfeeding are both achieved.

Lactose is a disaccharide molecule composed of single glucose and galactose units joined by a chemical bond. In its disaccharide form, lactose cannot be digested by humans.

Lactose digestion begins in the small intestine where the brush border secretes the enzyme, lactase, necessary for splitting the chemical bond between the two simple sugar units. Because lactase is secreted only at a relatively slow rate (regardless of the levels of lactose that may be present), fast gastric clearance does not allow for the equivalently slow hydrolisation of lactose that is programmed by human physiology. (3)



All human babies are necessarily lactose tolerant with extremely rare congenital exception. Varying degrees of acquired lactose intolerance as a result of genetically determined lactase insufficiency occur from the age of 5 years in about 70% of the world's population (5).

Therefore lactose intolerance in breastfed babies arises only secondarily under any conditions which:

(1) cause overly fast gastric clearance
or (2) damage the brush border of the small intestine. (5,6)

Clinical features of lactose intolerance

When the levels of lactose in the lumen of the small intestine exceed the capacity of the available lactase:

- the gastrointestinal (GIT) microbial flora ferment excess lactose, particularly in the colon, producing gases (carbon dioxide, hydrogen and methane) and acid

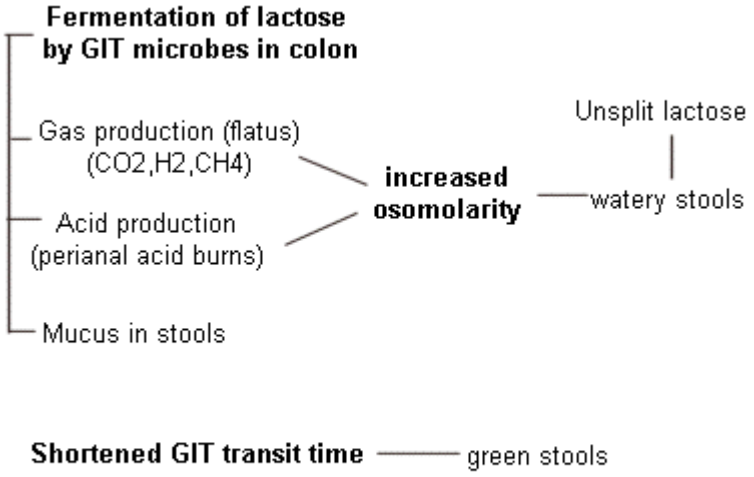
- lactose fermentation products in the colon increase the osmolarity of the lumen's contents, therefore increasing the volume of water that must be retained in the lumen.
- any unsplit lactose still remaining in the colon also mandates retention of water by the colon
- GIT transit time is shortened
- depending on severity, mucus may be evident in stools due to irritation of the GI mucosa (6).

Hence the **presenting symptoms** of lactose overload in breastfed babies are:

- excessive flatus (a "windy" baby)
- frequent explosive watery stools which may be yellow or green, depending on severity
- "colic" (defined in this case as crying due to overproduction of intestinal gases)
- unsettled baby
- perianal acid burns may occur
- stools may be mucousy (8)

Other "windy" babies:

Contrary to popular community folklore, our observation is that air swallowed by babies while feeding appears to bear no clinical relationship to flatus and colic symptoms in babies. This has been noted by other practitioners.(9)



Clinical features of lactose overload

The normal clinical picture is that intestinal gases are inevitably generated as part of the gastrointestinal passage of food, but not in such volumes as to cause significant distress to the baby. (5,9)

Until 6 weeks of age, fully breastfed babies may also be expected to pass frequent yellow bowel motions throughout every 24 hour period, but many of these stools are

of only small amounts (up to a few teaspoonfuls). Our recommendation is that **at least one bowel motion in every 24 hours is of fairly substantial volume, about half to a cupful**. (A "good handful" is a fairly graphic description that parents quickly relate to!) The stools are unformed and often have a noticeable watery component. Although yellow is the normal colour of these stools, an infrequent greenish yellow stool is acceptable (perhaps 1 - 2 over a week). After the first week, urine should be colourless, but a pale yellow is acceptable.

Beyond 6 weeks of age, the anal reflex that previously stimulated peristaltic activity at every feed, diminishes greatly. Thereafter, stools remain yellow (until other foods are introduced) but stool consistency becomes more like that of whipped cream. A noticeable watery component is unusual in these stools. The frequency of bowel motions subsides, commonly to one every day or so. Some fully breastfed babies stool once every 3 - 10 days or so, the colour thereof being more generally a light brown due to longer oxidation with slower GIT passage. **Stool volumes are copious, around a cupful**, even more with infrequent stooling. The urine is usually colourless. When the baby's output conforms with these criteria, good weight gains are guaranteed, and the baby will usually be well settled between feeds, crying very little as long as his needs are promptly met.

(If urine colour seems too yellow to match a perfectly adequate urinary and faecal output, it may be related to strong yellow colours in the mother's diet such as from vitamin B supplements.)

"What goes in has to come out"

An explanation that "what goes into the baby has to come out (the other end)" is one of the most helpful that practitioners can give to parents. World-wide, research has repeatedly found that one of the main reasons given by mothers for early weaning from the breast is *perceived low supply* (10).

In fact, within the first 3 months postpartum, lactating women are commonly oversupplied due to endocrine mechanisms that embellish the more usual autocrine control (supply equals demand) that operates beyond these early months (11). Given that so much parental anxiety is unnecessarily expended over "knowing if the baby is getting enough (milk)" and whether or not the mother has enough milk, practitioners can be a powerful force in relieving these parental concerns and simultaneously improving long-term breastfeeding rates.

If parents have a clear picture of what the baby's normal output should be, they are capable of using their baby's output as an assessment tool. When the baby's output matches the previously described criteria, parents have their own day-to-day reassurance that the baby is most certainly "getting enough" and that this automatically means that the mother's milk supply is quite adequate. On the other hand, when the baby's output is not sufficient or is abnormal, parents have an "early warning sign" to seek professional help well before problems become dire.

Fully Breastfed Babies, 1 - 6 weeks of age:

Normal Output	Inadequate Output	Lactose Overload Output
Urine		
colourless	mid to dark yellow	light yellow/colourless urine
Stools		
Yellow informed Watery component+ Frequent/ 1-3 teaspoons at least 1x($^1/_2$-1cup)/24hrs	yellow or green no Watery component infrequent/ 1-3 teaspoons larger stools are days apart	yellow or green Watery component++ / +++ frequent/ 1-3 teaspoons frequent copious stools/24hrs explosive acidic
Flatus		
None or +	None or +	++ / ++++ "colic" symptoms

Using the output as an assessment tool

When to ignore a green stool:
Parents need to be reassured that a single green stool in a fully breastfed baby is not usually significant. When accompanied by pain, it may reflect something unusual or excessive in the maternal intake, including medications. It is also desirable that parents understand that the darker the hues of green of freshly passed stools, the faster the passage of food through the baby's GIT. As the underlying problem is dealt with, green stools steadily become yellow. Occasionally a bowel motion may have been passed some time before the nappy is changed. The longer the time since the motion was fresh, the greener it is likely to be from oxidation processes. Therefore these green stools are not a reliable indicator of the colour of fresh stools.

Testing the stool for reducing sugars is not done at our clinic because the clinical presentation of lactose overload is seen as a clear enough indication of the presence of reducing sugars. In any case, a certain level of reducing sugars will normally be present in the stools of fully breastfed symptom-free babies, particularly those who are less than 6 weeks of age. (5)

Assessment of at least one breastfeed is an important means of establishing the effectiveness of the baby's suck. Simple positioning and attachment issues are often identified and mothers are helped to overcome these. This may be all that is required to resolve lactose overload, since these issues can in themselves be the cause of significant reduction in the baby's fat intake.
("Attachment" refers to the amount of breast tissue taken into the baby's mouth during breastfeeds. "Positioning" refers to the way that the baby's body is positioned for a breastfeed.)

Since the baby's fat intake steadily increases towards the end of feeds, it can be seen that any problem that reduces the baby's ability to reach the end of the feed will reduce his fat intake (1). The lower the fat levels of the feed, the faster will be the gastric clearance time. This results in various degrees of lactose overload.

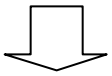
The most common problems that may reduce the baby's fat intake are:

- shortened breastfeeds due to maternal breast/nipple pain/damage,
- poor attachment resulting in long feeds and minimal milk intakes
- poor positioning resulting in baby having difficulty maintaining adequate breast tissue in his mouth throughout the feed
- timed feed schedules eg "10 minutes each side, 4 hourly"
- infant oral thrush
- suck problems including suck confusion due to the baby's oral experiences with such objects as nipple shields, teats and pacifiers
- infant infections

Assessment of the mother's diet is a relevant consideration. Some mothers are having minimal fat / high sugar intakes. Other mothers are simply eating very little and very infrequently because they are stressed or "too busy". Breakfast and lunch are commonly inadequate meals. There are also mothers who severely restrict their fat intakes to quickly lose weight gained in pregnancy. All of these situations are undesirable for the mothers as much as for their breastfed babies.

An inadequate fat intake in the maternal diet appears to make a direct contribution to the intensity of lactose overload symptoms, resulting in lower fat and higher lactose levels in their breast milk.
(12,13,14)

↑ protein + ↑ fat + ↑ complex carbohydrate + ↓ simple sugars
(maternal diet)



↓ [lactose] + ↑ fat (breast milk)

Summary of maternal dietary impact on milk lactose levels

Another aspect of maternal diet is that particular foods, commonly cow milk products, may cause **allergic responses in the baby** (15,16,17). When this allergic response targets the mucosa of the baby's gastrointestinal tract, the ensuing damage to the brush border may in itself be the cause of lactose overload, lactase production being directly compromised (18). In some of our cases, the maternal intake of the offending food has been minimal, but the baby's sensitivity has been extreme. We have also noted that this form of lactose overload often begins to manifest some weeks after birth, steadily becoming worse as long as the allergen remains in the mother's diet. It is not unusual for these babies to have blood in their stools. (These stools may be bright orange, may have obvious red or pink components or be black and tarry.) Once the allergen is removed from the maternal diet, symptoms begin to subside within days, but complete healing of GIT damage may require up to 6 weeks, with symptoms persisting at a lower level of intensity for many of these weeks. Others have reported similar cases (19,20,21,22).

Successful management of lactose overload depends on identification and correction of the underlying cause. The involvement of lactation consultants may be crucial to this process.

- If the baby's fat intake is the core of the problem, Woolridge and Fisher's research is summarised as:
  "Finish the first side first." (1)

This may simply mean allowing the baby more time at the first breast before swapping him to the other breast. A baby should be allowed to feed until he comes off the breast himself, rather than have a feeding regime imposed on him. *An efficiently breastfeeding baby is in charge of his mother's milk supply and his caloric needs* (16). Most babies under the age of 6 weeks may be expected to take 40-60 minutes to complete a breastfeed, including little rest breaks between successive flows of milk (milk ejection reflexes), nappy changes and some pleasant mother-baby interactions.

In order to "finish the first side first", some babies may need to be put back to the first breast again (1 - 3 times) before being offered the second breast. In **occasional** cases, symptoms may subside only when **one** breast is used per feed. (This means that the baby is put back to the same breast until he is sated. If he wants a "top-up" within an hour following his feed, he is returned to the same breast.)

When a baby is not feeding effectively, feeds may become never-ending marathons, with the baby never/rarely taking himself off the breast. These "all day suckers" never reach the end of the feed - they do not detach themselves from the breast because they know they have not finished. These babies may simply need to be more optimally positioned and attached for breastfeeds - others need interventions such as supplementing after shorter times at the breast, preferably with the mother's own milk so that her supply is easily maintained.

We have shown that bottles and teats can be used to supplement these babies and to steadily improve their competence at the breast **only if the teats are long round teats**. In Australia, the only ones available in a flow rate suitable for very young babies are Cannon newborn teats (round, not "orthodontic") - our preference is for latex rather than silicone teats because of infant oral sensory feedback considerations. Our experience is that when babies become accustomed to feeding with the end of the teat stimulating the junction of the hard and soft palates, over 90% of babies can be expected to resolve their breastfeeding difficulties within 1 - 6 weeks (23).

When the maternal diet contributes to lactose overload, mothers need to be guided with specific examples of the changes that may be necessary, and why.

For example, when the maternal diet has too little fat and too many simple sugars:

Instead of:	**Substitute:**
100% fruit juice, softdrinks, cordial	water, very dilute fruit juice, tea and coffee in moderation
lots of fresh or dried fruit	1-2 pieces fresh fruit daily, vegetables
honey, jam, golden syrup, Vegemite	fish/meat/cheese/egg spreads, peanut butter, sardines,

	canned fish, sliced meats/poultry
lollies, chocolate, biscuits, cake, desserts	nuts and seed mixes, corn chips, potato chips, chicken/meat sandwiches, sausage rolls, meat pies, savoury crackers with canned fish/smoked mussels or oysters/hard boiled egg, soup
salad sandwich for lunch	large serving of chicken/meat/fish with buttered bread roll, substantial side salad with oil based dressing

When cow milk products in the maternal diet need to be excluded:

Instead of:	**Substitute:**
cow milk on cereal	water, rice milk, diluted fruit juice, soy milk & have toast with egg, sardines, canned fish, ham, creamed corn and bacon etc
cheese, yoghurt	meats, chicken, pate, nut spreads/mixes, seafood
butter	milk-free margarine
Italian- and French-style cookery	roast meals, grills, Asian-style meals
ice-cream, cheese cake, custard	frozen fruit desserts eg Vitari, lemon sorbet, meringue fruit baskets, milk-free muffins
white sauces made with cow milk	sauces made with cornflour, coconut milk, rice milk or soy milk

Note: Soy protein is as potentially allergenic as cow milk protein, so only small amounts (less than a cup per day) should be substituted (24,25,26). Goat milk appears to be considerably less likely to incite allergic responses, but is not generally acceptable to most adults because of its strong taste.

In our experience, it is extremely unusual for food allergy to necessitate removal of more than one type of food from the maternal diet. (We refer these mothers to a dietician with particular expertise in managing these special situations.) It is desirable that mothers have as little dietary restriction as possible, not merely because of the inconvenience involved, but mainly because unnecessary food restrictions carry a risk of generating further food allergies(27). This may happen if basic commonsense dietary rules are not obeyed:

1. Have lots of variety in your diet

2. Eat everything in moderation

Why should weaning from the breast be avoided?

Practitioners frequently advise weaning for breastfed babies with symptoms of lactose intolerance because human milk has much higher lactose levels than other milks. This approach focuses erroneously on lactose as the cause of problems while discounting the importance of lactose in particular and human milk in general for human babies.

Lactose is a specific nutrient for infancy, supplying about 40% of the baby's energy needs, facilitating calcium and iron absorption, promoting a normal healthy GIT microflora which discourages and retards the growth of GIT pathogens, and perhaps most importantly of all, providing the galactose which is incorporated directly as galactolipids into the tissues of the central nervous system (28).

Considering the nutritional importance of lactose for human babies and the considerable time span during which lactose-free (soy) infant formulae have been marketed, it is remarkable that there appears to be no research exploring whatever short- and long-term consequences may predictably result from exclusion of lactose from babies' nutritional intakes(28).

In 1997, one manufacturer of a soy infant formula produced an advertisement for health care providers stating that their product "helps resolve both lactose intolerance and cow's milk allergy in one step" and that it is "suitable from birth to six months of age". The advertisement does not provide any other information and includes a photograph of a happy thriving baby. This kind of advertising, while superficially matching WHO guidelines for the marketing of infant formulae, nonetheless does not satisfy the spirit of the guidelines - the reader is not informed of other possible morbidities that may arise from the product's use, nor of the unproven safety status of lactose-free formulae for human babies.

Why do human babies need lactose?	**Particular deficiencies of soy infant formulae**
• to supply 40% of energy needs	• no lactose
• to facilitate calcium absorption	• soy is just as potentially allergenic as cow milk
• to facilitate iron absorption	• high aluminium content (31,32)
• to reduce the risks of GIT infection	• high phytoestrogen levels (33)
• for healthy growth and development of CNS	• safety is unsubstantiated by research

It has not helped practitioners that formula manufacturers have avoided mention of these and many other critical issues related to artificial feeding, promoting instead a distorted, idealised view of their products in the minds of many health care providers(29,30,34). In fact, the use of any kind of infant formula should be recognised as having a status similar to most drugs - an automatic cause of side effects in the short-, medium- and long-term (35). In the western country with the poorest of all breastfeeding rates (breastfeeding initiation rates no higher than 26%), the American Academy of Pediatrics has now firmly acknowledged the importance of human milk for human babies with new breastfeeding guidelines that recommend babies be **breastfed for at least the first year of life** (36).

Artificially fed children have been shown to have a greater risk of:(30,39,40)

gastroenteritis	colic	insulin dependent diabetes
colitis	iron deficiency anaemia	acute leukaemia
coeliac disease	otitis media	childhood lymphoma
necrotising enterocolitis	bronchiolitis	SIDS
Crohn's disease	pneumonia	meningitis
inflammatory bowel diseases	aluminium toxicity	autism
pyloric stenosis	learning disabilities	urinary tract infections
hypernatremic dehydration	neonatal death	upper respiratory tract infection
impaired vaccine response	poorer developmental outcomes	dental caries
food allergy	hospital admissions	orthodontic defects

With increasing concern over health spending, **the economic value of breastfed babies** to our world community needs to be emphasised. In Australia alone, it is easy

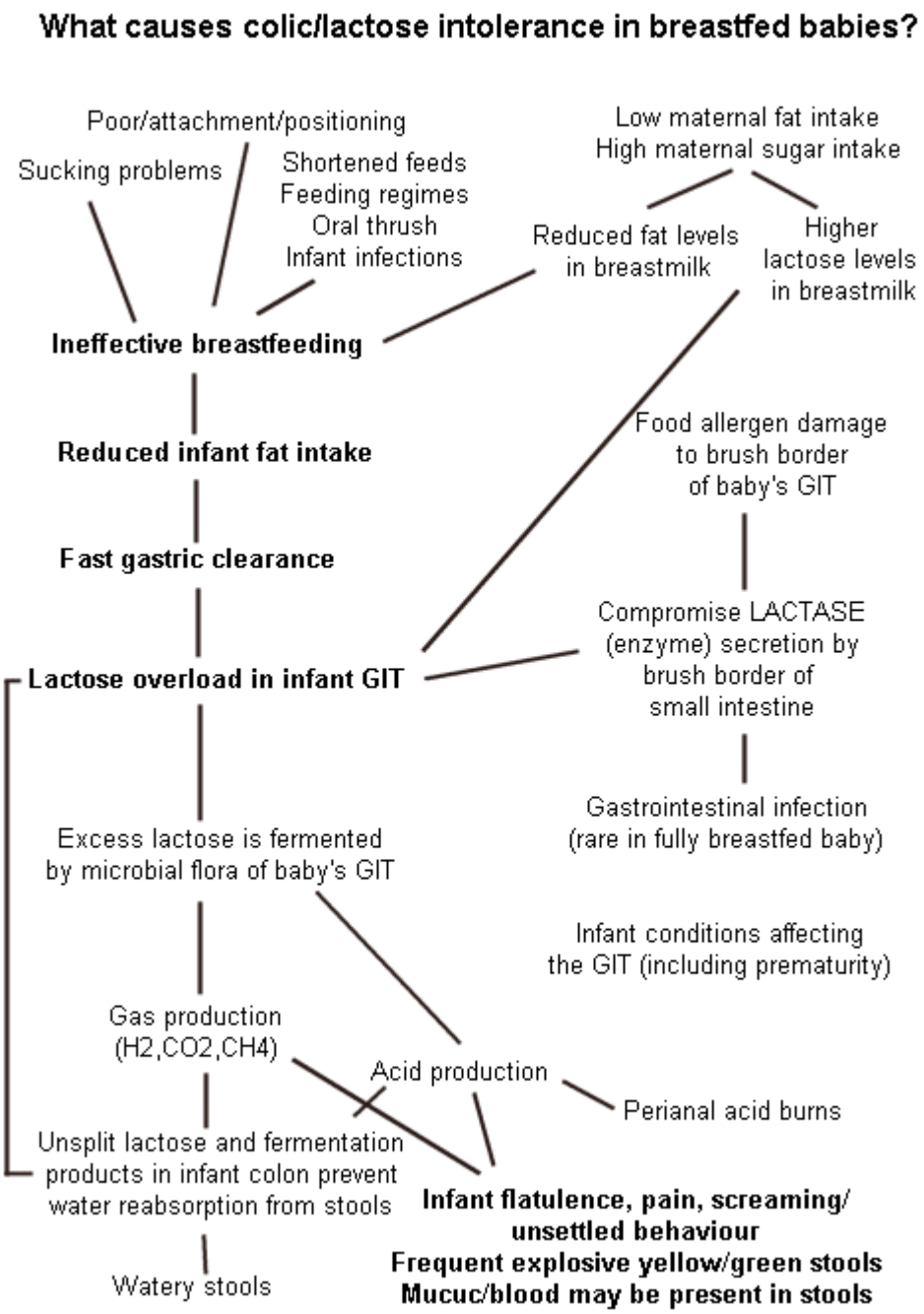
to show that if our national target for the year 2000 were achieved - 80% of babies still breastfed at 6 months of age (instead of the current 22%), billions of dollars would be saved from our health care bills(37,38). Unfortunately, in place of this understanding of the cost of artificial feeding of infants, Australian perceptions are that illnesses such as middle ear infections are a "normal", inevitable part of childhood.

In conclusion:

Lactose intolerance in breastfed babies is not so much a problem with lactose itself as a problem with conditions impacting on lactose metabolism in the GIT. Unfortunately, terminology that focuses on lactose naturally tends to distract practitioners from the core issues which are actually responsible for the presenting symptoms.

It has not helped clinicians that multinational baby food manufacturers have not closely adhered to WHO guidelines on the marketing of their products, even with their agreement to do so in Australia in 1992. This has resulted in a certain amount of advertising being offered to health care providers in the guise of professional information which is superficially true but which also fosters incorrect impressions and beliefs in the health professional community. This situation has contributed to professional advice to wean breastfed babies with lactose intolerance symptoms.

In reality there is no need for babies to be weaned off the breast because of lactose overload in the GIT. Maintenance of breastfeeding primarily benefits mothers and their babies, but has far wider health and economic repercussions for all of us.


What causes colic/lactose intolerance in breastfed babies?
Poor/attachment/positioning
Sucking problems
Shortened feeds
Feeding regimes
Oral thrush
Infant infections
Low maternal fat intake
High maternal sugar intake
Reduced fat levels in breastmilk
Higher lactose levels in breastmilk
Ineffective breastfeeding
Reduced infant fat intake
Fast gastric clearance
Lactose overload in infant GIT
Food allergen damage to brush border of baby's GIT
Compromise LACTASE (enzyme) secretion by brush border of small intestine
Gastrointestinal infection (rare in fully breastfed baby)
Excess lactose is fermented by microbial flora of baby's GIT
Infant conditions affecting the GIT (including prematurity)
Gas production (H2,CO2,CH4)
Acid production
Perianal acid burns
Unsplit lactose and fermentation products in infant colon prevent water reabsorption from stools
Watery stools
Infant flatulence, pain, screaming/ unsettled behaviour
Frequent explosive yellow/green stools
Mucuc/blood may be present in stools

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