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PERSISTENT DIARRHOEA AND BREASTFEEDING

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Persistent Diarrhoea and Breastfeeding

ABSTRACT

Persistent diarrhoea causes about 35 % of diarrhoeal deaths in children, half being of infants under 1 year of age. The typical child at risk is in the first or second year of life, is fed non-human milks, is malnourished, and has had multiple infections.

The mechanism of persistent diarrhoea seems to be mucosal damage, caused by infection, malnutrition, or animal milk proteins, often compounded by delayed mucosal repair. Lactose intolerance may be present, especially in younger malnourished children, but it is rare when breastmilk is the only source of lactose.

Optimal infant feeding practices would help to prevent persistent diarrhoea. These include exclusive breastfeeding for at least the first four and, if possible, the first six months of life, and continued breastfeeding with adequate complementary foods for up to 2 years or beyond. These practices help to prevent acute diarrhoea, and to shorten individual episodes, thus reducing the likelihood of persistent illness. Exposure to sensitising animal milk proteins is minimised.

For the treatment of persistent diarrhoea, breastmilk may be beneficial when fed exclusively, but it is less helpful when part of a mixed diet, even if non-human milk is excluded.

Mothers of infants less than about 6 months of age should be helped to re-establish exclusive breastfeeding and to stop artificial milk feeding, whether or not the infant suffers from persistent diarrhoea. Relactation, which means re-establishing breastfeeding by mothers who have stopped, is now recognised as a feasible intervention, particularly in this age group.

Mothers of older children with persistent diarrhoea should be encouraged to continue and increase breastfeeding; and to reduce or stop giving animal milks, at least temporarily, provided adequate alternative complementary foods are available. The need for specialised and expensive dietary or parenteral treatment could be reduced.

Persistent Diarrhoea and Breastfeeding

1. INTRODUCTION

WHO estimates that one third of all diarrhoeal deaths are associated with persistent diarrhoea. While it has long been recognized that breastfeeding is one of the most important ways to prevent diarrhoea, its role in reducing or preventing persistent diarrhoea and its complications has not been fully explored.

This review summarises available information on breastfeeding for the prevention and treatment of persistent diarrhoea., and its implications for clinical management.

2. DEFINITION

Persistent diarrhoea is defined as the continuation of a diarrhoeal episode for 14 days or more, which begins either as an acute attack of watery diarrhoea or as dysentery. It is often associated with weight loss and non-intestinal infections (WHO/CDR/95.3). Persistent diarrhoea does not include chronic or recurrent diarrhoeal disorders such as tropical sprue, hereditary syndromes, gluten-sensitive enteropathy or blind loop disease (WHO 1988).

3. EPIDEMIOLOGY

According to a recent review of community-based, longitudinal studies from Asia and Latin America (Black 1993):

> 3-23 % of all diarrhoeal episodes become persistent;
> the incidence is highest during the first and second years of life.

Data from India, Bangladesh, Brazil and Senegal indicate that case fatality from persistent diarrhoea is variable, ranging from 23 to 62% of affected children under five years of age. Of these deaths approximately half occur in the first year of life (Victora et al 1993). Based on these figures, WHO estimates that globally 35% of all diarrhoeal deaths in children less than 5 years of age may be due to persistent diarrhoea.

4. ETIOLOGY AND PATHOPHYSIOLOGY

It has been suggested that persistence of a diarrhoeal episode results from continuing mucosal injury or delayed mucosal repair which lead to impaired absorption oabnormal secretion of solutes and water (WHO 1988, Sullivan and Marsh 1992). The process seems to result from infection, malnutrition, or intolerance to non-human milk separately or together (see table 1).

Table 1: Pathophysiology of persistent diarrhoea
Recent intestinal infection
Malnutrition
Intolerance to non-human milk
Lactose intolerance
Cow's milk protein intolerance

Persistent diarrhoea can result from infection with many of the same organisms that cause acute diarrhoea (Lanata et al 1992$_2$). An association is rarely found with any specific enteropathogen, although enteroadherent E. coli, enteropathogenic E. coli, Cryptosporidium and Klebsiella are associated with persistence of diarrhoea in some settings (Black 1993, Bhatnagar et al 1992, Claeson and Merson 1990). Many long persisting episodes may be initiated by simultaneous or sequential infections with different pathogens (Black 1993). Small bowel bacterial overgrowth does not seem to influence the duration of diarrhoeal episodes (Penny 1992).

Recent intestinal infection

Infectious diseases, such as measles, may predispose to persistent diarrhoea either because of immunosuppression or because of direct damage to the intestinal epithelium (Black 1993).

Malnutrition

Malnutrition contributes to diarrhoea which is more severe and prolonged, probably because of delayed mucosal repair (Black et al 1984). Malnourished patients have histological abnormalities of the intestine, such as a thin mucosa, blunted microvilli and a decreased mitotic index which contribute to impaired nutrient absorption (Black 1993, Roy et al 1990, Roy et al 1992).

Intolerance to non-human milk

Persistent diarrhoea is often associated with and attributed to intolerance to lactose or protein in milk, but the true incidence of these conditions is uncertain (WHO 1988). Lactose intolerance and cow's milk protein intolerance (CMPI) are known to occur both separately and together (Harrison et al 1976). Both conditions usually occur secondary to damage to the mucosa from infection, malnutrition, or an allergic reaction to cow's milk or other food protein.

In hospital-based studies in India and Brazil 28-64% of malnourished infants with persistent diarrhoea were reported to have lactose intolerance, and 7-35% to have CMPI (Arora 1981, Khoshoo et al 1986, Thapa 1994, Fagundes-Neto et al 1985). However, intolerance is clinically important only when milk feeding causes a prompt increase in stool volume and a return or worsening of the signs of dehydration, often with weight loss (WHO/CDR/95.3). The incidence of lactose intolerance may have been over-estimated in three studies, in two of which the only tests conducted were for pH and reducing substances in the stools (Arora 1981, Thapa 1994). Such tests are over-sensitive, often detecting incomplete absorption of lactose which is of no clinical significance (WHO/CDR/95.3). Khoshoo et al (1986) diagnosed lactose intolerance after oral challenge with a very large load (2 g/kg body weight). Children seldom ingest such large quantities at a time, and the appearance of lactose in the stools could have been the result of overload rather than of intolerance. The diagnosis of CMPI also presents difficulties, because both clinical and histological signs lack specificity (Snyder 1992).

Lactose intolerance

In most populations, healthy infants and children up to three to five years of age digest lactose without any apparent difficulty (Johnson et al 1974). Primary congenital lactase deficiency is rare (Schrimshaw and Murray 1988).

Secondary lactose intolerance of varying degrees can occur when the intestinal brush border cells (where lactase is situated) are damaged by infection or malnutrition (Brown and Lake 1991). The degree of intolerance probably depends on the extent of the damage and hence is related to the severity and duration of the diarrhoea or malnutrition. Secondary lactose intolerance is mostly a problem in younger malnourished infants and children, when the diarrhoea persists, or the illness is severe (Penny and Brown 1992). In a small subgroup of children who are fed only on non-human milks, secondary lactose intolerance may be the only cause of prolonged diarrhoea (Penny et al 1989).

Cow's milk protein intolerance

Several clinical studies suggest that dietary protein sensitivity may be one mechanism responsible for persistent diarrhoea, especially in young infants fed cow's milk (Kleinman 1991, Snyder 1992).

The incidence of CMPI in developing countries is not known, but the condition is estimated to affect 2-7,5 % of infants in industrialised countries (Hill et al 1992). It appears not to be a specific entity, but can be induced by a variety of different food proteins, such as soya, gluten and egg, though cow's milk protein is the commonest

sensitizing agent in early infancy (Visakorpi 1983). Gastrointestinal symptoms are the commonest, but skin reactions, asthma and rhinitis also occur. Infants may have evidence of mucosal damage due to CMPI, but lack clinical symptoms. Most of these infants develop tolerance and the mucosa heals even while feeding with cow's milk continues (Iyngkaran et al 1988).

It has been suggested that sensitivity to cow's milk proteins can develop following damage to the mucosa by infection (Anonymous 1987), but other immune mechanims may also be important (Snyder 1992). An infant may be sensitized to CMPI in early infancy without developing signs or symptoms. Only after an intestinal infection does the sensitivity become manifest, and symptoms appear on challenge with cow's milk protein (Iyngkaran et al 1978).

Thus part of the reason why feeding non-human milk increases the risk of persistent diarrhoea, is likely to be because of intolerance to cow's milk or other foreign proteins they contain, while secondary lactose intolerance may prolong the symptoms.

5. RISK FACTORS

Possible risk factors for persistent diarrhoea are listed in Table 2, with references to relevant publications. Young age, use of non-human milks, and breastfeeding are discussed in more detail.

Table 2: Risk factors for persistent diarrhoea	References
Young age	see text
Recent diarrhoea or other illness	Black 1993
Immunological impairment	Saulsbury 1980 Keusch 1992 Black 1993
Antibiotic treatment	Shahid et al 1988 Claeson and Merson 1990 Nguyen Thi Kim et al 199?
Malnutrition Vitamin A deficiency Zinc deficiency	Black 1993 Shahid et al 1988 Hambidge 1992
Introduction of new foods or withdrawal of foods during acute diarrhoea	Baqui et al 1992 Nguyen Thi Kim et al 199?
Reduction or lack of breastfeeding before and during acute diarrhoea	see text
Use of non-human milks during acute diarrhoea	see text

Young age

In several longitudinal, community-based studies, the age at which diarrhoeal episodes most often became persistent was the first six months of life (Bhan et al 1989, Huttly et al 1989, Lanata et al 1991, Baqui et al 1992, Cruz et al 1992, Henry et al 1992). In one retrospective clinic-based study, the peak age for persistent episodes was from
2-3 years of age (Shahid et al 1988).

Reduction or lack of breastfeeding before and during acute diarrhoea

Persistent diarrhoea is commoner in infants who were not exclusively breastfed before the outbreak of diarrhoea. A longitudinal study by Brown at al (1989) showed that exclusive breastfeeding in the first six months of life was associated with diarrhoea of shorter duration than partial breastfeeding. Four hospital-based studies show that all infants admitted for persistent diarrhoea had stopped breastfeeding or were only partially breastfed at the beginning of the illness (Arora 1981, Khoshoo et al 1986, Thapa 1994, Fagundes-Neto et al 1985). In one retrospective, clinic-based, case-control study lack of breastfeeding increased the risk for persistent diarrhoea in severely malnourished infants (Guarino et al 1995).

Conversely, exclusive and to a lesser extent partial breastfeeding has been reported to protect against persistent and severe diarrhoea in the first 3 months of life in Peru (Black 1993) and in Southern Brazil (De Zoysa et al 1991). The clinical manifestation of diarrhoea seem to be milder and the duration of the episode shorter in exclusively breastfed than in formula fed infants as evidenced by longitudinal studies from the USA and Peru, and a case-control study from Bangladesh (Duffy et al 1986, Brown et al 1989, Clemens et al 1993).

Two health-facility-based and two out of three community-based studies show that reduced frequency or lack of breastfeeding during the acute phase of diarrhoea may predispose to its persistence, while continued exclusive breastfeeding may be protective (Shahid et al 1988, Nguyen Thi Kam et al 199?, Baqui et al 1992, Sazawal et al 1992, Table 3). However, in one longitudinal community-based study neither partial nor exclusive breastfeeding during acute diarrhoea appeared to provide any protection (Lanata et al 1992_1, table 3). The protective effect of exclusive breastfeeding may have been under-estimated in this study, since diarrhoea was defined strictly by 3-4 or more loose stools per day. This definition is likely to be inaccurate in exclusively breastfed infants, who may pass 8 or more soft stools daily without having diarrhoea. The mother's definition of diarrhoea should always be used for exclusively breastfed infants (WHO/CDR/95.3).

Use of non-human milks during acute diarrhoea

Two community-based studies have shown that feeding only non-human milks to infants with diarrhoea, and cow's milk consumption during an episode in children under five years of age, increases the risk of the diarrhoea becoming persistent

(Sazawal et al 1992, Baqui et al 1992, Table 3). However, where cow's milk is consumed in small quantities and together with other foods, it does not seem to increase the duration of diarrhoea (Lanata et al 1992_1, table 3). Further, in a recent meta-analysis of 29 randomised trials of feeding different kinds of non-human milk, no advantage was found for the majority of children with mild, acute diarrhoea, in using lactose-free or low-lactose milks (Brown et al 1994), compared with formula which contained lactose.

Thus, non-human milks taken during acute diarrhoea increase the risk of persistence of a diarrhoeal episode, but there is less risk if the milk is taken in small quantities with other food, and there is little advantage in using lactose-free or low-lactose or diluted non-human milks. Most children can continue to take undiluted lactose containing milks during acute diarrhoea, if this was their normal previous diet, unless symptoms are observed to increase, or the diarrhoea becomes persistent.

Table 3: Effect of breastfeeding and cow's milk feeding during acute diarrhoea on the development of persistent diarrhoea

Reference Country	Type of study	Study population at admission	Outcome	Preillness feeding
Shahid et al 1988 Bangladesh	retrospective clinic-based	n=410 age: < 5 y.	no BF increased risk 18-23 mo. OR=0.28 (s.) 24-29 mo. OR=0.67 (s.)	no info
Sazawal et al 1992 India	nested case-control in a prospective population-based	n=33/66 age: <12 mo. (of total n 22/46 <6 mo.)	eBF protective OR=0.06 (CI 0.002-2.1) pBF + cow's milk increased risk OR=2.5 (CI 1.0-9.9) only cow's milk increased risk OR=11.1 (CI 1.0-228.8)	as during illness
Lanata et al 1992_1 Peru	longitudinal community-based	n=677 age: < 3 y.	eBF& pBF not protective OR=0.6 (n.s.) cow's milk not increased risk OR=0.9 (n.s.)	no info
Baqui et al 1992 Bangladesh	longitudinal community-based	n=705 age: < 5 y.	reduced BF increased risk OR=1.75 (CI 1.12-2.75) cow's milk increases risk OR=1.71 (CI 1.04-2.8)	BF
Nguyen Thi Kam et al 1994 Viet Nam	case-control hospital-based	n=140/164 age: < 3 y.	BF protective OR=0.4 (CI 0.1-1.1)	no info

eBF= exclusive breastfeeding
pBF= partial breastfeeding
BF= breastfeeding
OR= odds ratio
n.s.= non significant
s.= significant

6. PROTECTIVE PROPERTIES OF BREASTMILK

Breastmilk may protect against persistent diarrhoea in several ways as summarised in Table 4.

Table 4: Protective properties of breastmilk

Defense against infection
avoidance of exposure to bacteria
antimicrobial agents
anti-inflammatory factors
immunomodulating factors
Promotion of a healthy microflora
Source of high-quality nutrients
Tolerance to lactose in breastmilk
Avoidance of sensitizing food proteins

Defense against infection

Breastfeeding provides protection against gastrointestinal infection and its consequences, which may be the principal reason why it plays a major role in the prevention of persistent diarrhoea. First, breastfeeding limits exposure to infective agents. Second, in the stomach more rapid emptying of breastmilk than other milks results in an early return to a low gastric pH, which may act as a barrier to bacterial invasion of the gut (Ebrahim 1985).

Breastmilk contains a large number of specific and non-specific antimicrobial agents, including secretory IgA, lymphocytes, and macrophages which may destroy micro-organisms and limit their growth, or prevent their attachement to the cells of the intestinal mucosa (Goldman 1994). Secretory IgA may also protect the mucosa against foreign antigens such as cow's milk protein (Wold and Hanson 1994).

Breastmilk contains anti-inflammatory factors, which reduce the mucosa's response to infection and which thus limit damage; and growth factors, such as epidermal growth factor which promote the mucosa's renewal and healing after infection (Goldman 1994, Wold and Hanson 1994, Lebenthal and Leung 1987). Immunomodulating agents influence the growth and functioning of the infant's own immune system (Goldman 1994).

Promotion of a healthy microflora

Exclusive breastfeeding maintains a low pH in the gut, which is favourable for the growth of bifidobacteria. This may play a role both in prevention of infection, and in

modulating the clinical course of diarrhoea (Ogawa et al 1992, Saavedra 1995, Murray 1992).

Source of high-quality nutrients

Breastmilk can provide all the nutrients and water needed for the majority of infants for about the first 6 months of life, and it continues to be a valuable source of high quality-nutrients, which may not be readily available from the family diet for two years or more (Prentice 1991). The protective effect of breastfeeding particularly in the first 6 months may be partly due to optimal nutrition and growth.

During acute diarrhoea the energy intake of children may decrease by 5 to 40 % (Brown and Perez 1992). Since breastfeeding is usually well accepted even by anorexic children and is maintained or even increased during diarrhoea its continuation minimizes any reduction in energy and nutrient intake (Brown and Perez 1992, Marquis et al 1993).

Tolerance to lactose in breastmilk

Breastmilk contains 7g of lactose/100g, which is considerably more than the 4.8g/100g found in cow's milk. However breastmilk lactose is well tolerated, and breastfeeding seldom if ever has to be interrupted during diarrhoea. It has been suggested that this tolerance may be partly due to frequent feedings, which reduce the amount of lactose reaching the intestine at any one time (Brown and Lake 1991).

In healthy neonates incomplete digestion and absorption of lactose is quite common and normally asymptomatic (Douwes et al 1980). However, symptoms including colic and loose, green or frothy stools have been observed in otherwise healthy breastfed infants when the feeding pattern is such that it could have caused disproportionate consumption of foremilk to hindmilk (Woolridge and Fisher 1988). It is conjectured that lactose overload results from ingestion of larges volumes of low-fat (hence relatively energy dilute) foremilk, and rapid gastric emptying. Symptoms are alleviated by simple changes in breastfeeding patterns such as feeding on only one breast at each feed. In children under two years old who are still breastfeeding only clinically harmless lactose malabsorption has been diagnosed during acute diarrhoea, and it is not a reason to stop breastfeeding (Tolboom et al 1986).

Avoidance of sensitizing food proteins

One benefit of exclusive breastfeeding during the first 6 months of life is reduced exposure to bovine milk proteins, such as beta-lactoglobulin, which may generate an antigenic response. Even occasional early exposure to cow's milk protein through prelacteal feeds may sensitize an infant (Høst 1988). Later, small amounts of bovine milk or bovine milk proteins from the mother's diet which are secreted in breastmilk may elicite symptoms of CMPI in these sensitized children (Høst et al 1988). This is

milk unless there is a strong medical indication. Exclusively breastfed infants may occasionally be sensitised to bovine milk protein in breastmilk without any other exposure. It may sometimes be necessary for the mother to avoid cow's milk in her own diet to avoid symptoms in the infant.

7. EFFECT OF BREASTFEEDING AND BREASTMILK ON DIARRHOEA

Ten studies were identified which examined the effect of breastfeeding (with or without complementary foods) in the management of diarrhoea. Four, of which two are controlled, show that continued breastfeeding shortens the duration of acute diarrhoea, which would thus be expected to protect against persistent diarrhoea (Table 5). Six studies are of children with persistent diarrhoea. Four clinical studies show beneficial effects from feeding human milk; two rather different studies show no effect (Table 6).

Of the studies during acute diarrhoea, Kassem and his co-workers (1983) showed that there was a significantly more rapid normalisation of stool consistency in the group receiving ORS together with unrestricted breastfeeding compared with those receiving ORS only until rehydrated. In a randomized study Khin-Maung-U et al (1985) found that the number and volume of stools and duration of acute diarrhoea was less in children receiving ORS and breastfeeding than in those receiving ORS for only the first 24 hours after admission. The beneficial effects were attributed to better nutrition and possibly enhanced absorption of sodium and water due to products of digestion, such as amino acids, dipeptides, and hexoses. Brown et al (1989) found that continuing to partially breastfeed while also taking solids and non-human milk was associated with shorter duration of diarrhoea than when breastfeeding was stopped. Haffejee (1990) found that continued exclusive breastfeeding significantly reduced the duration of acute rotaviral gastroenteritis when compared with feeding only cow's milk based formula. However, when considering all causes of diarrhoea together no significant differences were found in the duration of symptoms in infants taking cow's milk formula, soya-based formula, exclusive or partial breastfeeding (Haffejee 1990).

Of the studies during persistent diarrhoea, Saulsbury et al (1980) showed that persistent rotaviral diarrhoea was successfully cured in two immunosuppressed infants with modified, lactose-free human milk containing high antirotavirus antibody titers. Sunshine (1980) reported that 50 children with intractable non-specific enterocolitis were succesfully treated with banked human milk, however without giving any further details. MacFarlane and Miller (1984) used banked human milk to treat 11 of 13 children with persistent diarrhoea succesfully. This illness had been severe enough in several cases to require intravenous therapy. Disaccharide or monosaccharide intolerance had been present in all children at some stage during the illness, and cow's milk protein intolerance had been diagnosed in six. Fresh human colostrum was found to help recovery in 6 of 8 malnourished children (Saha et al 1990). These results must be interpreted with caution because of small sample sizes and lack of controls.

In contrast, in a small randomised trial, Shulman et al (1989) found that enteral feeds of banked, processed, low-lactose breastmilk did not accelerate functional recovery of the small intestinal mucosa any faster than sterile water in infants less than 6 months of age being treated for persistent diarrhoea with parenteral nutrition. The functional recovery of patients was measured by glucose and water absorption, disaccharidase activities and atrophy of villi. Lactose was hydrolysed to avoid problems of lactose intolerance, which may not have been necessary. However, the processing may have altered the functioning of other factors in breastmilk, such as hormiones and growth factors, which might otherwise have promoted recovery. Also, in a prospective multicentre study evaluating a low-lactose cow's milk based treatment protocol for persistent diarrhoea, continued partial breastfeeding did not contribute to the succes of therapy (IWGPD 1996).

It remains possible that breastmilk alone may be more effective in curing persistent diarrhoea than breastmilk combined with another source of nutrition, but appropriate studies have not been conducted.

Table 5: Effect of breastfeeding in the treatment of acute diarrhoea

Reference Country	Type of study	Study population at admission	Diet during therapy	Outcome of therapy	Preillness feeding
Kassem et al 1983 Egypt	controlled	n=60 age:<1 y. mild-moderate dehydration wellnourished	A. ORS B. BF&ORS until rehydration	Significantly faster normalisation in stool consistency with BF	BF
Khin-Maung et al 1985 Burma	randomized controlled	n=52 age: 6-24 mo. moderate-severe dehydration wellnourished	A. ORS alone B. BF&ORS during first 24 hours	number&volume of stools reduced significantly faster with BF	BF
Brown et al 1989 Peru	longitudinal community-based	n=153 age: newborns	eBF, pBF or not BF	shorter duration of diarrhoea with eBF and pBF	as during illness
Haffejee 1990 South Africa	clinical	n=309 age:3-28 mo. rotaviral diarrhoea in 127 25 % malnourished	A. cow's milk formula B.eBF C. pBF D.soya formula	Faster recovery with eBF than with cow's milk formula in rotaviral diarrhoea	as during illness

eBF= exclusive breastfeeding
pBF= partial breastfeeding
BF= breastfeeding
ORS= oral rehydration solution

Table 6: Effect of breastmilk in the treatment of persistent diarrhoea

Reference Country	Type of study	Study population at admission	Diet during therapy	Outcome of therapy	Preillness feeding
Saulsbury et al 1980 USA	clinical	n=2 age: 7&19 mo. immuno-deficient	banked, lactose-free BM with antirotavirus antibodies	both patients were eventually cured	no info
Sunshine 1980 USA	clinical	n=50 age: >1 y.	banked BM	succesful treatment of all patients	no info
MacFarlane and Miller 1984 Britain	clinical	n=13 age: mean 5.5 mo. severe malnutrition	banked BM either fresh or pasteurized gradually over 2-3 days	succesful treatment of 11/13 patients, 7 patients in 7 d, 4 patients eventually	no BF, different modified formulas
Shulman et al 1989 USA	randomized controlled	n=16 age: <6 mo. moderate-severe malnutrition	**A.** low-lactose processed BM 14 ml/kg/d for 2 weeks & TPN **B.** sterile water 14 ml/kg/d for 2 weeks & TPN	no acceleration in functional recovery of small intestinal mucosa with processed breastmilk	no BF, different modified formulas
Saha et al 1990 India	clinical	n=8 age:9-36 mo severe malnutrition marasmic	fresh, frozen human colostrum 20 ml/d for 7 days + supplementary foods	6 of 8 patients were cured eventually	no BF
IWGPD 1996 several countries	prospective multicentre	n=460 age:4 mo.-3 y malnourished very ill	low-lactose diet & continued BF 150 kcal/kg/d	no effect of pBF on the recovery	pBF

pBF= partial breastfeeding
BF= breastfeeding
BM= breastmilk
TPN= total parenteral nutrition

8. NUTRITIONAL TREATMENT OF PERSISTENT DIARRHOEA

WHO recommends that all children with persistent diarrhoea should be given a nutritious diet (WHO/CDR/95.3)

- which is appropriate for their age
- which has a limited content of lactose from animal milk
- which provides a daily intake of at least 110 kcal/kg
- which includes supplementary multivitamins and minerals, and
- which is given in small frequent feeds, at least six times a day

Most children with persistent diarrhoea can be treated at home. However, some require hospital treatment including

- children with moderate or severe malnutrition
- children with a serious systemic infection, such as pneumonia or sepsis
- children with signs of dehydration
- infants below 4 months of age

Breastfeeding

WHO recommends that infants up to at least 4, and if possible 6 months of age, should be exclusively breastfed. An infant below 4-6 months of age who is not exclusively breastfed should breastfeed more, and other food or fluids should if possible be reduced or stopped altogether, whether or not the infant has diarrhoea. In persistent diarrhoea, this can be a valuable part of treatment.

From 6 months of age up to 2 years or beyond, children should continue to breastfeed and also be given adequate complementary food. If a child in this age group has diarrhoea, and is breastfed, the mother should give more frequent, longer breastfeeds, day and night, in addition to appropriate complementary food.

The re-establisment of exclusive breastfeeding in partially breastfed infants below about 6 months of age is a new and promising approach in the treatment of diarrhoea. It has been investigated in a randomised study with mothers of babies under 12 weeks of age admitted to a diarrhoea treatment centre in Bangladesh (Haider et al 1996). Mothers in the intervention group received individual breastfeeding counselling by trained counsellors during their hospital stay and one week later at home, while mothers in the control group attended routine health education lessons without counselling. The success of the approach was remarkable with 75% of infants in the intervention group being exclusively breastfed two weeks later, compared to only 8% in the control group.

If an infant has stopped breastfeeding completely, it is usually possible for his mother to start breastfeeding again, that is to relactate (WHO/CHD - review in preparation). Relactation is well recognized as a feasible intervention and is already practised in many places. It is easier with younger babies, who are willing to suckle, and when the time since the mother stopped breastfeeding is shorter. However, it is possible at any age, and at any time. Infants who are unwilling to suckle can be

encouraged to do so by using a breastfeeding supplementer or syringe to provide them with milk while they suckle at the breast. Mothers require skilled support and frequent encouragement. It usually takes from 1-3 weeks to restart the production of breastmilk

Re-establishing exclusive breastfeeding, and relactation, should be considered highly feasible alternatives to complicated dietary interventions such as comminuted chicken or intravenous nutrition in the treatment of persistent diarrhoea, and preferable for younger infants.

Other milks

If a breastmilk substitute must be given to an infant less than 4 months of age with persistent diarrhoea, it should be low in lactose. A lactose-free infant formula can be used. Yoghurt is an alternative, but unmodified animal milks have a larger protein and solute load than is appropriate for young infants.

For older children yoghurt can be given in place of animal milk. Alternatively, the intake of animal milk can be limited to 50 ml/kg/day and mixed with the child's complementary food (for example, cereal). The milk should not be diluted. Children whose symptoms do not improve on a diet with a reduced lactose content, should be given a lactose-free diet with a reduced starch content.

Other foods

Infants older than 4 months whose only food has been animal milk should begin to take solid foods.

Recommended solid foods should be culturally acceptable, readily available, have a high content of energy, and provide adequate amounts of essential micronutrients. These foods should be well cooked, and mashed or ground.

After the diarrhoea stops the children may return to an appropriate diet for age. One extra meal should be given each day for at least two weeks. If the child is malnourished, extra meals should be given until the child has regained normal weight-for-height.

9. CONCLUSION

Breastfeeding, particularly exclusive breastfeeding, is important for the prevention of persistent diarrhoea. It reduces the incidence of acute diarrhoea, and continuing to breastfeed shortens individual episodes. With cow's milk or formula feeding, the risk of an episode becoming persistent is increased.

Breastmilk may be of value in the treatment of persistent diarrhoea, but this is less well established. There are few studies, and most have methodological problems which make it difficult to draw conclusions. Such evidence as there is suggests that breastmilk may be beneficial when fed exclusively, but is less helpful when part of a mixed diet, even if non-human milk is excluded. Most studies of the use of milk in the management of diarrhoea have compared only different kinds of non-human milks.

The aim for all infants under at least 4 and, if possible, 6 months of age, whether or not they have diarrhoea, should be to enable them to breastfeed exclusively and to stop artificial milk feeding. For children older than 6 months, the aim should be to continue or increase breastfeeding and to give adequate complementary foods, and if they develop persistent diarrhoea to temporarily reduce or replace any non-human milk in their diet. The need for alternative dietary treatment such as comminuted chicken, and for specialised and expensive treatment such as total parenteral nutrition, could be minimized.

In conclusion, optimal breastfeeding practices should be promoted to prevent the problem of persistent diarrhoea, particularly in younger age groups. In addition, helping mothers to increase their infants' breastmilk intake, or to relactate if they have stopped breastfeeding; and re-establishing exclusive breastfeeding for infants under about 6 months of age, should become routine in the management of persistent diarrhoea.

REFERENCES

Anonymous. What has happened to carbohydrate intolerance following gastroenteritis? Lancet 1987;1:23-24.

Arora NK, Bhan MK, Ghai OP. Protracted diarrhea of infancy: its aetiology and management in 25 patients. Indian Pediatr 1981;18:272-8.

Baqui AH, Black RE, Sack RB, Yunus MD, Siddique AK, Chowdhury HR. Epidemiological and clinical characteristics of acute and persistent diarrhea in rural Bangladeshi children. Acta Paediatr suppl 1992;381:15-21.

Bhan MK, Bhandari N, Sazawal S, Clemens J, Raj P, Levine MM, Kaper JB. Descriptive epidemiology of persistent diarrhoea among young children in rural Northen India. Bull WHO 1989;67:281-8.

Bhatnagar S, Bhan MK, George C, Gupta U, Kumar R, Bright D, Saini S. Is small bowel bacterial overgrowth of pathogenic significance in persistent diarrhea? Acta Paediatr suppl 1992;381:108-13.

Black RE. Persistent diarrhea in children of developing countries. Pediatr Infect Dis J 1993;12:751-61.

Black RE, Brown KH, Becker S. Malnutrition is a determining factor in diarrheal duration, but not incidence, among young children in a longitudinal study in rural Bangladesh. Am J Clin Nutr 1984;39:87-94.

Brown KH, Black RE, Lopez de Romaña G, Kanashiro HC. Infant feeding practices and their relationship with diarrhoeal and other diseases in Huascar (Lima), Peru. Pediatrics 1989;83:31-40.

Brown KH, Lake A. Appropriate use of human and non-human milk for the dietary management of children with diarrhoea. J Diarrhoeal Dis Res 1991;3:168-85.

Brown KH, Peerson JM, Fontaine O. Use of nonhuman milks in the dietary management of young children with acute diarrhea: a meta-analysis of clinical trials. Pediatrics 1994;93:17-27.

Brown KH, Perez F. Determinants of dietary intake during childhood diarrhea and implications for appropriate nutritional therapy. Acta Paediatr suppl 1992;381:127-32.

Claeson M, Merson MH. Global progress in the control of diarrhoeal diseases. Pediatr Infect Dis J 1990;9:345-55.

Clemens J, Rao M, Ahmed F, et al. Breast-feeding and the risk of life-threatening rotavirus diarrhea: prevention or postponement? Pediatrics 1993;92:680-5.

Cruz JR, Bartlett AV, Mendez H, Sibrian R. Epidemiology of persistent diarrhea among Guatemalan rural children. Acta Paediatr suppl 1992;381:22-26.

de Zoysa I, Rea M, Martines J. Why promote breastfeeding in diarrhoeal disease control programmes? Health Pol Plan 1991;6:371-9.

Douwes AC, Oosterkamp RF, Fernandes J, Los T, Jongbloed AA. Sugar malabsorption in healthy neonates estimated by breath hydrogen. Arch Dis Child 1980;55:512-5.

Duffy LC, Riepenhoff-Talty M, Byers TE, La Scolea LJ, Zielezny MA, Dryja DM, Ogra PL. Modulation of rotavirus enteritis during breast-feeding. AJDC 1986;140:1164-8.

Ebrahim GJ. Breast milk and the absorptive process (Editorial). J Trop Pediatr 1985;31:2-3.

Fagundes-Neto U, Wehba J, Viaro T, Machado NL, da Silva Patrício FR. Protracted diarrhea in infancy: clinical aspects and ultrastructural analysis of the small intestine. J Pediatr Gastroenterol Nutr 1985;4:714-22.

Goldman AS. The immune system of human milk: antimicrobial, anti-inflammatory, and immunomodulating properties. Breastfeeding review 1994;2(9):422-9.

Guarino A, Spagnuolo MI, Russo S, et al. Etiology and risk factors of severe and protracted diarrhoea. J Pediatr Gastroenterol Nutr 1995;20:173-8.

Haffejee IE. Cow's milk-based formula, human milk, and soya feeds in acute infantile diarrhea: a therapeutic trial. J Pediatr Gastroenterol Nutr 1990;10:193-8.

Haider R, Islam A, Hamadani J, et al. Breastfeeding counselling in a diarrhoeal disease hospital. WHO Bull 1996;74:173-9.

Hambidge KM. Zinc and diarrhea. Acta Paediatr suppl 1992;381:82-6.

Harrison M, Kilby A, Walker-Smith JA, France NE, Wood CBS. Cow's milk protein intolerance: a possible association with gastroenteritis, lactose intolerance, and IgA deficiency. BMJ 1976;1:1501-4.

Henry FJ, Udoy AS, Wanke CA, Aziz KMA. Epidemiology of persistent diarrhea and etiologic agents in Mirzapur, Bangladesh. Acta Paediatr suppl 1992;381:27-31.

Hill DJ, Hosking FRACP and CS. Patterns of clinical disease associated with cow milk allergy in childhood. Nutr Res 1992;12:109-21.

Huttly SRA, Hoque BA, Aziz KMA, Hasan KZ, Patwary MY, Rahaman MM, Feachem RG. Persistant diarrhea in a rural area of Bangladesh: a community-based longitudinal study. Int J Epidemiol 1989;18:964-9.

Høst A, Husby S, Østerballe O. A prospectiv study of cow's milk allergy in exclusively breast-fed infants. Acta Paediatr Scand 1988;77:663-70.

International working group on persistent diarrhoea. Evaluation of an algorithm for the treatment of persistant diarrhea: a multicentre study. WHO Bull 1996;74:479-89.

Iyngkaran N, Robinson MJ, Sumithran E, Lam SK, Puthucheary SD, Yadav M. Cow's milk protein-sensitive enteropathy. Arch Dis Child 1978;53:150-3.

Iyngkaran N, Yadav M, Boey CG, Lam KL. Effect of continued feeding of cow's milk on asymptomatic infants with milk protein sensitive enteropathy. Arch Dis Child 1988;63:911-5.

Johnson JD, Kretchmer N, Simoons FJ. Lactose malabsorption: its biology and history. Advan Pediatr 1974;21:197-237.

Kassem AS, Elaraby II, Madkour AA, Abdo MO, Elshehaby MA. Effect of non-interruption of breast feeding in acute infantile diarrhea. Gazette Egypt Paediatr Assoc 1983;31:61-66.

Keusch GT, Thea DM, Kamenga M, Kakanda K, Mbala M, Brown C, Davachi F. Persistent diarrhea associated with AIDS. Acta Paediatr suppl 1992; 381:45-8.

Khin-Maung-U, Nyunt-Nyunt-Wai, Myo-Khin, Mu-Mu-Khin, Tin-U, Thane-Toe. Effect on clinical outcome of breast feeding during acute diarrhoea. British Med J 1985;290:587-589.

Khoshoo V, Bhan MK, Arora NK, Sood D, Kumar R, Stintzing G. Leucocyte migration inhibition in cow's milk protein intolerance. Acta Paediatr Scand 1986;75:308-12.

Kleinman RE. Milk protein enteropathy after acute infectious gastroenteritis: experimental and clinical observations. J Pediatr suppl 1991;118:s111-5.

Lanata CF, Black RE, Creed-Kanashiro H, Lazo F, Gallardo ML, Verastegui H, Brown KH. Feeding during acute diarrhea as a risk factor for persistent diarrhea. Acta Paediatr suppl 1992;381:98-103$_1$.

Lanata CF, Black RE, Gilman RH, Lazo F, Del Aguila R. Epidemiologic, clinical, and laboratory characteristics of acute vs. persistent diarrhea in periurban Lima, Peru. J Pediatr Gastroenterol Nutr 1991;12:82-8.

Lanata CF, Black RE, Maurtua D, et al. Etiologic agents in acute vs. persistent diarrhea in children under three years of age in peri-urban Lima, Peru. Acta Paediatr suppl 1992;381:32-8$_2$.

Lebenthal E, Leung YK. Epidermal growth factor (EGF) and the ontogeny of the gut (editorial). J Pediatr Gastroenterol Nutr 1987;6:1-5.

MacFarlane PI, Miller V. Human milk in the management of protracted diarrhoea of infancy. Arch Dis Child 1984;59:260-265.

Marquis G S, Lopez T, Peerson J M, Brown K H. Effect of dietary viscosity on energy intake by breast-fed and non-breast-fed children during and after acute diarrhea. Am J Clin Nutr 1993;57:218-23.

Murray RD. Does the fecal flora of breast-fed infants limit gastroenteritis (editorial). J Pediatr Gastroenterol Nutr 1992;15:246-7.

Nguyen Thi Kim T, Pham Ngoc T, Dabis F. Recherche des facteurs de risque de diarrhee persistante par une etude cas-temoins chez les enfants de moins de trois ans hospitalises au sud du Viet Nam. abstract, unpublished, 1994.

Ogawa K, Ben RA, Pons S, de Paolo MIL, Fernández LB. Volatile fatty acids, lactic acid, and pH in the stools of breast-fed and bottle-fed infants. J Pediatr Gastroenterol Nutr 1992;15:248-52.

Penny ME, Brown KH. Lactose feeding during persistent diarrhea. Acta Paediatr suppl 1992;381:133-8.

Penny ME, Paredes P, Brown KH. Clinical and nutritional consequences of lactose feeding during persistant postenteritis diarrhea. Pediatrics 1989;84:835-44.

Penny ME. The role of the duodenal microflora as a determinant of persistant diarrhea. Acta Paediatr suppl 1992;381:114-20.

Prentice A. Breastfeeding and the older infant. Acta Paediatr Scand suppl 1991;374:78-88.

Roy SK, Akramuzzaman SM, Haider R, Majid N, Khatun M, Akbar MS, Alam AN. Persistent diarrhea: factors affecting absorption and clinical prognosis during management with rice-based diet. Acta Paediatr suppl 1992;381:139-43.

Roy SK, Haider R, Akbar MS, Alam AN, Khan M, Eeckels R. Persistant diarrhea: clinical efficacy and nutrient absorption with a rice-based diet. Arch Dis Child 1990;65:294-7.

Saavedra JM. Microbes to fight microbes: a not so novel approach to controlling diarrheal disease. J Pediatr Gastroenterol Nutr 1995;21:125-9.

Saha K, Dua N, Chopra K. Use of human colostrum in the management of chronic infantile diarrhoea due to Enteropathogenic *E. coli* infection with associated intestinal parasite infestations and undernutrition. J Trop Pediatr 1990;36:247-50.

Saulsbury FT, Winkelstein JA, Yolken RH. Chronic rotavirus infection in immunodeficiency. Pediatrics 1980;97:61-5.

Sazawal S, Bhan MK, Bhandari N. Type of milk feeding during acute diarrhea and the risk of persistent diarrhea: a case-control study. Acta Paediatr suppl 1992;381:93-7.

Schrimshaw NS, Murray EB. The acceptability of milk and milk products in populations with a high prevalence of lactose intolerance. Am J Clin Nutr 1988;48(suppl 4):1083-5.

Shahid NS, Sack DA, Rahman M, Alam AN, Rahman N. Risk factors for persistent diarrhoea. BMJ 1988;297:1036-8.

Shulman RJ, Lifschitz CH, Langston C, Gopalakrishna GS, Nichols BL. Human milk and the rate of small intestinal mucosal recovery in protracted diarrhea. J Pediatr 1989;114:218-24.

Snyder JD. Dietary protein sensitivity: is it an important risk factor for persistent diarrhea? Acta Paediatr suppl 1992;381:78-81.

Sullivan PB, Marsh MN. Small intestinal mucosal histology in the syndrome of persistent diarrhea and malnutrition: a review. Acta Paediatr suppl 1992;381:72-7.

Sunshine P. Use of human milk in the treatment of patients with intractable diarrhea of infancy and the short gut syndrome. In: Human milk - its biological and social value. Eds. Freier S, Eidelman AL. International Congress Series 518, 1980. pp. 214-7.

Thapa BR. Intractable diarrhea of infancy and its management: modified cost effective treatment. J Trop Pediatr 1994;40:157-61.

Tolboom JJM, Moteete M, Kabir H, Molatseli P, Fernandes J. Incomplete lactose absorption from breast milk during acute gastroenteritis. Acta Paediatr Scand 1986;75:151-5.

Victora CG, Huttly SRA, Fuchs SC, et al. International differences in clinical patterns of diarrhoeal deaths: a comparison of children from Brazil, Senegal, Bangladesh, and India. J Diarrhoeal Dis Res 1993;11:25-9.

Visakorpi JK. Milk and soybean protein allergy. J Pediatr Gastroenterol Nutr 1983;2(suppl 1): s293-7.

Wold AE, Hanson LÅ. Defense factors in human milk. Curr Opinion Gastroenterol 1994;10:652-8.

Woolridge MW, Fisher C. Colic, "overfeeding", and symptoms of lactose malabsorption in the breast-fed baby: a possible artifact of feed management? Lancet 1988;2:382-4.

World Health Organization. Persistent diarrhea in children in developing countries. Memorandum from a WHO meeting, Geneva, WHO. Bull WHO 1988;66:709-17.

World Health Organization. Relactation WHO/CHD/97.-- (in preparation)

World Health Organization. The treatment of diarrhoea. A manual for physicians and other senior health workers. WHO/CDR/95.3.