

Recent developments in the nutritional management of diarrhoea

3. Practical approaches towards dietary management of acute diarrhoea in developing communities

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Abstract

Diarrhoeal diseases are a major cause of malnutrition, partly due to poor dietary practices. Misconceptions among the general population and medical personnel lead to withholding of food or avoiding the use of nutritious, locally available and affordable foods. Breast-feeding should not be interrupted during diarrhoea. Many recent studies have shown that when cow's milk is used, full-strength milk should be fed throughout the disease and in convalescence. The concept of diluting milk with water should be altogether avoided. If necessary, full-strength milk should be mixed with equal amounts of other foods. Other recent studies have shown that several diets based on local staples are excellent choices for the dietary management of diarrhoea. An all-vegetable diet commonly eaten in Guatemala produced a sharp decrease in the duration of acute diarrhoea (median duration after feeding began: 1.8 d) and its macronutrients were reasonably well absorbed. Practical recommendations are given, including nutritional, physiological, cultural and economic considerations.

Introduction

Diarrhoeal diseases are a major cause of malnutrition. Pre-schoolchildren in many developing countries have diarrhoea 35-70 d per year, or about 10-20% of the time (BLACK *et al.*, 1981; CRUZ *et al.*, in press, b). Mortality has decreased with appropriate oral rehydration therapy, but nutritional damage is commonplace because of faecal losses of incompletely absorbed nutrients and reduced food or nutrient intake. The latter is due to anorexia and inadequate dietary practices. With each new episode of diarrhoea, nutritional damage increases and it is more severe when poor dietary practices continue into convalescence.

Although poor appetite is an important determinant of low food intake, adequate feeding practices are essential to prevent or reduce nutritional damage. Furthermore, feeding during diarrhoea helps to preserve the integrity of the intestinal mucosa, disaccharidase activity and absorptive functions (GREENE *et al.* 1975; KOTLER *et al.*, 1980; GUEDON *et al.*, 1986). However, although several reviews, technical reports and practical guidelines have insisted on the advantages of continued feeding during diarrhoea (MAHALANABIS, 1983; ROHDE *et al.*, 1983; BROWN & MACLEAN, 1984; URRUTIA & GARRIDO, 1984; NAS/

NRC, 1985; TORÚN, 1986; JELLIFFE & JELLIFFE, 1989), withholding food during the early stages of acute diarrhoea and substitution of nutritious foods with dilute preparations of low nutritional value are still common practices.

Causes of inadequate feeding practices

Misconceptions among the general population have led to the belief that a wide variety of foods should be withheld or markedly reduced during diarrhoea. Many people avoid milk for fear that children with diarrhoea cannot tolerate it. Doctors and health workers often encourage this practice, based on the decrease of lactase activity usually seen in diarrhoeal diseases, on the incomplete digestion of lactose (usually diagnosed from the presence of reducing substances in faeces or after giving a pharmacological dose of lactose), and on clinical observations and reports, not always adequately controlled. This is very unfortunate, as most children tolerate significant amounts of milk in spite of these considerations. In some instances these misconceptions have led to interruption of breast-feeding.

Many common foods are rejected because of the belief that their fibre or fat content might make the diarrhoea worse, or on culture-specific concepts that certain categories of foods, categorized as 'cold' or 'heavy', should not be fed to sick children (JELLIFFE *et al.*, 1987).

Economic factors are another cause of poor dietary practices during diarrhoea. Many of the foods often recommended by doctors are more expensive than those commonly available in low-income households. Special diets, such as commercial soy-based formulas and elemental or semi-elemental diets, are unaffordable by people in poor urban neighbourhoods or rural areas of developing countries.

Other issues include the sick child's poor appetite, the mother's attitudes towards foods that she dislikes, and inability or unwillingness to prepare foods that require much time or cooking fuels.

These cultural and economic constraints often lead parents to use watery solutions and extremely diluted preparations of starches or local staples to feed their sick children.

Adequate use of foods and diets

Although there is a reduction in appetite during acute diarrhoea, most children will eat nutritionally

important amounts of food (MOLLA *et al.*, 1982, 1983; BROWN, in press; TORÚN & FUENTES, in press). To counteract the low appetite, palatable foods should be offered frequently and patiently, giving priority to whatever the child wants to eat. Liquid foods should also be given priority, as they are usually better accepted than solid foods by the anorexic child, and take advantage of the child's thirst. Furthermore, in addition to nutrients, liquid foods provide water and electrolytes to compensate for faecal losses, thereby reducing the risk of dehydration. In clinical settings, patients with severe anorexia can be fed by nasogastric tube.

Breast milk

If the sick child is breast-fed, the mother's milk is the liquid food of choice. Controlled studies, where breast-feeding continued during the rehydration phase of acute diarrhoea, showed an improvement in stool consistency, a reduction in the number of stools and a tendency towards lower faecal output and improved rehydration (KASSEM *et al.*, 1983; KHIN MAUNG U, 1984; KHIN MAUNG U *et al.*, 1985). The protective effect of breast-feeding on diarrhoea morbidity and mortality was reviewed by FEACHEM & KOBLINSKY (1984). Other more recent studies have also shown that infants who were exclusively breast-fed had shorter and less frequent episodes of diarrhoea than those who were partially breast-fed or fully weaned (BROWN *et al.*, 1989; CRUZ *et al.*, 1990).

Cow's milk

Children who have been weaned must receive another liquid food. If a child is still partially breast-fed, continuation of this practice must be encouraged, alternating the breast with the other food.

The most commonly used liquid food in most societies is milk from other species, notably cow's milk. Some pediatricians recommend a reduction and gradual reintroduction of milk intake during or after acute diarrhoea. However, several studies in developing countries (BADR EL DIN *et al.*, 1983; HAQUE *et al.*, 1983) and industrialized countries (REES & BROOK, 1979; DUGDALE *et al.*, 1982; ISOLAURI *et al.*, 1986; ARMITSTEAD *et al.*, 1989; CONWAY & IRESO, 1989; HJELT *et al.*, 1989) have shown that gradual schemes have no advantage over the use of full-strength, non-diluted milk from the start, and that the latter may, in fact, be associated with better weight gain. Furthermore, the recommendation to use an initial regimen of diluted milk may confuse mothers, leading them to use diluted milk more often and longer than necessary, thereby providing insufficient amounts of nutrients to their children and augmenting malnutrition in areas where diarrhoeal diseases are prevalent.

Before recommending the uninterrupted use of cow's milk for children with diarrhoea, the following 8 factors must be considered. (i) Children of different ages, races and geographical origins may have different genetic and epidemiological characteristics related to lactase deficiency. Dietary habits, possibly associated with genetic traits, may also play a role (BRASSEUR & GOYENS, 1989). (ii) Lactose malabsorption (i.e., incomplete digestion of lactose in the small intestine) is not necessarily accompanied by gastroin-

testinal manifestations of intolerance, such as increased stool volume, weight loss, vomiting or dehydration (TORÚN *et al.*, 1979; SCRIMSHAW & MURRAY, 1988). (iii) Infants usually tolerate human milk quite well, although its lactose concentration is 50% higher than cow's milk. (iv) Intolerance to the pharmacological doses of lactose used in some diagnostic procedures does not necessarily indicate intolerance to the lactose contained in dietary amounts of milk (TORÚN *et al.*, 1979; SCRIMSHAW & MURRAY, 1988). Most patients with diarrhoea and some degree of lactose malabsorption have no problems with small amounts of milk, either alone or as part of a mixed diet (ISOLAURI *et al.*, 1986; BROWN *et al.*, 1980; WALKER-SMITH, in press). (v) The presence of reducing sugars in faeces does not necessarily indicate lactase deficiency, as they are often found in faeces of children who are receiving only oral rehydration solutions or other sugar-containing foods. (vi) Milk can usually be fed at full strength; when it is desired to reduce milk intake, the recommendation should be to mix full-strength milk with another nutritious food, rather than to dilute it with water. (vii) When food mixtures with gradually increasing concentrations of milk are indicated, each level of diluted milk must be given for only a short period of time (1–2 d). This must be clearly explained to the mothers. Full-strength milk is usually well tolerated in convalescence, and this also should be made clear to the child's mother. (viii) When culturally acceptable, yoghurts and fermented milks may be practical dietary options for children with lactose intolerance (DEWIT *et al.*, 1987). However, not all yoghurts have low concentrations of lactose (MARTINI *et al.*, 1987; WYTOCK & DI PALMA, 1988).

Other foods

Some cereals, prepared at home or industrially refined, are readily accepted by mothers and doctors; rice is probably the most widely used. A recent study using an industrially processed form of rice enriched with the stable isotope carbon-13 (C. Lifschitz *et al.*, paper in preparation), showed that infants as young as 2–4 months old, with acute diarrhoea, absorbed significant amounts of the macronutrients provided by an isoenergetic mixture of rice and cow's milk formula with 2.4 g protein and 255 J (61 kcal) per dl.

Several studies in developing countries suggest that a wide variety of common local foods, many of vegetable origin and some with significant contents of vegetable oil, may be used to feed children with diarrhoea (Table 1). The amounts of oil are particularly important to increase the diet's energy density and provide adequate amounts of dietary energy to anorexic or young children. Although some of those studies were done with small numbers of patients and inadequate controls, diarrhoea did not become worse and, when measured, there was fairly good absorption of macronutrients in the acute stage, which rapidly increased during convalescence (Table 2).

We recently studied 53 children, 7–32 months old, during acute diarrhoea and the first 3 d of convalescence (TORÚN & FUENTES, 1990). Thirty-one ate a diet of vegetable origin consisting of incaparina gruel (58% corn flour, 38% cottonseed flour, 4% lysine, vitamin and mineral mix) with 5% sugar and a pap with 5.6%

Table 1. Studies using staples and other foods in the dietary management of children with acute diarrhoea in developing countries

| Diet with staples or common local foods | Country (Reference) | Number and age of children ^a | Conclusions and comments ^b |
|---|---|--|--|
| Chick-peas (16%), skim milk | Chile (Garcia & Harum, 1975) | 68, 1-21 m | More children improved within 6 d than 36 others who received acid milk. |
| Carrots (5 or 20%), acid milk, sugar, oil | Chile (Ibáñez <i>et al.</i> , 1979, 1986) | 56, mean 4.6 m (1979) 11, mean 5.4 m (1986) | Shorter duration of diarrhoea, similar N absorption and weight gain, cf. similar children fed acid milk or diluted cow's milk |
| Chicken-lentils-oil; rice-egg-milk-butter-sugar; bread, banana, milk | Bangladesh (Molla <i>et al.</i> , 1982, 1983) | 32, 35±19 m (1982) 68, <5 y (1983) | Absorption of macronutrients relatively good during diarrhoea and increased in convalescence. Gradual increase in food intake did not increase faecal output. No control diet. |
| Wheat noodles (gradual increase to 50% of energy intake), milk or casein, oil and sugar | Peru (Brown <i>et al.</i> , 1982) | 10, 7-28 m | Feeding began after 2-8 d with oral or i.v. glucose-electrolytes. Absorption of macro-nutrients relatively good. No control diet. |
| Potatoes (50% of energy and 60% of protein intake) and casein-oil-sugar or milk | Peru (Brown <i>et al.</i> , 1988; Alarcón <i>et al.</i> , 1990) | 12, 4-31 m 29, 5-24 m | Absorption of N adequate. Clinical evaluation and recovery similar to historical controls fed casein-sucrose, oil or soya formula. |
| Soft rice and fish, or soft rice and pulses, or baked banana | Burma (Soe Soe Aye, cited by Khin-Maung-U, 1984) | ? | Preliminary results indicated no difference in severity of diarrhoea cf. control children whose mothers decided to withhold feeding. |
| Boiled rice, chicken and pulses | Bangladesh (Molla <i>et al.</i> , 1989) | 46, 44±15 m (cholera) | Stool output decreased with introduction of diet after 24 h with ORS. |
| Corn-cottonseed flour; rice-corn-black beans, oil and sugar | Guatemala (Torún & Fuentes, 1990) | 31, 7-32 m | Duration of diarrhoea and faecal excretion markedly lower than in children on lactose-hydrolysed milk and rice-egg-oatmeal diet. Absorption of macronutrients relatively good. |
| Milk-corn, or corn-cottonseed rice, or corn-black beans, or mixed Guatemalan diet | Guatemala (Dárdano <i>et al.</i> , 1990) | 12-16 with each diet, 6-36 m | Preliminary results indicated no increase in duration or severity of diarrhoea. Adequate growth, especially with milk-corn. |
| Wheat-peas-carrots-oil-sugar | Peru (Alarcón <i>et al.</i> , 1990) | 29, 5-24 m | Purging rate lower than with soy formula. Duration of diarrhoea markedly shorter than with soy formula or potato-milk diet. |

^aNumber of children receiving the diet with local foods. Ages are means with standard deviation, or ranges; d=days, m=months, y=years. Dates are shown in parentheses if more than one study done.

^bAbbreviations: cf., compared with; i.v., intravenous; N, nitrogen; ORS, oral rehydration solution.

Table 2. Apparent absorption of macronutrients with different diets in the acute phase of diarrhoea and in early convalescence

| Diet ^a | n ^b | Apparent Energy | absorption (%) ^c Nitrogen | Fat |
|--|-----------------|-----------------|---|-------|
| Acute diarrhoea | | | | |
| Mixed Bangladeshi | 39 | 71±24 | 47±33 | 58±36 |
| Mixed Bangladeshi | 29 ^d | 81±10 | 47±26 | 70±22 |
| Guatemalan, with milk | 20 | 73±15 | 65±17 | 76±14 |
| Guatemalan, all vegetable | 26 | 71±11 | 44±16 | 58±20 |
| Convalescence | | | | |
| Mixed Bangladeshi ^e | 39 | 85±10 | 66±23 | 83±15 |
| Mixed Bangladeshi ^e | 29 ^d | 91±4 | 73±11 | 90±9 |
| Guatemalan, with milk ^f | 20 | 87±6 | 81±9 | 84±16 |
| Guatemalan, all vegetable ^f | 26 | 88±4 | 67±11 | 89±10 |

^aDescribed in Table 1. Sources: Molla *et al.* (1983), Torún & Fuentes (1990).

^bNumber of subjects.

^cWithout accounting for faecal losses of bacterial or endogenous origin; means±standard deviations.

^dCholera patients.

^eDays 15-17 of convalescence.

^fDays 1-3 of convalescence.

rice, 7% corn, 2.5% black beans (*Phaseolus vulgaris*), 2.5% vegetable oil and 9% sugar. Twenty-two children drank a liquid formula of full-strength, lactose-hydrolysed, cow's milk and a pap with 6.4% rice, 8% hard boiled egg, 6% oatmeal, 3% vegetable oil and

Table 3. Clinical outcome of Guatemalan pre-schoolchildren with acute diarrhoea and fed on two different diets

| | Diet ^a | |
|-----------------------------------|-----------------------------|-----------------------|
| | Animal and vegetable (n=22) | Vegetable only (n=31) |
| Average duration of diarrhoea (d) | 5.3 (0.3-17.4) | ** 1.8 (0.2-20.0) |
| No. of patients with | | |
| Diarrhoea <1 d | 3 (14%) | ** 10 (32%) |
| Diarrhoea >10 d | 5 (23%) | ** 1 (3%) |
| Average no. of stools/d | 6.5 (3-13) | 7.9 (3-13) |
| Average purging rate (g/kg/d) | 33 (14-137) | 37 (12-103) |
| Total faecal losses (g/kg) | 215 (28-575) | ** 54 (5-435) |

^aSignificant difference between diets ($P<0.01$) indicated thus: **.

10% sugar. As shown in Table 3, duration of diarrhoea with the all-vegetable diet was one-third of that with the mixed animal-vegetable diet, and the vegetable diet did not increase severity (based on the number and weight of stools).

The coefficients of absorption (Table 2) indicated that, even without accounting for faecal losses of bacterial and endogenous origin, the children could absorb enough macronutrients to meet their requirements when food intake was adequate. The difference between diets in apparent nitrogen absorption can be

explained largely by the lower digestibility of vegetable proteins (15–25% lower than milk and egg proteins). The low absorption of fat with the vegetable diet during diarrhoea could have been a technical artefact due to the low amounts of dietary fat, which were increased in convalescence with additional vegetable oil.

The short duration of diarrhoea with the vegetable diet is noteworthy. Not only did it result in less total faecal loss of water and nutrients during the diarrhoeal episode, with positive implications for hydration and nutrition, but it is important to the sick child's mother, who wishes that the diarrhoea should stop as soon as possible. This may have a positive effect on the mother's acceptance and attitude towards health and nutrition recommendations, including oral rehydration therapy which, by itself, has no noticeable impact on the duration of the diarrhoeal illness.

Recent studies using common local foods in Peru (ALARCON *et al.*, 1990) and Nigeria (Grange & Brown, unpublished observations) gave results consistent with ours. The shortening of the diarrhoeal episode with the feeding of a Peruvian food based on a mixture of wheat, peas, carrots, sugar and relatively high amounts of vegetable oil, was of similar magnitude to that observed with the Guatemalan all-vegetable diet.

Studies by Chew *et al.* in Guatemala (unpublished) have shown that diets based on local staples must contain adequate amounts of sodium and potassium to produce an adequate growth response during diarrhoea and early convalescence. However, salty foods should be used with caution and given only with abundant liquids, to avoid hypernatraemia.

Conclusions and Recommendations

1. Feeding must be continued during diarrhoeal episodes. Withholding food will contribute to the intestinal damage and dysfunction, and will increase the nutritional deterioration caused by the disease.

2. Virtually all foods allow absorption and retention of nutritionally significant amounts of nutrients. This and the clinical state of the child are more important than the proportion of unabsorbed nutrients lost through the stools.

3. Foods and diets should be selected on the basis of the following features. (i) Good nutritional value in terms of nutrient quality, density and balance; (ii) adequate digestibility to allow absorption of nutrients during diarrhoea and convalescence; (iii) absence of deleterious effects on the evolution of the disease; (iv) palatability to, and tastes of, mother and child; (v) ease and low cost of preparation; (vi) cultural acceptance by the child's parents; and (vii) accessibility in terms of cost and availability.

4. Breast-feeding must be encouraged during diarrhoea, as it improves hydration and seems to reduce the severity and duration of the disease. This will also help to prevent premature weaning.

5. Foods with high energy density and high concentrations of nutrients should be used, especially with young children whose small gastric capacity limits food intake.

6. Starches should be the carbohydrates of choice, since a high concentration of mono- and disaccharides may increase food osmolality to a level that might make diarrhoea more severe.

7. Diets must contain adequate amounts of sodium and potassium. However, salty foods must be used with caution to avoid hypernatraemia.

8. Most children with diarrhoea tolerate cow's and other animal milks well. Practical advice for their use should include the following points. (i) Feed the type of milk used by the child before the disease; (ii) when skimmed milk is used, increase its energy density with 2 ml vegetable oil or 4–5 g sucrose per 100 ml; (iii) feed full-strength (undiluted) milk. If signs such as increased volume of stools, weight loss, vomiting or dehydration appear, mix full-strength milk with equal amounts of other foods for 1 or 2 d, followed by full-strength milk; (iv) soy-based and chicken-based formulas, other non-dairy foods, yoghurt or low-lactose milk can be used for children with intolerance to milk or lactose. Availability, cost and cultural acceptance must be considered in selecting the recommended foods; (v) tolerance to milk must be assessed again during convalescence in those children who were intolerant during diarrhoeal episodes. Milk should be reintroduced to their diet according to the results.

9. Lack of appetite is transient and can be countered with frequent offerings of the foods that the child likes best. Liquid foods tend to be better accepted. Nasogastric alimentation is recommended in severely anorexic patients who seek medical attention, but force-feeding should be avoided.

10. Many local animal-based and vegetable-based diets, which include cereals, pulses, sugar and vegetable oil, are well tolerated and assimilated in diarrhoea. Some of these diets seem to reduce the duration of the disease.

11. Further anthropological and nutritional investigations are needed to determine the acceptance of diets and their long-term impact on children with repeated episodes of diarrhoea.

12. Although the growth and clinical evolution of the child are more important than the number and characteristics of the stools, diets that will make stools appear more 'normal' may influence mothers to accept the recommended feeding practices.

13. Good feeding practices are particularly important during convalescence to allow growth and nutritional recovery.

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References

- Alarcon, P., Montoya, R., Perez, F., Dongo, J. & Brown, K. (1990). Clinical trial of locally available mixed diet or lactose-free soy-formula for the nutritional therapy of acute diarrhea in Peruvian children. *Proceedings of 14th International Congress of Nutrition, Seoul, Korea*: vol. 2. *Workshops*. Seoul: Ewha Women's University, pp. 87–88.
- Armitstead, J., Kelly, D. & Walker-Smith, J. (1989). Evaluation of infant feeding in acute gastroenteritis. *Journal of Pediatric Gastroenterology and Nutrition*, 8, 240–244.
- Badr El Din, A., Kassem, A. S. & Hussein, Z. M. (1983). Feeding during acute diarrhoea. *Gazette of the Egyptian Pediatric Association*, 31, 89–94.
- Black, R. E., Brown, K. H., Becker, S. & Yumus, M. (1982). Longitudinal studies of infectious diseases and

- physical growth of children in rural Bangladesh. *American Journal of Epidemiology*, 115, 305-314.
- Brasseur, D. & Goyens, H. L. V. (in press). Importance of genetic control of lactase activity of the jejunal mucosa in severely malnourished children: the example of central Africa. In: *Enteropathy of Infantile Malnutrition: Diagnosis and Management*, Nichols, B. L. & Lifschitz, C. H. (editors). 8th Bristol-Myers Symposium, Houston, Texas.
- Brown, K. (in press). Epidemiological relationship between malnutrition and chronic diarrhoea in infants and children. In: *Enteropathy of Infantile Malnutrition: Diagnosis and Management*, Nichols, B. L. & Lifschitz, C. (editors). 8th Bristol-Myers Symposium, Houston, Texas.
- Brown, K. H. & MacLean, W. C., Jr (1984). Manejo del niño con diarrea: prevención del daño nutricional por las enfermedades diarreicas. In: *Salud Materno-Infantil y Atención Primaria en las Américas: Hechos y Tendencias*, OPS Publicación Científica No. 461. Washington: Pan American Health Organization.
- Brown, K. H., Khatun, M., Parry, L. & Ahmed, M. G. (1980). Nutritional consequences of low dose milk supplement consumed by lactose-malabsorbing children. *American Journal of Clinical Nutrition*, 33, 1054-1063.
- Brown, K. H., López de Romaña, G., Graham, G. G. & MacLean, W. C., Jr (1982). Experience with a mixture of wheat-noodles and casein in the initial dietary therapy of infants and young children with protein-calorie malnutrition or acute diarrhea. *Human Nutrition/Applied Nutrition*, 36A, 354-366.
- Brown, K. H., Gastañaduy, A. S., Saavedra, J. M., Lembcke, J., Rivas, D., Robertson, A. D. & Yolken, R. (1988). Effect of continued oral feeding on clinical and nutritional outcomes of acute diarrhoea in children. *Journal of Pediatrics*, 112, 191-200.
- Brown, K. H., Black, R. E. & López de Romaña, G. (1989). Infant feeding practices and their relationship with diarrheal and other diseases in Huascar (Lima), Perú. *Pediatrics*, 83, 31-40.
- Conway, S. P. & Ireson, A. (1989). Acute gastroenteritis in well nourished infants: comparison of four feeding regimens. *Archives of Diseases in Childhood*, 64, 87-91.
- Cruz, J. R., Gil, L., Cano, F., Cáceres, P. & Pareja, G. (1990). Protection by breast-feeding against gastrointestinal infection and disease in infancy. In: *Breastfeeding, Nutrition, Infection and Infant Growth in Developed and Emerging Countries*, Atkinson, S. A., Hanson, L. A. & Chandra, R. K. (editors). Newfoundland: ARTS Biomedical Publishers, pp. 185-194.
- Cruz, J. R., Pareja, G., Cáceres, P., Cano, F. & Chew, F. (in press, b). Enfermedad diarreica aguda y persistente y sus consecuencias nutricionales en infantes de Guatemala. *Archivos Latinoamericanos de Nutrición*.
- Dárdano, C., Chew, F. & Gamero, H. (1990). Use of common Guatemalan foods during and after acute diarrhea. *Proceedings of 14th International Congress of Nutrition, Seoul, Korea: abstracts*. Seoul: Ewha Women's University, p. 497.
- Dewit, O., Boudrass, G., Touhami, M. & Desjeux, J. F. (1987). Breath hydrogen test and stools characteristics after ingestion of milk and yoghurt in malnourished children with chronic diarrhea and lactase deficiency. *Journal of Tropical Pediatrics*, 33, 177-180.
- Dugdale, A., Lowell, S., Gibbs, V. & Ball, D. (1982). Refeeding after acute gastroenteritis: a control study. *Archives of Diseases of Childhood*, 57, 76-78.
- Feachem, R. G. & Koblinsky, M. A. (1984). Interventions for the control of diarrhoeal diseases among young children: promotion of breast-feeding. *Bulletin of the World Health Organization*, 62, 271-291.
- Garcia, S. F. & Harum, A. (1975). Empleo de harina de garbanzo en el tratamiento del síndrome diarreico agudo del lactante. *Revista Chilena de Pediatría*, 46, 319-321.
- Greene, L. H., McCabe, D. R., & Merenstein, G. B. (1975). Protracted diarrhea and malnutrition in infancy: changes in intestinal morphology and disaccharidase activities during treatment with total intravenous nutrition or oral elemental diets. *Journal of Pediatrics*, 87, 695-704.
- Guedon, C., Schmitz, J., Lerebours, E., Metayer, J., Audran, E., Hemet, J. & Colin, R. (1986). Decreased brush border hydrolase activities without gross morphological changes in human intestinal mucosa after prolonged total parenteral nutrition of adults. *Gastroenterology*, 90, 373-378.
- Haque, K. N., Al Faryh, A. & El Rifai, R. (1983). Is it necessary to regraduate milk after acute gastroenteritis in children? *Tropical and Geographical Medicine*, 35, 369-373.
- Hjelt, K., Paerregaard, A., Petersen, W., Christiansen, L. & Krasilnikoff, P. A. (1989). Rapid versus gradual refeeding in acute gastroenteritis in childhood: energy intake and weight gain. *Journal of Pediatrics Gastroenterology and Nutrition*, 8, 75-80.
- Ibáñez, S., León, L., Fúnez, F., Puentes, R. & Gallo, A. (1979). Realimentación con crema de zanahorias de lactantes con diarrea aguda y deshidratación. *Revista Chilena de Pediatría*, 50, 5-9.
- Ibáñez, S., Puentes, R., Winter, A., Guajardo, Q. F. J., Jeroldo, E. U. A. & Jiménez, A. (1986). Composición de tres fórmulas dietéticas en lactantes con diarrea aguda. *Revista Chilena de Pediatría*, 57, 158-163.
- Isolauri, E., Vesikari, T., Saha, P. & Viander, M. (1986). Milk versus no milk in rapid refeeding after acute gastroenteritis. *Journal of Pediatric Gastroenterology and Nutrition*, 5, 254-261.
- Jelliffe, D. B. & Jelliffe, E. F. P. (1989). *Dietary Management of Young Children with Acute Diarrhoea*. Geneva: World Health Organization.
- Jelliffe, E. F. P., Jelliffe, D. B., Feldon, K. & Ngokwey, N. (1987). Traditional practices concerning feeding during and after diarrhea. *World Reviews of Nutrition and Dietetics*, 53, 218-295.
- Kassem, A. S., Elaraby, I. I., Madkour, A. A., Abdo, M. O. & El Shehaby, M. A. (1983). Effect of non-interruption of breast feeding in acute infantile diarrhea. *Gazette of the Egyptian Paediatric Association*, 31, 61-66.
- Khin Maung U. (1984). Effect of feeding during acute diarrhea on clinical outcome. In: *Feeding During and after Acute Diarrhoea*, working paper No. 12, Third Scientific Working Group on Drug Development and Management of Acute Diarrhoeas. Geneva: World Health Organization.
- Khin Maung U, Nyunt Nyunt Wai, Myo Khin, Mu Mu Khin, Tin U & Thame Toe. (1985). Effect on clinical outcome of breastfeeding during acute diarrhea. *British Medical Journal*, 290, 587-589.
- Kotler, D. P., Levine, G. M. & Shiau, Y. F. (1980). Effects of nutrients, endogenous secretions, and fasting on *in vitro* glucose uptake. *American Journal of Physiology*, 238, G219-G227.
- Mahalanabis, D. (1983). Feeding practices in relation to childhood diarrhea and malnutrition. In: *Diarrhea and Malnutrition*, Chen, L. C. & Scrimshaw, N. S. (editors). New York: Plenum, pp. 223-234.
- Martini, M. C., Smith, D. E. & Savaiano, D. A. (1987). Lactose digestion from flavoured and frozen yoghurts, ice milk, and ice cream by lactase-deficient persons. *American Journal of Clinical Nutrition*, 46, 636-640.
- Molla, A., Molla, A. M., Rahim, A., Sarker, S. A., Mozaffar, Z. & Rahaman, M. (1982). Intake and absorption of nutrients in children with cholera and rotavirus infection during acute diarrhea and after recovery. *Nutrition Research*, 2, 233-242.
- Molla, A., Molla, A. M., Sarker, S. A. & Khatun, M. (1983). Whole-gut transit time and its relationship to absorption of macronutrients during diarrhea and after recovery. *Scandinavian Journal of Gastroenterology*, 18, 537-543.
- Molla, A. M., Molla, A., Rohde, J. & Greenough, W. B.,

- III (1989). Turning off the diarrhea: the role of food and ORS. *Journal of Pediatric Gastroenterology and Nutrition*, 8, 81-84.
- NAS/NRC [National Academy of Science/National Research Council] (1985). *Nutritional Management of Acute Diarrhea in Infants and Children*. Washington, DC: National Academy Press.
- Rees, L. & Brook, C. G. D. (1979). Gradual reintroduction of full-strength milk after acute gastroenteritis in children. *Lancet*, i, 770-771.
- Rohde, J. E., Cash, R. A., Guerrant, R. L., Mahalanabis, D., Molla, A. M. & Valyasevi, A. (1983). Therapeutic interventions in diarrhea. In: *Diarrhea and Malnutrition*, Chen, L. C. & Scrimshaw, N. S. (editors). New York: Plenum, pp. 287-295.
- Scrimshaw, N. S. & Murray, E. B. (1988). The acceptability of milk and milk products in populations with a high prevalence of lactose intolerance. *American Journal of Clinical Nutrition*, 48, 1083-1159.
- Torún, B. (1986). Digestión y absorción de nutrientes como base para la alimentación en enfermedades diarreicas. *Revista del Colegio Médico de Guatemala*, 37, 23-31.
- Torún, B. & Fuentes, A. (1990). Local common foods in the dietary management of acute diarrhoea: experience in Guatemala. *Proceedings of 14th International Congress of Nutrition, Seoul, Korea: vol. 2. Workshops*. Seoul: Ewha Women's University, pp. 98-99.
- Torún, B., Solomons, N. W. & Viteri, F. E. (1979). Lactose malabsorption and lactose intolerance: implications for general milk consumption. *Archivos Latinoamericanos de Nutrición*, 24, 446-494.
- Urrutia, J. J. & Garrido, G. N. (1984). Manejo del niño con diarrea: prevención del daño nutricional por las enfermedades diarreicas. In: *Salud Materno-Infantil y Atención Primaria en las Américas: Hechos y Tendencias*, OPS Publicación Científica No. 461. Washington: Pan American Health Organization.
- Walker-Smith, J. (in press). General concepts of feeding after gastroenteritis. In: *Enteropathy of Infantile Malnutrition: Diagnosis and Management*, Nichols, B. L. & Lifschitz, C. (editors). 8th Briston-Myers Symposium, Houston, Texas.
- Wytock, D. H. & Di Palma, J. (1988). All yoghurts are not created equal. *American Journal of Clinical Nutrition*, 47, 454-457.