
Memoranda/Mémorandums

Research on improving infant feeding practices to prevent diarrhoea or reduce its severity: Memorandum from a JHU/WHO Meeting*

In developing countries the highest incidence of diarrhoea occurs among infants who are given fluids or foods to supplement or replace breast-feeding, and numerous studies have been conducted to examine the relationship between feeding practices during the weaning period and the risk of diarrhoea and malnutrition. This Memorandum summarizes current knowledge about the potential impact of improved infant feeding practices on diarrhoeal morbidity and mortality and describes experiences gained with interventions to promote improved practices. Further research activities to examine the role of improved infant feeding practices in the control of diarrhoeal diseases and to identify more effective approaches to the promotion of such practices in the context of a public health programme are also proposed. Finally, methodological issues concerning the design, implementation, and analysis of intervention studies are reviewed.

Infant feeding practices and the risk of diarrhoea

Breast-feeding

There is evidence that breast-fed infants have lower diarrhoeal morbidity and mortality rates than other, otherwise similar, infants. Furthermore, infants who receive no breast milk are at a greater risk of experiencing diarrhoea than those who are partially breast-fed, while infants who are partially breast-fed are at a greater risk than those who are exclusively breast-fed. These relative risks are especially high during the first few months of life. Breast-feeding

may also reduce the severity of diarrhoeal illnesses and has a powerful effect on the risk of diarrhoea-associated death.

In a recent case-control study in Brazil, infants who received no breast milk were 14 times more likely to die of diarrhoea-related illnesses than exclusively breast-fed infants. Also, infants who received animal milks in addition to breast milk were 4 times more likely to die of diarrhoea-related conditions than their exclusively breast-fed counterparts; even feeding with water, tea, and juices in addition to breast milk was associated with an increased risk of diarrhoeal death. A dose-response relationship was

* This Memorandum is based on the report (unpublished document WHO/CDD/EDP/88.1, in English and French) of a meeting held at The Johns Hopkins University (JHU), Baltimore, MD, USA, 23-26 April 1988, and organized by the Department of International Health, The Johns Hopkins University, with support from the Diarrhoeal Diseases Control Programme, World Health Organization, Geneva, Switzerland. A more detailed report of the meeting is available as an *Occasional Paper* from The Johns Hopkins University School of Hygiene and Public Health, Institute for International Programs, 615 North Wolfe Street, Baltimore, MD 21205, USA. A résumé in French appears on page 33.

The participants at the meeting were: H.J. Beckers, Laboratory for Water and Food Microbiology, National Institute of Public Health and Environmental Protection, Bilthoven, Netherlands; M. Bentley, R. E. Black (*Chairperson*), K. Brown, S. Esrey, M. Forman, S.L. Huffmann and C. Kendall, Department of International Health, School of Hygiene and Public Health, The Johns Hopkins University, Baltimore, MD, USA; D. Blum, The PRITECH Project, Arlington, VA, USA; H. Creed de Kanashiro, Instituto de Investigación Nutricional, Lima, Peru; C.H. Daza, Food and Nutrition Program, Pan American Health Organization, Washington,

DC, USA; I. de Zoysa, Diarrhoeal Diseases Control Programme, World Health Organization, Geneva, Switzerland (*Secretary*); M. Griffiths and E. Piwoz, Manoff International, Inc., Washington, DC, USA; J.-P. Habicht, Division of Nutritional Sciences, Savage Hall, Cornell University, Ithaca, NY, USA; K. Hendricks, Pediatric Gastroenterology Unit, Massachusetts General Hospital, Boston, MA, USA; B. Kirkwood, Department of Tropical Hygiene, London School of Hygiene and Tropical Medicine, London, England; J. Martines (*Rapporteur*) and C.G. Victora, Department of Social Medicine, Universidade Federal de Pelotas, Pelotas, Brazil; C. O'Gara and T. Sanghvi, Agency for International Development, Washington, DC, USA; C.O. Oyejide, Department of Preventive and Social Medicine, University College Hospital, Ibadan, Nigeria; G. Pelto, Department of Nutritional Sciences, University of Connecticut, Storrs, CT, USA; M. Perlatto, Academy for Educational Development, Washington, DC, USA; E. Piwoz, Manoff International, Inc., Washington, DC, USA; M.C. Saniel, Department of Health, Research Institute for Tropical Medicine, Metro Manila, Philippines; and M.F. Zeitlin, School of Nutrition, Tufts University, Medford, MA, USA.

observed, in which each additional daily breast-feed was associated with a 20% decrease in the risk of diarrhoeal death.

The protective effects of breast-feeding appear to be related to the intrinsic anti-infective properties of breast milk, reduced exposure to contaminated feeds and, possibly, improved nutritional status during the first months of life. Data from Bangladesh suggest that continued breast-feeding may protect against diarrhoeal morbidity and mortality well into the third year of life; the protection does not, however, appear to continue after the cessation of breast-feeding.

Nutritional status during the weaning period and its relation to diarrhoeal morbidity and mortality

Dietary intake, infectious diseases, and growth. Longitudinal studies in developing countries indicate that growth rate frequently falters (relative to international growth standards) from the second trimester of life and that this submaximal rate of growth often persists until 18–36 months of age. The relative importance of inadequate dietary intake and infectious diseases as determinants of impaired growth is still the subject of debate. Both of these factors are undoubtedly important, but the results of descriptive epidemiological studies rarely allow their effects to be assessed independently.

Insufficient consumption of nutrients during the weaning period is primarily due to inadequate complementation of breast milk, which may not fully satisfy energy requirements beyond the first few months of life. For the majority of children, complementary nutrient sources are required before 6 months of age in order to maintain optimal growth rates. Dietary intakes can be increased by providing more food at each feeding, by feeding more frequently, by increasing the energy and nutrient content of the food, or by a combination of these options. Dietary intake of a sufficient quantity of a number of micronutrients is also required for adequate growth, and zinc, iron, and vitamin A may be especially important in this respect.

Of the infectious diseases, diarrhoea and febrile illnesses, such as malaria and lower respiratory tract infections, seem to have the greatest negative effect on childhood growth. The nutritional impact of diarrhoea, however, depends on a number of factors including age, breast-feeding status, dietary intake, and etiology of the infection. Recent data from clinical trials conducted in Ecuador, Egypt, and Peru, as well as a community-based intervention study in Colombia show that the adverse nutritional consequences of acute diarrhoea can be minimized or prevented by continuing to feed children a nutritionally

balanced high-energy diet, and suggest that children with an adequate dietary intake may be resistant to diarrhoea-related growth failure. Also, results from Peru and the Gambia suggest that, at least in those countries, and among certain age groups, inadequate dietary energy consumption may be a more important determinant of impaired growth than diarrhoea. Furthermore, they indicate that breast-feeding may protect against the adverse nutritional effects of diarrhoea. In Peru, it was found that the energy intake derived from breast milk did not decline during episodes of diarrhoea and other illnesses, whereas that from other food sources was reduced. Since breast milk provides a greater proportion of dietary energy intake during the early months of life, breast-feeding may protect against the nutritional impact of diarrhoea during this period.

Nutritional status and risk of diarrhoeal morbidity and mortality. Data from a number of studies indicate that malnourished children are at increased risk of contracting diarrhoea, especially in a persistent or severe form. Protein–energy malnutrition, perhaps in association with micronutrient deficiencies, may predispose to diarrhoea and/or prolong the rate of recovery through its effects on immune function and, possibly, other non-specific protective factors such as gastric acid production and a sound intestinal mucosa. Indicators of nutritional status probably have to fall below the normal range (≤ -2 standard deviations) before an increased risk can be identified. In addition, there is evidence that malnourished children are at far greater risk of dying from diarrhoea. The reasons for this increased case fatality are not known, but may be related to the higher purging rates among children of small body size. Malnourished children also commonly suffer from electrolyte imbalance. Finally, the terminal illness among these children is usually complicated by other infections.

Improvements in nutritional status should result in a decreased prevalence and, possibly, incidence of diarrhoea. The magnitude of this effect may not be great, however, since the proportion of children with moderate or severe malnutrition in most populations is not large. On the other hand, children who are malnourished contribute disproportionately to diarrhoea-associated mortality. Measures to prevent and/or treat severe malnutrition could therefore offer a powerful approach to reducing diarrhoeal mortality.

Weaning food hygiene

Contamination of weaning foods. The increased risk of diarrhoea that is observed with the introduction of weaning foods suggests that such foods are an

important vehicle for the transmission of enteric pathogens. Food may serve as a medium for the multiplication of bacterial enteric pathogens and/or the production of enterotoxin. Enteric pathogens have repeatedly been isolated in a wide variety of foods, including those intended for infants. Moreover, the incidence of bacterial diarrhoeas in most countries is highest during the warmer months, when bacteria can multiply more rapidly in stored food. Finally, the number of pathogens required to induce illness may be less if they are ingested in food rather than in fluids, since food may protect the pathogens during their passage through the acidic environment of the stomach. Foodborne diarrhoea may therefore constitute a considerable proportion of all diarrhoeas, and numerous outbreaks have been traced to the consumption of specific foods. However, the relative importance of this route compared with transmission through contaminated water or direct person-to-person transmission is not known precisely and almost certainly depends on the pathogen involved.

Because of the difficulty of isolating enteric pathogens from food, most studies have used the enumeration of "indicator" organisms as evidence of the potential for transmission of diarrhoeal agents. Such organisms, primarily coliform or faecal coliform, serve as indicators of faecal contamination, since that is their predominant source; they have long been used in the assessment of the bacteriological quality of water. However, the presence of indicator bacteria in food suggests only that there is a risk of faecal contamination and consequently also a risk of contamination with an enteropathogen. The latter risk is in part determined by the frequency of enteropathogens in the stools of healthy persons, especially those involved in food preparation, and the prevalence of episodes of diarrhoea during which higher numbers of enteropathogens are excreted.

High levels of indicator bacteria have been found in animal milks and in traditional weaning foods, especially cereal gruels. Also, feeding bottles and rubber teats have been implicated as possible sources of contamination of milks and other fluids. Cups and feeding bowls have also been contaminated, although to a lesser degree than feeding bottles. Furthermore, water used for the preparation of foods and fluids given to young children can, if contaminated, be a hazard. Inadequate cooking and prolonged storage at ambient temperature are associated with the survival and growth of bacteria in food. It is therefore likely that poor personal hygiene on the part of food-handlers and inadequate preparation, storage, and handling of weaning foods, which can lead to the seeding and proliferation of enteric pathogens in such foods, are major risk

factors for childhood diarrhoea. Information on this aspect is, however, scarce. Only one study reported direct evidence that associated food contamination with a risk of diarrhoea: in Bangladesh, a significant relationship was found between the frequency of faecal contamination of weaning food and a child's annual incidence of diarrhoea associated with enterotoxigenic *Escherichia coli*.

Measures to reduce the contamination of weaning foods.

The survival or growth of enteropathogens in food can be reduced by altering certain characteristics of the food; for example, its microbial flora, pH, temperature, moisture content, oxidation-reduction potential, and nutrient content, as well as the presence of natural inhibitors of microbial growth, or of food preservatives. Each of these features has been manipulated to inhibit bacterial growth in commercial processed foods, while many have also been used in traditional methods of food preparation because they delay spoilage. For example, acidification of selected foods by either fermentation or addition of natural sources of acid is a common practice.

During the initial cooking process, food should reach a temperature ($> 70^{\circ}\text{C}$) that is lethal to vegetative forms of enteropathogens, and weaning food, once prepared, should be served immediately or very shortly afterwards. Reheating food to a proper temperature ($> 70^{\circ}\text{C}$) averts most problems arising from its prolonged storage. However, if financial resources and time permit, the safest practice is to eat all cooked food at one sitting and to prepare new servings, at least for infants, at the next meal. If this is impracticable, leftover food should be reheated at the correct temperature ($> 70^{\circ}\text{C}$) to kill pathogenic bacteria. More attention should therefore be given to identifying weaning foods that lend themselves to reheating before use or can conveniently be prepared fresh at each serving (with the possible exception of fermented foods) and at the same time provide children with an optimal nutrient content. Greater availability of safe water, improved sanitation, and improved personal and domestic hygiene are also likely to be important in this respect; hand-washing before preparing or giving food may be particularly effective for this purpose. Finally, the use of feeding bottles should be discouraged.

Interventions to promote improved infant feeding practices

Determinants of infant feeding practices

From a historical perspective, infant feeding patterns have shown considerable variation, both within the same society and across societies, with regard to the

prevalence and duration of breast-feeding, the use of animal milks, the timing and nature of weaning, and the mode of transition to adult diets. Despite consistent evidence that infant feeding behaviours can readily be modified, this is commonly held to be difficult to bring about, especially when the benefits are not immediately apparent to the target group and continuous compliance is required to achieve improvements. Interventions to promote improved infant feeding practices have tended to focus on changing the knowledge and practices of individual mothers. However, the social, cultural, economic, and environmental factors that shape infant feeding patterns are being increasingly recognized. These range from factors at the macrolevel that influence the distribution of food within the community to those at the microlevel that affect feeding practices in the household, such as the availability of fuel, water, and other food preparation resources, maternal work patterns, expectations about child growth and development, and beliefs about appropriate foods for infants.

Expectations of behaviour that are prevalent within a particular social and cultural setting are less easy to identify; however, the desire to satisfy group norms may be of fundamental importance. This could explain, for example, why the concerted efforts of public health workers have had so little influence on behaviours that appear to be susceptible to change over time. Maternal self-confidence may be a key factor in child feeding in some settings—that is, a mother's level of self-esteem and confidence can influence the likelihood that she will conform to group norms, her willingness to try new foods and practices, the extent to which she is swayed by her child's response to feeding, and her ability to cope with social dislocation or urban stress. It is important to bear these factors in mind when selecting an appropriate strategy for the promotion of improved infant feeding practices. For example, simply informing individual mothers about the benefits of breast-feeding and appropriate weaning is not likely to produce a major improvement in practices, since to achieve this the improved practices have to become the expected and institutionally supported behaviour over the long term. This implies a different level of effort that requires major changes in hospital routines, political and institutional support for changes in workplace rules, as well as communication efforts at the face-to-face level and in the mass media to create an expectation of these behaviours as the new norm.

Promotion of breast-feeding

A number of research or small-scale demonstration

projects have shown the effectiveness of selected interventions to promote breast-feeding. The results obtained illustrate the importance of motivating and training health professionals, changing hospital routines to facilitate immediate suckling by the infant following birth and rooming-in, discouraging the use of supplemental feeds and glucose water, and stopping the distribution of infant formula samples. These measures have been found to have a positive effect on the initiation of breast-feeding, the duration of exclusive breast-feeding, and the total duration of breast-feeding.

Intensive public health programmes have been developed in recent years to promote breast-feeding in a number of countries. For example, in Brazil, Honduras, Indonesia, Panama, and Thailand a common theme of projects has been the education and training of health professionals, followed by widespread changes in hospital practices. In some instances these have included the introduction of rooming-in arrangements for mothers of hospitalized infants. Also, some projects have implemented mass media campaigns to promote improved breast-feeding practices at the community level. In other countries, including Belize, Egypt, and El Salvador, strong support groups have been formed with the goal of promoting breast-feeding by, *inter alia*, influencing changes in health facilities and workplaces, educating health professionals, and providing encouragement to mothers and practical assistance in the management of breast-feeding.

Overall, the results from these projects suggest that large-scale efforts to promote breast-feeding can be successful in increasing both its prevalence and duration. In particular, they confirm that widespread changes can be achieved in hospital practices, with a concomitant increase in the rates of initiation of breast-feeding and decrease in the use of supplements and feeding bottles in health facilities. Most projects did not emphasize the importance of exclusive breast-feeding in the early months of life, but, where they did, a marked effect on the duration of exclusive breast-feeding has also been noted. However, formal evaluations to measure the impact on breast-feeding patterns were either not performed (in most instances) or suffered from various methodological problems, and the extent to which the observed change in breast-feeding behaviour can be directly attributed to the project activities remains unclear. Definitive data to substantiate the impact on feeding practices of selected interventions to promote breast-feeding are therefore lacking, and there is a need for a few carefully designed evaluations to better ascertain their level of effectiveness and cost. In particular, the role of breast-feeding support groups should be assessed.

Promotion of improved weaning practices

Programmes for the promotion of improved weaning practices have been successfully carried out in several developing countries, and have been reviewed elsewhere.⁹ Recent experiences in Nigeria and Peru have demonstrated the value of techniques for the rapid collection of ethnographic data in identifying problems that interfere with adequate feeding of young children and in formulating possible solutions. These techniques hold promise for the accelerated implementation of weaning interventions in an operational setting. Large-scale projects using a standardized methodology are now being carried out in a number of countries to identify feeding problems and promote low-cost, nutritionally sound, culturally appropriate, and sustainable remedies to these problems. In such projects, emphasis is laid on qualitative, consumer-based research using techniques derived from anthropology and market research; for example, focused group discussions, in-depth household interviews and observations, and key informant interviews. Small-scale "trial runs" are first carried out on the target audience to assess the acceptability of the proposed new or modified feeding practices before they are promoted at the community level. The results of a formal evaluation of a project of this kind conducted in Indonesia indicated that programme activities favourably influenced the consumption of key foods, the total energy and protein intake, and nutritional status.

Methodological issues

Approaches to identifying behavioural risk factors for diarrhoea

A number of studies have been completed or are being carried out to identify infant feeding behaviours that are associated with an increased risk of diarrhoea, and the results obtained could be useful in developing preventive interventions. The implementation and interpretation of such risk factors studies have not always been straightforward, however, and innovative research approaches are needed to circumvent some of the difficulties that may arise.

The assessment of possible risk-related practices may pose problems. Direct observation of behaviour is required, because the information provided by recall or knowledge-attitude-practice questionnaires is often inaccurate or misleading. However, observational studies are labour-intensive and time-consuming, and thus restrict the sample size for

comparison with health outcomes. Carefully structured observations of complex behavioural patterns are needed, since multiple transmission routes may operate. Also, individuals may not be consistent in their practice of a particular behaviour or set of behaviours, and those that affect risk of diarrhoea may not occur frequently enough to be observed, thus leading to a high level of exposure misclassification. More experience is therefore needed in the design, conduct, and analysis of structured observations, with a view to developing methods that are both rapid and valid.

Rapid assessment methods, including rapid ethnographic techniques, semi-structured interviews, and focused group discussions, are of value in describing behaviours that could affect the transmission of diarrhoeal diseases and in defining the variables to be included in structured observations. Such methods are also useful for delineating the political, social, cultural, and economic factors that determine which behavioural changes are possible. Furthermore, research activities of this type facilitate establishing rapport with communities and prepare them for active participation in the design and implementation of the intervention. However, the reliance of these rapid assessment methods on the insight, experience, and skills of the investigators is a major constraint on their more general use.

Finally, the interpretation of the results obtained may be problematic. For example, observational studies cannot provide definitive evidence that an association found between a potential risk factor and the incidence of diarrhoea is causal, and that the removal of the risk factor will lead to a subsequent reduction in this incidence. A cause-and-effect association is more likely if the magnitude of the observed effect is large and if a reasonable underlying mechanism can be identified. However, an association found between a specific behaviour and risk of diarrhoea may be a consequence of a relationship between the behaviour under consideration and another risk factor and thus it may not be of any direct significance. Of greatest concern, perhaps, is the difficulty in demonstrating a statistically significant effect for any behaviour that is practised almost universally in a community; nevertheless, it is interventions against precisely such behaviours that are likely to bring about the greatest public health benefits.

Approaches to assessing the impact of an intervention

Because it may be difficult in a risk factor study to demonstrate a clear association between specific infant feeding behaviours and the risk of diarrhoea,

⁹ Ashworth, A. & Feachem, R.G. Interventions for the control of diarrhoeal diseases among young children: weaning education. *Bulletin of the World Health Organization*, 63: 1115-1127 (1985).

high priority should be given to developing studies that measure the impact of interventions against supposed behavioural risk factors for diarrhoea. However, the evaluation of community-based interventions that depend on widespread behavioural changes also poses many methodological challenges.

The ideal study design to quantify the efficacy of interventions is the randomized, controlled trial. Unfortunately, there are difficulties in using this methodology to determine the health impact of interventions intended to promote improved feeding practices. In general, such interventions can only be applied effectively at the community level. However, the evaluation of community-based interventions is difficult and many issues remain to be resolved in this area. A major problem, for example, is that a substantial number of communities have to be studied to satisfy sample size requirements; also, adoption of the improved practices will probably not be universal in the intervention communities, and relating the health impact to exposure to the intervention may be difficult. Thus, the health impact of a particular practice will be closely related to the differential rates of adoption in intervention and control communities. For these and other reasons it may not be possible, or even desirable, to implement randomized study designs. Alternative approaches, for example, a comparison of health outcomes among those who adopt and those who do not adopt the improved practice, could provide valuable information for estimating the health benefits of the intervention. Such comparisons may be carried out using either a longitudinal or a cross-sectional observational study design or a case-control approach, the choice depending on the outcome of interest. Irrespective of whether or not health indicators are measured, however, attention must *always* be given to assessing the impact of the intervention on behavioural patterns—surprisingly, very little experience is available on this aspect.

Research priorities

Some areas of research, the results of which could lead to a better understanding of the role of improved infant feeding practices in the control of diarrhoeal diseases and to the identification of more effective approaches to their promotion in a public health setting, are proposed below. To be successful, research of this type requires a multidisciplinary approach involving collaboration between epidemiologists, nutritionists, social scientists (especially medical anthropologists and economists), communications experts, and possibly microbiologists.

- The role of non-food supplements, e.g., tea and water, in the transmission of diarrhoeal diseases in

the first months of life should be assessed. Of highest priority are trials to measure the impact of interventions intended to discourage the feeding of non-food supplements to exclusively breast-fed infants. Such trials should document the impact on behaviour, and if possible, on lactation performance, child growth, and diarrhoeal morbidity.

- Approaches to the promotion of improved breast-feeding practices in the context of public health programmes should be further evaluated. Of particular interest is the study of interventions to facilitate the establishment of lactation and the maintenance of exclusive breast-feeding during the first 4–6 months of life.^b

- Intervention studies are required to further elucidate the “weanling’s dilemma”. These should investigate the impact of interventions intended to modify the timing when food supplements should be included in the diets of exclusively breast-fed infants. The impact on behaviour, and also on growth and diarrhoeal morbidity, should be determined in various socioeconomic and environmental settings.

- The protective role of micronutrients against childhood diarrhoea, especially illness of a persistent or severe nature, warrants further investigation. In this respect, double-blind, randomized, placebo-controlled, community-based trials are needed to measure the impact on diarrhoeal morbidity of vitamin A, iron, zinc, vitamin B₁₂ and folate, alone or in combination.

- The roles of food preparation, processing, and storage techniques and feeding methods in the transmission of diarrhoeal disease need to be clarified. In particular, the impact of promoting specific changes in weaning practices intended to reduce the faecal contamination of foods should be determined. It might also be appropriate in some settings to include measures to enhance nutrient intake. Intervention studies should measure the impact on behaviour, and if possible on growth and diarrhoeal morbidity, and should be conducted in various cultural, socioeconomic, and environmental settings.

Résumé

Recherches en vue d'améliorer les méthodes d'alimentation des nourrissons pour prévenir la diarrhée ou en réduire la gravité: Mémoire d'une Réunion JHU/OMS

Dans les pays en développement, les taux les plus élevés de diarrhée chez les nourrissons se pro-

^b The ideal duration of exclusive breast-feeding in a particular setting should be determined after examination of local growth patterns.

duisent lorsque ceux-ci reçoivent une nourriture liquide ou solide destinée à remplacer ou à compléter l'allaitement maternel. Une forte corrélation a été établie entre l'alimentation des nourrissons et le risque de maladie diarrhéique et de décès. Les interventions visant à améliorer les méthodes d'alimentation pourraient donc jouer un rôle important dans la lutte contre les maladies diarrhéiques.

Il est bien établi que l'allaitement au sein protège les enfants contre la diarrhée et réduit nettement le risque d'issue fatale de la maladie. Cette pratique peut aussi réduire la gravité de la diarrhée et atténuer ses conséquences sur l'état nutritionnel. Les effets protecteurs de l'allaitement au sein sont plus marqués dans la petite enfance, mais ils continuent de se manifester jusque dans la troisième année de la vie.

L'amélioration des pratiques de sevrage peut aussi contribuer à la lutte contre les maladies diarrhéiques par ses effets bénéfiques sur l'état nutritionnel et l'hygiène alimentaire. Il est certain que les enfants malnutris risquent plus que les autres d'être atteints de diarrhée, et plus particulièrement de diarrhée persistante ou grave. La mortalité associée à la diarrhée est également plus élevée chez ces enfants. Les mesures destinées à prévenir ou à traiter la malnutrition grave pourraient donc être un moyen efficace de réduire cette cause de mortalité. Elles devraient aussi entraîner une réduction de la prévalence de la diarrhée et peut-être des taux d'incidence, bien que l'on ne puisse s'attendre à des effets spectaculaires dans ce domaine.

Le risque accru de diarrhée que l'on observe lors du sevrage donne à penser que les aliments jouent un rôle important dans la transmission des agents entéropathogènes. On a constaté que le lait d'origine animale et les aliments de sevrage traditionnels, notamment les bouillies de céréales, contenaient souvent de fortes quantités de bactéries indicatrices d'une contamination. L'eau servant à préparer les aliments solides ou liquides donnés aux nourrissons, de même que le matériel utilisé pour les nourrir, en particulier les biberons et les tétines, peuvent être à l'origine de cette contamination. Une cuisson insuffisante et une conservation prolongée à la température ambiante

favorisent la survie et la croissance des bactéries. Il est donc probable que le manque d'hygiène personnelle et les fautes commises dans la préparation, la conservation et la manipulation des aliments de sevrage, qui ont pour conséquence l'introduction et la prolifération d'organismes entéropathogènes dans ces aliments, constituent d'importants facteurs de risque de diarrhée infantile, mais on dispose de peu d'informations à ce sujet.

L'efficacité de certaines interventions visant à encourager l'allaitement au sein a maintenant été démontrée dans diverses situations. En particulier, des programmes soulignant la nécessité de motiver et de former les professionnels de la santé et de modifier profondément les habitudes hospitalières ont eu un effet positif sur le nombre de mères qui décident d'allaiter leur enfant et sur la durée de l'allaitement au sein exclusif. Des programmes visant à améliorer les pratiques de sevrage ont également été couronnés de succès dans plusieurs pays en développement. Des expériences récentes ont montré l'intérêt des techniques d'évaluation rapide, utilisées en anthropologie et dans les études de marché, pour reconnaître les obstacles qui s'opposent à une saine alimentation des jeunes enfants et pour trouver des solutions peu coûteuses, fondées sur des bases nutritionnelles solides, culturellement acceptables et permanentes à ces problèmes.

Il est proposé de poursuivre les recherches en vue d'examiner le rôle d'une meilleure alimentation des nourrissons dans la lutte contre les maladies diarrhéiques et de trouver des méthodes plus efficaces pour encourager une telle amélioration dans le cadre d'un programme de santé publique. L'article aborde également les aspects méthodologiques de la conception, de la mise en oeuvre et de l'analyse des études d'intervention destinées à améliorer les méthodes d'alimentation des nourrissons. Une priorité élevée est accordée à la mise au point de protocoles d'étude visant à mesurer l'impact des interventions sur le comportement. Il est cependant évident que l'évaluation d'interventions visant à provoquer des changements de comportement à grande échelle présentera de grandes difficultés méthodologiques.

