



WORLD HEALTH ORGANIZATION
ORGANISATION MONDIALE DE LA SANTÉ

WHO/DDC/79.4

ORIGINAL: ENGLISH

DIARRHOEAL DISEASES CONTROL PROGRAMME

INDEXED

CHILD CARE PRACTICES
RELATED TO DIARRHOEAL DISEASES



Report of a Scientific Working Group
(Geneva, 17-20 April 1979)

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1. INTRODUCTION

The Scientific Working Group on Child Care Practices Related to Diarrhoeal Diseases met in Geneva from 17 to 20 April 1979.

Diarrhoeal diseases are one of the major causes of morbidity and mortality in most developing countries, particularly in young children. A Diarrhoeal Diseases Control (CDD) Programme has recently been established by the Organization at the request of its Member States. This has been stimulated by recent developments such as the better understanding of the etiology, epidemiology and physiopathology of acute diarrhoeal diseases, the discovery of a simple and effective method of oral rehydration therapy that can be administered by mothers and other family members at home, and the commitment of Member States to primary health care¹, all of which provide new opportunities and challenges for the control of diarrhoeal diseases.

The initial emphasis of the CDD Programme is on cooperation with countries in the widespread implementation of oral rehydration therapy.² It is recognized, however, that although this measure can significantly reduce the mortality from acute diarrhoeal diseases, it will not reduce their incidence; there is therefore a need to develop new and appropriate technologies and approaches for the prevention of diarrhoeal diseases. Consequently, support for research is being planned in the following priority areas: immunology and vaccine development, clinical management of acute diarrhoea, epidemiology and etiology of acute diarrhoea, environmental health and diarrhoeal diseases prevention, and the area this Group was asked to consider - that of maternal and child health practices, including nutritional practices, as they relate to treatment and control of diarrhoeal diseases. This is an important but particularly difficult area for study because it is concerned very much with human behaviour, including that of health workers.

The Group agreed: to review the "state of the art" in this area; to recommend maternal and child health practices that could be followed on the basis of available knowledge; to identify gaps in knowledge that require further research in order to improve and facilitate action programmes for the control of diarrhoeal diseases; and to make recommendations for the strengthening of research capabilities in the developing countries.

2. REVIEW OF CURRENT KNOWLEDGE

2.1 Food, nutrition and diarrhoeal diseases

2.1.1 Breast feeding

2.1.1.1 Nutritional value of human milk

Breast milk is the natural food for infants. Its protein and energy content, and its concentrations of minerals and vitamins are excellently adapted to their needs. In addition, the bioavailability of some of its components (e.g. proteins, lipids, iron, vitamin D) is better in breast milk than in other foods.

2.1.1.2 Anti-infectious and anti-allergic properties of human milk

Whereas the nutritional value of breast milk has long been recognized, its significance in protection against infections has been less well appreciated. In several carefully controlled studies, a lower frequency of gastro-intestinal infections has been demonstrated in breast-fed than in artificially fed infants during the first months of life. This difference has been observed in children from both developed and developing countries, but has more important implications in the latter.

¹ Primary Health Care. Report of the International Conference on Primary Health Care, Alma-Ata, USSR, 6-12 September 1978, Geneva, WHO (1978).

² Development of a programme for diarrhoeal diseases control. Report of an Advisory Group, unpublished document WHO/DDC/78.1

Breast milk has been observed to have a protective capacity against certain specific bacterial pathogens causing diarrhoea. For example, disease caused by enteropathogenic Escherichia coli (EPEC) has been observed less often in breast-fed babies; furthermore, epidemics caused by EPEC have been controlled by feeding infants with human colostrum and milk. It has also been noted, in an area of Guatemala, that breast-fed babies often harbour Shigella in their intestine without developing symptoms, while artificially fed infants frequently experience illness when infected. In addition, in a recent investigation in Bahrain, the incidence of cholera was significantly less in breast-fed than in bottle-fed infants.

Although rotavirus is one of the most common causes of infantile diarrhoea and human milk from a number of geographical areas has been shown often to contain antibodies against the virus, there are not yet sufficient data to determine whether the disease has a lower incidence in breast-fed infants. However, the potential efficiency of anti-viral antibodies in milk is illustrated by the finding that colostrum anti-polio antibodies (but not lower titred mature milk) can neutralize the live virus after oral polio vaccination.

It has been speculated that, besides its anti-infectious capacity, human milk may also have anti-allergic effects, not only because total breast feeding diminishes exposure to food allergens, but also because human milk contains antibodies against food proteins (e.g. cow's milk proteins), which may diminish the exposure of the infant's intestinal mucosa to food introduced during weaning that could cause allergy in atopy-prone infants.

2.1.1.3 Specific immunological factors of human milk

There are about 10^5 to 10^7 leucocytes/ml in human colostrum; within the first week of lactation the number decreases to 10^4 to 10^5 /ml. Up to 20 to 30% of these can be lymphocytes, mainly T-lymphocytes. These T-cells, which can produce interferon, may differ in some of their characteristics from circulating T-cells in the blood. There is evidence that cell-mediated immunity in the form of tuberculin reactivity, presumably conferred by these T-cells, may be transferred from tuberculin-positive mothers to their breast-fed babies. B-lymphocytes in human milk have been demonstrated, by in vitro synthesis experiments and specific plaque-forming cell assays, to produce primarily IgA. Because of the considerable technical problems involved in separating these cells in milk, the above observations require further confirmation.

IgA has been shown to be the predominant immunoglobulin in human milk and is different from serum IgA in that it is composed of an IgA dimer stabilized by two additional glucopeptides, a join (J) chain and a secretory component (SC). The resulting molecule - called secretory IgA (SIgA) - is more resistant to enzyme degradation and pH changes than serum IgA. The SIgA concentration in colostrum can be as high as 20 g per litre and declines to about 0.25 to 0.5 g/l in mature milk. This rapid decrease in antibody levels is compensated, however, by the simultaneous increase in milk volume, so that after an initial fall-off, the total daily intake of specific IgA antibodies of the breast-fed baby is relatively constant throughout lactation. Initial observations have suggested no differences in the daily output of SIgA protein in privileged and underprivileged mothers, except possibly in severely malnourished women whose milk volume may be lower.

Human milk contains SIgA antibodies against the antigens of several microorganisms commonly found in the intestine. The explanation for this close connexion between microbial antigens in the gut and the appearance of SIgA in the mammary gland relates to the fact that the milk SIgA antibodies form part of a specific defence system of mucous membranes. SIgA is the predominating immunoglobulin in all exocrine secretions and is produced by special lymphoid cells, many of which are present in the Peyer's patches in the small intestine. It appears that these cells leave the patches and home to other parts of the intestinal mucosa and to other sites, including the mammary gland, where exocrine secretions bathing the mucous membranes are produced (Figure 1)¹. There is preliminary evidence that lymphocytes that

1 Report of the Scientific Working Group on Immunity and Vaccine Development, unpublished document WHO/DDC/78.2

home to the mammary gland may be directed by HLA-D antigens on the glandular epithelial cells, but further studies are required to confirm these observations. Thus, it is likely that the high SIgA levels in milk result from local production in the mammary gland, although it is not yet excluded that a selective uptake of IgA dimers from serum may also occur.

- The secretory Ig A system and the gut
- Homing of Ig A producing cells to exocrine glands

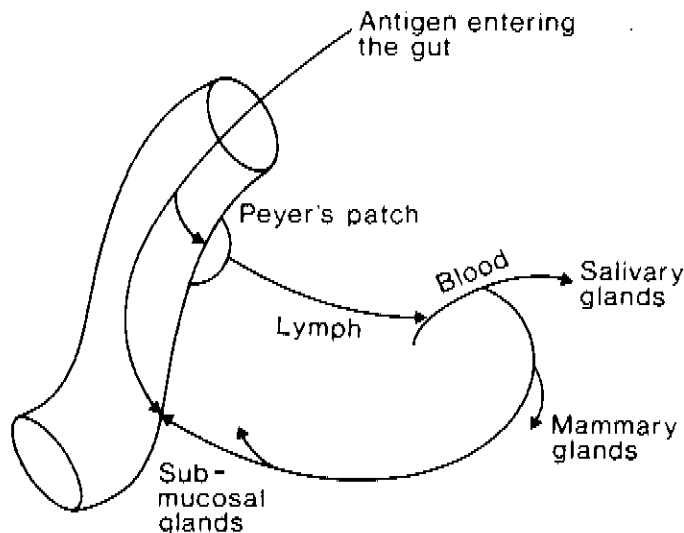


Figure 1

Reproduced from Hanson, L. Å., et al., Acta Paed. Scand., 67, 577 (1978) with kind permission of the author and publisher.

As a result of this gut-mammary gland relationship, mucosal defense against the mother's intestinal microbial flora is transferred in the form of milk SIgA to the intestine of the breast-fed baby where it is absorbed in insignificant amounts. It is clear that the SIgA antibodies of human milk are produced specifically to protect the mucous membranes; this is important since most infections occur via mucous membranes and the young infant is slower to produce SIgA antibodies than, for instance, IgM antibodies.

The major function of SIgA antibodies is presumably to bind the bacteria and keep them from attaching to the mucosal epithelium and initiating infection. The protective capacity of this anti-adherence activity demonstrated against, inter alia, E. coli, Vibrio cholerae and streptococci may be overcome by an increase in number and virulence of intestinal micro-organisms.

SIgA antibodies have been found in human milk against O antigens of E. coli strains commonly causing neonatal sepsis and/or meningitis and against E. coli K antigens, including the K1 capsular antigen which is found in approximately 80% of E. coli causing neonatal meningitis. Furthermore, antibodies against V. cholerae and E. coli enterotoxins, and against Shigella, Salmonella, EPEC, and V. cholerae O antigens can be found, but only in the

milk of women living in areas endemic for these organisms, again indicating the relationship between milk antibodies and intestinal exposure.

IgM and IgG antibodies are also found in human milk, but at lower levels than in serum. The initial IgM concentration is about 1 g per litre in colostrum, decreasing to around 0.1 g/l one week later, and after that often becoming undetectable. IgG is present in colostrum in a concentration of 0.2 to 0.3 g/l, decreasing to less than 0.1 g/l in mature milk. The IgG and IgM in breast milk are presumed to derive from serum.

2.1.1.4 Non-specific anti-infectious factors in human milk

Most of the leucocytes in milk are macrophages and neutrophilic granulocytes (and not lymphocytes). They have bactericidal activity but their biological and immunological significance is unknown. Lactoferrin is present in breast milk and is bacteriostatic as it binds iron which is required as a growth factor by many bacteria; milk antibodies work in synergy with the lactoferrin. Milk also contains lysozyme, lactoperoxidase, B12-binding protein, trace metals, complement and anti-staphylococcal factor, but the significance of these is unknown.

Milk has a high lactose and low protein content which, together with its low buffering capacity and possibly its "bifidus factors", are important for promoting the typical lactobacillus intestinal flora of the breast-fed infant. This flora may provide "colonization resistance" to potential pathogens by limiting their numbers in the intestine.

2.1.1.5 Possible improvement of breast milk protection by maternal vaccination

Parenteral vaccination of lactating women in endemic areas with killed cholera and polio vaccines has been shown to produce a booster effect on specific milk SIgA levels; thus maternal vaccination may improve protection for the breast-fed baby as well as the mother. Protection of suckling pigs and calves has also been noted in studies where *E. coli* vaccines have been administered to dams.¹

2.1.2 Weaning

For the purpose of this report, the weaning period starts when food other than breast milk is regularly added to the diet of the breast-fed infant, and is completed when breast feeding stops. For infants living in poor sanitary conditions, and particularly those with an inadequate diet, this is a period of high morbidity and mortality and one of the most critical in the child's life.

2.1.2.1 Age of weaning

There is unanimous agreement that breast milk is the best food for the infant, but from the age of 4 to 6 months it is not enough by itself to satisfy his nutritional requirements. Other foods are thus needed on nutritional grounds, but their introduction carries the risk of increasing exposure to enteric pathogens. Breast feeding should continue, however, since as discussed in section 2.1.1.2, it confers some protection against diarrhoeal diseases. In addition, after weaning has commenced, continued breast feeding into the second year of life has clear nutritional advantages. The benefits of prolonged breast feeding are supported by many cultural traditions and religious teachings (e.g. the Koran).

When breast feeding is not practiced, or is discontinued early in infancy, the nutritional and infectious problems in this age group are markedly increased. Factors leading to the termination of breast feeding include pressures of urbanization and attendant disruption of social structures and customs, disruption of the family unit, poverty and the need for maternal employment, pregnancy, and inappropriate advertising of breast milk substitutes.

¹ Escherichia coli diarrhoea. Report of a Sub-group of the Scientific Working Group on Epidemiology and Etiology, unpublished document WHO/DDC/EPE/79.1

2.1.2.2 Weaning, diarrhoeal disease and malnutrition

In the developing countries, up to half of all deaths occur in children below the age of 5 years, and malnutrition and diarrhoea are the most important contributory causes. This problem is most severe below the age of 2 years and coincides largely with the weaning period.

Two main factors are responsible. First, weaning diets are often inadequate in their energy and protein content and in other nutrients. Even when suitable foods are available locally, lack of knowledge, taboos and other cultural factors may interfere with their utilization. Few attempts, such as the provision of specific foods or the practice of separate cooking, are usually made to meet the special nutritional requirements of infants. Secondly, diarrhoeal disease has its highest incidence in this age group, resulting in reduced food intake and nutrient utilization, and increased nutrient losses.

2.1.2.3. Local weaning foods

In most developing countries located in tropical and sub-tropical regions, appropriate weaning foods are not regularly used, frequently because of a lack of knowledge or because of cultural or other limitations. Appropriate weaning foods, however, can be prepared in the home, in the community or in institutional settings with locally available and acceptable foods. Consideration should be given not only to the nutritional value of these foods but also to the risk of their contamination during preparation, storage or administration. In some areas where provision has been made for primary health care workers to teach mothers how to prepare appropriate weaning foods for their children, acceptance by mothers and children has been encouraging and initial experience suggests that this action may result in improved growth and a reduction in the incidence of diarrhoeal diseases.

2.1.3 Nutritional status of children

Several recent epidemiological studies carried out in different parts of the world have identified a significant association between diarrhoeal diseases and faltering body weight in infants and young children. A number of causal mechanisms underlying this association have been postulated, but unequivocal data supporting these hypotheses are limited. It is still uncertain, for example, to what extent undernutrition per se is responsible for increased diarrhoeal morbidity, or how big a role diarrhoea plays in the causation of malnutrition.

Although higher diarrhoea attack rates have been demonstrated in children of poor nutritional status in a number of studies, the more frequent rates of illness may be more a function of increased exposure to infectious agents than to impaired host resistance, as those children most prone to malnutrition, because of their socioeconomic condition, are also most likely to be living in a contaminated environment. Once exposed to pathogens, however, the individual's response may well be influenced by his nutritional status. Severe malnutrition is known to affect unfavourably a number of immunological responses, such as cell-mediated immunity, and may therefore lessen the active immunity gained following exposure to pathogens. Malnutrition may also interfere with non-immunological barriers to infection such as gastric acid production.

Existing information does indicate that a child's nutritional status may affect the duration and severity of acute diarrhoea and its complications. Undernourished children with cholera and rotavirus tend to have greater total fluid losses per unit of body weight because of prolonged purging. Electrolyte losses accompanying acute diarrhoea may be even more problematic in the malnourished child, whose electrolyte balance is already disturbed. For example, the diminished total body potassium seen in malnutrition may make the acute potassium losses of diarrhoea even more serious. Furthermore, nutrient malabsorption, which frequently accompanies diarrhoea, is also likely to have more severe effects in the malnourished patient. All this may explain why diarrhoea-specific mortality and morbidity rates are higher in the presence of malnutrition. Thus, despite the present gaps in our knowledge, good nutritional status can be regarded as protective against some of the major complications of acute diarrhoea.

The impact of diarrhoea on nutritional status is more obvious and has been more easily demonstrable. Each of the complications of diarrhoea - dehydration, electrolyte and acid-base disturbances, anorexia, voluntary dietary restriction, vomiting, malabsorption and increased catabolism - results in decreased nutrient intake or utilization.

Bacterial colonization of the small intestine has been independently associated with acute and protracted diarrhoea, malabsorption and severe malnutrition. Even apparently healthy children in some developing countries may demonstrate increased intestinal bacterial counts when compared with children from developed countries. Causal relationships between acute diarrhoea and bacterial colonization of the small bowel on the one hand, and diarrhoea, chronic malabsorption and malnutrition on the other, have not been well established and deserve further study.

Whether certain etiological agents of diarrhoea have more important nutritional consequences is not known. Data are similarly deficient regarding the frequency and severity of chronic diarrhoea following acute episodes of specific etiology. Nevertheless, prevention of diarrhoea will certainly improve the nutritional well-being of children; and the early, proper treatment of acute diarrhoea can be expected to have a similar positive effect on nutritional status.

2.1.4 Management of acute diarrhoea

The management of acute diarrhoea has three principal objectives: (1) prevention or correction of dehydration through early replacement of water and electrolyte losses, (2) maintenance of adequate nutrition to prevent malnutrition, and (3) nutrition rehabilitation where severe malnutrition coexists. Only the first two of these objectives are considered in this report.

In acute diarrhoea, large amounts of water and electrolytes, principally sodium, potassium, chloride and bicarbonate, are lost. Lactase deficiency of varying clinical severity frequently accompanies acute diarrhoea, and the ingestion of lactose may further increase water losses in the colon. Dehydration, therefore, is the most critical clinical problem that requires treatment.

2.1.4.1 Rehydration and other treatment of acute diarrhoea

The use of an oral rehydration fluid (ORS) containing glucose and electrolytes (NaCl 3.5, NaHCO₃ 2.5, KCl 1.5, Glucose 20 g per litre) corrects dehydration; this has been shown convincingly in hospital and community-based trials. Moreover, when combined with a proper diet (*inde infra*), oral rehydration therapy may reduce the negative impact of diarrhoea on weight and growth. Back-up medical support is necessary for the few cases that require additional treatment. The substitution of sucrose for glucose in the ORS solution appears to offer a practical alternative form of therapy.¹ A simpler method of home preparation of rehydration fluid using "sugar and table salt" may be worthwhile in the absence of pre-measured packets of the complete formula, but this practice needs to be carefully evaluated before it can be widely recommended.

Various traditional remedies have been empirically used in the treatment of acute diarrhoea, but none has been proved to be beneficial. Antidiarrhoeal preparations such as charcoal, kaolin, pectin and antispasmodics have not been shown to be of any value and some of them (e.g. antispasmodics) may, in fact, be harmful, especially in young children. Antibiotic therapy should be reserved for selected cases as indiscriminate use may actually lead to an increase in diarrhoea and persistence of the carrier state (in Salmonellosis).

¹ Report of the Scientific Working Group on Clinical Management of Acute Diarrhoea, unpublished document WHO/DDC/79.3

2.1.4.2 Nutritional maintenance

Correction of dehydration and acidosis is usually followed by return of appetite permitting prompt reintroduction of food. "Phasing-in" is a largely empirical measure which may not be justified in the absence of clear signs of food intolerance. In breast-fed babies, breast feeding should continue without interruption; in non-breast-fed infants, use can be made of diluted cow's milk formulas when available, but the child should be carefully observed for evidence of lactose malabsorption. For older infants and children, other bland nutritious local foods suited to culture, tradition and taste should be used as early as possible.

Such practices are recommended because they assure maximal availability of nutrients; however, more information is needed on the specific effects of the timing and the type of foods offered during acute diarrhoea on the duration of the disease and on the absorption of nutrients. This is important since specific nutrients, such as fat and disaccharides, may be poorly absorbed for a period following acute diarrhoea, which could influence the long-term clinical and nutritional outcomes. Whether any specific dietary or antimicrobial therapy can interrupt or mitigate the adverse effects of diarrhoea on nutrient absorption also remains to be determined.

2.2 Personal hygiene and food handling

2.2.1 Causes of acute diarrhoea

In the last decade there has been a considerable increase in knowledge about the etiology of acute diarrhoea. Some information about the agents and the importance of personal hygiene in their prevention is given below.¹

Viral gastroenteritis, largely due to rotavirus, is the most common cause of diarrhoea in infants and young children in all parts of the world. Rotavirus and other small viruses causing acute diarrhoea (e.g. Norwalk agent) are probably spread primarily by person-to-person contact and thus personal hygiene is certainly important in their prevention. Water-borne transmission of Norwalk agent has been reported.

Enterotoxigenic E. coli (ETEC) infections are also of particular importance in infants and young children. In developing countries, food-borne and water-borne transmission are thought to be important, although more information is needed.

Cholera is an important cause of diarrhoeal illness in endemic areas, where it is mainly a paediatric disease. It is usually water-borne but food-borne transmission also occurs. Personal and food hygiene and proper sanitation facilities are an essential component of control measures.

Salmonella gastroenteritis accounts for a relatively small part of the burden of diarrhoeal disease in developing countries; this is primarily due to the general absence of processed food supplies. Domestic animals are a major source, and cross infection of live cattle prior to slaughter in centralized abattoirs is particularly important. Person-to-person spread is rare.

The shigelloses are numerically of considerable importance and are transmitted by person-to-person contact, particularly among children. Water-borne epidemics occasionally occur; food-borne spread is less common. Personal hygiene is important and it is widely accepted that the incidence of shigellosis varies inversely with the accessibility of water supplies and sanitary facilities, and is sometimes influenced by fly control.

¹ Detailed information about the etiological agents of diarrhoea is provided in the Reports of the Scientific Working Sub-groups on Escherichia coli Diarrhoea (unpublished document WHO/DDC/EPE/79.1); Rotavirus and other Viral Diarrhoeas (WHO/DDC/EPE/79.2); Cholera and other Vibrio Infections; Salmonellosis, Shigellosis, Yersinia, Campylobacter and other Enteric Infections; Parasite-related diarrhoeas.

Yersinia and Campylobacter are recently identified causes of acute bacterial diarrhoea in children. These infections are probably mostly caused by the consumption of contaminated animal food products.

Parasite-related acute diarrhoea may be caused by Giardia lamblia and Entamoeba histolytica. Both are spread most commonly by person-to-person transmission and through water.

In addition to acute diarrhoeas, protracted diarrhoea is an important entity of poorly defined etiology in childhood.

2.2.2 Sources of infection

There are four factors to be considered in attempting to delineate the sources of the infections described in 2.2.1.

- (1) There is no evidence that milk suckled from the breast is of any importance as a source of diarrhoeal disease. However, in bottle-fed infants, the milk formula and the bottles themselves may be a source of infection.
- (2) The infant's habit of putting his hand and small objects in his mouth clearly makes exposure to pathogens more likely; the hygienic condition of the infant's immediate environment probably influences the extent of the risk involved.
- (3) The quantity and quality of water are important in the transmission of disease. There is some evidence that diseases like shigellosis, which spreads mainly by person-to-person contact, are less common when the quantity of water around the home is great; this is presumably due to improved personal hygiene. The quality of the water is also important; this is true not only for drinking water since water is ingested in some societies during bathing and washing and is often used in the preparation of food. In some communities, it is normal practice to give the wholly breast-fed infant water to drink; it is debatable whether this potentially hazardous custom is justified.
- (4) A major source of enteric infections during the weaning period is the consumption of food other than breast milk. The limited studies in developing countries on food hygiene suggest that foods prepared in an unhygienic environment are significantly contaminated with faecal and other bacteria; this is true even of traditional cooked foods, including those used in the weaning period. Sources of contamination are primarily domestic water used in food preparation and washing utensils, raw food and food handlers. Organisms introduced during food preparation may be reduced in numbers but not eliminated during cooking; in the interval between cooking and eating they can rapidly proliferate, especially in the absence of refrigeration. Alternatively, they may be reintroduced into the food after cooking. The degree of food contamination thus varies with the personal hygiene of the mother, water quality, the nature of the cooking and food-handling processes, and the duration of time between cooking and consumption.

2.3 Maternal health

The mother occupies a central position in the family and the life of the child. She provides the environment for the developing embryo, and from the onset of conception until delivery they are inextricably intertwined. After birth, the dyadic interaction between mother and infant is biologically maintained through breast feeding, and psychologically nurtured by child rearing.

The nutritional status of the mother has a direct influence on foetal growth and lactation. When analysing available data in this area, the long-term nutritional history of the mother has to be separated from her nutritional status during pregnancy. Women with

lifelong nutritional deprivation tend to deliver low birth-weight babies, with increased risks of mortality and morbidity (and poor sucking capacity); this phenomenon has clear inter-generational dependency. Supplementation of diet during pregnancy by energy sources and/or proteins confers clear benefits in terms of maternal weight gain, size of the baby at birth and perinatal mortality. The single study that has included childhood diarrhoea as an outcome failed to show a consistent association between ingestion of supplements by the mother and duration of diarrhoea; however, this might have been due to the small size of the population surveyed.

Lactation performance in malnourished mothers is remarkably efficient. Various studies have reported no major change in milk composition and only occasionally a decrease in milk volume (see 2.1.1.3). However, this favourable situation for the infant can cause further deterioration in maternal nutritional status. Unfortunately, studies of the efficacy of dietary supplementation in lactating malnourished mothers have as yet failed to indicate a regimen that is beneficial to both the mother and the infant.

Interventions aimed at maintaining energy balance during pregnancy and lactation have to be seen in the long-term perspective of stimulation, motivation and education. Community and governmental support systems may well act both directly and indirectly on maternal health. Many favourable traditional support systems are abandoned with urbanization and industrialization. As a case in point, the lessons learned by rediscovering the importance of breast feeding need to be disseminated.

The influence of maternal health on infant morbidity, including the incidence and duration of diarrhoeal disease, is largely indirect; the relative importance of factors contributing to maternal health has scarcely been studied. The explanatory model for a cause and effect relationship between maternal health and diarrhoeal disease in childhood will necessarily have to include examination of the mother's capacity for child rearing, dietary management, personal hygiene, etc.

2.4 Provision of child care

2.4.1 Beliefs and practices

Epidemiological studies continually emphasize that human behaviour patterns exert a major influence on the incidence and transmission of acute diarrhoeal diseases in children and on the nature and consequences of their sequelae. Programmes have been designed to change these implicated behaviour patterns in the home, e.g. by providing improved water supply and sanitation facilities, and by educating mothers about appropriate hydration and dietary management of children with acute diarrhoea.

Only a few programmes have thus far showed encouraging results. These have usually been ones in which an intensive input has been provided by highly trained and well motivated workers and a trusting relationship has existed between workers and recipients. The remainder have been unable to demonstrate significant changes despite a substantial investment in technical facilities, manpower training and community education.

Programmes that failed were often those planned in such a way that they could not be operated within the cultural framework of the target groups. Health workers, frustrated by their failures, frequently see local behaviour patterns as the result of a "rigid" set of traditional beliefs held by the communities with whom they work. They are not equipped to analyse local cultural patterns and identify those that might provide points of entry for changing behaviour. These failures are ascribed to "cultural blocks" that are seen as manifesting the "ignorance" of target communities.

Cultural patterns, however, can be understood. A community's central beliefs are largely concerned with longstanding concepts about the relationship between man and his environment. They may, in practice, be integrated with an identifiable religious framework. Values

derived from such beliefs can determine behaviour related to, for example, child weaning or the care of the sick; this behaviour, though, can be modulated by economic factors and social pressures. For example, studies investigating seasonal demands on women's labour in rural agricultural communities have emphasized that during busy months mothers have relatively little time to look after their children's daily needs. These busy periods may coincide with maximum diarrhoea incidence. Similar pressures are not shared by families in which there is greater labour availability in the home or less dependency on the seasonal harvest.

It is thus clear that workers concerned with the modification of behaviour patterns have to pay attention to the natural determinants of that behaviour in any family or social group. This will assist them to predict the potential for its successful modification as part of programmes to reduce diarrhoeal incidence.

It has become clear that improvements in community socioeconomic status *per se* can have a direct and immediate influence on diarrhoea-related behaviour patterns. Not only are economic constraints removed, but longstanding cultural beliefs and values may be quickly abandoned. However, although in many situations the average economic status has increased, it is always possible to find families who have not shared in this overall improvement. These families may well be unable to adopt the healthier hygienic and feeding practices that can result in a reduction of childhood diarrhoea incidence in those families who have benefitted from a higher standard of living. Similarly, when poorer rural families migrate to urban centres, they are often under immediate pressure to relinquish longstanding cultural values. Provided these families enjoy the anticipated improvement in economic status, their members should be able successfully to adopt new child-rearing practices associated with the more modern urban lifestyle and have healthier children. Frequently, however, migrant families are unable to adopt these practices and their incidence of diarrhoeal diseases actually increases. In such situations health education efforts alone are often insufficient to change behaviour.

Carefully designed epidemiological studies are continuing to provide new insights into the relationship between different behaviour patterns and the risk of childhood diarrhoea. Through these studies it is possible to identify specific behaviour patterns that need changing (e.g. withholding food from a child with acute diarrhoea). Valuable experimental approaches for the study of the natural determinants of specific behaviour patterns and the potential for their change have included in-depth investigations focussed on small, well-defined groups of people which concentrate on the relationship between expressed beliefs and attitudes and observed behaviour. These features are studied in specific situations (e.g. the action that a mother takes when her child has diarrhoea is compared in agriculturally busy and quiet seasons) and in families with different economic and social circumstances. If such studies are to produce useful information the lifestyle of those observed must be disturbed as little as possible. The initial assessment of the efficiency of different types of health workers as promoters of behaviour change also requires in-depth, descriptive/analytical approaches. Trends identified from these predominantly qualitative studies help in planning larger scale, more quantitative investigations of specific aspects of behaviour. Investigators who have furnished valuable information in this area have been flexible and innovative, have used multi-disciplinary approaches, and have also concentrated on producing relevant information that is of practical value.

2.4.2 Organization of child care

Standards of food, clothing, housing, medical care and social services are important variables in determining child health. In fact, more than 80% of the world's child population (0-14 age group) live in an environment lacking such basic living standards.¹ Acute diarrhoeal diseases and inadequate diet are the two most common factors responsible for the prevailing high childhood morbidity and mortality. To control this problem, preventive and curative services must be provided free or organized on a cooperative community basis.

¹ Maternal and child health - Report by the Director-General. WHO unpublished document A32/9 (1979).

Although oral rehydration therapy has been found to be an effective, inexpensive and simple health technology for the management of diarrhoeal disease in children, it has not reached the household level in the majority of the population living in rural areas, because of the lack of an organized structure for the delivery of health care. In order to improve this situation, the primary health care approach (PHC) has been adopted¹ and has been implemented in several countries. However, while each country has used an approach unique to its own local situation, few countries have tackled the problem of diarrhoeal diseases control at the community level using PHC workers. The first aim of the PHC worker should be to rehydrate the child with diarrhoea to prevent his death; the second should be to provide continued therapy to avoid the need for referral. Where this has been done, results indicate that the need for hospitalization of children with diarrhoeal diseases can be reduced.

3. CURRENT RECOMMENDATIONS FOR CHILD CARE PRACTICES

Based on the available information discussed above, the Group proposes the following specific guidelines for the provision of child care which should be promoted as part of national efforts to control diarrhoeal diseases.

- (1) Breast feeding is of fundamental importance in prevention and control of childhood diarrhoeal diseases because of its anti-infectious and nutritional advantages, and should be promoted at all levels and by all available means.
- (2) Supplementary weaning foods should be offered in addition to breast feeding at a time indicated by the infant's development; for most children, this will be between 4 and 6 months of age. The ideal weaning foods will vary according to local circumstances and resources, but they should be evaluated on the basis of nutritional quality, ease of preparation and suitability for infant consumption. They should be prepared locally in a hygienic manner and should be consumed as soon as possible after preparation.
- (3) Poor nutritional status increases the severity of diarrhoeal disease and the risk of complications. Efforts should be made to optimize children's nutritional status; this can be monitored most appropriately by periodic sequential weighings.² The clearly recognized impact of diarrhoeal disease on nutritional status must be minimized by all measures possible. Breast feeding should be continued throughout the illness and there should be no unnecessary withholding of supplementary foods. The post-recovery diet should ideally be sufficient to permit any catch-up growth necessary. Diarrhoeal diseases control programmes, nutritional support programmes and maternal and child health programmes are interdependent and complementary.
- (4) The value of oral glucose-electrolyte mixtures in preventing and correcting dehydration due to diarrhoea is established beyond doubt. Immediate action is required to deliver this therapy, together with nutrition education/dietary advice, at the family and primary health care level so that it may be introduced as early as possible during illness to achieve maximum benefit.
- (5) In delivering health care services for the treatment and prevention of acute diarrhoea it is important to adapt approaches to local beliefs, attitudes and cultural practices. Furthermore, though the end target is the child, all the approaches must be channelled through the mother; her health, well-being and work burden must be such as to permit her to participate effectively.

4. RECOMMENDATIONS FOR RESEARCH

Based on the currently available knowledge, the Group recommends the following research activities:

- 1 Primary Health Care. Report of the International Conference on Primary Health Care, Alma-Ata, USSR, 6 - 12 September 1978. Geneva, WHO (1978).
- 2 A Growth Chart for International Use in Maternal and Child Health Care. Guidelines for Primary Health Care Personnel. Geneva, WHO (1978).

4.1 Food, nutrition and diarrhoeal diseases

4.1.1 Breast feeding

- Further research is required to determine the mechanisms and capacity of the anti-infectious properties of human milk; this should include investigation of its protective efficiency against diarrhoea due to different organisms, including enterotoxin-producing bacteria, rotavirus, Giardia and Entamoeba histolytica, and against specific virulence antigens such as enterobacterial enterotoxins and O, K and pili antigens. The effective duration of breast milk-mediated protection beyond the first few months of life into the weaning period needs particularly to be investigated.

- The relationship between maternal health and nutritional status and the volume, nutritional and anti-infectious qualities of breast milk should be studied. It should also be determined whether the quality and volume of milk are affected by various substances used in some areas, including hormonal preparations (i.e., contraceptives) and traditional herbs.

- It is important to determine the frequency, causes and mechanism of prevention of sub-optimal lactation. Such studies should include careful methodological consideration and development of techniques for reliable measurement of 24-hour milk volumes that can replace test weighing.

- Investigations should be carried out to determine the difficulty of resumption of lactation after it has been temporarily stopped. This would involve studies of the influence of various factors such as suboptimal suckling, simultaneous formula feeding and maternal health on the ability to resume lactation successfully and on the quality and quantity of the milk.

- The specific protective role of other milk factors such as lactoferrin and lysozyme, and of milk leucocytes (in cell-mediated immunity), needs to be elucidated.

- Investigations should be done to assess the possible benefit of direct passive "immunization" of the baby against diarrhoeal pathogens via the breast milk by maternal vaccination.

- There is a need to know whether mucosal immunity (primarily SIgA) can be boosted actively in the baby by primary vaccination before weaning. This requires studies to find out when the SIgA response first appears in the infant and when it can be boosted.

- Milk SIgA antibodies are most efficiently measured by the enzyme-linked immunosorbent assay (ELISA), but simplification and standardization of the technique are required. An exchange of working standards for antigen-antibody systems should be organized by WHO.

- Techniques should be developed to test the adherence capacity of the diarrhoeal pathogens to the intestinal epithelium; the same model could be useful for measurement of the anti-adherence property of milk antibodies.

- Studies are needed to determine whether SIgA and humoral antibody responses against food constituents play a role in the normal handling of these nutrients at the intestinal mucosal level. It is still unknown whether this antibody production or specific immunological tolerance is the normal response to food. For example, the role of the intestinal immune response in resorption of undegraded proteins, protein degradation and uptake of peptides should be further studied. It is also necessary to determine what happens to these immunological activities following derangement of the mucosa during and after acute diarrhoea. The possibility that the immunological events at the gut mucosal level can contribute to food intolerance, including intestinal allergy, and increase the risk of developing protracted diarrhoea should be considered.

4.1.2 Weaning

- Present recommendations as regards the timing of the introduction of weaning foods are

based primarily on age. Other criteria such as growth or development should be examined in the hope of establishing better guidelines.

- Locally available foods should be critically evaluated for their suitability as weaning foods and for their ability to supply the nutritional requirements which are no longer met by breast milk alone after the fourth to sixth month of life.

- The epidemiology of the weanling diarrhoea syndrome should be further clarified. One basic question to be answered is the mechanism(s) whereby acute diarrhoea becomes chronic or protracted, which requires exploration of the significance and natural history of small bowel bacterial overgrowth to assess whether repeated low-dose ingestion of bacteria (of faecal or other origin) that are not conventionally considered as intestinal pathogens may be important. In addition, the role of chronic diarrhoea and malabsorption in weanling diarrhoea should be defined, and the value of interventions such as antimicrobial chemotherapy investigated.

4.1.3 Nutritional status

- Studies are needed to measure the effect of nutritional status and the impact of specific nutrition interventions (e.g. food supplementation programmes) on: (a) susceptibility to specific diarrhoea pathogens, (b) duration of diarrhoea, and (c) diarrhoeal-related sequelae (e.g. stool volume; type, degree, and duration of malabsorption; anorexia; mortality). Criteria for diagnosing morbidity events and classifying nutritional status should be clearly defined before initiating such studies.

- Determinations of the relative contribution of anorexia, malabsorption and food-withdrawal to the long-term nutritional consequences of diarrhoea are required. These should include quantitative studies of the usual food and nutrient intakes during and after recovery from acute diarrhoea carried out in a variety of sociocultural situations.

4.1.4 Dietary management

- Further studies are needed in the area of oral rehydration therapy, in particular to define the mechanism of its nutritional effects, the most appropriate means of its delivery and the most accurate methods of preparation and efficacy of home-made solutions containing only salt and sugar.¹

- Studies should be done to examine the effect of type (including breast milk) and components of diet (e.g. lactose, glucose) on short and long-term nutrient absorption during acute diarrhoea of specific etiology. These studies should also assess the effect of different diets on the duration and severity of acute and chronic diarrhoea.

- The value of supplementation with vitamin A, iron and folic acid during the acute phase of diarrhoea needs to be defined.

4.2 Personal hygiene and food handling

- The impact of the introduction of simple hygienic measures, such as the use of soap for washing hands and detergent for cleaning utensils, on the incidence of diarrhoeal disease should be determined.

- Research should be conducted into the development of appropriate technology to simplify some of the basic steps in food preparation. The possibility that weaning foods may be made safer by incorporating viable lactobacillus preparations or by applying other fermentation procedures merits consideration; such processes would improve "shelf-life" and perhaps also protect the infant intestinal flora. Relevant expertise may already be available both in communities traditionally using fermented preparations and through modern food technology.

¹ Report of the Scientific Working Group on Clinical Management of Acute Diarrhoea, unpublished document WHO/DDC/79.3.

- The need for additional fluids (e.g. water) for wholly breast-fed infants in hot climates should be evaluated so that definitive advice can be given on this practice.

4.3 Maternal health

- Since the major explanation for the effect of maternal health on childhood diarrhoeal morbidity is indirect and the number of confounding factors is immense, studies to determine this effect are very difficult and may even be undesirable. As a first step, however, the available health and vital statistics should be collected and analysed. In most countries it will probably be concluded from such exercises that the quality of the statistics needs improvement to be operationally useful and that further efforts are needed to record births and birth weights, to determine indicators for socioeconomic status and maternal health, and to monitor diarrhoeal morbidity. WHO may play a coordinating role and issue guidelines for these tasks.
- Since the time available to women for performing the child-rearing tasks may be important for the prevention of diarrhoeal diseases in young children, the effectiveness of various resources at the disposal of communities for improving "available time" for mothers should be studied (cooperative preparation of weaning foods would be one example that should be evaluated, taking into account the potential harm of a reduction in breast feeding).
- There is a need to further evaluate the effect of lactation on maternal health: body-weight monitoring would be one simple tool to use. The effect of repeated pregnancies on lactational performance also needs further investigation.
- The benefits of nutrition interventions during lactation and pregnancy require further study in different areas; for example, the effects of the use of locally produced foods as supplements and of the redistribution of heavy energy-consuming tasks during pregnancy on birth weight and lactation performance could be assessed.
- The beneficial effects of eliminating specific nutritional deficiencies (vitamin A, iron) in mothers on diarrhoeal morbidity among young children should be investigated, in ongoing nutrition programmes.
- Because of the importance of prolonging breast feeding, the most practical and effective supportive measures that can be provided for mothers living in different societies and engaged in different kinds of work should be identified.

4.4. Provision of child care

4.4.1 Beliefs and practices

- More basic information is required about the interrelationships between individual and family behaviour patterns of defaecation, water usage, food preparation, child hygiene, and infant feeding practices and the risk of developing diarrhoeal diseases. This information should be based on both expressed beliefs and attitudes and actual observed behaviour. The effect of established intervention programmes should be monitored with particular attention to changes in diarrhoea-related behaviour, the permanence of any changes introduced and their impact on mortality and morbidity due to diarrhoea.
- Situation-specific enquiries are needed into maternal, family and community attitudes towards the use of various remedies (traditional and Western) and the causes of diarrhoea.
- The influence of social factors (e.g. seasonal labour demands and occupations) and pressures (e.g. those associated with economic development) on diarrhoeal disease incidence and mortality needs better definition.
- The effectiveness of different health workers (e.g. local workers versus workers from outside the community) in changing behaviour should be studied. Similarly, the effectiveness of alternative training programmes in reorienting the skills, behaviour and practices of health workers needs to be examined.

- Ways of preserving "positive" (i.e. beneficial) cultural practices such as breast feeding should be explored.

4.4.2 Organization of child care

It is inappropriate to consider a single disease entity such as diarrhoea in isolation from the overall commitment of the primary health care system. With this perspective, it is proposed that studies be undertaken:

- to find the best means of generating local capacity to utilize the existing effective knowledge and technologies;
- to determine ways and means of strengthening the whole health care system so as to be able to provide technical and logistic support to primary health care workers;
- to investigate various aspects of the training of health workers on integrated approaches toward delivering primary health care;
- to determine the best means of obtaining local community participation in the use of oral rehydration therapy, and to investigate the feasibility of making it applicable in countries that have yet to adopt this approach.

5. RECOMMENDATIONS FOR RESEARCH STRENGTHENING

Although the problem of acute diarrhoea and its control is greatest in the developing countries, resources for conducting research in these countries are scarce. Not only are funds lacking for applied, not to mention basic, research, there is also a dearth of manpower technology, reference and laboratory facilities, and expertise for the undertaking of large research efforts.

There is therefore felt to be an imperative need to strengthen research capabilities in the developing countries. This effort should involve the channelling of available resources from developed countries, as well as from international organizations, towards the development of research competency. Collaborative research undertakings between institutions in developed and developing countries should be promoted in order to direct necessary support to the latter in the form of collaborating scientists, electronic data processing facilities, reference laboratories, etc. Support for scientific meetings and symposia is needed in areas where research is undertaken to increase awareness of the problem of diarrhoeal disease and promote programmes for its control.