Committee on Nutrition

Human Milk Banking

Human milk is unquestionably the best source of nutrition for full-term infants during the first months of life. Recent publications1 have emphasized the advantages of human milk's biochemical composition, and particularly of its immunological and cellular components. Renewed interest in also providing low-birth-weight infants with human milk stems partly from nutritional considerations, but more importantly from evidence that it confers some protection against infections and allergy. The degree of protection against necrotizing enterocolitis is uncertain. The disease has been reported in infants fed heat-treated breast milk,2 and it can occur in neonates fed fresh human milk. When frozen, breast milk seemingly offers little protection against necrotizing enterocolitis, although a recent paper3 does not exclude the possibility that breast milk could decrease its incidence.

MILK BANKS

Human milk has come back “into favor” in intensive care nurseries; consequently, there has been a resurgence of interest in human milk banks, which stopped operating in North America shortly after World War II. However, the milk bank tradition was never abandoned in certain British hospitals and in Scandinavia. The Helsinki Children’s Hospital experience now spans a 50-year period.4 The collection, processing, and storage of human milk may be initiated to meet the needs of low-birth-weight infants, of full-term newborns who temporarily cannot breast feed, or of sick infants with intractable diarrhea, the short-gut syndrome, or intolerance to cow milk or soy proteins who are responsive to other measures.

CONTAMINATION OF HUMAN MILK

An important property of breast feeding is the relative freedom from bacterial contamination of breast milk. However, bacterial contamination can be a major problem with banked human milk. The precautions which need to be taken to make breast milk microbiologically safe require careful attention, especially when breast milk is collected and stored prior to feeding. A recent outbreak of salmonellosis has been reported in a milk bank,5 and recurrent group B streptococcal disease has been associated with the ingestion of infected breast milk.6 A variety of other bacteria, bacterial toxins, and viruses such as rubella, cytomegalovirus, and hepatitis B particles have been identified. Breast milk may also be a vehicle for transmission of herpes simplex type I.7

COMPOSITION OF BREAST MILK

Human milk leukocytes are thought to constitute an important component of the antinfective and immunologic protection conferred by breast milk.8,9 Colostrum and breast milk phagocytes have a low-killing power but a considerable capacity for phagocytosis. They may sequester pathogens and prevent their attachment and subsequent colonization of the gut.10 In addition to the known enteromammary circulation of B lymphocytes,11 maternal T lymphocytes may also be absorbed intact through the gastrointestinal tract of newborn infants.12 This possibility raises theoretical questions about the safety of feeding “fresh” (unfrozen or unheated) human milk from a mother other than the infant’s own. A syndrome resembling a graft vs host reaction has been observed in young animals fed breast milk white cells from a different species; this is not the case with human breast milk.

From a nutritional standpoint, human milk offers the reassurance of being specific, but some doubts have been expressed regarding the adequacy of protein, sodium, chloride, and calcium in human milk for small premature infants.13,14 Although nitrogen and mineral requirements of the small premature infant are higher than in the full-term infants, they may be adequately met if the infant is fed by his/her mother because the composition of breast milk from mothers of young preterm infants is substantially different from that of mothers of full-term infants with regard to nitrogen,15 protein, sodium, chloride,16 and calcium.17 Additional short- and long-term growth studies of low-birth-weight infants fed milk from mothers of preterm infants.
are needed. Data on the benefits of the differences in composition of milk at term and preterm would be particularly important for extremely low-birth-weight infants. Donated human milk is usually mature milk; therefore, it may not meet protein and mineral (particularly sodium) needs of the extremely low-birth-weight infant. A sodium supplement has been recommended for these infants (P. Sunshine, personal communication, 1979) and the possibility of adding human milk protein is under study.

COLLECTION AND TREATMENT OF BREAST MILK

A woman’s fresh breast milk is especially suited to her infant’s nutritional and immunologic needs; and, breast milk can be made microbiologically safe if certain precautions are taken. Recent information suggests that bacterial contamination is minimized if the donor is properly selected and trained and if the first 10 ml of milk are rejected. Some authors feel that manual expression is preferable to the suction breast pump. Milk samples identified by bacteriologic screening as unacceptable must be rejected. Healthy donors are generally recruited from mothers who nurse their infants but have extra milk. The screening of potential donors, their training, and the set-up to carry out routine or spot-check bacteriologic cultures are essential components of a human milk bank.

Heat treatment is a widely used method for reduction of bacterial contamination. However, it is important to restrict the extent and duration of heating to that required for the destruction of pathogens. Holder pasteurization (62.5°C for 30 minutes) appears to be adequate, although 6% of the samples may not be acceptable. Even this modest heat treatment has had significant adverse effects on the protective immunocomedial constituents of human milk. At 80°C, the ability of human milk to inhibit the growth of added bacteria largely disappears.

There is little information on the effect of heat treatment on the nutritional properties of human milk, and the results are conflicting. A recent study suggests that Holder pasteurization decreases the high coefficient of fat absorption of fresh human milk. The likely explanation is that heat treatment inactivates milk lipase. Nitrogen retention is affected only if milk is boiled.

The storage of milk by freezing is an alternative to heating for the preservation of optimal nutritional value and immunologic benefits. The use of frozen storage requires more attention to bacteriologic screening. Efforts should be made to collect clean milk with minimal bacterial contamination and to store it immediately in a freezer until it is gently thawed and fed.

There are at least three routines for collecting human milk for infants who cannot be breast fed. These include: (1) collection of milk from a mother to be supplied to her own infant, (2) collection of milk from healthy donors for feeding specific infants, and (3) pooling of milk from several donors.

Collection of Milk for a Mother’s Own Infant

The collection of milk for a woman’s own infant is the most physiologic method. As previously noted, the composition of milk from the mothers of preterm infants has a higher protein, nitrogen, and mineral content than that from mothers of full-term infants. Although these differences may meet the needs or preterm infants, critical studies are needed. Furthermore, the mother who collects her milk for her own infant is usually highly motivated and more likely to take antiseptic precautions in collecting, storing, and delivering the milk; she also is more likely to avoid exposing herself to toxic substances that might be secreted into the milk.

The greatest obstacle to the wider use of this method is a logistic one. A growing proportion of preterm infants are cared for in referral centers, which frequently are located at a considerable distance from the home. This makes it difficult for some mothers to deliver milk to the hospital on a regular basis, especially if they have other children and/or heavy family responsibilities. Because most donors cannot deliver fresh milk daily, breast milk usually must be stored frozen, either in single donations or as pooled samples. Some mothers will experience lactation failure as they return home. This is not surprising because manual or mechanical expression is not as good as sucking for the stimulation of milk production and the “let down reflex.” In Finland, the percentage of mothers nursing their low-birth-weight infants at 3 months of age could not be raised above 30%, even with considerable effort (M. A. Siimes, personal communication, 1979).

The preservation of leukocytes in milk would be desirable when the mother’s milk is fed to her own infant, but there are practical obstacles to accomplishing this. Milk cells are best preserved by collecting the expressed milk in plastic bags because cell counts are much higher than those retrieved from samples in glass containers. However, plastic bags are prone to leak and to be easily punctured. Furthermore after 24 hours of storage, cell counts in glass containers are higher than in plastic bags. (D. Garza, personal communication). Freezing is necessary when the interval between collection and freezing is longer than 24 hours. This procedure will destroy viable cells. Storage of breast milk near body temperature is the most effective procedure to preserve viable cells, but this procedure also
Collection of Milk for a Specific Infant

Providing milk from an individual donor for each infant has been proposed as a means of decreasing the risk of infection after a donor's milk has been shown to consistently meet the criteria for numbers and types of bacteria. Disadvantages of this system are that it complicates banking procedures, results in some wastage of milk, and increases the risk of transmitting undiluted toxic substances (e.g., drugs, nicotine, pesticides and environmental contaminants) which are secreted in milk. Mills carries an increased risk of unacceptable bacterial growth. Because of these difficulties and unanswered questions regarding white cells from the milk of a mother other than the infant's own, a recent recommendation following a symposium on human milk suggests that attempts to preserve the cells should not influence the processing and storage conditions used for human milk.  

Collection of Pooled Milk

Pooled milk from several donors simplifies routine procedures for ensuring microbiologic safety. The mixing of milk from a group of donors also results in a more uniform nutrient content and dilutes drugs or toxins present in the milk of an individual donor. A possible disadvantage of pooled milk is the increased potential for the transmission of viral infections, particularly if the milk is frozen only.

CONCLUSIONS

The experience of Finnish workers, as well as that of others, shows that the banking of heat-treated and frozen human milk is a practical and safe means of feeding low-birth-weight newborn infants. The continuous and exclusive use of human milk is associated with a low incidence of infection and with a rate of survival which is among the highest reported. The rate of growth and weight gain is also considered satisfactory, although there is some controversy about whether weight gain is quite as rapid as in formula-fed infants. Long-term studies should be carried out to see if these infants grow and develop as well, or better than, those on formula feedings.

It is still uncertain whether banked human milk will prove sufficiently superior to formula with respect to its nutritional and immunologic characteristics to compensate for the difficulties of maintaining bacteriologic control and to warrant the cost of setting up and running a milk bank for premature infants. At this time, the Committee considers it optimal for mothers of low-birth-weight newborn infants to collect their milk for feeding their own infants fresh milk. Once home, the mothers can freeze the expressed milk and organize for transportation of samples on a regular basis. However, since this procedure will be impossible or impractical for many infants, bacteriologically safe milk from a donor seems a reasonable alternative for these infants.

REFERENCES

20. Asquith MT: Milk banking, collecting processing and distri-

PLATO ON SLAVES AND FREEMEN

Did you ever observe that there are two classes of patients in states, slaves and freemen; and the slave doctors run about and cure the slaves, or wait for them in dispensaries—practitioners of this sort never talk to their patients individually or let them talk about their own individual complaints. The slave doctor prescribes what mere experience suggests, as if he had exact knowledge, and when he has given his orders, like a tyrant, he rushes off with equal assurance to some other servant who is ill. But the other doctor, who is a freeman, attends and practices on freemen; and he carries his inquiries far back, and goes into the nature of the disorder; he enters into discourse with the patient and with his friends, and is at once getting information from the sick man and also instructing him as far as he is able, and he will not prescribe until he has at first convinced him. If one of those empirical physicians, who practice medicine without science, were to come upon the gentleman physician talking to his gentleman patient and using the language almost of philosophy, beginning at the beginning of the disease and discoursing about the whole nature of the body, he would burst into a hearty laugh—he would say what most of those who are called doctors always have at their tongues' end: Foolish fellow, he would say, you are not healing the sick man but educating him; and he does not want to be made a doctor but to get well.

Submitted by Student