COMMENTARIES

The Concept of Weaning: Definitions and Their Implications

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ABSTRACT - "Weaning" is usually said to refer to the entire process during which the infant changes from full dependence on breast milk to complete independence from it. However, "wean" is sometimes used to refer to provision of an "educational diet" during the first six months when exclusive breastfeeding is the ideal; to complementary feeding; to replacement of breastmilk; or to the cessation of breastfeeding. The processes involved are illustrated by a graph that theoretically compares the infant's nutritional needs with the proportion of those needs that can come from breastmilk under ideal circumstances. The development of consistent, relevant research, policies and programs on young child feeding may be particularly hindered by the failure to discriminate between complementation and replacement. *JHL* 12:123-128, 1996.

KEYWORDS: breastfeeding, complementary feeding, definitions, weaning.

DEFINING "WEAN"

The professional literature on infant feeding is replete with references to the "weaning period"—the transition from breastfeeding to complete reliance on other food. Additional convenient uses of the word include "the weaning age child" and "weaning foods."

Etymologically, the word "wean" means "to accustom." In one early, commonly cited article, Slome¹ states that "wean" comes from the Anglo-Saxon *wenian*. The Concise Oxford Dictionary² says this is Old English, compared to *wennian* in Old Saxon, *wennen* in Old High German and *venja* in Old Norse. In modern Swedish "avvänja" means to wean away from and "tillvänja" means to wean onto. In English these two meanings may be combined into one word and thus confused.

Slome used wean "as indicating the complete and permanent cessation of suckling," but in places referred to the process of weaning away from the breast. Jelliffe³ considered weaning to mean "the process whereby the infant gradually becomes accustomed to foods other than milk," acknowledged that it also is commonly used to refer to cessation of breastfeeding, and recommended the term be avoided "to reduce confusion." Thirty-five years later confusion still reigns.

In Slome's article, as in much of the English-language technical literature, it is not always clear that the author is aware that complementation and replacement of breast milk are two separate components of the "weaning process." For example, they are indistinguishable in the diagram in Figure 1, commonly used to illustrate weaning.⁴ Many authors explicitly or implicitly seem to believe that it is "normal" for breastmilk production to decline at 4-6 months of age and that solid foods are needed to make up for this: "...the weaning period, defined as the period during which breast milk is being replaced by other foods, usually begins when the infant is 4-6 months old..."⁵ Others seem to confuse "exclusive breastfeeding" with breastfeeding per se and believe that international recommendations imply that breastfeeding should stop at 4-6 months.

In fact, the word "wean," in addition to referring to the entire shift from breast to foods, is at times used to refer to four separate processes: (a) to accustom the infant to some food in the early months of life, though amounts given are not intended to provide any nutritional benefit, (b) to complement breast milk when it can no longer provide for the complete nutritional needs of the child, (c) to replace breast milk with other foods, and (d) to stop breastfeeding altogether.

The processes involved, under ideal conditions, can best be illustrated by Figure 2 from a paper by Greiner.⁶ It compares a schematic plot of the infant's total overall daily energy requirements (i.e., *not* their energy requirements per kg body weight) with the amount of energy that might be provided if the mother breastfed exclusively for a certain period, say, the first six months, and then continued to

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breastfeed equally effectively but with adequate complementary foods for many months thereafter. Obviously, some such plot could be made for any nutrient.

In Figure 2, zone "1" refers to the initiation of breastfeeding and zone "2" refers to the period of exclusive breastfeeding. The zone "3" illustrates complementation and the dotted plateau of zone "4" illustrates the desirability of continuing to breast feed at the same

level even once complementation begins. Zone "5" is located in the area which represents replacement. Cessation of breastfeeding takes place at zone "6".

Figure 2 is intentionally theoretical, that is, not based on any existing research findings. From the point of view of the role played by breastfeeding in the infant diet, it is conservative, since the slope of infant energy requirements could probably be lower than this after the first few months of life.

The point at which complementation should begin may be considered to be approximately six months of age. Numbering of the axes of Figure 2 was avoided, first because research to date would seem inadequate to provide a sound basis for it, and second to emphasize the universality of the concepts it illustrates, irrespective of exactly where the lines might be placed.

EARLY SUPPLEMENTATION

In the past, the term "exclusive breastfeeding" often allowed the use of many different supplements, even "formula $\leq 100\text{g}/24\text{ hr}$ occasionally..." In recent years, it is likely that authors who fail to define it mean that no infant formula or solids were given, but water and other fluids may be ignored. The best definition for many research purposes⁸ allows nothing else, not

Figure 2. Schematic diagram of the components of the breast-feeding process. Reprinted with permission. Greinter T: Sustained breastfeeding, complementation and care. *Food Nutr Bull* 16:317, 1995. (See text for explanation of the numbers.)

even vitamin drops. The definition suggested for use in household surveys by the World Health Organization is slightly less strict.⁹

We know that other fluids given in the first half year of life are physiologically unnecessary for healthy, exclusively breastfed infants, even under hot and arid weather conditions.¹⁰ However, many other reasons may be given by mothers, grandmothers, and health workers for feeding water and other supplements to young infants, as Almroth documents in Lesotho (Almroth S: Home management of diarrhoea and exclusive breastfeeding in Lesotho. Unpublished PhD dissertation, Cornell University, Ithaca, NY; 1995, pp.115-20). Some of the reasons for early supplementation have nothing to do with "the weaning process." Often they are (presumably misguided) attempts to cure or prevent disease based on the many different concepts of disease found in different cultures, particularly the widespread humoral "hot-cold" theory.

In some places infants may be given small tastes of solid foods, especially the staple food, in the early months of life or even at birth. This may be a ritual to "make the baby a part of the group" or it may be done for the purpose of accustoming the child to its taste (and presumably smell and "mouth feel") so that it will remember this later when it will be dependent on such food.¹¹ Confusingly, since this practice fits the definition of "weaning," it implies that weaning may begin at birth, even if mothers might not explicitly say that this is their intention.

For nutritional scientists, the question is whether such early introduction to food helps infants to accept it better when they get older, as these foods gradually take over as the main source of nutrients. Paine and Spiegiorin did raise the possibility that prolonged breastfeeding was associated with poor acceptance of solid food, but their research method was inadequate to actually shed much light on the question.¹²

Cohen, et al. experimentally determined that infants who first received complementary foods at six months accepted food as well at nine and 12 months of age as infants did who first received complementary foods at four months.¹³ That is, for exclusively breastfed infants, there was no advantage of introducing complementary foods at four months rather than waiting until six months.

In hygienic settings in industrialized countries, it is widely assumed that supplementation with anything besides milk or solids in the early months has no importance. Research in coming years may show the extent to which this is true, but there are grounds for being skeptical. At least one study suggested that

even plain water may have a replacement effect¹⁴ and another found that pacifier use increased the risk of earlier cessation of breastfeeding.¹⁵ Supplementary feeding may alter the microfloral composition in the infant gut.¹⁶ Rapid gastric emptying, possibly in part due to the high concentration of free amino acids and peptides in breastmilk,¹⁷ and the absence of antigenic effects may explain the high absorptive levels of many nutrients from breast milk as well as some of its protective effects. Such benefits may be lost when supplements are added. Water may be dangerous for infants if it is high in nitrates (as ground water can be in areas where nitrate fertilizer is widely used);¹⁸ herbal teas can be hepatotoxic.

Recent research discussed below also suggests that it is difficult to provide additional foods or fluids to breastfed infants without reducing breast milk production, at least in the early months of life. Infant appetite is affected by the amount of bulk and amount of energy recently consumed. In addition, infants suck on the breast (or a feeding bottle or a pacifier) to fulfill an innate need for sucking. Non-nutritive sucking has been shown to have a physiological impact on both mother and child and may have psychological effects as well.¹⁹ Because the infant gastrointestinal and immune systems are immature at this early age, supplements add risks of infectious disease and food allergies and intolerance.

COMPLEMENTATION

Apart from uncertainty as to any possible value (especially any net value) of early "educational" supplementation, it is now widely agreed that there is little nutritional need for providing extra food to the exclusively breastfed child during the first six months of life at least. At some point, and as Børresen²⁰ points out, more research is needed to determine when this might be—when additional energy, iron, and eventually other nutrients are needed beyond what can be provided by breast milk.

Under conditions where access to adequate quantities of hygienic food is guaranteed, infant growth is undoubtedly enhanced by starting supplementation earlier, even if this results in reduced breast milk production. There is need for research on any potential implications this may have for overfeeding, as well as possible long-term negative effects on infant health of early supplementation.

However, when complementary foods are likely to be contaminated and of low nutrient density, extended periods of exclusive breastfeeding may increase infant survival. In stable but environmentally stressed, poor, rural settings, mothers may have

learned that when the hungry season comes the ones who suffer most are young children recently taken off the breast. Those who suffer least are exclusively breastfed infants. The phenomenon common in many developing countries of delaying introduction to any substantial amounts of solid food may thus have promoted survival, even if it somewhat reduced growth rates. (Nationally representative studies in many countries in recent years suggest that early supplementation has now become the norm in most areas. This is partly linked to urbanization but also no doubt to the fact that health professionals in most areas have for decades been encouraging mothers to start solids earlier.)

Health professionals assume that increased growth rates are a proxy for improved health and survival rates. But this assumption has simply not been adequately tested, particularly in impoverished settings. Seeming "failures" of breastfeeding to protect infant health and survival may often be due to the nearly universal practice of early supplementation referred to above. (Supplementation with water and other fluids from birth or the early weeks of life has been common even in areas where the introduction of solid foods was delayed.)

In poor settings, anything that replaces breast milk is unlikely to provide net value for the infant. Yet we know little about how to achieve complementation rather than replacement, irrespective of what age may be best to initiate it. Advice commonly a part of nutrition education, like, "feed your baby x number of times starting at age y months," provides no indication of the desirability of ensuring that complementation and not replacement occurs, let alone advice on how to achieve it.

Achieving conceptual clarity on this issue may have been hindered by the fact that in industrialized countries and urban areas in much of the developing world, many mothers either do not breastfeed at all, stop early, or begin reducing how much they breastfeed long before six months of age. They commonly do not sleep with their babies, carry their babies close to them, or provide the breast for "comfort" or other purposes besides feeding. How to achieve complementation without replacement has never been an issue for such mothers, for the infant food industry, or for that portion of the health care establishment that serves the needs of either. In such a cultural setting, it may seem self-evident that replacing breastmilk with infant formula or other liquid and semi-solid foods begins in the early weeks or months of life. Readers from such a cultural background may assume that authors using the term "weaning foods" mean "foods to be used to wean the baby away from

the breast". Of course, some authors unfortunately do mean this. Brochures from Swedish infant formula companies long suggested that "breast milk meals," in the daily meal plans they advised mothers to follow, successively be replaced with meals of their products starting at four months or earlier.

When solid foods are added to the diet of "exclusively" breastfed infants in the USA, a partial replacement of breast milk occurs,²¹ even when the mothers are "advised to maintain the same nursing pattern, not to decrease nursing frequency, and to feed solid foods after nursing".²² Garza and Butte,²³ in a study of predominantly breastfed American infants, found that the addition of solid foods resulted in a reduction of breast milk production such that the total energy intake per kg body weight remained constant. However, we cannot know whether such research is measuring biological or behavioral effects. As described below, it cannot be assumed without further research that simple advice of this kind is optimally effective in avoiding partial replacement.

In a controlled experiment in Honduras, Cohen, et al.²⁴ found that commercial complementary foods from four months of age to one group of exclusively breastfed infants did, to a large extent, replace breast milk. In another group where mothers were instructed to use it as a complementary food, that is, to maintain breastfeeding frequency, this replacement effect was less. The net result was that these two groups grew as well as a third group which continued to exclusively breastfeed until six months of age. However, where sterile supplementary foods of high nutritional quality cannot be guaranteed, infants supplemented at four months of age might not do as well. This argues for waiting at least until six months of age to begin complementation.

Early supplementation is often recommended by health professionals who notice that "growth failure" seems to have begun in the early months. One reason for this is that breastfed infants grow differently than the bottle-fed infants on whom today's growth standards are largely based. Weight in breastfed babies increases faster than bottle-fed babies for about the first two months of life, more slowly up to about one year of age, and then somewhat more rapidly in the second year. This commonly leads to an incorrect assumption that early supplementation of predominantly breastfed infants is required due to "growth retardation."²⁵

Another problem is that, even when growth is retarded in the early months of life, health professionals often assume that breast milk is thus inadequate, and that supplements will have an additive rather

than a replacement effect. Kardjati et al.²⁶ illustrate this misconception: "In our area [East Java] it is the custom to give infants additional foods from as early as the second week. Such a tradition may have a sound reason. Even with these supplements, growth falters from the second month. It is therefore difficult to decide at this stage to postpone supplementary feeding till the fourth month."

When breastfeeding is sustained beyond about two years of age, it is often called "token breastfeeding" on the assumption that little, if any breastmilk is being provided to the child. This may be the case when the breast is offered only one or two times a day. However, a plateau in breastmilk production, as postulated in Figure 2 (zone "4"), has been found in traditional rural societies in Ivory Coast,²⁷ New Guinea,^{28,29} and Gambia.³⁰ These studies found that breastmilk production at 6 months was approximately sustained until 15 to 18 months postpartum. No matter at what exact level of breast milk production such a plateau is maintained, there is no physiological reason to assume that it could not continue for even longer than 18 months. In a large area of northern Bangladesh, Greiner and Mitra³¹ found that those children who were breastfed at 3-4 years of age received the breast 9-10 times a day, and those who were still breast fed at 4-5 years of age received it 7-9 times a day. Although the quantity of breast milk produced was not measured, this suckling frequency can be assumed to maintain a relatively high level of breast milk production (as indeed it does when women relactate³²), and should hardly be termed "token breastfeeding."

RESEARCH NEEDS

Research is needed to determine whether the provision of educational foods before complementation increases infant acceptance of foods later when they are nutritionally required. Even if this proves to be the case, research must determine under varying conditions whether the net impact is positive or negative.

Presumably the possibilities for achieving complementation rather than replacement increase with age of the infant, but researchers have not yet explored what such a sensitivity curve would look like. Research is needed to determine what kinds of skills mothers need in order to achieve complementation with as little replacement as possible. Then more research will be needed to determine what kinds of information are needed to convey those skills most effectively to them. And finally, "moral support" and assistance may be necessary, especially in cultural situations where women who do not provide large

amounts of foods and fluids of various kinds in the early months of life are considered by friends and family to be endangering the health of their infants. Research is also needed to examine in various settings and typologies the extent to which women already do manage to complement breast milk with minimal replacement, as well as the extent to which it is possible to introduce new ideas or techniques related to infant feeding without doing harm by damaging or reducing their ability to do so. Alternatively, in low-income settings where breast milk production at 6-12 months of age is low (say, under 400 ml per day), at least as much attention should be given to finding ways of increasing breast milk production as to increasing intake of other types of food.

Research like that done by Cohen, et al.²⁴ needs to be repeated in other settings. In particular, additional studies are needed which attempt to reduce the high dropout rates that made it difficult to interpret Cohen, et al.'s findings. In low-income situations, the elimination of early supplementation might result in a decline in infant morbidity and mortality even if exclusive breastfeeding is continued beyond six months of age.

There is some danger that "weaning foods" projects do harm by replacing breastmilk with food which, no matter how high its quality, is hardly likely to match the nutritional quality of breast milk, let alone its immunological and birth spacing effects. Perhaps this potential side effect is not looked into because researchers interested in "weaning foods" often do not understand much about breastfeeding. Holistic research designs are needed.

ACHIEVING CONCEPTUAL CLARITY

Many infant feeding problems, incorrect health worker advice, and lack of research attention to key issues in infant feeding stem in part from a lack of conceptual clarity. This has led to a lack of proper definitions and use of language which fails to communicate unambiguously about infant feeding. As a first step, it is suggested that authors avoid using the term "wean." It would be preferable to specify whether supplements are being given (or recommended) for "educational," complementation, or replacement purposes or whether it is the cessation of breastfeeding that is meant. (Some authors consider the French word "sevrage" to be "correct and evocative"³³ for this purpose, but this word also implies rapid cessation of breastfeeding.) Foods and fluids given in the first six months of life to breastfed infants are almost certainly having largely a replacement effect, whether intended or not, and should not be referred to as "complementary foods."

At the same time, it must be admitted that the "complementary-age child," though less ambiguous than the "weaning age child," still covers a large and somewhat uncertain age range and sounds too awkward to be widely adopted. At the very least it can be noted with satisfaction that the term "complementary foods" is beginning to replace the term "weaning foods." There is less risk that "complementary feeding" implies a need to "wean the child off the breast" at any given age.

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