



The Consultative Group on Early Childhood Care and Development

EARLY INFANT DEVELOPMENT AND IMPLICATIONS FOR FEEDING PRACTICES

Coordinators' Notebook No. 7, February 1989

by Cassie Landers

INTRODUCTION...	2
CAPACITIES OF THE NEWBORN...	2
BEFORE SPEECH: EARLY MOTHER-INFANT INTERACTION...	5
THE EFFECT OF FEEDING AND INFANT CARE PRACTICES ON EARLY DEVELOPMENT...	6
INFANT BEHAVIOUR AND EARLY MALNUTRITION...	8
PROGRAMME IMPLICATIONS...	9
TEN STEPS TO BETTER BREASTFEEDING...	10
REFERENCES...	11
ENDNOTES...	11

Over the past two decades, an exciting body of research has begun to inform us about the enormous capacities of the newborn infant. This awareness has forced us to move away from static models of development that perceived the infant as a helpless lump of clay waiting passively to be molded and shaped by both the strengths and weakness in his social and physical environment. Recognition of the newborn's innate capacities during this critical period of development will have an important impact both on caregiver behaviour and on the development of effective intervention programmes for infants and mothers at-risk.

Introduction

This article begins with a brief discussion of the infant's capacities during the first six months of life. The discussion emphasizes the infant's ability to interact and respond to his environment in ways that ensure both survival and healthy development. Equipped with highly developed sensory capacities, and a language consisting of smiles, gestures, eye-to-eye contact, and vocalizations, the infant develops with its mother a reciprocal communication system that sets the stage for all future development. The discussion also explores the enormous adaptability of human infants when confronted with biological and social risks that threaten their development. Through a process known as self-righting, infants are able to return to the path of normal development. The unfolding of this capacity, however, is dependent on appropriate maternal responses and culture-specific childrearing practices.

In spite of the recognition of the newborn's ability to interact and respond to the environment, surprisingly little attention has been paid to the behaviour of the infant in studies of the causation of early infant malnutrition. This article suggests a model that includes infant behaviour and patterns of interaction as factors to consider in the etiology of infant malnutrition. The discussion concludes with a set of programme implications recommending the need to integrate the insights gained from our enhanced understanding of newborn behaviour and mother-infant interaction with existing programmes and policies.

Capacities of the Newborn

From the moment of birth, human infants are born with a wide range of capacities that help to promote healthy development. They have reflexes for the basic biological functions, as well as reflexes that lay the foundation for more complex controlled behaviours that appear later on, such as grasping, crawling and walking. Their basic sensory capacities for seeing, hearing, touching, smelling and tasting are already functioning at birth, and the competence with which most newborns use these capacities is dramatic. The following discussion describes some of these amazing capacities of the newborn and describes how the existing reflex and sensory capacities of the newborn are transformed into skilled voluntary actions during the first six months of life.

■ REFLEXES

The newborn's reflexes enable him to suck, cry, see, hear, and grasp. One of the most important newborn capacities is the ability to suck competently enough to receive adequate nourishment. The sucking ability begins with several closely related reflexes, including rooting and sucking. Rooting is a reflex elicited by lightly touching the infant's cheek. The infant will turn his head in the direction of the touch and open his mouth as if seeking something to suck. As the newborn's mouth is brought into contact with an object, the sucking reflex is elicited. There are great individual variations in the pattern and strength of sucking. Some infants suck forcefully at birth, while others have to exert greater effort to obtain adequate nutrition. It takes several days to coordinate the sucking patterns with the mother's patterns of holding her baby, the flow of milk

from the breast, and the infant's individual tempo. Sucking not only provides a means of obtaining nutrition but also exerts a pleasurable calming effect on infants.

Like the newborn's appearance, some reflexes—crying, for instance—serve the purpose of bringing the adult into close proximity, thereby stimulating care. Crying can be elicited by pain or discomfort, but also can occur spontaneously. For the first several months, the cry is the infant's primary means of communication. Moreover, the quality of the cry seems to vary depending on whether the infant is hungry, in pain, or irritable. A mother is extremely sensitive to her infant's cry and can distinguish it from that of other infants. The cry causes the mother to respond, thereby positively affecting the amount of care and attention received.

■ STATE REGULATION

The infant's state (or level) of arousal is important to consider in attempting to understand the capacities and behaviours of newborns. The infant has several states that range along a continuum from deep sleep to active crying. Each state is characterized by a specific repertoire of behaviours that are often performed together, rather than independently, and are strongly associated with biological changes. The infant "state" is important to note when considering the degree and quality of interaction, as it constitutes a system through which important information is transmitted and received by the infant. During the quiet, alert, and wakeful state, which usually follows feeding, the infant is most receptive to external stimulation. The duration and quality of this state increases during the first month of life and varies tremendously from infant to infant. The frequency and duration of the wakeful state is affected both by the maternal caregiving behaviours and by the infant's capacity to regulate its own state of wakefulness. For example, newborns are equipped with a capacity known as habituation, which helps to shut out disturbing stimulation.

■ TOUCH AND SMELL

At birth, the dermal or touch system is the most mature of all the sensory capacities. The skin sends a multitude of sensory messages to the brain. The skin is the most extensive and basic of all sensory systems and contains receptors for temperature, contact, and pain. Body contact plays a major role in the establishment of relationships. During the first few hours and immediately after birth, the mother's extreme sensitivity to her infant facilitates and favors the development of emotional ties. Direct skin-to-skin contact is advised immediately after birth.

In addition to body contact, which is inseparably linked with movement, smell plays an important role in the establishment of emotional ties. Newborns are extremely sensitive to smell and respond differently to smells as indicated by the different facial expressions that are apparent immediately after birth. Within the first week of life the infant is able to distinguish the mother's breastmilk. Through this capacity, infants are able to elicit and maintain contact with their environment. Infants are attracted to what is familiar and express this comfort through bodily movements and facial expressions. This calm, quiet response of the infant is highly satisfying to the mother. She is reassured that her care has been effective and is encouraged to engage in a series of affectionate mutual exchanges. Although communication by touch and smell is quite

subtle, it occupies a critically important place in the development of emotional ties and sets the stage for more complex mother-infant communication.

■ HEARING

Hearing is a complex inborn ability. The fetus can respond to noise in utero, and this system is fully established at birth. One striking characteristic is the newborn's preference for the human voice, particularly the high-pitched female voice. Research indicates that infants stop sucking briefly in response to a noise and then immediately resume sucking. In response to the human voice, however, sucking is interrupted and then resumed in active sequences supported by regular pauses, as if in anticipation of repeated vocalizations. Observations of infants in the earliest days of life reveal that they react in specific ways to the mother's voice. Babies suck longer and more vigorously when they hear the mother's voice, suggesting that the infant is programmed to respond specifically to the individual who feeds him. Infants also have an inborn reflex to coordinate eye movements with sound, a reflex that enables them to turn towards the source of a sound. In a few months, this reflexive association between sight and sound becomes a skilled action enabling an infant to choose where to focus attention.

By 2 months of age, an infant is able to detect subtle distinctions between such similar sounds as "pa and ba," or "ma and na." Thus, the auditory perception of a 2-month-old infant is identical to that of an adult. Like other aspects of early development, the perception of verbal sound is conditioned by the child's environment and becomes functional only through appropriate stimulation. From perceiving sound to using meaningful language, however, is a long road. The ability to hear is only the first step; in order to formulate a response, a child must be able to receive and process information.

■ SIGHT

The infant is also able to elicit responses from the outside world through the sensory capacity of sight. At the moment of birth, infants are equipped to focus on and follow the well-shaped form of a human face. During the first few hours of life an infant will attend to and follow with eyes and head a picture of the human face. A picture of a scrambled face elicits little interest. Newborns have a limited field of vision and can only see things within a distance of 30 centimeters, but these visual capacities increase dramatically within the first 2 months, when longer periods of awake-states allow for greater periods of mother-infant interaction. By 2 months, the infant is capable of "looking around." Whereas at birth the infant focuses on faces at close range, by 2 months of age, more complex, shaded images are preferred. With maturation of the nervous system and adequate sensory stimulation, the infant's attention span increases, and they remain in the awake state for longer periods. This in turn allows for more complex modes of early communication. These early expressions of emotional ties pave the way for later cognitive and socio-emotional development. In the absence of human contact and appropriate environmental responses, infants will begin to withdraw from their environment.

Before Speech: Early Mother-Infant Interaction

Infants are also equipped with a complex repertoire of communication skills, including smiles, gestures and vocalizations. For example, newborns in the early days of life have a facial expression which suggests a smile that lasts for the first few months. Although the early smile seems to be reflexive and unrelated to specific events, parents react to this expression as if it were an attempt to communicate. At approximately 2-1/2 months, the unexplained smile turns into a social smile that appears regularly at the sight of a face. The maternal response to the smile plays a major role in the development of social communication. This facial expression becomes a tool and a means of communication and paves the way for more complex human interaction. By 3 months of age, the smile is well established and is used systematically to engage in communication.

The smile exemplifies the infant's capacity and need for interaction within the first few months. The infant's smile reassures the mother that her care is appropriate and that her child can distinguish her from other people. The use of the smile is one of the first means of intentional communication. The infant uses it to begin and maintain interactions through repeated smiles and exchanges. It is only through interaction that the child's smiles and other modes of communication become recognized as signals and are interpreted as such.

In addition to exchanging smiles, gazes, and facial expressions, mothers and infants use gesturing as a form of communication. Mothers teach this language to their children by interpreting their gestures as signals and responding to them accordingly. For example, at about 5 months of age an infant holds out its arms as the mother approaches, and the mother interprets this as the infant's desire to be picked up. Thus, this gesture acquires a specific meaning and regularly elicits a specific maternal response.

In progressing from the earliest seeing, hearing, smelling, and tasting to the recognition of faces and deciphering gestures, the infant has obtained the ability to communicate using a complex set of skills. The ability to communicate at a distance has been added to the ability to communicate at close range. Moreover, the language learned through exchanges of gazes, facial expressions, and gestures has introduced the infant to symbolic communication.

By age 3 months, infants communicate by babbling and are increasingly attracted to the human voice. Towards 6 months, they are aware of variations in voice, and by 7 months they use vocal abilities in more complex ways to attract maternal attention. They may intensify their vocalizations and repeat syllables to retain their mother's attention, cry when she goes away, and calm down when she speaks. By 8 months, infants possess the rudiments of speech. They are able to pronounce some syllables, such as "da", which the mother then interprets as words. It is aptitude for communication, which has developed through their entire previous interaction that forms the foundation for language development.

A mother's verbal response to her infant changes in accordance with the newly emerging developmental capacities of the infant. She changes her way of speaking by changing the pitch, tone, length of vowels, and by using repetition and shortened phrases. In this way, mothers help

infants to move along the developmental continuum and slowly introduce infants to the world of thought through the symbolic representation of objects and people.

The Effect of Feeding and Infant Care Practices on Early Development

During the first 4-6 months of life, much of mother-infant interaction is focused on feeding. Feeding provides an opportunity to observe the infant's increasingly complex set of capacities. Mother-child interaction with respect to feeding is a dynamic process that changes continuously over time and is affected by factors intrinsic to both the mother and infant, as well as factors extrinsic to them, factors that are imposed by the social and cultural environment. As discussed, newborns are programmed to elicit from their environments the resources necessary for survival. In addition to the rooting reflex by which they seek and find the breast, the sucking reflex allows them to obtain food. Sucking is then synchronized with swallowing and breathing.

In the earliest days of life, the mother-infant relationship capitalizes on the satisfaction of the physiological need of hunger. The newborn's equilibrium is satisfied, pleasure is felt, and the sensation of fullness replaces the discomfort of hunger. This harmonious relationship develops in the first 4-5 days, during which the infant coordinates the sucking pattern to match that of the mother. Through rapid early maturation, the infant becomes more alert and utilizes his rapidly developing sensory systems to interact with both the animate and inanimate environment. The infant recognizes the smell and taste of milk, discovers the mother's gaze and recognizes her speech. Gradually, feeding is associated with a feeling of pleasure and intense social stimulation.

The establishment of an optimal feeding pattern as described above is dependent on the interplay of infant, maternal, and environmental factors. This adaptability of human infant behaviour is more dramatic when viewed under stressful environmental conditions combined with maternal risk factors that would seemingly jeopardize the development of the infant. It is recognized that the human infant is well adapted to overcome the stress of a harsh environment and develop according to a predetermined path of optimal development. This ability is particularly apparent in the rapid catch-up growth exhibited by low-birth-weight infants. It is argued that although the biological capacity for catch-up growth is inherent in the species, it is dependent on appropriate maternal feeding and caregiving behaviours. For example, through the process of evolution, elaborate anatomic, physiologic, and behavioural adaptations for breastfeeding have developed in both mother and infant. Of all mammalian animals, only humans have protuberant breasts. Although their true physiologic value is unclear, it has been hypothesized that this feature enhances the capacity for mother-infant social exchange by allowing eye contact and the opportunity for the infant to scan the mother's face. The infant's rooting reflex initiates sucking, which triggers the maternal production of prolactin and oxytocin, which stimulates the release of milk. The amount of breastmilk produced is directly related to the quantity of sucking; without sucking, milk production ceases. Moreover, in the lactating woman, an infant's cry stimulates blood flow to the areolar area.

An additional physiologic adaptation concerns the interrelationship between infant feeding and the content of breastmilk. As the infant empties the breast during each feeding, the fat content of milk increases while the water content decreases. The associative changes in the texture and taste, obviously absent in infant formulas, have been suggested as factors in the infant's decreased appetite and the termination of feeding. In addition, the antibodies, lysozymes, lymphocytes, macrophages, and other components of colostrum and transitional breastmilk, serve to defend against infection, which may have been the major human "predator" during evolution. Because of these properties, a significantly enhanced resistance to enteric infection has been observed among breastfed babies.

In addition to having all the above properties, breastmilk has a composition that is particularly well suited to patterns of feeding on demand. In species that nest or cache their infants, breastmilk is high in protein and fat, mother-infant contact is intermittent, and feedings are spaced from 2 to 15 hours apart. By receiving their total nutritional requirements in short periods, these infants are adapted for long separations. In contrast, species that are carried by, hibernate with, or follow their mothers have low-fat, low-protein breastmilk, constant maternal-infant contact, and essentially continuous feeding. Human milk is low in fat and extremely low in proteins. Since human infants are immobile at birth, the insights of comparative physiology have identified the pattern of human care as that of carrying and continuous feeding. Thus the pattern of continuous feeding supports, reinforces, and enhances the biologic pro-adaptability of our species.

In addition to these biological factors, increasingly impressive data indicate the ability of the childrearing environment to influence the capacity of infants to exhibit catch-up growth. It is accepted that highly supportive environments produce patterns of care and handling that enhance the development of highly stressed infants. These strategies are passed down socially rather than biologically and are encoded in customs rather than genes. For example, it is well known that early patterns of infant rearing practices in many parts of the world include a high amount of skin-to-skin and tactile stimulation through elaborate bathing and massage rituals. Recent investigation on the physiology of growth suggests that certain brain chemicals released by touch may affect the rate of metabolism. In some dramatic new findings, premature infants who were massaged for 15 minutes three times a day gained weight 47 percent faster than those left alone. The massaged infants also showed signs of more rapid maturation of the nervous system (see the supplementary article, "The Experience of Touch: Research Points to a Critical Role" attached with this issue).

Evidence from animal models suggests that a particular pattern of touch by a mother rat inhibited the infant's production of beta-endorphins, a chemical that affects the level of insulin and growth hormone. It has been hypothesized that the touch system is part of a primitive survival mechanism found in all mammals. Because mammals depend on maternal care for survival, the prolonged absence of the mother's touch triggers a slowing of the infant's metabolism, thus lowering the demand for nourishment.

Infant Behaviour and Early Malnutrition

The ability of the infant to participate in such a complex set of interactions, and the capacity of the environment to respond to the infant's needs even when his or her survival is at-risk, contributes important and often overlooked insights into the etiology of growth failure in early infancy. Past investigators have appreciated the complex set of causal factors in infant malnutrition, and numerous models have been generated, each attributing differing weights to various combinations of factors. Factors identified in the etiology of malnutrition have included these: poverty, unsatisfactory physical and social environments, low maternal education, poor maternal nutritional status and reproductive history, inappropriate feeding patterns, and weaning to foods in the first 6 months of life. Given the extent of our knowledge on infant behaviour, the lack of specific attention to the behaviour of the infant and patterns of mother-infant interaction in the causation of infant malnutrition is curiously misleading. Static models offering explanations of unilateral causality often leave the impression of a helpless, passive infant adversely affected by the threats of a harsh environment. Moreover, investigations of the determinants of infant feeding patterns have failed to recognize the impact of the infant's condition at birth on the choice of feeding patterns. Illness or inappropriate infant growth patterns as perceived by the mother, culture, or health care provider may lead to a change in the type and quantity of food given. The effect the infant's behaviour has on feeding patterns and on growth deficiencies has not been carefully considered.

With this perspective in mind, a synergistic model that pays particular attention to the behaviour of the infant is proposed (Figure A)¹. As indicated in Figure A the concept of synergism refers to the combined effects of two or more factors being greater than the sum of their individual effects. The application of synergy to the effects of malnutrition indicates some of the major factors that further magnify the nutritional insult. In broad terms, one must recognize the prenatal environment and the ecological-sociological structure of the family. As also suggested, the model recognizes the interaction between the intrauterine environment and the fetus that may compromise the fetus and produce the at-risk infant. These factors act together to produce a stressed, underweight infant whose risk status is reflected in disorganized behaviour patterns. The poor eliciting behaviours of these infants exacerbate the effects of malnutrition. A poorly organized infant who has difficulty interacting with the environment and is unable to elicit the appropriate response from an already over-stressed and nutritionally depleted caregiver, may not receive the kind of attention and care necessary for its development. Thus, the capacity to exhibit catch-up growth is denied and the stage has been set to fuel the cycle of poverty. The lack of recovery in the infant becomes part of a cycle of synergistic forces that capitalize on the stressors inherent in the culture.

This model has particular saliency when one considers the effects of infant feeding on low-birth-weight infants, babies either pre-term or small for their gestational age. Although statistics on rates of low-birthweight infants in low-income countries are not routinely collected, the World Health Organization reports that approximately 25 percent of all babies born in less-developed countries are of low birth weight, compared to 6-9 percent in Europe. Current research indicates that low-birth-weight infants differ from full-sized infants in ways that directly effect a variety of feeding outcomes.

The low-birth-weight infant is likely to be less mature immunologically. Immaturity in other organs and biochemical systems contributes to different nutritional requirements. For instance, fat absorption is lower in pre-term infants, and they require higher levels of nutrients, especially protein and calcium. Evidence indicates that these infants are often irritable, have aversive high-pitched cries, and have lethargic behaviour and poor sucking reflexes that might adversely affect the ability of the infant to stimulate the attention of an already over-stressed caregiver. Given the greater nutritional needs as well as the need for more maternal attention, it is not surprising that infants who are of low birth weight and are small for gestational age have increased rates of morbidity and mortality.

Programme Implications

The implications of this growing body of knowledge with respect to the behaviour and development of the infant are important in the consideration of policies in both nutrition and primary health care programmes. The challenge is to create a process that ensures the integration of this perspective with existing programmes in a way that will enhance and strengthen programme effectiveness. The following recommendations are put forth as suggestions that, if implemented, will contribute to our efforts to break the cycle of early infant malnutrition.

- Development of parental and family education programmes to increase the awareness of mothers and other family members of both the capacities and the needs of infants. Educational messages should be carefully constructed in ways that will reinforce and support caregivers' existing and innate capacities in order to provide optimal care for their infants.
- Identification and reinforcement of traditional, culturally prescribed patterns and practices of childcare that support and enhance the "self-righting" capacities of the newborn.
- Support for the promotion and increased duration of breastfeeding and appropriate weaning practices as well as for the encouragement of hospital practices and policies that favor rooming-in, mother-support groups, and other supportive procedures.
- Development of techniques for the observation of infant behaviour and mother-infant interaction that can be easily integrated with existing growth-monitoring activities.
- Addition of information on early infant behaviour, mother-infant interaction, and feeding problems to primary health care and nutrition education programmes and training manuals.
- Development of screening measurements and techniques that will encourage the early identification of high-risk infants with the potential for feeding problems and subsequent development delay.

Ten Steps to Better Breastfeeding²

Every facility providing maternity services should:

1. Have a written breastfeeding policy that is routinely communicated to all healthcare staff;
2. Train all healthcare staff in skills necessary to implement this policy;
3. Inform all pregnant women about the benefits and management of breastfeeding;
4. Help mothers initiate breastfeeding within 1/2 hour of birth;
5. Show mothers how to breastfeed and how to maintain lactation, even if they have to be separated from their infants;
6. Give infants no other food or drink than breast milk;
7. Practice rooming-in—mothers and infants together—24 hours a day;
8. Encourage breastfeeding on demand;
9. Give no artificial teats or pacifiers (also called dummies or soothers) to breastfeeding infants;
10. Foster the establishment of breastfeeding support groups and refer mothers to them on discharge.

References

- D'Agostino, Micheline. "Early Mother-Child Interaction," Children in the Tropics No. 164, Paris: International Children's Centre, 1986.
- Fischer, K W., & Lazerson, A. Human Development: From Conception through Adolescence. New York: W.H. Freeman and Company, 1984.
- Hibbs, E. (Ed.) Children and Families: Studies in Prevention and Intervention. Connecticut: International Universities Press, Inc., 1988.
- Lester, B.M. "A Synergistic Process Approach to the Study Of Prenatal Malnutrition." International Journal of Behavioural Development, 2(1979), 377-393.
- LeVine, R. A. "Child Rearing As Cultural Adaptation." In Culture and Infancy, H. Leiderman, S. Tulkin, & A. Rosenfeld, (Eds.). New York: Academic Press, 1977.
- Lewis, M. & Rosenblum, L. The Effect Of The Infant On Its Caregiver. New York: John Wiley & Sons, 1974.
- Myers, R. M. "Programming For Early Child Development and Growth: The Value Of Combining Nutritional and Psycho-social Interventions and Some Ways to Do It." Paper prepared by the Consultative Group on Early Childhood Care and Development for publication as a UNESCO Digest, 1988.
- Rathus, S. Understanding Child Development. New York: Holt, Rinehart and Winston, Inc., 1988.
- Pollitt, E. "Behaviour of Infant in Causation of Nutritional Marasmus." The American Journal of Clinical Nutrition, 26 (1973) 264-270.

Endnotes

¹ Figure A not available.

² WHO/UNICEF statement on the "Protection, Promotion, and Support of Breastfeeding: The Special Role of Maternity Services." Presented to the Interagency Workshop on Health Care Practices Related to Breastfeeding, Washington, DC, 7-9 December, 1988.

An expanded version of this article appears in Dennis Drotar, (Ed.), New Directions In Failure To Thrive. New York: Plenum Press, 1985.

Copyright © 1989 Cassie Landers

Early Childhood Counts: Programming Resources for Early Childhood Care and Development. CD-ROM. The Consultative Group on ECCD. Washington D.C. : World Bank, 1999.