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BREASTFEEDING: AN INTERDISCIPLINARY REVIEW

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Theoretically, breastfeeding can be conceptualized as an ancient mammalian practice that has ensured the survival of the human species across evolutionary time (Dettwyler, 1995). However, with respect to current breastfeeding patterns, cultural beliefs and social expectations have been found to influence both the initiation and duration of breastfeeding rates across cultures. The World Health Organization, the Surgeon General of the United States, and the American Academy of Pediatrics have all stated that breastfeeding influences not only maternal and pediatric health outcomes, but also impacts broad range societal functioning. Scholars have suggested that breastfeeding is a multifarious variable that can be seminally linked with familial functioning, societal expectations, political structures, the medical community, and specific historical events (Palmer, 1991; Stuart-Macadam and Dettwyler, 1995). This paper explores the historical and cultural mechanisms that have influenced breastfeeding patterns throughout history and seeks to identify those biocultural processes that have led to America's relatively low incidence of breastfeeding.

Introduction and Historical Review

Throughout human history, mothers and their children have been physiologically linked by the process of breastfeeding (Dettwyler, 1995). Until relatively recently, breastfeeding was perceived as a fundamental, biologic process that ensured the survival of the human species (Dettwyler, 1995). However, with the advent of technology, the topic of breastfeeding has become a multifaceted, circuitous variable that engenders much controversy because of the determinants that are associated with human lactation in the 21st century. This paper will address the historical, physiological, economic, medical, and cultural factors that have been found to influence both the initiation and duration of breastfeeding in current day America.

Employing an evolutionary timeline, considerable scientific evidence suggests that for the vast majority of human existence, human females have sustained their children with milk secreted from their breasts (Stuart-Macadam and Dettwyler, 1995). Breastfeeding is an ancient mammalian practice that has ensured the survival of the human species by providing optimal nutrition and disease protection for children, ensuring optimal maternal physiological functioning, and by cementing the attachment process between mother and child (Jelliffe and Jelliffe, 1978).

Ancient breastfeeding patterns have been established by combining historical sources, ethnological data, and archaeological evidence (Dettwyler, 1995). Paleonutrition is the study of the dietary habits of ancient humans and this field has provided useful information about the breastfeeding habits of our early ancestors. Scientific data confirms that children living in the Archaic period (5,500-6,000 BC) were breastfed from 4-7 years and were introduced to foods other than human milk between 18 months and 3 years (Dettwyler, 1995; Fogel, Tuross, and Owsley, 1989; Sillen and Smith, 1984). Katzenberg, Saunders, and Fitzgerald (1993) reported that there existed in prehistoric times vast differences in weaning rates for individual children. Variables such as gender of the child, season of the year, the health of the lactating mother, and subsequent pregnancies were hypothesized to influence weaning patterns-even among the same group of prehistoric humans.

Dettwyler (1995) has hypothesized that the majority of prehistoric children were breastfed from 5-7 years. Dettwyler (1995) suggests that permanent molar eruption (which occurs between 5-7 years) in prehistoric humans allowed children access to the only foods that were available for consumption (i.e., raw meat, nuts, uncooked grains, and vegetation). Scientific data indicates that weaning rates began to vary significantly in ancient populations only after the advent of fire which allowed foods to be prepared in a way that was suitable for young children (Dettwyler, 1995).

The earliest known historical records regarding breastfeeding date back to 3000 B.C. and include material, epigraphic, and pictorial records (Stuart-Macadam, 1995). The vast majority of these historical records were found by archeologists in Mesopotamia, Lavant, and Egypt (Fildes, 1981; Stuart-Macadam, 1995). Researchers concur that children living in the Mid East from 3000 B.C.–1000 B.C. were nurtured in very similar ways as breastfeeding was the cultural norm and weaning occurred between 3–4 years of age (Fildes, 1986; Stuart-Macadam, 1995). Scientific evidence indicates that our ancient ancestors may have been aware of the fact that depriving human children of human milk could have deleterious consequences. The practice of "wet nursing" (i.e., employing another lactating female to breastfeed a child) was a widely accepted social custom for the ruling classes in the ancient Mid East. With regard to breastfeeding

practices in the ancient Near East, Hebrew women were least likely to employ a wet nurse, while aristocratic Egyptian women most often employed wet nurses to suckle their children (Stuart-Macadam, 1995). In Greece during the 4th century B.C., wet nurses were commonly employed by the aristocracy. The practice of aristocratic families employing wet nurses spread throughout the Roman Empire, and it is hypothesized that this practice was adopted in England during the period of Roman occupation (Fildes, 1988). Historical documents from antiquity to pre-industrial Europe indicate that wet nurses suckled individual children from 1-3 years on average (Fildes, 1988; 1991).

Historical records indicate that most of Western Europe's Aristocracy, from the beginning of the second millennium, employed wet nurses to sustain their children. However, the practice of wet nursing in Western Europe was never adopted by the masses as breastfeeding by the natural mother was the accepted norm (Fildes, 1988). McClaughlin (1976) hypothesized that the aristocracy's increased birth rates recorded during the second millennium can be directly traced to the custom of wet nursing. Birth rates among Europe's ruling class were extremely high when compared to birth rates among Europe's lower class citizens. Fildes (1986) documents that between 1400 and 1800, women understood breastfeeding influenced fertility rates as breastfeeding was actively discouraged among the aristocracy so that more children would be born to the ruling class. During the 1500s, aristocratic French women gave birth every one to two years. Lower class French women (who nursed their own children, and were employed as wet nurses) gave birth to 2-3 children in their lifetime (Fildes, 1986).

During the 1500-1800s, Europeans began feeding children with milk secreted from other mammals (i.e., cow and goat milk). Mortality rates were extremely high for children who were not fed human milk, and during the 1600s in England, over 50 per cent of the children who were not breastfed died in infancy (Fildes, 1986). In greater Europe during this time, the infant mortality rate was 500 per 1,000 births in non-breastfed populations. Interestingly, only one fifth of Europe's breastfed infants died during this same time period (Fildes, 1986; Wickes, 1953).

In America during the late 1800s and early 1900s, infant mortality rates were increasing (Stuart-Macadam and Dettwyler, 1995). The Victorian attitudes that permeated Europe spread to America during this time, and the act of suckling a child at the breast was viewed as "immodest" according to Victorian dictums (Riordan and Auerbach, 2005). As a partial result of the Victorian worldview, breastfeeding rates plummeted in the most industrialized regions. Advertising for formula began in the early 1900s, and this advertising campaign suggested that technological advances (i.e., artificially manufactured milk and nipples) could alleviate

the "distress" caused by suckling one's child (Morse, 1989). Advancements in technology added to the availability and acceptability of formula in the early twentieth century America. The mechanization of the dairy industry resulted in large surpluses of whey-a waste product generated by the mechanization process-which in turn fueled the mass marketing of whey-based baby milk (Palmer, 1991). By the early 1900s, artificial baby milk was widely marketed throughout the U.S. (Baumslag and Michels, 1995).

Soon after the mass distribution of formula occurred in the U.S., problems associated with the use of artificial baby milk became widespread. Rickets, Scurvy, diarrheal diseases, and vitamin A deficiency blindness became increasingly common in artificially fed populations (Baumslag and Michels, 1995). Artificial baby milk was marketed to the masses as a technological breakthrough, and ads promoting formula promised mothers more freedom than they had ever known. What was not told to the American public was that use of formula increased the risks of infant infection, malnutrition, anemia, brain damage, and death (Baumslag and Michels, 1995).

As is the case with most issues, the decline in breastfeeding rates in the early twentieth century was not dependent on any single factor. Occurring simultaneously with the Victorian ethos and the mechanization of the dairy industry was the insistence of the male dominated medical profession to take over the management of infant feeding practices and birthing procedures (Palmer, 1991).

Throughout the course of human history, women had been perceived as the experts with regard to birth and lactation. As industrialization permeated American culture, rapid changes in our perceptions of the birth and lactation process were underway (Palmer, 1991). Assimilation into this newly industrialized society brought massive changes; women were no longer viewed as the experts with regard to birth and lactation; urbanization resulted in the loss of breastfeeding role models within the familial sphere; and physicians began promoting formula feeding and hospital birth (Palmer, 1991).

Women were encouraged by their male physicians to make the "healthy choice" and to leave behind the antiquated practices of the past (i.e., home birthing and exclusive breastfeeding (Palmer, 1991). During the early 1900s, hospital births became fashionable and women were relinquishing their role as the primary authority concerning reproductive health (Palmer, 1991). It is commonly believed that the advent of medicalized hospital births dramatically reduced maternal and infant mortality rates. However, between 1915 and 1930 in the United States, both maternal and infant mortality rates increased as homebirths were outlawed and males within the medical profession continued their

domination of the birthing and lactation process (Fogel, 2001; Palmer, 1991).

Medical doctors were closely aligned with the distribution of formula in the early 1900s. As knowledge about the inadequate composition of Bovine-based formula increased, doctors became skilled at devising individual formulas for infants. The practice of doctor-created individual formulas was both time-consuming and costly, so during the early twentieth century, generic, over-the-counter formula became available to the American public (Fildes, 1986; Palmer, 1991). Initially, doctors objected to the mass distribution of generic formula, insisting that individual infants required specific formulas. Mothers who could purchase mass marketed generic formula at the store contributed to substantial monetary losses for physicians who profited from creating individual formula, yet the marketing and distribution of generic formula continued unabated (Baumslag and Michels, 1995; Palmer, 1991).

Nestle's Milk Food was the first to invent an artificial baby milk that needed only to be mixed with hot water–the first "instant formula" on the market (Palmer, 1991). Jelliffe and Jelliffe (1978) suggested that physicians came to the realization that it would be economically advantageous to align themselves with the manufacturing of generic formula and this is hypothesized to have begun the practice of physician recommended formula and the offering of free formula via doctors' offices and hospitals.

The alliance created in the early 1900s between physicians and the formula industry contributed to women's reliance on either the distributors of formula or medical doctors for information regarding infant feeding (Apple, 1980). Beginning in the 1930s, the promotion of formula increased exponentially, particularly in industrialized nations. As the pharmaceutical industry expanded their distribution of formula, researchers were in the seminal stage of discovering the risks associated with depriving human children of human milk (Palmer, 1991). Numerous studies conducted during the early 1900s documented the various risks associated with formula feeding, and as early as 1913, scientists concluded that artificially fed infants were six times more likely to die than were their breastfed cohorts (Davis, 1913).

A study conducted by Hector Cameron, M.D., (1913) classified the advantages of breastfeeding using three distinct codifications:

(1) More severe forms of alimentary disturbances were infinitely more common among bottle fed infants.

(2) When an illness such as influenza, bronchitis, or tonsillitis was contracted by an artificially fed child, the intensity and duration of the aliment was more pronounced.

(3) The artificially fed child is apt to show signs of the unnatural character of his/her diet. The skin was usually of an unhealthy pallor, the feet

> and hands were often cold and cyanosed, and the physical movements of the bottle fed infant were less vigorous and powerful (p. 911).

Cameron (1913) also documented that supplementing breast milk with formula hindered the lactation process by reducing the maternal milk supply which in turn led to total lactation failure.

Woodbury's (1922) statistical analyses demonstrated that artificially fed children had significantly higher morbidity and mortality rates. Woodbury concluded that artificially fed children were being deprived of the immunologic properties found in human milk; thus, their immature immune systems were not able to fend off various disease-causing pathogens. Woodbury's seminal research controlled for parental education, income level, and ability to afford quality health care. Woodbury (1922) demonstrated that even when optimal familial processes were in place (i.e., high education and income levels) artificially fed children were found to have a four fold increase in death rates when compared to their breastfed cohorts.

Woodbury (1925) later analyzed 22,422 infants from eight American geographical locations. This study controlled for race and socioeconomic status and was funded by the United States government in order to uncover causal factors in infant mortality rates. Woodbury's 1925 data demonstrates that during the first month of life, formula fed infants had a mortality rate three times higher than that of breastfed infants. In the second month of life, formula fed children had a death rate that was four times higher than that of their breastfed cohorts. By the seventh month of life, Woodbury found that mortality rates for formula fed infants were five times higher than that of breastfed infants.

In 1934, Grulee, Sanford, and Herron sampled 20,000 infants in the Chicago area. All of the infants lived with economically disadvantaged families and were under the supervision of state health care workers. Grulee and his colleagues found that with regard to low income infants, artificially fed children who were 10 months of age or younger were 50 times more likely to die than were those infants who were breastfed. In spite of the scientific evidence that documented the risks associated with formula feeding, the formula industry expanded its market in the 1940s and 1950s and worldwide breastfeeding rates plummeted as the advertising for formula became widespread during the post World War II era (Dettwyler, 1995). During this time period, the medical community was not informing women of the risks associated with the use of formula and physicians routinely recommended artificial feeding to their patients (Stuart-Macadam and Dettwyler, 1995; Palmer, 1991). Breastfeeding rates dropped from 95 per cent with weaning occurring at 2-3 years of age in the 1880s to less than 25 per cent in the 1960s (Minchin, 1985; Stuart-Macadam and Dettwyler, 1995).

Records of historical breastfeeding patterns indicate that many factors influence breastfeeding behaviors. The availability of alternative food sources, the cultural acceptability of alternative feeding methods, individual characteristics, familial attributes, cultural mandates, the medical community, governmental and institutional forces, and capitalism have all been intrinsically linked to variations in breastfeeding patterns cross-culturally (Palmer, 1991; Riordan and Auerbach, 2005; Stuart-Macadam and Dettwyler, 1995; Wolf, 2003).

Current Breastfeeding Patterns

The term "breastfeeding" is insufficient when describing the numerous types of breastfeeding behaviors found in the world today (Labbok and Krasovec, 1990). The vast majority of the breastfeeding research during the last three decades does not distinguish between full and partial breastfeeding, nor does it take into account frequency, timing, or duration of exclusive breastfeeding practices (Labbok and Krasovec, 1990). Considerable variations exist with regard to worldwide breastfeeding practices as cultural mandates dictate if, when, where, and how long a child will receive human milk (Palmer, 1991; Wolf, 2003).

Breastfeeding in the early 1900s was accurately defined as a categorical variable because during this time period, the vast majority of children received high frequency nursing, human milk exclusively (i.e., no formula supplementation), and breast milk for 2-4 years on average (Stuart-Macadam and Dettwyler, 1995). As breastfeeding rates fell and formula feeding became culturally acceptable, infant feeding practices begin to vary considerably. Currently, breastfeeding can no longer be defined as a categorical variable as a wide variety of different breastfeeding styles exists. Labbok and Krasovec (1990) postulated there exists (1) exclusive breastfeeding (no other liquids or solids given to infant); (2) almost exclusive breastfeeding (vitamins, water, juice, or ritualistic feeds are given infrequently in addition to breastfeeding); (3) partial breastfeeding (supplementing breast milk with formula); and (4) token breastfeeding (minimal, occasional, or irregular breastfeeds). Scholars have suggested that the differing breastfeeding styles must be acknowledged as a clear dose – response relationship exists with regard to breastfeeding behaviors. The literature documents that breastfed infants who receive formula supplementation are at higher risk for diarrhea, malnutrition, general morbidity, and infant mortality (American Academy of Pediatrics (AAP), 2005; Cunningham, 1979; Cunningham, Jelliffe, and Jelliffe, 1991; Dooley, 2002; Wolf, 2003).

Advances in the field of epidemiology demonstrate that breast milk contains powerful anti-infective properties and active immune modulators that are transferred from mother to child during breastfeeding

(AAP, 2005). Furthermore, researchers have found that the constituents of human milk vary by stage of lactation, time of day, maternal nutrition, and the unique needs of an individual child (Lawrence, 2005). Human milk contains all classes of immunoglobins, lysozyme (a nonspecific anti-microbial factor), lactoferrin (an iron binding protein), B_{12} binding protein (inhibitor of the growth of bacteroides), and interferon (an antiviral agent) which change in composition in order to meet the specific physiological needs of an individual child (Lawrence, 2005; Lawton and Shortridge, 1977). Human milk is a dynamic substance that changes according to specific environmental pathogens thus the shared environment of mother and child is a crucial component when analyzing the protective nature of human milk (Lawrence, 2005).

The Benefits of Breastfeeding

Cognitive Development

For over 70 years there has existed scientific evidence that distinct and measurable cognitive differences can be detected between breastfed and artificially fed children. Studies indicate that children who are breastfed score higher than their artificially fed cohorts on a number of standardized intelligence tests (Michaelsen, Lauritzen, Jorgensen, and Mortensen, 2003; Wolf, 2003). Breastfeeding has been correlated with elevated IQ scores and there are studies that indicate that there exists a positive correlation between duration of breastfeeding and increased cognitive functioning (Anderson, Johnstone, and Remax, 1995; Wolf, 2003).

The correlation between breastfeeding and enhanced cognitive functioning has been documented for over 75 years. In 1929, the Journal of the American Medical Association published Hoefer and Hardy's research which demonstrated that artificially fed children scored significantly lower than their breastfed cohorts on a number of standardized intelligence tests (Hoefer and Hardy, 1929). Currently, researchers continue to demonstrate a positive association between breastfeeding and cognitive development in early and middle childhood (Jacobson, Chiodo and Jacobson, 1999: Reynolds, 2001). Researchers have also concluded that there is a significant association between duration of breastfeeding in childhood and elevated adult intelligence (Mortensen, Michaelsen, Sanders, and Reinisch, 2003).

Studies thus far that have investigated the relationship between breastfeeding and cognitive performance have provided evidence that breastfeeding enhances cognitive performance in preterm infants, full term infants, early and middle childhood, and adulthood (Feldman and Eidelman, 2003; Mortensen, et al., 2003; Reynolds, 2001). Carefully designed quantitative studies have demonstrated that children who are breastfed the longest show the highest cognitive achievement as evidenced

by standardized intelligence test (Lucas, Morley and Cole, 1998; Mortensen, et al., 2003; Reynolds, 2001). The higher test scores in breastfed populations may be due in part to the constituents of human milk that contain various factors that cannot be duplicated in laboratory settings. Currently, it is impossible to understand in its totality the physiological composition of human breast milk as researchers are just now entering the seminal phase of deciphering the biologic components that interact during the lactation process (Stuart-Macadam and Dettwyler, 1995). Additional research is needed in this area before any consensus can be reached regarding the complex relationship that exists between breastfeeding and increased cognitive capacity.

Maternal Benefits

Physiologically, lactating women differ significantly from their non-lactating cohorts. The suckling of a child at the maternal breast sends messages to the pituitary gland which activates the secretion of prolactin and oxytocin (Lawrence, 2005). The hormone prolactin has been found to have a relaxing effect on the mother, and to intensify the need of the mother to stay in close physical proximity to her offspring (Mezzacappa, 2004; Sobrinho, 1993). The amount of prolactin produced by a lactating woman is hypothesized to be related to the frequency, intensity, and duration with which a child nurses (Jelliffe and Jelliffe, 1978). Scholars have suggested that when a child is breastfed on a schedule, or when formula supplements are used, the ensuing reduction of prolactin in the lactating mother leads to insufficient milk production, and may in fact be related to the "failure to thrive" syndrome that is common in western societies today (Gussler and Briesemeister, 1980).

Oxytocin and prolactin have been found to induce lactational infertility. Breastfeeding suppresses ovulation, and it has been demonstrated that the duration, frequency, and intensity of breastfeeding is most highly correlated with anovulation in lactating women (AAP, 2005; Konner and Worthman, 1980; McNeilly, 1993). Scientific data confirms that the hormones oxytocin and prolactin suppress ovulation and can lead to full lactational amenorrhea (McNeilly, 1993; United States Department of Health and Human Services (HHS), 2000). Data also confirms that breastfeeding is a highly effective means of contraception and has negatively affected fertility rates cross-nationally (AAP, 2005; Kennedy, 1992; McNeilly, 1993).

Oxytocin is a multifunctional hormone that has been correlated with decreased postpartum bleeding and rapid uterine involution (AAP, 2005). The release of oxytocin by the lactating female has also been correlated with reduced maternal stress, increased maternal affection, decreased anxiety and depression, increased maternal responsiveness, and an

increase in mother-child bonding (AAP, 2005; Else-Quest, Hyde and Clark, 2003; Mezzacappa, 2004).

Ethological data has demonstrated that elevated oxytocin levels in other mammals is significantly correlated with nurturing behaviors (i.e., nest building, licking, decreased levels of aggression, and staying in close physical proximity to one's offspring) (Insel and Shapiro, 1992; Silber, Larsson, Uvnas-Moberg, 1991). Although it cannot be assumed that oxytocin affects the human female in precisely the same way it affects other lactating mammals, there is strong evidence that oxytocin does play a role in human maternal behaviors (AAP, 2005; Dettwyler, 1995; Else-Quest, et al., 2003; Insel and Shapiro, 1992; Mezzacappa, 2004).

Supplementing human breast milk with formula has been shown to significantly decrease the levels of oxytocin found in the maternal bloodstream. Johnston and Amico (1986) found that mothers who breastfed exclusively produced significantly higher levels of oxytocin than did those mothers who supplemented human milk with formula. The differing breastfeeding styles that are practiced cross-culturally affect the production of both oxytocin and prolactin, thus affecting the volume of milk produced by the lactating female. Differing breastfeeding styles also affect the composition of milk produced, the reproductive status of the mother, and the biological and psychological functioning of the lactating female (Else-Quest, et al, 2003; Lunn, 1992; McNeilly, 1993; Mezzacappa, 2004).

Research indicates that breastfeeding reduces the risk of maternal ovarian, breast, and endometrial cancers (AAP, 2005; Jernstrom, Lubinski and Lynch, 2004; Wolf, 2004). Other advantages for women include uterine involution and decreased bleeding, an earlier return to pre-pregnancy weight, and decreased incidence of hip fractures and osteoporosis during the postmenopausal period (AAP, 2005). Women who breastfed their children have also been found to display increased affiliative behaviors, and to report increased levels of bonding with their young (AAP, 2005; Else-Quest, et al., 2003; Kennel and Klaus, 1998).

Child Centered Benefits

Extensive epidemiological research confirms that significant physiological differences can be detected between formula-fed and exclusively breastfed child populations. Research confirms that breastfed populations have lower morbidity and mortality rates, and that longer durations of breastfeeding have been associated with the most positive health outcomes in pediatric populations (AAP, 2005; Dooley, 2002; HHS, 2000; Wolf, 2004). The AAP (2005) has stated that breastfeeding protects children from infectious diseases such as bacterial meningitis, bacteremia, diarrhea, respiratory ailments, ear infections, necrotizing enterocolitis,

and urinary infections. Scientific data indicates that breastfeeding decreases the risks of Sudden Infant Death Syndrome (SIDS), types I and II diabetes, cancer, obesity, asthma, and hypercholesterolemia (AAP, 2005; Armstrong and Reilly, 2002; Gerstein, 1994; Mosko and McKenna, 1997; Smulevich, Solionova and Belyakova, 1999). Scientific data also indicates that formula fed children have higher hospital admission rates and are prescribed medication more often than their breastfed cohorts (Crespo, et. al., 2004; Stuart-Macadam and Dettwyler, 1995).

The protective effects of breastfeeding have been detected in infant, child, adolescent, and adult populations. Data confirms that the protective effects of breastfeeding have been correlated with the duration of breastfeeding, and these effects are evident throughout the life course. Individuals who were artificially fed, or who were breastfed for brief periods, have been found to have significantly higher rates of inflammatory bowel disease and Crohn's Disease in adulthood (Jayanthi, Probert, and Mayberry, 1991), and Celiac disease, diabetes, and multiple sclerosis are diagnosed more often in adults who were formula fed in infancy (Greco, Auricchio, Mayer and Grimaldi, 1998; Pisacane, Impagliazzo, Russo, Valiani, Mandarini, Florio, and Vivo, 1994). Research indicates that adults who were breastfed during childhood have lower risks of developing chronic respiratory disorders, coronary heart disease, high cholesterol, asthma, allergies, and anemia (AAP, 2005; Hanson, 2004; Jelliffe and Jelliffe, 1978; McConnochie and Roghman, 1986; Owne, et. al., 2002; Singhal, et. al., 2004).

Jelliffe and Jelliffe (1978) hypothesized that diseases that are common in western societies are rare in cultures that practice exclusive and long term breastfeeding. Furthermore, Jelliffe and Jelliffe (1978) have argued that the constituents contained in human milk are species specific, and when human children are deprived of human milk, they are inadvertently predisposed to a myriad of physiological ailments.

The American Academy of Pediatrics (2005) has stated that "[e]xclusive breastfeeding is the reference model against which all alternative feeding methods must be measured with regard to growth, health, development, and all other short and long term outcomes" (p. 496). It goes on to state that human milk is species specific and that all artificial formulas differ markedly from human milk and as such, is inferior to the milk produced by the lactating human female.

Human milk contains high concentrations of maternal white blood cells and live antibodies (Lawrence, 2005). Researchers have documented that human milk protects children by stimulating a forceful immune response to specific pathogens. Immunity to particular disease-causing agents is the result of the constituents contained in human milk which result from particular environments (i.e., when a mother is exposed to a

particular virus or bacterial infection, she begins to produce antibodies which are passed to her child via breast milk) (Hanson, et al., 2003; Jeppesen, et. al., 2004; Lawrence, 2005). Scholars have demonstrated that breastfeeding strengthens the immune system response by transferring cellular immunity from mother to child via breastfeeding, and creating in the process, long term immune modulation (Jeppesen, et. al., 2004).

Formula

In a relatively short time period, feeding human children with non-human milk has become an accepted practice in American culture. The vast majority of Americans do not feel uneasy when they witness a baby being fed formula; in fact, this practice has become so widespread that most people do not question the ethics surrounding the topic of artificial feeding. Following is a brief summation of the risks associated with the manufacturing and distribution of formula by the pharmaceutical industry.

Scholars in the field of human lactation have suggested that the manufacturers of formula have traditionally relied on the "trial and error" method when deciding what ingredients to include in their artificial baby milks (Walker, 1993). According to Baumslag and Michels (1995), formula companies have historically chosen ingredients that have been found to be the most economical for the formula industry. Ingredients such as coconut oil, palm kernel oil, and beef tallow are not ingredients that have been found to be nutritionally superior; rather, they are used in formulas because of the low cost and widespread availability of these ingredients (Baumslag and Michels, 1995). It is common knowledge that the use of fats such as palm kernel oil and coconut oil has been associated with increased risk of vascular diseases (i.e., heart attack and stroke). The Surgeon General has consistently warned the American public about the detrimental effects associated with use of these particular products, yet the formula industry continues to include these fats in all of their formulas currently on the market.

Walker (1993) asserts that formula ingredients are added or depleted only after detrimental physiological effects are detected in infants who have consumed a particular formula. Walker (1993) illustrates some of the errors that have been detected with recent formulas:

(1) low carnitine levels in formula led to hypoglycemia in infant populations.

(2) inositol deficient formula was correlated with lung and retinal diseases.

(3) chloride deficiency was correlated with neural and growth defects.

(4) excess copper was associated with cirrhosis of the liver.

(5) excess iron was associated with botulism, SIDS, and salmonella infection.

(6) excess lead was correlated with lead poisoning .

(7) large amounts of protein were associated with lowered IQ.

(8) zinc deficient formula was associated with inadequate growth and skin lesions.

The majority of formulas on the market are, according to Baumslag and Michels (1995), "Merely cows' milk that has been treated, altered, and added to in a vain attempt to replace the inimitable human milk" (p. 131). For those infants who are severely allergic to another species' milk (i.e., cow milk), the formula industry has invented a "milk" based on Soya beans–in spite of the fact that the American Academy of Pediatrics has warned that soy-based formula can cause anaphylactic shock in pediatric populations with a known cow milk allergy (Walker, 1993).

No laboratory-produced milk can replicate the milk of a particular mammalian species as milk secreted by the various species is uniquely designed for the optimal growth of their particular offspring (AAP, 2005). Jelliffe and Jelliffe (1978) postulated that human milk contains over 100 constituents that are present in different chemical compositions and in different amounts than are found in other species' milk. Formula manufacturers have based their "formulas" on limited samples of human milk, perhaps inadvertently neglecting to take into account that the milk a particular woman produces changes from feed to feed, day to day, and month to month, depending on the unique and complex need of her specific child (Lawrence, 2005). Live antibodies and active enzymes are secreted during the process of human lactation and it is impossible for formula companies to replicate the dynamic nature of the constituents found in human milk (AAP, 2005).

Economic Implications

The economic implications of breastfeeding are complex and multifaceted and include (1) the family unit; (2) costs to taxpayers; (3) the economic alliance that exists between the medical community and the formula industry; (4) formula industry profits; and (5) the formula industry's association with the scientific community.

According to the American Academy of Pediatrics (2005), breastfeeding could reduce annual health care costs in America by 3.6 billion dollars. Breastfeeding could reduce taxpayer burden by decreasing costs for public health programs such as WIC and Medicaid, and employers would benefit economically because of a significant decrease in employee absenteeism. Increased breastfeeding could alleviate some of the burden of environmental destruction by eliminating formula tins,

bottles, and artificial nipples in landfills, and breastfeeding would decrease the energy costs associated with the production and transportation of artificially produced baby milk (AAP, 2005; Baumslag and Michels, 1995).

Baumslag and Michels (1995) reported that 8 billion dollars a year was spent purchasing formula. Greer and Apple (1991) posited that the cost of formula itself is just one of the economic disadvantages associated with artificial feeding as the medical costs associated with depriving human children of human milk far outweighs the costs of purchasing the formula. Families are also at an economic disadvantage when they choose to formula feed as work absenteeism associated with increased illness in formula fed children can contribute to substantial economic loss within the familial sphere (AAP, 2005).

Taxpayer burden also increases as formula feeding becomes more culturally acceptable. Researchers have found that economically disadvantaged women are most likely to formula feed their infants (HHS, 2000) and a significant number of low income women depend on the federally funded WIC program to supply their infants with formula. Riordan and Auerbach (2005) reported that in the early 1990s, 500 million dollars a year was spent by the American taxpayer to purchase formula for low income infants. WIC is the largest purchaser of formula in the United States as 40 per cent of all formula sold is purchased by the American taxpayer and is distributed by the federal government via the WIC program (Riordan and Auerbach, 2005).

Formula fed children suffer higher morbidity and mortality rates, require more prescription medications, and are admitted to the hospital more often than their breastfed cohorts (AAP, 2005; Crespo, et al., 2004; HHS, 2003). Significant numbers of low income women depend on the taxpayer funded Medicaid health insurance program and it has been suggested that the medical costs associated with formula use in low income infants places a substantial financial burden on the American taxpayer (Stuart-Macadam and Dettwyler, 1995).

The formula industry routinely engages in activities that discourage breastfeeding. Scholars have documented that the formula industry (1) provides free samples of formula via hospitals and doctors' offices across America; (2) assisted in the design of hospital nurseries which promote the separation of mother and child during hospital stays; (3) fund major medical conferences specifically dealing with the lactation process (i.e., the American Academy of Pediatrics and the National Association of Neonatal Nurses); (4) entertain hospital staff and administrators at company sponsored events; (5) contribute millions of dollars to the American Academy of Pediatrics in the form of renewable grants; (6) contributed 3 million dollars to be used for the APA's national

headquarters in the state of Illinois; (7) funds physician research; (8) extends benefits to medical doctors and medical students in the form of school loans, grants, gifts, and trips to conferences; (9) gives cash grants to physicians who recommend particular formulas; (10) advertises formula in prestigious medical journals (i.e., the Journal of American Academy of Pediatrics and the Journal of the American Medical Association); and (11) contributed over $500,000 to the American College of Obstetrics and Gynecologists (Baumslag and Michels, 1995; O'Mara, 2004; Riordan and Auerbach, 2005).

Allain (1991) has referred to the partnership between the medical community and the formula industry as an "unholy alliance" because of the medical community's reliance on the formula industry to fund major medical research and to financially support individual doctors and their affiliate hospitals. Allain (1991) has suggested that the economic alliance that exists between the formula industry and the medical community must be severed because of the apparent conflict of interest that this partnership generates.

Walker (1993) has stated that parents have a fundamental right to be informed about the medical risks associated with formula use. Providing parents with accurate and scientifically substantiated information regarding the risks associated with formula feeding would ensure that the doctrine of informed consent is being properly implemented, and that parents are making informed decisions relative to the medical costs associated with particular feeding methods.

Lawrence (2005) has suggested that many physicians do not inform their female patients of the risks associated with formula feeding because to do so would make women feel guilty. This paternalistic worldview denies women not only agency and critical medical information; it also assumes that women are incapable of making informed medical decisions (Martin, 1987).

Economics is clearly associated with breastfeeding–both at the most proximal context (i.e., the family), and at a societal level (i.e., worldwide capitalism and cultural belief systems), as the profit motive is the driving force behind the sale and distribution of artificially-produced milk and to understanding low breastfeeding rates in the U.S.

Cultural Implications

The process of human lactation is a distinct biological function. However, specific cultural practices have been found to influence the heterogeneous breastfeeding behaviors that are found around the world. Research has indicated that the majority of Americans have adopted culturally prescribed practices that hinder the breastfeeding relationship (Stuart-Macadam and Dettwyler, 1995; Stolzer, 2005). These practices include:

scheduled feedings, pacifier usage, uni-sleeping practices (i.e., demanding that our children sleep in their own beds), parent initiated weaning, early introduction of solids, the acceptance of the separation of mother and child, and the overt sexualization of the female breast (Stuart-Macadam and Dettwyler, 1995).

The American acceptance of these practices has hindered what Millard (1990) refers to as the spontaneous physiological rhythms between mother and child. In traditional cultures, the art of breastfeeding is passed down through the generations and women are exposed to suckling children and breastfeeding women throughout their lives (Dettwyler, 1995). In the United States, women are routinely subjected to cultural practices which impede the breastfeeding relationship via the mass media and through contact with family, friends, and the culture at large (Dettwyler, 1995; Stolzer, 2005). There is a common misperception that the era of the working mother has made breastfeeding impractical. The fact is that women have worked for thousands of years and have successfully breastfed their children. Relatively recently, the western world has collectively decreed that breastfeeding and working are incompatible, and cultural dictums have surfaced that mandate that working and mothering cannot occur simultaneously (Stuart-Macadam and Dettwyler, 1995).

In various Western cultures, breastfeeding is currently compartmentalized as a private sphere activity. Hausman (2004) has suggested that cultural dictums that perpetuate the dichotomy of the public and private spheres exclude women from the public domain by demanding that breastfeeding take place in private. Bodies that are allowed into the public sphere must function as male bodies-that is, when women participate in the public sphere, uniquely female attributes such as breastfeeding must be concealed (Hausman, 2004). In the United States, work that is focused on nurturing and caring for children is typically culturally devalued (Dettwyler, 1995). In a relatively short period of time, we have constructed a society that clearly values the worker over the mother. We have, it seems, successfully indoctrinated the American public with the "theory of the self"–a theory which emphasizes individual achievement and autonomy at any cost (Stolzer, 2005). Breastfeeding by its very nature is a mutually dependent relationship, yet our present day culture does not honor this ancient, biological fact (Dettwyler, 1995). Currently, our cultural ethos–significantly dictated by material goals and an economic (work related) logic makes no concessions for the breastfeeding dyad (Hausman, 2004; Palmer, 1991).

Although some scholars have suggested that breastfeeding must be analyzed using a feministic framework (Blum and Vandewater, 1993; Blum, 1999), Dettwyler (1995) insists that breastfeeding is not a male versus female issue as the most ardent critics of breastfeeding in public

and/or breastfeeding older children are women. Dettwyler also takes issue with those scholars who have proposed that breastfeeding advocates want to return women to more traditional roles (i.e., back to the private sphere). According to Dettwyler, it is up to us, collectively, to demand that breastfeeding be compatible with both the public and private spheres. Dettwyler (1995) has called for a paradigm shift–a shift that demands an increase in "our cultures valuation of child rearing as an activity, and a change in the valuation of the important contributions that only women can make to the social reproduction of a society" (p.204).

Scholars have asserted that specific national policies could promote breastfeeding for working mothers. These policies include: a national paid maternal leave policy; nursing breaks; flexible work schedule; flextime, part-time, job-sharing; option to work from home; and various parental leave options (Baumslag and Michels, 1995; Galtry, 2003). Breastfeeding, though theoretically a biologic construct, is clearly influenced by cultural ideologies which are transmitted via specific national policies. (See Table 1)

Table 1

Country	*No. Weeks Paid Maternity Leave*	*% of Earnings*	*Comments*
Belgium	14	80	
France	16	90	Unpaid job protection for 2 years
Germany	14	100	Supplementary benefits available for up to 18 months
Italy	20	80	
Norway	18	100	Working mothers can take one hour each day (two if in public sector) to breastfeed or pump
Portugal	12	100	
Sweden	78	100	Six hour work day until child turns eight
U.S.A.	0	0	

(Baumslag and Michaels, 1995: 197)

Researchers in the field of human lactation have postulated that in America, the medical doctor is perceived as the primary authority regarding breastfeeding matters. In the past, prior to the medicalization of the lactation process, women (i.e., doulas and midwives) were considered to be the primary experts in this area (Jelliffe and Jelliffe, 1978; Palmer, 1991). Over the last century, a monumental cultural shift has occurred, and currently it is the physician that is expected to provide women with accurate information about breastfeeding.

Scholars in the field of human lactation have hypothesized that this cultural shift resulted from 1. a loss of breastfeeding role models (Stuart-Macadam and Dettwyler, 1995); 2. our willingness to hand over the control of our bodies to medical experts (Martin, 1987; Stuart-Macadam and Dettwyler, 1995); 3. the patronizing attitude of the medical profession (Martin, 1987; Stuart-Macadam and Dettwyler, 1995); and 4. our acceptance of the medical model standards which include compliance, regulation, and regimentation (Martin, 1987; Stuart-Macadam and Dettwyler, 1995). Despite the expert status conferred on modern day physicians, researchers have demonstrated that the majority of physicians practicing in the United States are not adequately trained to advise women about the numerous maternal and child health benefits associated with breastfeeding; thus, it has been hypothesized that physicians play a significant role in the low incidence of breastfeeding in America (Freed, Clark, Sorenson, Lohr, Cefalo and Curtis, 1995; Schanler, O'Connor, and Lawrence, 2005; Stolzer and Hossain, 2005).

The early twentieth century simultaneously ushered in the age of the medicalization of birth and lactation, physician-dominated feeding schedules, the production of artificial baby milk, bottles and nipples, and the practice of solitary sleeping for infants and children (Palmer, 1991). Along with the advent of uni-sleeping practices and artificial feeding came those products that were intended to separate mother and child (i.e., bottles, pacifiers, playpens, cribs) and these products contributed to the low incidence of breastfeeding in western societies (Dettwyler, 1995). Scholar's have hypothesized that traditional child-rearing practices (i.e., long term breastfeeding, child-led weaning, and staying in close physical proximity to one's offspring during the day and night) encourages optimal dyadic cue reading and leads to a distinct type of mother and child synchronicity; a synchronicity that has been perfected through millions of years of human evolution (Dettwyler, 1995; McKenna, 1993).

Dettwyler (1995) postulates that the ascent of the formula industry in tandem with the American practice of uni-sleeping illustrates specific cultural practices which deprive our children of their unique and ancient mammalian heritage; a heritage that was framed by natural selection over millions of years to ensure the survival of the human species. From an evolutionary standpoint, the practice of breastfeeding and co-sleeping increased the child's rates of survival, suppressed maternal ovulation, and optimized both maternal and child physiological functioning (Dettwyler, 1995; McKenna, 1993). In western cultures, the female breasts are perceived as sexually stimulating for both males and females (Palmer, 1991). It has been hypothesized that the West's preoccupation with the sexualization of the female mammary glands has decreased breastfeeding rates and has led to cognitive dissonance with regard to human lactation.

The West's preoccupation with the female breasts has its roots in specific cultural ideologies as attaching sexual significance to the female breast is not universally practiced among humans (Dettwyler, 1995; Ford and Beach, 1951).

According to Dettwyler (1995), perceptions of female mammary glands vary from culture to culture. Some cultures define female mammary glands as functional (i.e., as life sustainers for children) while other cultures define them as sexual entities (Dettwyler, 1995). Cultural definitions of the female mammary glands vary significantly and these divergent definitions have been found to influence the heterogeneous breastfeeding patterns found throughout the world (Dettwyler, 1988; 1995; Palmer, 1991). Scholars have hypothesized that particular cultures mandate what part of the anatomy is sexually stimulating. Throughout history, body parts such as the ankles, the neck, and the feet have all been culturally perceived as sexual aphrodisiacs (Dettwyler, 1995). With regard to human lactation, once sexual significance is culturally attached to female breasts, breastfeeding patterns have been found to decrease significantly (Dettwyler, 1995; Palmer, 1991).

The reasons why women do not breastfeed, or breastfeed for limited durations, are complex and multifaceted. The sexualization of the female breast, the dichotomy of the public and private spheres, the reliance on the medical community, national policies, and cultural ideologies have all been found to influence breastfeeding behaviors in America (Baumslag and Michels, 1995; Dettwyler, 1995; Fildes, 1986; Freed, 1995; Lawrence, 2005; Wolf, 2003).

Although formula feeding has become an accepted practice throughout the western world, the fact remains that there are negative consequences associated with refusing human children human milk (Jelliffe and Jelliffe, 1978; Stuart-Macadam, 1995). Breastfeeding decreases maternal and child morbidity and mortality rates, and decreases population rates worldwide (AAP, 2005; Cunningham, 1979; Dooley, 2002; McNeilly, 1993). Scientific data indicates that in order to achieve their optimum health potential, mother's need to breastfeed and children need their mother's milk (AAP, 2005; Stuart-Macadam, 1995). Regardless of our current cultural belief systems, our ancient mammalian heritage dictates that mothers and their children are interdependent and rely on each other for optimal physiological and emotional functioning (Stuart-Macadam, 1995).

Conclusion

In 1900, 97 per cent of all children in the United States were breastfed and weaning at the turn of the century occurred between 2 and 4 years (Dettwyler, 1995). Current data indicates that 71 per cent of American

women initiate breastfeeding. However, this figure is highly misleading as the majority of women recorded as "breastfeeding" are supplementing their infants with formula (AAP, 2005). Although breastfeeding initiation rates have been increasing since 1990 in America, exclusive breastfeeding has shown no detectable increase over the same time period (AAP, 2005). Furthermore, duration of breastfeeding in America is particularly low as data indicates that of the 71 per cent of women that initiate breastfeeding, only 18 per cent continue breastfeeding for one year or more (AAP, 2005).

Lactation is a distinct and measurable biological process that occurs in all mammalian mothers, yet the initiation and duration of breastfeeding is clearly influenced by specific cultural mandates (Dettwyler, 1995). For millions of years, breastfeeding human young was considered a fundamental component of the maternal experience as conception, pregnancy, birth, and lactation were universally perceived as intrinsically intertwined variables (Stuart-Macadam and Dettwyler, 1995).

The Surgeon General of the United States, the American Academy of Pediatrics, the World Health Organization, and the United Nation Children's Fund have all indicated that breastfeeding initiation and duration rates must increase in order to optimize maternal and pediatric health outcomes (AAP, 2005). In spite of the decades of scientific data which confirms the positive physiologic, cognitive, and emotional benefits associated with exclusive and long term breastfeeding, the United States consistently has one of the lowest breastfeeding rates in the world (AAP, 2005). In order to increase both the initiation and duration of breastfeeding rates in America, scholars have suggested the following:

- Requiring that the formula industry inform the American consumer of the risks associated with use of their products (Dettwyler, 1995; Walker, 1993).
- Incorporating breastfeeding role models in the familial sphere, the community, and in the mass media (Dettwyler, 1995; Palmer, 1991).
- Public Service Announcements (PSAs) that inform the general public of the risks associated with formula.
- Regulating the advertising of formula, particularly in medical journals, parenting magazines, and in physician offices and hospitals (Stuart-Macadam and Dettwyler, 1995).
- Emphasizing the needs of the child rather than the needs of the self (Dettwyler, 1995).
- Challenging the cultures that dictate that women must work outside of the home to be perceived as productive citizens (Dettwyler, 1995).
- Questioning the cultural myth that working and mothering cannot occur simultaneously (Stuart-Macadam and Dettwyler, 1995).

- Demanding that the economic alliance between the medical community and the formula industry be severed, including a halt to the formula industry's funding of medical research and conferences, as well as its practice of giving free samples to new mothers via hospitals and/or physicians' offices (Dettwyler, 1995; Jelliffe and Jelliffe, 1978).
- Reassessing America's cultural view of the female breast (Dettwyler, 1995; Fildes, 1986).
- Improving physician breastfeeding education (Freed, 1995; Schanler, et al, 1999; Stolzer and Hossain, 2005).

Breastfeeding in the U.S. is a multifaceted issue that can be seminally linked with human evolutionary history, biological functioning, mother-child attachment, mother-child physiologic interdependence, nutrition, economics, familial functioning, the medical community, political structures, and cultural belief systems (Stuart-Macadam and Dettwyler, 1995). Maternal and child health outcomes in America invariably affect the nation as a whole, and the health of mothers and children has been recognized throughout history as one of the fundamental foundations of human kind (Wolf, 2003). The time has come for a collective re-examination of our cultural views regarding human lactation. By challenging those existing cultural mandates that promote the widespread use of artificial baby milk, perhaps we can increase breastfeeding rates exponentially, and in doing so, affect change on a vast scale.

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