Spring 2013

The Milk Relationship: The Evolution And Significance Of Wet--nurses

Natalie Rosen
University of Pennsylvania

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Disciplines

Anthropology

THE MILK RELATIONSHIP: THE EVOLUTION AND SIGNIFICANCE OF WET-NURSES

By

Natalie Rosen

In

Anthropology

Submitted to the

Department of Anthropology

University of Pennsylvania

Thesis Advisor: Dr. Claudia Valeggia

2013

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This paper explores the evolutionary and cross-cultural significance of ***wet-nursing***, an ancient, cultural practice in which infants are breastfed by women other than their mothers. With reviews of literature, meta-analyses, and fieldwork, this work explores the history and biology of ***wet-nursing*** and concludes the three primary evolutionary advantages of the practice: optimization of lactational beneficiaries, logical resource provisioning, and increased community altruism.

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I. Introduction

An infant's earliest memories are probably those of nipple attachment. As a source of nutrients and comfort, mammary glands have had a rich, evolutionary significance for the hominin, and perhaps more generally, mammalian, lineage. This work explores the evolutionary and historical significance of ***wet-nursing***, an ancient, cultural practice in which infants are breastfed by women other than their mother. Exploring the evolution and science of breastfeeding, benefits of lactation, and history of wet-nursing, this paper will shed light on wet-nursing's many roles throughout history. It will ultimately conclude that among its multitude of social, economic, biological, and religious benefits, wet-nursing has three, primary evolutionary significances: optimization of lactational beneficiaries, logical resource provisioning, and increased community altruism.

II. The Evolution of Breastfeeding

At birth, the human infant is relatively helpless. With limited motor skills and the inability to cling to their mothers, humans are not well-developed, precocial inflants like their primate relatives. They cannot take flight on the day of birth like the Megapode birds or run with adults within minutes of having been born, like the infants of the Blue Wildebeest. Rather, as a result of years of natural selective forces, they are weak, vulnerable, and in need of care. (Trevathan, 2010, p. 108-121)

The underdeveloped, dependent nature of the human infant is the consequence of a 4.2 million year-old evolutionary adaptation: bipedalism. Forcing ancestral *Homo sapiens* to walk upright, bipedalism greatly affected the anatomical physiology of humans. When compared with four-legged, quadroped animals, bipeds are classified by a narrower birth canal and pronounced spines that protrude into the birth canal. As argued by Wenda Trevathan, "the hominin sacrum is also broader, which serves to provide stronger and better support for the upright trunk. The top of the sacrum (sacral promontory) also protrudes forward into the birth canal, reducing the opening size further and constricting the back portion. The actual birth canal or passageway has modified itself from a quadrupedal 'shallow bony ring' to a bipedal 'deep curved tube'" (Trevathan, 2010, p. 90).

With the advent of such pelvic modifications, hominins could no longer successively pass large neonatal crania through their now narrower, twisted birth canals. Thus, "an upper limit was placed on the size of the neonatal head" (Trevathan, 2010, p. 97) in order to prevent obstructed labor. As explained by Obstetrician Philip Steer, this evolutionarily established upper limit was in direct opposition to selection for increased brain size in humans. The dramatic increase in the average size of the human brain, "from about 500 cc in the Australopithecines, through 750 cc in *Homo erectus*, to greater than 1000 cc in modern humans" (Steer, 2006), was no longer favored by the birthing process; the trend in brain growth would cause the expansion of the birth canal and would sacrifice bipedal efficiency, thereby putting humans at a selective disadvantage. In order to resolve conflicting evolutionary trends, the needs for increased brain size and decreased pelvic width, directed selection favored "more and more brain development to be postponed until

after birth" (Trevathan, 2010, p. 97). By postponing hominins' brain growth until after birth, an infant could still reap the benefits of a large brain without imposing costs to itself and its mother during labor.

At birth, the brain of a *Homo sapien* is only about 25% grown. As a result, various psychological and physiological functions are limited and/or nonexistent. Gastrointestinal processes are underdeveloped. With limited enzymes, newborns cannot digest foods other than colostrum and milk. Thermoregulatory systems are inefficient, causing newborns to be dependent on their mother's grasp for the maintenance of a stable body temperature. Perhaps most importantly, infant immune systems are immature at birth. With few antibodies and a poorly developed immune system at birth, infants depend on maternally acquired immune properties (Stolzer, 2006; Woodbury, 1992). In need of nutrients and immune factors in order to enable further physiological, neurological, and emotional growth, the infant turns to the closest and most familiar source of food: breast milk.

III. The Science of Breastfeeding

Lactation, or "the secretion and yielding of milk by females after giving birth" (Donovan, 2013), may be divided into three stages: mammogenesis (the development of mammary glands), lactogenesis (the creation of milk), and galactopoiesis (the production and maintenance of mature milk).

In the first phase, mammogenesis, a woman's mammary glands are fully formed. This process begins in utero, is furthered during puberty, and, as a result of prolactin, progesterone, and estrogen influences, is completed during pregnancy. Interestingly, the

completion of mammary gland development does not immediately yield milk production. In fact, while a woman is pregnant, although her mammary glands may be fully formed, her ability to secrete milk is inhibited. Such inhibition, as studied in laboratory animals, is enabled by the combinatory effects of estrogen and progesterone, hormones circulating in the mother's bloodstream. Blocking the release of hormones from the pituitary gland, estrogen and progesterone, among other hormonal factors, prevent the accumulation of prolactin in the bloodstream and thus significantly decrease the probability of the hormonal synthesis of breast milk. Once the newborn is delivered, however, lactation may ensue. With the expulsion of the placenta, the mother loses her supply of prolactin-suppressing hormones, thereby removing the blockade against milk secretion. With no suppressants, estrogen is free to stimulate the release of prolactin from the pituitary gland and galvanize the "let-down" process. (Donovan, 2013; Trevathan, 2010, p. 122-133)

Although no longer inhibited, the production of milk does not occur for another two to three days after the birthing process is complete. Before that time, the mammary glands secrete a nutritious alternative: colostrum. As Wenda Trevathan discusses, "colostrum is lower in calories and fat than mature milk, but is more than twice as high in protein. More important, colostrum is high in immune factors that provide protection for the vulnerable newborn infant" (Trevathan, 2010, p. 122). Considering newborns lack fully developed gastrointestinal and immune systems, as discussed above, colostrum may be regarded as an evolutionary adaptation: it provides the weak infant with a concentrated dose of much-needed nutrients and immune factors.

After the cessation of colostrum, the mother enters the final stages of lactation, lactogenesis and galactopoiesis, and begins distributing mature milk to her child. Stimulated by suckling, or the latching of the child to its mother's nipple, breastfeeding is regulated by he hormones prolactin and oxytocin. When an infant suckles, a signal is sent to the hypothalamus of the mother's brain. Such a signal directs the secretion of dopamine and oxytocin, among other metabolic factors (Valeggia & Ellison, 2009), and inhibits the secretion of hormones that would otherwise lead to ovulation. Secreted dopamine triggers the increased release of prolactin from the anterior pituitary gland, which, in turn, "acts on the breast to maintain milk production if suckling continues" (Trevathan, 2010, p. 123). Oxytocin, released from the posterior pituitary gland, travels to the breast, via the bloodstream, causes the contraction of special muscle cells around the alveoli of the nipple and ensures the expulsion or "let-down" of milk.

Suckling is the ultimate enabler of the nursing process, stimulating a cascade of milk producing hormones, and may be regarded as a supply and demand phenomenon; the more a baby suckles, the more milk is produced by the breastfeeding woman. Such a phenomenon explains the ability of a woman to secrete enough milk for multiple children. In other words, a woman's production quantity is not determined by the number of children she has produced but, rather, by the amount of suckling she endures.

Research and historical records indicate that breastfeeding is not unique to pregnant women. In fact, with proper doses of prolactin in her bloodstream, even a non-pregnant woman can secrete milk if suckling is maintained. In one instance, "a baby who had lost his mother was suckled by his 60-year-old grandmother, who had borne her last

child 18 years before. The grandmother produced milk after a few days and continued to nurse the baby until he was a year old and could walk" (Donovan, 2013). Assuming proper concentrations of hormonal supplies, the same supply and demand laws of suckling apply to all women.

As elaborated below, in addition to yielding milk, suckling and lactation stimulate reduced fecundity. When suckled, a woman experiences a decrease in the secretion of GNRH. As a result, LH, an ovulatory hormone, is released in smaller quantities from the anterior pituitary gland. In combination with other metabolic factors, such as energy availability, the limited concentrations of LH and FSH produced during intense lactation inhibit ovulation during the postpartum period (Valeggia & Ellison, 2009). However, once one's suckling frequency and rate are lowered, a woman resumes her normal menstrual cycle and can once again become pregnant. (Trevathan, 2010, p. 122-144)

IV. Benefits of Lactation

It is extremely costly for a woman to lactate. Nine months of gestation requires 340,200 calories and the equivalent time lactating costs 676,620 calories. In addition to caloric costs, breastfeeding requires more vitamin C, thiamin, riboflavin, vitamin A, vitamin E, and iodine than does pregnancy. It also necessitates a 40% increase in protein consumption if the breastfeeding woman does not want to risk a loss of approximately 19% of her lean tissue. With such a high maternal expenditure, lactation must deliver substantial benefits in order to remain an evolutionary advantageous and stable strategy. Sure enough, breastfeeding is beneficial to both mothers and infants. (Dewey, 1997; Trevathan, 2010, p. 122)

A. For the Child

A mother's milk is highly nutritious and finely tuned to infant requirements. "Fat composition increases from the beginning to the end of a nursing bout, something that formula simply cannot mimic. Furthermore, milk composition changes as the infant grows, reflecting changing nutritional requirements" (Trevathan, 2010, p. 128). In general, maternal milk is composed of enzymes, growth factors, hormones, immune factors, lactose, fat-soluble vitamins and fatty acids, 11 water-soluble vitamins, 20 minerals, and other immune functioning cells. Perhaps most importantly, breast milk contains long-chain polyunsaturated fatty acids (LCPUFAs). Such fatty acids, primarily docosahexaenoic acid and arachidonic acid, are significant in the development of the infant brain and are absorbed with the aid of human milk specific enzymes. Considering *Homo sapiens* are born with underdeveloped neurological systems in order to enable bipedal efficiency, LCPUFAs are extremely important in the evolutionary history of hominin brain growth. (Orlando, 1995)

In 1999, Anderson, Johnstone, and Remley sought to confirm the above conclusion and prove that human milk benefits an infant's cognitive development. Twenty controlled studies between 1966 and 1996 were reviewed and analyzed. Researchers compared breastfed and formula-fed children's scores on several intelligence exams. Fourteen IQ assessments were utilized including the Bayley Mental Development Index, Peabody Picture Vocabulary Test, and the General Cognitive Index of the McCarthy Scale of Children's Abilities. After adjusting covariates such as socioeconomic, gender and age-related factors, Anderson et al. concluded that 11 studies observed a benefit associated

with breastfeeding. Breastfed children showed significant incremental benefits in developmental scores, an average of 3.16 points higher, in comparison with formula-fed children. Researchers concluded that such significant developmental augmentation was attributable to breast-feeding, was established early in the life of the subjects, and continued through mid-adolescence. Interestingly, greater cognitive scores were found with low birth-weight children as they were given greater doses of breast milk and LCPUFAs in their lifetime (compared to full-term children). All in all, the study reconfirmed the effects of human milk on an infant's cognitive development and stressed that such benefits were incremental and increased with the duration of nursing. (Anderson, et al., 1999)

In addition to aiding in the development of one's neurological functions, breast milk may be protective against several adult-onset disorders. Studies have indicated that breast milk may reduce one's risk of type 2 diabetes (Trevathan, 2010, p.122-130). In 1997, David Pettitt studied the association between breastfeeding and the incidence of type 2 diabetes among the Pima Indians, a population that has the highest prevalence of type 2 diabetes in the world. Pettitt obtained glucose-tolerance statuses from 933 Pima Indians using 75-gram oral glucose tolerance tests. He then questioned mothers and classified subjects' infant-feeding practices. Subjects were categorized into three groups: exclusively breastfed, sometimes breastfed, and exclusively bottle-fed. Data was analyzed and correlations were recorded. In the end, Pettitt found that exclusively breastfed individuals had a decreased rate of type 2 diabetes. Arguing that the increase in prevalence of type 2 diabetes in some populations may be due to the "concomitant decrease in global breastfeeding," Pettitt

supposed the following: “bottle-fed infants have increased basal and postprandial concentrations of insulin, neurotensin- which modulates insulin and glucagon release- and motilin, which contributes to the development of gastric and intestinal motility” (Pettitt, 1997). The notion that breast milk decreases one’s risk of type 2 diabetes was also confirmed, using similar methods, in a population of Native Canadian children. (Young, et al., 2002)

Some researchers have found that as breastfeeding duration increases, one’s risk of obesity decreases. A study conducted in 2005 by Harder and colleagues ran a meta-analysis of 17 former studies. By meta-regression, researchers showed that the duration of breastfeeding was inversely and linearly associated with the risk of being overweight. Data indicated a dose dependent association in which one month of breastfeeding yields a 4% decrease in risk of obesity in the breastfed infant. The notion that breastfed infants consume less during feeds, compared to bottle-fed children, may explain such an association. (Harder, 2005)

Breast milk may also decrease one’s risk of coronary heart disease. In 2007, Harit, Faridi, and Aggarwal compared the serum lipid levels of 200 exclusively breastfed infants and 200 mixed fed infants. The study was conducted over a six month time period and proved that infants who were breastfed had better lipid profiles (better HDL/LDL ratios) in the first six months of life than those who were fed according to a mixed strategy. Since lipid profiles are markers of heart disease, the experiment further concluded that breastfeeding might be protective against atherosclerotic cardiovascular disease and coronary heart disease. (Harit, 2007)

Additional studies have depicted similar health properties of breast milk. A 2005 study in which 732 British men were tested in a 65-year follow-up for intima-media thickness (IMT) and arterial plaque proved that breast milk yields a reduced risk for atherosclerosis later in life. “Breastfeeding was inversely associated with common carotid intima-media thickness, bifurcation IMT, and femoral plaque compared with breastfeeding” (Martin, 2005). A 2004 study by Martin, Gunnell, and Smith, reviewed 15 studies in a meta-analysis and concluded that breastfed infants are associated with small reductions in systolic and diastolic blood pressure (Martin, 2005). Although points of controversy, the above studies indicate that breastfeeding could reduce the prevalence of artery-related diseases and events. The frequency of hypertension, coronary heart disease, strokes, and transient ischemic heart attacks should theoretically decrease with an increase in breastfeeding efforts as breastfeeding reduces blood pressure, arterial plaque, and increases arterial thickness, common causes of the above conditions.

Breast milk also acts to strengthen one’s immune system. As discussed in the preceding section, newborn human infants are born with poorly developed immune systems. In order to gain immunity from their pathogenic surroundings, infants utilize colostrum, a maternal, mammary gland excretion that is rich in immune factors (Orlando, 1995). Unlike bovine milk and milk substitutes, colostrum transfers maternal immunity to environmental-specific pathogens to the infant. Breastfed babies are rich in secretory IgA, IgG, lactoferrin, lactoperoxidase, and lysozymes, compared to their bottle-fed counterparts, and thus have stronger immune systems and lesser mortality rates. (Trevathan, 2010, p.130-144)

Furthermore, "breastfed babies have lower incidence of diarrhea and other gastrointestinal diseases and both lower and upper respiratory illnesses" (Trevathan, 2010, p.133). Reducing infant morbidity and mortality rates, breastfeeding, too, protects against asthma. Countless studies have indicated the correlation between asthma, obesity, and respiratory illnesses (Oddy, 2004; Oddy, et al., 2004; Dell & To, 2001). Considering breastfeeding lowers one's risk of inheriting such conditions in a dose-dependent fashion, it invariably protects one from asthma as well.

Breastfeeding offers more to the infant than just nutritional and immunological benefits. Cholecystokinin, a hormone, is found in breast milk and acts as a sleep inducer upon consumption. Some argue that breast milk lowers an infant's levels of bilirubin, "a waste product formed by the destruction of red blood cells" (Stuart-Macadam, 1995, p.15), and contributes to a lower frequency of jaundice. Perhaps said best by Jean Astruc in 1746, "breast milk not only prevents many ailments, softens and cools the gums when inflamed, forwards dentition, and prevents its fatal consequences, but even lays a lasting foundation for a robust and healthy constitution" (Stuart-Macadam, 1995, p.15). Wielding protection against adult-onset disorders, immunological benefits, decreasing respiratory and gastrointestinal problems, and inducing sleep, breast milk is biologically beneficial for infants. As seen above, such biological benefits occur during infancy and persist into adulthood.

B. For the Breastfeeding Woman

The act of breastfeeding is beneficial for the health of the nurse as well as the health of those being nursed. During suckling, oxytocin is released into the bloodstream of the

feeder, promoting mother-infant attachment and anti-stress effects. As the child latches on to the mother's breast, maternal glial cells in her central nervous system, that are in contact with oxytocin producing neurons, contract. Such contraction stimulates a bursting-like electrical activity, indicative of neural synchronization, and releases oxytocin into the bloodstream. As breastfeeding and suckling continue, increased oxytocin is found in the body. This repeated release of oxytocin and associated endorphins cause lowered blood pressure, decreased cortisol levels, increased withdrawal latency, and increased release of vagally controlled gastrointestinal hormones. Together, these actions cause anti-stress effects. (Uvnas-Moberg, 1998)

According to Wenda Trevathan, "breastfeeding soon after delivery is one of the best 'natural' ways to protect against postpartum hemorrhage…" (Trevathan , 2010, p.137). Postpartum bleeding is the most common cause of maternal mortality related to birth and may be characterized by placental detachment from the uterine wall. With a resulting "wound" of open blood vessels, a mother is at risk of losing too much blood and dying. To prevent excessive hemorrhaging, a mother takes advantage of the biological effects of breastfeeding. When suckled, nipple contact stimulates oxytocin release into the bloodstream of the feeder, as mentioned above. Released oxytocin yields "uterine contractions, expulsion of the placenta, and closure of the open wound left behind by the placenta" (Trevathan, 2010, p.107). In essence, breastfeeding may be regarded as a low-tech preventer of postpartum hemorrhaging and as an adaptive solution to maternal mortality. (Drife, 1997; Magann , et al., 2005)

Various studies have suggested that by breastfeeding, a woman experiences a faster return to her pre-pregnancy weight. As Heinig references, "repeated pregnancy without lactation has been shown to promote obesity in rats" (Heinig, 2001). For humans, 6 out of 14 former studies indicate a relationship between infant feeding and weight loss. Of those 6, 6 months of postpartum breastfeeding was associated with dramatic weight loss. Although concluded by numerous researchers, a positive relationship between lactation and weight loss has not been consistently demonstrated. (Dewey, 1998; Heinig, 2001)

Research has suggested a negative relationship between lactation and one's risk of acquiring cancer. A study by Byers in 1985 found "a lower relative risk estimate among younger women [for breast cancer] who had ever breast fed their children as compared to those who had not" (Heinig, 2001). As posited by Newcomb, "the cumulative duration of breastfeeding required for reduction in [breast] cancer risk ranged from 4 months to 8 years" (Heinig, 2001). Additional experimentation and meta-analyses has concluded that premenopausal women, who had previously breastfed for at least 4 months, have a 22-28% lower breast cancer risk. In addition to lowering one's risk of breast cancer, lactation has been shown to decrease one's chances of acquiring ovarian and endometrial cancers. "In a multinational study, a 20-25% decrease in risk of ovarian cancer was observed in women who lactated for 2 months per pregnancy, compared to those who had not" (Heinig, 2001). Similar rates have been recorded regarding endometrial cancer. The reduced risk of such cancers occurs as a result of lactation-inhibited ovulation. When a woman ovulates, she experiences an increase in circulating levels of pituitary gonadotrophins and estrogens,

hormones capable of causing ovarian malignancy. As lactation prevents ovulation (see above), it invariably lowers malignancy. (Ma, 2006; Heinig, 2001)

A woman's decision to breastfeed may have long-term effects on her circulatory health and risk for adult-onset disorders. By regulating the feeder's metabolism, breastfeeding converts calories from maternal fat stores, a result of pregnancy weight gain, to nutritious energy for the infant (Dewey, 1998). This metabolic conversion reduces the frequency of heart attacks in feeders by directing potential arterial cloggers to another body. In fact, "in the Nurses' Health Study (NHS), women who breastfed for at least 2 years of their lives were 19% less likely to suffer a heart attack than those who did not breastfeed at all" (Trevathan, 2010, p.137). Prolonged lactation is also associated with a decreased prevalence of type 2 diabetes. A study of 2 large cohorts of US women found that individuals who breastfed for 6 months experienced an approximately 14.5% decrease in the risk of type 2 diabetes. This statistic was determined by testing nearly 1,239,709 persons for insulin sensitivity and glucose tolerance (Goldman, 1998). Further research has suggested that breastfeeding may reduce the severity of anemia, bladder and other infections, and spinal and hip fracture after menopause (Labbok, 2001). Controversial analyses have concluded that lactation may, too, reduce one's risk of acquiring osteoporosis. (Huo, 2003)

Clearly, breastfeeding is biologically beneficial for both the nurser and nursed. With that said, when one individual (a breastfeeding mother or infant) is absent or unwilling to engage in the lactation process, the other, according to historical records, is either nursed by another woman or becomes the nurse of another child. This cultural practice, termed

wet-nursing, as described below, pairs two individuals, an infant and breastfeeding woman, not necessarily biologically related, and enables them to wield the above benefits despite their unfortunate circumstances. In other words, the benefits of breastfeeding are not unique to a mother-child relationship. Wet-nursing takes advantage of this notion and optimizes the number of beneficiaries. In such a sense, it may be viewed as an evolutionary adaptive strategy.

V. History of Wet-Nursing

Wet-nursing, or the suckling of another woman's child, has a rich, global history. While wet-nursing frequently occurred in civilizations in which the death of mothers in childbirth or during lactation was common, it also occurred for a myriad of additional social, political, religious, and economic reasons.

Wet-nursing dates back to 3000 BC in Western history. Occurring first in Ancient Egypt, wet nursing was seen as the only alternative to a mother's inability to lactate. Without human milk, and with no known human milk substitutes, an ancient Egyptian child was destined for death. Wet-nurses were therefore perceived as saviors. Worshipped by many, they were idolized in early works of art and depicted as the goddess Hathor, a female human with the head of a cow. "Rulers claimed they were suckled by divine wet-nurses whilst, in others, the wet nurses of kings might be deified" (Fildes, 1998, p.3).

In Pharaonic Egypt, "the royal wet-nurses were selected from the harem of senior officials of the royal palace and enjoyed a high status" (Fildes, 1998, p.3). Each royal infant

had several wet nurses, as it was a customary method of feeding for future leaders. While used by the pharaoh and his relatives, wet-nursing was not exclusive to members of the royal family. Moses, a figure in the *Old Testament*, was given a wet-nurse when rescued, in the reeds, by the pharaoh's daughter. As stated in *Exodus*, "And Pharaoh's daughter said unto her, Take this child away, and nurse it for me, and I will give thee thy wages. And the woman took the child and nursed it" (Fildes , 1998, p.1). Muhammed, the Islamic prophet, would later have a similar, wet-nursing experience. Years later, in Ancient Rome, wet-nurses were often used to nurse unwanted children that had been thrown onto heaps of rubbish. In such instances, "people requiring an inexpensive slave could visit such places, choose an abandoned baby, and then select a wet-nurse to feed it for periods of up to three years" (Fildes, 1998, p.5). Others utilized the services of wet-nurses to inexpensively nurse the children of slaves in order to cheaply propagate one's supply of labor; it was cheaper for an owner to hire a wet-nurse and suggest slave interbreeding than it was to hire new slaves. (Fildes, 1998, p.11)

Wet-nurses were frequently used in Classical Greece (fifth-fourth century BC) and Rome, especially by the wealthier classes. Similarly to those in Ancient Egypt, wet-nurses of the time were regarded with high statuses and were often responsible for supervising servants and certain domestic tasks. Often brought into the child's home, nurses remained with her charge until he/she reached adulthood. In the case of female charges, wet-nurses remained with the child until she was married, sometimes serving as privileged domestic employees. While highly respected and loved by their employers, wet-nurses were, in essence, slaves. Romans who required a wet nurse could go to the Forum Olitorium, peruse

the merchandise, and purchase an individual with ideal physical and behavioral characteristics. (Fildes, 1998, p.11)

Wet-nurses were thoroughly screened before purchased. “There was a universal belief that the physical and mental characteristics of the nurse were imbibed by the child through her milk” (Fildes, 1998, p.20). With that said, the ideal wet-nurse had to possess certain qualities. She had to be honest, self-controlled, sympathetic, well tempered, in good health, and between 20 and 40 years old. The ability to speak Greek, a sign of intelligence, was also strongly favored. In some cultures, breasts and nipple sizes were heavily regulated. In Ancient India, “warning was given that nursing at the breast of a woman with upturned or flat nipples would deform the child’s features, while large and flabby breasts might suffocate the child by covering its mouth and nose” (Fildes, 1998, p.19). Pregnant and/or menstruating women were legally forbidden from becoming wet-nurses as it was believed that the blood of a pregnant/menstruating woman would spoil her milk. Such a law actually prompted women to hire nurses if they wished to conceive additional children.

In addition to analyzing a nurse’s physical and mental qualities, purchasers often tested the milk of a potential employee. “The milk of the nurse was naturally of great importance. It should be white, with a pleasant appearance, taste, and smell; of moderate consistency, and of the correct ‘age’” (Fildes, 1998, p.20). To test the consistency of the milk, a droplet of milk was placed on an individual’s fingernail. The milk was deemed acceptable if it did not drip down the individual’s fingertip or cling tightly to the nail (Stevens, 2009). Some ancient medical experts believed that the sex of the wet nurse’s own child was an important factor in the composition of her milk. To some, if a wet nurse had

been pregnant with a girl, feminine qualities would be imbibed by the nursed child, and vice versa if the child were a boy. A mismatched pair, if the nurse had been pregnant with a girl and was now feeding a boy, was avoided, as the nursed young would receive the incorrectly gendered traits. (Fildes, 1998, p.19)

The evolution of wet-nursing, from an alternative of need to an alternative of choice, was first protested in the Middle Ages. At that time, "society regarded childhood as a special time of fragility" (Stevens, 2009). Newborns were perceived as vulnerable to the "magical properties" of breast milk that differed from their mother's. The notion that "breast milk could transmit both physical and psychological characteristics of a wet nurse" (Stevens), scared parents into thinking that wet-nursed children would imbibe qualities of the lower class. As a result, the hiring of women for the purposes of wet-nursing declined.

The protesting of wet-nurses continued throughout the Renaissance period. In 1577, in the *Treatise on Children*, Italian Omnibonus Ferrarious further stressed the importance of mothers breastfeeding their own children. Worrying that infants would "savour of the nature of the person by whom they are suckled" (Stevens, 2009), Ferrarious was convinced that wet nursed children "would come to love a wet nurse because she had nurtured and cared for them more than their own mother (Stevens, 2009). An early 17th century work, *The Nursing of Children*, promoted similar claims. In it, the French obstetrician, Jacques Guillemeau, strongly advised mothers to breastfeed their own children. In regards to wet nurses, Guillemeau delineated four major objections: "1) the child may be switched with another put in its place, 2) the affection felt between the child and the mother will diminish, 3) a bad condition may be inherited by the child, and 4) the

nurse may transmit an imperfection of her own body to the child that could then be transmitted to the parents. However, if circumstances necessitated a wet-nurse, Guillemeau recommended a happy, healthy, conscientious, well-behaved, observant sober female who was willing to breastfeed. Most importantly, according to Guillemeau, the wet-nurse "should not have auburn hair because redheads were known to have a hot temperament that was harmful to their breast milk" (Stevens, 2009).

Despite the multitude of objections, wet-nursing remained a popular industry during the Renaissance period. Considered a highly organized and well-paid profession, wet-nursing was a source of income for many poor women. Women of the lower classes often became pregnant, got rid of their child, and then sought employment as a wet-nurse. Employment as a wet-nurse had two benefits: a reliable source of income and a means of contraception (lactation prevents ovulation). Poor women of the time were able to feed their families while, simultaneously, ensuring that their familial costs (e.g. the addition of a child) would not grow. With so much popularity, wet-nursing became highly regulated by governmental organizations. "In France, wet-nurses were registered at a municipal employment bureau, and laws were developed to regulate their employment. The laws required a wet-nurse to undergo a medical examination and forbade her to breastfeed another child until her own infant was 9 months old" (Stevens, 2009).

The aristocracy dictated breastfeeding practices during the 16th and 17th centuries. Women of the upper class refused to breastfeed, despite the earlier warnings of Ferrarious and Guillemeau, for fear that it was unfashionable and would ruin their figures. As Fildes notes, breastfeeding prevented women from wearing then popular articles of clothing. It

interfered with social activities, such as playing cards and attending theatre performances, and distracted women from her domestic duties (Fildes, p. 33). Such social pressures prompted the majority of aristocratic women to hire wet-nurses. In fact, French governmental records indicate that, in 1780, only 1,000 of 21,000 babies were nursed by their mother. (Hrdy, 1995)

In the 18th and 19th centuries, wet-nursing was utilized by members of lower classes more so than upper classes. Increased costs of living and lowered wages during the Industrial Revolution, prompted many women to seek additional sources of revenue. Wet-nursing became such a source. Wet nurses enabled two women to be employed at the same time: one woman was employed by a mother and a mother was employed in a factory setting. Wet nursing at the time also functioned as a way of lowering infant mortality rates as wet nursed infants were shipped out of urban metropolises, sites of squalor and disease, to rural peasants. (Stevens, 2009)

Although wet-nursing continued to exist at the end of the 18th century, through the 19th century, and even today, its popularity has diminished. A 1779 work, entitled *Domestic Medicine*, "displayed an open distrust of wet nurses and their use of home remedies" (Stevens, 2009) and advised many women to, once again, breastfeed their own children. Attention was drawn to a wet nurse's use of opiates, as a means of quieting children, in the 18th century and further prompted the usage of wet nurses to decline. The incidence of wet nursing reached its lowest point in the 19th century, when artificial feeding became a feasible substitute for breastfeeding. With advances in bottle-feeding and the availability of nutritious and infant-friendly animal milk, the use of wet nurses continued to decline. By

1900, with the exception of few cultures, as discussed below, "the once highly organized wet nursing profession was extinct." (Stevens, 2009)

VI. Cross-Cultural Roles of Wet-Nursing

Wet-nursing is not limited to the feeding of the abandoned poor or the elite rich. It is not merely used as an alternative means of acquiring nutrients. Rather, as seen in the cultures of the Najd and Hjaz of Saudi Arabia, Ancient Islam, and the Hindu Kush, wet-nursing may function as a constructor of kinships, regulator of marriage options, creator of alliances, and as a means of economic mobility. All of these functions further cement the evolutionary significance of the wet-nursing phenomenon.

Islamic law specifies three types of kinship: relation by blood (*nasab*), affinity (*musahara*), and milk (*rida'a*). The latter form, *rida'a*, is denoted by the "relationship between a child and a woman, not its own mother, who nursed it" (Altorki, 1980) and may be used to determine marriage suitors and potential allies. By forging "fictive" or "milk kinships" in Islamic communities, wet-nursing is a powerful, match-making and prohibiting force that controls blood and affinity relations.

A definition of the marital ramifications of *rida'a* relationships is found in the Koran: "Forbidden to you are your mothers, your daughters, your sisters, your parental aunts, brothers' daughters, sisters' daughters, those who are your mothers by having suckled you, those who are your sisters by suckling…" (Gil'adi, 1999, p.21). Believing that "the milk of a nursing woman is formed from the blood of her womb," Muslims insist that the "ties created by suckling are like ties of kinship" (Gil'adi, 1999, p.21). Hadith literature, a

collection of traditions containing sayings of the prophet Muhammed, further outlines the stipulations to be included in wet-nursing and marital contracts. The many *fatawa* present in the "*Book of Marriage*" illustrate the legal impediments to marriage of milk kin. Such *fatawa* are presented as types of non-marriageable relatives, from the perspective of the male ego, below (**Figure 1**). (Altorki, 1980)

Figure 1

By Blood (*nasab*)
Any lineal ascendant
Any lineal descendant
Any descendant of a parent
Any daughter of a grandparent
By Affinity (*musahara*)
The wife of any lineal ascendant
The wife of any lineal descendent
Any lineal ascendant of his wife
Any lineal descendant of his wife by another husband
By Milk (*rida'a*)
The milk-mother
The milk-mother's lineal ascendants
The milk-mother's lineal descendants
A daughter of his milk-mother's grand-parents
The milk-mother's milk-daughter
The milk-mother of a lineal descendant
The milk-sister of a lineal ascendant
The milk-daughter of a female lineal ascendant
The milk-daughter of a female lineal descendant
The milk daughter of a sibling
A milk-sibling's daughter
The milk-mother's husband's lineal ascendants
The wives of milk-mother's husband and his lineal ascendants
The milk-mother's husband's lineal descendants
A daughter of his milk-mother's husband's grand-parents
The milk-daughter of a lineal ascendant's wife
The milk-daughter of a lineal descendant's wife

As evidenced above, "the general rule stipulates that the prohibition precluding marriage between relatives by *rida'a* are the same that apply to relatives by *nasab*" (Altorki, 1980). If a child was breastfed by a woman different from his mother, whether due to natural (i.e. a mother's health problems) or social (i.e. divorce, a mother was busy) causes, he forged new kinships and thus extended his familial ties. In that sense, wet-nursing in Islamic communities could be described as a means of increasing family sizes and as a means of preventing marital relations. (Gil'adi, 1999, p.27)

The way in which one establishes a *rida'a* relationship is highly contested in Islamic communities. Soraya Altorki exclaims, in "Milk-Kinship in Arab Society: An Unexplored Problem in the Ethnography of Marriage," "although the first nursing of a child older than 24 to 30 months is generally not considered to create a milk relationship, the learned estimates of the amount of milk required to establish *rida'a* range from one, three, five, or ten feedings to a few drops on separate occasions" (Altorki, 1980). According to Koran 4/23, blood is equivalent to milk. As a result, "a single suck of even one drop of milk was enough to create an impediment to marriage between the nursling, on the one hand, and its nurse and her relatives, on the other" (Gil'adi, 1999, p.30). The mid-point on the spectrum, and the most commonly held belief, was that five feedings yielded a *rida'a*.

Ethnographic analyses of the urban elite from Najd of Central Arabia, "who consider themselves the 'truest' of all Arabs" (Altorki, 1980), and Hijaz, the Red Sea Province, best depict *rida'a* relations. As expressed by Soraya Altorki, the Najd and Hijaz peoples lie on opposite sides of the religious spectrum. "The main difference between Najdi and Hijazi concepts of *rida'a* and its consequences relates to the extension of the marriage taboo

beyond the range stipulated in Islamic law. While the opinions of Najdi informants were congruent with the orthodox doctrine described above, Hijazi people believed otherwise. Some assumed that a milk bond between two persons preludes marriage between any of their respective siblings; others asserted that only those siblings who were born after the child nursed by a woman not his mother were forbidden to marry the latter's children" (Altorki, 1980). In the follow ethnographic instance, *rida'a* relations are best specified:

> "Woman C, the wife of B, had nursed B's younger brother A; and H, the wife of G (a son of B and C) had nursed I, the daughter of B's brother D. Informant K (the daughter of G and his second wife F) married E, the son of A. She asserted that everyone in the family agreed that neither of her sisters, L and M, could marry J, the young brother of I, because the nursing of I by H preceded the birth of J and that of the three daughters of G.
>
> It is interesting to note that G addresses A with *amni* ("my father's brother"), which emphasizes their genealogical link rather than their milk-siblingship. Their milk-siblingship is, however, reflected in the term of address used for him by G's daughters (K, L, M) who also call A *amni*. And similarly, G's daughters call J, the brother of I, whom G's wife and M's mother had nursed, *sidi* (lit. "my master"), a term customarily used by a girl in speaking to her elder brother." (Altorki, 1980)

While *rida'a* relationships may bar marriage options, they, too, must be thought of, in the context of Islamic history, as a means of extending familial ties. "As we see from the Hadith literature, almost from the very beginning breastfeeding was practiced in the Islamic community so as to broaden the network of relatives on whom one could rely for assistance and support" (Gil'adi, 1999, p.27). The broadening of relatives, via wet-nursing, was accomplished in two ways. In the first, wet nursing forced Muslims to marry outside of their residential boundaries, and thus to meet new people, from diverse, surrounding communities. Records indicate that the majority of wet-nursing in ancient times occurred

between neighbors and was considered a matter of convenience. By wet-nursing neighboring youths, women reduced the range of local marriage options. "Thus, this group of Hadith reports more clearly reflects the emerging strategy whereby early Muslim believers were encouraged to seek their marriage partners beyond the boundaries of their own patrilineal-patrilocal extended families…to consolidate a community that would not only be larger than one based solely on blood ties but also inspired by a shared world view on common aims" (Gil'adi, 1999, p.29). Forcing exogamous marriages, *rida'a* ties created relations between sedentary Islamic communities, such as Mecca, and the tribes of the desert. As Islamic women continued to nurse children of other faiths in surrounding communities, the number of Islamic followers skyrocketed (breast milk transmits physical, mental, and religious qualities). With that said, by decreasing one's marital options, wet-nursing served to expand the Islamic contingency. (Gil'adi, 1999, p.120)

By broadening one's array of diverse relatives, wet-nursing also functioned as a means of establishing familial and/or national alliances. In fact, wet-nurses were distinguished, by Ibn Babawayh in the tenth century AD, as either those that offered their services in order to make a living and those who sought employment in order to gain nobility, glory, and bridge divergent cultures (Gil'adi , 1999, p.120). According to Jane Khatib-Chahidi, "it is reported that when Masai of East Africa wanted to make a lasting peace with an enemy tribe, the respective tribes would bring a cow with a calf and a woman with a baby. The two cows would be exchanged and the enemy's child suckled at the breast of the Masai woman; the Masai baby would be suckled by the woman from the enemy tribe" (Maher, 1992, p.110). To strengthen relations with surrounding clans, the

Hindus of India, specifically the royal Rajputs, chose their children's wet-nurse from a nearby, pastoral tribe. In 19th century Ratcha, Georgia, wet-nursing was utilized to "gain trading partners who could be relied upon in potentially hostile areas" (Maher, 1992, p.112). As expounded upon by Jane Khatib-Chahidi:

> "The Christian Georgians would send a new-born child to their Muslim trading partner in North Caucasia if the latter's wife was known to be breastfeeding. The Muslims would do the same but with another trading partner. It seems that the custom served the purpose of demonstrating that there was complete confidence between the parties concerned." (Maher, 1992, p.112)

While wet-nursing established alliances between neighboring, often times conflicting, communities, it was also used to strengthen intra-group unity. In the Ashimadek clans of Chitral in the Hindu Kush, "every infant was suckled in turn by every nursing mother of the clan" (Maher, 1992, p.111). With the constant exchange of infants, milk-relationships were consistently formed. Familial relations were broadened and individual's expanded their resources and sources of comfort. Additionally, such an exchange of infants between neighbors yielded assurances that neighboring families would not cheat on one another. Preventing options of adultery, wet-nursing, in turn strengthened families and inspired trust. In addition to preventing adultery and strengthening a clan, wet-nursing also served to bridge government officials with their constituents. Akbar, the Mogul Emperor of Delhi and descendant of Genghis Khan, would punish milk kin with less severity, regardless of their crime. In fact, during one court hearing, he stated: "between me and Aziz is a river of milk which I cannot cross" (Maher, 1992, p.110). In essence, wet-

nursing functioned as a transaction: suckling of an infant was exchanged for lifetime loyalty.

As evidenced in ethnographic analyses of life in the Hindu Kush, wet-nursing can function as a means of economic mobility. Located in Northern Pakistan, on the border region of Central and South Asia, Chitral is observant of the laws of milk-kinship (*rada'a*) and their social ramifications:

> "The custom of foster relations is maintained among all the ruling families, and its ties seem more stringent than those of blood kinship. On the occasion of a son or daughter being born, the child is assigned to a foster-mother, in whose house it is brought up, so that frequently the father does not see his children till they are six or seven years old…Whatever are a man's misfortunes or crimes in after-life, his good and bad fortunes are equally shared. Should exile be his lot, his foster kindred accompany him. On the other hand, if he rises to influence, his foster-father is generally his most confident adviser, and his foster-brothers are employed on the most important missions" (Parkes, 2001)

Enabling individuals to move among social strata, wet-nursing was a powerful social and economic force during the early 1900s. Perhaps most recorded in the reports of Hunza and Nager, provinces of the Hindu Kush, "terms of milk kinship also designated hereditary classes for purposes of accounting taxes and service dues, including an upper stratum of true 'suckling milk kin,' related by genuine fosterage to the ruling dynasty, and a lower stratum of 'clothing-and-food milk kin,' derived from an idiom of child rather than infant

fosterage" (Parkes, 2001). Put simply, the suckling of another's kin could reduce one's property taxes. Reducing one's costs, wet-nursing enabled families to spend more money on items of luxury and thus yield a perception that they were of a higher socioeconomic class. In Chitral, a province of the Hindu Kush, milk-kinships allowed individuals to move from one caste to another. If a woman suckled a member of an upper class, she and her children became members of such a class. When her children sought a husband/wife, they were able to marry members of nobility. In short, wet-nursing was regarded as process to acquire power and status within an Islamic community. (Parkes, 2001)

VII. Discussion and Evolutionary Significance of Wet-Nursing

It is evident that the cultural practice of wet-nursing holds social, biological, economic, and religious significances. Interestingly, these values may be understood from an evolutionary perspective.

As described above, the biological benefits of breastfeeding (e.g. decreased risks of cancer, obesity, diabetes, gastrointestinal problems, etc), for both the feeder and infant, may be optimized by the wet-nursing process. Mothers who either lost or discarded their children prior to weaning are able to elicit the same lactational benefits from feeding another child. Furthermore, children who have either lost their mothers before weaning or have mothers unable or unwilling to lactate are still able to gain the nutritional and immunological properties of breast milk. By optimizing the number of lactational beneficiaries, wet-nursing may be viewed as a cultural strategy with significant evolutionary advantages.

Wet-nursing may also be understood as a means of increasing the proportion of economically prosperous individuals in a society and, from another standpoint, the number of individuals capable of receiving successful parental investment. As reviewed above, history has indicated that the majority of wet-nurses were employed by financially stable families and, were, themselves, from financially unstable families. When such wealthy mothers delegated breastfeeding responsibilities to poorer women, they effectively altered the fecundity of the population. By paying another woman to breastfeed her child, a mother did not experience the ovulatory-suppressing consequences of lactation and could thus produce more children in shorter birth intervals. The wet-nurse, on the other hand, by breastfeeding a child, inhibited her ovulatory hormones and thus could not give birth. The high demand of wet-nurses forced many women to constantly feed and thereby extended the duration of her inability to reproduce (Hrdy, 1999, p. 360-366) . Since wealthy women hired wet-nurses, wealthy women were able to contribute more offspring to the population than were poorer women. In addition, since such women possessed financial, medical, and agricultural resources, scarce commodities at the time, her many sires received high levels of parental investment and had a lesser probability of early morbidity and disease. The evolutionary tradeoff, between quantity and quality of offspring, was therefore circumvented by elite families (Hrdy, 1999, p.361). In such a sense, wet-nursing ensured that those capable of investing in their offspring, were able to reproduce at a greater and more successful rate. In a highly socioeconomically stratified era, wet-nursing, theoretically, guaranteed that resources were provisioned in a logical manner: those with the most resources had the most offspring whereas those with the fewest resources were

able to conserve their wealth and distribute it to fewer offspring. Once again, this notion proves that wet-nursing had evolutionary advantages.

The idea of milk kin may be better understood through a resource-provisioning lens as well. According to Hamilton's Rule, resources are altruistically distributed using the formula, $C<Br$, where "C" equals the cost to the helper, "B" equals the benefit to the helped, and "r" indicates the degree of relatedness between both parties. An individual should be evolutionarily inclined to help someone if the imposed cost is less than the product of the benefits and degree of relatedness (Hrdy, 1999, p.364). In a community that respects and declares milk kin, all citizens should have higher "r" values between one another than biology would dictate. With greater "r" values, individuals should be more willing to help one another; a high "r" value will compensate for a low "B" value or a high "C" value. By increasing the degree of relatedness between community members, wet-nursing should increase altruism and resource sharing within a community. As illustrated in the above historical examples (e.g. alliances, lesser corporal punishment, etc.), this is the case (Maher, 1992, p.110-111). Overall, the altruistic consequences of wet-nursing prove that culturally determined "r" values are important in determining a species' evolutionary tendencies. Additional research should be conducted to determine the extent to which culturally and biologically determined "r" values are related.

VIII. Summary

Clearly the milk-relationship is highly complex. In addition to providing biological benefits to both the nurse and nursling, wet-nursing has functioned as a social, economic, and political force throughout history. Although in decline after the introduction of artificial

and bottle-feeding methods, wet-nursing remains a religious practice in many parts of the world. Constructing kinships, spreading religion, forming alliances, and enabling economic mobility, wet-nursing is not simply a biological phenomenon. Rather, its complex, biocultural roles are intertwined with its deep evolutionary history and significance. As more than just a viable alternative to maternal lactation, as evidenced in ethnographic and fieldwork literature, wet-nursing yields an optimization of lactational beneficiaries, logical resource provisioning, and increased community altruism. With such advantages, the cultural practice of wet-nursing may be seen as an evolutionarily advantageous strategy.

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