MA-06 Feeding infants without formula: breastfeeding, wet-nursing, milk sharing and the dangerous history of substitutes

HEALING after the FALL, research library, MA-06

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Scope and how to read this

Feeding in the first six months when there is no formula: supply, expression, relactation, wet-nursing, shared milk, the motherless baby and the record of substitutes. It builds on MA-05, which covers the first feed, spoon feeding and low-birthweight volumes (THRIVING library, MA-05). Weaning and the sick child are left to MA-07, lactational amenorrhoea to MA-08. Claims are labelled Tradition (what a people did), Record (what was counted) or Inference (my reasoning). [VERIFY] marks unverified claims and my arithmetic, and [OWNER] marks village rules for the owner.

1. The record before formula: what happened to babies who were not breastfed

Record. Dublin, 1730 to 1830. The Dublin Foundling Hospital took in about 127,000 children in its century of operation, and roughly 800 of every 1,000 died (Roe 2025). An enquiry in 1738 found 3,236 of 4,025 recent admissions dead. Sir John Blaquiere reported in 1790 that 2,087 of the 2,180 infants admitted that year, 96 per cent, were dead or unaccounted for. Between 1791 and 1796, 5,216 infants were sent to the hospital's infirmary and one recovered (Workhouses.org.uk n.d.). A university heritage account gives 5,016 for the same years (UCD Cultural Heritage Collections 2018). Of 52,150 children admitted in the thirty years to January 1826, 41,524 died: 14,613 in the hospital, 25,859 at nurse in the country and 730 in the infirmary (Workhouses.org.uk n.d.). A medicine known as "The Bottle" was passed round all the infants. Most Dublin foundlings were sent to paid wet nurses in the country, so Dublin is a record of institutional care, infection, neglect and poorly paid nursing together, not a clean test of hand-feeding. A figure often quoted from Fildes, that about 10,000 hand-fed infants passed through between 1775 and 1796 with almost none surviving, could not be found in any source I could read [VERIFY].

Record. Paris and France. The Paris foundling service took 5,500 to 7,500 infants a year around 1780, and at least two in three died in the first year (secondary source only) [VERIFY]. Most were sent to rural wet nurses. France regulated the trade: wet nurses had to be licensed, had to report deaths, and could not take a nursling until their own child was nine months old (Stevens 2009). The Roussel law of December 1874 placed every infant under two who was nursed for pay under public supervision (sources differ on the day of the month). From 1780 to 1790 the Vaugirard hospital in Paris tried to cure syphilitic infants by giving mercury to the wet nurses who suckled them. It failed and closed, and syphilis passed between nurses and nurslings in both directions, leading to lawsuits later in the century (Sherwood 2010, publisher summary only).

Record. London, the 1740s. Fildes's doctoral work identifies a sharp change in English infant feeding around 1748, tied to the first well-publicised experiments with dry nursing (hand-feeding without any breast milk) at the London

Foundling Hospital and to Cadogan's essay on nursing, which pressed mothers to suckle their own children (Fildes n.d., thesis abstract only). I could not read the thesis or Fildes's books.

Record and Tradition. Bavaria and the German south. In the 1830s and again in the 1870s, infant mortality in Upper Bavaria was 380 to 383 per 1,000 live births, in Swabia 383 to 400, in Lower Bavaria 337 and in the Upper Palatinate 314. In Münster, Köslin and Arnsberg in the north it was 128 to 147 (Gehrmann 2011, drawing on Knodel). The difference was driven by the widespread southern custom of not breastfeeding at all, giving cow's milk and flour paps from the first days (Gehrmann 2011). Knodel's own book was not read.

Tradition and Record. Iceland. In the eighteenth and early nineteenth centuries Icelandic mothers rarely breastfed. Poor women breastfed only when no cow's milk could be had, so suckling was a mark of poverty. In the south and west, infants in their first month were given meat, fish or butter chewed first by an adult and wrapped in a cloth to suck, called dúsa. Infant mortality in the mid nineteenth century was 250 to 300 per 1,000, against about 140 in Denmark, and above 600 per 1,000 in the epidemic year of 1846. In Hvalsnes parish it was above 300 per 1,000 from 1766 to 1810, and about half of all infant deaths fell in the first month. Danish doctors and Icelandic midwives pressed for maternal breastfeeding through the later nineteenth century, and by soon after 1900 Icelandic infant mortality had fallen to about 100 per 1,000, while Bavaria's was still above 200 (Guttormsson and Garðarsdóttir 2002).

Tradition. The Greek and Roman world. Soranus of Ephesus, writing in Rome in the second century, held that the newborn should not take its mother's first milk. Colostrum was discarded and the baby was given boiled honey-water, or goat's milk with honey, for two to three days (Oribasios says four). Soranus wanted a wet nurse no younger than 20 to 25 and no older than 40 to 45, healthy, of good size, with a bland diet and no sexual relations, and he advised more than one nurse so the baby would not starve if one fell ill. He preferred a Greek nurse so the child would hear good Greek. First-year mortality in Rome is estimated at 20 to 30 per cent (Trenchard-Smith 2020). Wet nurses in Rome and Roman Egypt worked under written contracts that fixed pay, term and conduct (Stevens 2009).

Tradition. The old substitutes. Pap was bread soaked in water or milk. Panada was flour or bread cooked in broth. They were given from a pap boat, a small spouted vessel that could blow food straight down a baby's throat, or from a cow's horn pierced at the tip, the medieval feeding bottle. Rubber teats were patented in 1845 and Liebig's commercial infant food followed in 1865 (Stevens 2009). In the early nineteenth century the dirt in feeding vessels, never properly cleaned, is said to have killed about a third of artificially fed infants (Stevens 2009, citing Weinberg).

Record. The first cohort studies, 1900 to 1925. In Derby, the medical officer William Howarth followed 8,343 infants born from November 1900 to November 1903. Mortality in the first year was 70 per 1,000 among breastfed infants, 99 among mixed-fed and 198 among hand-fed. His women inspectors found that sweetened condensed milk was the worst food, followed by bread, rusks and other bread mixtures (Howarth 1905, read through Reid 2017). In eight American cities, the Children's Bureau followed 22,967 live births. Artificially fed infants died at three to four times the rate of breastfed infants. By cause the excess was 7.7 times for gastric and intestinal disease, 6.1 for the diseases of early infancy, 2.3 for communicable disease and 1.8 for respiratory disease. Gastrointestinal deaths in August were 13 times those in January (Woodbury 1925).

What the record teaches (Inference). The killing was done less by the wrong food than by the water, the vessel and the season, and summer diarrhoea in hand-fed babies was the great slaughter of the pre-formula world. The second lesson is that wherever motherless babies were gathered in one place, nearly all of them died.

2. The modern evidence: what not breastfeeding costs, and what losing a mother costs

Record. A pooled analysis of studies in Brazil, the Gambia, Ghana, Pakistan, the Philippines and Senegal (1,223 deaths) found that infants who were not breastfed were 5.8 times as likely to die of infection in their first two months as breastfed infants (95 per cent confidence interval 3.4 to 9.8). The ratio fell to 4.1 at two to three months, 2.6 at four to five, 1.8 at six to eight and 1.4 at nine to eleven. In the first six months the protection was stronger against diarrhoea

(6.1) than against respiratory infection (2.4), and it persisted at 1.6 to 2.1 in the second year (WHO Collaborative Study Team 2000).

A meta-analysis found that compared with exclusive breastfeeding in the first six months, all-cause mortality was 1.5 times higher with predominant breastfeeding, 4.8 times with partial breastfeeding and 14.4 times with no breastfeeding. Infection-related mortality was 8.7 times higher in the not-breastfed. From six to 23 months, not breastfeeding roughly doubled mortality (Sankar 2015, abstract only). The Lancet series of 2016 estimated that scaling breastfeeding to near-universal levels would prevent 823,000 child deaths and 20,000 breast cancer deaths a year, and that only 37 per cent of infants under six months in low- and middle-income countries were exclusively breastfed (Victora 2016). Most of the child deaths averted would be in infants under six months (Amat Camacho 2023, citing Victora).

Record. The motherless child. In Matlab, Bangladesh, 144,861 births were followed from 1982 to 2005. When the mother died, 24 per cent of her children survived to age ten, against 89 per cent when she lived. The risk was highest close to her death: for a child aged two to five months whose mother died, the death rate was 25 times higher (rate ratio 25.05, 95 per cent confidence interval 18.57 to 33.81). The father's death made almost no difference to child survival (Ronsmans 2010).

Record. What happens when formula and clean water fail together. In early 2006, floods in Botswana contaminated water supplies at a time when a national programme was giving free formula to the infants of HIV-positive mothers. National diarrhoea cases rose to about 3.5 times the usual and deaths to about 25 times the usual. Among 153 children admitted with diarrhoea in one hospital study, almost all were under two years old, about nine in ten of these were not breastfed, and 22 per cent died. Cryptosporidium and enteropathogenic E. coli were the main organisms (secondary summaries of work by Creek and colleagues) [VERIFY]. A case-control study confirmed that sick children were less likely to be breastfed (Arvelo 2010, abstract only).

Inference. After the Fall a baby without breast milk is in the position of Woodbury's and Howarth's hand-fed babies, or worse, and a mother's death in early infancy is close to a death sentence unless another woman's milk is found.

3. Making and keeping the supply

Record. How the supply is set. Milk production is driven by removal. Australian mothers of infants one to six months old fed on average 11 times a day (range 6 to 18), taking about 76 g per feed, and feeding at night was a normal and substantial part of the day's intake. The number of feeds was not related to the total volume made, which differed widely between women (Kent 2006, abstract only). The daily total in this age group is usually reckoned at about 750 to 800 mL [VERIFY]. MA-05 covers putting the baby to the breast in the first hour and avoiding prelacteal feeds, which carried about four times the risk of neonatal death (THRIVING library, MA-05).

Signs that a baby is getting enough. At least six wet nappies (or six good wettings of cloth) in 24 hours, and a weight gain of at least 125 g a week or 500 g a month (WHO 1998). Where there is no scale, the village can rig a steelyard or balance against known weights [OWNER, whether the dispensary keeps one]. Most mothers who believe their milk is failing are wrong. The usual causes of true low supply are poor attachment, infrequent feeding, long gaps at night, giving water or other fluids, and early use of a dummy or bottle (WHO 1998).

Expression by hand (Tradition and Record). Every mother and every midwife should know hand expression, because a baby too weak to suckle, a mother separated from her baby and a wet nurse providing for a second child all depend on it. The standard technique, taught in WHO counselling courses, is: wash hands, sit leaning slightly forward with a clean wide cup under the breast, place thumb above and fingers below the areola about 3 cm behind the nipple, press back toward the chest wall, squeeze the thumb and fingers together, release, and repeat in a rhythm, moving round the areola so every part of the breast is emptied, and changing breasts every few minutes [VERIFY]. A mother separated from her baby should express at least 8 times in 24 hours, including at night, to keep the supply going (WHO 1998, by analogy with the suckling frequency it sets for relactation).

Storage of expressed milk (Record, two sources). Freshly expressed milk keeps up to 4 hours at room temperature (25 °C or below), up to 4 days in a refrigerator, and about 6 months in a freezer, with 12 months acceptable. Milk left over from a feed should be used within 2 hours or discarded (CDC n.d., Eglash 2017, abstract and derived handouts only). The two sources agree. Neither gives figures for a cool larder, a spring house or a cold cellar, which is what most villages will have. **Inference:** treat a cool place below about 15 °C as somewhere between the two, and do not keep milk longer than 24 hours there [VERIFY]. Hot weather shortens every limit.

The mother's own health and food (Inference with some Record). Lactation is protected by the body even in hunger: women in poor countries make adequate volumes of milk on diets that would be called inadequate elsewhere, and the first thing to fall in a hungry mother is her own reserves, not her milk [VERIFY]. The village should feed the nursing mother first in a lean season [OWNER]. Mastitis and breast abscess belong to the postnatal infection material and are not treated here, except for the rule that milk from an inflamed breast is still given and the breast kept emptied.

Drugs and ferments. The probiotic warning in ME-12 applies: a probiotic product killed a preterm infant (THRIVING library, ME-12). Nothing living should be fed to a young infant on purpose except breast milk.

4. Relactation and induced lactation

Record. It works, and it works without drugs. The WHO review of 1998 gathered the experience then available (WHO 1998, read in the Spanish edition because the English PDF is a scan without text). In Delhi, Seema and colleagues supported 50 mothers whose babies had stopped breastfeeding or were partly breastfed. Forty-six relactated (the review also says "all but one"). Seventy-four per cent of the babies refused the breast at first. Milk appeared in 2 to 6 days, partial relactation came in 4 to 28 days and full relactation in 7 to 60 days. Half the mothers were randomised to metoclopramide 10 mg three times a day for 10 days, and it made no difference (Seema 1997, WHO 1998).

In Nigeria, Abejide described six adoptive mothers, none recently pregnant, who produced milk in 4 to 7 days, partial lactation at 11 to 18 days and exclusive breastfeeding at 21 to 25 days, without drugs. In Papua New Guinea, 11 of 12 women who had never lactated before achieved adequate lactation in 5 to 13 days (Nemba). In Karnataka, India, Banapurmath reported success in 15 of 15 women in one series without drugs, while with metoclopramide in another series 5 of 10 succeeded. In Natal, South Africa, Slome described ten grandmothers who brought back their milk to nurse their grandchildren (WHO 1998). Babies under one week took to the breast at once in 90 per cent of cases, those of one to eight weeks in 75 per cent and those over eight weeks in 51 per cent (Auerbach and Avery, in WHO 1998).

A systematic review of 16 later studies, mostly observational and mostly from middle-income countries, found that in 13 studies over 80 per cent of mothers restarted breastfeeding. Pooled, 1,972 of 2,478 mothers (79.5 per cent) restarted, 48.5 per cent to exclusive and 28.3 per cent to mixed feeding. Milk returned in 2 to 15 days, mixed feeding was reached in 2 to 18 days and exclusive in 3 to 30 days. Success was 81 per cent for infants under two months against 24 per cent over four months in one study. The things that helped were a young infant, a short gap since lactation stopped, a motivated mother, family support and skilled continuous help (Amat Camacho 2023).

Record. The method. The baby suckles often, 8 to 10 or more times in 24 hours, about every two hours and at night, at both breasts. While the milk is coming, the baby gets a full supplement by cup, or better by a supplementer, so that it never goes hungry. The supplement starts at about 150 mL per kilogram per day, spread over the feeds, and is cut by about 50 mL a day every few days as the mother's milk increases, watching wet nappies and weight. No dummy and no bottle. A woman who has not lactated for a long time, or never, may need 4 to 6 weeks, and a woman who has never been pregnant does not make colostrum (WHO 1998).

The supplementer. A fine tube runs from a cup of milk to the nipple and is taped or held there, so the baby draws milk through the tube while suckling and the breast is stimulated at the same time. The tube is cleaned in hot soapy water after every use, sterilised (WHO 1998 says by bleach, and boiling is the post-Fall option), and replaced every few days (WHO 1998). Before the Fall a nasogastric tube of size 5 or 6 French was used [VERIFY]. After the Fall

a fine tube of silicone, rubber or a cleaned hollow plant stem must be found and its use tested [OWNER, what the dispensary stocks].

Inference. Relactation is the most powerful tool in this report: it turns one surviving woman into a full supply and needs only hands, time and a cup. It is slow, fails in about one in five, and needs a supplement while it builds, which is where wet-nursing, shared milk and, last, animal milk come in.

5. Galactagogues

Tradition. Nearly every people has foods or herbs believed to bring in milk. Fenugreek seed (Trigonella foenum-graecum) is used across South Asia, the Middle East and North Africa. Goat's rue (Galega officinalis), whose name speaks of its old use in livestock, was used in Europe, and its leaves and flowering tops are the parts used. Torbangun leaf (Coleus amboinicus, also called Plectranthus amboinicus) is eaten in soup by Batak women in North Sumatra after childbirth [VERIFY], and dates (Phoenix dactylifera) are eaten for milk in the Middle East. Beer, oats and abundant fluids are European folk galactagogues.

Record. A Cochrane review of 41 trials in 3,005 mothers found that drugs raised milk volume by about 64 mL a day (95 per cent confidence interval 26 to 102), with low certainty, and that the evidence for natural galactagogues was of very low certainty with extreme variation between trials (Foong 2020, abstract only). A network meta-analysis of fenugreek in 122 women found a small increase, but fenugreek did less well than Coleus amboinicus or palm dates (Khan 2018, abstract only). The usual fenugreek dose is 1 to 6 g of seed a day. Its effect may be partly psychological. Reported harms include stomach upset, liver injury, allergy with cross-reaction to peanut and chickpea, falls in potassium and blood sugar, one case of toxic epidermal necrolysis, and an interaction with warfarin. In one survey 45 per cent of 85 users reported a side effect. It makes urine and sweat smell of maple syrup, in mother and sometimes baby, which can be mistaken for maple syrup urine disease (LactMed n.d.). Goat's rue contains galegine, a guanidine and the forerunner of metformin, which can lower blood sugar. There are no valid trials, and liver enzyme rises have been reported with combination products. It is toxic to grazing sheep [VERIFY] and looks like other pea-family plants with pinnate leaves, such as vetches (Vicia) [VERIFY] (LactMed n.d.).

Among drugs, domperidone raises milk output by 90 to 94 mL a day in the short term in mothers of preterm infants, at 10 mg three times a day for 4 to 10 days, with 30 mg a day the most effective dose and nothing gained at 60 mg. Above 30 mg a day it carries a risk of heart rhythm disturbance and sudden death, and it should not be given to a woman with a known arrhythmia (LactMed n.d., single source for this dose) [VERIFY]. Metoclopramide 10 mg three times a day was the drug used in the older relactation work, for no more than two weeks, and only after two weeks of physiological methods had failed (WHO 1998). It made no difference in the one randomised trial (Seema 1997). It can cause depression with longer use (LactMed n.d.). Chlorpromazine (25 to 100 mg three times a day for 7 to 10 days) and sulpiride were used in refugee camps in India, Vietnam and Uganda in the past (WHO 1998). Sulpiride also carries a risk of depression (LactMed n.d.).

Inference. The baby at the breast is the real galactagogue. Fenugreek tea may help a mother's confidence but must never replace frequent suckling, and a mother with diabetes, on blood thinners or with a legume allergy should not take it. Goat's rue should not be used after the Fall.

6. Wet-nursing: the tradition on its own terms, and the record

Tradition. Wet-nursing as kinship. In many societies, nursing another woman's child was not a trade but a bond. In the Islamic tradition, the Qur'an sets the full nursing period at two years and forbids marriage to one's milk mother and milk sisters (Qur'an 2:233 and 4:23). The law schools differ on how much suckling creates milk kinship. A common Sunni position is five separate satisfying feeds within the first two years, while Hanafi and Maliki scholars hold that a single feed is enough [VERIFY]. Milk kinship extends to the nurse's own children, so a child nursed by a neighbour cannot later marry the neighbour's children. Where it is honoured, a village must record who

nursed whom [OWNER]. Among the Efe foragers of the Ituri forest in what is now the Democratic Republic of the Congo, newborns are nursed by several women of the camp, and infants are passed among many carers through the day, so that the death or absence of a mother is not left uncovered (Tronick 1987, read only in secondary summary) [VERIFY]. In Natal, grandmothers relactated to nurse their daughters' children (WHO 1998).

Tradition and Record. Wet-nursing as trade. In Rome, early modern England and above all France, wet-nursing was paid work, and poor women often weaned their own babies early to sell their milk (Stevens 2009). Writers such as Guillemeau warned that a nurse's character and diseases passed with her milk (Stevens 2009). They were partly right, since syphilis passed both ways (Sherwood 2010).

Record. Modern guidance. International guidance for emergencies puts wet-nursing second only to the mother's own milk and relactation. Where the mother is absent or cannot feed, the order to explore is relactation, wet-nursing, donor milk, then a breast-milk substitute, and wet nurses should go first to the youngest infants. A wet nurse can bridge the gap while a mother relactates. Where HIV testing is available, a wet nurse should be offered it. Where it is not, a risk assessment is done, and where neither is possible wet-nursing is still supported (IFE Core Group 2017).

Record. The infections that pass in milk. HIV passes in breast milk. In an analysis of African cohorts, late postnatal transmission ran at about 8.9 infections per 100 child-years of breastfeeding, a cumulative risk of 9.3 per cent by 18 months, with a constant risk over time and higher risk when the mother's immunity was low (BHITS 2004, abstract and summaries only). HTLV-1, which can cause leukaemia and nerve disease decades later, passes mainly through milk, and in Japan breastfeeding for 90 days or less carried no more risk than formula (Itabashi 2023, abstract only). Cytomegalovirus passes readily, and matters mostly for the very preterm. Hepatitis B and C are screened for by milk banks, as is syphilis (milk-bank screening practice, secondary sources only) [VERIFY]. Tuberculosis is not passed in milk, but an untreated coughing nurse passes it by breath [VERIFY].

Inference. Weighing the risks after the Fall. No village will have HIV testing for long. A baby given another woman's milk may catch an infection that kills slowly or not at all, while a baby given animal milk faces a several-fold higher risk of death within months. The emergency guidance chose wet-nursing even without testing, and the numbers support it. Choose nurses with healthy, thriving children and no sores or rashes, and heat expressed milk (section 7).

7. Milk sharing and heat treatment

Record. The danger of casual sharing. Of 101 samples of human milk bought over the internet in the United States, 74 per cent were contaminated with Gram-negative bacteria or had total counts above 10,000 per millilitre (Keim 2013, abstract and summaries only). A reported figure for cytomegalovirus in these samples could not be confirmed. Milk that is expressed into dirty vessels, kept warm and carried about becomes a culture medium. Milk suckled straight from the breast does not have that problem.

Record. Holder pasteurisation. Milk banks heat donor milk to 62.5 °C for 30 minutes (Holder pasteurisation). This inactivates HIV, CMV, HTLV-1 and, in recent work, SARS-CoV-2 (Israel-Ballard 2005, Unger 2020). Parvoviruses are reported as the exception [VERIFY]. It costs some of the milk's protective proteins and some vitamins, and leaves fat, carbohydrate and most nutrition intact (Israel-Ballard 2005).

Record. Flash heating, a pot-and-jar method. Designed for HIV-positive mothers in poor settings, flash heating places 50 mL of milk in an uncovered glass jar, stands the jar in 450 mL of water in a one-quart (about 1 litre) aluminium pan, and heats the pan over a flame until the water reaches a rolling boil. The jar is then taken out at once and the milk left to cool. In the pilot study the milk stayed above 56 °C for 6 minutes 15 seconds and peaked at 72.9 °C. Pretoria pasteurisation, where boiled water is poured round a jar and left, kept the milk above 56 °C for 13 minutes 52 seconds with a peak of 63.8 °C. Both methods cut HIV-1 by at least 3 logs, and flash heating left no detectable reverse transcriptase activity. Both destroyed added E. coli and Staphylococcus aureus. Vitamin losses were small, with some loss of vitamins C and E (Israel-Ballard 2005, full text read). A larger study of 98 samples from 84 HIV-positive South

African mothers found no detectable virus in any sample after flash heating (Israel-Ballard 2007, abstract only). The two studies agree on the method and the result. The 2005 paper is in the Journal of Acquired Immune Deficiency Syndromes, not the Journal of Human Lactation as the brief gave.

Inference. Flash heating is the village's milk bank, needing a glass jar, a small pot, fire and a few minutes. Use it for all expressed milk given to a baby other than the donor's own. The method was tested only at 50 mL in 450 mL of water in an aluminium pan, and a different pan or volume changes the heating curve. A mother's own fresh milk for her own baby is not heated.

8. Animal milk and other substitutes in the first six months

Record. Why animal milk is dangerous to the young infant. Cow's milk has about three times the protein of human milk and much more sodium, potassium and phosphate. Its potential renal solute load, the load of salts and protein waste the kidney must clear, is about 300 milliosmoles per litre, against about 135 to 177 for infant formulas (Ziegler and Fomon 1989, abstract) and about 90 for human milk [VERIFY]. A young infant's kidney cannot concentrate urine well, so in heat, fever or diarrhoea, or when a feed is made too strong, the baby loses water faster than salt. Of 25 dehydrated infants in one British series, the 15 with hypernatraemia (dangerously high blood sodium, which can cause fits, brain damage and death) had all been given feeds high in sodium, often made too concentrated (Chambers and Steel 1975, abstract only). The phosphate in cow's milk can cause late neonatal hypocalcaemia, with twitching and fits at 5 to 10 days of age (Merck Manual n.d.). Cow's milk carries little iron and can cause small losses of blood from the gut in young infants [VERIFY]. Goat's milk has the same high solute load and is also low in folate and vitamin B12, causing megaloblastic anaemia. Raw goat's milk given to infants has caused electrolyte disturbance, metabolic acidosis, anaphylaxis, haemolytic uraemic syndrome and infection, and in one case cerebral infarcts with high sodium and kidney failure (Basnet 2010, abstract and summary only). An 11-month-old in Sydney fed goat's milk had a red-cell folate of 2.1 nmol/L (secondary report) [VERIFY].

Record. The home-modified recipe. Emergency guidance does not recommend home-modified animal milk under six months, except as a last-resort stop-gap (IFE Core Group 2017). When nothing else is to be had, three independent sources give the same dilution for whole cow's or goat's milk: two parts milk to one part boiled water, with sugar added.

Age	Milk	Boiled water	Sugar	Feeds a day	Total a day
Birth to 1 month	40 mL	20 mL	1 level teaspoon (4 g)	8	480 mL
1 to 2 months	60 mL	30 mL	1 rounded teaspoon (6 g)	7	630 mL
2 to 4 months	80 mL	40 mL	2 level teaspoons (8 g)	6	720 mL
4 to 6 months	100 mL	50 mL	2 rounded teaspoons (10 g)	6	900 mL

The volumes and teaspoon measures are from a counselling leaflet based on WHO guidance (OVCsupport leaflet n.d.). The grams of sugar are from Count Me In (n.d.). The leaflet gives its age bands as 3 to 4 and 5 to 6 months for the per-feed table and 2 to 4 and 4 to 6 months for the daily totals, and the table above uses the second. A Book for Midwives gives 100 mL cow's, goat's or camel's milk, 50 mL water and 10 g (2 teaspoons) sugar, and for sheep's or buffalo milk, which are richer, 50 mL milk, 50 mL water and 5 g sugar (Hesperian n.d.). Count Me In names cow's and goat's milk only. The leaflet boils the water for 2 minutes and brings the finished mix just to the boil, Count Me In boils it for 1 minute, and A Book for Midwives boils the mix, cools it and feeds it at once. Sources disagree on camel's milk, and I found no tested dilution for mare's or donkey's milk.

My arithmetic (Inference) [VERIFY]. The 2:1 mix with 4 g of sugar per 60 mL gives about 70 kcal per 100 mL, close to breast milk, but about 2.2 g of protein per 100 mL, twice breast milk, and a solute load of about 200 milliosmoles per litre. That is why the water must never be left out and the mix must never be made stronger "to build the baby up".

Record. What the recipe lacks. A South African analysis found that home-modified fresh or powdered milk with sugar gave under half the infant's needs for vitamins E and C, folate, iodine and selenium, under three-quarters of zinc, 11 per cent of linoleic acid and, for fresh milk, at most 32 per cent of vitamin D. The authors recommended adding vegetable oil and a micronutrient supplement, and found the cost was about a fifth of household income (Papathakis and Rollins 2004, abstract only). The WHO 2006 guidance on home-modified milk was read only in secondary sources, and I did not find a tested oil quantity [VERIFY]. **Inference:** the baby on home-modified milk needs, at minimum, the mother's or a neighbour's milk for some feeds, any multivitamin the dispensary holds, and early and careful introduction of other foods at six months (MA-07).

Record. Foods never to give. Sweetened condensed milk was the worst food in Howarth's Derby (Howarth 1905, via Reid 2017), and the emergency guidance excludes it (IFE Core Group 2017). Breads, paps and cereal gruels came second worst. Honey must not be given before 12 months because it can carry spores of Clostridium botulinum, which grow in the infant gut and cause infant botulism (California Department of Public Health n.d.). In one American survey of the 1970s, 9 of 90 honey samples held spores, 6 of them linked to cases. Other surveys found 0 to 5 per cent in Bavaria, 1.1 per cent in Argentina and 3 to 7 per cent in Brazil (secondary summaries) [VERIFY]. The honey-water of Soranus and of many folk traditions is therefore a danger. Plain water, sugar water, tea, rice water and other prelacteal or filler feeds in the first six months displace milk and bring in infection (THRIVING library, MA-05).

Record. Powdered formula as salvage. Powdered formula is not sterile and can carry Cronobacter. WHO and FAO advise making each feed with water at 70 °C or above, feeding at once or cooling and storing below 5 °C, and discarding after 2 hours at room temperature (WHO and FAO 2007). In practice the water cools as it meets the powder and the bottle, and one study measured only 57.5 to 60 °C in 200 mL of reconstituted formula (Silano 2016, abstract and summary only). Cronobacter has also been found in ready-to-use therapeutic food (THRIVING library, HY-09). **Inference:** scavenged formula should be made with water just off the boil, for one feed at a time, with the scoop measure exactly as the tin says, and kept for the youngest and the sickest.

Record. Diluted F-100 for the sick young infant. HY-09 gives F-100 made from fresh cow's milk and notes that infants under six months need breast milk or diluted F-100, not ready-to-use therapeutic food. That belongs to the treatment of the starving infant and is not repeated here (THRIVING library, HY-09).

9. Vessels: cup, spoon, tube, bottle and cleaning

Record. In a Cochrane review, mostly of preterm babies, those supplemented by cup rather than bottle were more likely to be fully breastfed at discharge (risk ratio for not fully breastfeeding 0.61) and somewhat more likely to be breastfeeding at three and six months (risk ratio 0.83 for each). There was no difference in weight gain, and results on length of stay were mixed (Flint 2016, abstract only). The emergency guidance says to avoid bottles and teats and to use open cups without spouts from birth, because bottles and teats are hard to clean (IFE Core Group 2017). The case for cups on infection grounds rests on that cleaning argument and on the historical record of the pap boat and the horn, not on a trial.

Tradition. In India the paladai, a small boat-shaped vessel with a lip, has long been used to feed infants [VERIFY]. MA-05 describes spoon feeding for the newborn and the boiled spoon (THRIVING library, MA-05).

Record. Cleaning. A Book for Midwives boils feeding utensils for 20 minutes, and says no feed should stand at room temperature for more than 2 hours (Hesperian n.d.). HY-02 sets the boil for drinking water at a rolling boil (WHO) or one minute (CDC), three minutes above 2,000 metres, and says water for infants should be boiled, cooled covered

and used the same day, because in one Vietnamese study 60.5 per cent of stored boiled water was recontaminated (THRIVING library, HY-02). Rainwater must be treated before it is given to infants (THRIVING library, HY-02).

10. The motherless baby and the order of choices

Record. The emergency priority order is: the mother's own milk (with relactation if she has stopped), then another woman's milk at the breast (wet-nursing), then expressed donor milk, then a breast-milk substitute, and only as a last-resort stop-gap under six months, home-modified animal milk (IFE Core Group 2017). From six months, whole animal milk (cow, goat, buffalo, sheep or camel), long-life milk, evaporated (not condensed) milk or yoghurt can be used as part of a mixed diet (IFE Core Group 2017).

Inference. The baby's age decides most of the answer. The first 48 hours are covered in MA-05. A baby under two months with no milk is the most urgent case in the village and should be at a lactating woman's breast within hours. A baby of four to six months survives a stop-gap on home-modified milk with less loss. A grandmother, aunt or neighbour willing to relactate is worth trying at every age.

Inference. The danger of the orphan house. The record of Dublin, Paris and London is clear that gathering motherless babies into one place, with hired nurses who each care for several, kills nearly all of them. After the Fall, a motherless baby should be placed with one household that includes a nursing or relactating woman, not housed with other orphans [OWNER].

Evidence grades

Grades: A, consistent trials or systematic reviews. B, consistent observational evidence. C, case series, expert guidance or physiology. D, tradition without testing. X, evidence of harm.

Measure	Grade
Breastfeeding (exclusive to 6 months) against no breastfeeding	B (large consistent cohorts, causal by plausibility)
Relactation and induced lactation by frequent suckling with supplement	B
Metoclopramide as galactagogue	B against benefit (one trial, no effect)
Domperidone	B for small volume gain (low certainty), X above 30 mg a day
Fenugreek seed (Trigonella foenum-graecum)	C for a small effect, with harms
Goat's rue (Galega officinalis)	D, X for unsupervised use
Coleus amboinicus, dates	C
Wet-nursing	B (historical and modern record)
Flash heating of expressed milk	B (laboratory studies)
Holder pasteurisation	A for viral inactivation
Cup rather than bottle	A for breastfeeding outcomes in preterm babies, C for infection
Home-modified cow's or goat's milk under 6 months	C as stop-gap, X as sole long-term food
Unmodified animal milk under 6 months	X
Condensed milk, honey, paps under 6 months	X
Prelacteal feeds	X

Means ledger

Measure	Hands	Hearth	Garden and still	Village dispensary	District infirmary	Hospital before the Fall
Breastfeeding, positioning, night feeds	Yes			Scale for weighing		Lactation consultant
Hand expression	Yes	Clean cup, boiled water				Electric pump
Relactation	Yes, suckling	Cup, boiled vessels		Fine tube for supplementer	Tube supply	Nasogastric tubes, domperidone
Wet-nursing	Yes			Screening by history	Syphilis test if available	HIV, HTLV, hepatitis tests
Flash heating		Glass jar, aluminium pan, fire		Thermometer to check		Holder pasteuriser, milk bank
Home-modified animal milk		Boiled water, sugar, milk animal	Oil	Multivitamin syrup		Formula
Galactagogues		Fenugreek tea	Fenugreek, dates, torbangun	Metoclopramide stock		Domperidone

Harm test

Each remedy against the question: could it kill or maim, and how?

1. Home-modified animal milk made too strong causes hypernatraemic dehydration, fits and death. Made too weak, it starves. The table must be followed exactly, with measured vessels.
2. Unmodified cow's or goat's milk under six months causes the same hypernatraemia, late hypocalcaemic fits, anaemia, and with goat's milk, folate deficiency.
3. Any substitute given from a dirty vessel or with unboiled water causes diarrhoea, which kills fastest in summer.
4. Honey given to an infant can cause botulism.
5. Wet-nursing can pass HIV, HTLV-1, syphilis and other infections from nurse to baby, and syphilis from baby to nurse.
6. Shared expressed milk can carry bacteria if expressed or stored badly.
7. Domperidone above 30 mg a day can cause sudden cardiac death. Metoclopramide and sulpiride can cause depression. Chlorpromazine sedates.
8. Fenugreek can cause allergy, liver injury, low blood sugar and bleeding with warfarin, and its smell can confuse a diagnosis of metabolic disease in the infant.
9. Goat's rue can cause low blood sugar and has lookalikes.
10. Gathering motherless babies in one house historically killed most of them.
11. Pressure on a mother who cannot breastfeed, or who chooses not to wet-nurse, can harm her mental health and must not become coercion [OWNER].

Red flags

Send for the most skilled help in the village, or move the baby up the ladder, when:

1. A baby has fewer than six wet nappies in 24 hours, or dark urine, after the first week.
2. The baby has lost more than 10 per cent of birth weight, or has not regained birth weight by two weeks [VERIFY].
3. The baby is sleepy, will not wake for feeds, or feeds for less than a few minutes every time.
4. The fontanelle is sunken, the mouth dry, or the skin stays tented when pinched.
5. A baby on animal milk becomes irritable, then drowsy, with a doughy skin, which is a sign of hypernatraemia.
6. A baby on animal milk twitches or fits at 5 to 10 days of age (hypocalcaemia).
7. Any diarrhoea in a baby under six months who is not breastfed. Treat as urgent and see MA-07 for rehydration.
8. The baby is constipated, weak, cannot suck or swallow and its head flops after honey or any unusual food (botulism).
9. The mother's breast is red, hot and hard with fever.
10. A wet nurse or donor has open sores, a rash on palms and soles, a persistent cough or weight loss.
11. The mother has died and the baby is under two months old: this is an emergency of hours.

The case against

The strongest objection is that this report asks a great deal of women. Breastfeeding costs the mother time, sleep and food, relactation asks a grieving grandmother to suckle every two hours for weeks, and wet-nursing has a history of poorer women fed on by richer babies while their own died. "Breast is best" was also used to blame mothers when babies died of poverty and dirt.

A second objection is that the mortality figures for not breastfeeding are observational. Babies who were not breastfed were often poorer, sicker, illegitimate, twins or motherless, and Howarth himself noted that hand-fed children in Derby were better housed than breastfed ones. The size of the effect may be overstated. The answer is that the effect is large, consistent across centuries and continents, strongest exactly where hygiene is worst, and has an obvious mechanism, so the direction is not in doubt even if the size is.

A third objection is that the home-modified recipe is offered at all, when emergency guidance does not recommend it under six months. It is included because a village will face babies with no other option, and a correctly made recipe kills fewer than a wrongly made one. It must be taught as the last rung.

A fourth objection is that HIV, HTLV-1 and syphilis cannot be screened after the Fall, so wet-nursing and shared milk carry an unmeasured risk. The answer is in the numbers: the baby given no human milk faces a several-fold higher risk of death within months, which outweighs the risk of late infection for almost every baby.

10-line summary

1. A baby without breast milk in its first two months is several times more likely to die, mostly of diarrhoea.
2. A mother's death in early infancy multiplies her baby's risk of death about 25-fold.
3. The pre-formula substitutes killed mostly through dirty water, dirty vessels and summer heat.
4. Supply follows suckling: 8 to 12 feeds a day, including at night, with no water or dummies.
5. Relactation works in about four in five women, including grandmothers and adoptive mothers, without drugs.
6. Wet-nursing is the next best food after the mother's own milk and should go first to the youngest babies.
7. Flash heating makes expressed donor milk safe from HIV and bacteria with a jar, a pan and fire.
8. Home-modified animal milk is the last resort: 2 parts milk, 1 part boiled water, sugar, exactly measured.
9. Never honey, condensed milk, paps or undiluted animal milk under six months.
10. Feed by open cup, boil every vessel, and never gather orphaned babies together.

Open questions

1. What dilution and additions make mare's, donkey's or camel's milk safe for young infants? I found no tested recipe.
2. What safe storage times apply to expressed milk in a cool larder, cellar or spring house without a refrigerator?
3. How much vegetable oil, and of what kind, should be added to home-modified milk? WHO 2006 was not read directly.
4. Does flash heating behave the same in steel, clay or cast-iron pots, and with volumes other than 50 mL?
5. What fine tubes can be made or salvaged for supplementers, and how long do they last with boiling?
6. How should the village balance a wet nurse's own baby's needs against a nursling's?
7. What are the precise Dublin hand-fed survival figures that Fildes reported?
8. How common was cross-nursing among the Efe and among other forager peoples, and how was it organised?

Sources to read in full

1. Fildes V. Breasts, Bottles and Babies: A History of Infant Feeding (Edinburgh University Press 1986), and Fildes V. Wet Nursing: A History from Antiquity to the Present (Blackwell 1988). Not read.
2. Knodel J. Demographic Behavior in the Past (Cambridge University Press 1988). Not read.
3. WHO 1998 relactation review, English edition, with the original Seema, Abejide, Nemba and Banapurmath papers.
4. WHO 2006 guidance on home-modified animal milk for replacement feeding.
5. Woodbury 1925, already open at FRASER, for its tables by feeding and month.
6. Sherwood 2010 for the full wet-nursing and syphilis record.
7. Tronick, Morelli and Winn 1987 on Efe multiple caretaking.
8. Israel-Ballard 2007 in full, and later flash-heat field studies.

At the bedside after the Fall

A mother has died, and her baby is three weeks old. The midwife does not reach for the goat. She asks which women are nursing now. A woman with a healthy four-month-old and no sores or rash agrees to feed the baby, who is at her breast within the hour. The dead mother's sister, who weaned her own child last spring, agrees to try relactation.

The sister suckles the baby every two hours, day and night, while milk the wet nurse expresses twice a day is flash-heated and fed through a fine tube taped to the sister's nipple. The midwife weighs the baby weekly and counts wet cloths. After ten days the sister has drops of milk, and after a month the baby feeds from her alone.

In another house a five-month-old has lost his mother and no nursing woman can be found. The midwife teaches the father the 2:1 cow's milk with measured cups, boiled water and an open cup, and visits every second day until the baby reaches six months and the foods of MA-07.

Protocols

Protocol 1. The baby with no milk: the ladder 1. Mother alive: keep or restart her own milk (Protocol 2). Supplement only while it builds. 2. Mother dead, absent or unable: a nursing woman at the breast within hours. Youngest babies first. 3. No wet nurse able to suckle: expressed milk from any lactating woman, flash-heated (Protocol 4), by cup (Protocol 6). 4. At the same time: a willing woman in the household starts induced lactation (Protocol 2). 5. Only when 1 to 4 fail, home-modified animal milk (Protocol 5), still with any human milk to be had. 6. From 6 months: whole animal milk within a mixed diet (MA-07). 7. Rung notes: hands for 1 and 2, hearth for 3 to 5, dispensary for scale and multivitamin, infirmary for syphilis testing where held.

Protocol 2. Relactation and induced lactation (WHO 1998, Amat Camacho 2023) 1. Suckle 8 to 10 or more times in 24 hours, about every 2 hours, at night too, both breasts, 10 to 15 minutes each side [VERIFY]. 2.

Supplement while suckling, by supplementer or after the breast by cup. Start at 150 mL per kg per day, divided over the feeds. 3. As milk comes, cut the supplement by about 50 mL a day every few days. Never cut while wet nappies are under 6 a day or weight is falling. 4. No dummy, no bottle. 5. Expect milk in 2 to 15 days, exclusive feeding in 3 to 30 days. Never-lactated or long-gap women may need 4 to 6 weeks. 6. Drugs only if 2 weeks of suckling have failed, and only where stock exists: metoclopramide 10 mg three times a day for no more than 2 weeks (WHO 1998). Domperidone no more than 10 mg three times a day (LactMed) [VERIFY]. 7. Check weekly: gain at least 125 g a week or 500 g a month.

Protocol 3. Hand expression and storage 1. Wash hands. Boil the cup 20 minutes beforehand and let it cool covered. 2. Express as in section 3, both breasts, about 20 to 30 minutes per session, at least 8 sessions in 24 hours for a separated mother [VERIFY for minutes]. 3. Cover and label with the time. Room up to 25 °C: use within 4 hours. Refrigerator: 4 days. Freezer: 6 months, 12 at most. Leftover after a feed: discard within 2 hours. 4. Warm by standing the cup in warm water. Never boil it.

Protocol 4. Flash heating (Israel-Ballard 2005, 2007) 1. Glass jar, uncovered, holding 50 mL of expressed milk. 2. Stand it in a small aluminium pan holding 450 mL of water (about one quart pan). 3. Heat over a strong flame until the water reaches a full rolling boil. 4. Lift the jar out at once. Cool to body warmth. Cover. 5. Use within the room-temperature limit of Protocol 3. 6. Do not change the jar, volume or pan without testing with a thermometer: the milk must stay above 56 °C for about 6 minutes and peak near 73 °C. 7. Not needed for a mother's own milk for her own baby.

Protocol 5. Home-modified animal milk, last resort under 6 months 1. Whole fresh cow's or goat's milk from a trusted, undiluted source. Never condensed, never skimmed. 2. Boil water at a rolling boil (HY-02), cool covered. 3. Measure with marked vessels: milk and water 2 to 1, sugar as in the table in section 8 (4 to 10 g per feed). Sheep or buffalo milk: 1 to 1, 5 g sugar per 100 mL. 4. Bring the mix just to the boil, cool covered, feed within the hour, discard any leftover after 2 hours at most. 5. Add any multivitamin syrup held, and give human milk for any feeds that can be had. 6. Never stronger, never weaker. Never honey. 7. Visit every 2 days. Weigh weekly. Watch for the red flags.

Protocol 6. Cup feeding and cleaning 1. Baby upright, awake, wrapped with hands free. 2. Small open cup, half full, rim resting on the lower lip. 3. Tip so milk touches the lip. Let the baby lap or sip. Never pour. 4. Stop when the baby closes its mouth or turns away. 5. After each feed: wash cup, spoon and tube in hot soapy water, rinse, boil 20 minutes, dry covered. 6. Never use a bottle, teat, horn or spouted vessel.

Protocol 7. Choosing a wet nurse 1. Lactating now, own baby thriving and over 2 weeks old, own baby fed first. 2. No sores on mouth, breasts or genitals, no rash on palms and soles, no persistent cough, no weight loss, no jaundice. 3. Ask about past illness of husband and children. Test for syphilis, HIV and hepatitis if the infirmary can. 4. Not ill now. Not taking drugs the dispensary marks as unsafe in lactation. 5. Willing. Never coerced. 6. Her food ration raised for as long as she nurses [OWNER]. 7. Record who nursed whom for milk-kinship rules [OWNER]. 8. Payment, duties and how a dispute is settled agreed before she starts [OWNER].

Numbers to carry

- Exclusive breastfeeding to 6 months. Feeds 8 to 12 times in 24 hours.
- Adequate: 6 or more wet nappies a day, at least 125 g a week, 500 g a month.
- Supplement while relactating: 150 mL per kg per day, cut by about 50 mL every few days.
- Relactation: milk at 2 to 15 days, exclusive at 3 to 30 days, about 4 in 5 succeed.
- Not breastfed in first 2 months: about 6 times the infection death rate.
- Mother dead at 2 to 5 months: about 25 times the death rate.
- Expressed milk: 4 hours room, 4 days cold, 2 hours after a feed starts.
- Flash heat: 50 mL in jar, 450 mL water, to rolling boil, remove.

- Home-modified milk: 2 milk to 1 water, 4 g sugar per 60 mL, 150 mL per kg per day [VERIFY].
- Boil vessels 20 minutes. Boil water at a rolling boil.
- No honey under 12 months. No animal milk alone under 6 months.
- Domperidone never above 30 mg a day.

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