

Challenging the Maligning of Homemade Human Milk Substitutes During a Shortage of Commercial Formula



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ABSTRACT

Infant formula (human milk substitutes) has been commercialized and capitalized in such a way that during times of shortages, families unable to offer human milk struggle to provide for their infant's needs. A thoughtfully designed and safely prepared homemade recipe may meet the needs of families struggling to access commercial products. Analysis of a simple recipe indicates that it appears to be of greater nutritional value than the emergency formula suggested by the World Health Organization. Naturopathic doctors play a key role in empowering parents to provide safe and reliable nutrition for infants. As a profession, we have a great responsibility to advocate for the decommodification of food in order to promote food security and sovereignty, ensuring that people of all ages, including infants, have access to the most appropriate food for their health.

Key Words Human milk substitute, breastmilk, food supply

The principles of naturopathic medicine instruct us to understand and address the underlying cause of disease and dysfunction. This includes not only looking at the physical, emotional, and spiritual influences on the individual human experience of health, but also investigating the social and ecological determinants of health, advocating for necessary change when these present obstacles to well-being. During and subsequent to the COVID-19 pandemic, there was a shortage of infant formula across North America, which threatened the health and well-being of our youngest community members. In this article, we interrogate the political and corporate drivers of the commercial formula monopoly and its consequences.

Naturopathic doctors are poised to play a pivotal role in such crises. There is a gaping absence of reliable information to share with patients when neither human milk nor commercial formula is readily available. While this is a perspective piece, in order to demonstrate the opportunities this offers, we present a case in which an infant's health was threatened when her caregiver was unable to provide human milk, was unwilling to use commercial formula, and lacked reliable guidance for making a substitute herself. Provision of a homemade recipe resulted in the infant's health improving. We conducted a nutritional analysis of a homemade recipe similar to what was recommended in this case and compared it with a common commercial formula option, an approximation of human milk, a World Health Organization (WHO) emergency formula, and the recommended dietary allowances for infants in the United States. We conclude that appropriately prepared homemade milk substitutes may fill a critical gap in infant nutrition, particularly in emergency situations.

It is imperative that, in our desire to educate and serve our communities, we make space for the multitude of reasons why parents may choose to feed their infant a human milk substitute. This decision is deeply seated in social and cultural values, closely tied to impacts of poverty and privilege (which are themselves created and perpetuated by political and corporate influences), and ultimately a private and very individual choice for each parent to make—one that naturopathic doctors have an obligation to support. Naturopathic doctors have a role to play in continuing to encourage and support breastfeeding,* while also advising on other safe and effective strategies of feeding infants in various circumstances. We provide strategies by which naturopathic doctors might engage effectively with patients under their care.

This article focuses on the United States and Canada. However, the impact of pharmaceutical formula marketing around the world has played a significant role in the morbidity and mortality of innumerable infants, not only due to situational supply chain breakdown.¹

THE BUSINESS OF FORMULA: CAUSES AND CONSEQUENCES

In order to make meaningful change, it is important to explore the historical context in which formula became a staple in infant nutrition and the drivers of the global infant feeding crisis. Substitutes

* We are using the term "breastfeeding" to mean both breast- and chestfeeding, a term sometimes preferred by individuals who are not women (e.g., trans men) and who feed their infants from their bodies. Similarly, we use the term "human milk" rather than "breast milk."

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for human milk have always been essential, in cases such as parental death or inability to breastfeed. Because the nutritional profiles of animal milks vary considerably from human milk, their exclusive use is not appropriate as a substitute.¹ In some cultures, wet nurses played a role in feeding infants—often at the expense of their own children.² Commercial formulas are—in theory—a nutritionally effective and accessible option. However, the marketing of commercial infant formulas has played a direct role in reducing rates of breastfeeding in North America and around the world, compromising the health of infants and breastfeeding parents while putting profit in the pockets of corporations and their shareholders.³

Cow milk became the basis of the first commercial infant formula, created by Justin von Liebig in 1865. By 1970, widespread availability of commercial formula, paired with strong marketing campaigns and cultural shifts associated with the feminist movement, resulted in an increase in the use of commercial formula. This resulted in a corresponding decrease in breastfeeding rates in North America.³ A 2022 report from the World Health Organization (WHO) reveals that the global formula industry is currently valued at US\$55 billion.⁴ Pervasive marketing methods significantly influence choices parents make with respect to feeding their babies, largely through reinforcing misinterpretations and false information,⁵ undermining parents' confidence in themselves and their ability to breastfeed. When breastfeeding dyads become dependent on formula, the positive feedback mechanism essential to human milk production is halted. In 1981, the World Health Assembly developed “The International Code of Marketing of Breast-Milk Substitutes” to stop aggressive and inappropriate marketing of formula and ensure breastfeeding is encouraged.⁶

Although commercial human milk substitutes are not considered drugs (i.e., products do not require a Drug Identification Number), they are regulated by the Food and Drug Administration (US) and Food and Drug Regulations (Canada). Commercial formula is manufactured in laboratories; it is not food. Ideally, it is used only in rare situations in which human milk is not available. Commercial formulas are convenient because they are *pre-formulated*, theoretically ensuring that the baby is getting macro and micro-nutrients in an appropriate amount. They are designed to approximate human milk as closely as possible, an impossible task given human milk's dynamic and individualized nature.¹ In addition, commercial formulas do not offer the myriad other benefits that human milk and the breastfeeding process provide for the lifelong health of children and those who feed their infants from their bodies, as well as communities as a whole.^{7,8} The health of infants dependent on formula in lower-income settings is threatened when commercial formula is unaffordable or unavailable, or the water used to prepare it is contaminated.⁹ Many commercial formulas also contribute significantly to broader animal cruelty and climate destruction through industrial farming of dairy cows (with its impact on deforestation, methane production, and antibiotic resistance), monoculturing of genetically-modified soy, and the destruction of critical tropical habitat for the extraction of palm oil.^{10,11}

The authors emphasize that the pharmaceutical industry is to blame for these harms, emphatically *not* the families that turn to formula to feed their infants with the best of intentions. Formula

manufacturing and marketing is big business, and its primary purpose is to create profit, not support good health.¹²

The combination of the COVID-19 worldwide pandemic, ongoing climate breakdown, and numerous human conflicts around the globe resulted in a general breakdown of food supply chains. This, combined with recalls of several infant formula products due to poor manufacturing practices, led to shortages of infant formulas in North American markets in 2022.¹³ We saw the latest consequence of the commodification of infant nutrition: when there is a shortage of formula, babies go hungry, particularly those already made vulnerable by socioeconomic systems that include racism, heterocis patriarchy, misogyny, and capitalism.^{14,15}

Parents are advised to feed infants up to 6 months of age human milk exclusively, or commercial milk substitute (i.e., formula). However, the only guidance that healthcare organizations provide parents who are not able to fully satisfy their infant's nutritional needs during a crisis is to keep looking.¹⁶⁻¹⁸ Not only does this put the onus for solving a public health problem on already overwhelmed parents, it perpetuates the corporate commodification of child feeding. Some parents resort to diluting the commercial formulas they can find, which can result in delayed growth and development due to insufficient calories or nutritional imbalances. Milk banks can be difficult to access, and many are understocked. Some parents may seek human milk through social media platforms, which can pose a risk of infection transmission since these sources cannot be screened as would those at a milk bank.

Parents may also seek recipes online, which is strongly discouraged by the conventional medical community due to concerns that raw materials may be contaminated, that they may lack essential nutrients, or that they will be unsafely prepared or stored.^{19,20} A scan of the peer-reviewed literature reveals extremely limited information on the subject, and that which is available describes only harms.^{21,22} This may be in part due to publication bias associated with commercial interests, or the fear of liability associated with publishing such literature. In fact, concern about bias in the literature surrounding commercial formula (or “breastmilk substitutes”) is such that a recent Delphi study was undertaken to create guidelines around the scientific and ethical conduct of such studies.²³ Unfortunately, clinical decisions and medical research (or lack thereof) driven by fear of liability can lead to devastating gaps in medical care and can result in even greater harm for patients who are left to make uninformed decisions without the support of their doctor. A harm-reduction approach, conversely, can allow for pragmatic conversations with patients regarding the risks, benefits, and research available.²⁴ It prompts clinicians to take the time to understand the motivations behind decisions and build a meaningful therapeutic alliance in order to allow for incremental health-promoting behaviour change. Nuanced conversations such as these are not possible when a provider is crippled by a fear of liability, or when reliable scientific data is unavailable.

AN ILLUSTRATIVE CASE

As healthcare providers with expertise in nutrition, naturopathic doctors are well equipped to provide nutritional guidance in

situations where neither human milk nor commercial formulas are readily available. This is an important role and potentially fills a critical gap, as the case study below illustrates.

A 3-week-old infant was brought to the clinic by her legal guardian to establish primary care. The patient had been exposed to benzodiazepines *in utero*, which could have contributed to the infant being small for gestational age (4th percentile for weight and 6th for length). The physical exam was otherwise unremarkable, and a heel stick for a standard newborn metabolic screening was performed. A comprehensive feeding history revealed that the child had received human milk for the first 5 days of life, at which point she was removed from her mother's care and placed with her guardian. From the infant's 5th day of life on, she had been fed exclusively goat's milk pasteurized at home, as the guardian was fearful about the highly processed ingredients in commercial formula and wished to offer an alternative. The guardian was educated about the dangers associated with nutrient deficiencies associated with pure goat's milk supplementation for infants and strongly encouraged to switch to a commercially available infant formula, which she verbally agreed to do. The infant was brought back to the clinic approximately one month later with a concern about seizure-like episodes. The infant was afebrile and appeared healthy in the clinic. When questioned about feeding, the guardian disclosed that she had continued to feed the infant goat's milk only. Results from the newborn screening subsequently revealed organic acidemia. A consult with the neurology and pediatric metabolic departments at a local hospital suggested that the seizure-like activity and acidemia were both likely due to a deficiency of folic acid.

Although motivated to change the infant's food, the guardian was still reluctant to use conventional formula and didn't have access to human milk. She was, however, willing to try a homemade formula. She was provided with a recipe that included store-bought pasteurized goat's milk, lactose powder, folic acid, iron, and flax or fish oil. Within 2 weeks, bloodwork revealed that the previous acidemia had resolved and seizure-like activity had decreased in frequency and duration. The infant was followed for approximately 1 month, over which time the seizures eventually stopped, and then the patient was lost to follow-up.

This case is an example of a situation that had potentially dangerous implications resulting from a poorly assumed "black-or-white" approach to infant feeding; the caregiver agreed to change her approach to appease the provider, when in reality no behaviour change was made. Taking a harm-reduction approach on follow-up and offering a homemade alternative, an option that aligned with the caregiver's values, made her willing to modify her behaviour. Ultimately, both the caregiver and medical provider were able to provide the care the infant needed, and she received the nourishment required for her to survive.

CREATING AN EMERGENCY HOME-MADE INFANT FORMULA

The World Health Organization (WHO) offers some hard-to-find guidance for infant feeding in emergencies.²⁵ It is clear from a quick glance that the basic ingredients ($\frac{1}{2}$ cup of boiled water,

$\frac{2}{3}$ cup of boiled milk, and 5 mL of sugar), although likely easy to access, only provide adequate *macronutrients*, and are not suitable for longer-term use. Despite the fact that there would be major micronutrient gaps in this simple formula, the WHO is the only medical institution that has been willing to publicly take a harm-reduction approach to offering families in crisis an alternative to a starving infant. We argue that there is a great nutritional distance between the WHO emergency formula and the tightly regulated commercial milk substitute which is staunchly insisted on in all other circumstances.

We sought to create a recipe that caregivers could easily make at home for short-term situations in which human milk and commercial formula were unavailable (Table 1). Our process was iterative; we started with a recipe that has been mentioned in the naturopathic literature and, using the FoodData Central database,²⁶ modified it to meet, as closely as possible, the nutritional profile of a commercial formula commonly available in Canada.²⁷

We also analyzed the WHO emergency recipe and offered some comparison with the nutritional profile of human milk (Table 2).^{28,29} It is important to note that the nutritional profile of any milk expressed from a mammal, including that of humans, is dynamic and unique to the nursing dyad at that moment, as well as the nutritional status of the parent, and environmental and genetic factors. Nutritional assessments are thus approximations.^{1,30,31} We also provide the recommended daily intakes per the United States Department of Agriculture (USDA) for infants under 6 months of age.³²

DISCUSSION

This process was a thought experiment intended to demonstrate that a homemade recipe may be a viable short-term option for emergency situations. It appears to be of greater nutritional value than the formula suggested by the WHO, with comparable excesses of protein, phosphorus, calcium, and potassium (as well as vitamin A) beyond what is recommended for daily intake. For example, excess nutritional calcium in infants can result in problematic hypercalcemia.³⁴ The extra phosphorus that this recipe

TABLE 1 Homemade human milk substitute recipe

Batch recipe to be kept in the fridge until consumed. Please refer to Table 2 for guidance on determining appropriate daily volume.
2.5 cups pasteurized goat milk
1.5 cups filtered water
1 tsp flax seed oil
0.25 tsp cod liver oil (ideally third-party tested for contaminants)
3 tbsp blackstrap molasses
1 tbsp sunflower oil
Per daily preparation, add:
400 mcg folate (ideally methylated)
400 IU/10 mcg cholecalciferol (vitamin D)
100 mcg liquid iodine
75 mg ascorbic acid powder
450 mg magnesium

TABLE 2 Nutritional comparison of human milk, commercial formula, homemade substitute, and WHO emergency recipe; USDA RDI standards for a 4.75 kg infant provided as comparison; volumes of milk and substitutes reflect 475 kcal.

	USDA RDI for 4.5 kg infant	Human milk per 698 mL	Commercial substitute per 712.50 mL	Homemade substitute per 608 mL	WHO recipe per 1016 mL
Energy (kcal)	4.75*				
Protein (g)	9.10	6.98	9.43	12.76	22.36
% of total energy	-	0.06	0.08	0.11	0.19
Carbohydrate (g)	60.00	46.67	53.10	38.92	48.72
% of total energy	-	0.39	0.45	0.33	0.41
Fat (g)	31.00	29.67	25.15	30.57	21.83
% of total energy	-	0.56	0.48	0.58	0.41
Minerals					
Calcium (mg)	200.00	216.74	370.32	480.23	838.78
Phosphorus (mg)	100.00	94.82	202.63	397.99	687.66
Magnesium (mg)	30.00	20.32	377.31	314.57	81.96
Iron (mg)	0.27	0.20	8.52	7.23	0.01
Zinc (mg)	2.00	1.15	4.75	1.08	2.80
Manganese (mg)	0.00	0.00	0.07	0.00	0.00
Copper (mg)	0.20	0.35	0.36	0.16	0.01
Iodine (mg)	0.11	0.00	0.07	0.06	0.00
Selenium (mg)	0.02	0.01	0.01	0.01	0.01
Sodium (mg)	110.00	115.14	127.17	249.66	259.30
Potassium (mg)	400.00	345.42	510.07	1224.81	1023.45
Chloride (mg)	0.18	0.00	300.45	0.00	0.00
Vitamins					
Vitamin A (mcg)	400.00	413.15	419.24	402.40	218.32
Vitamin D (mcg)	10.00	0.68	7.16	12.17	7.49
Vitamin E (mcg)	4000.00	541.84	6319.97	5066.67	341.04
Vitamin K (mcg)	0.00	2.03	42.62	1.74	2.05
Vitamin C (mg)	40.00	33.87	56.60	48.71	0.00
Thiamine (mg)	0.20	0.07	0.38	0.17	0.38
Riboflavin (mg)	0.30	0.35	0.66	0.49	0.94
Niacin (mg)	2.00	1.20	4.75	0.99	0.42
Pantothenic Acid (mg)	1.70	1.26	2.38	0.44	1.01
Vitamin B6 (mg)	0.10	0.07	0.29	0.16	0.00
Folic Acid (mcg)	65.00	33.87	75.46	238.52	0.00
Vitamin B12 (mcg)	0.40	0.34	1.40	0.25	3.69
Choline (mg)	125.00	108.37	113.19	57.30	121.32

USDA: United States Department of Agriculture; RDI: recommended daily intake.

*Caloric requirement for infants is appropriate to age (a proxy for velocity of growth) and weight: A simple estimate is 100 cal/kg/day.³³

provides may compensate for that impact, although hyperphosphatemia is also potentially a burden to the kidneys, which may also be strained by the high amount of protein provided by this recipe.³⁵ Potassium is also eliminated via renal mechanisms; if this system is already strained, the excess potassium in this recipe could lead to hyperkalemia if used for extended periods of time.³⁶

Because we have not clinically tested this recipe, it is impossible to fully assess the benefits and risks associated with it, or the long-term health implications. The infant in the cited case was also lost to follow-up. However, the resolution of seizure-like activity

suggests that acute micronutrient deficiencies had been addressed. It is important to emphasize that a recipe such as the one analyzed here is to be used only in emergency situations, as opposed to being a viable long-term alternative to breastfeeding or the use of a commercial infant formula. There is an opportunity to conduct further research in order to adjust and evaluate the recipe for longer-term use.

As in all naturopathic care, clinicians are encouraged to engage in collaborative partnership with patients, which includes independent critical analysis of available options and appropriate

discussion of risks and benefits relevant to the individual family. Ideally, we encourage parents to breastfeed as much as possible through breastfeeding-friendly strategies, which include countering the pervasive propaganda of formula companies.³⁷ We also are well-positioned to discuss options for human milk substitution, including in a crisis.

Both harm reduction²⁴ and motivational interviewing³⁸ frameworks offer principles and strategies (including empowerment, self-efficacy, empathy, pragmatism and individualism) to support caregivers in making the safest and most appropriate feeding decision for their infant. Vaccine hesitancy is a parallel challenge for those working with children and families in practice; the most successful approaches for supporting patients in making the best decision for their family involve non-confrontational and open discussions built on trust and respect.³⁹

As this manuscript was being prepared, an interesting parallel piece was published in *The New Yorker* which offered very similar critiques of the socio/economic/political influences on infant feeding and the drivers of the recent formula shortage.⁴⁰ The solution being explored therein was that offered by the biotech industry in the form of laboratory generated “milk components.” While scientifically fascinating, this only serves to perpetuate the structures of oppression and inequity that drove the formula crisis in the first place. Those who already benefit from structural privilege—who have higher health literacy, economic position, access to resources, ability to navigate infrastructure—will find it easier to access formula, donated human milk, or “Biomilk” during a crisis. The same privilege will also make it easier for some to access the ingredients and time to safely prepare an emergency recipe. Additional research on this topic is desperately needed to further investigate and validate recipes that are accessible, available and acceptable to people and places around the world. As with all recommendations, it behooves naturopathic doctors to be mindful of the individual circumstances of families and ensure that they are able to compassionately and competently provide the support required to implement recommendations.

CONCLUSION

As naturopathic doctors, we educate, empower, and trust parents to care for and meet their infants’ myriad needs. Ensuring safe and reliable nutrition should be no different. To optimize lifelong health, we have a responsibility to contribute to the collective efforts to support access to human milk, actively counter the harmful messaging of commercial formula companies, and provide non-judgemental support for families who find themselves choosing to use a commercial product. In the context of emergencies, such as food supply chain challenges, a thoughtfully designed and safely prepared homemade recipe may meet the needs of families struggling to find commercial products. The recipe analyzed here appears to be of greater nutritional value than the emergency formula suggested by the WHO, with comparable excesses of protein, phosphorus, calcium, and potassium. As a profession, we have a great responsibility to advocate for the decommodification of food in order to promote

food security and sovereignty, ensuring that people of all ages, including infants, have access to the most appropriate food for their health.

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