Title: There is no iron in human milk

James Friel PhD
Departments of Human Nutritional Sciences and Pediatrics
University of Manitoba
Winnipeg, Canada
R3T 6C5
Phone; 204-474-8682
FAX: 204-474-7553
e-mail: James.Friel@umanitoba.ca

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Author : James K Friel

Authors’ affiliations: Department of Human Nutritional Sciences, University of
Manitoba, Winnipeg, Canada.
R 203, Richardson Centre for Functional Foods and Nutraceuticals
196 Innovation Drive, Winnipeg, MB R3T 6C5 Canada
Phone No.: (204) 474-8682
Fax No.: (204) 474-7552
E-mail: james.friel@ad.umanitoba.ca
Iron stores in the full term healthy newborn infant are assumed to last 4-6 months (1). Elegant calculations by Dewey (2) and Ziegler (3) suggest that newborn infant iron stores suffice for growth to 6 months. Both studies did not analyze tissue iron content directly but were based on the findings and assumptions of others. With the assumption that iron stores are sufficient, and with the small contribution from mother’s milk, it is believed that the needs for growth are met (1, 4).

Human breast milk has very little iron (0.4mg/L) (5). Since breast milk is designed for humans by humans we assume what is in breast milk is optimal for developing infants. Thus while the small amount of iron in human milk is acknowledged to be low, the amount present must in some way be sufficient and different than other forms of iron in the body for which we would never assume such low quantities to be sufficient. Indeed breast milk is “a special form” of iron often stated to be “highly bioavailable” (2). To support this thinking, Lonnerdal has shown the presence of a receptor in the infant gut specifically for lactoferrin-iron (6).

This research perspective is shaped by public health policy where every attempt is made to justify exclusive breast-feeding in all infants for 6 months. While controversial (7), this is a laudable goal. However, to claim that human milk iron is sufficient to 6 months for all breast fed infants is stretching the evidence.

Cai et al (8) have shown that the only known membrane iron transporter is not present in human mammary epithelial cells. Thus mammary cells do not appear to secrete iron into mother’s milk. This is in keeping with the accepted dogma that body iron levels are controlled by absorption not excretion (9). The very low content of iron in human milk can be accounted for by the adventitious iron content of the cells that make up
human milk. Intracellular iron content of breast cancer epithelial cells is approximately 2.5 pg/cell (10). Total cell number in early human milk (1-3 month) is approximately 23 x 10^4 – 26 x 10^4 cell/mL, in which the dominant cells are epithelial cells when the mothers are healthy (11). The total intracellular iron content of human milk is estimated to be 0.58-0.65 mg/L. The total iron content in human milk between one to three months is about 0.27-0.45 mg/L (5). Thus intracellular iron accounts for a large proportion if not all of the total iron content in human milk. Evolutionarily this makes sense. Iron is by mass the most common element on Earth and is widely available. Increased hygiene has lowered our exposure to dirt and other sources of iron only recently (12, 13).

The assumption that iron stores are adequate for 6 months can result in unnecessarily withholding iron rich solid foods from some infants who, at 4 months of age, would benefit from earlier introduction of iron rich solids (14). There is a greater risk of iron deficiency anemia developing in these infants the longer the period of exclusive breastfeeding is continued (1). Indeed, this author has never seen a table of iron rich foods that includes human milk.

Nonetheless, every attempt has been made to justify the almost non-existent levels of iron in human milk as beneficial. It is as if low iron levels are simply a matter of ignorance on the part of researchers who just haven’t figured out yet how iron works. We dare not suggest human milk alone does not meet infant iron needs as this would undermine breastfeeding. We attempt one more study, search for yet another elusive molecule/receptor, to justify why human milk must have the right amount of iron. Our rationale includes allowing (assumed) iron stores to deplete before repleting them. For no other nutrient at any time in the cycle do we use such reasoning.
If we reframe the discussion around the concept that breast milk does not contain iron, alternate perspectives to infant feeding are possible: a) some, if not many, infants would benefit from consumption of iron rich foods earlier than 6 months and reduce the incidence of potentially harmful iron deficiency (14); b) The debate on when to start solid foods (14) might soften (i.e.) feed the infant solid foods when all the cues say they are ready rather than hanging on until the prescribed 6 months; c) Iron drops at 4 months of age as recommended by the AAP (15) may be a more acceptable adjunct to exclusive breast-feeding particularly in vulnerable subsets of infants rather than be seen as the introduction of a new risk factor (2); d) Even with earlier introduction of solids or the use of iron drops, breast-feeding itself remains the optimal choice and is not undermined. Certainly the use of vitamin D supplementation is and was controversial, but the use of it has not stopped breast-feeding.

This author thinks the field should move forward. We need to reflect on the best way to meet iron needs of exclusively breast-fed infants who are at risk as much from our unfounded beliefs as they are from delayed feeding of iron rich complementary foods.
References:


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