Iron-Rich Complementary Foods: Imperative for All Infants

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ABSTRACT

Nearly 1 in 5 (18%) infants in the United States is not consuming sufficient iron. A deficiency of iron during early life may be associated with long-term neurodevelopmental consequence(s). The 2020–2025 Dietary Guidelines for Americans (DGA) are the first DGA to address recommendations for children under 2 y of age. The 2020 Dietary Guidelines Advisory Committee scientific report includes food-group combinations emphasizing iron-rich foods for 6–12-mo-old infants, but these examples did not meet criteria to establish DGA recommended dietary patterns; consequently, iron-rich dietary patterns for ages 6–12 mo are not provided in the 2020–2025 DGA. The 2020–2025 DGA encourage iron-rich foods by 6 mo of age while emphasizing the importance “particularly for infants fed human milk.” Early feeding transitions are dynamic and milk feeding groups are rarely static or exclusive such that emphasizing milk feeding groups may become confusing. Risk-to-benefit favors iron-rich complementary feeding for all infants. Curr Dev Nutr 2021;5:nzab117.

Keywords: infants, older infants, complementary feeding, dietary guidelines, infant formula, breast milk, human milk, heme iron, nonheme iron, iron deficiency

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Introduction

Nutritional surveys, such as the Feeding Infants and Toddlers Study (FITS) and NHANES, show that among 6–12-mo-olds, iron intake is low and has fallen over the past two decades (1, 2). With iron needed to support development of the nervous system, erythropoiesis, and other critical aspects of growth and development, iron requirements for 6–12-mo-old infants are the highest in life, at 1 mg/kg per day (3). Iron deficiency is the most common nutritional deficiency among children in developing countries (4). In the United States, the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) was established in 1975 to address iron insufficiency and other nutrient concerns among those at risk for poor nutrition (5). Today, over half the newborns in the United States are WIC eligible due to poverty or nutritional risk (6); yet, despite recent revisions to the WIC feeding package, data show that nearly 1 in 5 US infants is still consuming insufficient iron in their diets (7). The American Academy of Pediatrics has noted that a deficiency of iron during the first 1000 days of life may be associated with long-term neurodevelopmental consequence(s) (8).

The 2020–2025 Dietary Guidelines for Americans (DGA) is the first edition of the DGA to directly address food and nutrient needs from birth to 24 mo (9). To address this critical dietary period, the 2020 Dietary Guidelines Advisory Committee (DGAC) relied on 3 approaches to evidence analysis including data analysis, food pattern modeling, and systematic review (SR) conducted by the Nutrition Evidence Systematic Review (NESR) team of the USDA (10). The conclusions of a NESR SR suggest that consuming iron-rich complementary foods will support the micronutrient status of those infants, especially those exclusively breast-fed or with known iron insufficiency (11). Specifically, NESR concluded that “Strong evidence suggests that consuming complementary foods and beverages that contain substantial amounts of iron, such as meats or iron-fortified cereal, helps maintain adequate iron status or prevent iron deficiency during the first year of life among infants with insufficient iron stores or breastfed infants who are not receiving adequate iron from another source. However, the benefit of these types of complementary foods and beverages for infants with sufficient iron stores, such as those consuming iron-fortified infant formula, is less evident” (11). Evidence from the NESR SR informed the DGAC scientific report and the 2020–2025 DGA, which also emphasize iron-rich complementary food...
intake "particularly for human milk fed infants" (not defined further as exclusively breastfed or ever breastfed), noting in one instance that "Infants receiving most of their milk feeds as iron fortified infant formula are likely to need less iron from complementary foods beginning at 6 months of age" [Table 1; (11)]. While true, the statement does not offer practical guidance.

Far from being dichotomous, milk feeding in the United States represents a continuum between exclusive breastfeeding and exclusive formula feeding, with most US infants consuming a mixed pattern that is continually shifting throughout the initial 12 mo of life (12, 13). Clear guidance regarding the importance of iron-rich foods during complementary feeding is necessary for all older infants and young children. In fact, the European Society for Paediatric Gastroenterology, Hepatology, and Nutrition European (ESPGHAN) notes, "Although there are theoretical reasons why different complementary foods may have particular benefits for breast-fed or formula-fed infants, attempts to devise and implement separate recommendations for breast-fed and formula-fed infants are likely to be confusing and is therefore not recommended" (14). Instead, the ESPGHAN Committee on Nutrition recommended that "From the age of 6 months, all infants and toddlers should receive iron-rich (complementary) foods, including meat products and/or iron-fortified foods. Unmodified cow milk should not be fed as the main milk drink to infants before the age of 12 months and intake should be limited to <500 mL/day in toddlers. It is important to ensure that this dietary advice reaches high-risk groups such as socioeconomically disadvantaged families and immigrant families" (14).

While the DGAC scientific report provides example combinations of complementary foods emphasizing iron-rich first foods for all infants between 6 and 12 mo of age (Table 2), these combinations were not incorporated into the 2020–2025 DGA due to dietary pattern modeling constraints.

Exclusive breastfeeding rates in the United States are estimated at 47% at 3 mo and 25% at 6 mo, with the majority of breastfed infants in the United States supplemented with iron-containing infant formula (12). The NESR SR conclusion of strong evidence supporting iron-rich complementary foods for "infants with insufficient iron stores or breastfed infants who are not receiving adequate iron from another source" considered findings of studies enrolling "exclusively" breastfed infants (15–19). Importantly, however, in most of these studies (16, 18, 19) up to 50% of participants began formula supplementation during the course of the study.
Iron-rich complementary feeding

TABLE 2  Example intake amounts of iron-rich complementary foods for older infants provided in the 2020 Dietary Guidelines Advisory Committee Scientific Report

| Food group identifier | Age group | Intake recommendation (ounce equivalents)—2020 DGAC scientific report |
|-----------------------|-----------|--------------------------------------------------|
| Meats3                | 6–9 mo    | 4.66 –16 (per week)4                             |
| Poultry               | 6–9 mo    | 0.5–1.25 (per week)                              |
| Fortified infant cereals | 6–9 mo | 0.5 (per day)                                    |
| Meats                 | 9–12 mo   | 8.5–15.5 (per week)                              |
| Poultry               | 9–12 mo   | 1 (per week)                                     |
| Fortified infant cereals | 9–12 mo | 0.5 (per day)                                    |

1Data from reference (10). DGAC, Dietary Guidelines Advisory Committee.
2The DGAC report makes the following note: “Total protein foods includes a majority from meats rather than poultry because meat has higher iron content than poultry.”
3“Meats” in the DGAC report is considered as red meat.
4“When a range is shown, the lower amounts generally correspond to the lower energy levels and/or a higher proportion of energy from human milk, and the higher amounts correspond to the higher energy levels and/or a lower proportion of energy from human milk.” (10)

of the trial, initiated anywhere from enrollment at 4 mo of age to periods within complementary feeding. Two of these studies (16, 18) reported no significant between-group differences for measures of iron status. The NESR SR further concluded that the benefit of iron-rich complementary foods to infants fed iron-fortified formulas is “less evident,” but only 1 study in the NESR SR evidence base randomly assigned exclusively formula fed infants to high or low iron from complementary foods and considered iron status (20).

Additional evidence considered by the DGAC was provided by NHANES data from 2007–2014 (n = 988 infants), which finds that “human milk fed infants” (n = 141; milk feeding group not specified, but assumed exclusive) are at highest risk for iron inadequacy, with 77% of these US infants under 1 y failing to meet the Estimated Average Requirement (EAR) (21). NHANES data further suggest that “less than 7% of infants in the formula and mixed-fed group have total dietary intakes of iron less than the EAR (all dietary sources, not including dietary supplements)” (10) and “infants who do not have compromised iron stores or who receive fortified infant formula with iron likely have adequate intakes or may have intakes that approach or exceed the Tolerable Upper Intake Level (UL)” (10). Importantly, however, these same data estimate that 19% of all US infants under 1 y of age, nearly 750,000 infants annually (22), fail to meet the EAR for iron. These data are supported by the ongoing FITS with FITS 2016 data indicating that iron intakes among older infants (6–11.9 mo of age; n = 902) have been on a declining trajectory since 2002 (23). FITS results indicate that this decline is due to a 30% decrease in consumption of iron-fortified cereal from 2002 to 2016 and a shift away from intake of iron-rich red meat such as beef and pork (23), noting that “the types of meats consumed were not iron-rich sources, like turkey, chicken or processed meats.” (24). In fact, findings from the 2016 FITS indicate that chicken or turkey was the most popular meat (consumed by 17% of infants) between 6 and 11.9 mo followed by processed meat (hotdogs, cold cuts, sausages) consumed by 7.0% of infants, as compared to 2.5% of infants consuming beef or 1.6% consuming pork (23). Declining intake of iron-fortified cereal may be exacerbated by guidance to decrease exposure to arsenic in rice and rice products (25). FITS researchers note, however, that “if the decline of infant cereal, a key source of iron for infants, is not replaced with other bioavailable sources of iron in the diet, lower consumption of infant cereal could contribute to inadequate iron intakes” (25).

The decline in iron-rich foods during complementary feeding has also been attributed to an “increased focus on preventing excessive energy intake and increasing fruit and vegetable intake in the wake of the childhood obesity epidemic” (24). Consequently, 12% of older infants participating in FITS consumed less than the EAR for iron in 2008. By 2016, the percentage was estimated to be 18% of older infants failing to meet the EAR (23). Evidence is lacking from biomarkers or clinical health indicators as “serum ferritin is not measured as part of national nutrition monitoring for children younger than age 12 months” (10), making estimates of iron adequacy (inadequate or sufficient) for the entire US infant population unreliable.

Despite the assumption that infants receiving iron-fortified infant formula are likely to have adequate iron intake, based on an 11-mg estimated requirement and fortification of infant formula at 10–12 mg/L, iron sufficiency is not guaranteed. Iron absorption varies due to many factors, including milk source of iron (e.g., human vs. cow), iron compound consumed (e.g., ferrous sulfate vs. pyrophosphate), foods eaten at the same time, and iron status of the infant (26, 27). While greater than 50% of iron from human milk is absorbed, generally less than 12% of iron is absorbed from infant formula (26). Iron from meat sources is better absorbed than iron from nonmeat sources (26). Infants with poorer iron status or in negative iron balance absorb a higher percentage of dietary iron (26). Larger dietary doses are also necessary when conditions that promote iron losses (e.g., inflammation, chronic disease, occult gastrointestinal bleeding associated with exposure to cow milk protein, food allergies, or infectious agents) are considered (26, 27). A recent study by Abrams et al. (28), using data from FITS, reported that daily iron absorption was below the recommended amount in 54.3% of 6–24-mo-old infants and ranged from 19.5% in exclusively formula-fed infants, to 95.8% in exclusively breastfed infants, with 72.2% in mixed-fed infants. The calculated mean iron absorption of 6- to 9-mo-old breastfed infants was lower than the estimated physiologic requirement (i.e., 0.27 mg/d vs. 0.69 mg/d, respectively). The authors concluded that “rates of low absorbed iron indicate that all infants may need monitoring for clinical evidence of low iron status” (28).
Concerns regarding excess intake from the combination of iron-fortified infant formula and iron-rich complementary foods are likely misplaced. The daily need for iron in the 6–12-mo age range is 11 mg, while the UL for iron is 40 mg (29), representing considerable latitude. The risks of iron supplementation in infants who are already iron-sufficient have been reviewed and include limitations of growth, higher risk of infections (malaria), interference with zinc absorption, and possibly delayed cognitive development (3, 26). However, these issues have been attributed almost exclusively to medicinal iron supplementation where a spike in free iron following medical iron occurs, which is not seen with dietary iron (30). Adverse effects from consumption of iron-fortified foods consumed along with iron-containing infant formulas appear to be unlikely (26). In fact, the DGAC scientific report includes a summary of estimated iron from combinations of complementary foods and beverages with and without 0.5 ounces of fortified infant cereal for infants fed varying combinations of human milk and formula. This analysis found the highest estimated intake of iron to be 19.9 mg at 6 to 9 mo, which is half the 40 mg UL for iron (31).

Why Recommend Red Meat as a Primary Source of Iron during Complementary Feeding?

The DGAC scientific report provides approximate amounts of food groups and subgroups in example combinations of complementary foods and beverages for ages 6 to 12 mo (10). These example combinations provide a range of intakes anchored on estimated human-milk and/or energy intake and emphasize more servings of red meat (Text Box 1) than any other food group, with allowance for up to 16 ounces of red meat per week during complementary feeding (Table 2).

Text Box 1
What is Red Meat?
“Red meat” is referred to as mammalian meat, most commonly noted as beef, pork, and lamb. In contrast, “white meat” is inclusive of poultry (muscles from birds) and fish (muscles from aquatic animals). While some consider pork “white meat” due to appearance, pork is red meat.

However, because these example food combinations could not be adequately modeled within the dietary pattern methodologies utilized to create recommended food patterns for the general population, these example food combinations were not included in the 2020–2025 DGA. Thus, while the DGA recommend introducing iron-rich foods to infants starting at about 6 mo old (Table 1), no guidance regarding specific intake amounts or distribution of iron-rich first foods for 6–12-mo-old infants could be provided. Lack of specific guidance may have implications for iron sufficiency. Animal and plant proteins are not interchangeable with regard to iron bioavailability, and meat currently makes up little of the complementary diet of American infants. Heme iron from red meat (i.e., beef, pork) is estimated to be 25% bioavailable, while that found in iron-fortified cereal-based foods is estimated to be 10% bioavailable (32). High-quality protein, iron, zinc, and other nutrients from red meat strengthen a balanced diet and complement the nutrients found in plant foods, while enhancing the absorption of nutrients, including nonheme iron from plant foods (32).

To compensate for the limited bioavailability of iron and other micronutrients in plant foods, the National Academy of Medicine Committee on Micronutrients recommends that vegetarians consume 1.8 times the daily iron compared with those consuming meat (29). Despite the endorsement of vegetarian diets as healthful for infants and young children (33), a recent systematic review of vegetarian diets in children found insufficient evidence “to draw firm conclusions on the health benefits or risks of present-day vegetarian type diets on the nutritional or health status of children and adolescents in industrialized countries” (34). With regard to iron, the systematic review found that iron deficiency was reported in more than half of studies of vegetarian children and other studies reported lower or similar biomarkers of iron status (34). As such, regarding meatless complementary diets, medical experts note that while “a similar intake of most nutrients and protein can be achieved…,” “there is a higher risk of deficiency of individual nutrients, such as iron, zinc and DHA (35). Similarly, with regard to micronutrient status and fruits and vegetables in complementary feeding, NESR found insufficient evidence to determine the relation between these plant-based foods and iron status (11).

With regard to the need to raise awareness among clinicians for the importance of meat in the diet of US children, FITS researchers note that it “is imperative that they emphasize the importance of iron, recognizing the very low intake of iron-rich meats and the declining use of iron-fortified infant cereal among young children in the US as strong reasons to recommend iron-rich and iron-fortified complementary foods” (24). Educating caregivers about the importance of iron-rich foods in complementary feeding is important and can be accomplished by increasing clinician awareness about declining iron intake (24), promoting the American Academy of Pediatrics’ endorsement of meat and other iron-rich foods as an early complementary food (4), and providing clear guidance via the DGA (23).

Conclusions

Given the consequence(s) of insufficient iron during early complementary feeding, food-based dietary guidance that aims to provide specific intake amounts and distribution of iron-rich first foods for 6–12-mo-old infants is justified and necessary. Emphasizing iron-rich foods for infant population subgroups based on milk feeding may lead to confusion and exacerbation of an already concerning public health situation. The preponderance of available literature, and the high benefit versus low risk of iron-rich complementary feeding, supports creating clear, specific, and strong future DGA recommendations for the consumption of iron-rich foods with high bioavailability starting at the first introduction of solid foods, and continuing regularly throughout the complementary feeding time frame.

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References

1. Eldridge AL, Catellier DJ, Hampton JC, Dwyer JT, Bailey RL. Trends in mean nutrient intakes of US infants, toddlers, and young children from 3 Feeding Infants and Toddlers Studies (FITS). J Nutr 2019;149:1230–7.

2. Davis KE, Li X, Adams-Huet B, Sandon L. Infant feeding practices and dietary consumption of US infants and toddlers: National Health and Nutrition Examination Survey (NHANES) 2003-2012. Public Health Nutr 2018;21:711–20.

3. Domellöff M. Iron requirements in infancy. Ann Nutr Metab 2011;59:59–63.

4. Baker RD, Greer FR; Committee on Nutrition, American Academy of Pediatrics. Diagnosis and prevention of iron deficiency and iron-deficiency anemia in infants and young children (0-3 years of age). Pediatrics 2010;126:1040–50.

5. Oliveira V, Racine E, Olmsted J, Gelli LM. The WIC program: background, trends, and issues. Food Assistance and Nutrition Research Report No. 27. Washington, DC: Food and Rural Economics Division, Economic Research Service, US Department of Agriculture; 2002.

6. USDA. Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) [Internet]. [cited 2021 April 6]. Available from: https://www.fns.usda.gov/wic.

7. FHI Solutions. A snapshot of the first 1000 days in America [Internet]. [cited 2021 April 6]. Available from: https://thousanddays.org/resource/snapshot-first-1000-days-americas/.

8. Schwarzenberg SJ, Georgieff MK; Committee on Nutrition. Advocacy for improving nutrition in the first 1000 days to support childhood development and adult health. Pediatrics 2018;141:e20173716.

9. US Department of Agriculture; US Department of Health and Human Services. Dietary guidelines for americans, 2020-2025 [Internet]. 9th ed. 2020. [cited 2021 April 6]. Available from: https://www.dietaryguidelines.gov/.

10. Dietary Guidelines Advisory Committee. Scientific report of the 2020 Dietary Guidelines Advisory Committee: advisory report to the Secretary of Agriculture and the Secretary of Health and Human Services [Internet]. Washington (DC): US Department of Agriculture, Agricultural Research Service; 2020 [cited 2021 April 6]. Available from: https://www.dietaryguidelines.gov/resources/about-process.

11. Obbady JE, English LK, Psota TL, Wong YP, Butte NF, Dewey KG, Fox MK, Greer FR, Krebs NF, Scanlon KS, et al. Complementary feeding and micronutrient status: a systematic review Am J Clin Nutr 2019;109(Suppl 1):852S–71S.

12. Centers for Disease Control and Prevention. Breastfeeding among U.S. children born 2010–2017, CDC National Immunization Survey, 2017 [Internet]. [cited 2021 April 6]. Available from: https://www.cdc.gov/breastfeeding/data/nis_data/results.html.

13. Grummer-Strawn LM, Scanlon KS, Fein SB. Infant feeding and feeding transitions during the first year of life. Pediatrics 2008;122:S36–42.

14. Fewtrell M, Bronsky J, Campoy C, Domellof M, Embleton N, Fidler SJ, Georgieff MK, Jaksic T, Krebs N. Iron fortification of infant formulas. Pediatrics 1999;104:119–22.

15. Ziegler EE, Nelson SE, Jeter JM. Iron status of breastfed infants is improved equally by medicinal iron and iron-fortified cereal. Am J Clin Nutr 2009;90:76–87.

16. Krebs NF, Sherlock LG, Westcott J, Albert NF, Robinson C, Bell M, Hambidge KM. Meat as a first complementary food for breastfed infants: feasibility and impact on zinc intake and status. J Pediatr Gastro Nutr 2006;42:207–14.

17. Krebs NF, Sherlock LG, Westcott J, Culbertson D, Hambidge KM, Feazel LM, Robertson CE, Frank DN. Effects of different complementary feeding regimens on iron status and enteric microbiota in breastfed infants. J Pediatr 2013;163:416–23.

18. Makrides M, Leeson R, Gibson R, Simmer K. A randomized controlled clinical trial of increased dietary iron in breast-fed infants. J Pediatr 1998;133:559–62.

19. Ziegler EE, Nelson SE, Jeter JM. Iron status of breastfed infants is improved equally by medicinal iron and iron-fortified cereal. Am J Clin Nutr 2009;90:76–87.

20. Davidsdottir L, Mackenzie J, Kastenmayer P, Rose A, Golden BE, Aggett PJ, Hurrell RF. Dietary fiber in weaning cereals: a study of the effect on stool characteristics and absorption of energy, nitrogen, and minerals in healthy infants. J Pediatr Gastroenterol Nutr 1996;22(2):167–79.

21. Dietary Guidelines Advisory Committee. Scientific report of the 2020 Dietary Guidelines Advisory Committee: advisory report to the Secretary of Agriculture and the Secretary of Health and Human Services. U.S. Department of Agriculture, Agricultural Research Service, Washington, DC. Iron (mg): mean and percentiles of usual intake from all food and beverages including human milk and infant formula, of infants 6-11 months old by milk reporting status, 2007-2016. Table 4.32 [Internet]. 2020 [cited 2021 April 6]. Available from: https://www.dietaryguidelines.gov/sites/default/files/2020-07/DA_Supplement_FoodGroup_NutrientDistribution.pdf.

22. Martin JA, Hamilton BE, Osterman MJK, Driscoll AK. Births: final data for 2019. National Vital Statistics Reports. Vol. 70, no. 2 [Internet]. Hyattsville (MD): National Center for Health Statistics; 2021. [cited 2021 Sep 2]. Available from: https://doi.org/10.15620/cdc100472.

23. Roess AA, Jacquier EF, Catellier DJ, Carvalho R, Lutes AC, Anater AS, Dietz WH. Food consumption patterns of infants and toddlers: findings from the Feeding Infants and Toddlers Study (FITS) 2016. J Nutr 2018;148:1525S–35S.

24. Finn K, Callen C, Bhatia J, Reidy K, LJ B, Carvalho R. Importance of dietary sources of iron in infants and toddlers: lessons from the FITS study. Nutrients 2017;9:733.

25. Duffy EW, Kay MC, Jacquier EF, Catellier D, Hampton J, Anater AS, Story M. Trends in food consumption patterns of US infants and toddlers from Feeding Infants and Toddlers Studies (FITS) in 2002, 2008, 2016. Nutrient 2019;11:2807.

26. Baker SS, Cochran WJ, Flores CA, Georgieff MK, Jacobson MS, Jaksic T, Krebs N. Iron fortification of infant formulas. Pediatrics 1999;104:119–22.

27. Hurrell R, EglI I. Iron bioavailability and dietary reference values. Am J Clin Nutr 2010;91(5):1461S–7S.

28. Abrams SA, Hampton JC, Finn KL. A substantial proportion of 6-12 month-old infants have calculated daily absorbed iron below recommendations, especially those who are breastfed. J Pediatr 2021;231:36–42.e2.

29. Panel on Micronutrients, Subcommittees on Upper Reference Levels of Nutrients and of Interpretation and Uses of Dietary Reference Intakes, and the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes. Dietary Reference Intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc [Internet]. Washington (DC): National Academy Press; 2001 [cited 2021 April 6]. Available from: https://www.ncbi.nlm.nih.gov/book/INBK222309/.

30. Domellöff M. Benefits and harms of iron supplementation in iron-deficient and iron-sufficient children. Nestle Nutr Workshop Ser Pediatr Program 2010;65:153–62.

31. Dietary Guidelines Advisory Committee. Scientific report of the 2020 Dietary Guidelines Advisory Committee: advisory report to the Secretary of Agriculture and the Secretary of Health and Human Services. U.S. Department of Agriculture, Agricultural Research Service, Washington, DC. Summary of iron and zinc estimates in combinations of complementary foods and beverages without and with 0.5 ounce equivalents of fortified infant cereal for infants fed infant formula at ages 6 to 9 months and 9 to 12 months. Table D7.6 [Internet]. 2020 [cited 2021 April 6]. Available from: https://www.dietaryguidelines.gov/resources/about-process.

32. Domellöff M, Braegger C, Campoy C, Colomb V, Deci T, Fewtrell M, Hojsak I, Mihatsch W, Molgaard C, Shamir R, et al. Iron requirements of infants and toddlers. J Pediatr Gastroenterol Nutr 2014;58:119–29.

33. Melina V, Craig W, Levin S. Position of the Academy of Nutrition and Dietetics: vegetarian diets. J Acad Nutr Diet 2016;116:1970–80.

34. Schurmann S, Kersting M, Alexy U. Vegetarian diets in children: a systematic review. Eur J Nutr 2017;56:1797–817.

35. Prell C, Koletzkö B. Breastfeeding and complementary feeding. Deutsches Ärzteblatt International 2016;113:435–44.