

DECISIONS

Iron deficiency in early childhood

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An 18-month-old girl is seen by her family physician for her 18-month check-up. Her weight and height are at the 50th percentile. She was breastfed in the first year, introduced to complementary (i.e., solid) foods at 6 months and cow's milk at 12 months, and currently drinks 1 L of cow's milk per day by bottle. Her parents describe her as a fussy infant who has never eaten solid foods well and has poor meat and vegetable intake. They ask if she should take a vitamin and mineral supplement.

Is the child at risk for iron deficiency?

As a healthy term infant, this child was born with sufficient iron stores for the first 4 to 6 months. However, at her age, she is at risk for iron deficiency, which peaks in prevalence during the toddler years (1–3 yr).¹ Although there are no nationally representative data, small regional studies suggest a prevalence among young Canadian children of 12% or higher for nonanemic iron deficiency and 1.5% or higher for iron deficiency anemia.² In addition, she has several dietary risk factors (Box 1), including prolonged bottle use, excessive consumption of cow's milk and poor intake of iron-rich complementary foods.^{1,3–5} Should this child have iron deficiency, she would be at risk for poor cognitive development, which has been shown in animal studies, observational studies and randomized trials.^{6,7}

The role of screening and prevention for iron deficiency remains unclear. In a consensus statement, the American Academy of Pediatrics recommends the following: that universal screening be employed to identify anemia at 12 months of age using risk assessment and laboratory tests, that exclusively and partially breastfed infants receive 1 mg elemental iron/kg daily beginning at 4 months of age until iron-containing complementary foods are introduced, and that preterm breastfed infants receive 2 mg elemental iron/kg daily by 1 month of age until weaned to iron-fortified formula or beginning complementary foods.¹ There is no Canadian recommendation for routine screening or iron supplementation.⁸

What investigations, if any, should be ordered?

On clinical examination, this child does not have pallor. However, in a meta-analysis, the diagnostic accuracy of pallor (i.e., conjunctival, palmar or nail bed) was shown to be poor until anemia is severe (i.e., hemoglobin level < 50 g/L).⁹ Considering this child's age and risk factors, laboratory testing, including hemoglobin, serum ferritin and C-reactive protein levels, is indicated.¹ Based on the results (hemoglobin 87 g/L, serum ferritin 6 µg/L and C-reactive protein < 8.0 mg/L), the child has iron-deficiency anemia. In children aged 1–3 years, iron deficiency anemia is defined as a hemoglobin level of less than 110 g/L along with a measure of iron deficiency, such as a serum ferritin level of less than 14 µg/L, whereas nonanemic iron deficiency is defined as iron deficiency with a hemoglobin level of 110 g/L or higher.¹⁰ The American Academy of Pediatrics recommends simultaneously measuring C-reactive protein.¹ If the C-reactive protein level is elevated (> 8.0 mg/L), the serum ferritin level (an acute phase reactant) may be falsely elevated, and thus the laboratory results should be interpreted with caution.¹ Reticulocyte hemoglobin and transferrin receptor 1 are promising new tests of iron status.¹

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Box 1: Risk factors for iron deficiency in early childhood^{1,3–5}

- Prematurity
- Low birth weight
- Infants born to iron-deficient mothers
- Bottle use beyond 12–15 mo
- Exclusive breastfeeding beyond 6 mo
- Longer total breastfeeding duration
- Excessive cow's milk (> 500 mL/d)
- Early introduction of cow's milk (before 12 mo)
- Diet poor in iron-rich complementary foods
- Feeding problems
- Poor growth, including obesity
- Low socioeconomic status

What treatment should the child receive?

A Cochrane systematic review identified 2 randomized placebo-controlled trials of 2 and 4 months duration suggesting improved psychomotor development following iron therapy.⁷ The American Academy of Pediatrics report recommends that children with iron deficiency anemia be given 6 mg/kg/d elemental iron (ferrous fumarate or sulfate), orally as a single dose or divided into 2 or 3 doses, for 4 months.¹ Additionally, the child's parents should receive dietary advice regarding foods that are rich in iron and contain vitamin C, and diet practices that prevent iron deficiency (Box 2).^{1,3-5} For children with non-anemic iron deficiency, dietary advice is recommended;¹ it is not known whether the addition of oral iron is superior to dietary advice alone.

What follow-up is needed?

This child may experience difficulties with adherence because of the poor palatability of oral iron and should be monitored closely. To confirm the diagnosis and ensure adherence, she should have a repeat measurement of hemoglobin and serum ferritin 4 months after treatment is started or earlier if there are concerns about adherence.⁷ She should undergo developmental screening and be referred for developmental assessment if there is evidence of delay.

Case resolution

The child's parents received dietary advice, and she was given oral iron for 4 months. No concerns were identified on developmental screening. Her

parents reported good adherence, improved diet and dietary practices, and improvement in her fussy behaviour. At 4 months after initiation of iron, repeat blood tests showed a hemoglobin level of 112 g/L and serum ferritin level of 32 µg/L. Iron was discontinued. She remained adherent to the dietary recommendations and showed appropriate growth and development. No further blood tests were ordered.

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Box 2: Dietary advice for children aged 12 to 36 months to prevent or treat* iron deficiency^{1,3-5}

Foods rich in iron

- High: meat and eggs
- Medium: meat alternatives (e.g., beans, tofu)
- Lower: grain products (e.g., oatmeal, enriched pasta, enriched rice), vegetables and fruit (e.g., broccoli, spinach, prune juice)

Foods containing vitamin C that increase iron absorption

- Fruits: citrus fruits (e.g., oranges, grapefruit) and juices, tomatoes, cantaloupe, kiwi
- Vegetables: leafy greens (e.g., spinach, cabbage), cauliflower, broccoli, Brussels sprouts, green and red peppers

Dietary practices that prevent iron deficiency

- Limit cow's milk to 2 to 3 cups (500–750 mL) per day
- Limit juice to 1/2 to 3/4 cup (125–175 mL) per day
- Cow's milk, juice and water should be offered from an open cup, and baby bottles should be discontinued when the child is 12–15 months of age or preferably earlier
- Ensure iron-rich and vitamin C-containing foods for infants breastfed beyond 6 months
- Do not give tea, which impairs iron absorption

*Iron deficiency anemia should be treated with oral iron plus dietary advice.

Decisions is a series that focuses on practical evidence-based approaches to common presentations in primary care. The articles address key decisions that a clinician may encounter during initial assessment. The information presented can usually be covered in a typical primary care appointment. Articles should be no longer than 650 words, may include one box, figure or table and should begin with a very brief description (75 words or less) of the clinical situation. The decisions addressed should be presented in the form of questions. A box providing helpful resources for the patient or physician is encouraged.