

# **Iron nutrition for children < 2 years of age: Supplementation is needed in developing countries**

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# Facts

- **In many developed countries, low prevalence of anemia and iron deficiency in children <2 years of age can be attributed to:**
  - **diets that include highly-fortified, commercially marketed cereal products**
  - **diets that include iron-fortified formula**
  - **regular administration of oral supplements containing iron**

# Facts

- **In most areas of developing countries:**
  - **Commercially prepared, fortified, infant cereals are**
    - seldom available or affordable
  - **Fortified infant formula, and “follow-on” formulas are**
    - seldom available or affordable
    - use not recommended (unless medically prescribed).

# Facts

- Children ages 4-24 months need to absorb 0.8 milligrams of iron daily.
- At about 6 months of age,
  - Breastmilk is providing no more than 0.4 mg
  - Iron stores are most likely depleted
- Complementary diets that provide 0.4 mg of iron without commercially fortified are **impractical for families in developing countries.**

# Facts

- Children 6-24 months in developing countries must obtain nutritionally available 0.8 mg iron.
- Practical potential sources are a combination of:

breastmilk (about 0.4mg)

+

complementary foods prepared in the home

+

an oral iron supplement

# Different daily diet models

**Diet 1: Exclusive breastmilk model**

**Diet 2: Developed country model**

breastmilk + non-processed and commercial foods  
(including specially fortified infant cereals).

**Diet 3: Developing country model A:  
(moderately well off family)**

breastmilk + meat + other complementary foods.

**Diet 4: Developing country model B:  
(moderately well off family)**

breastmilk + vegetarian complementary foods

**Diet 5: Less than adequate calorie diet  
(poor families and refugees)**

breastmilk + no meat (providing 80% calorie needs).

# Application of daily diet models

- Age groups to which model diets were applied:
- Four month old infants:
  - Exclusive breastfeeding
  - Exclusive breastfeeding plus an iron supplement
- Six month old infants (models 1,2,3,4,5)
- Nine month old infants (models 1,2,3,4,5)
- 12/24 month old children (models 2,3,4,5)

Foods used in daily diet models

Calorie contributions

# Graphics charts

- **Set A:**

- Shows daily calorie contribution for each model diet for each age group

- breast milk + complementary foods from various food groups

- vegetables, fruit, meat, unfortified cereals and commercially prepared fortified cereals for infants and young children.

- **Set B:**

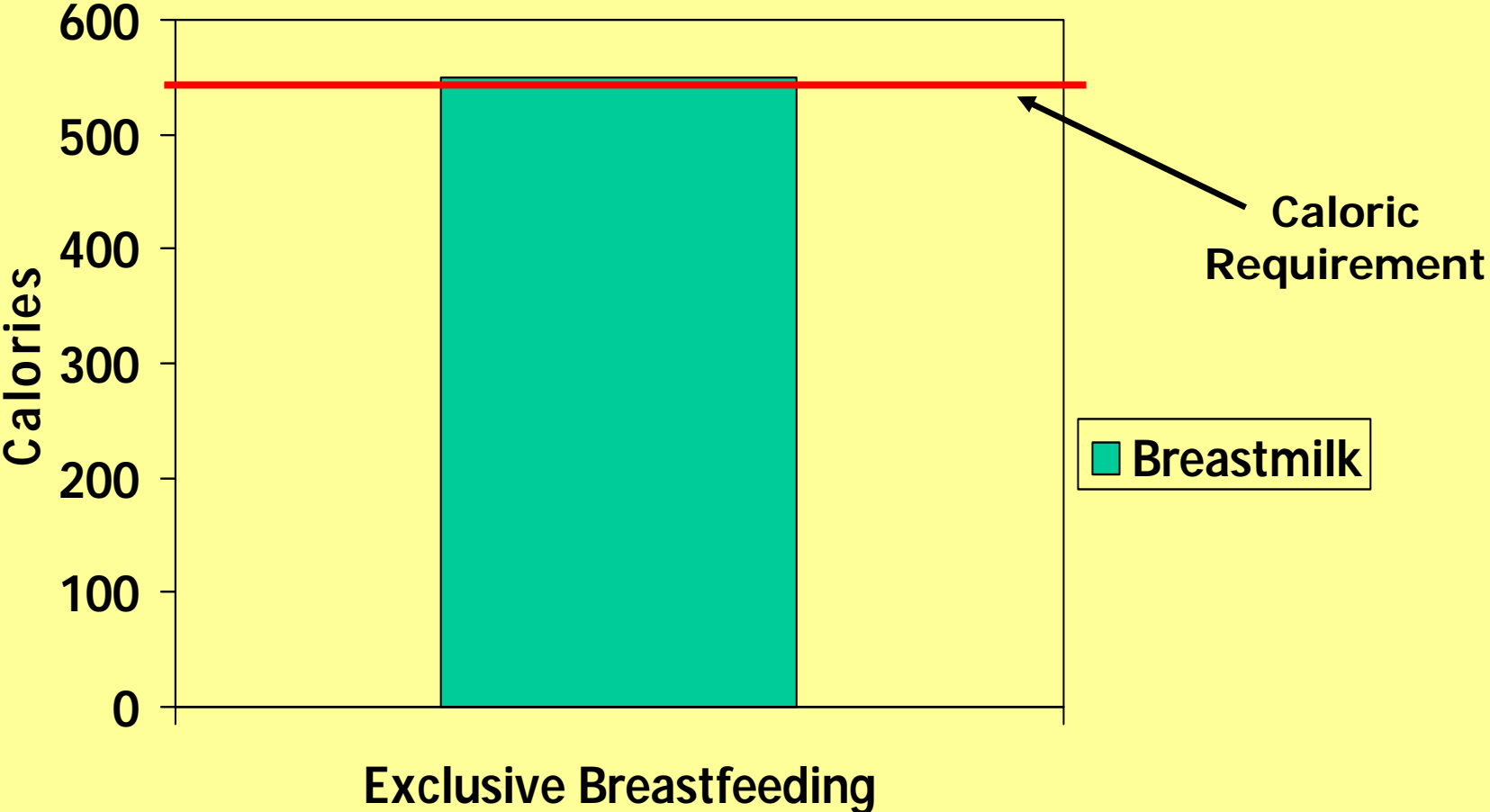
- Shows the absorbed iron from the various diet models as well as the contribution an oral supplement.

# Iron bioavailability in model diets

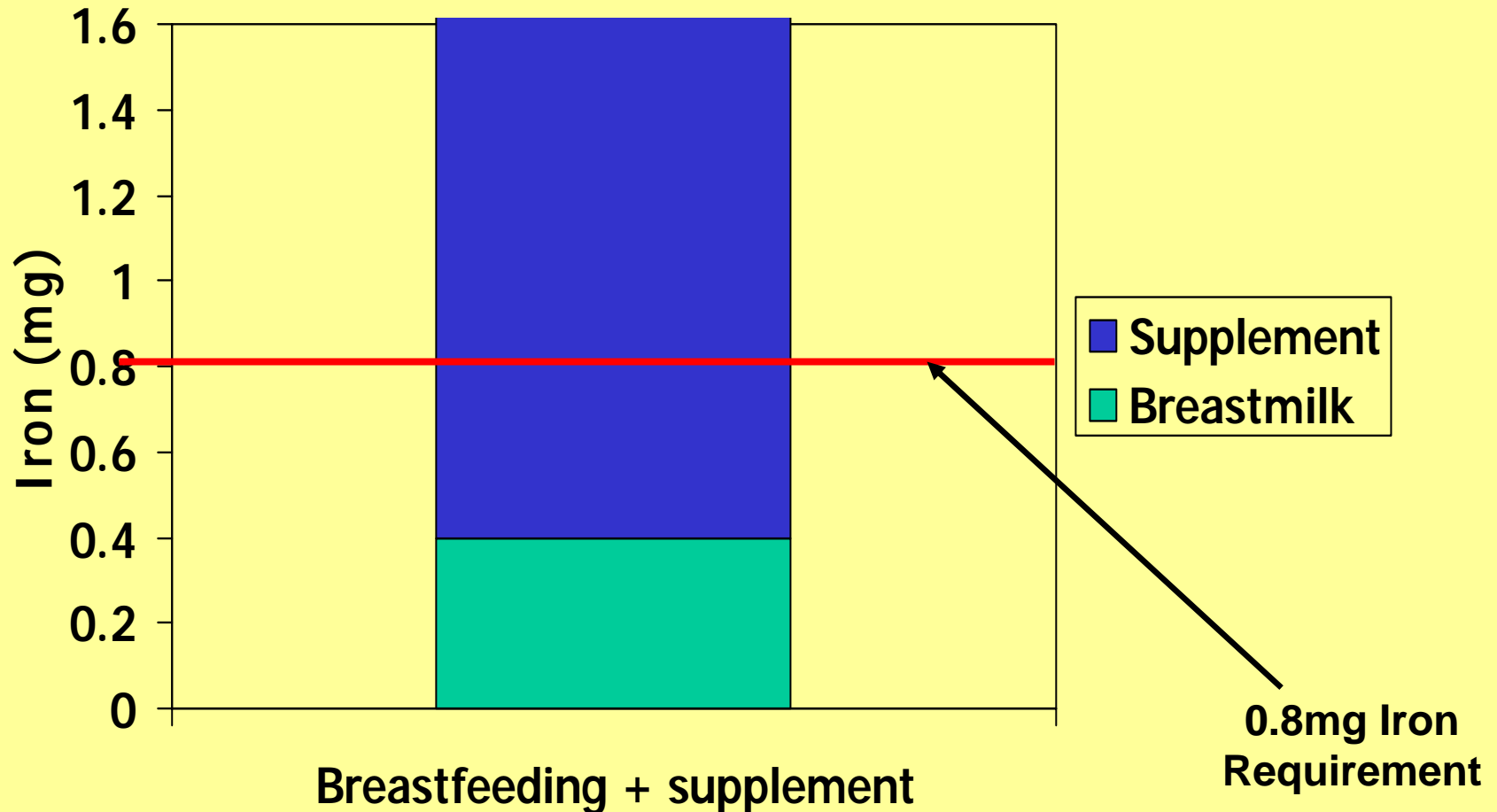
	Breast milk	Fruit	Vegetables	Cereal	Meat
Diet 1	50%	N/A	N/A	N/A	N/A
Diet 2	50%	10%	10%	10%	15%
Diet 3	50%	10%	10%	10%	15%
Diet 4	50%	5%	5%	5%	N/A
Diet 5	50%	5%	5%	5%	N/A

Note: Lentils given absorption rate of 3% due to the high phytate content

# Set A1) Caloric Intake in Four-month Olds

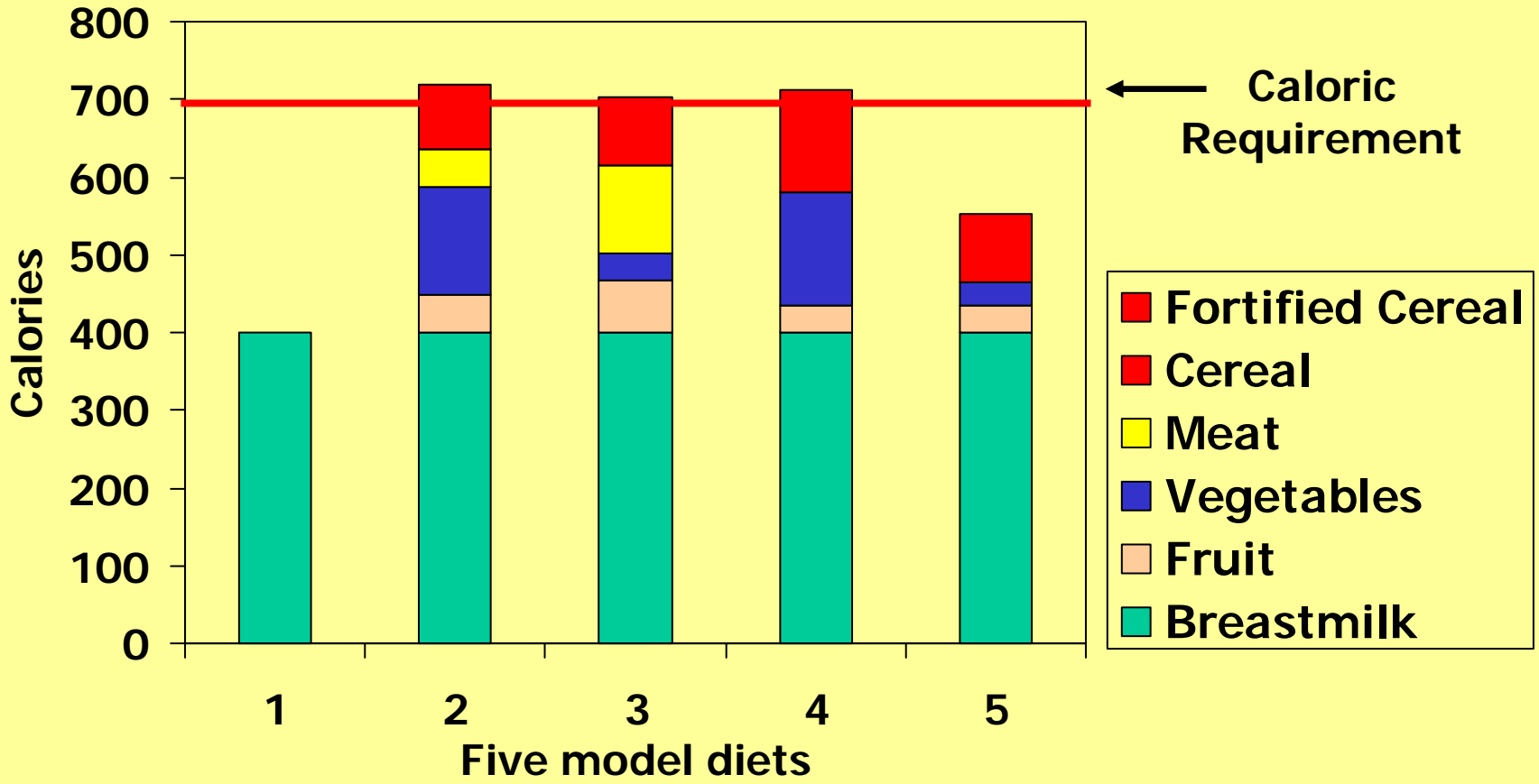


# Set B1) Dietary Intake of Bioavailable Iron in Four-month Olds

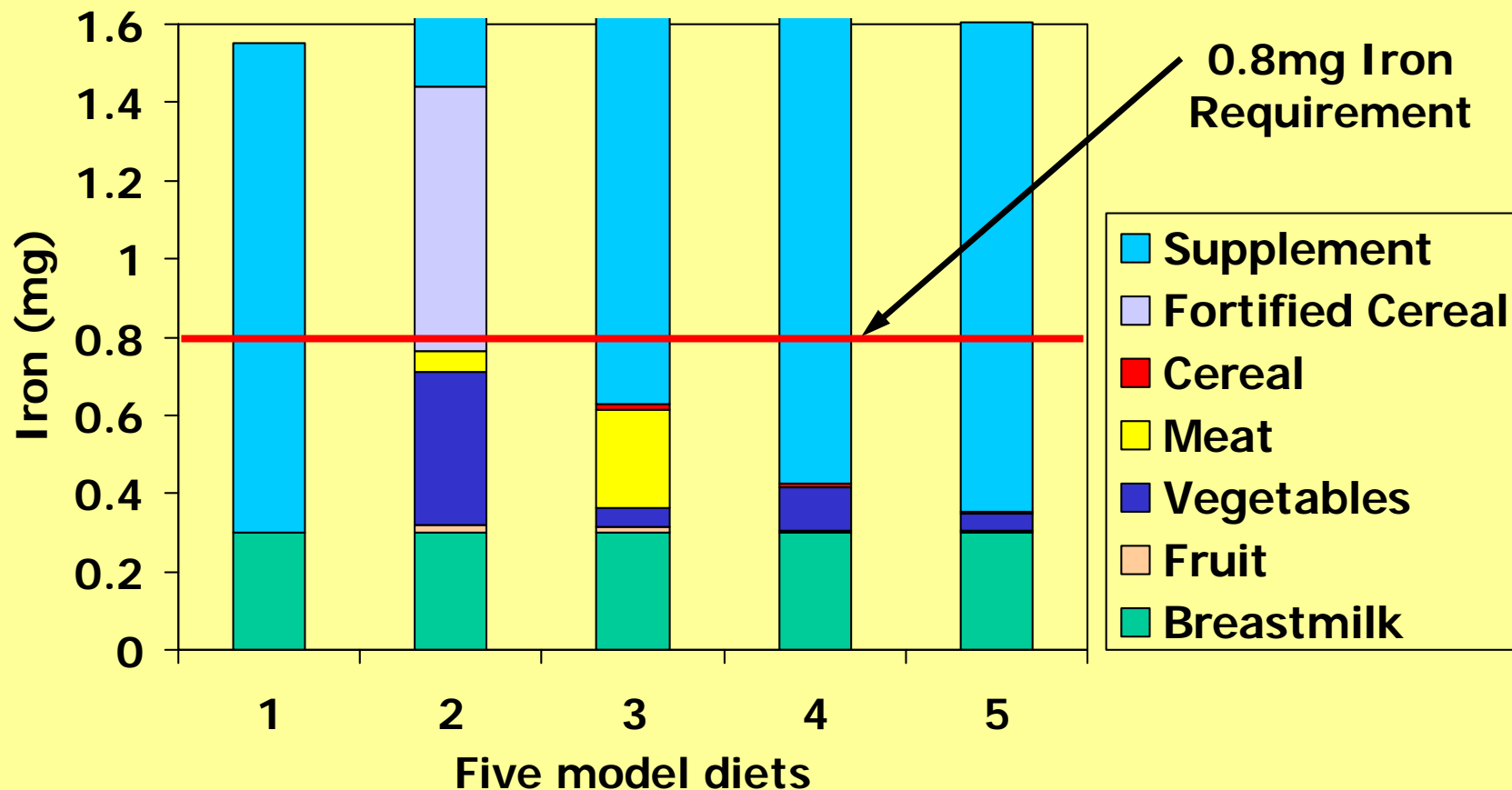


**Note:** Four-month old infants rely on iron stores to supplement the iron from breast milk. This combination, stores and breast milk, generally meets the iron requirements.

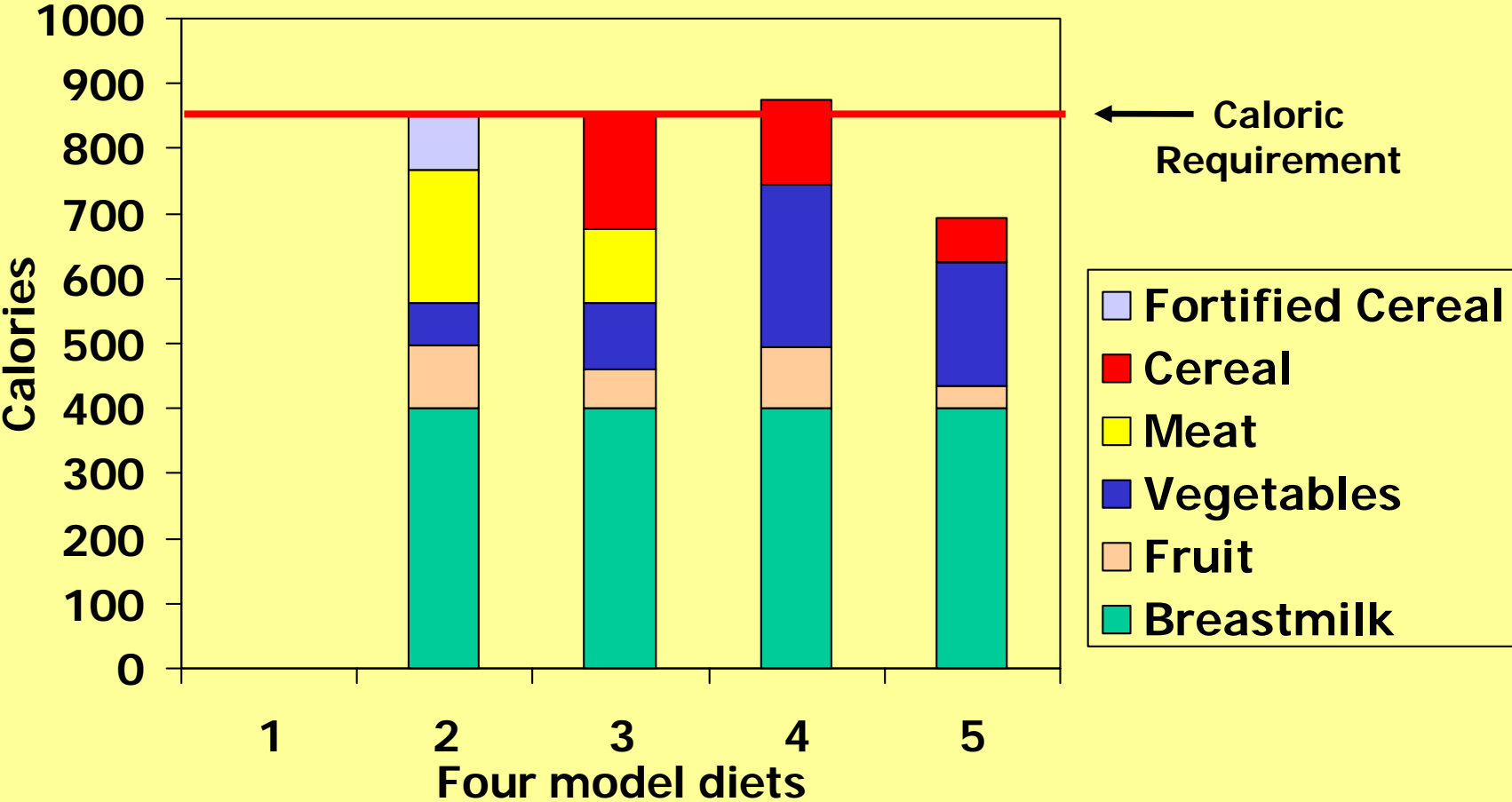
# Set A2) Caloric Intake for Five Model Diets in Six-month Olds



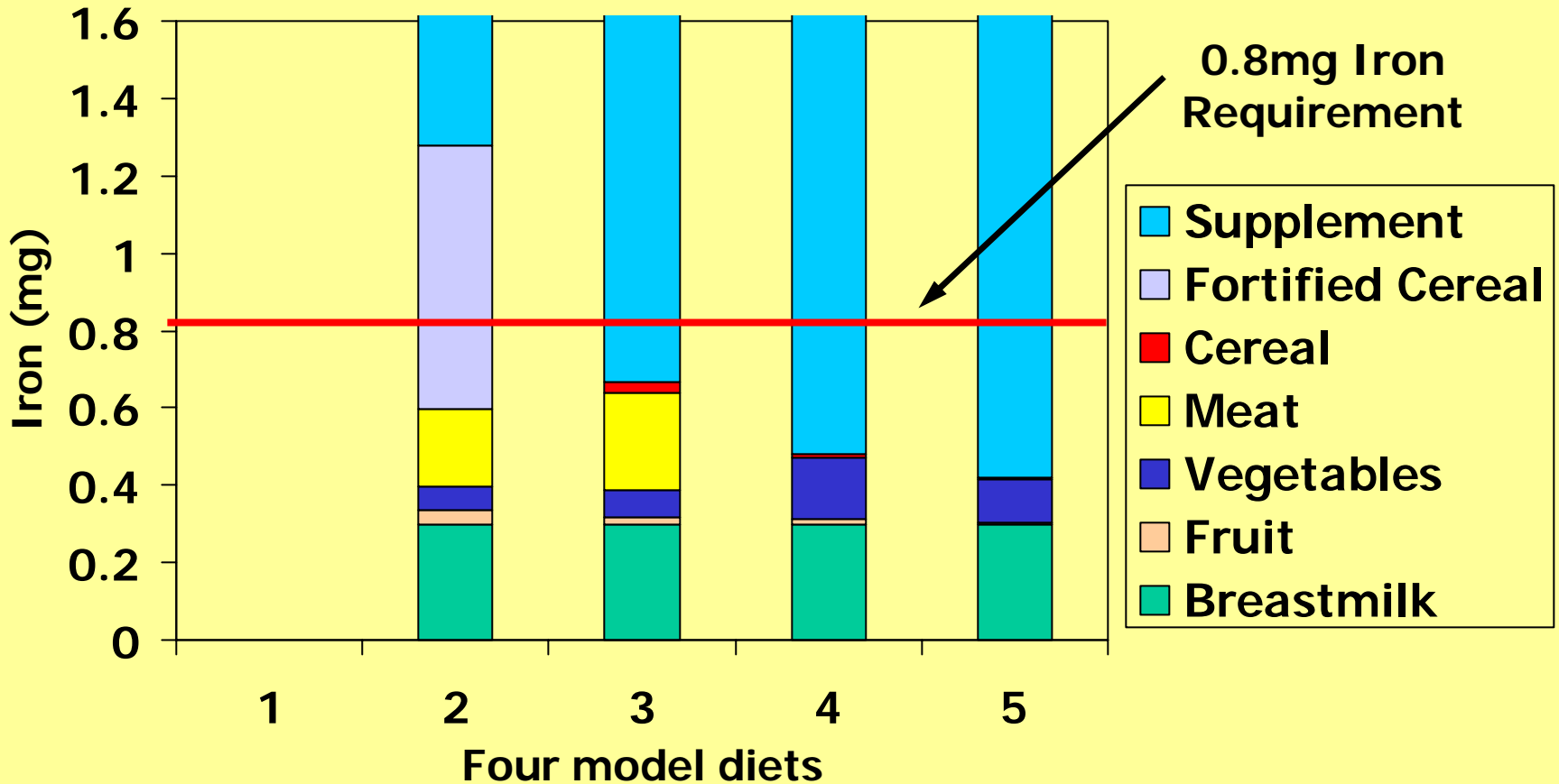
## Set B2) Dietary Intake of Bioavailable Iron for Five Model Diets in Six-month Olds



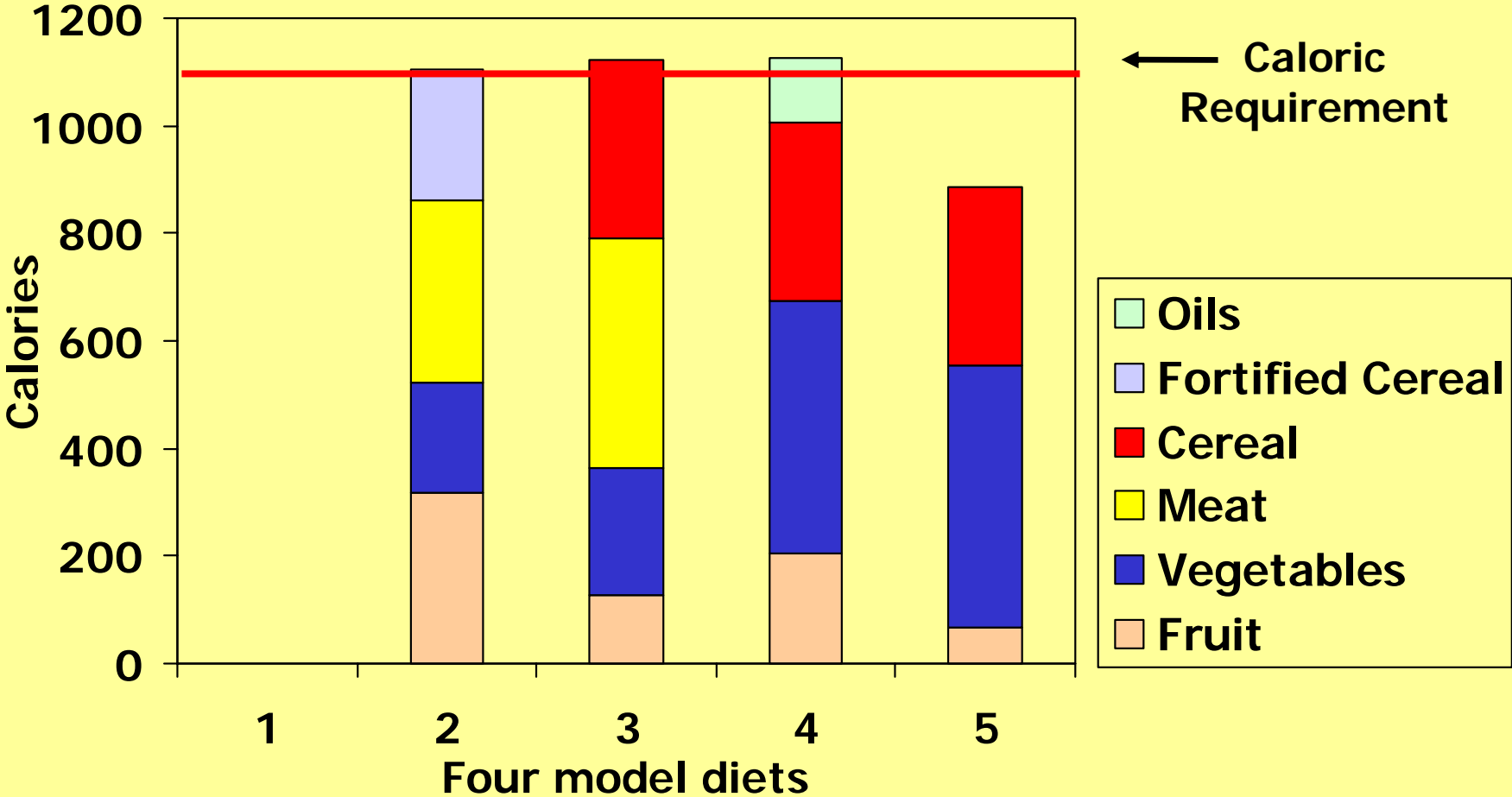
# Set A3) Caloric Intake for Four Model Diets in Nine-month Olds



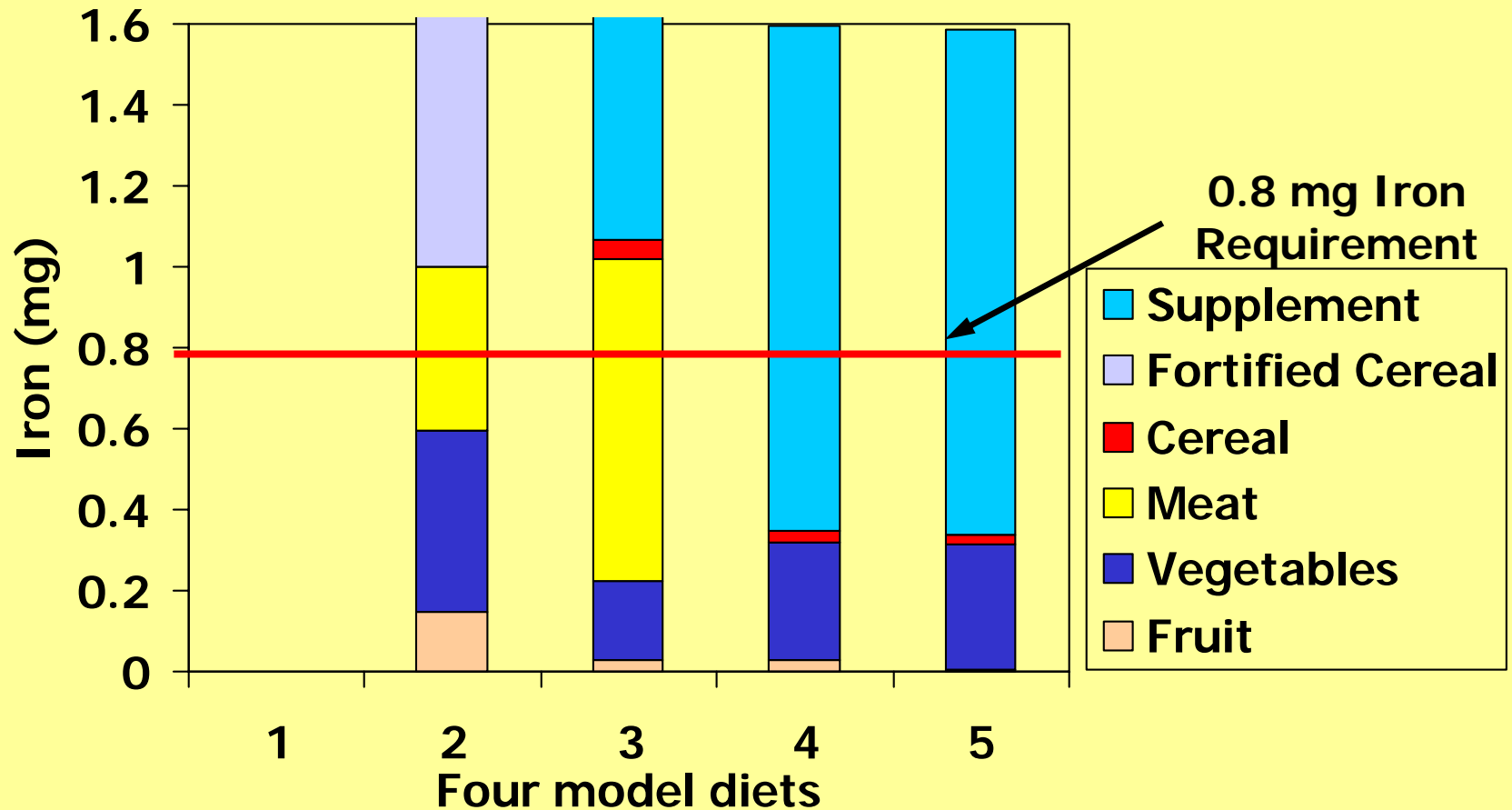
# Set B3) Dietary Intake of Bioavailable Iron for Four Model Diets in Nine-month Olds



# Set A4) Caloric Intake for Four Model Diets in 12/24-month Olds



# Set B4) Dietary Intake of Bioavailable Iron for Four Model Diets in 12/24 month olds



# Conclusions (for discussion)

- **At four months of age:**
  - **normal birth weight, exclusively breastfed children meet their daily iron requirements based on:**
    - iron absorbed from breast milk (about 50% of daily requirements)
    - use of iron stores (based on stores at birth plus stores from hemoglobin circulating at birth).
  - **iron stores for a low birth weight child are lower and unlikely to sufficiently complement iron from breastmilk after 2-3 months of age. For low birth weight babies an additional source of iron (supplement) is needed from two months of age.**

# Conclusions (for discussion)

- **By six-months of Age:**
  - The rapidly growing child has iron needs (0.8mg/day) that can no longer be met by stored iron and that absorbed from breastmilk.
- **Integrated interventions are the best option to meet the iron requirements of a six month old breastfed child.**
- **Three options:**
  - An effective program to deliver or market and promote oral iron supplements.
  - An effective program to deliver or market highly fortified infant cereals.
  - An effective program to deliver or market and promote in-home fortification of complementary foods (sprinkles, foodlets, spreads, etc.).

# Conclusions (for discussion)

- Meeting the iron requirements of a nine month old:
  - An increasing amount of calories from complementary foods does not meet the nine month old infants' iron needs.
- Even the breastfed child requires linked interventions.

## Options:

- An effective program to deliver or market and promote an oral iron or multi micronutrient supplement.
- An effective program to deliver or market highly fortified infant cereals.
- An effective program to deliver or market and promote in-home fortification of complementary foods (sprinkles, foodlets, spreads).
- An effective program to promote a diet of complementary foods with adequate heme-iron (3-5 oz of meat per day).
- Linkage to IMCI, anti-helminthes, Malaria Roll Back programs.

# Conclusions (for discussion)

- Meeting the iron requirements of a 12-24 month old child:
  - Options:
    - A diet of complementary foods rich in heme- iron (3-5 oz of meat per day)
      - or
    - A diet of complementary foods with little meat plus oral iron supplements
      - or
    - A complementary diet with fortified infant cereals

# Conclusions (for discussion)

- Promotion of dietary changes aimed at improving iron nutrition are a key part of all integrated programs to reduce anemia in children < 2 years of age.
- Even successful promotion of dietary changes will not be effective alone in preventing iron deficiency and anemia in children < 2 years of age.
- A breastfed child 6-9 months of age would need a daily diet containing 3-5 ounces of meat or commercially fortified infant cereal to obtain adequate iron.
- Such diets are often unfeasible or unacceptable due to socioeconomic constraints or cultural beliefs and practices.

# Conclusions (for discussion)

- The most effective strategy currently available for decreasing the prevalence of iron deficiency and anemia in children < 2 two years of age in developing countries will be a linked package of interventions. These include:
  - Some form of supplementation (multivitamins with iron, commercial vitamin/mineral drinks, syrups, etc.)
  - or
  - In-home fortification (sprinkles, foodlets, spreads)
  - +
  - Dietary education stressing need for meat and/or other iron rich foods and meals that enhance absorption
  - Community involvement in supplement distribution, family purchase and compliance
  - Fortification of infant cereals (where there is market penetration and families can afford the product)



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# **Models demonstrating daily diets that aim toward providing iron needs for children 4-24 month of age**

- Five models of daily diets show how calorie and iron needs might be met for children 4, 6, 9, and 12-24 months of age based on different socio-economic and cultural factors.**

# Calorie contributions from different foods

- Diet models, 1,2,3, and 4 include similar calorie levels (+/- 25 kcals).
- Each model differs in the calorie contribution from each food group
  - breastmilk amounts remains constant in all models for ages 6 and 9 months.



# Examples of foods used in five model diets

- **Model Diet 1:**
  - **Breast milk**
- **Model Diet 2:**
  - **Highly fortified commercially prepared cereals**
  - **Processed baby food**
    - **Peas, apricots, chicken, beef and noodles, bananas and applesauce**
- **Model Diet 3:**
  - **Beef**
  - **Carrots, sweet potatoes, cassava, squash**
  - **Rice**
  - **Mangos, papayas**



# Examples of foods used in five model diets (2)

- Model Diet 4:
  - Carrots, sweet potatoes, cassava, lentils, squash
  - Rice
  - Mangos, papayas
- Model Diet 5:
  - Carrots, sweet potatoes, cassava, lentils, squash
  - Rice
  - Mangos, papayas



# Calorie and bioavailability estimates

- Calorie needs were based on WHO/UNICEF recommendations on complementary food intake for children 6-24 months.
- Bioavailability estimates were based on FAO/WHO recommendations.
- Three levels of iron bioavailability:
  - low absorption (5%)
  - intermediate absorption (10%)
  - high absorption (15%)

