ENERGY VALUES FOR HUMAN MILK

U.S. and Canadian Human Milk Composition Initiative (HMCI)

Goal of The Human Milk Composition Initiative (HMCI)

Support coordination of the development of human milk composition data in the U.S. and Canada for use by federal policy, program, and other stakeholders.

**Purpose:** To support nutrition and dietary monitoring, guidelines, education, and other policy, programs, and regulations in maternal and child health.

Agenda

- HMCI Overview (Ashley Vargas)
- Historical data sources for energy for human milk (Kellie Casavale)
- New data sources for energy for human milk (Kathryn Hopperton)

HMCI Leadership

- Ashley Vargas, PhD, MPH, RD, *U.S. Coordinator*
- Kimberla Gehrke, MPH, RD, CHES, *Executive Secretary*
- National Institute of Child Health and Human Development, National Institutes of Health

- Kellie Casavale, PhD, RD, *Office of Nutrition and Food Labeling*
- Center for Food Safety and Applied Nutrition, Food and Drug Administration

- Dennis Anderson-Vilikas, MBA, RD, *Office of Disease Prevention and Health Promotion*
- Agricultural Research Service, United States Department of Agriculture

- Sophie Parnel, MSc, RD, *Canadian Coordinator*
- Subhadeep Chakrabarti, PhD
- Kathryn Hopperton, PhD, MSc
- Marie-France Verreault, RD
- Food Directorate, Bureau of Nutritional Sciences, Health Canada
Agenda

- HMCI Overview (Ashley Vargas)
- Historical data sources for energy for human milk (Kellie Casavale)
- Factors influencing the energy content for human milk (Kathryn Hopperton)

Energy Values for Human Milk Used in Current DRIs

Kellie Casavale, PhD, RD
Senior Nutrition Advisor
Office of Nutrition and Food Labeling
Center for Food Safety and Applied Nutrition
Food and Drug Administration, HHS

Background

- DRIs - Infants mostly HM composition from 1970s to early 1990s
  - All AIs and EAR for zinc and iron (with additional considerations for iron)
  - Exception – EAR for protein
  - No AMDRs for infants

Basis for most DRIs for infants

- 75 kcal/100 mL

Used in DRI for Energy - Lactation

- 69 kcal/100 mL

Sources: Dale Debakcsy; Article in print on Jan. 13, 1984, Section D, Page 15 of the National edition with the headline: Icie Macy Hoobler dies at 91; nutrition studies won award

A Pioneer

- Determined the most effective doses of enhancing dairy with vitamin D, which became a staple in the dairy market.
- Studied the effects of HM composition on newborns and elderly persons, and discovered the link between low levels of choline and depression.
- Carried out research on nutrition, including the formulation of diets for infants and children.
- Determined the crucial role of prenatal care in child and mother health.

Sources: Dale Debakcsy; Article in print on Jan. 13, 1984, Section D, Page 15 of the National edition with the headline: Icie Macy Hoobler dies at 91; nutrition studies won award

Icie Macy Hoobler – An Exemplar of Strength and Excellence

1946 Francis P. Garvan Medal
1993 National Academy of Sciences Award
1972 National Medal of Science
1972 National Medal of Science
1973 National Medal of Science
1892 – 1984 Awards
22 citations, awards, and honors including the Medal Award by the Nominating Committee
**Background**

- Basis for most DRIs for infants

<table>
<thead>
<tr>
<th>0 – 6 months</th>
<th>7 – 12 months</th>
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<tbody>
<tr>
<td>Human milk composition</td>
<td>Human milk composition + Complementary foods and Beverages (CFB)</td>
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</table>

**Key factors**

**AIs for 7 – 12 mo**

- Caloric value of human milk
- Mean concentration value used for the nutrient of exposure
  - Human milk
  - Complementary foods and beverages

**Adequate Intakes (7 – 12 months)**

**Estimate energy intake from HM**

\[ \text{Estimated energy intake from HM} \]

- 75 kcal/100 mL \times 600 mL/d = 45 kcal/d

**Human milk composition**

<table>
<thead>
<tr>
<th>Estimated energy intake from CFB</th>
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<tbody>
<tr>
<td>845 kcal/d – 45 kcal/d = 390 kcal/d</td>
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</table>

**Average energy intake**

**Energy from HM**

<table>
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<tr>
<td>600 mL HM</td>
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</table>

**Energy from CFB**

**Energy from HM**

\[ \text{Estimated energy intake from HM} = 75 \text{ kcal/100 mL} \times 600 \text{ mL} = 45 \text{ kcal/d} \]

**Energy from CFB**

\[ \text{Estimated energy intake from CFB} = 845 \text{ kcal/d} - 45 \text{ kcal/d} = 390 \text{ kcal/d} \]

**Estimated total nutrient intake for Adequate Intakes**

<table>
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<td>Mean nutrient concentrations for HM and CFB</td>
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</table>

**2020 Dietary Guidelines Advisory Committee**

**Did not use**

- 75 kcal/100 mL (DRI Reports)
- 74 kcal/100 mL (Standard Reference legacy nutrient profile)

**Instead used**

- 68 kcal/100 mL
- Metabolizable energy of human milk*
- Align energy contributions from human milk and infant formula

Energy Content of Human Milk in DRI Reports as 75 kcal/100 mL

Citation Tree

Energy Content of Human Milk in DRI Reports continued

Evidence cited for Energy Content of Human Milk in DRI Reports continued

Unpublished data may be from:

Nutritional status of children, XII.

Nutritional status of children, XIII.
Accuracy of calculated intakes of food components with respect to analytical values.
Human Milk in the Energy DRI

EER Lactation (adult)
EER pre-pregnancy + HM energy output – weight loss

1st 6 mo
EER = 500 – 170

2nd 6 mo
EER = 440 – 0

* Based on human milk density of 1.03 g/mL


19 References


Looking Forward
Human Milk Data for DRIs

Kathryn Hopperton, PhD, MSc
Food Directorate
Bureau of Nutritional Sciences
Health Canada
Factors That May Influence Human Milk Energy Content

- Time post-partum
- Higher fat, lactose and energy, lower protein in mature milk
- Associated with higher total fat
- BMI
- Positively correlated with total fat content, in some studies with energy content
- Socioeconomic status
- Associated with higher total fat
- Volume of production
- Negatively correlated with energy density
- Human milk feeding exclusivity
- ~28% non-exclusive at 1 month, 47% by 5 months
- Infant energy requirements (sex, growth rate)
- Maternal diet
- Higher in high fat, low carbohydrate diet
- Ethnicity and genetic factors

Sources of New Data

- International milk Composition Consortium – IMiC – expected 2022-2023
  - 1300 dyads from Tanzania, Pakistan, Burkina Faso and Canada
  - Milk collected 3-6 months post-partum, not full expression
  - Macronutrients by mid-infrared analyzer
  - Canadian subjects from the CHILD cohort, n=400
  - Associations with infant growth and developmental outcomes
  - IMiC: https://www.milcresearch.com/imic.html

- Mothers, Infants and Lactation Quality study – MILQ – Expected completion December 2023
  - 1000 subjects, 500 each from Bangladesh, Brazil, Denmark and the Gambia
  - Milk collected 3-4 months post partum, not full expression
  - Macronutrients by mid-infrared analyzer
  - Associations with infant growth and developmental outcomes

Conclusions

- The energy content of human milk is variable
- Parent and infant characteristics likely affect the energy content of human milk
- More research is needed to understand the impact
- New studies reporting in the next two years will provide new data on volume of human milk production and sources of variability in macronutrient composition of human milk from large multi-ethnic cohorts

Sources of New Data

- IMiC: https://www.milcresearch.com/imic.html
- MILQ: https://www.nichd.nih.gov/about/advisory/council/archive/202110/PRiMORDIAL-PRiGNB-202110
- For more information about either project: ashley.vargas@nih.gov