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Critical Review

Use of the net metabolizable energy values for labeling of infant formulas and foods—potential issues

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Abstract

The use of net metabolizable energy (NME) rather than metabolizable energy (ME) to determine energy values for food labeling has been suggested. A review was undertaken to determine issues that might arise if NME were applied to infant formulas and foods for infants.

Both ME and NME factors derived from adult studies appear to be reasonably applicable to infants. Use of NME rather than ME values decreased the *apparent* energy density of human milk by about 4%; that of infant formulas, 4–6%. Even though the regulatory requirements for upper and lower limits of nutrients in infant formulas are expressed per 100 kJ or per 100 kcal, few significant issues would be expected based on a change in the declared energy content of this magnitude. Energy content of representative baby foods decreased 2–9%. The regulatory implications of using NME are at least a requirement to relabel virtually all products.

The use of NME as it relates to selection of a healthy diet for infants, scientific validity, comparability of food energy values and requirements, interproduct comparisons and facilitation of trade are briefly addressed. It is recommended that factors used to calculate food energy in infant formula and foods for infants and small children be consistent with those used for other foods.

Keywords: Net metabolizable energy; Infant; Energy density

1. Background and introduction

There has been a lively debate in the literature about the desirability of using net metabolizable energy (NME) rather than the classic metabolizable energy (ME) Atwater factors to calculate energy values of foods for labeling purposes (Warwick and Baines, 2000; Livesey, 2001). This

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proposal also has been discussed in recent FAO/WHO/UNU working groups and consultations. An extensive review of the issues surrounding the use of NME in general was submitted by Livesey (2004a, b), who is a strong advocate of such an approach. In his review he noted that the digestibility of food energy, one important component of NME, by infants is less than that in adults and recommended that that area be specifically addressed. This and other considerations have prompted this review of the implications of changing to the use of NME factors to calculate food energy values for infant formulas and foods for infants and small children.

There are three principal reasons why such a review is needed. First, the scientific validity of applying NME values to foods for infants and children has not been examined in any detail. Second, not all regulations for infant formulas, including Codex (1981), specify an energy content or concentration for formulas (apparently relying on manufacturers to mimic the energy density of human milk), but they do express requirements for all other nutrients on the basis of energy content (per 100 kJ or per 100 kcal). Changing the way energy values are calculated will change the apparent content of nutrients in infant formulas. The volume that provides 100 kJ or 100 kcal (listed on the label) also will necessarily change. Other infant food products will be affected in a similar fashion regarding the energy content of one serving. Third, FAO/WHO is currently reviewing energy requirements of infants and children. In the past, these requirements have been estimated based on energy intakes. Butte et al. (2000) has proposed that in the future these be based on measurements of total energy expenditure, for which there is now a reasonable body of data from studies of infants and young children using the doubly labeled water method. Conceptually, this method for estimating energy requirements seems to tie more closely to the ME approach to estimating available food energy than to the use of NME conversion factors. Practically, Butte et al.'s estimates, if adopted, will effect a downward revision of requirements by as much as 20%, and these changes could lead to confusion among health care professionals and parents if energy values for formulas and foods for infants were not expressed in a compatible system.

With the above in mind, the goals of this review are to do the following: (1) Examine the assumptions underlying the various components that define NME to determine if the scientific underpinnings of NME can reasonably be extrapolated to infants and young children. (2) Apply NME conversion factors to the known analytical composition of human milk to determine the effect on currently accepted views of its energy content. (3) Apply NME conversion factors to representative infant formulas and to the extreme limits for macronutrients specified in regulations to ascertain the effect on stated energy contents and the regulatory effect on labeling, with an eye toward potential incompatibilities of currently "acceptable" formulas with current regulations, and possible unintended consequences regarding need for reformulations by industry. (4) Apply NME conversion factors to current baby foods to look at similar issues. (5) Look at selected suggested benefits, especially to consumers, of using NME in food labeling for foods in general to see if these also apply when used for labeling of infant formulas and foods. (6) Make specific recommendations about the use of NME for infant formulas and foods for infants, especially, and young children.

2. How do the ME and NME calculations of food energy differ?

There are two approaches to the determination of food energy content that are conceptually based on metabolizable energy. First introduced early in the 20th century, the Atwater general