Total individual macronutrient intake

Overview

Total individual macronutrient intake is a member of the class of indicators that measure individual intake of nutrients. It quantifies the percentage of caloric intake from the three major macronutrient groups: protein, fats, and carbohydrates. These three nutrients have distinct and important functions in the body, and all are necessary for proper growth, development and cognitive and physical functioning. Both undernutrition and over-nutrition due to improper macronutrient intake, and the related health complications, continue to be a major health concern in the developing world (Muller & Krawinkel, 2005 [1]). Other indicators included in the Data4Diets platform that measure individual nutrient intake include Nutrient Adequacy Ratio (NAR), Mean Adequacy Ratio [2](MAR), probability of inadequacy of specific micronutrient intake [3] or Mean Probability of Adequacy (MPA) across several micronutrients, total individual micronutrient intake [4], and total individual energy intake [5]. For more discussion on the comparative uses of these indicators, refer to the 'Uses' section below.

Method of Construction

In order to estimate an individual's caloric intake from the three macronutrients, survey data must be collected from a 24-hour Dietary Recall [6], a Weighed Food Record [7], or a Food Frequency Questionnaire [8] (FFQ). Population mean consumption can be estimated with a single survey, but the survey must be repeated on at least a subsample of the survey population for two non-consecutive days of intake to estimate "usual intake" (Institute of Medicine [IOM], 2000 [9]). This should be completed in a way such that the final sample is representative of all days of the week. Using a Food Composition Table (FCT) and the weight (grams) of the foods consumed, an estimate of the amount of protein, fat, and carbohydrates consumed per subject is calculated (distinguishing between fiber and other forms of carbohydrates). The total grams of each macronutrient are added together, and the caloric value of each is calculated using the following equation:

Calories (*Kcal*) = [*Protein* (*g*) × 4] + [*Fats* (*g*) × 9] + [Av. *Carbohydrates* (*g*) × 4] + [*Fiber* (*g*) × 2] + [*Alcohol* (*g*) × 7]

*Note in this equation, Total Carbohydrates = [Available Carbohydrates + Fiber]

Finally, the proportion of calories from each macronutrient is calculated by dividing the calories from each by the total calories consumed. For more information on calculating this indicator, refer to the first method discussed in the 'New Methods Considered' section of the following paper published in the *Journal of Food Composition and Analysis* (Schakel et al., 2009 [10]).

Uses

Individual macronutrient intake is a useful indicator for understanding the dietary intake and quality (especially balance) of population subgroups, such as pregnant and lactating women, and for understanding the allocation of food resources among household members (Ferro-Luzzi, 2002 [11]). These data can also contextualize shifting diet composition that has been observed in conjunction with demographic and economic transition in low- and middle-income countries, as individuals consume a higher percentage of their calories from fat (Popkin, 2001 [12]). When

expressed as percentages of total energy intake, the information provided is limited and should therefore be complemented by the total intakes in energy and the intake of each macronutrient in grams. In addition, since this indicator does not include information on micronutrient intake, it is not useful for capturing a full picture of dietary quality. More inclusive indicators such as the NAR, MAR [2], probability of inadequacy, [3] or MPA are more appropriate for using individual nutrient intake data to provide a picture of the diet as a whole.

Strengths and Weaknesses

An advantage of this indicator is that it allows researchers to estimate an individual's intake of specific macronutrients and, in gathering data on individual intake, researchers are able to pair findings with individual health outcomes and demographic information, such as religion, age, sex, education, or any other characteristics of interest, assuming the study has been designed for these purposes (Ferro-Luzzi, 2002 [11]). However, a weakness of this indicator is that it does not provide information on the diet as a whole or whether intake levels are adequate and within a healthy range (IOM, 2000 [9]).

Data Source

Intake data can be obtained from 24-hour Dietary Recall [6], Weighed Food Records [7], and FFQs [8]. The Food and Agriculture Organization and the World Health Organization's Global Individual Food consumption data Tool (FAO/WHO GIFT [13]) is a source for individual-level quantitative dietary data. The FAO/WHO GIFT aims to make publicly available existing quantitative individual food consumption data from countries all over the world. National or regional Food Composition Tables should be used to identify the nutrient contents of the foods and can be found at FAO's International Network of Food Data Systems (INFOODS [14]) or the International Life Science Institute's (ILSI) World Nutrient Databases for Dietary Studies (WNDDS [15]). Recommended Daily Allowances can be obtained from IOM (2006 [16]). In addition, Food Balance Sheet [17] (FBS) data could be used to calculate a similar indicator, such as national average supply of protein [18]. Alternatively, Household Consumption and Expenditure Survey [19] (HCES) data could be used to calculate household share of dietary energy from different macronutrients [20].

Links to guidelines

- Schakel et al., (2009). "Adjusting a nutrient database to improve calculation of percent of calories from macronutrients" [10]

Links to validation studies

- Basiotis et al., (1987). "Number of days of food intake records required to estimate individual and group nutrient intakes with defined confidence" [21]
- Jackson et al., (2007). "Reproducibility and validity of a quantitative food-frequency questionnaire among Jamaicans of African origin" [22]
- Lanigan et al., (2000). "Validation of food diary method for assessment of dietary energy and macronutrient intake in infants and children aged 6-24 months" [23]

Links to illustrative analyses

- Cui & Dibley, (2012). "Trends in dietary energy, fat, carbohydrate, and protein intake in Chinese children and adolescents from 1991-2009" [24]

Expert review conducted by:

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Food Security Dimensions

- Quantity [26]
- Quality [27]

Data Collection Levels

- Individual [28]

Data Sources and Methods

- 24-Hour Dietary Recall (24HR)
- Weighed Food Record (WFR)
- Food Frequency Questionnaire (FFQ)
- Food Composition Databases

Requires Food Composition Database

- Yes [29]

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