

# The Non-Environmental Nature of Current Standards in Nutrition\*

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## Introduction

What does it really take to be a good environmental dietitian? As dietitians who are both trained in nutrition and concerned about the planet, it would be nice if we could just take our training and concern and add the two together like variables in an equation that defines “environmental dietitian” as “dietitian” + “special training in ecology.” In other words, it would be convenient if we could leave our previous nutritional training intact and place new knowledge about the ecosystem on top of it. Unfortunately, we can’t.

To become good environmental dietitians, we have to do more than become better educated about the ecosystem. In addition, we have to question our previous training as dietitians because the nutrition we currently practice has widely abandoned the ecosystem as a context for decision-making. Ecosystems carry along with them a variety of intrinsic standards. These standards include diversity (the richness housed by our planet), and wholeness (the fact that everything belongs and finds a planetary home). In the following sections of this article we will look at another intrinsic ecological standard, namely, the standard of *interaction*.

## Ecosystems and Interaction

Maintenance of ecological diversity requires constant interaction between organisms and their environment. Interaction takes place simultaneously on a variety of levels. All forms of organisms (including microbes, plants, and animals) interact with each other, and researchers have studied these interactions in each of six possible categories: plant-microbe, animal-microbe, microbe-microbe, plant-plant, animal-plant, and animal-animal. Organisms also interact directly with their environment. Direct interactions typically involve sensitivity on the part of organisms to environmental cycles like photoperiod (day-light cycle) or thermoperiod (temperature cycle), as well responses to geomagnetic, gravitational, and electromagnetic patterns

Loss of an interactive ecological standard has become a hallmark of nutrition across its spectrum of practice. Except in the area of nutrient-drug interactions, where many clinicians have made a concentrated effort to address the impact of prescription medications on nutrient status, interaction is not a standard that has been adhered to in agricultural practice, food supply dynamics, public health recommendations, or clinical decision-making.

## Nutrient Reference Books

A static, non-interactive view of food and nutrients has become the standard in nutritional reference books, nutrient databases, and product labeling. When ascertaining the vitamin C content of broccoli, for example, dietitians commonly refer to Bowes and Church's *Food Values of Portions Commonly Used*. In that reference source, raw broccoli is listed as containing 41 milligrams of vitamin C per half cup serving.<sup>1</sup> From an ecological standpoint, the idea of broccoli containing a fixed and static amount of vitamin C (or any other nutrient) is both illogical and scientifically unfounded. For example, at least twenty one studies have shown organically grown foods (including cruciferous vegetables like broccoli) to contain significantly greater amounts of vitamin C than their non-organically grown counterparts.<sup>2</sup> Similarly, nutrient content of foods have been shown to vary along with seasonal change, climate, soil conditions, seed stock, planting, harvesting, and storage methods.<sup>3</sup>

## Nutrient Databases

Nutritional databases have also adopted a static, non-interactive standard for data inclusion. United States Department of Agriculture (USDA) Handbook No. 8, originally developed in 1950, has remained the primary source of food composition data in the U.S.<sup>4</sup> As standards for obtaining accurate and reliable nutrient data, USDA researchers established a variety of acceptable sampling procedures as appropriate in the gathering of nutrient data. These sampling standards included single sampling, in which average nutrient content was calculated from several individual samples of a single food; single composite sampling, in which mixed samples of a food obtained at different times and places were combined, analyzed, and reported as a single food; and multiple composite sampling, in which different brands or cultivars of a food were combined, weighed to approximate a single food product as it would appear in the marketplace, and subsequently analyzed.

These sampling procedures virtually guaranteed a nutrient database that would remain indifferent to the environmental dynamics that shaped the nutrient content of foods contained within it. Random combining of cultivars, selection of samples without respect to seasonal or geographical variation, and restriction on the total number of samples were research decisions that produced a database insensitive to environmental standards and potentially non-representative of the nutrient content of foods actually being eaten by the U.S. public. As one representative of the Quaker Oats Company in Chicago, Illinois remarked in an address to the 14<sup>th</sup> National Nutrient Database Conference in 1989 in Iowa City, Iowa, "it is nearly impossible to keep up to date on any nutrient database which would adequately represent the foods now available to the American public".<sup>5</sup>

## Clinical Recommendations

### The Example of Fatty Acid Ratios

The abandonment of an interactive environmental standard in nutrition has also been exemplified in the area of clinical practice. While many aspects of the clinical decision-making process could serve as examples of this lost standard, neglect of fatty acids ratios stands out for two reasons. First is the total human dependence on diet for establishment of optimal fatty acid ratios. From an environmental standpoint, the position of humans with respect to fatty acid ratios is striking, since humans lack the delta 15 and delta 12 desaturase enzymes required to synthesize 3 and 6 fatty acids *de novo*, i.e., “from scratch”. Many plants, including mosses, ferns, grasses, and trees, possess these enzymes. (They are also commonly found in algae and phytoplankton.) In the absence of *de novo* synthesis capability, or the presence of conversion enzymes, humans are completely dependent upon diet for establishment of optimal balance in omega 3 and omega 6 fatty acid ratios. While this dietary dependency obviously places a premium on the interaction between humans and their food, it also points to the importance of interactions that underlie the final fatty acid composition of food.

### Omega 3:6 Ratio and Plant Development

A second reason for focusing on fatty acid ratios as an example of lost standards in clinical practice is the unique nature of fatty acid ratios in plant growth and development. Studies on plant development and nutrient content have shown dramatic changes in fatty acid ratios occur within a three-week period after flowering. These changes occur while young, growing plants make continual metabolic adjustments to their new environment. In corn oil, an omega 6:omega 3 fatty acid ratio of 3.8 has been shown to rise to 11.4 during this time.<sup>6</sup> In soybeans, during a one-week period, the same ratio has been observed to increase from 1.2 to 3.8.<sup>7</sup> These agricultural findings have suggested that the age at which fat-containing foods are harvested or consumed can make a significant difference in fatty acid balance, both for the plants and the human who consume them.

### Omega 3:6 Ratio and Human Metabolism

An interactive standard is also maintained inside the body following ingestion and absorption of dietary fatty acids. Even if dietary ratios have been well-balanced, a wide variety of metabolic interactions are necessary in order for this balance to be maintained. Because most omega 3 and omega 6 molecules are highly unsaturated, long-chain fatty acids, oxidative metabolism must be optimally supported in order to avoid peroxidation of omega 3 and 6 fats. This support requires the presence of a wide variety of antioxidant nutrients. Successful elongation and desaturation of omega 3 and 6 family members also requires proper function of enzymes like delta 5 and delta 6 desaturase. These enzymes cannot function in the absence of additional nutrients, including vitamins B-3, B-6, C, and the minerals zinc and magnesium. Finally, maintenance of omega 3:6 balance in the body requires non-excessive conversion of fatty acid molecules into eicosanoid messengers by cyclo-oxygenase and lipoxygenase enzymes. Overactivation of these enzymes is often the result of exposure to prescription medicines and environmental toxins.

## Omega 3:6 Ratio and Human Disease

The importance of these interactive aspects has been further solidified by establishment of omega 3:6 ratio as a major risk factor in human disease.<sup>8</sup> Decreased ratios (typically produced by deficient intake of omega 3 fatty acids) have been shown to be a risk factor in the development of neurological problems of infancy,<sup>9</sup> childhood hyperactivity,<sup>10</sup> and numerous chronic conditions of adulthood including coronary heart disease<sup>11</sup> and chronic obstructive pulmonary disease.<sup>12</sup> Yet in spite of these findings, omega 3:6 ratio has remained almost totally ignored in public health recommendations by nutritional organizations and by most dietitians in clinical practice.

## Neglect of Omega 3:6 Ratio in Dietary Guidelines

Omega 3:6 fatty acid ratios were not mentioned in the United States Department of Agriculture's 1992 release of the Food Guide Pyramid.<sup>13</sup> (A 1997 survey showed this widely-publicized guide to be the single most recognized nutritional guideline in the U.S., acknowledged by more than two thirds of all U.S adults).<sup>14</sup> Similarly, a 1998 American Dietetic Association position paper on fat intake and fat replacement made only one mention of omega 3 or omega 6 fatty acids.<sup>15</sup> This single mention involved the suggestion that deficiency symptoms could be prevented if 1-2% of total caloric intake was derived from omega 6 fatty acids and if 1% was derived omega 3 fatty acids.<sup>16</sup> The recommendation was not translated, however, into any food recommendations. More importantly, it ignored the reality of fatty acid intake by U.S. adults, who had already been estimated to receive approximately 6% of total calories from omega 6 fatty acid intake.<sup>17</sup>

As dietitians concerned about the well-being of the planet, we have to recognize that this omission of omega 3:omega 6 ratio in our practice is related to our lack of environmental standards. We also have to recognize that our best way of correcting this omission is by deconstructing our previous knowledge and re-thinking our basic assumptions based on an interactive environmental standard that focuses attention on relationship between organisms, their environment, and food.

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<sup>1</sup> Pennington JAT. (1994). *Bowes and Church's food values of portions commonly used*. 16<sup>th</sup> Edition. J.B. Lippincott, Philadelphia, p. 296.

<sup>2</sup> Worthington V. (1998). Effect of agricultural methods on nutritional quality: a comparison of organic with conventional crops. *Alt Ther* 4(1):58-69.

<sup>3</sup> Smith JL. (1994). Atwater to present: what have we learned about our food supply? *J Nutr* 124(suppl):1780S-1782S.

<sup>4</sup> Southgate DAT and Greenfield H. (1992). Principles for the preparation of nutritional data bases and food composition tables. *Wrld Rev Nutr Diet* 68:27-48.

<sup>5</sup> Hurt HD. (1989). Nutrient databanks: the role of the food industry. In: Stumbo PJ. (Ed). *Proceedings of the fourteenth national nutrient databank conference*. 1989 June 19-21. Iowa City, Iowa. The CBORD Group Inc., pp.11-15.

<sup>6</sup> Bengmark S. (1998). Ecoimmunonutrition: a challenge for the third millennium. *Nutr: Internatl J Appl Basic Nutr Sci* 14(7/8):566.

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<sup>7</sup> *Ibid.*

<sup>8</sup> Simopoulos A. (1991). Omega-3 fatty acids in health and disease and in growth and development. *Am J Clin Nutr* 54:438-463.

<sup>9</sup> Makrides M, Neumann M, Simmer K et al. (1995). Are long-chain polyunsaturated fatty acids essential in infancy? *Lancet* 345:1463-1468.

<sup>10</sup> Stevens L. (1995). Essential fatty acid metabolism in boys with attention-deficit hyperactivity disorder. *Am J Clin Nutr* 62:761-768.

<sup>11</sup> Simopoulos A, *op. cit.* (see reference 50).

<sup>12</sup> Shahar E, Folsom AR, Melnick S et al. (1994). Dietary n-3 polyunsaturated fatty acids and smoking-related chronic obstructive pulmonary disease. *New Engl J Med* 331:228-233.

<sup>13</sup> Human Nutrition Information Service. (1992). USDA's Food Guide Pyramid. United States Department of Agriculture. Home Garden Bulletin 249. U.S. Government Printing Office, Washington. D.C.

<sup>14</sup> American Dietetic Association, *op.cit.* (see reference 15).

<sup>15</sup> American Dietetic Association. (1998). Position of the American Dietetic Association: fat replacers. *JADA* 98(4):463-468.

<sup>16</sup> *Ibid*, p.464.

<sup>17</sup> National Center for Health Statistics. (1996). Energy and macronutrient intakes of persons ages 2 months and over in the United States: Third National Health and Nutrition Examination Survey, Phase 1, 1988-1991. Available through the Centers for Disease Control Internet website at: <http://www.cdc.gov/nchs/products/pubs/pubd/ad/260-251/ad255.htm>.