A Pediatrician’s View

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Digging Up Old Information About Human Nutrition

Science has given us a huge database about nutrition. We understand much about metabolism and about the need for vitamins, minerals, essential fats, and amino acids and how these influence growth and development. Our technology has given us formulas for alimental and intravenous feedings that aid the management of chronic disease. We are even trying to shape the dietary habits of children to reduce cancer, heart disease, and osteoporosis 50 years from now and congenital defects during pregnancy. So, we are doing great, right? This issue describes many of the above advances, but also gives insight into things that are not going so well.

How about the growing epidemic of obesity among children, adolescents, and adults in the United States? The Third National Health and Nutrition Examination Survey, 1988–1994 revealed that 13.7% of children aged 6 to 11 years were overweight, defined as a body mass index greater than the 95th percentile for age. This problem is due to eating too much and exercising too little, and the United States has a growing problem with the latter as well. A 1994–1995 national survey found that 29% of adults reported no leisure time physical activity as in exercise or recreation during the preceding month. And less than half of high school students are enrolled in a physical education class.

And the prevalence of nutritional deficiencies is higher during adolescence than at any other age. In this issue, Wahl lists deficiencies in calcium, iron, riboflavin, thiamin, and vitamins A and C as most common in teens. The average calcium intake of 15- to 18-year-old girls has dropped to half of the daily recommended allowance at one of the most important periods for establishing lifelong bone mineral content. Eating disorders are rising as well. Sixty percent of girls in grades 9 through 12 reported trying to lose weight in the previous 30 days in a 1997 national survey.

What is wrong here? How can we know so much about the science of nutrition and be doing so poorly in these global issues? Our knowledge about nutrition does not seem to offset the impact of, for example, television, which simultaneously promotes fast foods, an ideal body shape, and a sedentary lifestyle. Such contradictions in what we know and what we do can relate to a clash between our evolutionary or cultural origins and our technologically and economically driven present lives. So, the following is a brief review of the early history of human nutrition to gain insight into how we evolved in this regard.

Through most of our earliest evolutionary history, or before we had tools to capture and kill animals, we must have subsisted on whatever plants and small animals could be gathered or caught by hand. The first of these tools were stone points to tip spears, which appeared in Africa a little more than 100,000 years ago. However, with a few exceptions, these tools were unspecialized until approximately 40,000 years ago. This important era saw an explosion of tool making, including the appearance of “blade technology” so that standardized blanks could be modified into a wide range of cutting instruments. At this time, there was a sudden burst in art and burial customs. The presumption is that language also blossomed 40,000 years ago, allowing cultural evolution to facilitate inventions, art, and culture. The amount of meat available from wild game would have slowly increased through the use of these tools and new hunting strategies.

However, humans still had to rely on hunting and gathering until agriculture and animal domestication began to appear 10,000 to 13,000 years ago. Most evidence implicates goats and sheep (and pigs at one site only) as the first domesticated animals. The method for timing domestication is partially based on determining the age and gender of animal bones left by humans. For example, there was little difference in the ages of killed goats (determined by bone fusion—
the same principle we use to measure bone age by radiographs) or the distribution of male and female goats of different ages (males of a given age are larger) in bones dated 40,000 to 10,000 years ago. However, soon following this, few billy goats lived beyond 24 months, whereas most nannies survived 36 months or more in many sites. The assumption is that early man learned to slaughter males as they reached full size, but kept the females and a few males to breed, thus signifying the beginning of animal husbandry. Cattle and pigs were generally domesticated within a thousand years or so after goats and sheep.7

The appearance of agriculture is judged primarily on the size of fossilized foods from plants, fruits, and seed remains. Domesticated plants are larger, presumably because humans learned how to select the most productive plants for replanting. The first cultivated food was yam, appearing approximately 13,000 years ago in the Near East. Squash and rice appeared in Ecuador and China 10,000 to 11,000 years ago. Other early agricultural products included tubers, lentils, hackberries, acorns, pistachios, wheat, barley, and sunflower seeds. Maize cultivation began in the Americas approximately 7,700 years ago. However, the transition from gathering wild foods to farming was slow. Although rice was planted widely in suitable sites around the world, it took 4,000 years for the domestic variety to dominate wild rice as a dietary staple. Dairy farming, judged by art and tools, began approximately 6,000 years ago. The era when farming blossomed approximately 10,000 years ago is known as the neolithic period and corresponds with the end of the latest ice age (when flora and fauna changed, making previous foods less plentiful) and the first appearance of villages and larger settlements. Although it had been thought that farming allowed people to live in villages, it now appears that people began to live in settlements without agriculture in many areas (for reasons unclear) and this may have stimulated agriculture rather than vice versa.8

In summary, early humans were selected to make the most of whatever foods were available and to survive famine. Our physiologic evolution also probably adapted well to the gradual introduction of meat from game between 150,000 and 10,000 years ago and perhaps fairly well to the foods we raised and grew from 10,000 years ago until the past few centuries. The amounts of meat and animal fats in our diets must have increased slowly and remained relatively low through both time periods. But our physiologic evolution could not be expected to keep up with the progressively more rapid changes that have occurred in the most recent two or three centuries. Quantities of total food, meat, fat, and sugars have expanded logarithmically, whereas fiber has dropped for people of the developed world.

Enter the recommendations of the National Research Council of 1989 and the U.S. Department of Agriculture, as illustrated by the food pyramid on the cover of this issue and described on the table of contents page. This pyramid is based on scientific evidence for health risks and benefits of various types of food, and it reduces prior standards for meat, fat, and sugars while boosting those for fruits, vegetables, and grain products. The pyramid is already out of date in some ways. Willett identifies several changes that should be addressed in future editions.9 For example, the pyramid makes no allowance for type of fat, ie, that monounsaturated and polyunsaturated oils are healthier than saturated or transsaturated fats and cholesterol. It also does not distinguish low fat from regular dairy products. The recommendation of two or three servings of meat per day may still be excessive, and more emphasis should be placed on minimally processed grains to increase fiber.

Wait a minute. Is it déjà vu or does this pyramid, especially with changes likely to be added in the next edition, look like the diet our ancestors evolved to accommodate? It does and it should. The ways that evolution has shaped us should be considered in making dietary recommendations. Breast milk is the best example of this. We are still identifying and trying to emulate the advantages of breast milk in our manufactured formulas. Now if we could only find a way to deal with a problem that evolution has had much less experience with and thus has not prepared us to handle: We have too much food that tastes and looks too good. If we could eat less, we might live longer. Mice fed near-starvation diets live 40% longer than better-fed controls, and recent preliminary but ongoing studies suggest that rhesus monkeys that received 30% fewer calories had fewer signs of aging as demonstrated by lower blood lipids, lower blood pressures, and less diabetes compared with normally fed controls.10 Similar studies in humans are a long way off, if they are ever done. But, on average, we eat too much. And I guess we should be more like our ancestors in terms of exercise and physical activity.

REFERENCES