Nutritional Education: Understanding the Past to Prepare for Future Medical Practice

Judith Wylie-Rosett*, C.J. Segal-Isaacson*, Darwin Deen*,†, and Christopher Cimino‡
Department of Epidemiology and Population Health*
Department of Family Medicine and Community Health†
Department of Neurology‡
Albert Einstein College of Medicine
Bronx, New York 10461

ABSTRACT

The examination of nutrition from a historical perspective provides the framework for developing a nutrition teaching program that considers the breadth and complexity of the nutrition issues physicians will face in clinical practice. Data from observational studies and randomized clinical trials are used to develop nutrition guidelines for health promotion as well as for disease prevention and control. The National Heart, Lung, and Blood Institute funded Nutrition Academic Award supports the integration of nutrition as a theme throughout the Albert Einstein College of Medicine curriculum. The pre-clerkship nutrition curriculum focuses on the role of various nutrients in metabolic pathways, nutritional aspects of pathophysiology, and nutrition assessment skills. The clerkship nutrition curriculum focuses on nutritional aspects of clinical care. Integrating nutrition into clinical care addresses briefly assessing and counseling related to weight activity, variety, and excess (using WAVE as an acronym) and making referrals for Medical Nutrition Therapy to address more complex nutrition issues. Nutrition resources are available to students and faculty via the Internet. Resources available via Albert Einstein College of Medicine nutrition web page include: the nutrition modules from Albert Einstein College of Medicine courses, the Nutrition Academic Award curriculum guide, patient education materials, and annotated web links for nutrition information. Some resources can be downloaded to facilitate wider spread emphasis on nutrition in primary care.

HISTORICAL OVERVIEW OF NUTRITION IN MEDICINE

Examining the history of nutrition as a field of scientific inquiry provides a framework for examining the current nutrition-related guidelines that address the role of diet in health or the use of medical nutrition therapy. A history of the role of nutrition in diabetes treatment (Wylie-Rosett and Rifkin, 1985) suggests that treatments evolved from observing how modifying dietary intake affected clinical symptoms. Diet has been considered important to health since the days of Hippocrates when sweet smelling urine led to the identification diabetes and dietary modifications to control its symptoms. Although some foods were viewed as remedial in nature, this early naturalistic approach considered foods as aliments, which were selected on the basis of taste and smell for medicine proprieties, rather than more complex substances that form the foundation for the science of nutrition. For many centuries before chemical assays were available to measure glucose, high urine volume, and sweet odor were used to diagnosis diabetes and to judge the effects of dietary modifications. However, the rationale for dietary recommendations varied from restricting foods such as honey and other sweets that were thought to increase these symptoms to increasing such foods to replace the losses. Opinion varied widely regarding the importance of metabolic control, until the Diabetes Control and Complication Trial (1993) proved that diabetic complications could be prevented by intensive treatment that improved glycemic control. Approaches to medical nutrition therapy in diabetes continue to vary greatly, but the goal of restoring normal metabolism is universally shared.

The final edition of the *Recommended Dietary Allowances* developed by the Food and Nutrition Board of the Commission on Life Sciences of the National Research Council of the National Academy of Sciences (1989) provided a historic overview of how chemical constituents in foods were identified as essential nutrients for health. Nutrition developed as a field of scientific inquiry in the nineteenth century based on chemical analysis of foods to identify four constituents – protein, carbohydrate, fat, and mineral ash (left after foods were completely combusted). Early nutrition research also included the study of digestion. Early in the twentieth century there was greater emphasis on discovering constituents in foods that were removed in milling but were essential to health. Before the discovery of most vitamins, the concept of protective foods was developed to describe the potential role of food constituents in health and disease prevention based on the assumption that biochemical properties of specific compounds were not yet identified. The term vitamin(e) was introduced in 1912 to describe an amine compound prepared in the laboratory from the discarded remains from polished rice that would forestall the development of beriberi in rats and was considered vital to life. The effort to address public health problems associated with the refinement of grain products led to the rapid development of nutrition research. Diseases such as pellagra were assumed to be infectious diseases until experimental studies with

niacin demonstrated that it was preventive as well as curative. Much of this early work in vitamin research focused on isolating the specific organic compounds in food that were essential to human life. Most of the vitamins had been identified during the first half of the twentieth century, and the nutrients lost in food processing were replaced by enrichment. During the latter half of the twentieth century nutrition research began to address the longer-term effects of dietary pattern and nutrition excess on chronic diseases.

The Framingham Heart Study, which began in the middle of the twentieth century, has provided insights linking the intake of animal fat to a higher risk of heart disease and ultimately to the Framingham equation, which predicts cardiovascular risk (Anderson et al., 1991). Intervention studies such as the Diet-Heart Study (1968) demonstrated that reducing the intake of saturated fatty acids could reduce blood cholesterol levels. During the 1980s, the randomized controlled clinical trial of the Lipid Research Centers provided the "proof" that lowering blood cholesterol prevented coronary disease, which led to a concerted national effort that focused on the detection and treatment of elevated blood cholesterol (National Cholesterol Education Program Expert Panel, 1993). Questions remained regarding whether it was realistic to use nutrition to prevent cardiovascular disease. However, more recent research including the Lyon Diet Heart Study (DeLorgeril et al., 1999) has provided evidence that nutrition intervention can prevent cardiovascular events. The Lyon Diet Heart Study was a secondary prevention study that determined a "Mediterranean" diet rich in fruits and vegetables and fiber, as well as modified fat, decreased cardiovascular disease event rates.

Nutrition research in the twenty-first century will address the relationship between gene expression and nutrient metabolism. This research is likely to integrate the examination of genetic factors in observational studies of dietary habits, short-term metabolic feeding studies, and randomized controlled clinical trials of diet and of medical nutrition therapy. Research during the twenty-first century will also need to address behavioral issues related to improving the health of the population by implementing current nutrition knowledge.

NUTRITION GUIDELINES AND RECOMMENDATIONS

Hippocrates made a number of dietary recommendations to improve health and cure disease. Many of the early dietary recommendations were based on the mystical properties attributed to foods. The rationale for current dietary recommendations is usually based on health considerations with an increasing emphasis on using evidence-based literature review. As globalization of agriculture increases, there are a growing number of nutrition recommendations that also consider how production and consumption of various foods may affect the ecosystem.

For over 50 years, expert panels have developed dietary recommendations to improve health in the United States. These recommendations provide guidance for developing policies for food labeling and feeding programs. Expert opinion reviews were initiated in 1940 by the National Academy of Sciences to assure that the United Stated would have an adequate food supply. This led to the introduction of the Recommended Daily Allowances (RDAs) in 1943 by the Food and Nutrition Board of Commission on Life Sciences of the National Research Council within the National Academy of Sciences (1989). The RDAs for individual nutrients were estimated to provide an adequate intake based on the level needed to prevent deficiency diseases with an additional margin for safety. The Food and Nutrition Board of the Institute of Medicine within the National Academy of Sciences (2000) has begun replacing the RDAs with Dietary Reference Intakes (DRI) to focus on the ranges of nutrient intakes that are associated with good health rather than providing a margin of safety to prevent deficiency diseases.

Lohr et al. (1998) describes the process that expert panels for the National Academy of Sciences and other organizations use to weigh evidence in developing guidelines and recommendations. Randomized controlled clinical trials are used as the "gold standard" in weighing evidence. While epidemiological studies can link food patterns and nutritional factors to morbidity and mortality, the findings are subject to confounding by concomitant factors. Foods contain thousands of phytochemicals that may play a role in human health. Isolating a single compound that accounts for an observed relation between a food pattern and health can be difficult. The current debate over the advisability of using nutritional supplements reflects the lack of scientific evidence for evaluating their potential benefits and risks. The surprising results of beta-carotene research in lung cancer provides a good case study of this debate.

A number of epidemiological studies provided early evidence that eating a diet containing large amounts of vegetables and fruits rich in beta-carotene may play a role in cancer prevention (Albanes, 1999). Several observational studies indicated that lung cancer rates were lower as the estimated intake of beta carotene increased. Laboratory studies suggested several potential mechanisms for inhibiting neoplastic cell transformation. The use of beta-carotene supplements became increasingly popular based on the assumption that their use could do no harm. However, health organizations were cautious about making any statements about increasing beta-carotene intake beyond recommending increased fruit and vegetable intake. Subsequent randomized controlled clinical trials tested in various populations whether taking beta-carotene supplements reduced cancer rates. Supplementation with beta-carotene did not decrease cancer rates. However, since there is strong

epidemiological evidence that population groups that consume more vegetables and fruit have lower cancer rates. Nutrition recommendations continue to emphasize the need for eating more fruits and vegetables. A food guide pyramid is often used to convey this message and appears on the label of many food products.

The United States Departments of Agriculture (USDA, 2000) issued its current Dietary Guidelines using expert panels to review testimony from a variety of investigators and the published literature. The Guidelines are used to guide policy development for federally funded nutrition programs as well as public education programs using the food guide pyramid. The food pyramid has generated debate regarding potential sources of error and bias (Tavelli et al, 1998; Bertrom et al., 1999). The USDA (2001a) food pyramid now contains links to websites with vegetarian and ethnic specific food pyramids in order to address the diversity in food preferences in the United States. The vegetarian food pyramid, which was developed by Haddad et al. (1999), places greater emphasis on legumes than the one developed by the American Dietetic Association (1997). Despite the differences among food pyramids, they share a common emphasis on encouraging dietary patterns in which grains, fruits and vegetables form the foundation. Encouraging an increased intake of vegetables and fruits is also addressed in the 5-A-Day campaign of the National Cancer Institute.

Guidelines for chronic disease prevention and treatment focus on the need for individually tailored recommendations. The American Dietetic Association (1999) provides evidence that Medical Nutrition Therapy cannot only improve health outcomes but can also reduce health care costs. The American Heart Association's Dietary Guidelines (Krauss et al., 2000) use the framework the USDA Dietary Guidelines use the general population but focus on medical nutrition therapy for the subpopulation with cardiovascular disease (CVD) or CVD risk factors. The American Diabetes Association (2002) advocates an individualized dietary approach to achieve the desired levels for glycemic, lipid, and blood pressure control.

Dietary fat intake recommendations are currently being widely debated. Additional research is needed to address the risks and benefits of reducing total fat to less than 30% of energy intake compared to a higher fat Mediterranean diet with 35 to 40% of calories from fat but a greater emphasis on monounsaturated fatty acids. Writing in support of the Mediterranean approach, Katen et al. (1997) recommend reducing the intake of foods rich in saturated fatty acids, such as high-fat meats and full-fat dairy product, and increasing the intake of fruits and vegetables rather than substituting new, lower-fat versions of highly processed foods that merely replace fat with fat substitutes. Writing in support of reducing total fat intake, Connor and Connor (1997) advocate the same dietary changes. These positions differ regarding whether monounsaturated fatty acids should replace up to approximately 10% of calories that would potentially be consumed as starch. Refined starches are low in fiber, which may have beneficial effects on blood cholesterol and glucose (Krauss et al., 2000).

The Food and Drug Administration (FDA) is responsible for regulating food labels including nutritional and health claims. Table 1 lists the health claims currently permitted by the FDA (2001) regarding relationships between a food or nutrient and the risk of a disease or health-related condition. Labeling regulations from FDA (2001) also define the standards that a food product must meet to use terms such as low fat and low-calorie on the label. More recently, food manufacturers have sought FDA approval to be allowed to put health claims on food products. Labeling terms such as "organically grown" are under the purview of the FDA as well.

In the twenty-first century, governmental and health agencies will have to address issues such as the environmental and health impact of genetically modified food crops. Genetically engineered plants have the potential to produce vaccines, which could be developed as an immunization delivery system. Policy and regulations are needed to address the growth of the herbal supplement market, which already includes nutriceuticals (food products altered to provide an additional nutritional or health benefit). Food will increasingly be viewed as medicine by the food and pharmaceutical industries, which will involve new areas for the FDA to address.

Environmentalists and others are becoming increasingly concerned about the environmental effects of agribusiness and are seeking governmental and public oversight. Some of these issues are highlighted by John Robbins (1987) in the book and film *Diet for a New America* in the appeal to consider a vegetarian diet and locally grown foods. The USDA (2001b) now provides information about locally grown organic foods in conjunction with the Community Supported Agriculture (CSA) program, which include a Bronx distribution site. The Moshlulu Montefiore Community Center participates in the CSA program by sponsoring a seasonal food "cooperative" that sells community residents shares of the crops produced by on a Hudson Valley organic farm. The CSA encourages the participation of low-income residents by developing "work" shares for helping with the weekly distribution of food and by providing the option of paying for the food in installments with food stamps.

NUTRITION IN MEDICAL EDUCATION: A NATIONAL PERSPECTIVE

As the knowledge base in medicine increases, there is considerable competition for classroom and hospital teaching time in medical education. As the awareness and scientific understanding of nutrition increases, more

creative approaches to including nutrition in the medical curriculum need to be developed. Initially, nutrition was taught as an integral component of biochemistry courses and physicians emphasized therapeutic approaches such as reducing dietary sodium for hypertension because pharmacological treatment options were not yet available. The rapid proliferation of scientific knowledge puts nutrition in competition with other medical education topics. The metabolic functioning of nutrients as coenzymes remains an integral component of biochemistry courses, but providing the link back to foods is often taught as a separate topic. The issue of how to integrate nutrition into medical education has become increasingly challenging.

Almost 40 years ago, the American Medical Association (AMA) Council on Food and Nutrition (1963) sponsored a conference than focused on integrating nutrition education into the clinical training of physicians rather than as a pre-clerkship course that would be less meaningful and potentially forgotten. The AMA conference recommended that "nutrition teaching should be primarily at the bedside and in clinical conferences" and that "supervision of experiences in applied nutrition should be a qualification to be met in the approval of hospitals."

The growing national effort to increase nutrition in medical education has largely focused on pre-clerkship years despite the longstanding recommendation to focus on integrating nutrition into undergraduate clerkships. Shils (1989) indicated that teaching nutrition in the clinical clerkships is a missing link "needed to sensitize students to the importance of nutrition in clinical care." The Committee on Nutrition in Medical Education of National Academy of Sciences (1985) recommended that every medical school should devote a minimum of 25 hours of curriculum time to nutrition. However, too often the nutrition curriculum is limited to a single discrete pre-clerkship course that is lecture-based. This approach may do little to help students integrate nutrition into clinical practice or to answer concerns that may be raised by patients. Efforts to increase nutrition teaching have resulted in an increase in the number of questions dealing with nutrition on the National Medical Board Examination, but Hark et al. (1997) report that most of the questions focus on overt nutritional deficiencies rather than more common clinical issues related to chronic disease prevention and management. The lack of nutrition questions related to chronic disease management and prevention may be related to the perceived lack of consistency with respect to dietary recommendations regarding chronic diseases. Deficiency diseases are readily produced under experimental conditions and replacing the nutrient ameliorates deficiency symptoms. Thus, the evidence of specific nutrients in preventing acute deficiencies is readily demonstrated. However, nutrition needs to be incorporated into medical training to assure that physicians acquire sufficient knowledge and skills to address the nutrition related health disparities outlined in the Healthy People 2010 (United States Department of Health and Human Services, 2000). Various ethnic and economically disadvantaged populations suffer excess morbidity and mortality from chronic diseases including CVD, diabetes, and cancer than the population as a whole.

NUTRITION CURRICULUM: LESSONS LEARNED FROM THE PAST

Efforts to address nutrition in the Albert Einstein College of Medicine (AECOM), curriculum have largely focused on a vertically integrated approach but have also included the creation of a distinct nutrition course in the late 1970s with the lecture-based Return to Basic Sciences. Students indicated that this educational approach did not meet their needs, and the Return to Basic Sciences was discontinued in the early 1980s, although elective course work in nutrition has been an option on an ongoing basis.

In a 1983 survey of AECOM students, the following nutrition topics, listed in rank order, were identified as priorities: 1) dietary recommendations (lifestyle) and desirable body weight for healthy patients, 2) diets for patients with chronic illness, 3) biochemical function of vitamins, 4) malnutrition, and 5) nutrition histories and nutritional physical diagnosis. Interestingly, when asked about the amount of emphasis on nutrition in teaching, faculty felt that significantly greater emphasis was given to nutrition topics than did students. Barriers to teaching nutrition identified by the faculty included deficits in their own knowledge and difficulty with nutrition-related resources and nutrition services.

The AECOM curriculum has, for some time, included pre-clerkship case-based learning to address the biochemical aspects of nutrition. As students move into their clerkship years, the focus shifts to nutrition-related skills related to patient care. For example, the third-year clerkship in Family Medicine teaches students basic nutrition interviewing skills using the techniques described by Hark and Deen (1999). While many course and clerkship leaders have lacked the time and expertise in the past to focus on nutrition, the collaborative development of case materials with nutrition experts have enabled course leaders to include nutrition content as an integral component. A 1997 survey of AECOM course leaders determined the extent to which the nutrition topics selected by the American Medical Student Association (AMSA, 1996) for inclusion in medical education were being taught at AECOM. The responses from the pre-clerkship course and clerkship leaders (n=31) provided a foundation for those changes proposed in the AECOM Nutrition Academic Award (NAA). Table 2 provides an overview of courses that address topics and priorities for curriculum development. The indication that a topic was addressed in a pre-clerkship course or during clerkship

rotations does not assure that students have sufficient knowledge related to the topic. Rather, the designation provides at least the foundation for building an integrated nutrition curriculum and exposes students to topics deemed to be essential by the AMSA (1996). Approaches used by medical schools to provide a nutrition curriculum include: addressing nutrition as a theme (Lo, 2000); using the internet for faculty development in nutrition (Armstrong and Koffman, 2000); use CD-ROM for teaching nutrition teaching (Cooksey et al, 2000); and including case-based nutrition teaching (Hark and Morrison, 2000).

NUTRITION ACADEMIC AWARD: IMPLICATIONS FOR THE AECOM CURRICULUM

The National Heart, Lung, and Blood Institute and subsequently the National Institute of Diabetes, Digestive, and Kidney Diseases have provided funding to advance nutrition teaching in medical education. A total of 21 medical schools including AECOM have received the Nutrition Academic Award (NAA). The AECOM program uses a vertically integrated model to assure that nutrition becomes a permanent theme in the curriculum and that AECOM graduates acquire knowledge and skills needed to incorporate nutrition into clinical practice. Thus, we are integrating nutrition learning objectives into various courses and clinical rotations in collaboration with the Pre-clerkship and Clerkship Curriculum Committees. Each student has computerized portfolio that tracks computer-based nutrition activities across courses. The NAA and Office of Computer Medical Education have developed a NAA Website that students can use to complete computerized cases and other nutrition assignments. The NAA Website includes links to resource material useful in patient assessment, education and care. The AECOM "virtual" nutrition course utilizes content from the nutrition textbook, *Medical Nutrition and Disease* by Morrison and Hark (1998). Table 3 provides an overview of the nutrition knowledge and skills that are the targets for curriculum development at AECOM. The AECOM nutrition program is designed to build a nutrition knowledge base early in medical training to provide the foundation for addressing nutrition as a integral component of patient assessment and care.

Much of the pre-clerkship teaching addresses normal nutrition and methods for evaluating nutrition information. Students complete a quick dietary self-assessment to provide a link between nutrient intake and metabolism as well as to introduce them to dietary assessment techniques. The role of nutrient in various metabolic pathways is an integral component of biochemistry, which may include case illustration that address in-born errors of metabolism and other situation in which dietary modification is needed. The introduction to evidence-based medicine includes analysis of nutritional variables in epidemiological studies and in clinical trials. Nutrition issues and the principles of medical nutrition therapy are integrated into the organ-based pathophysiology teaching program. Nutrition assessment is be integrated into the skills development program for obtaining a medical history and physical diagnosis. Clinical rotations are increasingly addressing nutrition in the case-based teaching program.

NUTRITION RESOURCES

The NAA program has developed collective curricular, case and evaluation materials to be disseminated through the national NAA Website. Collaboration among the funded schools is achieved through semi-annual meetings and ongoing committee activities. The NAA Website (2002) at AECOM is also being used to disseminate nutrition materials. Resources available via AECOM nutrition web page include: the nutrition modules from AECOM courses, the NAA curriculum guide, patient education materials, and annotated web links for nutrition information. Some resources, such as the WAVE (weight, activity, variety, and excess) Pocket Guide for Primary Care, can be downloaded to facilitate wider spread emphasis on nutrition in primary care. Patient education materials that are identified as priorities in Healthy People 2010 (United States Department of Health and Human Services, 2000) and the Dietary Guidelines for Americans (USDA, 2000) and other materials distributed by health organizations that are linked to the other NAA websites.

The link to the USDA Website provides access to consumer issues. The AECOM NAA web site also includes behavioral resources within the Web site and hyperlinks to Internet sites that focus on how to make dietary changes as well as information pertinent to the nutrition content of specific AECOM nutrition courses and clerkships. Faculty and students can use the AECOM nutrition web page from the NAA to search for nutrition information. Other material that that are being make accessible from the web page includes a mini diet manual that can be downloaded. Web-based resources focusing on weight control and diabetes (Kalten et al., 2000) are also being linked.

SUMMARY AND CONCLUSIONS

The growing recognition of the importance of nutrition presents medical schools with the challenge of how to address the environmental, ethical, and health aspects of nutrition. The traditional approach of offering one pre-clerkship nutrition course was inadequate to address the breadth and complexity of the nutrition issues that physicians face in clinical practice. AECOM is using the NAA funding to integrate nutrition as a theme throughout the curriculum. AECOM is developing its NAA web page to expand teaching via computerized cases and provide information about nutrition resources.

TABLE 1 | FDA REGULATIONS FOR NUTRIENT CONTENT CLAIMS

The regulations also spell out what terms may be used to describe the level of a nutrient in a food and how they can be used. These are the core terms:

- **Free.** This term means that a product contains no amount of, or only trivial or "physiologically inconsequential" amounts of, one or more of these components: fat, saturated fat, cholesterol, sodium, sugars, and calories. For example, "calorie-free" means fewer than 5 calories per serving, and "sugar-free" and "fat-free" both mean less than 0.5 g per serving. Synonyms for "free" include "without," "no" and "zero." A synonym for fat-free milk is "skim."

- **Low.** This term can be used on foods that can be eaten frequently without exceeding dietary guidelines for one or more of these components: fat, saturated fat, cholesterol, sodium, and calories. Thus, descriptors are defined as follows:

    o low-fat: 3 g or less per serving
    o low-saturated fat: 1 g or less per serving
    o low-sodium: 140 mg or less per serving
    o very low sodium: 35 mg or less per serving
    o low-cholesterol: 20 mg or less and 2 g or less of saturated fat per serving
    o low-calorie: 40 calories or less per serving.

The FDA allowed nutrient-disease relationship claims and rules for using such claims are:

- **Calcium and Osteoporosis:** To carry a claim, a food must contain 20 percent or more of the Daily Value for calcium (200 mg) per serving, have a calcium content that equals or exceeds the food's content of phosphorus, and contain a form of calcium that can be readily absorbed and used by the body. The claim must name the target group most in need of adequate calcium intakes (that is, teens and young adult as well as White and Asian women) and state the need for exercise and a healthy diet. A product that contains 40 percent or more of the Daily Value for calcium must state on the label that a total dietary intake greater than 200 percent of the Daily Value for calcium (that is, 2 g or more) has no further known benefit.

- **Fat and Cancer:** To carry a claim, a food must meet the nutrient content claim requirements for "low-fat" or, if fish and game meats, for "extra lean."

- **Saturated Fat and Cholesterol and Coronary Heart Disease:** A claim may be used if the food meets the definitions for the nutrient content claim "low saturated fat," "low-cholesterol," and "low-fat" or, if fish and game meats, for "extra lean." It may mention the link between reduced risk of coronary heart disease and lower saturated fat and cholesterol intakes to lower blood cholesterol levels.

- **Fiber-containing Grain Products, Fruits, and Vegetables and Cancer:** To carry a claim, a food must be or must contain a grain product, fruit, or vegetable and meet the nutrient content claim requirements for "low-fat," and, without fortification, be a "good source" of dietary fiber.

- **Fruits, Vegetables, and Grain Products that contain Fiber and Risk of Coronary Heart Disease:** To carry a claim, a food must be or must contain fruits, vegetables and grain products. It also must meet the nutrient content claim requirements for "low saturated fat," "low-cholesterol," and "low-fat" and contain, without fortification, at least 0.6 g soluble fiber per serving.

- **Sodium and Hypertension:** To carry a claim, a food must meet the nutrient content claim requirements for "low-sodium."

- **Fruits and Vegetables and Cancer:** A claim may be made for fruits and vegetables that meet the nutrient content claim requirements for "low-fat" and that, without fortification, for "good source" of at least one of the following: dietary fiber, vitamin A, or vitamin C. This claim relates diets low in fat and rich in fruits and vegetables (and thus vitamin A, vitamin C, and dietary fiber) to reduced cancer risk. FDA authorized this claim in place of an antioxidant vitamin and cancer claim.

- **Folic Acid and Neural Tube Defects:** A claim is allowed on dietary supplements that contain sufficient folate and on conventional foods that are naturally good sources of folate, as long as they do not provide more than 100 percent of the Daily Value for vitamin A as retinol or preformed vitamin A or vitamin D. A sample claim is "healthful diets with adequate folate may reduce a woman's risk of having a child with a brain or spinal cord defect."

- **Dietary Sugar Alcohols and Dental Caries:** A claim may be made for food products, such as candy or gum, containing the sugar alcohols xylitol, sorbitol, mannitol, maltitol, isomalt, lactitol, hydrogenated starch hydrolysates, hydrogenated glucose syrups, or a combination of any of these. If the food also contains a fermentalbe carbohydrate, such as sugar, the food cannot lower the pH of plaque in the mouth below 5.7. Besides the food ingredient's relationship to dental caries, the claim also must state that frequent between-meal consumption of foods high in sugars and starches promotes tooth decay. A shortened claim is allowed on food packages with less than 15 square inches of labeling surface area.

- **Soluble fiber and Heart Disease:** Any claim must state that the fiber also needs to be part of a diet low in saturated fat and cholesterol, and the food must provide sufficient soluble fiber (such as whole oats and psyllium seed husk). The amount of soluble fiber in a serving of the food must be listed on the Nutrition Facts panel.

TABLE 2 | A 1997 Course Review based on the AMSA's Listing of Topics Deemed Essential to Developing Physician Competency in Nutrition (Updated for 2002)

Topics Deemed Essential to Developing Physicians' Competencies in Nutrition			
TOPIC	ADDRESSED	**TOPIC**	ADDRESSED
Biochemistry, Physiology, Pathophysiology		**Diet and Prevention**	
Deficiency of vitamins and minerals	1, 8	Cancer	5
Sources of antioxidants	2	Osteoporosis	8
Sources of:	2	Obesity	1, 5, 6, 8
B_{12}	2	Hypertension	5, 9
Calcium	1, 8	Criteria for an adequate diet	8*
Complex Carbohydrates	2	National nutritional programs and goals	5*
Fats	2	Nutritional supplements	5, 8
Fiber	2	Low-sodium diet	5, 8, 9
Iron	2, 8	Vegetarianism	8
Potassium	2	**Nutritional Therapy**	
Protein	2, 8	Digestive enzyme therapy	8
Sodium	2, 8	The MD-RD team	2, 8*
Energy balance	2, 6	Nutritional supplements	8
Gastrointestinal tract: An overview of function	3	Alcohol abuse	1, 4
Deficiency of:		Enteral nutrition support	8*
A, C, D, K, B complex vitamins	4	Parenteral nutrition support	8
Zinc, Iron	8	Writing nutrition prescriptions	8
Protein	8	Writing nutrition referrals	2, 8
Criteria for an adequate diet	2, 8	Cultural issues	8
Hormonal control of nutrient metabolism	1	**Nutrition and Diseases**	
Lipids	1, 8, 9	Bulimia	4, 8
Nutrition and immunity	1	Anorexia	4, 8
Physiology of hunger and satiety	1	Depression	4
Water and electrolytes	4	Schizophrenia	4
Trace minerals	4	Failure to thrive	8
Nutrition Assessment		**Nutritional anemias**	7, 8
Body composition	8	Diabetes	1, 6, 8
Waist to hip ratio	8	Cancer	5, 8
Diet history taking	2, 8	Hypertension	5, 8, 9
Nutrition physical examination	2, 8	Osteoporosis	8
Biochemical evaluation	3, 5, 6, 7	Hyperlipidemia and atherosclerosis	1, 8, 9
Anthropometrics	8, 9	Coronary artery and cerebrovascular disease	9, 9
Assessments of:	8	Reflux disease	3, 8
Vitamin intake and balance	2, 8	Liver disease	3
Mineral intake and balance	2, 8	Peptic ulcer disease	3
Electrolyte intake and balance	2, 8	Water, electrolytes, and acid -base balance	1, 4
Antioxidant intake and balance	2, 8	Hospital malnutrition	8
Protein intake	2, 8	Surgery, trauma and infection	8
Carbohydrate intake	2	Food-borne illness	1, 8
Fat intake	2	Drug-nutrient interactions	8*
Energy balance	2	Primary malnutrition	8
Fiber intake	2	Diet and wound healing	8
Plotting growth	8	Allergies	8
Diet and Prevention		Cystic fibrosis	1, 8
Pregnancy	8	Rheumatoid disease	8
Lactation	8	Oral cavity	8
Growth and development	1, 8	Inborn errors of metabolism	1
Geriatrics	8	Acquired immunodeficiency syndrome	8
Cardiovascular disease	5, 8, 9	Tests of digestive function	3, 8

Courses Covering Nutrition: 1. Molecular and Cellular Foundations of Medicine; 2. Introduction to Clinical Medicine: Nutrition Assessment Workshop; 3. Gastrointestinal and Liver Disease; 4. Nervous System and Human Behavior; 5. Principles of Preventive Medicine; 6. Endocrine System; 7. Hematology; 8. Infectious Disease; 9. Cardiovascular Disease. * represents major areas of curriculum development.

TABLE 3 | AECOM NAA - Curriculum Objectives for Medical Students and Physicians

1. Pre-clerkship

a) Knowledge of nutritional biochemistry
b) Knowledge of adequate and optimal vitamin and mineral levels
c) Knowledge of drug and nutrient interactions
d) Basic nutrition and physical activity assessment skills
e) Knowledge of nutrition and the life-cycle
f) Basic knowledge of nutrients and energy density in food groups
g) Skill at assessing different degrees of overweight and obesity and referring appropriately for treatment
h) Sensitivity to cultural and gender issues related to food, nutrition, and body size
i) Knowledge of appropriate diet therapy for different disease states
j) Skill at assessing malnutrition as well as implementing the appropriate diet therapy for repleting the patient in both outpatient and inpatient settings
k) Skill at evaluating nutrition information based on the criteria of evidence-based medicine

2. Clerkship

a) Skill at performing inpatient and outpatient nutrition assessments using the WAVE approach
b) Ability to assess the nutrition status of the pregnant patient and counsel or refer appropriately
c) Skill at using diet therapy to complement drug therapy objectives in type 2 Diabetes and congestive heart failure
d) Skill at communicating evidence-based nutrition information to patients

3. Residency and Postgraduate

a) Increasing level of skill at performing nutrition assessments
b) Increasing level of skill at providing basic nutrition and lifestyle counseling to patients
c) Keeping up-to-date on evidence-based nutrition and diet therapy knowledge

4. Interdisciplinary/Team

a) Ability to collaboratively plan patient care with other members of the health care team such as dietitians, nurses, and pharmacists
b) Knowledge of the range of skills and services other health care team members can provide to patients
c) Knowledge of when to refer to other health care team members

ACKNOWLEDGEMENTS

We are deeply grateful to the AECOM faculty and students whose commitment and contributions have improved nutrition education. We are particularly grateful to Mindy Ginsberg and Drs. Penny Grossman Albert Kuperman for their insights and technical expertise. We could not have developing an integrated nutrition program without the efforts of Amanda Cox (Class of 2002), Jakemia Wilson (Class of 2002), Marion Vetter (Class of 2002), Denise George (Class of 2000), and Nicole Weintraub (Class of 2003).

REFERENCES

Albanes, D., (1999) Beta-carotene and lung cancer: A case study. *Am. J. Clin. Nutr.* **69:**1345-1350S.

American Diabetes Association Position Statement. (2002) Evidenced-based nutrition principles for the treatment and prevention of diabetes and related complications. *Diabetes Care* **25:**S50-S60.

American Dietetic Association Position Statement. (1997) Vegetarian diets. *J. Am. Diet. Assoc.* **97:**1317-1321.

American Dietetic Association Position Statement. (1999) Medical nutrition therapy and pharmacotherapy *J. Am. Diet. Assoc.* **99:**227-230.

American Medical Association Council on Foods and Nutrition. (1963) Nutrition teaching in medical schools. *J. Am. Med. Assoc.* **183:**955-959.

American Medical Student Association. (1996) Nutrition Curriculum Project Report. Essentials of nutrition education in medical schools: a national consensus. *Academic Med.* **71:**969-971.

Anderson, K.M., Wilson, P.W.F., Odell, P.M., and Kannell, W.B. (1991) An updated coronary risk profile: a statement for health professionals. *Circulation* **83:**356-362.

Armstrong, E.G. and Koffman R.G. (2000) Enhancing nutrition education through faculty development: from workshops to Web sites. *Am. J. Clin. Nutr.* **72:**877S-881S.

Bertron, P., Barnard, N.D., and Mills, M. (1999) Racial bias in federal nutrition policy, Part II: Weak guidelines take a disproportionate toll. *J. Natl. Med. Assoc.* **91:**201-208.

Committee on Nutrition in Medical Education of the National Research Council. (1985) *Nutrition education in US medical schools*. National Academy of Science Press, Washington, D.C.

Connor, W.E., and Connor, S.L. (1997) Should a low-fat, high-carbohydrate diet be recommended to everyone? *N. Engl. J. Med.* **337:** 562-563.

Cooksey, K., Kohlmeier, M., Plaisted, C., Adams, K., and Zeisel, S.H. (2000) Getting nutrition education into medical schools: a computer-based approach. *Am. J. Clin. Nutr.* **72:**868S-876S.

Diabetes Control and Complications Trial Research Group. (1993) The Effect of Intensive Treatment of Diabetes on the Development and Progression of Long-term Complications in Insulin-Dependent Diabetes Mellitus. *N. Engl. J. Med.* **329:**977-986.

Diet Heart Study Research Group. (1968) The National Diet-Heart Study-Final Report. *Circulation* **37:**1-428.

DeLorgeril, M., Salen, P., Martin, J.L., Monjaud I., Delaye, J., and Mamelle, N. (1999) Mediterranean diet, traditional risk factors, and rates of cardiovascular complication after myocardial infraction: final report of the Lyon Diet Heart Study. *Circulation* **99:**779-785.

Food and Drug Administration. (2001) The new food label. Retrieved December 2001 from the Food and Drug Administration website. http://www.fda.gov/opa-com/backgrounders/foodlabel/newlabel.html.

Food and Nutrition Board of the Commission on Life Sciences of National Research Council. (1989) *Recommended Dietary Allowances,* 10th edition. National Academy of Sciences Press, Washington, D.C.

Food and Nutrition Board of the Institute of Medicine (2000) *Dietary Reference Intakes (DRI): application in dietary assessment*. National Academy of Science Press, Washington, D.C.

Haddad, E.H., Sabate, J., and Whitten, C.G. (1999) Vegetarian food guide pyramid: a conceptual framework. *Am. J. Clin. Nutr.* **70:**615S-619S.

Hark, L. Iwamoto, L.A., Melnick, D.E., Young, E.A., Morgan, S.L., and Hensrud, D.D. (1997) Nutrition coverage on medical licensing examinations in the United States. *Am. J. Clin. Nutr.* **65:**568-571.

Hark, L. and Deen, D., Jr. (1999) Taking a nutrition history: A practical approach for family physicians. *Am. Fam. Physician* **59:**1521-1528, 1531-1532.

Hark, L.A. and Morrison, G. (2000) Development of a case-based integrated nutrition curriculum for medical students. *Am. J. Clin. Nutr.* **72:**890S-897S.

Katen, M., Grundy, S.M., and Willet, W.C. (1997). Beyond low-fat diets. *N. Engl. J. Med.* **337:**562-563.

Kalten, M.R., Ardito, D.A., Wylie-Rosett J., and Cimino, C. (2000) A Web-accessible core weight management program. *Diabetes Educ.* **26:**929-936.

Krauss, R.M., Eckel, R., Howard, B., Appel, L.J., Daniels, S.R., Deckelbaum, R.J., Erdman, J.W., Jr., Kris-Etherton, P., Goldberg, I.J., Kotchen, T.A., Lichtenstein, A.H., Mitch, W.E., Mullis, R., Robinson, K., Wylie-Rosett, J., St Jeor, S., Tribble, D.L., and Bazzarre, T.L. (2000) Revision 2000: A Statement for Healthcare Professional from the Nutrition Committee of the American Heart Association. *Circulation* **102:**2284-2299.

Lo, C. (2000) Integrating nutrition as a theme throughout the medical school curriculum. *Am. J. Clin. Nutr.* **72:**882S-889S.

Lohr, K.N., Eleazer, K., and Maukaupf, J. (1998) Health policy issues and application for evidence-based medicine and clinical practice guidelines. *Health Policy* **46:**1-19.

Morrison, G. and Hark, L. (1998) *Medical Nutrition & Disease,* 2nd edition. Blackwell Science, Inc. Massachusetts.

National Cholesterol Education Program Expert Panel. (1993) Summary of the second report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. *J. Am. Med. Assoc.* **269:**3015-3023.

Nutrition Academic Award Website. (2002) Retrieved May 2002 from the Albert Einstein College of Medicine Website, http://www.aecom.yu.edu/nutrition/default.htm.

Robbins J. (1987) *Diet for a New America.* KJ Kramer Press, California.

Shils, M.E. (1989) The missing link: formal case related teaching in clinical clerkships. *Bull. N.Y. Acad. Med.* **65:**975-984.

Tavelli, S., Beerman, K., Shultz, J.E., and Heiss, C. (1998) Sources of error and nutrition adequacy of the food guide pyramid. *J. Am. Coll. Nutr.* **47:**77-82.

United States Department of Agriculture. (2000) Dietary Guidelines for Americans, 5th edition. Home and Garden Bulletin No. 232. US Government Printing Office, Washington, D.C. Retrieved December 2001 from the United States Department of Agriculture Website, http://www.nal.usda.gov/fnic/dga.

United States Department of Agriculture. (2001a) Community Supported Agriculture Resources from the Alternative Farming System Information. Retrieved December 2001 from the United States Department of Agriculture Website, http://www.nal.usda.gov/afsic/csa/.

United States Department of Agriculture (2001b) Ethnic/cultural and special audience food guide pyramids. Retrieved December 2001 from the United States Department of Agriculture Website, http://www.nal.usda.gov/fnic/etext/000023.html#xtoicd2381818.

United States Department of Health and Human Services. (2000) Healthy People 2010: Understanding and Improving Health. Government Printing Office. Washington, D.C. Retrieved December 2001 from U.S. Department of Health and Human Services Website, http://www.health.gov/healthypeople.

Wylie-Rosett, J. and Rifkin, H.R. (1985): History of Nutrition and Diabetes, In: *Nutrition and Diabetes.* Jovanovic, L. and Peterson, C. (eds.), Allan Liss, New York. pp. 1-8.