Summary of a Scientific Conference on Preventive Nutrition: Pediatrics to Geriatrics

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The Nutrition Committee of the American Heart Association, with cooperation and support from the Council on Cardiovascular Disease in the Young and the Council on Epidemiology and Prevention, convened a scientific conference on "Preventive Nutrition: Pediatrics to Geriatrics" in Salt Lake City, Utah, 1997. Other sponsors in this endeavor were the American Cancer Society, American Dietetic Association, American Academy of Pediatrics, Division of Nutrition Research Coordination of the National Institutes of Health, and American Society for Clinical Nutrition. The participants of the conference were asked to review the dietary recommendations from several health agencies and the scientific evidence in support of the recommendations and to describe how their commonalities make them appropriate as effective preventive health measures against the major chronic diseases (coronary heart disease, cancer, obesity, and diabetes) for particular age and ethnic groups. Dietary recommendations have been published by each of the above-named health agencies. These recommendations deal with primary prevention. The participants were asked to participate because of their expertise in basic and applied nutrition research and education.

To ensure that the goals of the meeting were effectively met, the plenary session consisted of 18 speakers with expertise in their respective fields. They reviewed the science base for nutrient/disease interactions in the causation of cancer, atherosclerosis, obesity, and diabetes. For each of these chronic diseases, nutrition interactions were addressed from both the epidemiological and clinical perspectives and the biochemical and molecular mechanisms by which specific nutrients are linked to disease. Other speakers and experts were selected to participate in 1 of 4 specific population committees that addressed recommendations targeted to the elderly, women, children, and minorities. They reviewed the available information and identified research needs and gaps in existing recommendations directly relevant to the respective subpopulation. The summary reports from each of these groups are presented later in this document. The conference was directed to physicians and other health professionals (dietitians, dietetic technicians, behavioral scientists, health educators, nutritionists, and nurses), city/county and school healthcare administrators, media and communications specialists, food industry personnel, and members of federal, state, and municipal health and educational agencies.

Objectives

The objectives of the conference were as follows:

- To review the current state of knowledge on the role of nutritional factors in the pathogenesis of major chronic diseases.
- To synthesize comprehensive preventive nutrition strategies applicable to a broad spectrum of chronic diseases.
- To define links between common preventive nutrition strategies that decrease risks for specific diseases such as atherosclerosis, cancer, diabetes, and obesity in children, adults, and the elderly.
- To summarize common recommendations for the nutrient groups, carbohydrates, proteins, fats, vitamins, antioxidants, minerals, and fiber in the prevention of atherosclerosis, cancer, diabetes, and obesity.
- To emphasize specific needs and differences in various socioeconomic, cultural, and genetically susceptible groups and integrate dietary recommendations for specific groups (namely, children, the elderly, women, and minorities) that can be used to decrease the risk of several chronic diseases.

Scientific Process

The current scientific basis for nutrient/disease interactions was presented, and the capability of nutritional approaches to decrease risk for several chronic diseases was reviewed. A consensus was then reached through discussions that involved a thorough review of existing recommendations. This review process was based on published clinical and epidemiological literature as well as experimental, biochemical, and molecular studies for recommendations concerning cancer, atherosclerosis, obesity, and diabetes. A review of the database for recommendations in each of the specific population groups was included in discussions by the specific population committees.

Scientific Overview

"For the two out of three adult Americans who do not smoke and do not drink excessively, one personal choice seems to influence long-term health prospects more than any other:

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TABLE 1. Common Clinical/Epidemiological Links Between Specific Nutritional Factors and Risks for Chronic Disease

	Disease Risk			
Dietary Intake	Cancer	Atherosclerosis	Obesity	Diabetes
High calories	↑*	↑	↑	↑
High total and/or saturated fat	↑*	↑	↑†	↑†
High salt	↑‡	↑	...	↑
Low fiber and complex carbohydrates	↑	↑	...	↑
Low antioxidants	↑	↑	...	↑

Arrows indicate increased risk; ellipses (...), no definite association.

*High fat intake is associated with increased risk of certain cancers. Recent evidence suggests that high caloric intake may be more important than high fat intake for increasing risk of breast cancer.

†Although some evidence indicates that higher proportions of total caloric intake from fat are associated with increased risk for obesity and type 2 diabetes, this point is still unresolved.

‡Increased risk is associated with salts used in pickling or preserving meats and other foods.

what we eat." Evidence in support of this statement from the first Surgeon General's Report on Nutrition and Health was extensively reviewed during the meeting. A substantial body of clinical and epidemiological evidence shows many common links between nutrients and diet in the 4 major disease categories under consideration: cancer, atherosclerosis, obesity, and diabetes (Table 1). For example, dietary and diet-related factors are estimated to have contributed to >30% of cancer cases in North America. Dietary factors, including a high intake of saturated fat, are related to some types of cancer (eg, colon, prostate, and lung). Substantial evidence supports the role of high total and saturated fat intake in increasing the risk of atherosclerosis, and there is evidence that dietary factors are related to higher risks of obesity and diabetes. Foods rich in other dietary components such as fiber and complex carbohydrates appear to decrease the risk of certain forms of cancer, such as colon cancer, as well as coronary heart disease (CHD) and manifestations of diabetes. In another example, data from a number of sources suggest that certain components of foods (eg, vitamins A, C, and E) and other antioxidant compounds are not only protective in terms of carcinogenesis but also decrease the risk of atherosclerosis and complications of diabetes.

The most likely biological basis for the clinical and epidemiological evidence is that nutrients contained in the diet can affect a number of cellular metabolic mechanisms that are common in the pathogenesis of chronic diseases (Table 2). For example, inflammation, cell-proliferative responses, and cell-signaling pathways, each potentially important in the pathogenesis of cancer, atherosclerosis, and diabetes, can all be affected by different dietary fatty acids.

In the course of reviewing the science base for recommendations for different age groups and for cancer, atherosclerosis, obesity, and diabetes, it was realized that there were far more commonalities among different sets of recommendations than there were differences. Existing literature provided a scientific basis to support the conclusion that existing recommendations

TABLE 2. Cellular and Biochemical Mechanisms That Play a Role in the Pathogenesis of Major Chronic Diseases

	Cancer	Atherosclerosis	Obesity	Diabetes
Insulin resistance	−	+	+	+
Cell proliferation	+	+	−	+
Inflammation	+	+	−	+
Apoptosis	+	+	−	+
Changes in signal transduction and gene expression	+	+	+	+
DNA modifications/ mutations/genetic variation	+	+	+	+

A plus sign indicates association; minus sign, no specific body of evidence is available to suggest that a specific mechanism or pathway correlates with the indicated disease.

crossed disease categories rather than separated them. In addition, although specific population groups did have particular needs, the available evidence essentially suggests that all the major recommendations apply across different population groups. Each of these sets of recommendations developed by different private and government organizations may help reduce the risk of cancer, atherosclerosis, obesity, and diabetes (Table 3).

Summary Recommendations for Common Nutritional Guidelines

The consensus in nutrient recommendations from different organizations can be summarized as follows:

- Saturated fat <10% of calories
- Total fat ≤30% of total calories
- Polyunsaturated fat ≤10% of total calories
- Monounsaturated fat ≤15% of total calories
- Cholesterol ≤300 mg/d
- Carbohydrates ≥55% of total calories
- Total calories to achieve and maintain desirable weight
- Salt intake limited to <6 g/d

Because it is difficult for many individuals and populations to calculate diets in weights and percentages, these recommendations can best be achieved by following the US Dietary Guidelines and the Food Guide Pyramid of the US Department of Health and Human Services and Department of Agriculture (USDA). Guidelines include the recommendations that follow:

- Eat a variety of foods.
- Balance the food you eat with physical activity—maintain or improve your weight
- Choose a diet with plenty of grain products, vegetables, and fruits.
- Choose a diet low in fat, saturated fat, and cholesterol.
- Choose a diet moderate in sugars.
- Choose a diet moderate in salt and sodium.
- If you drink alcoholic beverages, do so in moderation.

Issues in Special Populations

It was agreed that the recommendations listed above should apply to the whole population >2 years of age: children ages 2

TABLE 3. Common Themes in Current Dietary and Lifestyle Recommendations

Recommendations	ACS	AHA	ADA*	ADiabA	NIH	AAP	USDA/HHS, FDA
Consume adequate calories to achieve/sustain desirable weight.	+	+	+†	+	+	+	+
Maintain intakes of total fat at ≤30% of total energy, saturated fat at ≤10% of total energy, and cholesterol at ≤300 mg per day.	+	+	+‡	+§	+	+	+
Eat a variety of foods and emphasize foods from plant sources (fruit, vegetables, whole grains, legumes).	+	+	+	+	+	+	+
Choose a diet moderate in sugars and salt.	+	+	+	+	+	+	+
Maintain an adequate level of physical activity.	+	+	+	+	+	+	+
Do not smoke.	+	+	+	NR	+	+	+
If you drink alcohol, do so in moderation (1–2 drinks per day).	+	+	+	+	+	NR	+

ACS indicates American Cancer Society; AHA, American Heart Association; ADA, American Dietetic Association; ADiabA, American Diabetes Association; NIH, National Institutes of Health; AAP, American Academy of Pediatrics; USDA/HHS, FDA, US Dept of Agriculture/Health and Human Services, Food and Drug Administration; and NR, no specific recommendation.

*The American Dietetic Association has no published dietary guidelines but concurs with those of the USDA/HHS Dietary Guidelines for Americans and the National Cholesterol Education Program.

†Note that growing children should not be placed on restrictive calorie diets (ADA, 1995).

‡Supports the USDA Dietary Guidelines for Americans but also recommends that nutritional adequacy of diets of children at various fat-intake levels be evaluated with respect to effects on growth, development, and disease prevention.

§Based on nutritional assessment and treatment goals. Supports <10% of calories from saturated fats and ≤300 mg cholesterol per day.

to 5 should be phased into the diet. In addition, the specific population committees identified needs and points of emphasis for children, women, the elderly, and minorities, which are summarized below.

Children

Additional evidence from the Pathobiological Determinants of Atherosclerosis in Youth (PDAY) study has shown that in older children, the risk factors for coronary artery disease are the same as in adults. These include elevated plasma cholesterol levels, diabetes, physical inactivity, and smoking. These risks are associated with the extent of fatty aortic lesions. Data are accumulating that dietary and lifestyle modifications begun in childhood are likely to have benefits later in life. Comparable studies in the cancer field are lacking, but it is presumed that early adoption of healthy practices will also decrease long-term cancer risks. A major concern in the pediatric population is the increasing prevalence of obesity, which also requires intensive nutritional education.

Over the past 2 decades, dietary saturated fat and cholesterol intakes have decreased in American children without causing an increase in nutrient deficiencies. Nevertheless, data from the 1994 Infant Nutrition Survey and the USDA Nationwide Food Consumption Survey (1987–1988) indicate that ≤23% of young children (<5 years) receive less than two thirds of the Recommended Dietary Allowance (RDA) for calcium, iron, or zinc. In several studies in children, the safety and efficacy of diets to reduce plasma lipid levels have been demonstrated repeatedly, thus indicating that it is feasible for school-aged children to adopt diets lower in saturated fat and cholesterol without compromising growth and development, which is always a special concern in the pediatric age group.

Research Needs

- Develop informative biomarkers for all nutrients to distinguish between RDAs that are set too high and true nutritional deficiencies.
- Develop methods to assess long-term physical activity.
- Determine desirable fiber intake on the basis of available evidence.
- Develop foods that will help meet nutritional goals by contributing to a healthy diet.

Public Policy

- Implement current and future knowledge relevant to children through the use of improved physical education and lunch programs in schools.
- With the help of healthcare providers, identify families at high risk of developing chronic diseases.
- Promulgate dietary and exercise recommendations to parents, schools, government, industry, and health organizations.

Elderly

The risk of developing any of several major chronic diseases that kill most Americans, such as CHD, cancer, and diabetes, increases in the elderly. For example, the 10-year probability of developing heart disease is 10-fold higher in men or women >65 years of age versus individuals aged 30 to 34 years. For heart disease, risk factors in the elderly are similar to those in younger age groups. These include hyperlipidemia, smoking, low HDL cholesterol, diabetes, and obesity. Obesity can be difficult to prevent or treat in the elderly because the ability to regulate energy intake with energy expenditure appears to decline with age.

Diet-related factors are also thought to either increase or decrease the risk for cancer, the other major cause of death and disability in the elderly. The benefits of weight control and the consumption of diets rich in food from plant sources and low in saturated fat have been shown to be as important in the elderly as in the general population.

The results of epidemiological and intervention studies indicate that the dietary recommendations promulgated by the USDA, the American Heart Association, the American Can-

cer Society, and others should lead to decreased rates of heart disease and cancer in the elderly. Specific concerns involving factors that interfere with adoption of these recommendations by the elderly include undernourishment (either in calories or specific macronutrients and micronutrients) secondary to various diseases or deficient diets and the effects of medications administered over the long term.

Research Needs

- Determine the role of micronutrients in the prevention of heart disease and cancer.
- Identify specific components of fruits and vegetables that exert beneficial effects.
- Identify factors that can maintain muscle mass with increasing age.
- Determine methodology to promote optimal diets and maintain physical activity.
- Determine role of hormone replacement therapy.
- Identify specific genes and genetic variations that affect risk directly and indirectly by the way they interact with nutrients.
- Improve methods of objectively assessing dietary intake.

Public Policy

- Coordinate efforts of public and private health organizations to publicize the major dietary recommendations developed at this conference to the population at large as well as the elderly.
- Facilitate cooperative efforts between health organizations and the food industry, the American Association of Retired Persons, health maintenance organizations, insurance plans, nursing homes, and community groups.
- Advocate for improvement in the national nutrition database for the elderly.

Women

The target population was defined as healthy women and women at risk for chronic diseases and included all postpubertal females regardless of age. Obesity is a significant problem in women. Similar to the population as a whole, dietary factors contribute to the development of several chronic conditions in women. A number of factors deserve special emphasis in this group.

Obesity increases a woman's risk for ≥5 of the leading causes of death (heart disease, stroke, diabetes, atherosclerosis, and some types of cancer) and is associated with increased morbidity and mortality overall. Women have greater overall weight gain and experience more notable weight fluctuation than men. Approximately 35% or more of all women ≥20 years of age are overweight. Importantly, the majority of women consider themselves overweight, and most are usually trying to lose weight. Thus, women are particularly at risk for development of psychological or behavioral disorders associated with food intake, weight/body image, and self-efficacy. Eating disorders occur more frequently in young women, and dissatisfaction with body weight and consequent dieting may continue into adulthood, which contributes further to weight gain, weight fluctuation, and psychological problems. As women gain weight, body fat distribution increases risk. Upper-body obesity in particular has been associated with increased risk of diabetes mellitus.

The risk of cardiovascular disease and breast cancer increases with age. CHD is the major cause of death in women and generally occurs ≈10 to 12 years later in life for women than for men. Premature menopause without estrogen replacement therapy is a risk factor for CHD. When CHD is diagnosed in women, the rate of morbidity and mortality is greater than in men. The risk of breast cancer also increases with early menarche and late menopause and occurs more frequently in countries in which women have a high average intake of total and saturated fat, animal protein, total energy, and excess alcohol. In addition, hypertension occurs in ≈20% of the adult population, and women may respond better than men to dietary sodium and salt restriction. Osteoporosis in aging women, iron deficiency in women of childbearing age, and risk for neural tube defects in the infant that develop during pregnancy have all been shown to place women at special risk, with increased needs for calcium, iron, and folic acid, as well as improved overall dietary adequacy despite overall energy intake and weight status.

Research Needs

- Determine the independent effects of vitamin supplements, calcium, folic acid, alcohol, and phytoestrogens on health and disease prevention, as well as in the context of the total diet.
- Determine the effect of contraceptive use and estrogen replacement on nutrient needs.
- Determine the interactions of hormone status, diet, and exercise/physical activity.
- Determine the effect of maternal intake of dietary fatty acids on infant growth and development as well as the impact of low birth weight and excessive maternal weight gain on the risk for chronic disease.
- Use behavioral research to better understand and characterize eating patterns and dietary practices to improve weight management and develop more effective long-term interventions.

Public Policy

- Target the periconceptional population through physicians' offices (especially obstetrics and gynecology practices) for the implementation of the dietary recommendations.
- Encourage professional organizations, media groups, and industries that target women to publicize the dietary recommendations for women.

Minority Populations

Although it seems reasonable to assume that all ethnic groups have similar dietary/nutritional needs, there are numerous observations of ethnic differences in the occurrence of nutrition-related risk factors and diseases. Still, the database to support preventive nutrition recommendations is derived primarily from studies in white populations. Theoretically, genetic differences can render a particular set of dietary conditions more harmful or beneficial in one ethnic group than in another. This is one explanation for why individuals of different ethnic groups who consume similar diets might have varying disease profiles. However, another important explanation does not preclude the

presence of ethnic differences in the predisposition to diet-related diseases; that is, populations differ in the extent to which they have been exposed to social, cultural, and economic conditions known to be major determinants of diet-related diseases. More importantly, even in the presence of known genetic predisposing factors, conditions such as obesity, diabetes, CHD, and cancer develop only in the context of a certain set of environmental circumstances. Genetic factors determine individual variations in disease susceptibility in response to environmental factors, but the commonality in genetic factors is much greater than the differences across ethnic groups. The racial/ethnic designations for US minority populations are very general groupings based as much on sociopolitical as on biological influences, and there is tremendous diversity in these categories. Nonetheless, there is ample evidence that certain minority populations have acquired the adverse lifestyles that are dominant in the US population and in some cases have a worse profile than the white population for lifestyle-related diseases such as obesity, hypertension, diabetes, CHD, and certain types of cancer. However, similar findings can be noted for persons living in poverty or other disadvantageous social circumstances.

Ethnic and socioeconomic factors are critical considerations for the prevention of lifestyle-related diseases. Attention must be directed toward culturally determined attitudes, beliefs, and practices, both those that are socioeconomically related as well as those that may be relatively independent of socioeconomic status. Some cultural factors that influence lifestyle behaviors in racial/ethnic minority populations may be advantageous, such as traditional beliefs and practices that protect against the adoption of adverse behaviors. Culturally protective behaviors may coexist with behaviors that reflect the acquisition of risk associated with the earlier stages of westernization and upward social mobility.

Research Needs

- Emphasize research on national, social, and behavioral variables to better identify appropriate environmental, family, and individual intervention paradigms specific to different minority populations.
- Identify reasons for the increased prevalence of obesity in certain minority populations.
- Identify reasons for less favorable cardiovascular disease and cancer trends in blacks versus whites.
- Determine the role of genetic factors in cross-population differences in disease.

Public Policy

- Involve individuals from the ethnic group in the earliest stages of intervention programs. The paradigm must be compatible with the cultural perspectives and social circumstances of the program's target audience.
- Encourage local, state, and federal government to characterize food and nutrient intakes of racial/ethnic minority populations.
- Encourage federal, state, and local health authorities to seek creative ways, including funding, to overcome obstacles to increased physical activity and availability of healthful foods in populations of low socioeconomic status.
- Encourage public and private sources to fund more interdisciplinary research on communities and cultural change to support the development of culturally appropriate paradigms for reaching low-income and minority populations.
- Encourage private industry, especially the food industry, to assume a share of responsibility for closing the diet-related health disparities that affect low-income and minority populations.
- Encourage all federally sponsored food programs to adhere to the dietary recommendations.
- Encourage state and local health departments to work with local, voluntary health organizations to institute environmental changes that reduce the difficulty of adopting dietary changes at individual, household, and institutional levels.

Conclusions

The dietary recommendations promulgated by diverse US organizations are in remarkable agreement in their major tenets: (1) consumption of a diet containing a variety of foods; (2) decreased intake of fat, particularly saturated fat, and cholesterol; (3) increased consumption of fruits, vegetables, and whole grains; and (4) consumption of the proper amount of calories to maintain a desirable weight, a goal that is facilitated by regular physical activity. Evidence from numerous published studies indicates that adherence to these recommendations will decrease the risk of developing heart disease, cancer, diabetes, and obesity, the major causes of morbidity and mortality in the United States.

There are major gaps in our knowledge about nutritional adequacy, nutrient-disease interactions, and effective strategies to implement the current recommendations, which have the widely recognized potential to decrease the disease burden of the American population. For example, the reasons for the epidemic of obesity in adults and children of both sexes and all ethnic groups must be firmly established if progress in the prevention and treatment of obesity is to be made. Better indexes of biological sufficiency of micronutrients are needed in order that more accurate RDAs can be determined. Continued identification of specific substances in foods with adverse or beneficial effects on diseases is needed. The numerous genes that probably play a critical role in the causation of major diseases or the protection of individuals from such diseases must be isolated, and their interactions with nutrients must be investigated. Similarly, the roles of specific polymorphic forms of genes that influence individual susceptibility to specific dietary factors must be identified.

Because of the special needs of particular subpopulations, namely, children, women, the elderly, and minorities, some specific recommendations require special emphasis or are not included under the more global recommendations. For children, these include adequate intake of macronutrients to maintain normal growth and development. Special concerns that involve the elderly include undernourishment secondary to chronic disease or the effects of medications and obesity caused by lack of physical activity. Special needs for women include the regular consumption of low-fat dairy products and other calcium-rich foods to prevent osteoporosis and the consumption of folate-rich and folic acid–fortified foods, especially during the childbearing years, to prevent birth defects. Because conditions such as

hypertension, obesity, diabetes, heart disease, and certain cancers, all known to be influenced by dietary factors, are often more prevalent in certain ethnic groups, it is extremely important to stress implementation of these recommendations. The challenge of preventing or ameliorating diet-related diseases in minority populations is considerable and involves overcoming the adverse effects of poverty and social disadvantage. Finally, despite significant efforts by all the major health organizations, both public and private, widespread adherence to the current recommendations is lacking. Therefore, innovative programs for education and implementation that involve maximum cooperation between diverse disciplines, thereby minimizing duplication and excess costs, are urgently needed.

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